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Title:	Transmittal of 2019 Hazardous Waste Minimization Report, Los Alamos National Laboratory, EPA ID# NM0890010515
Author(s):	Moss, Philip Michael
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U.S. DEPARTMENT OF ENERGY

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Date: NOV 2 5 2019
Symbol: EPC-DO: 19-400
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Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6313

Dear Sir or Madam:

Subject: Transmittal of 2019 Hazardous Waste Minimization Report, Los Alamos National Laboratory, EPA ID# NM0890010515

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

Enclosures 1 and 2, 2019 Los Alamos National Laboratory Hazardous Waste Minimization Report drafted by Triad and N3B, respectively, satisfy the reporting requirements as outlined in Section 2.9 of the Permit. 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 Department of Energy (NA-LA) at (505) 665-7314 or Jennifer Payne (Triad) at (505) 665-2211. If you have questions or comments concerning this submittal for N3B, please contact Arturo Duran of the Department of Energy - Environmental Management (EM-LA) at (505) 257-7907 or Elizabeth Lowes (N3B) at (505) 309-1134.

Sincerely,

Karen E. Armijo
Permitting and Compliance Manager
National Nuclear Security Administration
Los Alamos Field Office

Sincerely,

Arturo Duran
Environmental Protection Specialist
DOE Environmental Management
Los Alamos Field Office

Enclosure(s): 1) 2019 Los Alamos National Laboratory Hazardous Waste Minimization Report (Triad)
2) 2019 Hazardous Waste Minimization at Los Alamos National Laboratory for Newport News Nuclear BWXT-Los Alamos, LLC (N3B)

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ENCLOSURE 1

2019 Los Alamos National Laboratory Hazardous Waste Minimization Report (Triad)

EPC-DO: 19-400

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Date: NOV 2 5 2019

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November 2019

Title: **2019 Los Alamos National Laboratory Hazardous Waste Minimization Report**

Author(s): **Environmental Protection and Compliance Division**

Intended for: **New Mexico Environment Department**

Document: Hazardous Waste Minimization Report

Date: November 30, 2019

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.

22 November 2019

Jennifer Payne
Division Leader
Environmental Protection and Compliance
Triad on behalf of U.S. Department of Energy
Los Alamos National Laboratory
Operator

Date Signed

22 Nov 2019

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

Date Signed

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List of Acronyms

ABF	ammonium bifluoride
CFR	Code of Federal Regulations
CMR	Chemistry and Metallurgy Research facility
DOE-EM	US Department of Energy – Environmental Management
EPC	Environmental Protection and Compliance
EPA	Environmental Protection Agency
FY	fiscal year
hiRX	high resolution X-ray
LANL	Los Alamos National Laboratory
LED	light-emitting diode
LLW	low-level waste
MLLW	mixed low-level waste
MTRU	mixed transuranic waste
M^3	Cubic meters
NB3	Newport News Nuclear BWXT-Los Alamos, LLC
NMED	New Mexico Environment Department
NNSA	National Nuclear Security Administration
Np	Neptunium
PCB	polychlorinated biphenyls
P2	Pollution Prevention (program)
RCRA	Resource Conservation and Recovery Act
TA	technical area

TRU	transuranic
TRIAD	Triad National Security, LLC
WCATS	Waste Compliance and Tracking System
WCRRF	Waste Characterization, Reduction, and Repackaging Facility
XRF	X-ray fluorescence spectrometry

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). The U.S. Department of Energy (DOE)/National Nuclear Security Administration (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 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 Triad 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.

On April 30th, 2018, Newport News Nuclear BWXT-Los Alamos, LLC (N3B) assumed the Consent Order and legacy cleanup responsibilities for Department of Energy – Environmental Management (DOE-EM) at LANL. This new operating company did not ship remediation waste offsite in fiscal year (FY) 2018. DOE-EM and N3B managed Consent Order activities including remediation waste and legacy cleanup responsibilities after April 30th, 2018 and in FY 2019.

