Subject: Distribution of DOE CBFO and NWP LLC Generator Site Technical Review  
GSTR-SR-1-17-01 Final Report

Dear Mr. Craig:

As co-permittees of the Waste Isolation Pilot Plant (WIPP), Department of Energy (DOE) Carlsbad Field Office (CBFO) and Nuclear Waste Partnership LLC (NWP) conducted a Generator Site Technical Review (GSTR) of the transuranic waste management activities currently ongoing at the Savannah River Site.

Successful completion of this review and the resolution of all identified issues is required by the WIPP Document Safety Analysis (DSA) prior to shipment of the newly certified waste to WIPP. The review, identified as GSTR-SR-1-17-01, was conducted in accordance with the DOE CBFO 16-3563, GSTR Plan; and DOE WIPP-16-3564, GSTR Procedure.

The GSTR is intended to assess the sufficiency of generator site activities applicable to treatment, packaging, and management of transuranic waste, before newly certified waste is presented to the CBFO-approved waste certification program. The review is designed to identify and mitigate deficiencies that could adversely affect the certification program.

On site review activities were conducted during the week July 17 - 21, 2017. A preliminary and tentative post-review meeting with the Savannah River Nuclear Safety (SRNS) personnel was conducted on July 21, 2017. The review remained ongoing, however, until additional documents (identified during the initial review), were evaluated and supplemental inquiries made. The review was subsequently concluded on September 7, 2017.

The final report for GSTR-SR-1-17-01 is enclosed. Twelve issues were identified; one of which will not require resolution as it describes a noteworthy practice. Please refer to the attached report and Issues Tracking System for specific details.

Please provide your responses for the remaining eleven issues in accordance with the negotiated schedule. In accordance with the WIPP DSA, CBFO and NWP concurrence, closure of all issues is required before newly certified waste may be disposed at WIPP.

Thank you for the support provided during the performance of the review. If you have any questions or comments, please contact Mr. Courtland Fesmire, CBFO TRU Site Technical Review Coordinator, at (575) 706-0044.

Sincerely,

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I. EXECUTIVE SUMMARY

The U.S. Department of Energy Carlsbad Field Office (DOE-CBFO) and Nuclear Waste Partnership LLC (NWP), as co-permittees, performed Generator Site Technical Review (GSTR) SR-1-17-01 July 17 – 21, 2017. The review was conducted of Savannah River Nuclear Solutions (SRNS), the Management and Operating (M&O) contractor responsible for transuranic waste processing activities at the Savannah River Site (SRS). The specific areas reviewed and evaluated as associated with generation, handling, packaging and/or treatment of transuranic waste, included: SRNL (Savannah River National Laboratory); F/H Lab, C-Lab (772-F), 235-F-cell area; K-Area and HB-Line. The team conducted a preliminary and tentative post-review meeting with the SRNS personnel on July 21, 2017. At that time, eight draft issues were communicated. The review remained ongoing until additional documents (identified during the initial review), were evaluated and supplemental inquiries made. The review was concluded on September 7, 2017 with twelve issues noted and cited herein.

The review team determined that the SRNS and its supplementary TRU waste generating and processing/packaging facilities and organizations are satisfactorily implementing their respective programs and established procedural requirements. The review team also concluded, however, that several “issues”, as documented throughout this report, warrant additional attention. While the issues do not reflect significant conditions adverse to quality, they document “issues” which if afforded a degree of attention - could yield process improvements which in the long run could reduce the risk of a similar occurrence, as the radiological release of February 14, 2014.

As described in the Issues section of this report, twelve (12) issues were identified by the review team. The issues relate to: layers of confinement; independent verification of waste package contents; certification of large, dense waste items; cellulose and nitric acid controls; certification assay during downblending of material at K Area; Program Management and Federal Oversight; Noteworthy Practices by Personnel; Data Package Irregularities; and Procurement and other controls of Absorbents.

II. REVIEW DETAILS

Purpose and Scope:

The purpose of this review was to assess TRU waste management and handling operations at the TRU waste generating facilities within the SRS, prior to presentation to the WIPP Certified Program. In response to the Accident Investigation Board Report (AIB) on the radiological release event at WIPP, this review is designed to assess the sufficiency of generator site activities applicable to treatment, packaging, and management of TRU waste, with the intent of identifying and mitigating deficiencies or potential deficiencies similar to the chemical incompatibilities described in the DOE AIB report, Radiological Release Event at the Waste Isolation Pilot Plant, February 14, 2014.

The review was conducted to ensure that necessary and sufficient processes and procedures are in place and are implemented to assure TRU waste containers meet WIPP Waste Acceptance Criteria (WAC) requirements prior to transfer or re-entry into the Certified Program, and that deficiencies are detected and corrected prior to shipment of waste to WIPP. The scope of this review focused on the following programs:

- Quality assurance program, including procurement processes, and training and qualification of personnel involved with waste processing activities
• Performance Assurance program, generator site assessment program and issues management system
• Conduct of operations, including verification that changes to existing procedures and processes related to TRU waste management are incorporated into AK
• Federal oversight at the SRS
• TRU waste management programs at the SRS that result in the following:
  - Waste generation, treatment, and packaging processes
  - RCRA permitting and implementation
  - Hazardous waste determinations
• Deferred maintenance (i.e., potential impacts to TRU waste processes)

Areas Observed and SRNS TRU Waste Overview:

This section is intended to discuss the site history, current operations, structure, and interfaces within the SRNS facilities that are currently involved with the generation, treatment/packaging, storage and/or shipment of transuranic waste.

Site History

The Savannah River Site was constructed during the early 1950s to produce the basic materials used in the fabrication of nuclear weapons, primarily tritium and plutonium-239. A heavy water extraction plant, a nuclear fuel and target fabrication facility, a tritium extraction facility, five production reactors, and two chemical separations plants were constructed and operated to obtain a wide spectrum of nuclear materials. The primary nuclear waste resulting from these activities consisted of highly radioactive liquid wastes, which were treated with sodium hydroxide and piped to underground storage tanks at two separate tank farms. SRS built a total of 51 such tanks, storing over 37 million gallons of High Level Waste (HLW), generated over decades of fuel and target reprocessing.

Production of other isotopes increased throughout the 1960s, including Curium 244, Plutonium 238, Americium 243 and Californium 252.

Environmental missions were added in the 1970s, with the establishment of the first National Environmental Research Park, and the Savannah River Archaeological Program.

Significant waste management activities began in the 1980s, with construction of three major treatment facilities. The Defense Waste Processing Facility (DWPF) and the Saltstone Disposal Facility (SDF) were designed to treat the liquid waste stored in the tank farms. Pretreatment involves separating the high-level waste and low-level waste components. The high-level waste contains the insoluble metal hydroxides (referred to as sludge) as well as cesium and strontium, and is vitrified in the DWPF, resulting in a borosilicate glass waste form suitable for long term storage and eventual disposal off site at a federal repository. The low-level liquid is mixed with cement, fly ash and blast furnace slag to form grout. The grout is then pumped into large concrete vaults divided into sections (called cells); here, it cures into stable concrete (called "Saltstone"). The Saltstone is permanently disposed on site at SRS. The Effluent Treatment Facility (ETF) was designed to treat low-level radioactive wastewater from the F and H Area separations and waste management facilities, F/H Laboratory, the Savannah River National Laboratory, and miscellaneous sources, such as environmental cleanup of well purge water. ETF removes
chemical and radioactive contaminants before releasing the water into Upper Three Runs Creek, a stream that flows into the Savannah River.

The 1990s brought the end of the cold war, and a complete change to the overall mission of the site. All production reactors were shut down by 1997. Both canyons resumed processing (Pu in F-Canyon and Highly Enriched Uranium (HEU) in H-Canyon) in the last half of the 1990s to stabilize the remaining inventory of Special Nuclear Material (SNM). Both DWPF and Saltstone initiated operations, and the first underground HLW tank in the nation was closed.

The 2000s introduced downblending operations to convert weapons grade materials into fuel for commercial reactors. Work was initiated in the H-canyon and the associated HB Line to convert HEU to Low Enriched Uranium (LEU), while the F-canyon and FB line were deactivated. The Mixed Oxide (MOX) plant construction was begun to disposition the excess weapons plutonium stockpile into commercial fuel, based on a treaty agreement with Russia. In 2001, SRS was the first site where the mobile Central Characterization Project (CCP) out of Carlsbad NM was certified for transuranic waste certification and transport.

The 2010s have focused primarily on waste management and environmental cleanup, with additional funding provided early in the decade by the American Recovery and Reinvestment Act (ARRA). By the time of the WIPP release event in 2014, all of the legacy transuranic waste originally stored at SRS, which amounted to approximately 30,000 drums, had been processed, and only a small number of standard large boxes remained to be shipped to WIPP via the TRUPACT III; and drums and Standard Waste Boxes (SWBs) in storage, to be shipped in TRUPACT II.

**Current Transuranic Waste Generating Operations**

Today, only five facilities are generating, or expected to generate, TRU waste in the near term. These consist of the SRNL, the F/H laboratory, building 235-F, the HB Line, and the K-Area complex. The GSTR visited all five areas, as further described in the following discussion. Other waste and material processing areas have the potential for TRU waste to be generated during decommissioning or equipment repairs, but routine generation is not expected in the near future.

**Building 235F:** This facility was part of the original construction at SRS in the early 1950s. It had had three primary missions over the years, consisting of (1) target fabrication for specific isotope production in the reactors; (2) the Plutonium Fuel Fabrication (PuFF) project to fabricate heat source materials used in space exploration; and (3) it provided a secure storage vault for SNM.

Essentially all of the transuranic waste generated in this facility will come from the removal of the Pu-238 holdup remaining in the facility's hot cell bank as residue material from the PuFF project. This risk reduction effort is expected to generate up to 25 drums per year.

**SRNL operations:** This laboratory has been designated at the corporate laboratory for the Environmental Management (EM) branch of the Department of Energy, and as such, is involved in a wide variety of research and development activities supporting EM work throughout the complex. Unique and small quantities of transuranic waste will be generated from these individual activities. All such activities from SRNL are expected to generate 10 to 20 drums per year.

**F/H laboratory:** This facility is used to provide analytical support for ongoing operations throughout the site. These activities differ from those at the SRNL in that this laboratory performs many repetitive and routine analyses. Examples include verification of quality control parameters.
for radiological or chemical content, and confirmation of system status or conditions, such as fissile content of materials in process. These activities are expected to produce about the same as SRNL, 10 to 20 drums per year.

**H canyon/HB Line:** The H canyon continues to perform various campaigns of nuclear chemical separation, but is not currently involved in any operation that is expected to generate TRU waste. The HB line generates TRU from the Alternative Feed Stock-2 processing operations in support of the mixed oxide fuel program. This program is expected to generate between 20 and 60 drums per year.

**K Area:** This reactor complex has been repurposed to the receipt, storage and surveillance of nuclear material. TRU job control waste (JCW) waste is generated from two operations. The first is the destructive analysis of a statistical sample of SNM containers from the stockpile, and the second is the downblending of SNM for disposal at WIPP. The destructive surveillance activities are only expected to generate a couple of drums per year, but the downblending process is expected to generate up to 25 drums of JCW per year.

**Site Structure, and TRU program interfaces**

In response to DOE order 435.1 Radioactive Waste Management, SRS implemented Procedure Manual 1S, *SRS Radioactive Waste Requirements Manual*. This manual is designed to impose a waste management system on all on-site waste generators that will consistently ensure all waste is properly identified, documented, packaged, labeled, characterized, and transported. The manual is divided into 9 chapters, the first few of which apply to all waste, and the last several address specific waste types.

Solid waste management activities throughout the SRS, which include all of the transuranic wastes, are coordinated by the Solid Waste Management (SWM) group. This group is responsible for receipt and storage of waste from the other groups on site, and the subsequent final characterization, certification, and disposal. Waste from throughout the site is stored at the Solid Waste Management Facility (SWMF). For TRU waste, SWM coordinates with the Central Characterization Project (CCP) out of Carlsbad, NM to perform final characterization, certification, and shipment activities. The SWM Subject Matter Experts control the technical content of the 1S Manual.

The GSTR team found this particular organizational structure to be very effective, and provide several distinct benefits. First, the 1S Manual provides a single source of information easily available to all waste generators that comprehensively describes the various types of waste and the requirements associated with each type.

Second, it defines the roles and responsibilities between the site organizations, the waste generating facility, and the SWM group.

Third, it is designed such that the generating facility owns, and is therefore responsible, for the waste generated in that particular facility. This ensures each facility’s active involvement in all waste management activities, and allows SWM to act in an oversight and advisory role.

The manual defines the roles for four specific positions within each generating facility. These consist of the responsible manager, the Generator Certification Officer (GCO), the Environmental Compliance Authority (ECA), and the Cognizant Technical Function (CTF).
The manager is responsible for the development and implementation of a Waste Certification Plan (WCP) unique to the waste generated at the particular facility. The GCO is responsible for providing oversight and assistance to ensure that waste is managed in accordance with the WCP, and to ensure compliance with the applicable waste acceptance criteria. This includes waste stream identification, contents, characterization, records retention, and process knowledge. The GCO reports to facility management. The ECA is responsible for providing advice, assistance, and review in the interpretation and implementation of environmental regulations relating to the waste stream characterization process, particularly from a hazardous constituent perspective, and conducting hazardous waste determinations and documentation. The ECA reports back to the site environmental group. For SRNL, ECSs are direct reports to SRNL and matrixed to the site environmental group. The CTF is responsible for performing engineering calculations required for completing waste characterization documentation (e.g., rad calculations, curie quantifications, etc.), and providing advice and assistance to the GCO relating to the waste stream characterization process. The CTF normally reports to the facility management. Each of these positions has a qualification process, and requires both site based training and facility specific training.

In addition, the manual specifies the format and content of the WCP, defines the documentation required to support waste stream Acceptable Knowledge (AK) compilation and waste characterization, and specifies how this information is to be transmitted to SWM.

Each generating facility submits its waste related information to SWM, who then evaluates the facilities’ waste management program. If acceptable, SWM certifies the generating facility, and waste generation begins. SWM continues to evaluate the health of the generating facility program via independent audits as well as review of the generator self assessment program.

Areas Observed and SRNS TRU Waste Overview:
This section is intended to identify the SRNS facilities that are currently involved with the generation, treatment, storage or shipment of transuranic waste, how that waste is organized into AK reports by the CCP, and how SRNS intends to manage this waste going forward. This information is relevant to the GSTR evaluations, as the GSTR performed during the week of July 17, 2017 was only intended to address specific newly generated transuranic waste processing operations.

