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ESHID-603311

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Symbol: EPC-DO: 18-417
Locates No: Not Applicable
Date: NOV 28 2018

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

Subject: Transmittal of 2018 Hazardous Waste Minimization Report, Los Alamos National Laboratory Hazardous Waste Facility Permit

Dear Mr. Kieling:

This letter transmits a report required by Permit Section 2.9, *Waste Minimization Program*, of the Los Alamos National Laboratory (LANL) Hazardous Waste Facility Permit (the Permit). The Permit authorizes the U.S. Department of Energy (DOE); Triad National Security, LLC (Triad); and Newport News Nuclear BWXT-Los Alamos, LLC (N3B) to manage, store, and treat hazardous waste at LANL. The waste minimization report is submitted annually to the New Mexico Environment Department-Hazardous Waste Bureau (NMED-HWB) by December 1 for the previous fiscal year (FY) ending September 30.

Included herein (Enclosures 1 and 2), are reports generated for FY 2018 that were drafted by Triad and N3B, respectively. Each enclosure also contains a signed certification from the responsible Co-Permittees.

If you have questions or comments concerning this submittal for Triad, please contact Karen E. Armijo of the DOE- National Nuclear Security Administration Los Alamos Field Office (NA-LA) at (505) 665-7314 or Terence Foecke (Triad) at (505) 665-9822.

If you have questions or comments concerning this submittal for N3B, please contact David Rhodes of the DOE- Environmental Management Los Alamos Field Office (EM-LA) at (505) 665-5325 or Frazer Lockhart (N3B) at (505) 257-8049.

Sincerely,

Enrique Torres
Division Leader

ET/TLF/PMM:lrvh

Enclosure (s): 1) 2018 Los Alamos National Laboratory Hazardous Waste Minimization Report – LA-UR-18-30332
2) 2018 Hazardous Waste Minimization at Los Alamos National Laboratory for Newport News Nuclear BWXT - Los Alamos, LLC

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Division Leader

ENCLOSURE 1

2018 Los Alamos National Laboratory Hazardous Waste Minimization Report

EPC-DO: 18-417

LA-UR-18-30332

NOV 2 8 2018

Date: ______________________________

LA-UR-18-30332
Approved for public release; distribution is unlimited.

November 2018

Title: 2018 Los Alamos National Laboratory Hazardous Waste Minimization Report

Author(s): Environmental Protection Division

Intended for: New Mexico Environment Department

Los Alamos
NATIONAL LABORATORY
EST. 1943

Document: Hazardous Waste Minimization Report
Date: November 30, 2018

CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Michael W. Hazen
Associate Laboratory Director
Environment, Safety, Health & Quality & Safeguards & Security
Triad on behalf of U.S. Department of Energy
Los Alamos National Laboratory
Operator

28 Nov 2018
Date Signed

Peter Maggiore for
Karen E. Armijo
Permitting and Compliance Program Manager
National Nuclear Security Administration
U.S. Department of Energy
Owner/Operator

11/28/18
Date Signed

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List of Acronyms

ADEM	Associate Directorate of Environmental Management
ESHQSS	Environment, Safety, Health, Quality, and Safety Services
CFR	Code of Federal Regulations
CMR	Chemistry and Metallurgy Research facility
CRWSSDR	consolidated remote waste storage site disposal request
CWDR	chemical waste disposal request
D&D	decontamination and demolition
DOE-EM	US Department of Energy – Environmental Management
EMS	Environmental Management System
EPC-ES	Environmental Stewardship Group
EP-CAP	Corrective Actions Projects
EPA	Environmental Protection Agency
ESH	Environment, Safety, and Health Directorate
FY	fiscal year
GIC	Green is Clean
ISO	International Organization of Standardization
LANL	Los Alamos National Laboratory
LANS	Los Alamos National Security, LLC
LANSCE	Los Alamos Neutron Science Center
LED	light-emitting diode
LLW	low-level waste
MDA	Material Disposal Area
MLLW	mixed low-level waste
MTRU	mixed transuranic waste
NMED	New Mexico Environment Department
NNSA	National Nuclear Security Administration
NPDES	National Pollutant Discharge Elimination System
PCB	polychlorinated biphenyls
P2	Pollution Prevention (program)
R&D	Research and Development
RCA	radiological control area
RCRA	Resource Conservation and Recovery Act
RLUOB	Radiological Laboratory/Utility/Office Building
RLWTF	Radioactive Liquid Waste Treatment Facility
TA	technical area
TRU	transuranic
TSDF	treatment, storage, and disposal facility
TWSR	TRU waste storage request
URWSSDR	universal remote waste storage site disposal request
WCATS	Waste Compliance and Tracking System
WIPP	Waste Isolation Pilot Plant
WPF	Waste Profile Form

1.0 Hazardous Waste Minimization Report

1.1 Introduction

Waste minimization and pollution prevention are goals for Los Alamos National Laboratory (LANL or the Laboratory) and are included in the operating procedures of Triad National Security, LLC (Triad) and include the operating procedures of Los Alamos National Security, LLC (LANS) before November 1, 2018. The US Department of Energy (DOE)/NNSA and Triad are required to submit an annual hazardous waste minimization report to the New Mexico Environment Department (NMED) in accordance with the Los Alamos National Laboratory (LANL) Hazardous Waste Facility Permit. The following report was prepared pursuant to the requirements of Section 2.9 of the LANL Hazardous Waste Facility Permit and consists of information during LANS operational control of the facility. This report describes the hazardous waste minimization program for LANL, which is implemented by the Environmental Protection and Compliance (EPC) Division and the Pollution Prevention (P2) program.

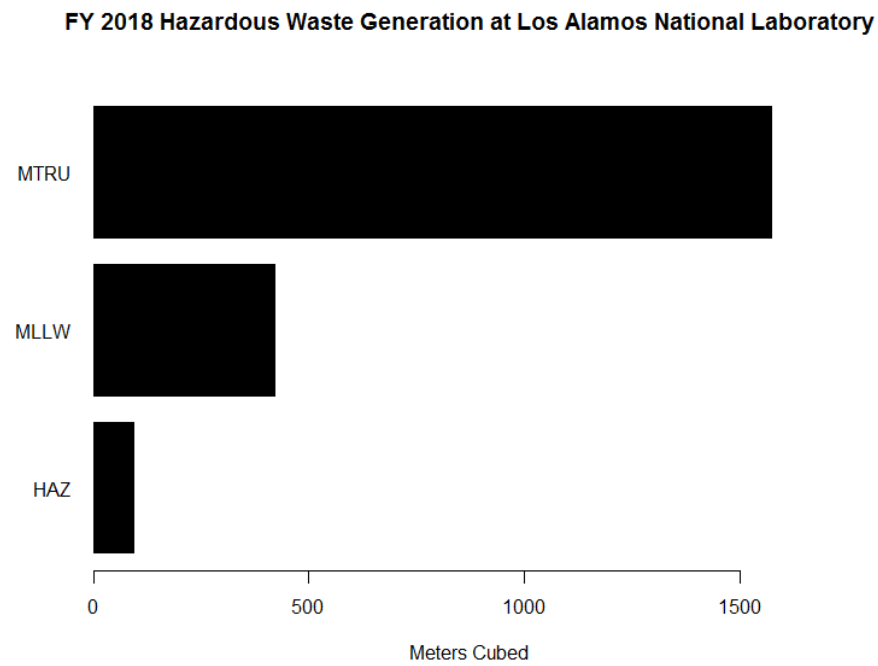
LANS was active in fiscal year (FY) 2018 (October 1, 2017 - September 30, 2018) in waste minimization efforts. Several projects, summarized later in this report, targeted minimization of hazardous waste. In FY 2018, debris from repackaging activities of legacy radioactive waste was a significant component of LANL's mixed-transuranic waste (MTRU) and mixed low-level waste (MLLW). More non-remediation hazardous waste was generated in FY 2018 than in FY 2017 due to increased amounts of lamp/bulb and unused/unspent chemical waste. The Laboratory's waste minimization efforts and analysis of these waste streams are discussed in detail in this report.

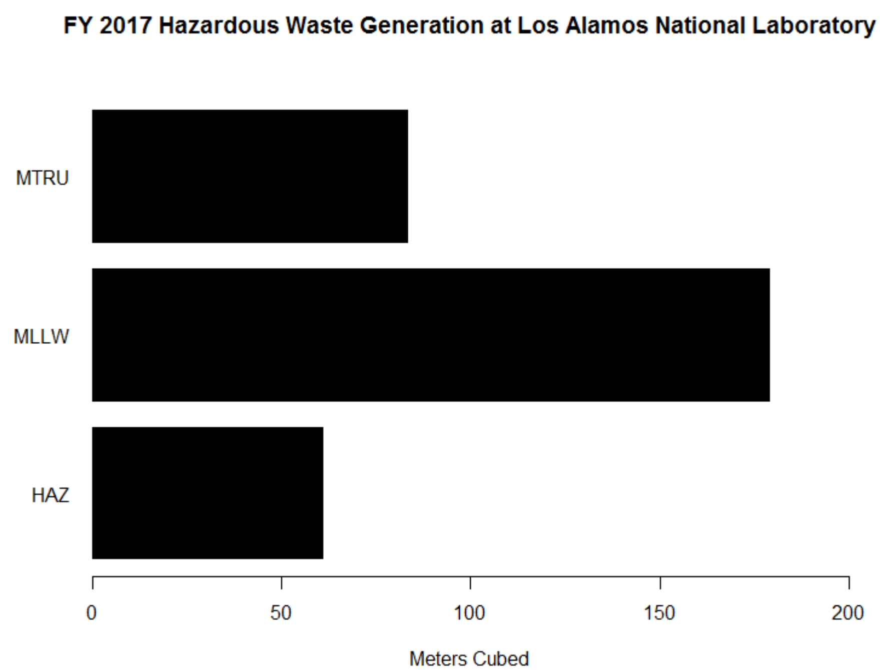
On April 30th, 2018, N3B (Newport News Nuclear BWXT-Los Alamos, LLC) assumed the Consent Order and legacy cleanup responsibilities for DOE-EM (Department of Energy – Environmental Management) at LANL. This new operating company did not ship remediation waste offsite in FY 2018. Therefore, this FY 2018 report includes waste processed and shipped by LANS. DOE-EM and N3B will continue Consent Order activities in FY 2019 and beyond, and these will be incorporated into this report in the future.