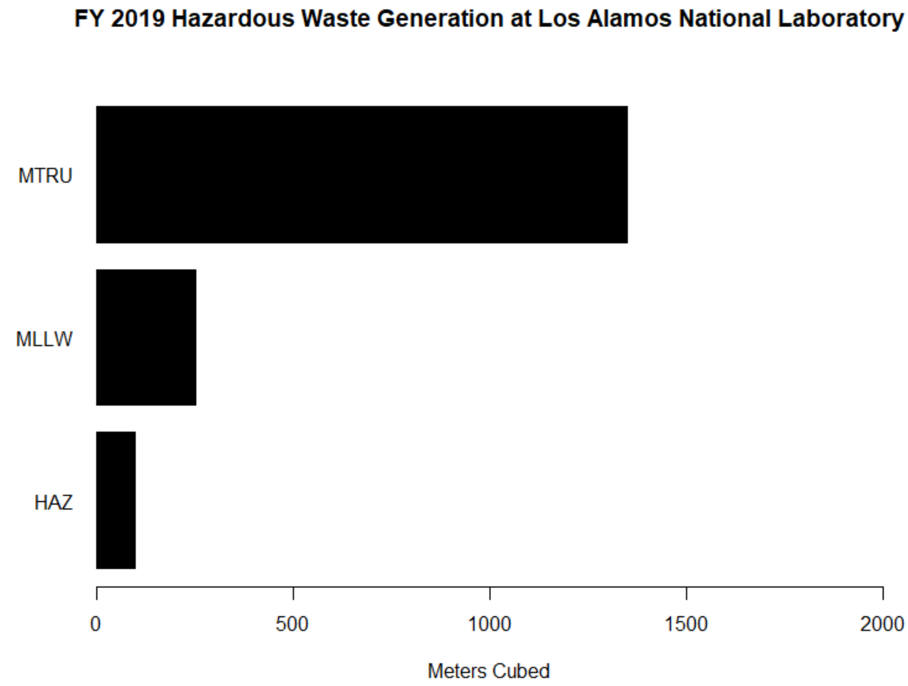
Triad is responsible for current waste (not legacy waste) generated at the Laboratory from areas such as the Chemistry and Metallurgy Research Facility (CMR) and the Plutonium Facility at Technical Area 55; these waste streams can include hazardous waste, mixed-transuranic waste (MTRU) and mixed low-level waste (MLLW). Triad is also the owner of some legacy waste containers, but those containers are managed by N3B.

Projects, summarized later in this report, targeted minimization of hazardous waste. In FY 2019, debris from repackaging activities of legacy radioactive waste was a significant component of LANL's MTRU and MLLW. Similar amounts of hazardous waste was generated in FY 2018 and FY 2019 due to lamp/bulb and unused/unspent chemical wastes. The Laboratory's waste minimization efforts and analysis of these waste streams are discussed in detail in this report.

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 2019, and waste minimization efforts for those wastes. In addition, the report documents FY 2019 waste quantities processed in comparison with FY 2018 and waste minimization efforts applied during those years.

Figure 1. Hazardous Waste Generation Summary at LANL for FY 2019



1.3 Requirements of LANL's Hazardous Waste Facility 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 Environmental Protection Agency (EPA).

The list of permit requirements in Table 1 corresponds with a report section of this report that addresses the requirement.