The review was performed in accordance with prepared checklists/lines-of-inquiry. Review activities included review of documentation, personnel interviews, and observations of plan of the day and pre-job briefings, processing and waste handling activities.

Criteria/Requirements Documents:
- DOE/CBFO-16-3563, Waste Isolation Pilot Plant Generator Site Technical Review Plan
- DOE/WIPP-16-3564, Generator Site Technical Review Procedure
- DOE/WIPP 07-3372, Waste Isolation Pilot Plant Documented Safety Analysis; Chapter 18, Key Element 18-4
- DOE/WIPP-02-3122, Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant
- DOE Order (O) 226.1B, Department of Energy Oversight Policy
- DOE O 227.1A, Independent Oversight
- DOE O 414.1D, Quality Assurance
• DOE O 422.2, Conduct of Operations
• DOE O 435.1, Radioactive Waste Management

Review Team:

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Date of Review: July 17 – 21, 2017 and subsequent extension until September 7, 2017. This extension was a result of emergent conditions requiring the teams' review of additional documentation to conclude its review.

Location(s) of Review: SRS; SRNL / F-Areas 772-F (F/H Lab.) & 235-F / H Canyon/HB Line / and K-Area

Conclusions:

Quality Assurance/Performance Assurance:

The Quality Assurance and Performance Assurance program documents associated with the SRS and associated facilities are cited in Attachment 2 and throughout this report. Specific requirements for the "Performing Entity Quality Assurance Program" at the SRS are contained in the 1Q Manual (Quality Assurance Manual), Procedure 2.1, Quality Assurance Program. The provisions of this procedure apply to the Management and Operations (M&O) contractor at the SRS, and to subcontractors performing work for the contractor when required by subcontract or applicable law. This procedure is applicable to facility and project work activities utilizing NQA-1 2008/2009a Code of Record as specified by approved design, project, or facility work documents. For facility and project work activities utilizing NQA-1 2000 as the Code of Record, Manual 1Q, Procedure 2-1Q is used in lieu 2.1.

These QA Programs apply in a graded manner throughout the life cycle of a facility. The activities which affect quality include experiments, research and development, siting, designing, handling, shipping, receiving, storing, cleaning, procuring, fabricating, erecting, installing, training, inspecting, testing, operating, manufacturing, maintaining, repairing, refueling, modifying, deactivating, decommissioning, and the planning, scheduling, and cost control considerations associated with these activities.

The TRU waste management process is integrated into the SRS organizational structure as described in the Savannah River Site Solid Waste Management System Plan 2017 (SRNS-RP-2016-00638). This plan provides a management tool to assist the Solid Waste Management (SWM) Project with resource allocation and with the integration and documentation activities.
associated with the SWM project. Wastes managed by SWM fall into two main categories: DOE 435.1 wastes and non 435.1 wastes. Wastes managed under DOE O 435.1 include low level waste (LLW), transuranic (TRU) waste, and high level waste (HLW), however, SWM does not manage HLW. If LLW and TRU have a hazardous component present in the waste form, then the waste is identified as mixed waste, i.e., MLLW or MTRU.

The previously mentioned plan is also augmented by the 1S Manual, SRS Radioactive Waste Requirements Manual; Chapter 2, titled: Waste Certification Program. This program document includes the requirements for the development, documentation and implementation of a SWM approved Waste Certification Program and Waste Certification Plan to ensure that waste transferred to a Treatment, Storage, and Disposal (TSD) facility meets the receiving facility’s Waste Acceptable Criteria (WAC).

The 1S Manual also requires that all generator Waste Certification Programs/Plans must include verification for activities and items associated with waste certification, as one of the many quality assurance program elements. Verification activities provide assurance that the WAC requirements are being met with respect to waste segregation, package marking and labeling, exclusion of prohibited items/materials, characterization and manifest data quality and adherence to other relevant regulatory requirements.

Waste Certification Plans evaluated and reviewed included the following and others mentioned throughout this report and in Attachment 2:

- Q-IIM-K-00001, K Area Complex (KAC), Transuranic and Mixed Transuranic Waste Certification Program Plan
- Q-RWM-F-00006, 235-F Risk Reduction Low Level, TRU, and Mixed Radioactive Waste Certification Plan

Roles, responsibilities and interfaces between the Environmental Management (EM) Carlsbad Field Office (CBFO) and EM Savannah River Operation Office (SROO), relative to ongoing Waste Certification Oversight and Generator Site Technical Reviews are defined in the DOE Memorandum of Agreement (MOA), approved 1/25/17.

Audits, assessment, surveillance and other oversight activities performed throughout the SRS and TRU waste generating entities are cited in the attached list of documents reviewed. (See Attachment 2) The generators waste management programs are assessed annually through SWM SME participation with the SRS Independent Evaluation Board (IEB). All waste management functional elements for all waste streams generated by the facility are evaluated for compliance to applicable requirements during a two week review period. Individual facilities and Facility Functional Area Managers (FAMs) establish, schedule and conduct their respective assessment/surveillance activities in accordance with the established program documents, i.e., 1Q and 12Q manuals. Facility assessment results are available via the Site Tracking, Analysis,
and Reporting (STAR) system. This system also includes documented results, findings/opportunities for improvement, corrective actions/schedules, etc. and a commitment tracking system (CTS), for use when applicable.

The performance assurance measures established at the SRS to address and evaluate work processes, deficiencies, including trends, deficiency resolution and associated corrective actions to prevent recurrence and etc., are contained in the 12Q Manual, Procedure PA-1, *Performance Indicators and Analysis*; 22Q Manual, Procedures: MM-1, *Managing Metrics* and CAP-1, *Corrective Action Program*. Other 12Q Manual/Assessment procedures and lessons learned processes mentioned throughout this report also contribute to the support of performance assurance measures.

Specific program, procedures and documents that address the QA and Performance Assurance aspects of this review include:

- 1-B Manual; *Management Requirements and Procedures Manual*; Procedure 4.23, *Corrective Action Program*; [Issue Reports (IRs) will be issued per Site Tracking, Analysis, and Reporting (STAR), when programmatic waste issues are discovered]
- 1-Q Manual; *Quality Assurance Manual*
- 1-Q Manual; *Quality Assurance Manual*; Procedure 2-1, *Quality Assurance Program*
- 1-Q Manual; *Quality Assurance Manual*; Procedure 15-1, *Control of Nonconforming Items*
- 1-S Manual; *SRS Radioactive Waste Requirements Manual*
- 1-S Manual; Chapter 2, *Waste Certification Program*
- 12Q Manual; *Assessment Manual*; Procedure FEB-1, *Performance of Company Directed Independent Evaluations*
- 12Q Manual; *Assessment Manual*; Procedure PA-1, *Performance Indicators and Analysis*
- 12Q Manual; *Assessment Manual*; Procedure SA-1, Self-Assessment
- Self Assessment 2016-SA-003573, *SRS TRU Program Self Assessment Validating Compliance to WIPP WAC Requirements*
- SRNS-RP-2016-00638, *Solid Waste Management System Plan 2017*

Other documents mentioned throughout this report and in Attachment 2, Table of Documents Reviewed, also confirm the sufficiency of the QA and Performance Assurance programs.

While these program measures demonstrate assurances that deficiencies similar to the chemical incompatibilities described in the DOE AIB report should be prevented or mitigated; it is the teams' opinion however, that enhancements in certain areas as described throughout this report, would augment an acceptable program and provide an extra measure of confidence while enhancing the defense in depth concept.
Procurement/Training of Waste Processing Personnel/Contractor Assurance and Deferred Maintenance:

Procurement:

Procurement is performed using a set of procedures in the site wide Procurement Specification Procedure Manual (Manual 3E). Procedure 1.1, General Process for Specifying Procurement Requirements, defines the process to identify and specify the functional, technical, and quality requirements associated with any item or service to be procured. Procedure 1.2 specifies the associated documentation requirements. Procedure 1.6 specifically addresses engineering documents and quality verification requirements. In general, this system is designed to ensure that the procurement package associated with any item or service specifies and documents the appropriate level of pedigree.

For some components, such as waste packaging and transport materials (i.e., drums and SWBs), the GSTR team found the procurement package to be complete and comprehensive, providing a specification, referencing the appropriate standards, specifying the required testing, specifying the required vendor certifications, and the necessary receipt inspections and material controls.

For absorbents in particular, however, the team could not identify a similarly comprehensive package. Chapter 7 of the 1S Manual provides a listing of pre-approved absorbents that may be used with TRU waste. The listing identifies 6 different absorbents (all of which are generally clay or mineral based), and goes on to say that any other absorbents, such as organic or engineered absorbents, require SWM approval prior to use.

However, the listing uses tradenames and general terms, such as Oil Dry. Oil Dry makes many different products, some of which use organic based materials, such as their L71320 spill pads, made of melt blown polypropylene. SWM does not review nor concur with all such procurements, so it appears plausible that a generator could procure an incompatible Oil Dry product, believing it to be in accordance with the 1S Manual requirements, and use it during waste processing activities. Although the controls in place at SRS are more robust than those in place at LANL during the generation of the drum that caused the release at WIPP, it was a similar lack of specificity that contributed to the inappropriate procurement of the absorbent at LANL.

Accordingly, the team recommends SWM take two process improvement actions. First, provide additional clarity or specificity in the 1S manual to preclude using an organic absorbent. Second, reassess the extent to which SWM should be involved in waste related procurements. (Issue I-11)

Training and Qualification:

The GCOs, ECAs, and CTFs are trained and qualified in accordance with a site wide program to ensure minimal technical understanding and consistency for all site activities. Then per the 1S manual, each facility is required to develop a facility specific training program for all personnel involved with waste management activities (including these three positions). The plan is referenced and outlined in the individual WCPs. The WCPs are reviewed and approved by SWM.
The team reviewed the site qualification program for the GCOs, each generating facilities’ WCP and associated training plan, and a sampling of the completed qualification cards and training class contents.

Three training courses were selected for content review by the team; NSAGWCOPCBT000103 for F-area waste certification, RKROK1S3STGD000102 for K-area Interim Surveillance TRU waste operations, and SE010502000106 for the F/H laboratory waste generator. In every case, the course content provides useful information at an appropriate level of detail. All of the reviewed training materials use the 1S Manual as the source of waste management requirements, and the facility GCO as the person to contact for any questions or off-normal conditions. As part of their site qualification, the GCOs are directed to use the SWM engineers or subject matter experts to resolve their questions or concerns.

The GCO qualification process provides a comprehensive foundation for all waste management activities. Written tests are used with each training module to ensure appropriate understanding, and a final exam is administered at the completion of all modules. Eighty hours of field work under the supervision of a qualified GCO are also required.

The WCPs are created by each facility using a template provided in Chapter 2 of the 1S manual, and describe the facility purpose, the waste to be generated (including chemical and isotopic content), the processes that generate the waste, the organizational structure, the personnel training requirements, and the waste characterization methods, records, and disposal plans. As such, each facility uses a consistent and formal method of thinking through the necessary waste management steps before such waste is created.

The effectiveness of this program was demonstrated during the interviews with personnel from all facilities, as they correctly stated the requirements, responsibilities, and organizational interfaces associated with their portion of the TRU waste management workscope.

The effectiveness of the SRS TRU waste management system is due in large measure to the oversight and advice provided to the generating facilities by the SWM SMEs. Several of these individuals have years of TRU waste experience, dating all the way back to SRS’ first certification work. As these folks begin to retire, training of the new SMEs presents a daunting challenge. SRS fully recognizes this challenge, and has taken significant action to address it. In addition to the formal engineering qualification and training program, they have hired five to ten additional staff. The GSTR team developed a WIPP specific training module, which could be of benefit to the SME training. It is included as an attachment to this report for SRS consideration.

**Contractor Assurance System (CAS):**

The site wide Contractor Assurance System description is provided in SRNS-RP-2016-00352. It contains all of the information required by DOE-O-226.1B, and has been approved by the local DOE office. This program is used by all facilities on site, and is constructed as a continuous improvement cycle involving assessments, corrective actions, lessons learned, worker feedback, metrics and reporting.

Internal assessments are governed by the 12Q manual, and include management assessments, self assessments, and management field observations. External assessments are driven by audits, regulatory agencies, and DOE HQ directives. The corrective action program is governed by the 1B manual. Actions are identified, documented, and tracked to closure using the Site
Tracking Analysis Reporting (STAR) system. The Operating Experience (lessons learned) Program is also governed by the 1B manual. Worker feedback is based on the Voluntary Protection and Behavior Based safety programs. Metrics are developed, tracked, and reported in accordance with the 8B manual.

The team reviewed documents from each of these programs for each of the facilities expected to generate TRU waste in the near term. The assessment documentation shows assessments being performed at all levels within each organization, and indicate issues are being identified for resolution. The corrective action program documentation indicated the issues are evaluated for severity, have independent review by QA, and are routed to the appropriate departments.

The lessons learned program provided several examples of timely distribution of information relevant to the waste management efforts. The team did note, however, that one of the bulletins, SWM-BUL-2017-00002, which was issued on January 18, 2017, removed from the list of approved absorbents acrylic acrylate resin, NoChar, and polypropylene. F/H Lab procedure L2-1-50003, which was revised in March of 2017, still lists these as acceptable, so either the information did not reach the appropriate F/H Lab personnel, the need to change the procedure was not recognized, or the implementation of the corrective action has not been timely. In any case, the team recommends SWM should evaluate what occurred in this instance, and develop the associated corrective actions. (Note: The HB-Line TRU waste cert plan also lists these same three absorbents as acceptable). (Issue I-12)

Several examples of worker feedback were reviewed in the form of the documented hazard assessments, and interviews with waste handing personnel indicated these personnel were satisfied that their input was both valued by the management team and incorporated into waste management activities.

The site wide system for developing, reporting, and evaluating metrics is provided in Procedure MM-1, of the 22Q Manual.

Except for the single issue concerning lessons learned noted above, the GSTR team concluded that the Contractor Assurance System components were all in place, and appear to be functioning as designed.

Deferred Maintenance:

The GSTR reviewed the status of maintenance activities for equipment that could potentially impact the safety boundary of the waste containers. This portion of the review is intended to protect against a situation similar to the deferred maintenance on the mining equipment at WIPP, which ultimately contributed to the February 2014 fire.

The GSTR interviewed maintenance and operations personnel. No issues with the potential to affect waste safety were noted.