1.2 Purpose and Scope

The purpose of this report is to describe the waste minimization program that LANL has implemented and maintained to reduce the volume and toxicity of hazardous wastes generated to minimize potential threats to human health and the environment. This report discusses the main components of hazardous waste, MTRU, and MLLW for FY 2018 and waste minimization efforts for those wastes. In addition, the report documents FY 2018 waste quantities processed in comparison with FY 2017 and waste minimization efforts applied during those years.

Figure 1.1. Hazardous Waste Generation Summary at LANL for FY 2017 and FY 2018





1.3 Requirements of the Operating Permit

As a permitted facility, LANL must fulfill Operating Permit requirements. According to Code of Federal Regulation 40 CFR § 264.73(b)(9), a certification process is required that shows LANL has a plan in place to reduce volumes and toxicity of hazardous waste. LANL certifies through this written document which is submitted annually to the NMED in lieu of the EPA (Environmental Protection Agency).

The list of permit requirements in Table 1.1 corresponds with a section of this report that addresses the requirement. Changes from the previous year are noted throughout this report.

Table 1.1. LANL Hazardous Waste Facility Permit Section 2.9

Permit Requirement	Topic	Report Section
Section 2.9 (1)	Policy Statement	Section 2.1
Section 2.9 (2)	Employee Training and Incentives	Section 2.2
Section 2.9 (3)	Past and Planned Source Reduction and Recycling	Sections 2.4.1, 3.4, 5.3
Section 2.9 (4)	Itemized Capital Expenditures	Section 2.4.1, 3.4
Section 2.9 (5)	Barriers to Implementation	Sections 3.5, 4.3, 5.4, 6.0
Section 2.9 (6)	Investigation of Additional Waste Minimization Efforts	Sections 2.4.1, 3.4, 5.3
Section 2.9 (7)	Waste Stream Flow Charts, Tables, and Analysis	Sections 3.1, 3.2, 3.3, 3.4, 4.2, 5.1, 5.2, 6.0
Section 2.9 (8)	Justification of Waste Generation	Sections 2.3

2.0 Waste Minimization Program Elements

2.1 Governing Policy on Environment

LANL Governing Policy on Environment states:

> *"We are committed to act as stewards of our environment to achieve our mission in accordance with all applicable environmental requirements. We set continual improvement objectives and targets, measure and document our progress, and share our results with our workforce, sponsors, and public. We reduce our environmental risk through legacy cleanup, pollution prevention, and long-term sustainability programs."*

Regulatory drivers of waste minimization include the Resource Conservation and Recovery Act (RCRA), the Pollution Prevention Act of 1990, and the Code of Federal Regulations (CFR), Title 40, Parts 260–280.

2.2 Employee Training and Incentive Programs

Several employee training and incentive programs exist to identify and implement opportunities for recycling, pollution prevention, sustainability, waste minimization, and source reduction of various waste types.

Training courses that address waste minimization and pollution prevention requirements include:

- General Employee Training;

- Waste Generator Overview;
- Radworker II;
- RCRA Personnel Training; and
- EMS Environmental Awareness Training.

The Laboratory, DOE, and NNSA sponsor annual sustainability award competitions. The awards recognize personnel who implement pollution prevention projects. LANL's Biobased Lubricant Transition Project received an Innovative Approach to Sustainability Award from DOE and NNSA. In FY 2018, the P2 Program managed a LANL environmental awards program that emphasized source reduction of all types of waste. The 156 award winners were recognized by senior management with a certificate and a small cash award, which serve as incentives for participation in future years.

2.3 Utilization and Justification for the Use of Hazardous Materials

LANL is a research and development (R&D) facility that executes thousands of experiments requiring the use of chemicals or materials that may create hazardous waste. Pollution prevention and waste minimization requirements for waste generators include source reduction and material substitution techniques through process improvements and best management practices. However, customer requirements, project specifications, validated protocols, or the nature of the research may demand the use of specific chemicals that are hazardous.

To encourage the use of nontoxic or less hazardous substitutes whenever possible, the P2 program staff help LANL worker to identify the least toxic chemicals that have the desired characteristics for his or her particular project using waste process and input alternative analysis.

2.4 Investigation of Additional Waste Minimization and Pollution Prevention Efforts

The Laboratory's P2 program monitors waste trends and works with programs to develop process improvement projects. In addition, the P2 program provides financial analysis support for these projects to better understand the return on investment. Project ideas often come directly from researchers, waste management coordinators, and the P2 program staff. Since project ideas come from different sources with different levels of P2 expertise, the program makes support decisions after a comparative ranking using scoring criteria that emphasize source reduction, return on investment, transferability and waste minimization support of the LANL mission.

2.4.1 Funding for Past Projects

The following paragraphs describe P2 projects and capital funding for the past two years. P2 projects implemented at the Laboratory address all types of waste and pollutants. However, the following list includes projects designed to reduce hazardous waste, MLLW, or MTRU. Projects that address other waste types are not described in this report.

In FY 2017, funds were allocated to the following projects:

- Dissolving Post-Detonation Debris with Ammonium Bifluoride ($85,000)

  This project explored the use of Micro X-ray fluorescence spectrometry (MXRF) as a pre-screening tool prior to sample digestion and the chemistry of ammonium bifluoride (ABF) as a digestion reagent for debris dissolution for nuclear forensic study. This project has the potential to eliminate the use of hydrofluoric acid, an extremely hazardous chemical and related hazardous waste generated by this process.

- Determine if manipulation of water's properties within the supercritical region can induce the precipitation of heavy metals. ($65,000)

  Reducing the total volume and/or the dissolved solids content in LANL's aqueous waste streams could significantly impact recovery, concentration, stabilization, and disposal costs and environmental stewardship. This is true of both the radioactive waste streams and those containing metals of environmental concern (e.g. chromium).

  The initial results reported from project study suggest that a significant reduction in dissolved metal (uranium) could potentially be achieved at high temperatures and low density. Precipitation of most of the radioactive and other hazardous metals from aqueous solution would obviously reduce the burden placed on existing recovery processes (e.g. ion exchange units). If proven viable, the process could also enable the handling of highly concentrated solutions (precipitation should actually be easier to induce in such cases), thus avoiding any need for dilution that increases the volume of the waste stream.

In FY 2018, pollution prevention funds were allocated to the following projects:

- Dissolving Post-Detonation Debris with Ammonium Bifluoride and diluted Nitric Acid ($45,000)

  This project continued exploration of the use of Micro X-ray fluorescence spectrometry (MXRF) as a pre-screening tool prior to sample digestion and the chemistry of ammonium bifluoride (ABF) as a digestion reagent for debris dissolution for nuclear forensic study. In addition to ABF, diluted Nitric Acid will be examined as a digestion reagent. This project has the potential to eliminate the use of hydrofluoric acid, an extremely hazardous chemical and related hazardous waste generated by this process.

- Green Chemistry: Measuring Neptunium without Chemical Reagents ($50,000)

  Neptunium (Np) is an important element in nuclear forensics because it is a by-product of nuclear reactors. This project aims to develop the use of monochromatic wavelength dispersive XRF (MWDXRF), also known as high resolution X-ray (hiRX) for determination of trace Neptunium as a "chronometer" to calculate the age of nuclear materials and "fingerprint" process features. Successful use of hiRX in this application has the potential to 1) eliminate the use of hazardous chemicals; 2) eliminate a mixed radioactive waste stream; and 3) improve worker health and safety by reducing the radiation dose exposure. Extensions of this application are possible to mobile detection and pre-detonation nuclear forensics.

- Solvent Evaporator Purchase for PCB Analysis ($38,000)

  The PCB screening project has developed "in-house" capabilities to understand concentrations and compositions of PCBs in LANL wastewater flows. During the extraction concentration step in PCB sample processing, LANL chemists noticed high amounts of hazardous hexane solvent evaporation and waste generation. After using the Solvent Evaporator, there was a reduced consumption of hexane solvent in addition to a reduction in solvent exhaust. Over a 3 week period of PCB chemical analysis, 2 Liters of hexane was recovered for one reuse as opposed to immediately being disposed of as a hazardous waste. After the second reuse, unfortunately the hexane solvent still gets characterized as a hazardous waste.

- GC x GC HR-TOFMS Instrument Purchase ($250,000)

  This chemical analysis instrument combines two-dimensional gas chromatography with high resolution mass spectrometry. By using this tool, LANL chemists will be able to better understand complex mixtures. Before purchasing it, chemical wastes would be considered hazardous by default. Now with this state of the art instrumentation, those difficult to identify waste streams will be understood and have the potential to be disposed of as non-hazardous waste. Once installed, this instrument will lead to less hazardous waste being shipped offsite by LANL.