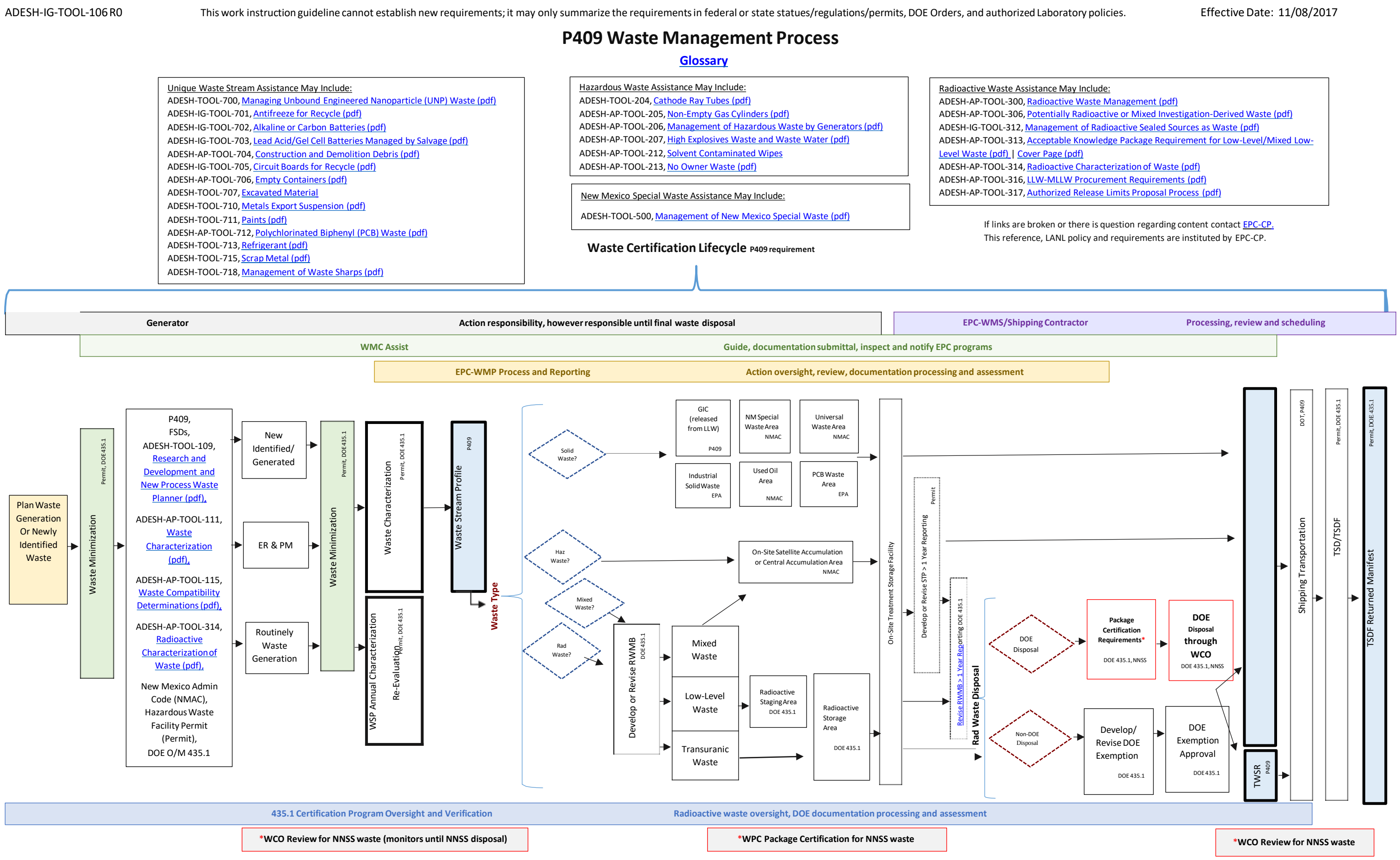
Table 1. LANL Hazardous Waste Facility Permit Section 2.9

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

Permit Requirement	Topic	Report Section
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

The governing document for waste management at the Laboratory is P409. The below Figure 2 provides a flow chart of the waste management process. Due to the large amount of information provided in the chart, increase the zoom level to 250% or higher for better resolution.

Figure 2. P409 Waste Management Process



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, the Code of Federal Regulations (CFR), Title 40, Parts 260–280, and the ISO 14001 Standard for the Laboratory's Environmental Management System.

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
- LANL and McCoy RCRA personnel training and
- Environmental Management System awareness training

The Laboratory, DOE, and NNSA sponsor annual sustainability award competitions. The awards recognize personnel who implement pollution prevention projects. In FY 2019, the P2 Program managed a LANL environmental awards program that emphasized source reduction of all types of waste. The 62 award winners were recognized by senior managers Michael Hazen and Bill Mairson with a certificate and a small cash award, which serve as incentives for participation in future years. Although award winners did not focus on hazardous waste reduction, this program will provide an opportunity for hazardous waste minimization in future years.

2.3 Utilization and Justification for the Use of Hazardous Materials

LANL is a research and development 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 other 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 2019, pollution prevention funds were allocated to the following project:

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

  Based on FY 2017 and FY18 results, showing that ABF is a viable alternative to strong acids for quick dissolution of glass materials for nuclear forensic analysis, in FY 2019 actinide analytical chemists tested the ABF glass material dissolution to synthetic post-detonation debris studied widely in the nuclear forensic world. Results indicate ABF is capable of synthetic post-detonation debris dissolution. Next steps would be to test the ABF process on live nuclear forensic samples.

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)

  In FY 2017, 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. In addition to ABF, diluted Nitric Acid was 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. For FY 2018, P2 funding was utilized to evaluate nitric acid concentrations on ABF dissolution.

- 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. The results from this study indicate MWDXRF has sufficient sensitivity and selectivity to be useful for process monitoring applications, but would require testing and demonstration with actual materials and comparison with conventional methods for full confidence in deployability of the technique.

- Solvent Evaporator Purchase for polychlorinated biphenyls (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 three 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. The Solvent Evaporator will continue to be utilized during PCB analysis efforts in FY 2019 and beyond.