Waste Management – Including Generation, Treatment, Packaging, RCRA and Hazardous Waste Determinations:

The waste management portion of the SRS GSTR review confirmed that appropriate processes and procedures governing the treatment, packaging, certification, and management of TRU waste are adequately implemented at the organizations reviewed for the areas that were available for review.
The processes reviewed at 772-F, 235-F, SRNL, H-Area, and K-Area and also those that apply site-wide produce TRU waste containers that are compliant with WIPP requirements. The processes and procedures in place are sufficient and are implemented such that TRU waste containers meet the WIPP WAC requirements prior to storage and prior to being offered to the certification program for characterization. SRS has partially adopted the WIPP packaging instructions into Manual 1S and the various facility waste management procedures which aids in ensuring waste will continue to meet the WIPP WAC.

The TRU waste management programs at SRS were reviewed for:

- Waste generation, treatment, and packaging processes
- Resource Conservation and Recovery Act (RCRA) permitting and implementation
- Hazardous waste determinations

The review of those programs included:

- Evaluation of waste generator packaging and repackaging operations that prepare TRU waste for characterization by CCP;
- Implementation of waste generator site processes as they relate to TRU waste management;
- Verification that changes to processes are correctly incorporated into acceptable knowledge summary reports at each of the organizations;
- Verification of effective implementation documentation and programs to ensure that waste generator activities comply with the generator site Resource Conservation and Recovery Act permit at each of the organizations.

The GSTR visit could not review all of the waste generating processes that could result in TRU waste at SRS. Some were active but rarely generate TRU waste and some are currently idle. The numerous laboratory operations performed at F-Area laboratories and SRNL were represented with a single activity at each facility that was representative of waste packaging (235-F-WH-030, R4, General Decontamination and Waste Removal in the 235-F PUFF Facility at F and Manual L1, Procedure 6.24, R23, Transuranic Waste Procedure at SRNL). Operations at 235-F (procedure 235-F-030) and HB-Line (assay of waste cuts), were observed but they did not generate TRU waste. Operations at K-Area were evaluated at the blend-down mock up. Liquid waste operations were not reviewed.

Review of maintenance and D&D activities were performed by observation of a non-rad filter change out in 772-F (maintenance), and the 235-F Risk Reduction activity (procedure 235-F-030). Maintenance activities are controlled using work instructions that are written, reviewed, and approved similar to procedures and the D&D activity observed was performed using a controlled procedure. No issues with maintenance were identified.

The results for the reviews at each organization are provided below. The GSTR Waste Management checklist provides details regarding what documents were reviewed and the results of the operator interviews. SRS operates with site-wide procedures for some activities such as RCRA implementation, USQ evaluations, and document control. They also operate the TRU waste management activities through a single waste management manual. This provides a good
degree of standardization between organizations. The Generator Certification Officials (GCOs) are employed at the facility rather than as matrixed employees from the Solid Waste organization. This relationship ensures the GCOs are intimately familiar with facility operations and plans while still being waste management experts for SW. This relationship was recognized by the GSTR Team as a noteworthy practice. (Issue I-8) Common themes that were noticed across the organizations are:

- SRS hazards assessment processes do not include a formal chemical compatibility screening tool such as that available from the Environmental Protection Agency or the National Oceanic and Atmospheric Administration (NOAA). Incorporation of a formal screening tool for TRU waste generation would provide assurance of absence of incompatible materials in the waste.

- Chemical hazard training is typical of other sites and is geared towards general industrial hygiene and laboratory chemical safety. SRS should consider including some waste incompatibly material in the training for operators.

- The 1S Manual has a list of approved absorbents and states that others must be pre-approved by SW. Some procedures include other items such as PIG products and acrylate resins; the 1S Manual should include these items if they have been evaluated and approved for use.

- Drum packages do not always reference the original waste cut paperwork used to complete OSR 29-90. SRS needs to ensure that the original waste cut data is available for future AK evaluations.

- Although CCP is not currently active at the site, the AK briefings appear to be provided to management rather than the operators. All operators that generate materials that are packaged for eventual disposition need to receive the briefing. SRS has ongoing waste generation activities with AK reports in place. The operators should be given more exposure to what CCP has published to ensure that what they are doing is, in fact, true as represented in the AK report. Manual 1S, Section 5.1, item 2, require "generators” to be cognizant of the information in the applicable AK Summary Report, as described in 1S Chapter 4.”

- The use of “signatures” of two operators who package the waste for waste cuts would be smarter than just initials. If the SRS facilities would take the position that these two operators are verifying that the material in a cut is accurately represented on the data sheet, the need to open a package that may have radiography issues years from now could be avoided.

- 235-F-WH-030, R4 doesn’t say to document the use of absorbents, only to use “approved absorbents” at 4:1 ratio and to document the waste item on the Appendix.

- SRNL does not control TRU drum lids, only the entry into rooms where drums are staged. This passive control will make it impossible to defend inventory logs against radiography questions later on, should there be a discrepancy between the two.

• SRNL L1 Procedure 7.23 should include specific direction for waste generation during R&D planning. Procedure L2-1-50003 requires non-cellulose materials as absorbents but cellulose wipes are still being used in the lab. The procedure never actually says to record waste on Attachment 8.4 or 8.5. This was observed on a waste cut in CLAB160016, where absorbed Pu Oxide is listed but no other information was recorded.

• Complete data packages for drums 772F140008 and 772F1402001 were provided and review. These data packages date from 2014 and it is not clear if the procedure required a form at that time; however, unsigned sheets of paper should not have been acceptable at that time. L2-1-50003, R21, Packaging TRU Waste identifies Attachment 8.4 as the container summary form to record TRU waste items. This form was not used, the inventory was provided as hand-written notes on an unsigned blank sheet of paper. Because the waste cut information is the base record, SRS needs to ensure that it is being preserved as AK information. (Issue 1-9)

The interface between SRS and CCP for identification of the critical procedures that are required to be included on the Interface Waste Management Documents List (IWMDL) was not reviewed because CCP is not currently present on site.

SRS Site Wide Processes

DOCUMENT CONTROL

Document Control is derived from the PS Manual, Procedural Document System. PS-TS-4005, Procedural Document Structure, governs most of SRS; however, PS-TS-4005 is not applicable at SRNL. PL-AP-4006, Administration of SRNL Research and Development Work Control Documents, is dedicated to the unique R&D issues at SRNL. Manual 2S, Conduct of Operations, Procedure 1.1, Procedure Administration, provides the details for procedure writing and describes the level of detail required in operating procedures. In general, personnel identify the need for a new or revision to a procedure and work with a facility technical writer to prepare the document. The procedure owner, along with the writer, determine if the change is a major or minor change and they determine if there is a need to add additional cognizant personnel to the minimum required list of reviewers identified in the procedure (the owner and writer determine the list for new procedures). Operators are involved with procedure validation once the reviews are completed. After reviews have been completed a USQ is performed and the writer and Training determine how the procedure will be released to the workers. Training can range from formal classroom presentation with testing to an informal discussion during a prejob brief. No document control concerns were identified by the GSTR Team. Records of procedure development and revision are maintained in the Electronic Document Workflow System (EDWS).

UNREVIEWED SAFETY QUESTION EVALUATION

Each facility performs USQ evaluations during procedure writing and revisions. Manual 2S, Procedure 1.1, titled: Procedure Administration, R18, states "The maintenance manager or designee will verify that the CTF has reviewed the procedure and that the USQ/TSQ/MSB process has been implemented as required by Manual 11Q, Procedure 1.05 or 1.07, Management of Safety Basis Change Process for Non-Nuclear Facilities, or by Manual 19Q,
Procedure 4.05, Transportation Safety Questions, then stamps or writes "APPROVED FOR VALIDATION USE ONLY", with initials and date, on page one of the validation copy.

Manual 11Q, Procedure 1.05, Rev. 10, Nuclear Facility Unreviewed Safety Questions, requires no particular TRU or chemical training beyond the initial USQ training and facility-specific training. USQ reviewers are trained to employ SME or CTFs with other expertise when the issue involves matters outside their particular discipline. Section 5.4 lists the screening criteria, which is based on 10 CFR 830.203(d). Section 5.6 is the USQ Evaluation process. "Uncontrolled Chemical Reactions" is one of the accident types listed in the USQ guide for evaluation.

While each facility is responsible for its own USQE, the CTF that performs the review is trained by the central SRS USQ organization. Training is to the SRS USQ procedure and 10 CFR 830. Implementation relies on use of the DOE Guide.

The team did not identify any concerns with the SRS USQ process.

ENVIRONMENTAL COMPLIANCE AUTHORITY

Each facility has an Environmental Compliance Authority (ECA) assigned to it from the site-wide Environmental Compliance organization. The ECA is resident at each facility. The waste generator is responsible for the RCRA hazardous waste determination but is assisted by the ECA. That determination is reviewed by a peer ECA and documentation of the determination is required to be maintained (per 3Q Procedure 6.3), "Hazardous/non-hazardous waste determinations are to be traceable to the waste stream or waste package and the final document referenceable and retrievable from records." It is not defined what the documentation should be or how it is to be tracked, although interviews suggested that the 29-90 should indicate the results of the determination." No evidence of this was seen on the 29-90s for the containers observed, they were non-hazardous wastes.

HAZARD ASSESSMENTS

Assisted Hazards Assessment (AHA), Electronic Hazards Assessment Package (EHAP) at SRNL (under Manual L1, Procedure 7.02), Job Hazard Analysis (JHA), and Consolidated Hazards Analysis (CHA) are used to evaluate proposed activities for potential hazards and to identify mitigative actions for those hazards. Before work is done at SRS, an AHA is generated (an EHAP would be the similar activity at SRNL designed for the research environment). The AHA will list chemicals to be used in the proposed task. To perform work at SRS, one of two forms of written instructions are provided to field personnel, a written procedure with input from engineering, operations, and other personnel as appropriate or a written work order. Work orders are written and approved similarly to procedures prior to work. Both forms of written instruction undergo a formal and documented review and approval process. The GCO is responsible for the chemical review at this point in the work planning. The GCO, CTF, and the ECA review the documents for any chemicals used during the performance of the proposed work. This review is to determine if the chemical, when placed into a waste container, would result in the generation of hazardous waste and for chemical compatibility with other chemicals within the waste, the waste itself, and with the container. There is no formal requirement for this review and it is generally based on personnel experience.

The GSTR Team reviewed AHA Report V35-1310, R3 for work to be performed in 235-F as an example of an AHA. Completion of the hazard assessment is the responsibility of the procedure
initiator or it could be initiated by a cognizant SME if requested by the procedure owner. The Determination Guide includes questions that would identify TRU or hazardous materials, including chemicals. The report then identifies and suggests typical controls. There is a checklist which requires verification by initials that the hazard controls are in place. Procedure 122 in Manual SQ identifies a list of minimum expectations that should be in an AHA report which includes a work release and a chemical application form (if applicable). Neither was included in V35-1310.

A Consolidated Hazards Assessment (CHA) kick-off meeting for F-Canyon was observed. This CHA was observed because it occurred during the site visit and is expected that it would be representative of what would occur at each facility. The CHA was conducted as a team of a number of disciplines such as operations, criticality, engineering, industrial hygiene, hazard analysts, and design basis authority. Waste management was not included in this particular AHA because the action under consideration would not be generating waste; however, the team lead stated that the facility GCO would typically be included. The CHA will be completed over several months and will include evaluation of chemical controls. The CHA process appears to be a thorough assessment of the possible hazards and consequences of a planned activity.

While the hazards assessment process does not include chemical compatibility screening tools such as that available from the Environmental Protection Agency or the NOAA, the capabilities of the GCOs, ECAs, and CTFs, as well as the Principle Investigators at SRNL, appear to adequately address compatibility issues. SRS would benefit from inclusion of a formal compatibility assessment procedure for TRU waste.

772-F

Document reviews and interviews were conducted at F-Area to determine if the organization provides adequate waste management for TRU waste being packaged for disposal at WIPP. 772-F packages newly generated waste in compliance with Manual 1S to ensure that the waste will meet the SRS WAC. There are numerous processes in place in the 772-F and 772-1F facilities that generate TRU waste. The operators that generate those materials are knowledgeable and readily engage the GCO when packaging TRU waste. Waste is removed from glove box lines in clear bags and packaged into clear ice-cream cartons prior to being loaded into drums. Processes that routinely generate TRU vs. LLW are known and pre-job briefs are conducted every time TRU waste is being pulled from the lines. The GCO is required to be present at the pre-job. The GSTR team observed a waste packaging operation and noted that a first line supervisor was always present with the laboratory technician and also observing the waste cut. However, only the laboratory technician signed the packaging form attesting to the content. A minor change to include the second signature could eliminate rework in the future if there are radiography issues with the drum from the laboratories. (Issue I-2)

The team also noted the use of blue absorbent pads in the glove box lines and noted their exclusive use in the 772-F and 772-1F laboratories. For several years, the 772-F labs have excluded cellulosic materials in the glove box lines and only use the plastic based blue wipes. Organics are in general, excluded from the labs and minimize potential for incompatibles in their analytical operations.

During the tour of 772-F, the team selected drums CLAB160011, CLAB160012, and CLAB160016, located in room L136-A&B, for data package review. Solid Waste Management had no information on drums 160011 and 160012. The data package provided for 160016 included documentation demonstrating how a deviation from the 1S manual is addressed (in this case, use of SP-400 to absorb water prior to changing the 1S manual that prohibited SP-400). The laboratory procedure L.3.05-1035, Particle Size Analysis by Laser Diffraction, required SP-400 (removed in revision 6). Later data provided - showed that waste cut number ALT-04229 in drum CLAB160016 contains "ABSORBED Pu OXIDE 50-3017.02" but no information as to how much or what absorbent was used, nor was recorded on the TRU Container Summary Report.
Complete data packages for drums 772F142001 and 772F140008 were provided. Review of L2-1-50003, R21, Packaging TRU Waste identifies Attachment 8.4 as the container summary form to record TRU waste items. This form was not used, the inventory was provided as hand-written notes on an unsigned blank sheet of paper; however, these two drums were filled in 2014. It is not clear what the requirements were in 2014 but the use of handwritten notes on a blank page should never have been accepted. (Issue I-9)

235-F

235-F is undergoing cleanup to reduce the amount of material-at-risk in the operating cells (Risk Reduction). The cleanup has not yet begun. The plan is to scoop, sweep, and vacuum as much material as can be removed. These cells performed work with Pu-238 and therefore there is extensive Pu-238 contamination in the cells. The GSTR Team noted that packaging large quantities on Pu-238 into bags with four layers of confinement may pose shipping problems years after packaging. (Issue I-1)

The GSTR Team observed the plan-of-the-day shift briefing given by management to supervisors. The GSTR team then observed a prejob brief for an installation of gloves and an electrical pass-through in Cell #7. Work performed in 235-F consisted of removing blank flanges from the back side of Cell #7 and installing two gloveports and an electrical pass-through. The task includes an inspection for liquids and nitrates in the cell. If liquids or nitrates are identified the operators were to stop and contact the GCO for further evaluation (none were identified). The Team was able to observe this work through the hot cell window on the opposite side of the cell. No TRU waste was generated or expected. This work was performed using procedure 235-F-030.

