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QUARTERLY REPORT
TRANSURANIC WASTE
AVOIDANCE AND MINIMIZATION

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Quarterly Report of TRU Waste Avoidance and Minimization

August 2001

Acronym	Description
CBFO	DOE-Carlsbad Field Office
CMR	Chemical and Metallurgical Research building
D&D	Decontamination and Decommissioning
DCP	Design Change Plan
DP	Defense Program
DVRS	Decontamination and Volume Reduction System
E-ET	Environmental Technology Group
ER	Environmental Restoration
FRP	Fiberglass Reinforced Plywood
FWO	Facility and Waste Operations
FY	Fiscal Year
GDMS	Glow Discharge Mass Spectrometer
HEPA	High Efficiency Particulate
HTP	Hydrothermal Processing
IOC	Initial Operating Capacity
IPABS	DOE Integrated Planning, Accounting and Budgeting System
L/day	Liters per day
LANL	Los Alamos National Laboratory
LLW	Low Level Radioactive Waste
MSO	Molten Salt Oxidation Process System
MTRU	Mixed Transuranic
NARS	Nitric Acid Recovery System
NDA	Non-Destructive Assay
NMT	Nuclear Materials Technology Division
NRC	Nuclear Regulatory Commission
Ops	Operational funding
OSR	Offsite Source Recovery Program
PF-4	Plutonium Facility-4
Pu	Plutonium
RLWTF	Radioactive Liquid Waste Treatment Facility
ROD	Record of Decision
S&S	Safeguards and Security
SAR	Safety Analysis Report
SWB	Standard Waste Box
SWEIS	Site Wide Environmental Impact Statement
SWO	The Solid Waste Operations
TA-55	Technical Area –55
TBD	To Be Determined
TCE	Tricloroethylene
TRU	Transuranic
USQD	Unresolved Safety Question Determination
WFM	Waste Facility Management
WIPP	Waste Isolation Pilot Plant
WMS	Waste Management System
WPO	Waste Isolation Pilot Plant Program Office

1. Introduction

The main objectives of this report are to provide the status of waste avoidance and minimization projects and estimate the effectiveness of those projects in reducing the amount of TRU waste requiring disposal at the Waste Isolation Pilot Plant (WIPP). It is hoped this report will promote coordination among the organizations that have the opportunity to minimize TRU waste. Although this report provides information on TRU waste from generation through disposal, it focuses on those activities that avoid or minimize routinely generated TRU waste.

The LANL TRU Waste System process flow sheet (figure 1) generally illustrates how each process relates to the overall minimization of TRU waste at LANL.

Sources of Information: Information on the volumes and types of TRU waste generated by LANL during routine operations was derived from several sources. Information on newly generated waste was gathered from the Nuclear Materials Technology Division (NMT) Waste Management System (WMS). The WMS contains data from 1995 through the present and the waste streams used in this report are based upon the waste types tracked by NMT. The Facility and Waste Operations Solid Waste Operations group (FWO-SWO) provided information on the amounts of legacy waste stored at TA-54 Area G and FWO-Waste Facility Management (WFM) supplied information on the volumes of liquids managed at the Radioactive Liquid Waste Treatment Facility (RLWTF). Information on the volumes and schedule for shipping to WIPP is provided by E-ET through reports prepared for the Waste Management Program Office. The estimated waste volume to be shipped to WIPP exceeds the total waste volume in storage because of the need to volume expand the waste to meet wattage limits.

Newly generated wastes are grouped by common characteristics and the waste minimization measure applied to them. As such the waste are grouped into Non-Actinide Metal Waste, Liquids and Evaporator Bottoms (currently cemented wastes) and a third group consisting of Combustibles, High Efficiency Particulate (HEPA) Filters, Plastic, Glass, Rubber and other wastes.

Development of the Base Case: The amount of TRU waste generated by LANL varies on a yearly basis depending on mission-related work activities. The effectiveness of the waste avoidance and minimization projects in this report was determined from a comparison to a base case generation rate. A base case generation rate is the amount of TRU waste LANL would generate if all mission and waste system operations were fully funded and operational throughout a year. Three sources of information on the amount of TRU generated were reviewed in order to estimate the base case rate. The first source of information was the Site Wide Environmental Impact Statement (SWEIS) Record of Decision (ROD). The ROD depicts a bounding case for a combination of routine and non-routine TRU waste and indicates LANL could produce a total of $322m^3$ of TRU annually. A second estimated rate is provided to the DOE Integrated Planning, Accounting and Budgeting System (IPABS). The IPABS indicates LANL could produce approximately $185m^3$ of routine TRU annually from all sources. The third source of waste information is the actual waste generation data. The generation rate of routine TRU waste has been increasing since 1993 and was $115m^3$ in 2000.