3.0 Hazardous Waste

3.1 Introduction

The annual hazardous waste quantity that is reported here is based on the total amount of waste by volume 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 2019 on Oct 11, 2019.

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 1,000 ppm of total halogens.

3.2 Hazardous Waste Minimization Performance

The amount of non-remediation hazardous waste shipped from LANL in FY 2019 was 99.05 m^3 compared to 93.3 m^3 of hazardous waste shipped in FY 2018. These waste stream volumes are primarily due to lamp/tube and unused/unspent chemical waste. All of the hazardous waste processed from LANL in FY 2018 and FY 2019 is shown in Table 2 sorted by the amount of waste originating in each technical area (TA), further sorted for FY 2019 to show the quantity of waste generated from highest to lowest.

Table 2. Generation of Hazardous Waste by Technical Area during FY 2018 and FY 2019, FY 2019 ranked by volume

Technical Area (TA)	FY 2018 Hazardous Waste (M^3)	FY 2019 Hazardous Waste (M^3)
60	38.42	26.12
35	7.09	25.54
03	20.33	15.27
22	3.13	7.86
16	6.00	6.67
46	5.06	4.68
52	-	2.55
43	-	2.52

Technical Area (TA)	FY 2018 Hazardous Waste (M^3)	FY 2019 Hazardous Waste (M^3)
59	1.54	1.21
55	1.48	1.13
09	2.32	0.85
03-CMR	0.12	0.66
36	0.58	0.53
40	0.58	0.53
48	1.00	0.52
49	0.06	0.49
14	-	0.42
15	0.87	0.41
50	0.06	0.36
53	2.07	0.27
08	0.09	0.26
64	0.11	0.16
39	0.14	0.04

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 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 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 2019 Hazardous Waste

Table 3. Constituents of Hazardous Waste in FY 2019

Waste Stream Number	Volume (m^3)	% Total	Waste Description
41435	27.085	27	Fluorescent lamps/tubes
47155	15.29	15	Peel Away 7 paint removal
42308	14.131	14	Unused/unspent chemical waste

The remaining hazardous waste generation at LANL consists of 42.54 m^3 of different wastes and is consistent with the hazardous waste descriptions in section 3.3.

The largest component of hazardous waste at LANL by volume in FY 2019 was from fluorescent lamps/tubes, which represents 27% of the total (27.085 m^3 out of 99.05 m^3). The waste stream number in WCATS is 41435. According to EPA and NMED standards, crushing bulbs is considered treatment and is prohibited, 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 Peel Away 7 Paint Removal representing 15% (15.29 m^3 out of 99.05 m^3) of hazardous waste generation. The waste stream number in WCATS is 47155. Peel Away 7 was applied to remove lead paint from a floor. Once applied, it was covered with plastic and allowed to dry; it bonded to existing paint. Once dried, the plastic containing Peel Away 7 and paint was rolled up and disposed of as hazardous waste. Since the process did not work as well as anticipated, this is a one-time hazardous waste stream.

Another large hazardous waste stream is unused/unspent chemicals representing 14% (14.131 m^3 out of 99.05 m^3) of hazardous waste generation. The waste stream number in WCATS is 42308. For more information on how the Laboratory is addressing this waste stream, see the section **Unused/Unspent Chemical Waste Reduction** on page 14.

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 are considered treatment and is prohibited, 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.

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 remaining hazardous waste generation at LANL consisted of 38 m^3 of different wastes and is consistent with 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 Technical Area 60-86 at LANL. Spent bulbs, aerosol cans, and batteries are collected from various sites and brought to Technical Area 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 4. Universal Waste Recycled at LANL in FY 2018 and FY 2019

Universal Waste Type	FY 2018	FY 2019
Aerosol cans (m^3)	2.086	1.302
Lamps/Bulbs/Tubes (m^3)	43.0215	27.38
Batteries (m^3)	0.2546	0.5678118
Total Volume (m^3)	**45.362**	**29.250**
Total Cost	**$13,568**	**$8,749**

Total cost in Table 4 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 2018 and FY 2019 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. The P2 Program did not fund projects in this area in FY 2019 due to investing resources in the Chemical Management Program; see the section **Unused/Unspent Chemical Waste Reduction** on page 14**.**

- 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.

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 processing. 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/onsite sample preparation operations. In addition, the high concentration of the acid wastes are a waste management challenge due to exceeding the Lab waste acceptance criteria (WAC) for discharge to the Radiological Liquid Waste Treatment Facility (RLWTF).