Interviews with operators were conducted after the job. They stated that they would stop work in the event of unusual situations and notify supervision. They expect to generate LLW but no TRU waste until they need to begin bagging waste out of the cells. If liquids were to be identified, the liquid would be absorbed according to procedure 235-F-030 using an absorbent identified by the GCO. The GCO would select the absorbent from the list of approved absorbents found in Manual 1S.

SRNL

The SRNL uses a number of the same programmatic documents as the rest of SRS; however, as a research laboratory it has several processes that are unique to it and therefore operates to other control plans ("L-Manuals"). Document reviews and interviews were conducted to determine if the SRNL organization provides adequate waste management for TRU waste being packaged for disposal at WIPP from the numerous laboratory spaces by numerous Principle Investigators (PIs).

The team observed packaging at K-Area Interim Surveillance (KIS) and job control waste contained in waste cuts previously bagged out and placed into a 55-gallon drums. The KIS work is performed in C059, Glovebox 34. The lid of the TRU drums was lifted and the operator placed the materials inside the drum. Drum packaging information, including the waste cut data sheets were available in the room. Waste was packaged using L2-1-50003, but the procedure never actually says to fill out Attachment 8.4 or 8.5.

A second activity, (a waste bagout), was observed from the hallway adjacent to the glovebox located in one of the laboratories. The GSTR Team observed the pre-job brief and then interviewed the PI. The waste had already been identified by the PI, inspected by the TRU waste coordinator, and packaged by the PI. The wad of material that came out of the glovebox would not be amenable to visual examination; the inspection therefore, had to be performed prior to wadding the material in the bag for bagout. The team observed the bagout and drum loading operation through a window in the door to the laboratory because the bagout operation requires respirators; the ability to observe the operation through the window was acceptable.
Document changes at SRNL are processed by the SME with input from the operators. The SME follows the process in Manual PS, PL-AP-4006, R1, Administration of SRNL Research and Development Work Control Documents which are the SRNL requirements document for procedures. The SMEs stated that they work with document control on procedure changes. Changes are implemented using formal prejob briefings.

TRU waste drums at SRNL may take extended time to fill. The drum lids are placed on top of the drum but are not sealed. Although accesses to the rooms where the drums are located are controlled, the ability to place items into the drum is not. SRNL stated that only people who have been trained are allowed to place items into TRU drums but it would appear that as a passive control there is a potential for escorted personnel to use the drum for disposal unknowingly.

A container data package was provided for drum 773A-14-0015. This drum was packaged on February 5, 2015 and contains 14 waste cuts. The package contained the TRU Waste Identification Form and the TRU Waste Container Contents Record Form. The TRU Waste Identification Form has the entry “90 ml residue on 1800 g Oil Ori.” That this is a summary across the waste cuts is not clear and the identification of “residue” is not identified as required by the procedure and will likely be assumed worst case in the future BoK calculations. The waste cut paperwork includes two initials or signatures but they are not intended to document that the waste was verified by two independent trained individuals. This would mean that should questions arise after the drum is closed, the certification program would not be able to rely on the original drum packaging paperwork as definitive proof of the container contents. SRNL should consider revising the process to include that verification to minimize the need for repackaging in the future. (Issue 1-2)

**H-Area**

The GSTR Team observed the daily shift briefing and a prejob brief for assay operations. The daily brief addressed activities that were to be performed in the facility that day. The Prejob brief addressed the particular issues related with the assay activity that the GSTR Team observed later. General safety and hazards were addressed; however, the assay operation does not involve hands-on work with TRU waste or chemicals and was therefore silent on these concerns (the assay is of closed containers). “Time out” authority of each worker was stressed.

The GSTR Team toured the HB-Line operating spaces and observed an assay activity. The team later interviewed operators and, separately, the GCO, ECA, and CTFs.

The GSTR Team interviewed the GCO and observed how the GCO manages waste information for H-Area. The waste cut information can contain “neutralization kits” which are used to neutralize acids with soda ash, rendering them absorbed. The type of acid is not identified. Waste packaging information includes initials of waste generators, not signatures. Because the reader-worker method is used, the initials of the waste operator are recorded by the reader. The operator is present performing the task and the waste verification. As with SRNL, this part of the TRU waste packaging process could be improved.

A drum data package was provided for HBL160029. The drum was packaged on November 15, 2016 and contains 11 waste cuts. The package contains the 29-90, the TRU Waste Drum Contents Data Sheet from 221-HB-4721, and the OSR 48-380 TRU Waste Identification Slips for the waste cuts that were packaged to procedure 221-HBL-2092-5.12 (other TRU waste procedures include 221-HB-4710 and 4721). The 29-90 included a reference to the EDWS for the TRU waste content data.
**K-Area**

K-Area TRU waste generating operation are the K-Area Interim Surveillance (KIS), Pu blend-down, and HEPA filter changes. The team observed the blend-down operation at the mockup facility. HEPA filter changes are very infrequent. Actual blending operations were not observed however the activity was adequately represented by the mockup. Interviews were held with the glovebox operators and separately with the GCO, ECA, and CTFs.

A drum data package was provided for KAC1400011. The 29-90 refers to “waste cuts” but there is no reference to identify those cuts. The form SOP-CSS-106-K should have identified those waste cuts but it appears SRS provided the wrong form; regardless, the 29-90 does not reference back to that form. Calculation Q-CLC-K-00233, R.0, was provided, with 12 waste cuts loaded on November 2, 2014 using procedure SOP-CSS-106-K. This calculation is the record of how the Waste Engineer combines the individual waste cut information into a single drum data set and is used to complete the 29-90. It was not referenced on the 29-90. It includes detailed waste cut information, including photographs of some individual waste items, but not the original waste cut data sheets (FRM-CSS-009-K, TRU Waste Staging Drum Contents or FRM-CSS-016-K, for example).

**Conduct of Operations:**

The Conduct of Operations functional area was reviewed at the facilities on the Savannah River Site (SRS) that generate transuranic (TRU) /mixed transuranic (MTRU) waste. The review consisted of document reviews, field observations, and interviews to determine the knowledge and implementation of key requirements of DOE O 422.1 within the TRU/MTRU waste generation programs. The review found that the Conduct of Operations program is well established and implemented.

The team attended Plan of the Day meetings in each facility. These meetings were well structured, and well led. The topics discussed included facility priorities, priority safety related work, nuclear safety surveillances, and routine work scheduled for the day. Pre-job briefings were also observed in the facilities. Workers, supervisors/managers, and applicable safety representatives were in attendance. Work plans and safety considerations were discussed in detail during these meetings. Radiological Control personnel were involved and the applicable Radiological Work Permits were discussed in detail.

Operations or demonstration of operations using mockups were observed in the facilities generating TRU waste. These operations primarily consisted of bagging TRU waste out of various gloveboxes in the facilities generating TRU waste. At the K Reactor facility, a demonstration of down blending operations was observed. The operators were proficient in the work that was observed or demonstrated. Supervisors were present and observing the work performed. The procedures used in the generation of TRU/mixed TRU waste are followed by the operators. One concern was identified during these observations. Although not a violation of facility procedures, the processes and use of the forms documenting the TRU/TRU mixed waste transferred out of a glovebox are inconsistent from facility to facility and sometimes within the facilities themselves. Each of these forms requires two signatures. The first signature belongs to the operator packaging the waste to be transferred and the second is usually signed by a supervisor or Principal Investigator. The supervisor or principal investigator does not need to be present as the waste is packaged in order to sign the form verifying the waste being transferred out of the glovebox. In one facility, Principal Investigators stated that they could and did sign both
signatures documenting the waste transferred out of a glovebox. At K reactor, the down blending process and the documentation produced used two operators independently verifying the waste generated. However, the operators only initialed rather than signed the documentation produced. Issue number 2 was generated by the GSTR team to recommend a consistent approach to the documentation of the waste making the data more useful for the generation of acceptable knowledge reports and future disposal characterization activities. Personnel involved in the waste generation/transfer processes were knowledgeable of their processes and Conduct of Operations requirements. Of particular note were the GCO, CTF, and ECA responsible for the waste generated from the down blending process. Operators were consistent in responding that a time out would be taken any time an operation could not be conducted in accordance with the approved procedure or process. Operators were also consistent that no operation would resume until the procedure or process issue was resolved. Logbooks and Laboratory notebooks are used and document routine and off normal activities.

Operator aids seen in the facilities and those provided to the team for review were posted and approved in accordance with Procedure 5.10 of the 2S manual. Three-way communication was observed during waste bag out operations. These operations typically present some of the worst barriers to communications in any operation. The operators and Radiological Control personnel effectively used radios with headsets or dry erase boards to communicate back overcoming PPE, noise, and isolation barriers. Shift turnovers presented a clear picture of the status of the facility for on-coming operators. No operations were observed that required independent verification in any of the waste generating facilities.

A formal process is used to develop, revise, and approve procedures at SRS. This process is centralized and used for all site procedures. Operators were knowledgeable of the procedure review and approval process.

Program Management and Federal Oversight:

DOE SRS – DOE O 226.1

SROO has limited TRU Waste Operations. As legacy waste disposal is mostly complete, TRU waste activities are greatly reduced from the past. The former TRU waste processing area (AREA E) is now mostly involved in low level waste activities. TRU waste activities are scattered in several locations throughout the SR complex. The staff member who holds the position of program manager for TRU waste is currently on a detail. Therefore, Program Federal Oversight is an "other duty as assigned" within the Waste Disposition Programs Office. The staffing of this office has been seriously drawn down from sixteen to nine FTEs including staff on detail. Fifty-five percent of this staff is eligible to retire. The staff member currently covering the TRU activities has done a good job of covering considering this is not his primary job. The contractor reports that DOE Program Staff talks to them on a daily basis and spends time in the TRU area. This is also the subject of a DOE self-assessment which identified the need for increased oversight of the TRU waste activities. SROO should implement this suggestion. There are plans for additional TRU waste generator site oversight in conjunction with the CBFO on-site certification manager which will increase the federal oversight. This plan should also be implemented. Management is working the staffing issue. (Also see Issues 1-6 and 1-7)

As with most sites, emphasis is placed by management on the fact that Facility Representatives (Fac Reps) are conducting oversight on a routine basis in the TRU areas. However, Fac Reps as a whole receive no training in TRU waste and TRU waste activities. This limits their usefulness in the oversight of TRU activities and should not be considered defense in depth to protect WIPP.
Program Staff with knowledge of and experience in TRU waste need to be in generator spaces on a routine basis as self-identified.

Should downblending become a more significant part of TRU waste activities, additional oversight will be necessary by program staff. If and when this occurs, CBFO will reexamine oversight as well as other activities reviewed in the GSTR. (Issues 1-6 and 1-7)

DOE/NNSA – DOE O 435.1

In accordance with the Federal Oversight review portion of this review and relative to DOE O 435.1; it was confirmed that the SRS is compliant with the order. The following material represents a sampling of the information resulting from the Checklist/Lines of Inquiry that were used, and may or may not include elements previously addressed:

Review questions and discussions indicate that the E-Area is the only storage facility which is located in the central part of the General Separations Area. The TRU waste storage pads are used to store the waste containers until they are ready for shipment to the WIPP. This is described in the TRU waste certification plans. The E-Area TRU waste storage facility receives TRU waste from the site generating facilities. It serves as the central storage location until the waste is shipped to WIPP. E-Area is the only SRS facility designated as a RCRA Treatment, Storage, and Disposal Facility (TSDF). E-Area applies to storage greater than 1 year. Accumulation/staging areas at the generating facility’s facilities are for less than 1 year.

The generating facilities are authorized to package or repackaging TRU waste. For ALARA purposes, the TRU waste containers are not repackaged once they are received in E-Area. If the TRU waste container does not meet the WAC or if the containers are suspect then the containers are returned to the generating facility for repackaging - they are not accepted in E-Area until meeting WAC requirements. (Reference SRNS-RP-2016-00638, Solid Waste Management System Plan 2017)

The Radioactive Waste Management Basis (RWMB) consists of physical and administrative controls for the generation, treatment, storage and disposal of TRU waste which in turn ensures the protection of workers, the public and the environment. Prior to generating TRU waste the generator facility must follow the waste certification program and submit an RWMB to the Department of Energy to review the waste acceptance requirements, the facility’s waste certification program, the facility's specific procedures which implement the site's radiological control program, a Health and Safety Plan, a Training and Qualification Program, the Quality Assurance Plan and all record keeping and waste tracking programs.

Documents implementing the RWMB include the: Radiological Control Program; the Site Health and Safety Plan; Safety and Analysis Report (SAR); Operational Safety Requirements/Technical Safety Requirements; Basis for Interim Operations; Technical Standards; Unreviewed Safety Questions Evaluations; DOE Safety Evaluation Report; and documents which are part of Configuration Management.

Prior to the transfer of TRU waste to the WIPP, each waste generator facility transports the waste to the E-Area Facility for storing the waste. The RWMB includes the development and implementation of a monitoring program designed to evaluate the performance of the
facility. Compliance of the facility is ensured through the waste certification program and site Performance Assessment.

Department of Energy staff reviews the subject RWMB and supporting documentation as well as perform field surveillances of the TRU waste generating facility operations to ensure that the requirements to protect the worker, the public and the environment are met. An assessment of the field surveillances is included with the evaluation of the RWMB and incorporated into the Site Tracking and Analysis Reporting (STAR) database. Once the RWMB is determined to have met all requirements, a confirmation report is sent to the Field Element Manager recommending approval of the RWMB. The Field Element Manager has the ultimate approval authority for the RWMB.

Savannah River demonstrated the use of physical and administrative controls during this review. Tours of the facilities and observations of personnel revealed the use of proper boundaries, postings, monitoring, pre and post job briefs to discuss the day's operations and documentation of controls through use of work documents, radiation work permits, procedures, local and environmental monitoring, and proper use of storage and other posted area. All radiological waste facilities operate under Savannah River's quality assurance program.

As demonstrated through interviews during this assessment, personnel who are associated with the management of transuranic wastes are provided training to ensure competency in their assigned tasks. Training covers a broad spectrum of expertise such as planning, generation, identification, characterization, storing, processing, treating, monitoring, packaging and transporting.