Historically the difference between routine and non-routine waste was based on the size and the type of waste item generated. Recent clarifications on the definition of routine vs. non-routine waste should increase the percentage of TRU waste categorized as routine. The current definition of routine waste generation includes process waste as well as waste generated during maintenance and end-of-life replacement and spill cleanups which occur as a result of these processes. Other TRU wastes such as the waste generated during the CMR upgrades are considered non-routine.

For the purposes of this report $185m^3$ was used for the routine solid TRU waste output from NMT and an additional $15m^3$ of liquid waste was estimated for treatment at the RLWTF. An additional $5m^3$ of solid TRU waste was estimated from other sources including the Offsite Source Recovery Program (OSR). The Offsite Source Recovery Program (OSR) was included in this analysis because it contributes TRU waste to storage. The Environmental Restoration (ER) and Decontamination and Decommissioning (D&D) Programs do not generate TRU waste on a regular basis. Non-DP TRU waste (primarily Pu^{238} contaminated) is included in this assessment since it is managed within the LANL waste management system. Use of these estimated generation rates gives a total base case of $205m^3$ and places the base case rate between the current generation rate and the ROD rate.

The effectiveness of the various avoidance and minimization technologies was applied against the base case rate. Since many of the processing systems covered in this report are not yet operational, assumptions were made about the their operational startup, waste processing rates and minimization capabilities. Once those systems begin operations, actual operation data will be used.

No Path Forward Waste: No path forward waste includes those waste streams that presently do not have a disposal option without the development of new treatment technologies, changes in disposal regulations, etc. Those waste streams include TRU wastes such as testing spheres that can't be shipped to WIPP due to size constraints and non-Defense Program (DP) wastes such as the civilian OSR waste and Heat Source Program waste. TRU waste items that are too large for transport in the TRUPACT II and that cannot be processed by the Decontamination and Volume Reduction System (DVRS) are included as no path forward waste. All LANL No Path Forward TRU wastes are included in this report since they require management at LANL facilities. The No Path Forward TRU waste volume includes some radioactive materials that will become waste after further processing.

Explanation of Waste Reduction Tables: Where information on the effectiveness of the TRU waste avoidance or minimization technologies was not available, assumptions were used in place of that information. The sources and assumptions associated with the data and technologies discussed in this report are documented so that better information may be incorporated becomes available.

The effects of the minimization technologies applied to each waste stream are provided in both a table and a chart. The table headings are as follows:

- The **Funded/Implemented Minimization Processes** list the projects/technologies applicable to the waste stream. Only those technologies that have been implemented, funded, or are planned are included.
- The **Status** column provides the overall status of each project/technology. A green triangle pointing up indicates the project/technology is operational or on schedule. A yellow circle means

the project is behind schedule, over budget, or has other issues associated with it. A red triangle pointing down indicates that progress on the project has stopped.

- The **IOC** is the Initial Operating Capability. This is the year the waste stream minimization improvement project either began operation or is the best estimate of when it should begin operation.
- The **Cost** column includes current year and future costs until the project is operational. Previous or sunk costs are not included. Projects that are already operational and whose funding is part of a larger operational budget are noted with "Ops".
- The **Input** column is the amount of waste available for minimization with the selected technology and is calculated from the base case or output from upstream improvement projects.
- The **Output** is the resulting volume after the waste has been processed. The resulting volume is estimated from previous operations, operator estimates, or estimated technology efficiencies.
- The **% Reduction** is calculated using the total volume of the base case waste stream, not the input to the waste minimization improvement project. Waste minimization processes that only apply to a small portion of the overall TRU waste stream will have a small calculated % reduction even though they might be very efficient in reducing that portion of the waste stream.