3.0 Hazardous Waste

3.1 Introduction

The annual hazardous waste quantity that is reported here is based on the total amount of waste recorded in LANL's Waste Compliance and Tracking System (WCATS) database. Information about specific wastes is searched for in WCATS with waste stream numbers. This report does not include waste quantities generated prior to onsite treatment, which is why waste quantities do not match those reported in LANL's biennial report. Additionally, this report uses fiscal year data, and the biennial report uses calendar year data. The WCATS data used in this report was collected for FY 2018 on Oct 11, 2018.

In brief, 40 CFR §261.3, as adopted by the NMED as 20.4.1.200 NMAC, defines hazardous waste as any solid waste that

- is not specifically excluded from the regulations as hazardous waste;
- is listed in the regulations as a hazardous waste;
- exhibits any of the defined characteristics of hazardous waste (i.e., ignitability, corrosiveness, reactivity, or toxicity);
- is a mixture of solid and hazardous wastes; or
- is a used oil having more than 1000 ppm of total halogens.

3.2 Hazardous Waste Minimization Performance

The amount of non-remediation hazardous waste shipped from LANL in FY 2018 was 93.3 m^3 compared to 61 m^3 of hazardous waste shipped during FY 2017 due to higher amounts of lamp/tube and unused/unspent chemical waste. All of the hazardous waste processed from LANL in FY 2017 and FY 2018 is shown in Table 3.1 sorted by the amount of waste originating in each technical area (TA), further sorted for FY 2018 to show the quantity of waste generated from highest to lowest.

Table 3.1. Generation of Hazardous Waste by Technical Area during FY 2017 and FY 2018, FY 2018 ranked by volume

Technical Area	FY 2017 Hazardous Waste (M^3)	FY 2018 Hazardous Waste (M^3)
60	29.13	38.42
03	7.16	20.33
35	2.17	7.09
16	5.64	6.00
46	3.48	5.06
22	2.12	3.13
09	0.28	2.32
53	1.24	2.07
59	0.59	1.54
55	3.12	1.48
72	0	1.32
48	1.2	1.00
15	0.04	0.87
43	0.93	0.60
36	1.78	0.58
40	0.37	0.58
54	0.37	0.17
33	0	0.15
39	0	0.14
03-CMR	0.25	0.12
64	0	0.11
08	0.02	0.09
49	0.11	0.06
50	0.07	0.06
54-L	0.32	0.02
TOTAL	**61**	**93.30**

3.3 Waste Stream Analysis

Hazardous waste commonly generated includes many types of research chemicals, solvents, acids, bases, carcinogens, compressed gases, metals, and other solid waste contaminated with hazardous material. Hazardous waste may include equipment, containers, structures, and other items intended for disposal and that are considered hazardous (e.g., compressed gas cylinders). Some wastewaters that cannot be sent to the sanitary wastewater system or to the high explosives wastewater treatment plant can also qualify as hazardous waste. After material is declared waste, the hazardous waste is characterized, labeled, and collected in appropriate storage areas. The waste is ultimately shipped to offsite Resource and Recovery Act (RCRA) Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDFs) for final treatment or disposal. Some hazardous wastes can be recycled. These include aerosol cans, light bulbs, batteries, mercury, and ferric chloride solution.

The largest non-recyclable hazardous waste streams are described in this section. High explosives waste is treated onsite and is excluded from the analysis.

Unused/Unspent Chemicals. The volume of unused and unspent chemicals varies each year. Researchers are encouraged not to buy more of any chemical than they are certain to need for several months to avoid having any unused amount. Researchers are also encouraged to share chemicals among multiple users when possible.

Solvents. EPA-listed and characteristic solvents and solvent-water mixtures are used widely in research, maintenance, and production operations, especially for cleaning and extraction. Nontoxic replacements for solvents are used whenever possible. New procedures are also adopted, where possible, that either require less solvent than before, or eliminate the need for solvent altogether. However, solvents are still required for many procedures, and solvents persist as a large component of the hazardous waste stream.

Acids and Bases. A variety of strong acids and bases are routinely used in research, testing, and production operations. Over the past decade, the overall volume of hazardous acid and base waste has been reduced mainly by using new procedures that require less acid or base, by recycling acids onsite for internal reuse, and by reusing spent acids and bases as part of established neutralization procedures onsite.

Hazardous Solids. This waste stream includes inert barium simulants used in high explosives research, electronics, contaminated equipment, broken leaded glass, firing site debris, ash, and various solid chemical residues from experiments.

Hazardous Liquids. This waste stream is primarily aqueous, neutral liquids that are generated from a variety of analytical chemistry procedures. This waste stream also includes aqueous waste from chemical synthesis, spent photochemicals, electroplating solutions, refrigerant oil, and ethylene glycol.

Laboratory Trash and Spill Cleanup. Laboratory trash mostly consists of paper towels, pipettes, personal protective equipment, and disposable lab supplies. Rags are used for cleaning parts, equipment, and various spills. Equipment improvements have reduced the number of oil spills from heavy equipment, and new cleaning technologies have eliminated some processes where manual cleaning with rags was required in the past.

FY 2018 Hazardous Waste

The largest component of hazardous waste at LANL in FY 2018 was from fluorescent lamps/tubes, which represents 45.2% of the total (42.136 m^3 out of 93.297 m^3). The waste stream number in WCATS is 41435. According to EPA and NMED standards, crushing bulbs is considered treatment and therefore the fluorescent lamps/tube waste is collected whole and packaged in cardboard boxes for disposition.

The second largest component of hazardous waste is unused/unspent chemicals representing 12.3% (11.49 m^3 out of 93.297 m^3) of hazardous waste generation. The waste stream number in WCATS is 42308. The Laboratory is researching unused/unspent chemical management at LANL to identify waste minimization opportunities. One solution could be the development of an on-site chemical pharmacy, which would allow for increased control of chemical purchases, dispensing of chemicals at volumes specific to researcher needs and locations where chemicals could be returned and then dispensed back out. This increased management of chemical purchases and the opportunity for chemical reuse could reduce hazardous waste generation.

Another large component of hazardous waste is spent ferric chloride etchant at 1.8% of the total (1.665 m^3 out of 93.297 m^3). The waste stream number is 41866. This waste stream is produced from rinsing and draining of the etching machine at TA-22. The P2 program is currently working with programs to pursue alternatives that would eliminate this hazardous waste stream.

The remaining hazardous waste generation at LANL consists of 38 m^3 of different wastes and is consistent with the hazardous waste descriptions in section 3.3.

FY 2017 Hazardous Waste

The largest component of hazardous waste at LANL in FY 2017 was from fluorescent lamps/tubes representing 51.36% of the total (31.33 m^3 out of 60.99 m^3). The waste stream number in WCATS is 41435.

The second largest component of hazardous waste is unused/unspent chemicals representing 10.7% of hazardous waste generation (6.56 m^3 out of 60.99 m^3). The waste stream number is 42308.

Another large component of hazardous waste is spent ferric chloride etchant at 3.4% of the total (2.08 m^3 out of 60.99 m^3). The waste stream number is 41866. This waste stream is produced from rinsing and draining of the etching machine at TA-22.

The remaining hazardous waste generation at LANL is 21.02 m^3 of different wastes and is represented by the hazardous waste descriptions in section 3.3.

3.4 Hazardous Waste Minimization and Operational Funding

Starting in FY 2011, special recycling operations were established in TA-60-86 at LANL. Spent bulbs, aerosol cans, and batteries are collected from various sites and brought to TA-60 for empty aerosol cans to be punctured, used bulbs to be packaged together, and batteries to be packaged all for recycling. Consolidating these operations at one location is cost effective and maximizes recycling potential. In regards to lead acid battery recycling, this component of the recycling waste stream is managed by salvage at LANL.

Table 3.2. Universal Waste Recycled at LANL in FY 2017 and FY 2018

Universal Waste Type	FY 2017	FY 2018
aerosol cans (m^3)	1.3249	2.0860
lamps/bulbs/tubes (m^3)	32.1584	43.0215
batteries (m^3)	0.1325	0.2546
Total Volume (m^3)	33.6157	45.3618
Total Cost ($)	**10054.4698**	**13567.7274**

Total Cost in Table 3.2 is based on recycle invoice dollar amount and volume of shipment on invoice. The invoice payment is $4,802.35. The volume of the material on the invoice is 16.0557 m^3. Therefore the unit cost is $4,802.35 divided by 16.0557 m^3 = $299.1/ m^3. This unit cost number is then multiplied by FY 2017 and FY 2018 Total Volume (m^3) to get the Total Cost for each year.

Solvent Waste Reduction and Recycling

At LANL, there have been many projects implemented to reduce the use of solvents because they are a common component of the hazardous waste stream; some of these are described below.

- Two laboratories in LANL's Bioscience Division installed solvent recovery systems for acetonitrile in high performance liquid chromatography waste. These systems prevent the generation of about 0.4 m^3 of hazardous waste solvents per week.

- In FY 2018, P2 funding allowed for the purchase of a GC x GC HR-TOFMS (Two-Dimensional Gas Chromatography with Time-of-Flight Mass Spectrometer) instrument that allows LANL chemists to characterize complex mixtures. Without the proper instrumentation, chemical waste streams would be disposed of as hazardous waste by default. With the GC x CG HR-TOFMS, these complex mixtures will be understood. Therefore, this instrument has the potential to reduce LANL's hazardous waste stream by characterizing complex mixtures as non-hazardous waste.