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 (National Institute of Standards and Technology certified reference material) can be digested when mixed with ABF solid powder and heated at 125^oC 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 2019 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

By analyzing hazardous waste generation data at the Laboratory, unused and unspent chemical waste was flagged as an item needing attention for waste minimization. For example, in FY 2019, LANL lab packed 11,115 items under the unused/unspent chemicals waste profile, which does equate to 14.131 m^3 of waste generation considering lab packed items tend to be small. They are first packaged in small containers and then placed into large drums indicating there is void space.

In FY 2019, the P2 Program devoted significant staff resources to analyze the site-wide Chemical Management Program and overall chemical usage for source reduction opportunities. This effort identified three areas of concern: pre-procurement review of chemicals, chemical ordering practices, and inventory management.

The LANL Chemical Management Program has been transferred to the Environmental Stewardship Group (EPC-ES) in Technical Area 00-0795 from Operations and Business Systems (OS-OBS) in order to take a lifecycle management approach to chemicals, from pre-purchase screening through efficient use and effective inventory practices to establishing a path to disposal. This enhanced program is staffed with chemical purchasing and inventory specialists and serves as a central source of information and analysis for chemical management at LANL.

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 2019. As of FY 2016, there were over 5,000 legacy waste containers at Technical Area 54-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 1,349.84 m^3 of MTRU in FY 2019. The majority of this MTRU waste generation is due to legacy waste and debris waste associated with legacy repackaging. DOE-EM took ownership of Technical Area 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 resumed MTRU waste disposal shipments.

4.2 Waste Stream Analysis

Legacy Waste

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

- Remediated nitrate salts mixed inorganics,
- Mixed inorganic waste from TA-55,
- Cemented waste (with liquids) from TA-55,
- Cemented waste from TA-55,
- Mixed heterogeneous debris waste,
- Mixed heterogeneous debris waste,
- Cemented waste from TA-50 (rad liquid waste),
- Sludge waste from TA-50 (rad liquid waste),
- Mixed inorganics from TA-55, and
- Cemented waste from CMR.

Table 5. MTRU Summary

Year	Volume (m^3)	Generation	Waste Minimization	Projects	Projected Reductions
FY 2019	1349.84	Legacy MTRU repackaging; Debris from repackaging	Difficult to minimize since legacy waste has already been generated	None	NA
FY 2018	1572.45	Legacy MTRU repackaging;	Difficult to minimize since legacy waste	None	NA

Year	Volume (m^3)	Generation	Waste Minimization	Projects	Projected Reductions
		Debris from repackaging	has already been generated		

Table 6. Constituents of MTRU in FY 2019

Waste Stream Number	Volume m^3	% Total	Waste Description
42617	591.80	43.8	Heterogeneous debris waste from repackaging
42272	256.13	19.0	Inorganic homogeneous solid wastes (cemented TRU)
42614	115.21	8.5	Homogeneous cemented inorganics from pretreatment
42618	79.85	5.9	Homogeneous dewater sludge
42333	72.38	5.4	Inorganic particulate waste from remediated nitrate salts
42134	66.95	5.0	Inorganic homogenous solid waste (cemented TRU) at TA-55

The waste profiles above represent 87.6% of MTRU by volume. The remaining 12.4% of MTRU consists of 18 waste stream profiles (from WCATS) and are not as prominent of a MTRU source by volume.

4.3 Barriers to MTRU Waste Minimization

A majority of MTRU generation at LANL consists of legacy waste and falls under the responsibility of N3B and DOE-EM. This waste type 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 (e.g., 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 2019 was debris from repackaging of legacy waste containers and under the management of N3B and DOE-EM. 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 7. MLLW by Location during FY 2018 and FY 2019

*Technical Areas 54-G, 54-L and 54 are not owned and operated by Triad; they fall under operating control of N3B and DOE-EM.