Assumptions: The assumptions used in calculating the effectiveness of waste minimization technologies are provided in the write-up for each of the technologies. The solid waste base case of $185m^3$ was divided into three groups: metals, combustibles and evaporator bottoms. Metals make up 60% of the solid waste stream with large metal items (primarily gloveboxes) being $61m^3$ of the waste stream. Metal items that are too large to place in a drum but that fit inside a standard waste box (SWB) are $16.65m^3$ of the waste stream. Small metal items that fit inside a 55-gallon drum comprise $33.30m^3$ of the waste stream. Electrolytic decontamination is applied to 90% of the large items and is effective in reducing 50% (45% of the total) to Low Level Waste (LLW). Sort and segregation is applied to the SWB sized items in 2002 and 50% are categorized as LLW. When applied to the small items, sort and segregation identifies 15% as LLW. Electrolytic decontamination for small items is available in 2003 and is 60% effective in reducing the TRU waste to LLW. The DVRS begins processing NMT gloveboxes after receiving Nuclear Hazard Category 3 status in 2004. DVRS provides a 75% reduction in the volume of large metal items. It is important to note that the DVRS is used to size reduce those large metal items than are not previously decontaminated to LLW through electrolytic decontamination.

The Cemented Waste stream comprises 5% of the solid TRU waste generated by NMT or about $9.25m^3$ per year of the base case. An additional $5m^3$ per year is generated by the RLWTF from processing of NMT liquid waste. Two technologies apply to that waste stream. Vitrification of the evaporator bottoms reduces the base case waste stream by about $7m^3$ per year and the Nitric Acid Recovery System has a yet to be determined effect on the cemented waste from the RLWTF.

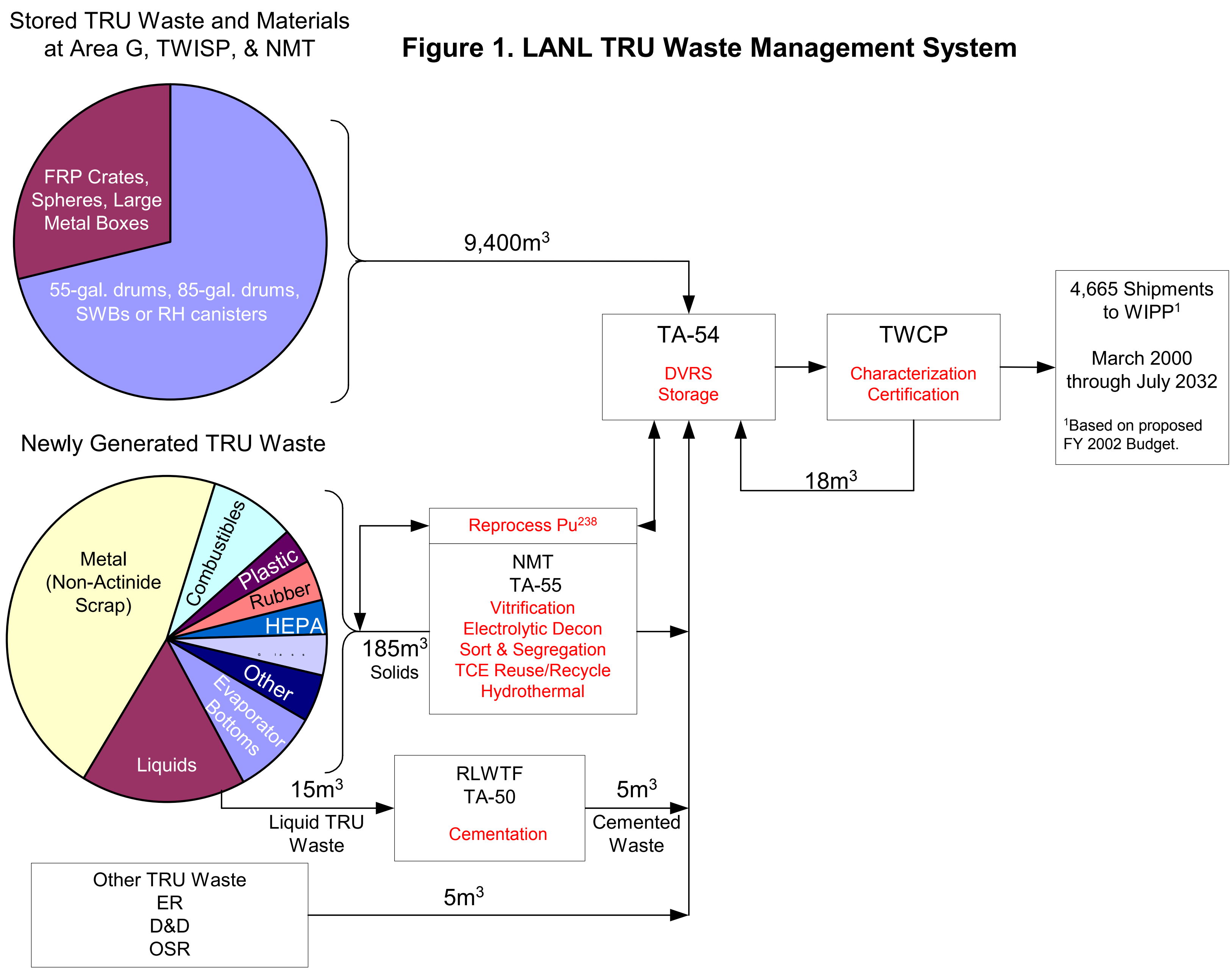
The "Other" waste stream is 35% of the solid TRU waste and it is comprised of combustibles, glass, HEPA filters, plastic, rubber and other waste materials. The two largest waste minimization technologies applicable to the other waste stream are the sort and segregation program (approximately 15% reduction) and the granulation of combustible materials (TBD). The sort and segregation program is only applied to the 50% of the waste stream that is non-mixed so its effective minimization rate is reduced to approximately 7%.