- In FY 2018, P2 funding was used to purchase a solvent evaporator to reduce hazardous hexane solvent exhaust and to be able to reuse captured hexane solvent for one reuse when processing wastewater samples. With the possibility of having "in-house" PCB analysis for compliance sampling, the solvent evaporator will reduce consumption of the hazardous hexane solvent per PCB sample processed. For FY 2019, data on hazardous dichloromethane, a solvent used for the extraction of wastewater, will be collected to determine if the solvent evaporator reduces dichloromethane exhaust and consumption per PCB sample processed.

Acids and Bases Reduction

- In the field of nuclear forensics, there is potential to reduce hazardous hydrochloric acid as a waste stream. One of the biggest challenges is post-detonation debris solubulization. Debris generated after detonation is a glassy material that is difficult to dissolve with chemicals. Traditionally, corrosive acids such as nitric acid, hydrofluoric acid, and sulfuric acid, in the most concentrated form, are employed during the dissolution. Often times, the complete dissolution is not warranted. These acids, due to their corrosive nature, are not suitable for in-field/on-site sample preparation operations. The high concentration of the acids exceeds the Lab waste acceptance criteria (WAC) for discharge to the Radiological Liquid Waste Treatment Facility (RLWTF) from the Chemistry and Metallurgy Research facility (CMR) and the Radiological Laboratory/Utility/Office Building (RLUOB).

  Scientists in Actinide Analytical Chemistry have been testing a chemical called ammonium bifluoride (ABF, NH_4HF_2) for its potential application in debris sample preparation. ABF is the active ingredient in car wheel cleaner and can be obtained from ordinary hardware stores. Due to its less hazardous chemical properties, ABF has been used as a replacement for hydrofluoric acid, an extremely hazardous chemical, in industry. Utilizing P2 Program FY 2017 funding, LANL scientists demonstrated that glass materials (NIST certified reference material) can be digested when mixed with ABF solid powder and heated at 125^{o}C for a couple of hours. The pellet formed can also be completely dissolved in 20% nitric acid. Identification and quantification of actinide isotopes and trace metals provide valuable nuclear forensic signatures in the post-detonation debris. But more trace elements and more isotopes need to be evaluated; hence, in FY 2018 the same project's scope was extended to analyze a larger pool of trace elements/isotopes that are of interest to nuclear forensic studies. As a larger pool of trace elements/isotopes are evaluated for ABF digestion, there is potential for more hazardous acid waste to be reduced.

Unused/Unspent Chemical Waste Reduction

Unused/Unspent chemicals is a large component of LANL's hazardous waste stream. Due to this, the P2 program has been looking into how Unused/Unspent chemicals are managed at LANL from the purchasing side to the disposal side. In FY 2019, the P2 program will develop a clear strategy to reduce hazardous waste generated as unused/unspent chemicals. One solution could be the development of an on-site chemical pharmacy allowing for tighter control of chemical purchases, dispensing of chemicals at volumes specific to researcher needs, as well as a location for chemicals to be returned and then dispensed back out. This increased management of chemical purchases, and the associated opportunity for chemical reuse could reduce hazardous waste generation.

3.5 Barriers to Hazardous Waste Minimization

LANL has a long history of successful waste minimization. However, the next stage of waste minimization will require more research, more investment and more time to accomplish than past efforts. This is because the remaining hazardous wastes, if they are to be minimized, will require changes to core processes rather than support processes, always a difficult undertaking in a research and laboratory environment. In the future, every waste minimization project will be unique and require innovation to enhance LANL's mission and that will require researcher engagement. Early integration of P2 strategies into program and project design and lifecycle planning is LANL's approach going forward.

4.0 Mixed Transuranic Waste

4.1 Introduction

Activities associated with legacy radioactive waste repackaging was the primary MTRU source in FY 2018. As of FY 2016, there were over 5,000 legacy waste containers at TA-54 Area G (2,400 transuranic waste containers). The majority of these containers were generated in the 1970's, 1980's and early 1990's, which is, in some cases prior to RCRA, and in all cases prior to the implementation of a strong waste profiling program at LANL. In the mid 1990's, LANL implemented a requirement that a Waste Profile be developed for all waste generated, to comply with RCRA requirements.

LANL generated 1,572.45 m^3 of MTRU in FY 2018. DOE-EM took ownership of TA-54 in May 2018 and N3B became responsible for legacy MTRU disposition in May 2018 but did not ship waste in FY 2018. In FY 2019, N3B will resume MTRU waste disposal shipments.

4.2 Waste Stream Analysis

Legacy Waste

To categorize the legacy waste at TA-54 Area G, new waste profiles were created. These are:

- Remediated Nitrate Salts Mixed Inorganics
- Mixed Inorganic Waste from TA-55
- Cemented Waste (with liquids and PIDs) from TA-55
- Cemented Waste from TA-55
- Mixed Heterogeneous Debris Waste
- Mixed Heterogeneous Debris Waste with PIDs
- Cemented Waste from TA-50 (Rad Liquid Waste)
- Sludge Waste from TA-50 (Rad Liquid Waste)
- Mixed Inorganics from TA-55
- Cemented Waste from CMR

Table 4.1. MTRU Summary

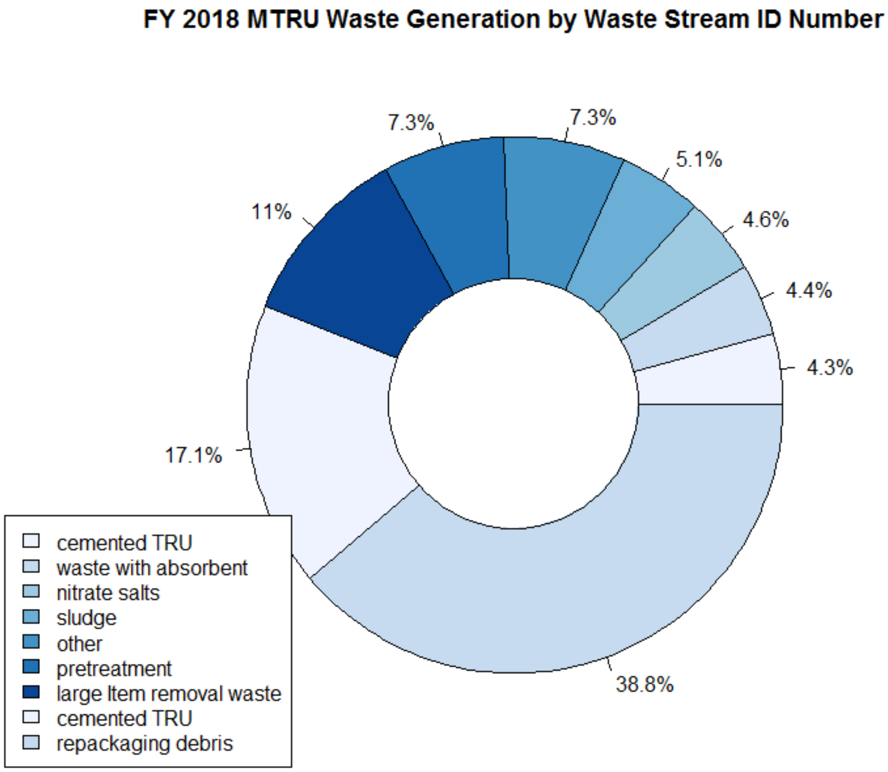
Year	Volume (m^3)	Generation	Waste Minimization	Projects	Projected Reductions
FY 2018	1572.45	Legacy MTRU repackaging; Debris from repackaging	None	None	NA
FY 2017	83.3	Debris from repackaging; Waste characterization changes from repackaging	None	None	NA

Table 4.2. Constituents of MTRU in FY 2018

Waste Stream Number	Volume m^3	% Total	Waste Description
42617	610.6	38.8%	heterogeneous debris waste from repackaging
42272	269.5	17.1%	inorganic homogeneous solid waste (cemented TRU)
43143	173.7	11.0%	large item removal wastes
42614	115.2	7.3%	homogeneous cemented inorganics from pretreatment
42618	79.8	5.1%	homogeneous dewatered sludge
42333	72.4	4.6%	inorganic particulate waste from remediated nitrate salts
42136	68.5	4.4%	inoganic particulate with absorbent generated at TA-55
42134	67.5	4.3%	inorganic homogeneous solid waste (cemented TRU) at TA-55

The waste profiles above represent 93% of MTRU by volume. The remaining 7% of MTRU consists of 11 waste stream profiles (from the Waste Characterization and Tracking System (WCATS)) and are not as prominent of a MTRU source by volume.

Figure 4.1. Constituents of MTRU in FY 2018



The “other” section represent 7% of MTRU by volume and consist of 11 waste stream profiles.

4.3 Barriers to MTRU Waste Minimization

A majority of MTRU generation at LANL consists of legacy waste which is already generated and cannot be minimized in an efficient and cost effective manner. In fact, legacy waste disposal is increasing waste volumes since historical parent containers are being repackaged into daughter containers (for example, one parent container can turn into two or three daughter containers). This will increase the number of drums being shipped for disposal. It will also lead to more debris waste from the repackaging activities.