The protection of workers, the public and the environment as required under the RWMB is further supported by personnel with technical expertise in Radiological Controls, Industrial Hygiene, Criticality Safety, Industrial Safety, Fire Protection, Emergency Management, etc. These functional areas are supported by approved operational/training procedures and follow the Integrated Safety Management philosophy. The RWMBs include documentation covering the radiological control program, the site health and safety plan, safety and analysis reports, operational safety requirements, technical safety requirements, basis for interim operations, technical standards, un-reviewed safety questions evaluations, and DOE safety evaluations.

Record keeping was another key component demonstrated during the observation and interview process. Savannah River has the capability of demonstrating compliance with DOE Order 435.1 requirements through its maintenance of records. Savannah River's records are maintained in a secure environment in accordance with D.O.E., Federal, State and Local requirements. It was also recommended during this review, that Savannah River consider having two knowledgeable individuals concur via signature on waste tracking forms to assure independent verification of waste packaging contents.

The receiving facility in E Area uses procedures to address how non-conforming waste will be segregated from acceptable waste, the process for notifying the generating facility on the non-conformance, and the acceptable methods for dispositioning the non-conforming waste. The process requires consideration of risk and costs in determining the disposition of
the non-conforming waste. The determination of TRU waste which is non-conforming and
does not meet the WAC of the receiving facility and is to be returned to the generator facility
for testing, sampling, and analysis of the waste and remediation of the waste material. The
procedures that cover this process are as follows:

- Manual SW15, Procedure SW15.3-SOP-REC-01, TRU Waste Receipt
- Manual SW15, Procedure SW15.3-SOP-REC-02, Receipt of Stored TRU Waste
- SW-HM-9005, Transuranic Waste Container Characterization Form Review and
  Approval
- SWMF-WM-TRUSHP-01, TRU/MTRU Waste Receipt Preparation

Savannah River performs life cycle planning which primarily accounts for newly generated
waste as well as Plutonium down-blending waste. This is performed in order to plan for
adequate storage space, ensure a path for disposal is available and evaluate future needs
for certifying the waste.

In the event that a process that produces TRU waste without a defined path for disposal is
deemed necessary, the process is placed into life cycle planning where the necessity of the
process and resultant waste generation is evaluated. Consideration given in the evaluation
is the programmatic need to generate the waste, characteristics and issues preventing
disposal of the waste, safe storage of the waste until disposal can be achieved, and
activities/plans for achieving final disposal of the waste.

It is ultimately the Field Element Manager’s decision to determine that generation of TRU
waste with no path to disposal is acceptable. The decision will take into consideration the
importance of the project and the plans that the Department of Energy is pursuing to resolve
the disposition of the waste. Documentation for the TRU waste stream needs to include the
cognizant Field Element Manager approval to generate the waste, an explanation of the need
for the process that generates the TRU waste, a discussion of the reason it cannot be
disposed of, the proposed management plan for the waste, and an up to date schedule of
activities being pursued to resolve constraints to the disposal of the subject waste.

Interviews with waste generators at Savannah River as well as documentation reviewed,
revealed that this determination is made prior to the transfer of waste to area E for storage.
The methods of making this determination include process knowledge of the waste as well
as confirmation through radiological analysis/evaluation of the waste. The requirement for
determining a waste stream to be transuranic is provided in Savannah River’s 1S Manual,
SRS Radioactive Waste Requirements for Transuranic Waste. Savannah River generates
Mixed Transuranic Waste however in accordance with the WIPP Land Withdrawal Act of
1992, transuranic mixed waste that is to be disposed of at the WIPP is exempt from having
to comply with the treatment standards of the Federal Facility Compliance Act of 1992
(FFCA) and is not subject to the land disposal restrictions of 40 CFR Part 268. There were
no issues identified is this segment. (Reference: Manual 1S SRS Radioactive Waste
Requirements, Waste Management Requirements, Chapter 1)

During the interview process, Savannah River personnel discussed their corrective action
program. Their corrective actions system is part of the Savannah River Quality Assurance
program. Its function is to document non-compliant or hazardous conditions, identify the
organization or individuals who are responsible for developing and implementing the corrective action plans and tracking the progress of the corrective actions.

The receiving facility evaluates waste for acceptance, including confirmation that technical and administrative requirements have been met. Interviews with Savannah River personnel confirmed that the waste acceptance requirements for all TRU waste storage treatment and disposal facilities are required to meet the WIPP Waste Acceptance Criteria (WAC). TRU waste must meet the applicable Basis of Knowledge, Acceptable Knowledge and Chemical Compatibility Evaluations. Savannah River's performance assessment, safety analysis reports, technical safety requirements, criticality analyses, and other safety authorization basis documents are used to establish the waste acceptance criteria for facilities receiving TRU waste for storage, treatment or disposal. The main objective is to ensure that no TRU waste received at a facility contains material that will compromise the safety or integrity of the facility under the expected operating conditions. Personnel responsible for TRU waste storage or treatment facilities which manage waste which is destined for disposal at the WIPP must ensure compliance with the WIPP WAC in the development of acceptance criteria for their facilities. If there is a question regarding whether a waste form is defense or non-defense related, its history is evaluated by legal counsel of both the generator site and WIPP where final determination is made. Waste concentrations are accounted for and assessed by the site for safety and regulatory limitations and reported to WIPP for its necessity of remaining within their bounds for safe and legal facility operation.

Savannah River provides process knowledge of the waste, direct (sampling) and indirect (Non-Destructive Assay/Acceptable Knowledge) of TRU waste generated. The physical, chemical and radiological aspects of the waste are accounted for and evaluated in Basis of Knowledge, Acceptable Knowledge and Chemical Compatibility Evaluations. Analytical procedures are used for lab analyses which include data quality objectives in order to obtain the best level of accuracy.

Savannah River packages waste compliant with the WIPP WAC and waste is stored in a ventilated building and protected from degradation by the elements. Vents are installed on containers to address the concerns of flammable or explosive gases. One concern brought up during this review is the use of cellulose rags in some cases which are, or may be disposed of as TRU waste. The combination of such rags with nitric acids in the waste can result in a reaction. A recommendation to use non-cellulosic rags was made. Containers are clearly marked for identification of contents and waste is segregated from non-defense waste.

**Safety and Security:**

Program areas evaluated during this review were primarily administrative in nature and those various operations and activities that were observed did not require special personal protective equipment (PPE) to be worn by the GSTR team members. Appropriate and required protocols and signage were understood and followed by the review team and as instructed by the host.
**Issues:**

**Issue [I-1] SR-1-17-01 [Waste Management, Packaging]**

This issue relates to "layers of confinement" – The 1S manual limits the layers of confinement within TRU waste to 4 layers, and all interviewed waste generators were familiar with the requirement. While sufficient for most debris waste, heat source material, such as that expected from the 235F risk reduction work, becomes problematic as the allowable alpha activity content within the waste becomes severely restricted with increasing layers of confinement. The problem may be further compounded by the fact that radiography will ultimately be used to certify the waste for WIPP disposal, and the methods used to remove bags from the gloveboxes frequently result in 2 "horse-tails" per bag, causing the radiography operators to overestimate the layers of confinement present in a waste drum.

Accordingly, the GSTR team recommends clarifying the 1S manual to delineate the reasons for limiting layers of confinement, rather than just specifying a limit of 4, ensuring the generators understand the calculations necessary to ensure their waste packages will meet the WIPP acceptance criteria, and ensuring the generators supply the necessary supporting documentation as part of the 2990 submittals to Solid Waste. The 1S manual is also silent on the use of vented bags.

**Issue [I-2] SR-1-17-01 [Waste Management, Packaging]**

This issue relates to "independent and/or "second person verification" of waste package contents" – Independent verification of waste cut or package contents are usually not performed. While not a requirement, such verification could be very beneficial when addressing any questions that may arise when radiography is eventually performed on the waste for certification purposes. Most waste operations the team observed appear to involve at least two people, and the associated documentation frequently has two signatures, or at least initials, so the additional work necessary to implement the verification appears minimal.

Accordingly, the team recommends the site consider implementing independent and/or "second person verification" of waste cut contents, documented by signatures, to minimize the probability of waste repackaging during certification activities.

**Issue [I-3] SR-1-17-01 [Waste Management]**

This issue relates to "large, dense waste items" – Occasionally, waste activities involve large components that cannot easily be sized to fit in drums and thus require larger waste packages, such as Standard Waste Boxes. The eventual certification of these containers require Non-Destructive Examination (NDE) using either Visual Examination or Radiography. Radiography is problematic for larger containers, as mobile equipment is very limited, and large items, such as equipment, tend to be dense.

As such, the GSTR team recommends SRS evaluate methods to either perform Visual Examination, or document the conditions well enough to ensure that radiography will not have to be performed during waste certification.

Relative to this issue, the team observed a noteworthy practice, implemented by the GCO for the HB Line. When asked for information concerning an agitator packaged for disposal in an SWB, the GCO presented pictures, an engineering diagram, and historical information for the component, all of which provide a complete package for disposal. The GCO attaches this information to the 2990 form, as well as submitting the information to the records system,
ensuring it will be available to the waste certification program. They are well written, concise, and convenient for the users.

This issue relates to "cellulose and nitric acid" – Throughout the site, there is significant variability in how contact between cellulose and nitric acid is controlled. In the F/H lab, cellulose use within the glove box lines has been eliminated entirely. Within SRNL, cellulose is still used in some cases, but is rinsed afterward to remove the hazard. In cases where cellulose is/or may be used; and if no rinsing is performed and the cellulose is then packaged with soda ash – the probability exists that the potential oxidizer/fuel hazard remains.

The GSTR team recommends SRS develop a consistent policy or protocol to deal with this material, as it affects several organizations and will be needed to resolve the chemical compatibility evaluations with the certified program. The following is being emphasized, as it would appear that this recommendation has already been made mandatory; In reviewing procedures, Manual L2-1, Procedure L2-1-50018, R18, Analytical Laboratory Safety Practices; it was noted that Section 5.6 states that non-cellulose materials are to be used to wipe up or absorb nitric acid. It was also noted that Procedure L2-1-50003 states that this is mandatory.

Issue [1-5] LA-1-17-01 [Waste Management]
This issue pertains to "certification assay during downblend of material at K area" – The output of the K Area downblending operations will be a 55-gallon CCO drum containing a CCC filled with the downblended material. The WIPP certification program would normally perform Non-Destructive Assay (NDA) on this configuration during final characterization activities, which in this case may not occur for some time. This could be problematic, in that assay of this configuration will necessarily involve higher uncertainties than the assay performed during the downblending operation. Because the CCO loadings are maximized in order to minimize overall waste volumes, it is possible that the assay performed during downblending would meet the WIPP waste acceptance criteria, but the final certification assay would not.

Therefore, the GSTR team recommends SRS pursue with CBFO the steps necessary to qualify the SRS assay equipment used during downblending such that it can be used for the waste certification.

WDPD (Waste Disposition Programs Division) staff should spend more time reviewing operations throughout the SRS complex with regard to waste that may become TRU waste to ensure these activities will not create issues when the time comes to characterize this waste several years down the road.

Issue [1-7] SR-1-17-01 ([Program Management and Federal Oversight]
There was a staffing concern identified by WDPD staff during a self-assessment. Supervisors confirmed the significant reduction in staff from 20 to 8 staff members. Currently TRU waste federal oversight is an "other duty as assigned". This limits the amount of time WDPD staff can spend in potentially TRU waste generating spaces. (see 6 above)
Issue [l-8] SR-1-17-01 [Noteworthy Practice]

At every facility visited by the team; personnel throughout the organizations demonstrated both an awareness of the importance of waste related activities, and the knowledge of the necessary review and approval processes. The team believes this is a direct result of maintaining waste ownership with the generating facility by embedding the GCOs, CTFs, and ECAs within each facility.

Resolution: NA – This issue commends the facility and personnel and highlights a noteworthy practice.

Issue [l-9] SR-1-17-01 [Waste Management]

A Data Package sent in for 772F140008, for team review and evaluation; revealed some irregularities as identified by M. Doherty on 8/17/17. Appropriate information relative the following was sent to Mr. L. Fox on 8/17/17 via eMail:

The waste cut data was recorded by hand on an unsigned blank sheet of paper in 2014. The procedure has a form for that, but it was not used. It is not clear if the form was required in 2014; however, even this recording method would not be considered adequate for a QA record. The raw data is not signed and is of little value as a record until authenticated, i.e., stamped, initialed, or signed and dated as complete by authorized personnel. The FHAL-057 (TRU Waste Generation Checklist) is used by the GCO (Generator Certification Official), to fill out the 29-90 (TRU Waste Container Characterization Form) but with the data appearing suspicious and filling out the 057 form nonetheless; a second problematic situation appears to have been formed?

It will therefore be suggested that this issue relative an apparent procedural non-compliance, be self-identified within the appropriate NCR and/or corrective action reporting system for subsequent tracking to closure. This action and commitment would enable resolution and closure.

Issue [l-10] SR-1-17-01 [Procurement Processes]

This issue is being documented to express a concern regarding the procurement controls of absorbents and their respective use on TRU waste processes and packages. While it is understood that absorbents are consumable, commercial grade items – it remains a product that could lead to detrimental effects when an inappropriate type i.e., organic versus inorganic is used.

The review team, therefore, is searching for sufficient and reasonable assurances that steps are documented and implemented to prevent and/or mitigate the use of an inappropriate absorbent.


Chapter 7 of the 1S Manual provides a listing of pre-approved absorbents that may be used with TRU waste. The listing, however, uses trade-names and general terms, such as Oil Dry. Oil Dry makes many different products, some of which use organic based materials, such as their L71320 spill pads, made of melt blown polypropylene. SWM does not review nor concur with all such procurements, so it appears plausible that a generator could procure an incompatible Oil Dry product, believing it to be in accordance with the 1S Manual requirements, and use it during waste processing activities. Accordingly, the team recommends SWM take two process improvement actions. First, provide additional clarity or specificity in the 1S manual to preclude using an organic absorbent. Second, reassess the extent to which SWM should be involved in waste related procurements.
Issue [I-12] SR-1-17-01 [Contractor Assurance]

Operating experience bulletin SWM-BUL-2017-00002, issued on January 18, 2017, discussed the removal of acrylic acrylate resin, NoChar, and polypropylene from the list of approved absorbents from the 1S manual. Chapter 7 of the 1S manual was revised on January 26, and incorporated this change. F/H Lab procedure L2-1-50003, which was revised in March of 2017, still lists these as acceptable. As such, the team recommends SWM needs to investigate what occurred in this instance, and develop the associated corrective actions/process improvements.

Note₁: The aforementioned issues are not of a severity level or of a magnitude that would affect or be detrimental to future WIPP shipments. All issues will, however, require resolution and closure through mutual agreement prior to site qualification and approval to ship TRU waste to WIPP.