A fourth waste stream, the no-path forward waste stream, assumes a yearly production $24.5m^3$ from the following sources: $16.5m^3$ of materials contaminated with Pu^{238} and one large sphere of $8m^3$. It is also assumed that the sphere size reduction program is successful and that programmatic funding to continue the size reduction effort becomes available in FY04. Because the disposal of Pu^{238} contaminated material is a congressional issue, it is not addressed in this report.

Waste Process Flow Chart: Figure 1 is a generalized schematic of the LANL TRU waste management system. It was developed to provide the reader an overall picture of the organizations, processes, and facilities involved in the management of TRU waste.

References: Some of the numerous plans and presentations on the various technical options for minimizing TRU waste are listed as references in the back of this report. Those references contain recommendations and strategies for minimizing TRU waste.

Figure 1. LANL TRU Waste Management System



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2. Non-Actinide Metal Waste Stream

Waste Description: Non-actinide metals are any metallic waste constituents that may be contaminated with, but are not fabricated out of, actinide metals. Metallic wastes typically include tools, process equipment, glovebox structures, facility piping, and ventilation ducting.

Table 2. Non-Actinide Scrap Metal Waste Stream Minimization Improvement Projects

Funded/Implemented Minimization Processes	**Status[a]**	**IOC Year[b]**	**Cost[c]**	**Before[d]**	**After[e]**	**% Reduction[f]**
2.1 Large Item Electrolytic Decon	▲	2000	Ops	40	20	9%
2.2 Sort and Segregation	▲	2001	Ops	50	37	6%
2.3 Small Item Electrolytic Decon	●	2003	TBD	28	11	8%
2.4 DVRS	●	2001	$1,750K	20	5	7%
2.5 TRUPACT III (No Path Forward Waste)	●	2004	TBD	23	20	1%
Unfunded Minimization Projects						
2.6 Sphere Size Reduction (No Path Forward Waste)	▼	2004	TBD	24	15	35%
Waste Not Addressed: Non-DP Waste						
Waste Stream Issues: Although DVRS is scheduled to be operational in August 2001, there is a multi-year backlog of legacy waste that needs to be processed and DVRS will not contribute to the reduction of newly generated waste until 2003. DVRS will only process TRU waste that is less than the Category 3 radiological limits (8.4 grams Pu^{239} equivalent) until the Safety Analysis Report (SAR) is approved in 2003. At that time the DVRS will become a Nuclear Category 3 facility and will be able to process waste with an inventory up to 900 grams Pu^{239} equivalent. Demonstration of Sphere Size Reduction is still in the planning process.						

[a] Code Description

▲ Project is either completed or on schedule with no outstanding issues.

● Project is either behind schedule, over budget, or has technical or programmatic issues.

▼ Project has been terminated or has unresolved technical or programmatic issues.

[b] Initial Operating Capacity

[c] Currently estimated cost to IOC

[d] Estimated portion of the baseline volume ($205m^3$) to be managed by the minimization process including wastes that may come from another minimization process. No Path Forward waste is $11m^3$.