5.0 Mixed Low-Level Waste

5.1 Introduction

A significant component of the MLLW stream in FY 2018 was debris from repackaging of legacy waste containers. As of January 2016, there were over 2,600 low-level waste (LLW) and MLLW legacy waste drums. During repackaging of legacy waste containers into daughter drums, debris waste is generated and characterized as MLLW. In some instances, debris from repackaging activities can be reclassified from MTRU to MLLW.

Table 5.1. MLLW by Location during FY 2017 and FY 2018

Technical Area	FY 2017 MLLW (m^3)	FY 2018 MLLW (m^3)
54-G	111.5	196.5
50	0.4	78.7
55	30.4	71.1
03	1.8	20.2
50-WCRRF	0.0	13.4
48	3.3	8.3
53	29.1	8.3
55-PF4	0.0	7.4
54-L	0.0	5.7
54	0.0	3.6
35	1.3	2.8
36	0.0	2.5
16	0.0	1.3
21	0.0	0.2
33	0.0	0.2
03-CMR	0.1	0.1
46	0.0	0.1
TOTAL	**178.9**	**420.2**

5.2 Waste Stream Analysis

Table 5.2. MLLW Summary

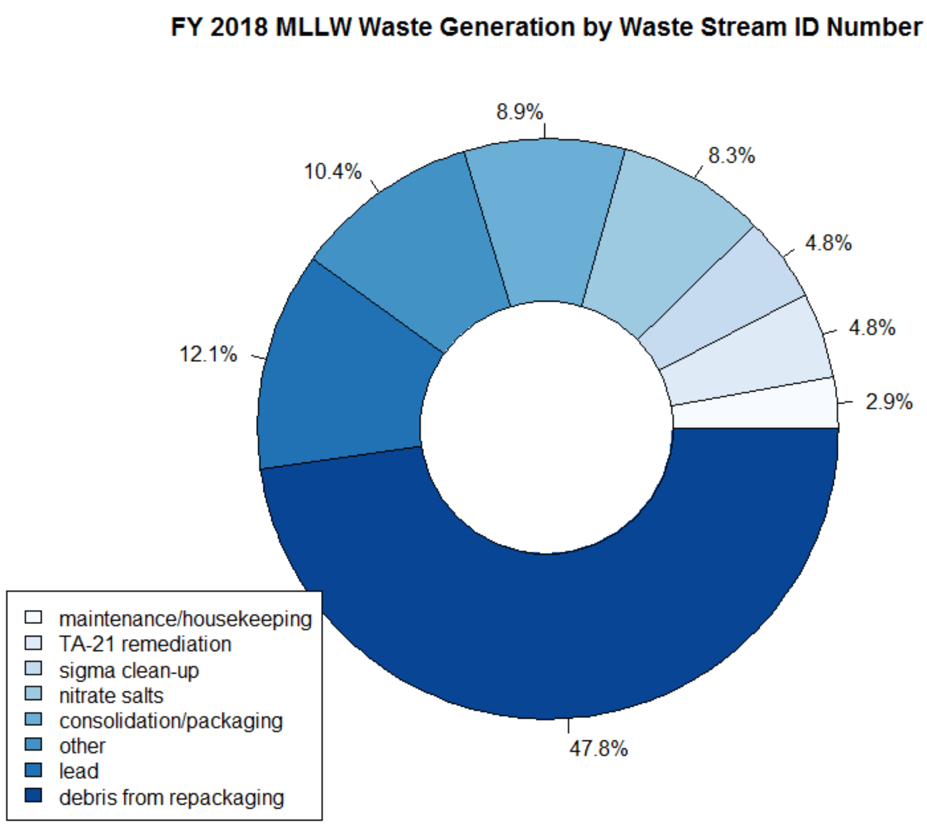
Year	Volume (m^3)	Major Generation Source	Waste Minimization	Projects	Projected Reductions
FY 2018	420.2	Debris from repackaging legacy waste	Difficult to minimize since legacy waste has already been generated	Using XRF to eliminate MLLW in nuclear forensic analysis	NA
FY 2017	178.9	Debris from repackaging legacy waste	Difficult to minimize since legacy waste has already been generated	Replace fluorescent fixtures with LEDS in radiological areas	NA

Table 5.3. Constituents of MLLW in FY 2018

Waste Stream Number	Volume m^3	% Total	Waste Description
42822	200.8	47.8%	heterogeneous debris waste from repackaging
43500	51.0	12.1%	lead solids and lead contaminated materials
35717	37.5	8.9%	consolidation and packaging of MLLW waste
43578	35.0	8.3%	parent containers from remediated nitrate salts activities
45972	20.0	4.8%	cleanup of legacy machinery at Sigma
45281	20.0	4.8%	electric forklift used during TA-21 remediation
44317	12.1	2.9%	routine maintenance and housekeeping

The above table represents 90% by volume of MLLW waste in FY 2018. The other 10% is represented by 40 waste stream numbers and each represents a small percentage of MLLW by volume.

Figure 5.1. Constituents of MLLW in FY 2018



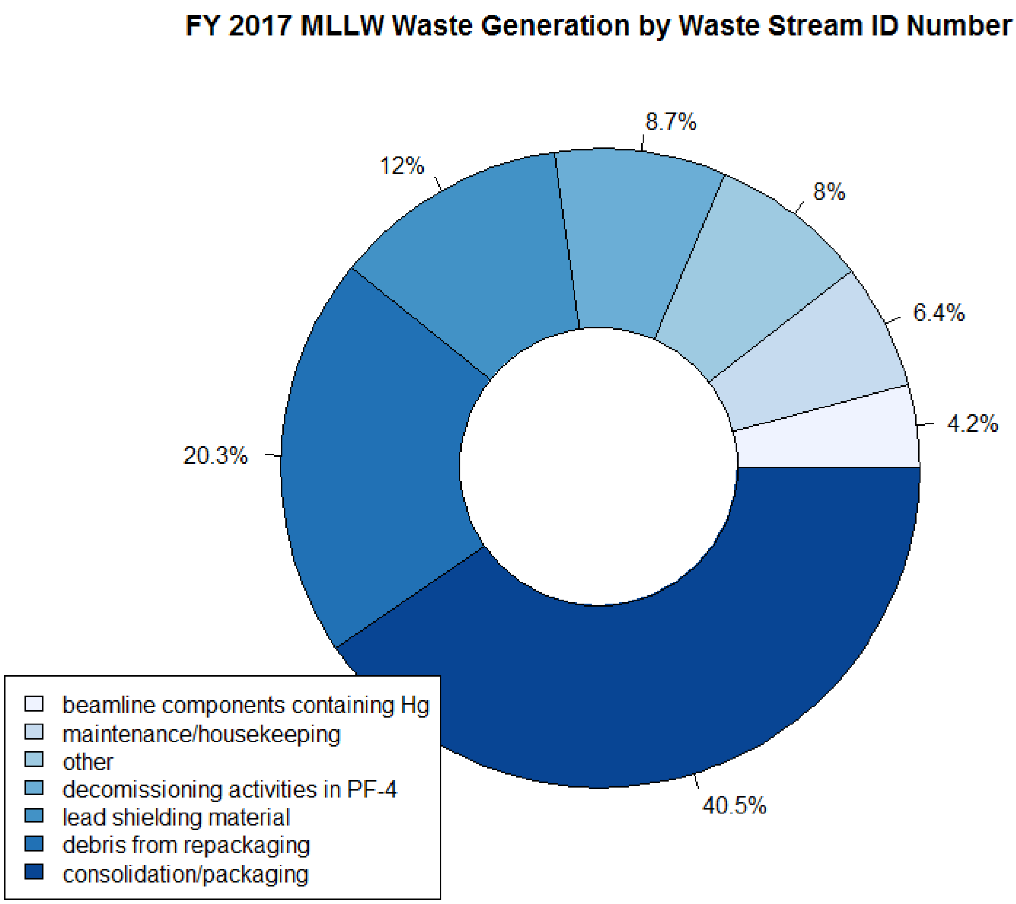
The "other" section represents 10% of MLLW by volume and represents 40 waste stream profiles.

Table 5.4. Constituents of MLLW in FY 2017

Waste Stream Number	Volume m^3	% Total	Waste Description
35717	72.5	40.5%	consolidation/packaging
42822	36.3	20.3%	heterogeneous debris waste from repackagaing
43429	21.4	12.0%	lead lined shielding blocks/shielding material
43330	15.5	8.7%	decommissiong activities in PF-4 319
36573/38355	11.4	6.3%	routine maintenance/housekeeping
43444	7.6	4.3%	LANSCE beamline components/equipment containing mercury

The above waste stream numbers represent 92% of MLLW waste by volume; the remaining 8% of MLLW waste is represented by 28 waste stream numbers and are not as prominent a waste stream source by volume.

Figure 5.2. Constituents of MLLW in FY 2017



The "other" category is represented by 28 waste stream numbers and is not as prominent a waste stream by volume compared to the remaining categories.

5.3 Mixed Low-Level Waste Minimization

LANL is working on projects to reduce MLLW:

- One effort involves replacing traditional fluorescent fixtures with LED fixtures in gloveboxes. The LEDs are much smaller and lighter than fluorescents, and the LEDs last longer, use less electricity, and generate less heat than fluorescents. Since they last longer, they ultimately generate less waste. From FY 2008 through FY 2018, groups at TA-55 and TA-48 purchased more LED lights for gloveboxes, and future plans are to expand use of LED lights in radiological areas across LANL.