Note₂: "Issue" as used herein is an all-inclusive term used by the GSTR team to document subject(s) or problem(s) that the review team are thinking and talking about; an issue is also a final conclusion or decision about something arrived at after the teams’ consideration. "Issues" are not necessarily “findings” in the negative sense nor are they “conditions adverse to quality”. If however, an issue is identified as a “condition adverse to quality” it will be elevated and documented through the appropriate CBFO Issue Collection and Evaluation (ICE) system. Conditions adverse to quality protocols would then be followed by identifying the specific requirement(s) violated, how they were violated; significance; expected corrective actions; impact statement request; action to prevent and/or mitigate recurrence and etc.

III. ATTACHMENTS

Attachment 1, Table of Personnel Contacted
Attachment 2, Table of Documents Reviewed
Attachment 3, WIPP Specific Training Module

SIGNATURES

Prepared by: P. V. Rodriguez, NWP GSTR Team Lead

Approved by: C. Fesmire, CBFO GSTR Coordinator
Attachment 1, Table of Personnel Contacted

[A] Attended Review Entrance Meeting
[B] Contacted During the Review
[C] Attended Review Exit Meeting

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<td>Lee Bell, SRS</td>
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<td>Pat Casey, DOE</td>
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<td>Lawrence E. Cheatham, AD Sr. Lab. Tech./Waste Generator</td>
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<td>Albert (Buddy) Chestnut, CQF, SRNS HB-Line</td>
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<td>Wyatt Clark, Sr. VP EM Operations, SRNS</td>
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<td>Mark Cochran, Destructive Examination (DE) Operators/Matl.</td>
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<td>C.W. Gardner, Director Analytical Labs., SRNL</td>
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<td>Dennis Knapp, Waste Generator Services Group, Independent Evaluation Board (IEB)</td>
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<td>Huey, Lane, SW Procedure Writer, SRNS</td>
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<td>Craig Lewis, CQF, F/H Labs and SRNL, Environmental</td>
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<td>Verne Mooneyhan, SWMF FM, SRNS</td>
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### Attachment 2 Table of Documents Reviewed – GSTR-LA-1-17-01

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WIPP Specific Training Module

This training module is designed for generator site personnel involved with the generation, data collection, records management, packaging, repackaging, characterization, and handling of transuranic waste prior to its disposal at the Waste Isolation Pilot Plant (WIPP). It provides general information in accordance with the following outline:

Summary

WIPP Purpose and Description

Timeline to Open WIPP

Regulatory Framework of WIPP

Requirements for Waste Disposal at WIPP

Central Characterization Project

CCP Responsibilities

Acceptable Knowledge (AK)

Characterization

Certification

Shipment Preparations

Generator Site Responsibilities

Planning

RCRA Compliance

Worker Safety

Training

Control and Conduct of Waste Management Operations

Contractor Assurance System

DOE Oversight

Lessons Learned

INL Transcription Error

LANL drum certification based on incorrect characterization data

LANL organic absorbent used with nitrate salt waste
Radiological contamination found inside TRUPACT-II during unloading
7-packs of CH drums exceeding RH limits/items shifting during transport

Summary

The WIPP is a one of a kind, highly regulated, politically sensitive facility. Any errors, omissions, or events at the facility generate negative publicity; adversely impact operations, have significant costs, and undermine public confidence in the country's ability to safely dispose of nuclear waste. Waste Generator activities can significantly impact the facility in that any non-compliant conditions within the waste may have the ability to shut down the repository. Indeed, this has happened several times in the past, literally costing millions, or even hundreds of millions, of dollars to recover from each event.

This training is intended to provide generator site personnel an understanding of the WIPP repository; its history, requirements, and waste characterization, certification, and disposal methods. The ultimate goal of this training is to stress the importance of generator site and WIPP site cooperation to ensure that all transuranic waste management activities are performed in full compliance to the many requirements, ensuring the integrity and protection of the national transuranic nuclear waste disposal program.

WIPP Purpose and Description

The Waste Isolation Pilot Plant (WIPP) is the country's only repository licensed to permanently dispose of transuranic radioactive waste generated from national defense related activities.

The repository is located approximately 26 miles east of Carlsbad, New Mexico, 2150 feet below the surface, near the center of an ancient 2000-foot thick salt formation, created more than 250 million years ago by repeated evaporation of an inland sea.

This location was selected as the site for the repository for three primary reasons. First, the salt formation has been stable for millions of years. Second, at sufficient depth, salt plastically deforms, a phenomena known as “Salt Creep”, which allows it to both seal fissures or cracks which may appear in the formation, and to flow in and around the waste, entombing and isolating it from the biosphere. Third, the local community was supportive of the project.

Timeline to Open WIPP

The National Academy of Sciences recommended deep geologic salt formations for all long half-life radioactive waste disposals in 1957. Although the concept of the
repository is simple and straightforward, establishing the actual repository was a long, difficult process, spanning decades.

In order to separate the cold war era clean-up activities at DOE sites throughout the nation from the spent fuel disposal issues, the Atomic Energy Commission created the category of transuranic waste in 1970, and began to place all such material in retrievable storage, rather than permanent disposal pits, anticipating the opening of a WIPP-like facility.

After a nation-wide survey of suitable locations, on-site studies near the current site were initiated in 1974, with Sandia National Laboratories drilling test wells, and evaluating volcanism, tectonics, hydrology, salt dissolution, erosion, geochemistry, mineral resources, and other site characteristics. This effort culminated with a published Final Environmental Impact Statement in 1980 that concluded there were no natural geologic or hydrologic processes that could breach the repository for millions of years.

Following Congressional approval of funding in 1980, construction began in 1982, with the first underground rooms completed in 1983.

Disagreements over how the site would be regulated were resolved in 1992 with the passage of the Land Withdrawal Act by the US Congress, which required EPA to issue final regulations concerning the disposal of transuranic waste, and gave EPA the primary regulatory authority for the site.

DOE submitted the Compliance Certification Application to EPA in 1996, an 80,000 page document providing the evidence necessary for EPA to determine if the repository was robust enough to isolate the waste for a period of no less than 10,000 years.

EPA approved the application in 1998, and the first waste shipments occurred in 1999.

The New Mexico Environmental Department issued the final hazardous waste facility permit in 1999, allowing mixed waste shipments to begin.

**Regulatory Framework of WIPP**

The regulatory framework of the WIPP involves numerous organizations. The following is a brief summary of the roles and responsibilities of each organization.

The DOE is responsible for ownership, operation and maintenance of the facility. *DOE O 435.1 Radioactive Waste Management*, is the definitive controlling order for all DOE radioactive waste management activities, and requires that all radioactive waste management activities be systematically planned, documented, executed, and evaluated. It contains both general requirements, applicable to all classes of radioactive waste, and a set of requirements specific to transuranic waste. The order is supported by both an associated DOE Manual and a DOE Guidance document.
At the WIPP site; the DOE contracts private sector companies to perform operations and maintenance, and technical services, in accordance with a comprehensive set of DOE Orders, guides, policies, and directives. The DOE contracts national laboratories for scientific studies needed to support waste disposal activities. DOE provides oversight of both contractor and laboratory activities from local and headquarter offices.

The US Congress designated the EPA as the primary regulatory agency for WIPP, as set forth in the Land Withdrawal Act, which required EPA to both issue final regulations for this type of repository, as well as establish the disposal standards for WIPP. EPA performs a baseline inspection of the waste management activities at each generator site to ensure compliance with the transuranic radioactive waste disposal standards, and once approved, performs periodic audits as they deem necessary to ensure continuing compliance. The evidence of compliance includes such things as an active and involved quality assurance program to ensure waste is being appropriately characterized, the appropriate data is recorded and validated, and issues and discrepancies are tracked and satisfactorily resolved. Every 5 years, the EPA re-evaluates all changes to WIPP operations to ensure the repository continues to conform to the waste disposal standards, isolating the waste from the biosphere for at least 10,000 years, as specified in the WIPP certification and recertification requirements detailed in 40CFR194. The recertification of WIPP involves evaluating the models used to predict the repository performance, the confirmation that the assumptions supporting the models remain valid, and no changes or events have occurred which would require modification of the models. The EPA also regulates other federal statues, such as specific materials under the Toxic Substances Control Act (TSCA), and emissions under the Clean Air Act.

The State of New Mexico is authorized by EPA to carry out the State’s base RCRA and mixed waste programs in lieu of the equivalent Federal programs. Nearly all waste disposed at WIPP is categorized as mixed transuranic waste, meaning it contains both chemical and radiological hazardous components. Accordingly, New Mexico’s Environment Department issues and regulates the WIPP Hazardous Waste Facility Permit (HWFP), which defines the requirements for acceptance, handling, storage and disposal of this waste under Subtitle C of the RCRA regulations.

The federal Mine Safety Health Administration (MSHA) has regulatory authority over the WIPP underground operations.

The Federal Department of Transportation regulations govern the transport of hazardous materials under 49CFR. All waste is delivered to WIPP using designated highway transport routes, shipped inside Type B containers. The Nuclear Regulatory Commission regulates the contents and performance of the Type B shipping containers, which are rigorously tested to ensure waste isolation during any plausible transport accident. The testing includes multiple drops of the container onto unyielding surfaces, using the worst-case geometries, followed by exposure to a fuel pool fire. The NRC regulates the design, construction, and use of these specialized transport packages.

Several other agencies, such as the Western Governors association, the Southern States Energy Board, the Council of States Governments, Native American Tribes and
Pueblos through which the transport routes pass, all have a voice in how transportation of transuranic waste is transported. These agencies are not regulators, per se, but have agreements with DOE concerning local requirements such as shipment times, traffic routes, and emergency response training.

The bottom line is that the WIPP is extensively regulated, and as such, the requirements imposed on the waste generator sites are numerous, complex, and very prescriptive.

Requirements for Waste Disposal at WIPP

The WIPP Waste Acceptance Criteria (WIPP WAC) is the primary document that defines the requirements for waste disposal at WIPP. It compiles the requirements from several higher-tier documents, including the WIPP Documented Safety Analysis (DSA); the Certificates of Compliance for the various CH and RH transport packages (i.e., TRUPACT-II, TRUPACT-III, HalfPACT, RH-TRU 72-B and 10-1608); the WIPP Land Withdrawal Act (LWA); the WIPP Hazardous Waste Facility Permit (HWFP); the U.S. Environmental Protection Agency’s Compliance Recertification Decision, the EPA’s approval for polychlorinated biphenyls (PCBs) disposal; and the EPA’s letter of approval of DOE’s RH TRU Waste Characterization Program.

The WAC does not address the subject of waste characterization relating to a determination of whether the waste is hazardous as defined under RCRA, as this determination is made by the site generating the waste, as it is required to comply with generator site’s waste management program. The Waste Analysis Plan (WAP) contained in the WIPP HWFP does, however, provide details of the protocols to be used in determining compliance with the HWFP-required physical and chemical properties of the waste.

Central Characterization Project

In general, for any waste management system, there are two major components: (1) Generator and Treatment Facilities, and (2) Transport, Storage, and Disposal Facilities. The first group produces waste with specific chemical, radiological, and physical characteristics, and develops all of the waste information. The second group uses this information to develop processes that ensure protection of the public, workers, and the environment during transport and disposal operations.

When WIPP first opened, the operating model was that generator site personnel would perform all waste handling and processing operations on their respective sites, including the certification and shipment of TRU waste to WIPP. DOE-CBFO would ensure that generator sites correctly implemented the requirements applicable to TRU waste by conducting audits for both TRU waste certification and shipping activities, with EPA as participants in the audits, and NMED as observers.
It did not take long for DOE to recognize the shortcomings with this approach. Inconsistencies between sites, unfamiliarity with the complex set of requirements contained in the WIPP WAC and the WIPP HWFP, and the difficulty of sharing lessons learned between sites, all pointed to the need for a centralized organization to perform certification and shipping activities. Particularly for sites with small inventories of TRU waste, the certification and shipping infrastructure burden was deemed impractical.

The Central Characterization Project (CCP) was thus established. The intent was to deploy the CCP to a generator site, bringing mobile characterization and shipping equipment, along with necessary certification and shipping personnel. In this fashion, CCP would bring the expertise associated with the WIPP transportation and disposal requirements, and the generator sites would bring the expertise associated with the generation of specific waste streams and performing nuclear operations at a DOE site.

In essence, the CCP acts as a bridge between the generator/treatment facility and the disposal facility. This is the model in use today at nearly every site throughout the DOE complex.

The single largest difficulty with implementation of the CCP has proven to be defining the operating framework for two different DOE offices, with at least two different operating contractors, at the same site, performing similar work on the same task. In order to address this issue, an interface agreement is employed at each site, to define the specific roles and responsibilities for each organization. In summary, CCP activities are overseen by DOE CBFO and EPA, and consist of the activities unique to TRU waste; AK, characterization, certification, and shipping. The generator site activities are overseen by the generator site DOE office, and host state environmental department for mixed waste, and consist of activities associated with operating a DOE nuclear site; nuclear safety, industrial safety and hygiene, radiological controls, emergency management, configuration management, engineering, maintenance, work control, conduct of operations, environmental compliance, etc.

Because this training module is specific to WIPP requirements, it will focus on the CCP activities performed at the generator site and the generator site responsibilities that affect waste disposal.

**CCP Responsibilities**

The CCP is responsible for four primary functions at a generator site:

1. Collecting and compiling all relevant information associated with the waste containers and waste streams, and summarizing this information in a report, a process typically referred to as Acceptable Knowledge (AK);
2. Performing measurements or examinations on each individual waste container, typically referred to as characterization;
3. Certifying each waste container, ensuring conformance to the WIPP waste acceptance criteria, the WIPP HWFP, and the WIPP transportation
requirements, and ensuring all associated documentation is complete, typically referred to as certification;

4. The transuranic shipping operations, including payload selection, assembly, loading, and leak testing of the Type B packages used to transport the waste from the generator site to WIPP.

**AK**

Acceptable Knowledge is defined in detail in Attachment C4 of the WIPP HWFP. AK requires that all relevant, or even potentially relevant, information is gathered, organized, evaluated, compiled, and summarized in a document called the AK Summary Report for each waste stream. This report forms the technical basis for identifying the steps necessary to treat and otherwise process the waste, ultimately ensuring it is acceptable for transport to, and disposal at, the WIPP.