[e] Estimated portion of the treated baseline volume that remains after application of the minimization process

[f] Percent reduction of the total baseline volume of $205m^3$

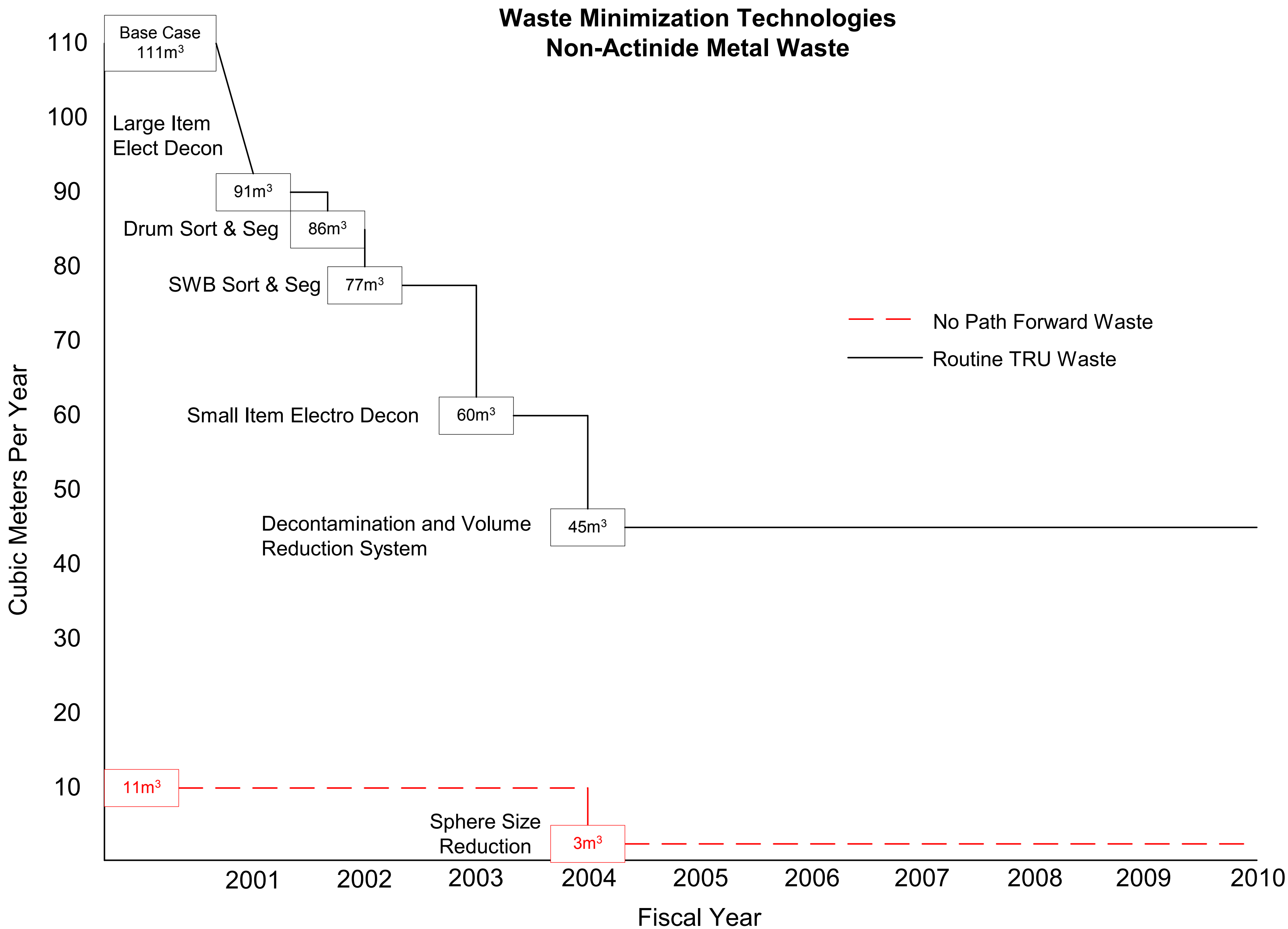

Figure 2. Waste Minimization Technologies Applied to Metal Waste

2.1 Large Item Electrolytic Decontamination **Contact: Doug Wedman, NMT-15**

Description: The Plutonium Processing facility at Los Alamos National Laboratory, TA-55, PF-4, contains hundreds of gloveboxes that are used to provide containment for process equipment and work areas. Many gloveboxes contain lead shielding for personnel exposure reduction, which also constitutes a mixed waste. When taken out of service, gloveboxes are large volume waste items and, since they are typically categorized as TRU/MTRU waste, they are packaged in oversized containers that are not certified for disposal at WIPP. These oversize containers will require costly size-reduction and repackaging to meet certification requirements prior to disposal at WIPP. Decontaminated gloveboxes are either reused at LANL or disposed as LLW after the lead shielding is removed. Electrolytic decontamination is not used for gloveboxes that processed Pu^{238} materials or gloveboxes in poor physical condition. A separate system that uses the same technology may be developed for decontamination of smaller metallic tools and process equipment.