- In FY 2018, the P2 program funded a project called "Measuring Neptunium without chemical reagents using X-ray fluorescence spectrometry (XRF)". Neptunium (Np) is an important element in nuclear forensics studies because it is a by-product of nuclear reactors. Because of chain reaction decay, the ratio of Np-237 relative to other isotopes such as Pu-241 and U-233 can be used as a chronometer to calculate the age of the nuclear material and even finger-print the process features. Although such a critical isotope, trace Np determination is difficult. The most commonly used method is radiochemistry alpha spectrometry, but this requires separations including use of ion chromatography columns and organic solvent extractions. Most importantly, the separation protocol uses extremely hazardous chemicals such as hydrofluoric and hydrochloric acids and organic solvent, which result in production of radioactive mixed waste. XRF is a nondestructive elemental analysis method in which characteristic X-ray emissions proportional to the element content in the material are measured after exciting the sample with X-rays. By using the state-of-the-art hiRX technology for Np measurement, this could 1) eliminate the usage of the hazardous chemicals; 2) eliminate a mixed radioactive waste stream; and 3) improve worker's safety by reducing the radiation dose exposure.

  Inductively coupled plasma-mass-spectrometry (ICP) instrumentation is used widely throughout Chemistry division and other organizations throughout LANL. ICP instrumentation is used to detect trace levels of elements in solutions. These analyses are accomplished by a constant flow of solution that can range from a few to tens of milliliters of waste an hour; these instruments are often run constantly during business hours. These solutions often present a mixed waste scenario as they are usually acidic, contain trace levels of hazardous metals, and can often be radioactive given LANL's mission space. If a unique valving system (FAST) is added to the ICP instruments, MLLW waste production can be reduced by at least 50% and sample throughput can be increased by 2-5 times. Expanding this project will be considered in FY 2019.

5.4 Barriers to MLLW Minimization

Since debris from repackaging of historical containers is a large component of the MLLW waste stream, it may be possible to minimize the debris waste from the repackaging activities. However, this is difficult because it would require procedural changes. This process can take multiple years since safety for personnel and efficacy of a new process must be ensured. In addition, the waste minimization change may not be cost effective since the repackaging processes are already in place.

6.0 Remediation Waste

In FY 2018, due to the transition from LANS to N3B, Environmental Remediation (ER) projects were ramped down before April 30, 2018. No hazardous remediation waste was generated at LANL during FY 2018. Interim measure activities of the chromium plume in Mortandad Canyon did occur in FY 2018. However, any hazardous waste generated from this activity would have been sent to a Satellite Accumulation Area (SAA) and not shipped offsite. LANL generated both MTRU and MLLW from activities related to remediation of legacy drums. Since legacy waste containers are being remediated, this will increase the amount of drums being shipped offsite since legacy waste containers are repackaged into daughter drums and the repackaging activities generate a debris waste stream. Waste minimization is difficult in regards to legacy waste since it has already been generated and repackaging of the waste containers is often required prior to shipment for offsite disposal. The primary legacy waste project during FY 2018 was the remediation of the nitrate salt waste stream at LANL.

ENCLOSURE 2

2018 Hazardous Waste Minimization at Los Alamos National Laboratory for Newport News Nuclear BWXT - Los Alamos, LLC

EPC-DO: 18-417

Date: NOV 2 8 2018

November 2018
EM2018-0093

2018 Hazardous Waste Minimization at Los Alamos National Laboratory for Newport News Nuclear BWXT – Los Alamos, LLC

Los Alamos National Laboratory Hazardous Waste Facility Permit

N3B Los Alamos

CERTIFICATION

NEWPORT NEWS NUCLEAR BWXT – LOS ALAMOS, LLC

CERTIFICATION STATEMENT OF AUTHORIZATION

In accordance with the New Mexico Administrative Code Title 20, Chapter 4, Part 1 (incorporating the Code of Federal Regulations, Title 40 CFR § 270.11):

> "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

[signature] 10/31/18

Frazer Lockhart, Program Manager
Regulatory and Stakeholder Interface
Newport News Nuclear BWXT – Los Alamos, LLC

Date

[signature] 10-31-2018

David Rhodes, Director
Office of Quality and Regulatory Compliance
Environmental Management
Los Alamos Field Office

Date

CONTENTS

1.0 HAZARDOUS WASTE MINIMIZATION REPORT

1.1 Introduction

Hazardous waste minimization and pollution prevention are incorporated as much as possible into operating procedures for Newport News Nuclear BWXT – Los Alamos, LLC (N3B) and the U.S. Department of Energy (DOE) Environmental Management Los Alamos Field Office (EM-LA). EM-LA and N3B are required to submit an annual hazardous waste minimization report to the New Mexico Environment Department (NMED) in accordance with the Los Alamos National Laboratory (LANL or the Laboratory) Hazardous Waste Facility Permit, Section 2.9. This report describes the N3B Hazardous Waste Minimization Program, which is a component of the Environmental Management System (EMS), administered by the Environment, Safety, and Health (ES&H) Program. This report also describes pollution prevention goals.

N3B is the contractor selected to support DOE EM-LA's mission work. The Los Alamos Legacy Cleanup Contract encompasses ongoing disposition of above-ground stored legacy transuranic (TRU) waste; groundwater and surface water monitoring and protection programs; groundwater contaminant plume investigation and evaluation for hexavalent chromium and high-explosive contamination; aggregate area investigations and remediation activities; and facility decontamination, decommissioning, and demolition (DD&D) activities.

Fiscal year (FY) 2018 when referred to within this document is from April 30, 2018, through September 30, 2018, because N3B came into existence and became a co-permittee of the LANL Hazardous Waste Facility Permit on April 30, 2018. N3B was not a co-permittee nor in control of any permitted facilities before April 30, 2018.

N3B conducted hazardous waste minimization and pollution prevention efforts in FY 2018. N3B did not ship any hazardous, mixed-transuranic (MTRU), or mixed low-level (MLLW) remediation waste off-site in FY 2018. Additionally, no hazardous waste resulting from remediation was shipped off-site under N3B authority. N3B FY 2018 accomplishments and analysis of the waste streams are discussed in the following sections.

1.2 Background

The 1990 Pollution Prevention Act changed the focus of environmental policy from "end-of-pipe" regulation to source reduction and waste generation minimization. Under the provisions of the Resource Conservation and Recovery Act (RCRA), and in compliance with the Pollution Prevention Act of 1990 and other institutional requirements for treatment, storage, and disposal of wastes, all waste generators must certify that they have a waste minimization program in place.

Specific DOE pollution prevention requirements are found in DOE Order 436.1, Departmental Sustainability. The Order contains greenhouse gas emission reduction goals, energy and water conservation goals, and places a strong emphasis on pollution prevention and sustainable acquisition. DOE Order 436.1 requirements will be executed through N3B's EMS.

1.3 Purpose and Scope

This report describes the Hazardous Waste Minimization Program that N3B is implementing to reduce the volume and toxicity of hazardous wastes generated to minimize the threat to human health and the environment. This report discusses methods and activities employed (or will be employed) to prevent or reduce hazardous waste generation and documents hazardous waste minimization efforts made in the last 5 mo of FY 2018. In most cases, hazardous waste minimization activities that were executed during FY 2018 will continue to occur during FY 2019 and will be developed into a more robust program. This report also discusses N3B's commitment to pollution prevention, pollution prevention efforts, and the barriers to implementation. The report provides waste minimization information by the following waste types: hazardous waste, MTRU, MLLW, and remediation wastes.

1.4 Operating Permit Requirements

Section 2.9 of the LANL Hazardous Waste Facility Permit requires that a waste minimization program be in place and that a certified report be submitted annually to NMED. The list of permit requirements in Table 1-1 corresponds with the section of this report that addresses the requirement. Changes from the previous year are noted throughout this report.

Table 1-1
LANL Hazardous Waste Facility Permit, Section 2.9

Permit Requirement	Item	Report Section
Section 2.9 (l)	Policy Statement	Section 2.1
Section 2.9 (2)	Employee Training and Incentives	Section 2.2
Section 2.9 (3)	Past and Planned Source Reduction and Recycling	Sections 2.4, 3.4, 4.3, 5.3, 6.3, and 6.4
Section 2.9 (4)	Itemized Capital Expenditures	Section 2.5
Section 2.9 (5)	Barriers to Implementation	Sections 3.5, 4.4, 5.4, and 6.5
Section 2.9 (6)	Investigation of Additional Waste Minimization Efforts	Section 2.4
Section 2.9 (7)	Waste Stream Flow Charts, Tables, and Analysis	Sections 3.3, 4.2, 5.2, and 6.2
Section 2.9 (8)	Justification of Waste Generation	Section 2.3

1.5 Organizational Structure and Staff Responsibilities

The Regulatory Compliance group under the Regulatory and Stakeholder Interface Program has primary responsibility and oversight responsibilities for hazardous waste, air, water, and Compliance Order on Consent (Consent Order).

The ES&H Program is developing and managing the EMS, which will include the Pollution Prevention Program. The EMS establishes both institutional waste minimization and pollution prevention objectives and targets and environmental action plans that contain waste minimization, pollution prevention, and other environmental improvement actions.

The Contact-Handled Transuranic Waste (CH-TRU) Program provides all waste packaging, transporting, and disposal services for N3B.