Technical Area (TA)	FY 2018 (m^3)	FY 2019 (m^3)
54-G*	196.5	98.2
50	78.7	76.2
53	8.3	24.0
03	20.2	18.7
50-WCRRF	13.4	10.7
48	8.3	7.1
55-PF-4	7.4	4.7
55	71.1	4.4
54*	3.6	3.6

Technical Area (TA)	FY 2018 (m^3)	FY 2019 (m^3)
54-L*	5.7	2.4
35	2.8	1.3
03-CMR	0.1	1.2
21	0.2	0.2
16	1.3	0.1

5.2 Waste Stream Analysis

Table 8. MLLW Summary

Year	Volume (m^3)	Major Generation Source	Waste Minimization	Projects	Projected Reductions
FY 2019	252.86	Debris and containers from repackaging legacy waste	Difficult to minimize since legacy waste has already been generated	None	NA
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

Table 9. Constituents of MLLW in FY 2019

Waste Stream Number	Volume (m^3)	% Total	Waste Description
42822	153.56	60.3	Heterogeneous debris waste from repackaging
43578	35.04	13.9	Nitrate salt related debris waste containers

Waste Stream Number	Volume (m^3)	% Total	Waste Description
47426	15.29	6.0	Mercury contaminated wastes from flight path shutter system
47126	6.44	2.5	Hydraulic oil drained from press building
45161	5.27	2.1	Contaminated equipment and electronics

The above table represents 84.8% by volume of MLLW waste in FY 2019. The other 15.2% is represented by 47 waste stream numbers and each represents a small percentage of MLLW by volume.

Table 10. 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 machinery at Sigma
45281	20.0	4.8	Electric forklift used during TA-21 remediation

Waste Stream Number	Volume (m^3)	% Total	Waste Description
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.

5.3 Mixed Low-Level Waste Minimization

LANL is working on projects to reduce MLLW:

- One effort involved replacing traditional fluorescent fixtures with light-emitting diode (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 Technical Area 55 and Technical Area 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. Results from the FY 2018 study indicate XRF has sufficient sensitivity and selectivity to be useful for process monitoring applications, but would require testing and demonstration with actual materials and comparison with conventional methods for full confidence in deployability of the technique.

5.4 Barriers to MLLW Minimization

Since debris from repackaging of legacy 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 2019, DOE/NNSA and Triad did not participate in environmental remediation activities except for the RCRA closure of the Technical Area 16-399 Burn Tray open burning treatment unit. Closure activities began February 28, 2019 and have been extended into December 2019.

Under requirements of the Consent Order, DOE-EM and N3B conducted all other remediation activities.

ENCLOSURE 2

2019 Hazardous Waste Minimization at Los Alamos National Laboratory for Newport News Nuclear BWXT - Los Alamos, LLC (N3B)

EPC-DO: 19-400

Date: NOV 2 5 2019

November 2019
EM2019-0425

2019 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."

Elizabeth Lowes — 11-5-2019

Elizabeth Lowes, Program Manager
Environment, Safety, and Health
Newport News Nuclear BWXT-Los Alamos, LLC

Date

David Nickless — 11/13/19

David Nickless, Acting 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 the U.S. Department of Energy (DOE) Environmental Management Los Alamos Field Office (EM-LA) and Newport News Nuclear BWXT-Los Alamos, LLC (N3B). 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 EM-LA's mission work. The Los Alamos Legacy Cleanup Contract encompasses ongoing disposition of aboveground stored legacy transuranic (TRU) waste; groundwater and surface water monitoring and protection programs; groundwater contaminant plume investigation and evaluation for hexavalent chromium and high-explosives contamination; aggregate area investigations and remediation activities; and facility decontamination, decommissioning, and demolition (DD&D) activities.

Fiscal year (FY) 2019, when referred to within this document, is from October 1, 2018, through September 30, 2019. FY 2020 when referred to within this document is from October 1, 2019, through September 30, 2020.

N3B conducted hazardous waste minimization and pollution prevention efforts in FY 2019. N3B shipped hazardous, mixed-transuranic (MTRU) and mixed low-level (MLLW) remediation waste off-site in FY 2019. N3B FY 2019 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 goals for greenhouse gas emission reduction and for energy and water conservation 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. The report also discusses methods and activities employed (or that will be employed) to prevent or reduce hazardous waste generation as well as documents hazardous waste minimization efforts made in FY 2019. In most cases, hazardous waste minimization activities that were executed during FY 2019 will continue to occur during FY 2020 and continue to be developed into a 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 (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, 3.3, 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 3.4, 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 3.2, 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 ES&H Program has primary responsibility and oversight responsibilities for hazardous waste, air, water, and corrective actions governed by the 2016 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 (1) institutional waste minimization and pollution prevention objectives and targets and (2) 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. The Environmental Remediation (ER) Program cleans up legacy contaminated sites on and around the Laboratory. The cleanup is conducted under the Consent Order.