Status: This on-going project is decontaminating gloveboxes being removed from service within TA-55, PF-4 with an electrolytic process. Between 1997 and 1999 nine gloveboxes were processed with electrolytic decontamination. Three of those gloveboxes were reused, three were discarded as low-level radioactive waste and three were disposed as TRU waste. One glove box has been decontaminated and placed back into service the first half of this fiscal year.

Key Milestones	Date	Status
Decontaminate four gloveboxes.	9/28/2000	▲

Funding by Fiscal Year	FY2001	FY2002	FY2003	FY2004	FY2005
	Ops	Ops	Ops	Ops	Ops

Waste Minimization Assumptions: For this report it was assumed electrolytic decontamination is used only on 90% of the large items. Of that 90%, only half (45%) are decontaminated for reuse with the remaining (45%) discarded as waste. The discarded gloveboxes are sent to the DVRS for a 75% volume reduction.

Waste Avoided: $20m^3$/year if applied to 60% of the large non-actinide metal waste stream.

Issues:
Glovebox decontamination has not been established as a standard process where all gloveboxes and large metal objects are evaluated for use of electrolytic decontamination prior to release.

2.2 NMT Sort and Segregation **Contact: Andy Montoya, NMT-7**

Description: Historically all TA-55 process waste has been considered TRU waste because the Safeguards and Security (S&S) Non-Destructive Assay (NDA) equipment in PF-4 can't achieve sufficient detection sensitivity for determining when a waste item is low level waste. NMT-7 is instituting a segregation program to separate items that assay below detection limits ("zero count item"). Re-assay of zero-count items using better measurement techniques in a low background environment is required to validate the initial waste determination. The waste materials to be included in the sort and segregation project are limited to those non-mixed waste items that can be packaged in a 55-gallon drum or SWB.

Status: NMT-7 implemented Sorting and Segregation of non-mixed waste items on June 1, 2001. The Transuranic Waste Certification Program in E-ET will provide NDA of the zero count drums on a demonstration basis. Should the initial segregation prove successful, arrangements for continuing assay services will be made.

Key Milestones	**Date**	**Status**
Implement Sort and Segregation of 0-gram waste items	6/1/2001	▲
Assay of 0-gram drums by TWCP	10/1/2001	▲
Issue letter report on TRU waste avoided for FY 2001	10/1/2001	▲
Review first year of the program and recommend improvements	7/31/2002	▲
Issue letter report on TRU waste avoided for FY 2002	7/31/2002	▲

Funding by Fiscal Year	FY2001	FY2002	FY2003	FY2004	FY2005
	Ops	Ops	Ops	Ops	Ops

Waste Minimization Assumptions: The analysis presented in this report assumed that sort and segregation was applied to those waste that fit inside a 55-gallon drum or a standard waste box (SWB). For the base case of $185m^3$, $86m^3$ meet those size requirements. Since a previous re-assay of 64 low-mass drums determined 24 to be LLW, a 15% avoidance rate was applied to all TRU waste that can be placed in a 55-gallon drum and a 50% avoidance rate was applied to the SWB waste (primarily metal waste). Due to their weight it was assumed more of the metal waste items would be determined to be LLW.

Waste Avoided:. It is estimated that segregating LLW from TRU will avoid 15% of the smaller TRU waste items or approximately $23m^3$ annually.

Issues: Potential mixed TRU wastes will not be included in the sort and segregation program to avoid the possible generation of mixed LLW with no path forward.

2.3 Small Item Electrolytic Decontamination — Contact Doug Wedman, NMT-15

Description: The Plutonium processing facility at Los Alamos National Laboratory, TA-55, PF-4 generates metal tools, parts, and equipment. While larger metal items can be decontaminated with the existing electrolytic decontamination system, there is not a method for decontaminating the small metal parts. This proposed project would develop a method for applying electrolytic decontamination technology to the decontamination of small metallic tools, parts and process equipment.

Status: This proposed project was initially planned as a follow-on project to the Large Item Electrolytic Decontamination project. A proposal to develop the small item decontamination system has not been developed and alternative methods for managing the small metal waste items are being discussed.

Key Milestones	**Date**	**Status**
Develop proposal for electrolytic decontamination of small metal items.	8/17/2001	
Implement electrolytic decontamination of small metal items.	9/28/2002	

Funding by Fiscal Year	FY2001	FY2002	FY2003	FY2004	FY2005
	TBD	TBD	Ops	Ops	Ops

Waste Minimization Assumptions: The analysis presented in this report assumed that the small item electrolytic decontamination was applied to those waste items that fit inside a 55-gallon drum. For the base case of 185m^3, 33m^3 meet those size requirements. It was assumed that the electrolytic decontamination was successful on 60% of the metal items and that the small metals items are sorted and segregated before the electrolytic decontamination is applied.