2.0 WASTE MINIMIZATION PROGRAM ELEMENTS

2.1 Governing Policy on Environment

N3B EMS policy N3B-SD400 includes the Pollution Prevention and Site Sustainability Programs. As required by DOE Order 436.1, Departmental Sustainability, the EMS provides the framework for integration of sustainability and pollution prevention goals. N3B is developing their environment goals and governing policy and will include them in the FY 2019 Waste Minimization Report. These goals and governing policy will be fully implemented in FY 2019.

ES&H Environmental Programs/Services is developing a charter for the EMS Integrated Project Team, which will meet in late 2018 to develop environmental objectives and targets for the calendar year 2019. This EMS Integrated Project Team will be composed of professionals from across N3B functional areas in order to ensure that the environmental objectives and targets are integrated across functional areas to cultivate a systematic approach to organizational sustainability initiatives.

2.2 Employee Training and Incentive Programs

N3B is developing training and incentive programs to identify and implement opportunities for waste recycling and source reduction. These programs will be fully implemented in FY 2019.

2.3 Hazardous Materials Use and Justification

N3B is the contractor selected to support DOE EM-LA's mission work. This work encompasses ongoing legacy aboveground stored TRU waste disposition activities, ground and surface water monitoring and protection programs, groundwater contaminant plume investigation and evaluation including for hexavalent chromium and high-explosive contamination, multi-campaign soil investigations and remediation activities including below-grade recoverable/remediation wastes, and facility (DD&D) activities.

The use of hazardous materials will be minimal. The majority of newly generated hazardous wastes will be minimal. The majority of hazardous wastes associated with this contract are investigation/remediation wastes and shipment of existing Federal Facility Consent Order (FFCO) site treatment plan (STP) wastes to final disposition. N3B did not produce or ship any hazardous wastes in FY 2018.

2.4 Investigation of Additional Hazardous Waste Minimization and Pollution Prevention Efforts

N3B is developing procedures and programs that address hazardous waste minimization and pollution prevention efforts throughout the organization. These procedures and programs will be fully implemented in FY 2019.

2.5 Itemized Capital Expenditures

N3B did not produce or ship any hazardous wastes in FY 2018. Capital expenditures for FY 2019 will be tracked and reported next year.

3.0 HAZARDOUS WASTE

3.1 Introduction

Hazardous wastes commonly generated, or may be generated in the future, include solvents, compressed gases, metals, and other solid waste contaminated with hazardous waste. This waste may include equipment, containers, structures, and other items that are intended for disposal and that are contaminated with hazardous waste (e.g., compressed gas cylinders). Potentially generated contaminated wastewaters may be considered hazardous waste. Recycled wastes may include aerosol cans, light bulbs, batteries, and mercury.

3.2 Waste Stream Analysis

Hazardous waste is generated from hazardous materials and chemicals, hazardous materials disposed of as part of equipment replacement or facility decommissioning, and water contaminated with hazardous materials. After material is declared waste, the hazardous waste is characterized, labeled, and collected in appropriate storage areas. The waste is ultimately shipped to off-site treatment, storage, and disposal facilities for final treatment or disposal.

N3B is still developing and implementing its Hazardous Waste Management Program. N3B had not shipped any hazardous wastes in FY 2018; however, N3B anticipates shipping hazardous wastes in FY 2019.

3.3 Hazardous Waste Minimization

During project planning, waste characterization strategy forms (WCSFs) are developed and reviewed by waste management coordinators to either minimize waste or eliminate hazardous materials by replacement with nonhazardous substitutions before project initiation. Per N3B procedure P351, Project Review Process, project proposals are presented to N3B subject matter experts (SMEs) for review before project initiation. SMEs routinely identify opportunities for waste minimization, substitution, and hazardous waste management best management practices. As N3B develops and refines their waste shipments and remediation work, hazardous waste minimization is being incorporated into policies and procedures.

Universal wastes are minimal as N3B offices are leased and light tubes are managed by landlord or management companies. N3B recently began a battery recycling program, allowing N3B employees to recycle their used batteries. Five-gal. recycling bins were placed at four buildings within N3B-controlled areas. The bins are collected on a routine basis and shipped to an appropriate facility for recycling. Rechargeable batteries are used for electronic devices, when feasible.

N3B currently uses and will continue to implement equipment lubricating fluids that are recyclable. N3B plans to use fluids/oils that have already been recycled and will be recycled again at end of life.

Because N3B has been operating for less than 6 mo and is still standing up programs, hazardous waste shipments have not yet occurred.

3.4 Barriers to Hazardous Waste Minimization

Because N3B is a new company, operating for approximately 5 mo in FY 2018. N3B is still developing and implementing its Hazardous Waste Minimization and Pollution Prevention Programs. Current barriers include limited staff availability and limited procurement of services and goods that will assist recycling and waste minimization. Another barrier is that most material generated is radioactive, and therefore goes off-site for disposal as waste without the possibility of reducing volume because of the radioactivity.

N3B developed a WCSF to incorporate the recycling of empty environmental media sample containers returned to the Sample Management Office, which was estimated at around 2000 L per year.N3B was unable to procure (in FY 2018) services that would allow recycling empty containers. N3B anticipates having these services and numbers to report for FY 2019.

4.0 MTRU

4.1 Introduction

MTRU waste contains more than 100 nCi of alpha-emitting TRU isotopes per gram of waste and hazardous waste regulated under RCRA. TRU isotopes (atomic number greater than 92) have half-lives greater than 20 yr. TRU waste does not include (1) high-level waste; (2) waste that DOE has determined, with the concurrence of the U.S. Environmental Protection Agency Administrator, does not need the degree of isolation required by 40 Code of Federal Regulations (CFR) 191; or (3) waste that the U.S. Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR 61.

MTRU waste is generated from research, development, nuclear weapons production, and spent nuclear fuel reprocessing. N3B does not generate these wastes but has taken on these legacy wastes for final disposal. MTRU waste is disposed of at the Waste Isolation Pilot Plant (WIPP), a geologic repository near Carlsbad, New Mexico.

MTRU waste can be liquids, cemented residues, combustible materials, noncombustible materials, and non-actinide metals. Liquid MTRU is a small percentage of total MTRU, and these wastes are primarily organic liquids. MTRU solid waste is packaged for disposal in metal 55-gal. drums, standard waste boxes, and oversized containers, and then is stored before being certified for transport and disposal at WIPP.

Repackaging waste standards for waste acceptance at WIPP change periodically, so when this occurs, some drums of MTRU waste are repackaged to conform to these new packaging standards. The waste inside the drums is old operational waste that is now packaged to meet the new standards. In many years, the majority of the MTRU waste shipped to WIPP comes from repackaging activities.

4.2 Waste Stream Analysis

All MTRU wastes located at Technical Area (TA-54) are legacy wastes and are included in the FFCO STP for ultimate disposal. No new MTRU wastes will be purposefully generated unless through routine management of existing MTRU wastes or environmental remediation wastes, which are discussed in section 6.0 of this report.

4.3 MTRU Minimization

The N3B CH-TRU Program, which manages and ships MLLW and MTRU wastes, has implemented several activities in order to reduce the amount of hazardous waste generated from ongoing operational activities; however, no MTRU minimization programs are in place at this time. The primary function of the CH-TRU Program is MLLW and MTRU management and shipping.

4.4 Barriers to MTRU Minimization

Packaging requirements at WIPP often make minimization efforts difficult. There are wattage and dose limits that must not be exceeded, and a very small volume of MTRU may have a high wattage. Containers sent to WIPP will be 55 gal. or larger, and often the containers have very small volumes of waste inside the overpacks, with the majority of the internal volume being empty space.

5.0 MLLW

5.1 Introduction

For waste to be considered MLLW, it must contain both hazardous and radioactive waste, but not be classified as high-level waste, TRU waste, spent nuclear fuel, or by-product materials such as uranium or thorium mill tailings. Test specimens of fissionable material irradiated only for research and development, not for the production of power or plutonium, may be classified as LLW, provided that the activity of TRU waste elements is <100 nCi/g of waste.

Most of the routine MLLW comes from stockpile stewardship, remediation activities, and from DD&D activities. Most of the nonroutine waste is generated by off-normal events such as spills in legacy-contaminated areas. Typical MLLW items include contaminated debris, old gloveboxes, legacy chemicals, mercury-cleanup waste, electronics, copper solder joints, and used oil.

5.2 Waste Stream Analysis

Materials and equipment are introduced into a radiological controlled area as needed to accomplish specific work activities. In the course of operations, materials may become externally contaminated or become activated, thus becoming MLLW when the item is no longer needed.

MLLW is transferred to a satellite accumulation area after it is generated. Whenever possible, MLLW materials are surveyed to confirm the radiological contamination levels. If decontamination will eliminate the radiological or the hazardous component, materials are decontaminated to prevent them from becoming MLLW.

MLLW is managed in accordance with appropriate waste management and U.S. Department of Transportation requirements. It may be shipped to and stored at on-site <90-day storage areas or permitted storage facilities before transport to off-site commercial or DOE-operated permitted treatment, storage, or disposal facilities.

Reclassification. This waste was formerly classified as MTRU, but as MTRU standards changed, these wastes were reclassified and disposed of as MLLW. Since this waste is already generated, there are not many opportunities for minimization of this component of the MLLW stream.

Lead Debris. This waste stream could include copper pipes with lead solder, lead contaminated equipment, brass contaminated with lead, sheets, rags, circuit boards, cathode ray tubes, and personal protective equipment contaminated with lead from maintenance activities. This waste stream will be generated primarily from remediation campaigns and volumes of this waste stream are expected to decrease as remediation efforts progress.