2.0 WASTE MINIMIZATION PROGRAM ELEMENTS

2.1 Governing Policy on Environment

N3B EMS policy N3B-SD400, "Environmental Management System," addresses 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 developed environment goals and a governing policy in FY 2019 as part of the EMS. Of the 23 objectives identified by the EMS Integrated Project Team (IPT), 20 were fully implemented. The 23 goals were grouped under the 5 following overarching goals:

1. Establish a culture of sustainability among N3B employees and subcontractors.
2. Develop environmentally responsible procedures.
3. Reduce waste from office and support activities.
4. Reduce energy consumption, greenhouse gas emissions, and natural resource consumption.
5. Manage and remove waste in support of lab operations and legacy waste remediation.

Objectives associated with these goals, which support N3B's overall waste minimization strategy, follow:

- Goal 1, Objective 4 – Utilize EMS training to educate employees on individual contributions to EMS goals.
- Goal 3, Objective 1 – Install battery recycling bins at all N3B office locations, and ensure disposal pathways through a facility-specific waste management plan.
- Goal 3, Objective 2 – Place recycling centers for paper, cardboard, plastic, and aluminum cans in administrative buildings at TA-54.
- Goal 5, Objective 1 – Ship 250 cubic meters by volume of mixed/low-level waste generated in FY 2019.
- Goal 5, Objective 2 – Sort, segregate, treat, and package as necessary 192 containers of Legacy suspect transuranic waste.

This EMS IPT is composed of professionals from across N3B functional areas in order to ensure that the environmental objectives and targets are integrated across the organization to cultivate a systematic approach to organizational sustainability initiatives. This group met monthly in FY 2019 to track the goals and objectives that they developed, which were approved by N3B senior management in January 2019. The EMS IPT is currently initiating a self-assessment of program effectiveness and will conduct a management assessment with N3B senior staff in November 2019 to pursue continual improvement to environmental protection initiatives in FY 2020.

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. To date, these trainings include the EMS bi-annual training that is required for all N3B employees and the trainings associated with N3B-P409, "N3B Waste Management" (Course #23263, Waste Generation Overview-Live; Course #21464, Waste Generation Overview Refresher SS; Course #8504, WCATS: Waste Documentation).

2.3 Hazardous Materials Use and Justification

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

The use of hazardous materials and the generation of new hazardous wastes is minimal. The majority of hazardous wastes associated with this contract are investigation/remediation wastes and shipment of existing Federal Facility Compliance Order (FFCO) site treatment plan (STP) wastes to final disposition.

2.4 Investigation of Additional Hazardous Waste Minimization and Pollution Prevention Efforts

In FY 2019, N3B established its EMS to address hazardous waste minimization and pollution prevention efforts. The EMS fully met 87% of its objectives and made progress toward completing the remaining 13% of the objectives. This program is not fully mature, and we expect continued improvements and enhancements in FY 2020 in support of waste minimization.

2.5 Itemized Capital Expenditures

During FY 2019, capital expenditures and operating costs devoted to source reduction and recycling of hazardous waste were minimal. Because N3B typically generates very little, if any, new hazardous waste, most capital expenditures and operating costs resulted from the off-site shipment of MTRU waste to final disposal facilities. Table 1-2 provides a generalized estimate of shipping and disposal costs for FY 2019.

Table 1-2
CH-TRU Waste Shipments in FY 2019

Waste Type	FY 2019 Hazardous Waste Shipments (m^3)	FY 2019 Disposal Costs
MTRU/TRU	49.88	$340,000
MLLW/LLW disposed legacy and newly generated waste	1237.37	$4,515,000
Chemical hazardous waste	100.97	$53,000

3.0 HAZARDOUS WASTE

3.1 Introduction

Hazardous wastes commonly generated, or which 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), as well as other wastes resulting from DD&D and maintenance activities. 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. The majority of hazardous waste managed and disposed of by N3B is legacy and environmental remediation waste.

In FY 2019, N3B shipped MTRU wastes from the cemented sludge waste stream (LA-CIN01.001) and combustible-non-combustible waste stream (LA-MHD01.001). N3B sorted, segregated, and packaged 263 containers of legacy MTRU waste 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 N3B-P351, R1, "Project Planning and Regulatory Review," 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 best management practices. As N3B develops and refines the waste shipment process 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 has a battery recycling program, allowing N3B employees to recycle their used batteries. Recycling bins with a 5-gal. capacity 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. Additionally, all administrative buildings at Technical Area 54 (TA-54) have recycling centers for universal waste.

Scrap metal from remediation sites and TA-54, for which assays show no radioactive contamination, is recycled. N3B currently uses and will continue to implement equipment lubricating fluids that are recyclable. N3B uses highly refined mineral oil instead of more hazardous hydraulic fluid; the highly refined mineral oil is recycled at useful end of life.