Waste Avoided: Approximately 15 m^3/year if all the remaining small metal items were to be processed through electrolytic decontamination.

Issues: Compared to other work activities the development of a proposal is currently a low priority. However a more efficient method for packaging the smaller metal waste items is being explored.

2.4 Decontamination & Volume Reduction System (DVRS) **Contact: Kevin Vancleave, FWO-SWO**

Description: The DVRS is designed for the decontamination and size-reduction of oversized TRU waste items including gloveboxes and process equipment. It consists of an outer building that provides secondary containment and storage and preparation space and an inner building that houses a shear-bailer volume reduction machine and provides segmented space for removal of packaging and decontamination of the waste materials. DVRS will only be able to process TRU waste that is less than the Category 3 radiological limits (8.4 grams Pu^{239} equivalent). SWO will not be able to have more than 8.4g of Pu^{239} (covers approximately 125 legacy Fiberglass Reinforced Plywood crates (FRPs)) in the DVRS facility until the SAR is approved in approximately two years. At that time the DVRS will become a Nuclear Category 3 facility and will be able to process waste with an inventory up to 900 grams Pu^{239} equivalent.

Status: The DVRS building is complete and the shear-baler is installed and has completed cold tests. The DVRS startup team is working through a lengthy punch list of items that need correction before the readiness review.

Key Milestones	**Date**	**Status**
Complete Construction	4/27/2001	○
Acceptance and start up tests	5/02/2001	○
Final procedure walk-downs, processes practices, self-assessments	7/20/2001	○
Readiness review	7/26/2001	○
Hot Operations Start Up	8/10/2001	○

Funding by Fiscal Year	FY2001	FY2002	FY2003	FY2004	FY2005
	$1,750K	Ops	Ops	Ops	Ops

Waste Minimization Assumptions: The initial estimates for the DVRS assumed that a significant portion of the legacy waste is actually LLW. That resulted in an initial volume reduction estimate of 90%. However newly generated TRU waste should be much better characterized and a much smaller percentage will be LLW. The analysis presented in this report assumes the DVRS will achieve an approximate 4:1 volume reduction of large item TRU waste that were not previously decontaminated to LLW by the electrolytic decontamination process.

Waste Avoided: Because this report assumes that 45% of the large item TRU waste are previously decontaminated to LLW by the electrolytic decontamination process, DVRS only shows a volume reduction of 12m3.

Issues: Completion of the DVRS is delayed and that has delayed the walkthrough of procedures and acceptance testing of the operational and support systems. Use of the DVRS on smaller metal TRU waste items is being investigated.

2.5 Development of TRUPACT III **Contact: Darrik Stafford, SWO**

Description: Three transportation containers have received NRC certification for transporting transuranic waste to WIPP; the TRUPACT-II and the Halfpack for contact-handled transuranic radioactive waste and the RH-72B for remote-handled waste. Development of a new transportation container, the TRUPACT-III is under consideration for transporting oversized waste containers. The approximate maximum dimensions for the oversized containers that could fit in the TRUPACT-III are 4.5 x 4.5 x 7 feet for truck shipments and 6 x 6 x 14 feet for rail shipments. The Fissile Gram Equivalent limits for the TRUPACT-III are expected to be 325 grams.

Status: The DOE-Carlsbad Field Office (CBFO) held TRUPACT-III Workshop February 13-14, 2001. In addition to the scheduled milestones below, CBFO is also investigating the TN-Gemini cask, a rectangular packaging that the IAEA has certified as Type B for use in Europe. The TN-Gemini cask as a TRUPACT-III will be evaluated as part of the trade study of TRUPACT-III alternatives.

Key Milestones	**Date**	**Status**
Obtain additional oversized package inventory	6/28/2001	▲
Trade study comparing alternatives for the transportation and disposal of oversized CH-TRU waste inventory	7/31/2001	▲
Develop and finalize a design basis for the TRUPACT-III	9/28/2001	▲
Determine acceptance of IP (Types 1 and 2) in lieu of Type A containers.	9/28/2001	▲

Funding by Fiscal Year	FY2001	FY2002	FY2003	FY2004	FY2005
	Funded through the Carlsbad Field Office				

Waste Minimization Assumptions: The TRUPACT-III is a shipping container and as such does not minimize or avoid waste. However use of the TRUPACT-III will reduce the amount of oversized waste that needs size reduction which, in turn, reduces the amount of secondary waste generated during sized reduction activities.