In the process of collecting this information, it is worth noting there are two basic populations of transuranic waste; the first is generally referred to as “legacy” or “retrievably stored” waste, and is comprised of the packaged waste that has been in storage for years, or even decades, since transuranic waste was set aside starting in 1970, well before the WIPP was available. The second is generally referred to as “newly generated” waste, and is comprised of the waste generated by ongoing activities at DOE facilities. For legacy waste, the people that originally generated the waste have usually long since retired, and the organization that generated the waste may no longer exist. AK for this category of waste is largely dependent on historical documents. For newly generated waste, AK is dependent on accurate and timely descriptions of current operations, and is therefore much more dynamic, changing as the operations change.

The AK process is intended to ensure adequate information is collected for both of these populations, and is therefore very prescriptive. The WIPP HWFP requires that all of the following information be included:

- Map of the site with the areas and facilities involved in TRU mixed waste generation, treatment, and storage identified
- Facility mission description as related to TRU mixed waste generation and management (e.g., nuclear weapons research may involve metallurgy, radiochemistry, and nuclear physics operations that result in specific waste streams)
- Description of the operations that generate TRU mixed waste at the site (e.g., plutonium recovery, weapons design, or weapons fabrication)
- Waste identification or categorization schemes used at the facility (e.g., item description codes, content codes)
- Types and quantities of TRU mixed waste generated, including historical generation through future projections
- Correlation of waste streams generated from the same building and process, as appropriate (e.g., sludge, combustibles, metals, and glass)
- Waste certification procedures for retrievably stored and newly generated wastes to be sent to the WIPP facility
• Area(s) and/or building(s) from which the waste stream was or is generated
• Waste stream volume and time period of generation (e.g., 100 standard waste boxes of retrievable stored waste generated from June 1977 through December 1977)
• Waste generating process described for each building (e.g., batch waste stream generated during decommissioning operations of glove boxes), including processes associated with U134 waste generation, if applicable.
• Documentation regarding how the site has historically managed the waste, including the historical regulatory status of the waste (i.e., TRU mixed versus TRU non-mixed waste)
• Process flow diagrams (e.g., a diagram illustrating glove boxes from a specific building to a size reduction facility to a container storage area). In the case of research/development, analytical laboratory waste, or other similar processes where process flow diagrams cannot be created, a description of the waste generating processes, rather than a formal process flow diagram, may be included if this modification is justified and the justification is placed in the auditable record
• Material inputs or other information that identifies the chemical content of the waste stream and the physical waste form (e.g., glove box materials and chemicals handled during glove box operations; events or processes that may have modified the chemical or physical properties of the waste stream after generation; data obtained through visual examination of newly generated waste that later undergoes radiography; information demonstrating neutralization of U134 [hydrofluoric acid] and waste compatibility)
• Procedures for identifying and assigning the physical waste form of the waste
• Procedures for delineating waste streams and assigning Waste Matrix Codes
• Procedures for resolving inconsistencies in acceptable knowledge documentation
• Procedures for visual examination and/or radiography, if applicable
• For newly generated waste, procedures describing process controls used to ensure prohibited items (specified in the WAP, Permit Attachment C) are documented and managed
• Procedures to ensure radiography and visual examination include a list of prohibited items that the operator shall verify are not present in each container (e.g., liquid exceeding TSDF-WAC limits, corrosives, ignitables, reactives, and incompatible wastes)
• Procedures to document how changes to Waste Matrix Codes, waste stream assignment, and associated Environmental Protection Agency (EPA) hazardous waste numbers based on material composition are documented for any waste
• Procedures that ensure the assignment of EPA hazardous waste numbers is appropriate, consistent with RCRA requirements, and considers site historical waste management
• Procedures for estimating waste material parameter weights
• Process design documents (e.g., Title II Design)
• Standard operating procedures that may include a list of raw materials or reagents, a description of the process or experiment generating the waste, and a description of wastes generated and how the wastes are managed at the point of generation
• Preliminary and final safety analysis reports and technical safety requirements
• Waste packaging records
• Test plans or research project reports that describe reagents and other raw materials used in experiments
• Site databases (e.g., chemical inventory database for Superfund Amendments and Reauthorization Act Title III requirements)
• Information from site personnel (e.g., documented interviews)
• Standard industry documents (e.g., vendor information)
• Analytical data relevant to the waste stream, including results from fingerprint analyses, spot checks, routine verification sampling, or other processes that collect information pertinent to the waste stream. This may also include new information which augments required information (e.g., visual examination not performed in compliance with the WAP, radiography screening for prohibited items
• Safety Data Sheets, product labels, or other product package information
• Sampling and analysis data from comparable or surrogate waste streams (e.g., equivalent nonradioactive materials)
• Laboratory notebooks that detail the research processes and raw materials used in an experiment

The CCP AK Experts (AKEs) are responsible to collect, report, and maintain this information, but of course most of it is generated by the host site. As such, adequate, accurate, and timely communication between CCP and the generator site personnel is imperative. It was lack of such communication that caused a major problem at WIPP, as discussed in the lessons learned section of this training module, which lead to the establishment of additional AK requirements. These additional requirements are collectively termed "Enhanced AK", and are detailed in Appendix H to the WIPP WAC.

The Enhanced AK requirements include:
• An Interface Waste Management Documents List (IWMDL). This list identifies a central generator site contact representative, and the generator site plans, procedures, and reports associated with current waste management and packaging operations (e.g., waste management, waste generation, waste treatment, waste packaging, waste repackaging, waste remediation, waste stream delineation, and waste characterization procedures), all of which must be
reviewed before containers are allowed to proceed through characterization activities.

- A Certified Program Enhanced Chemical Compatibility Evaluation. While an evaluation of the chemical content and compatibility within a container has always been part of the AK process, the evaluation has been enhanced to require formal documentation and generation of a chemical compatibility evaluation memo (CCEM) for the waste stream, or sub-population of the waste stream, as needed. The CCEMs are written by CCP AKEs using procedural requirements based on the method described in the 1980 EPA method EPA-600/2-80-076, "A Method for Determining the Compatibility of Hazardous Wastes".

- Basis of Knowledge for Evaluating Oxidizing Chemicals in TRU Waste. Transuranic waste throughout the complex has the potential for some level of oxidizers to be present in the waste, as the use of chemicals such as nitric acid, and the resulting nitrate salts, were common. CBFO has performed a series of evaluations to determine the bounding conditions for the acceptability of these chemicals. Based on these evaluations, CBFO will issue a Basis of Knowledge Document, which will specify when waste with oxidizing chemicals is acceptable as is, or when treatment will be required, along with the treatment that must be performed.

- Certified Program Acceptable Knowledge Assessments. For currently certified waste containers throughout the complex already included in an existing AK Summary Report, a onetime AK assessment will be performed to ensure that the AK documentation relating to the management of potentially reactive, corrosive, ignitable, and incompatible TRU waste materials is adequate, current, and accurately described. Any AK Summary Reports not already approved by CBFO will have this same review incorporated into the approval process.

- AK Briefings. The CCP AKEs will now be required to provide AK briefings to the generator site personnel directly involved with waste generation, characterization, and management activities. The intent of these briefings is to both ensure site personnel are aware of the content and conclusions presented in the AK reports, and to ensure that the description of the waste streams in the AK Summary Reports are complete and accurate.

Characterization

Characterization normally consists of (1) the non-destructive examination of the waste, either through direct visual examination of the waste prior to packaging or repackaging, or real time radiography (e.g., X-ray) if the waste is already packaged; (2) radioassay, to quantify the radiological properties of the waste; and (3) flammable gas concentration or generation rate measurements.
Non-destructive examination is required by both the WIPP WAC, which details the EPA specific requirements, and the WIPP HWFP, which details the NMED specific requirements.

The choice of the non-destructive examination method to use, either VE or RTR, is normally determined based on the characteristics of the waste. RTR offers the advantages of easier examination of solidified waste forms and the ability to examine packaged waste, but it may be limited by high density items within the waste, or the level of image interpretation required. VE offers the advantages of correcting prohibited items or conditions as soon as they are found, and easier segregation of materials of similar densities, but usually requires increased personnel exposure. Either method is acceptable, and it is not uncommon to use both at a given generator site.

Non-destructive examination is performed for several reasons, including to:

- Describe and document waste container contents
- Confirm the absence of prohibited items
  - Observable liquid in excess of limits (limits vary with specific waste components)
  - Sealed containers in excess of 4 liters by volume
  - Unapproved shielding configurations
- Estimate the material parameter weights
- Ensure proper venting
- Identify or estimate the layers of confinement
- Confirm the waste content matches the waste stream description
- Confirm the proper assignment of the waste matrix code
- Correct assignment of hazardous waste numbers, as practical
- Identify packaging configurations (e.g., drum liners)

Radioassay is required by the WIPP WAC, and is the process used to determine the nuclear properties of the waste container, including:

- Fissile content
- Curie content
- Isotopic content
- Decay heat
- Transuranic alpha activity concentration

Flammable gas testing is required by the Type B transport package safety analyses, as during transport, the waste containers are in a sealed environment. To ensure the integrity of the Type B package during any of the plausible accident scenarios, it is necessary to ensure any such gas, which is generated primarily by the radiolytic decomposition of waste materials (e.g., hydrogen liberated from plastics by alpha decay) does not accumulate in high enough concentrations to exceed the lower flammability limits in either the individual waste packages, or the inner volume of the shipping package during transport.
Flammable gas testing is usually performed by sampling each container individually, after thermal equilibrium has been achieved, and processing the sample through a gas chromatograph/mass spectrometer system. However, there are some types of waste where the gas generation rate is temperature dependent. Such waste is tested using specialized equipment that heats the individual waste container and collects all of the off-gassing for measurement, bounding the conditions expected during transport of the containers.

**Certification**

Certification is the process of demonstrating that each waste container conforms to the full set of all WIPP requirements. The data obtained from field activities is verified and validated at two levels; level 1, which is where the personnel collecting and recording the data check each other's work for accuracy and completeness, and level 2, where the Site Project Manager (a specifically designated position within the certification program) performs an independent check.

Once the data associated with several containers from a given waste stream is verified and validated, the certification program prepares a Waste Stream Profile Form (WSPF), which includes a summary of the characterization results, and the relevant information about the waste stream from AK. The WSPF is submitted to the WIPP Operating contractor, who in turn evaluates whether or not the subject waste stream is safe and appropriate for disposal at WIPP.

Following approval of the WSPF, the verified and validated data for containers from the associated waste stream are entered into the WIPP Data System, where additional limit checks are performed by the software.

**The WIPP Operating contractor performs an evaluation of each shipment prior to final approval of that waste to be shipped to WIPP**

**Shipment Preparations**

Shipments are prepared in accordance with the Transuranic Waste Authorized Methods for Payload Control (TRAMPACs) for each of the different types of Type B packages used to ship the waste to WIPP. The TRAMPACs define the allowable contents for the packages, to ensure that even in the event of an accident, the waste remains isolated in the package. As such, there are limits (or prohibitions) associated with the following parameters:

- **Physical components**
  - Types of allowed containers
  - Dunnage
  - Blocking and bracing
  - Weight
- **Radiological properties**
  - Fissile content
  - Curie content
  - Isotopic content
Flammable gases within the waste, specifically hydrogen and methane, usually generated by radiolytic decay of the waste materials, are frequently the limiting parameter in shipping. In general, minimizing the resistance of hydrogen release will maximize the amount of waste that can be shipped. Methods of minimizing the resistance include the use of filter bags within the waste containers, elimination of heat sealed bags, use of larger (or more) filters, and elimination of the inner plastic liner shells or bags.

The CCP Transportation Certification Official coordinates and directs the transportation activities, including determining which waste containers will be included in a given shipment (payload selection), arranging the containers into the proper shipping configurations, such as the shrink wrapping of a 7-pack (payload assembly), marking and labeling, loading the waste container assemblies into the Type B shipping package, performing leak testing of the shipping package, and coordinating activities with the WIPP Central Monitoring Room to release, track, and receive shipments.

The State Police inspect and concur with each shipment prior to release.

The Generator site performs the waste manifesting.

**Generator Site Responsibilities**

*DOE O 435.1 Radioactive Waste Management,* identifies the numerous and comprehensive set of responsibilities for the Generator Sites, along with the associated DOE Orders or Directives. These include all of the programs associated with conducting high hazard nuclear operations at a DOE site. However, relative to transuranic waste management activities, the following set is considered of particular importance.
Planning

Before any waste is actually generated, a systematic and comprehensive review of all waste activities is performed to ensure safety of the public, workers, and environment. The review requires specific consideration of numerous other DOE orders as they apply to waste activities, such as hazard evaluation, conduct of operations, training, oversight, regulatory compliance (RCRA, CERCLA, and TSCA), emergency management, etc.

The results of the review are incorporated into the Facility Authorization Basis Document, or a Radioactive Waste Management Basis Document, and are thus used to construct the waste processing activities.

RCRA Compliance

In most cases, the waste sent to WIPP for disposal consists of mixed waste, meaning it has both radiological and chemical hazardous components. The regulations governing the hazardous chemical components are contained in 40CFR239 through 282, issued as part of the Resource Conservation and Recovery Act (RCRA). The RCRA statute authorizes states to carry out many of the functions of the federal law through their own hazardous waste programs (as well as their state laws) if such programs have been approved by the EPA. As such, RCRA oversight of DOE programs involves primarily the individual state's environmental departments, as well as EPA.

Waste processing activities, including generation, storage, treatment, marking, labeling, inspections, environmental monitoring, and record keeping, may all be governed by a RCRA permit, which is approved and issued by the state environmental department. In this fashion, the state approves the manner in which waste processing activities are conducted.

The state environmental department also conducts audits and inspections, as they deem appropriate, to ensure operations are being conducted in accordance with the permit, and thus protective of both human health and the environment.

The determination of which EPA hazardous waste numbers (HWNs) should be assigned to each waste stream has often been a point of contention between the generator sites and the certification program. Because the WIPP site is exempted from compliance with the Land Disposal Restrictions (LDRs) because of the repository design, the certification program conservatively assigns the HWNs, as there is little to no penalty for being overly conservative. This is not true for the generator sites, in that waste must be treated to mitigate the specific HWNs before waste can be disposed at a site subject to the LDRs. In the past, it has not been uncommon to resolve these differences by applying additional HWNs as the waste leaves the generator site, so that both organizations can assign the HWNs in accordance with their specific requirements. However, in light of the WIPP release event caused by incompatible chemicals within the waste, and the resulting new requirements for chemical compatibility evaluations, this is an area that will require ever greater cooperation between the generator site and the certification program.
Worker Safety

DOE requires contractors, through the federal acquisition process, to establish a Worker Safety and Health Program. From the standpoint of waste processing activities, the program includes requirements to encourage the involvement of workers, identify workplace hazards, evaluate the risk of injury and illness, identify and implement mitigation of hazards, provide worker protection training, and comply with DOE-prescribed worker protection standards.