Trash and Maintenance. This waste stream will be composed of personal protective equipment, dry painting debris, spent light bulbs, and paper towels and rags. This waste stream could also include unwanted equipment that was removed during remediation campaigns.

5.3 MLLW Minimization

MLLW will be generated by cleanup activities and repackaging efforts. The volume of nonroutine MLLW from cleanup and repackaging efforts tends to vary significantly and often cannot be substantially minimized, so it is useful to examine the routine fraction of the MLLW waste stream separately to identify good waste minimization opportunities.

5.4 Barriers to MLLW Minimization

Packaging requirements at final disposition locations often make minimization efforts difficult. Containers sent for final disposition will be 55 gal. or larger, and often the containers have very small volumes of waste inside the overpacks, with the majority of the internal volume being empty space.

6.0 REMEDIATION WASTE

6.1 Introduction

The mission of N3B's corrective actions activities is to investigate and remediate potential releases of contaminants as necessary to protect human health and the environment. These activities are implemented to comply with Consent Order requirements.

In completing this mission, activities may generate large volumes of waste, some of which may require special handling, treatment, storage, and disposal. Because the activities involve investigating and, as necessary, conducting corrective actions at historically contaminated sites, source reduction and material substitution are impossible to implement. The corrective action process, therefore, includes the responsibility and the challenge of minimizing the risk posed by contaminated sites while minimizing the amounts of waste that will require subsequent management or disposal. Minimization is desired because of the high cost of waste management, the limited capacity for on-site or off-site waste treatment, storage, or disposal, and the desire to reduce the associated liability.

6.2 Waste Stream Analysis

This report addresses all RCRA-regulated waste that may be generated by corrective actions while planning and conducting investigations and remediation of contaminant releases. Wastes generated include "primary" and "secondary" waste streams.

Primary waste consists of generated contaminated material or environmental media that was present as a result of past DOE activities, before any containment and restoration activities. It includes contaminated building debris or soil from investigations and remedial activities.

Secondary waste streams consist of materials that were used in the investigative or remedial process and may include investigative-derived waste (e.g., personal protective equipment, sampling waste, drill cuttings); treatment residues (e.g., spent resins and activated carbon from groundwater treatment); wastes resulting from storage or handling operations; and additives used to stabilize waste. The corrective actions may potentially generate hazardous waste, MLLW, and MTRU.

6.3 Remediation Waste Minimization

Waste minimization and pollution prevention are integral parts of planning activities and field projects through recycling, reuse, contamination avoidance, risk-based cleanup strategies, and other practices.

Waste reduction benefits are typically difficult to track and quantify because the data to measure the amount of waste reduced as a direct result of a pollution prevention activity are often not available and are not easily extrapolated. In addition, many waste minimization practices employed during previous years are now incorporated into standard operating procedures.

Techniques used to reduce investigation-related waste streams include the following:

Land application of groundwater extracted during well drilling, development, sampling, and rehabilitation/reconfiguration. Drilling, development, reconfiguration, and purge waters constitute a major potential waste source. This procedure incorporates a decision tree negotiated with NMED, allowing groundwater to be land applied if this will be protective of human health and the environment. Use of this procedure minimizes the amount of purge water that must be managed as wastewater.

The routine sampling of regional and intermediate groundwater wells generates "purge water" that must be containerized and analyzed before land application per the Land Application of Groundwater Decision Tree approved by the NMED Ground Water Quality Bureau. Because of the transition from Los Alamos National Security, LLC to N3B as the prime contractor for the Environmental Management scope, approximately 75 land application data packages and the associated containerized water were close to their expiration dates. This would have resulted in the water having to be shipped off-site as waste, rather than land applied. N3B determined a path forward to reevaluate the land application data packages and recertify that, in almost all cases, the containerized purge water met the requirements for land application.

The formal procedure for land application of drill cuttings. Drill cuttings constitute a major potential source of solid wastes generated. This procedure, which incorporates a decision-tree negotiated with NMED, allows drill cuttings to be land applied if this will be protective of human health and the environment. These drill cuttings do not have to be managed and disposed of as waste. Additionally, land-applied drill cuttings can be beneficially reused as part of drill site restoration.

Integration of the EMS into remediation activities and to improve awareness of the EMS by N3B subcontractors. N3B's EMS is being developed to integrate requirements into the subcontracts and continuing environmental communications through Worker Safety and Security Teams. These activities will increase awareness of waste minimization requirements and opportunities by N3B and its subcontractors.

Sort, decontaminate, and segregate. This technique is designed to segregate contaminated and uncontaminated soils so that uncontaminated soils can be reused as fill. These practices are implemented at sites where contaminated subsurface soils and structures are overlain by uncontaminated soils. During excavation to remove the contaminated soils and structures, the uncontaminated overburden is segregated and staged apart from contaminated materials.

Following removal of the contaminated soils and structures, the overburden is tested to verify that it is nonhazardous and meets residential soil screening levels. If so, this material is used as backfill for the excavation. This practice minimizes the amount of contaminated soil that must be disposed of as waste and also minimizes the amount of backfill that must be imported from off-site.

In an effort to reduce hazardous waste within the TA-21 remediation effort, the field execution team requested soil sampling for all excavated materials for the TA-21-257 demolition project. It is expected that a sampling campaign will proceed as follows.

All soil and tuff, removed from, within, adjacent to, (e.g., from benching and/or sloping to stabilize a trench) or below excavated material shall be placed in piles of no more than ~100 yd^3. Overburden shall be separated from under-burden from those objects to be removed and sampled accordingly.

If the soil and tuff are determined to be suitable for reuse (i.e., is not hazardous waste and meets residential soil screening levels [SSLs] and screening action levels [SALs]), the evacuated environmental media will be segregated from man-made debris, and the soil will be used to backfill the excavations. If the media does not meet residential SSLs/SALs, or are determined to be a hazardous waste, the excavated media will be containerized at the point of generation and stored in a secure, designated waste staging area. Man-made debris that may be present in the excavated material waste stream must be reported for the off-site profile. N3B expects 70% to 75% of soils will be used as backfill, and therefore will not require waste management disposal.

Additionally, five 20-yd^3 roll-off bins of drill cuttings were generated during the chromium project in Mortandad Canyon and staged at TA-21. The drill cuttings were not contaminated other than very low levels of radiation. Rather than ship the drill cuttings off-site as low-level waste, the waste management coordinator identified that the cuttings could be used as fill for remaining space in Pit 38 at TA-54. No waste generating activities occurred at the material disposal areas for the FY 2018 period.

Risk assessment. Risk assessments are routinely conducted for corrective action projects to evaluate the human health and ecological risk associated with a site. The results of the risk assessment may be used by NMED to determine whether corrective measures are needed at a site to protect human health and the environment. The risk assessment may demonstrate that it is adequately protective and appropriate or beneficial to leave waste or contaminated media in place, thus avoiding the generation of waste. Properly designed land-use agreements and risk-based cleanup strategies can provide flexibility to select remedial actions (or other technical activities) that may avoid or reduce the need to excavate or conduct other actions that typically generate high volumes of remediation waste.

A risk-based data evaluation procedure is used to determine whether extent of contamination is defined at sites being investigated under the Consent Order. This approach will result in protection of human health and the environment while requiring fewer samples and generating less investigation-derived waste.

Equipment and material reuse. The reuse of equipment and materials, after proper decontamination to prevent cross contamination, such as plastic gloves, sampling scoops, plastic sheeting, and personal protective equipment produced waste reduction and cost savings.

6.4 Pollution Prevention Planning

The potential to incorporate pollution prevention practices into future activities will be evaluated annually as part of the EMS planning efforts. Actions related to pollution prevention are being incorporated into the EMS. Waste generation, management, and disposition processes are being developed to minimize waste generation and maximize pollution prevention. As appropriate, specific actions and approaches that will be incorporated into planned corrective action projects include

- segregation and recycle or reuse of uncontaminated materials,
- continued use of land application of drill cuttings and fluids,
- waste avoidance,
- reuse and recycling of equipment and materials,

- increasing use of sustainable acquisition strategies, and
- risk-based cleanup strategies.

Additionally, pursuant to the January 2012 Framework Agreement, DOE and NMED have agreed to increase the efficiency of cleanup activities, while maintaining protection of human health and the environment. These increased efficiencies should result in a reduction in sampling activities for future investigations, with a commensurate reduction in investigation-derived waste generation.

To help improve the implementation of waste minimization activities, N3B ensures communication of environmental issues to project participants through the Project Review Process Procedure. Environmental issues are and will continue to be integrated into routine project communications to increase awareness about waste minimization and promote sharing of lessons learned.

6.5 Barriers to Remediation Waste Minimization

The single largest potential source of waste generated by corrective actions is removal of buried waste or contaminated soil during implementation of corrective measures. This has the potential to generate thousands of cubic meters of waste. In evaluating corrective measure alternatives, corrective action program and project leaders generally give preference to alternatives that would avoid generating large volumes of waste, provided they are protective of human health and the environment. The consideration of other factors by external stakeholders, however, may result in selection of an alternative that generates more waste than the alternative recommended.

Cleanup of canyon-side disposal sites in the Los Alamos townsite requires use of specialized equipment that is not easily mobilized. In delineating areas to be remediated, a conservative approach has been used to provide a high likelihood that cleanup levels are reached in order to avoid remobilization.