3.4 Barriers to Hazardous Waste Minimization

Current barriers to hazardous waste minimization include limited staff availability and limited procurement of services and goods that will assist in recycling and waste minimization. Another barrier is that most material generated is radioactive and therefore the volume cannot be reduced on-site. This waste goes off-site for disposal.

N3B developed a WCSF to incorporate the recycling of empty environmental media sample containers returned to the Sample Management Office; these sample containers were estimated to represent a waste stream of 2000 L per year. In June 2019, the N3B Sample Management Office coordinated with craft support to take empty environmental media sample containers to the transfer station to be recycled. All caps were removed from the containers, and a total of 11 bags with 50 containers each (1 bag contained only 44 containers), for a total of 544 containers, were delivered to the Los Alamos County transfer station. This waste stream realized approximately a quarter of the estimated waste volume, since each container held a 1-L capacity. This waste was generated by best management practice installation and soil erosion activities conducted by the Storm Water Program.

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, does not need the degree of isolation required by 40 Code of Federal Regulations (CFR) 191; and (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 the standards change, 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 TA-54 are legacy wastes and are included in the FFCO STP for ultimate disposal. No new MTRU wastes will be purposefully generated except through routine management of existing MTRU wastes or environmental remediation wastes, which is discussed in section 6.0 of this report.

4.3 MTRU Minimization

The N3B CH-TRU Program, which manages and ships mostly legacy 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 since all MTRU wastes are legacy wastes. The primary function of the CH-TRU Program is legacy MLLW and MTRU management and shipping.

4.4 Barriers to MTRU Minimization

Packaging requirements at WIPP often make minimization efforts difficult. In order to be protective of human health and the environment, the MTRU packaging requirements are very stringent. There are radiological 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 in capacity, 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 DD&D activities. Most of the non-routine 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.

If any MLLW is generated, it is transferred to a satellite accumulation area after generation. 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 to minimize 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 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 are often barriers to MLLW minimization. Containers sent for final disposition will have a 55-gal. or greater capacity, 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 during the planning and conducting of 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. Primary waste 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. Well drilling, development, sampling, rehabilitation/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.

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.

EMS integration into N3B and Subcontractor remediation activities. N3B's EMS is being developed to integrate requirements into the subcontracts and environmental communications through Worker Safety and Security Teams. These activities will increase N3B and subcontractor awareness of waste minimization requirements and opportunities.

Sorting, decontamination, and segregation. 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 (SSLs). 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. A sampling campaign is expected to 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 managed as environmental media until sampling analysis results are received and reviewed. For those objects to be removed, overburden shall be separated from underburden and sampled accordingly.

If the soil and tuff are determined to be suitable for reuse (i.e., is not hazardous waste and meets residential SSLs and screening action levels [SALs]), the excavated environmental media will be segregated from man-made debris, and the soil will be used to backfill the excavations. If the media do not meet residential SSLs/SALs, or are determined to be hazardous waste, the excavated media will be managed as waste. Man-made debris that may be present in the excavated material waste stream must be reported for the off-site profile. N3B expects that 70% to 75% of soils will be used as backfill and therefore will not require waste management disposal. No waste-generating activities occurred at the material disposal areas for the FY 2019 period.

Approximately 2492 m^3 of concrete and metal from Phase I Site Cleanup and Preparation were recycled. Based on 30 miles round trip and 8 hours of truck and driver time per container, the estimated cost to recycle the metal and transport the concrete to TA-54 for reuse is $133,000.

The cost to ship and dispose of this material at EnergySolutions, LLC, in Clive, Utah, would have been approximately $1,194,000. N3B saved approximately $1,061,000. Additionally, CH-TRU saved additional money by not purchasing approximately 765 m^3 of fill material.

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 (e.g., plastic gloves, sampling scoops, plastic sheeting, and personal protective equipment) after proper decontamination to prevent cross-contamination can provide waste reduction and cost savings.

6.4 Pollution Prevention Planning

The potential to incorporate additional pollution prevention practices into future activities will be evaluated annually as part of the EMS planning efforts. This report will be used during the EMS annual management assessment to continue integration efforts across the organization and align environmental protection and sustainability goals. As such, further actions related to pollution prevention will be incorporated into the EMS as they are identified. 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 and waste minimization concerns to project participants through the Project Review Process Procedure. Waste minimization opportunities 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 approach 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.