There are many outputs to this process, depending on both the type of hazard, and the waste management activity. The Documented Safety Analysis (DSA) provides the analysis to protect the public, workers, and environment from the radiological characteristics of the waste. The RCRA permit provides this analysis and protection for the hazardous chemicals regulated under RCRA. Industrial safety and hygiene has numerous programs to analyze and protect against the physical hazards (e.g., weight, respiratory, pressure, temperature, sharps, etc.). The radiological control program provides the analysis and protection relative to occupational exposure. Work control and conduct of operations require a hazard assessment be performed for each specific task, usually referred to as a job hazard analysis (JHA). The JHA is conducted by supervision, subject matter experts, industrial safety and hygiene professionals, and the involved workers, and evaluates each processing activity, identifies the possible hazards, and establishes the controls necessary to protect workers from those hazards.

The above listing is only a summary, and by no means complete, listing of these types of activities required at every DOE site. This series of analyses and the associated protective measures developed are designed to result in a complete bounding of the chemical, radiological, and physical hazards associated with the waste, and therefore serves not just to protect the generator site, but transport and disposal activities as well.

Training

DOE Order 426.2, Personnel Selection, Training, Qualification and Certification Requirements for DOE Nuclear Facilities, requires that each site evaluate each job position, and establish the associated training requirements. The output of this process is usually the Training Implementation Matrix (TIM). The TIM identifies the formal class room training, on the job training, educational, experience and job specific requirements for each position.

For waste processing activities, this will include items such as basic chemistry, including hazards and exothermic reactions; basic nuclear physics, including isotopic content and radiological hazards, expected waste constituents; hazard determinations and documentation methods; marking, labeling, and tracking of waste containers; waste disposal path alternatives; disposal Facility Waste Acceptance Criteria; interface requirements with waste certification program; waste treatment requirements; applicable RCRA/CERCLA/TSCA regulations; complex wide events and lessons learned; procedural requirements for waste processing operations, including change control; spill cleanup and associated waste generation; notification requirements; abnormal conditions and response; and TSRs associated with waste processing activities.
Such training is also mandatory for involved personnel to be able to recognize off-normal conditions, where something is not as expected or planned. Many off-normal conditions may only be easily observed by a small number of individuals, so it is important that all involved personnel be appropriately trained.

Control and Conduct of Waste Management Operations

DOE-O-422.1 Conduct of Operations, provides detailed instructions concerning how all field operations are to be conducted. The major areas include organization and administration, shift routines and operating practices, control area activities, communications, on-shift training, investigation of abnormal events, conditions and trends, notifications, control of equipment, equipment status, lockouts/tagouts, independent verifications, log keeping, turnover, control of interrelated systems, required reading, timely orders, technical procedures, operator aids, and component labeling.

While all of these areas can and will impact waste processing activities, the generation, approval, and change control processes associated with technical procedures tends to have the largest impact, as the technical procedures specify to the workers exactly how waste processing activities are to occur.

The type and quantity of absorbents to add, filter serial numbers, container labeling and marking, torque values, weights, calibrations, secondary waste generated, packaging configurations, etc., are all examples of the information dictated and collected by use of technical procedures.

Waste processing procedures, and the associated records generated, are the primary method of demonstrating compliance with the WIPP waste acceptance criteria. It is thus of vital importance that all waste management activities be conducted in accordance with formal procedures. Simple omissions, such as not verifying that a new waste container is empty prior to loading operations can cause significant issues downstream.

Contractor Assurance System (CAS)

DOE-O 226.1B, Implementation of Department of Energy Oversight Policy, requires contractors to establish a performance assurance system to ensure work is being performed safely, securely, and in compliance with all requirements; risks are being identified and managed; and that the systems of control are effective and efficient.

For waste management activities, the applicable CAS components include management and supervisory assessments of field activities, ensuring that management and supervisory personnel are engaged with, and aware of, all field operations; the collection, tracking, and trending of data, maximizing the chance of correcting issues before they become significant problems; establishment of a robust issues management program, ensuring deficiencies are corrected and corrective actions are effective; establishment of a risk analysis system, ensuring risks have been evaluated and mitigations implemented, and establishment of a continuous improvement program, ensuring lessons learned are communicated, and improvements implemented.
DOE Oversight

DOE-O 226.1B, Implementation of Department of Energy Oversight Policy, requires DOE line management to evaluate contractor and DOE programs and management systems, including site assurance systems, for effectiveness of performance (including compliance with requirements). Such evaluations must be based on the results of operational awareness activities; assessments of facilities, operations, and programs; and assessments of the contractor's assurance system.

For waste management, this requires the DOE line management maintain sufficient technical capability and knowledge of the waste management program, and perform assessments to ensure the compliance, safety, and progress of waste processing activities.

Lessons learned

The following examples illustrate some of the kinds of issues the national transuranic waste program has experienced in the past, along with the program changes implemented to prevent recurrence. They are presented here to highlight the interface between the certification program and generator site personnel, as well as the importance of the actions each perform.

Perhaps the most important aspect of these issues is the fact that most are not indicative of programmatic failures. Relatively minor operational errors can have enormously adverse impacts to WIPP Operations, and the ability of generator sites to dispose of their waste.

INL Transcription Error

During a routine inventory of waste stored at the AMWTP, the production planning manager found a drum that was recorded as having been shipped to WIPP the previous month. Subsequent investigations showed that the drum had been approved to be placed in a Standard Waste Box (SWB) - a type of overpack container - for the shipment, but that another drum had been mistakenly put in the SWB. The drum that was recorded as having been placed in the SWB had not been certified to WIPP program requirements prior to shipment. The container identification number of this drum was 10161094. The container identification number of the drum that should have been overpacked in the SWB was 10106194.

The drum that was shipped to WIPP contained prohibited items in the form of liquid contained within two internal containers, with a total volume of approximately 0.75 cups. Based on the facts that the drum was from a well-defined waste stream which did not contain reactive or ignitable liquids, the small quantity of liquid involved, and the overpacking of the liquid inside a drum, inside an SWB, WIPP proposed leaving the drum emplaced, as it posed no threat to human health or the environment.
This course of action was rejected. Instead, all shipments to WIPP were suspended, except for those enroute; emplacement operations were suspended; a retrieval plan was developed; regulatory approvals were obtained; 36 rows of emplaced waste were relocated to elsewhere within the facility to allow removal of the SWB; the SWB was retrieved and returned to INL.

In short, a transcription error when selecting the drums and placing them inside the SWB resulted in the shipment of a non-certified container.

In response to this event, the following changes were implemented: (1) Certification rows were established to physically separate containers acceptable for shipment from the rest of the waste inventory to minimize the chance of pulling an incorrect container; (2) use of hand held bar code scanners was mandated to reduce or eliminate the chance for transcription error; (3) checks were incorporated into the software for hand held barcode scanners to flag any outstanding non-conforming condition reports.

Throughout the complex, there have been several related events, such as different bar code labels applied to the same waste container, waste containers not labeled prior to loading, waste containers not verified as empty prior to loading, replacement or repair of damaged labels performed incorrectly, and incorrect or missing ties between overpack labels and the internal drum labels. Obviously, ensuring the identity of the waste container is the foundation for all other information, so this operation needs to be performed by written procedure, with independent verifications performed to ensure correct labeling.

**LANL drum certification based on incorrect characterization data**

LANL 55-gallon drum LAS817174 was processed through Real Time Radiography (RTR) in April of 2004; no deficiencies were identified.

The hazardous waste facility permit in place at that time required that a portion of the waste containers processed through RTR must also be processed through Visual Examination (VE), in order to ensure the adequacy of RTR. This drum was selected for VE, and processed in April of 2005. During this examination, liquid in excess of 1% of the waste container volume was identified. This can sometimes occur when the liquid is near the top of an internal container, and therefore not as obvious to the RTR operator. An NCR was issued for this condition, and the drum was tagged and set aside for remediation. The liquid was identified as water, based on the following historical information for containers from this waste stream as well as specific information from this drum:

- The waste form is an aqueous based sludge, where some level of dewatering is expected;
- Similar de-watering conditions have been found in other containers from this waste stream;
- The VE tape shows clear liquid, with the apparent viscosity of water;
The liquid was confined to the inner most layer of confinement, eliminating any external source (e.g., rain water through the filter).

In April of 2008, the drum was mistakenly certified by the CCP as a compliant waste container, based on the RTR process. Because the 55-gallon drum did not meet the WIPP requirements for container integrity, the drum was overpacked with three other drums from the same waste stream, all of which also had container integrity issues, into a Standard Waste Box (SWB). The SWB was then shipped from LANL to the WIPP site on May 20, 2008. It was received at WIPP on May 21, 2008, and emplaced on May 28, 2008.

No NCR tag was noted on the waste container when it was pulled from the inventory to be assembled into the SWB.

WTS became aware of the problem on June 6, 2008, when a routine check of unresolved NCRs identified this drum as emplaced within the repository. CBFO was immediately notified, and we decided to retrieve the SWB and return it to LANL for remediation. It should be noted that the prohibition on liquids is based on the volume of the payload container. Thus, even though the drum was overpacked for container integrity reasons, the overpacking effectively remediated the prohibited condition. The total residual liquid in the 4 drums overpacked into the SWB is approximately 5 to 7 liters, well below the 1% value for the SWB (approximately 18 liters). The decision to retrieve the SWB was based on the fact that the 55-gallon drum was inappropriately certified by the CCP, as an unresolved NCR did exist at the time of certification, and the fact that the SWB was emplaced within an active room.

A similar process was followed as with the previous retrieval (suspension of shipments, recovery plan, regulatory approvals, and relocation of drums necessary to access the SWB), and the SWB was shipped back to LANL for reprocessing. During removal of the individual drums from the SWB, it was confirmed that no NCR tag was present.

As a result of this event, several requirements were changed. First, the NMED modified the permit to apply the liquid limits to the inner most container of waste, to preclude the possibility of overpacking waste just to address excessive liquids. Next, CCP implemented a procedural requirement for an additional NCR check, insuring an independent evaluation of the closure of NCRs applicable to a given container, and initiated a campaign to replace the plastic ties used to attach NCR tags to waste containers with metal cables. Finally, the LANL waste handling operations added instructions to procedures to direct personnel on the corrective actions to be taken when NCR tags were found separated from the associated containers.

LANL organic absorbent used with nitrate salt waste

By far the biggest impact to WIPP operations came from a LANL container which experienced an exothermic reaction after being emplaced in WIPP. The reaction was caused by incompatible materials within the waste container, which were introduced during a treatment and repackaging campaign on a legacy waste stream containing vacuum dried nitrate salts produced during a plutonium recovery operation. The
treatment was intended to blend additional inorganic absorbent material to the waste to address liquids identified during RTR. Instead, a wheat based organic material was added, which ultimately reacted exothermically with the nitrate salts. The reaction was energetic enough to breach the container, and expel a portion of the waste container contents. Sampling probes stationed in the downstream air flow detected the radiological release, and automatically redirected the ventilation system from the normal mode (approximately 350,000 cubic feet of air per minute) to the filtration mode (approximately 60,000 cubic feet of air per minute). Nonetheless, due to the response time and some leakage, some radiological contamination was released to the environment.

The associated DOE's Accident Investigation Board Report concluded the event occurred as a result of a series of miscommunications and omissions, and identified a host of issues that contributed, including:

- The personnel performing the work were inadequately trained, and did not fully appreciate the chemical hazards presented by the operation;
- When they did raise concerns on observed reactions, their concerns were not adequately addressed.
- The procedure specified the incorrect type of absorbent, and was approved and issued without adequate technical input;
- The USQ review process associated with the procedure change also failed to identify the hazard;
- The hazard identification process was inadequate and failed to identify the incompatibility;
- LANL inappropriately determined the nitrated salt waste stream did not need to be categorized as an oxidizer, nor carry the applicable EPA HWN;
- The absorbent material was procured as a commercially available product, and thus bypassed any procurement reviews, specifications, or receipt inspections;
- Oversight at all levels was inadequate;
- The CCP AK report did not accurately reflect the treatment process;
- Failure to comply with the HWF Permits at both WIPP and LANL;

This event, more so than any other event in the history of WIPP, illustrates the integrated nature of waste disposal; all the component parts must work together for the disposal to be performed compliantly. There are many checks and balances throughout the program, designed so that failure of one may be detected and corrected by another. But when several failures occur together, as was the case for this event, the results can be catastrophic.

Numerous changes have occurred as a result of this event, including all of the Enhanced AK requirements previously discussed, and the implementation of Generator Site Technical Reviews (GSTR) program.
Radiological contamination found inside TRUPACT-II during unloading

When shipments are received at WIPP, they are unloaded within the Waste Handling Building. One of the precautions taken is a sample of the air within the interior of the package to ensure no airborne radiological contamination, before the package lid is removed. On an incoming shipment from INL, one such sample did indicate an airborne contamination situation inside the package. The affected TRUPACT-II container was returned to INL for resolution. Special arrangements had to be made to develop a location where the package lid could be removed in a controlled environment. Once opened, radiological contamination was found, and the source determined to be a drum lid ring that was not properly secured.

As a result of this event, the drum lid ring torquing operation is signed by both the performer and an observer, and the calibration of the torque wrench is verified and recorded.

7-packs of CH drums exceeding RH limits/items shifting during transport

Another check performed during receipt is to measure the dose rate at the surface of the waste containers to ensure they comply with the 200 mR/hr limit for Contact Handled (CH) waste. Most of the time, these measurements are well below the limit, but there have been instances where the 200 was exceeded on 7-packs of drums. When this first occurred, the concern was that at least one of the drums within the 7-pack should have been characterized and certified as Remote Handled TRU waste, the requirements of which are significantly different from CH. In all cases thus far, however, the instances where the dose exceeded 200 have been traced back to the fact that a 7-pack of drums containing 2 or more drums that are close, but under the limit, can result in a dose measurement for the assembly that exceeds the limit. In these cases, it is vitally important to have complete and accurate surveys of the component drums.

It should be noted that it is possible for items to shift during transport. It was common practice, in the earlier timeframes in which some of the legacy waste was packaged, to place the most radioactive items in the middle of the waste container, and use the other waste materials as shielding, as this could effectively reduce personnel exposure. From a transuranic waste disposal perspective, however, this is not an acceptable practice, as it could result in RH waste arriving at WIPP, having been certified as CH waste. Because WIPP does not have a facility to open and correct waste container contents, the response to this type of situation is difficult, as shipping the waste back to the generator site may be problematic.

For this reason, as CH transuranic waste is repackaged (or initially packaged) at a generator site, the WIPP requirements dictate that the highest dose materials be placed within the container next to the outer surface.