Waste Avoided: According to Appendix B of the TRUPACT-III Workshop Summary Report (March 2001) the TRUPACT-III could be an alternative to repackaging and size-reducing 2405m^3 of LANL TRU waste items that are smaller than or equal to 4 x 4 x 7 feet.

Issues: According to Appendix B of the TRUPACT-III Workshop Summary Report (March 2001) LANL has 4,710m^3 of wastes that are greater than 4 x 4 x 7 feet (too large for the proposed TRUPACT III dimensions). Some spheres and possibly other items will not fit the proposed inside dimensions of the TRUPACT III without size reduction. Spheres are discussed in the next project description.

2.6 Sphere Size Reduction **Contact: Tony Drypolcher, NMT-4**

Description: This project applies to LANL generated testing spheres that must be managed as TRU waste. This project would demonstrate the cutting of a non-contaminated sphere using commercially available diamond wire cutting technology. Once segmented, the material could be decontaminated or packaged in a SWB for transport in a TRUPACT-II or in the TRUPACT-III when it becomes available.
Status: This project is not funded.

Key Milestones	**Date**	**Status**
Submit proposal for demonstration of diamond wire technology	5/25/2001	▲
Obtain funding for diamond wire demonstration	TBD	TBD
Select location for demonstration	TBD	TBD
Complete demonstration of diamond wire technology	TBD	TBD

Funding by Fiscal Year	FY2001	FY2002	FY2003	FY2004	FY2005
	TBD	TBD	TBD	TBD	TBD

Waste Minimization Assumptions: The Sphere Size Reduction project addresses the need to size-reduce TRU waste items so they can fit inside a shipping container and be disposed at WIPP. No waste minimization assumptions have been applied to this project. It is assumed that $8m^3$ of spheres will be generated yearly and could benefit from size reduction. The diamond wire technology could be applied to approximately 40 legacy spheres.

Waste Avoided: This project does not avoid waste but does provide a disposal path for large TRU waste items that are not planned to be managed in the DVRS.

Issues: The DVRS shear/bailer will not process thick-walled metal items like spheres. A location for conducting the demonstration and methods for handling the sections of the spheres have yet to be identified. A building is planned for storing the spheres at TA-55 that reduces the urgency for size reducing the spheres.

3. Evaporator Bottoms and Liquids Waste Stream

Waste Stream Description: The evaporator bottoms and liquids waste stream includes both the Caustic (24%) and Acidic (76%) liquid waste and the evaporator bottoms from the TA-55 evaporator. The liquid TRU wastes from the nitric acid (acidic) and hydrochloric acid (caustic) aqueous processes are transferred from TA-55 to the TA-50 RLWTF via separate, doubly encased transfer lines. The TA-55 evaporator bottoms and the RLWTF precipitate are cemented into 55-gallon drums. The high concentrations of actinides in the evaporator bottoms frequently exceed the thermal wattage limit for WIPP disposal and require dilution by as much as a factor of five to meet certification requirements.

Table 3. Evaporator Bottoms and Liquids Waste Stream Minimization Improvement Projects

Funded/Implemented Minimization Processes	**Status[a]**	**IOC Year[b]**	**Cost[c]**	**Before[d]**	**After[e]**	**% Reduction[f]**
3.1 Nitric Acid Recovery System (NARS)	▲	2001	Ops	TBD	TBD	TBD
3.2 Vitrification System	▲	2003	TBD	4m^3	1m^3	75%
3.3 Revision 20 TRUPACT SAR	▲	2002	NA	TBD	TBD	TBD
Unfunded Minimization Projects						
Waste Not Addressed: None						
Waste Stream Issues: None						

[a]<u>Code</u> <u>Description</u>

▲ Project is either completed or on schedule with no outstanding issues.

● Project is either behind schedule, over budget, or has technical or programmatic issues.

▼ Project has been terminated or has unresolved technical or programmatic issues.

[b] Initial Operating Capacity

[c] Currently estimated cost to IOC

[d] Estimated portion of the baseline volume (205m^3) to be managed by the minimization process including wastes that may come from another minimization process. No Path Forward waste is 11m^3.

[e] Estimated portion of the treated baseline volume that remains after application of the minimization process

[f] Percent reduction of the total baseline volume of 205m^3

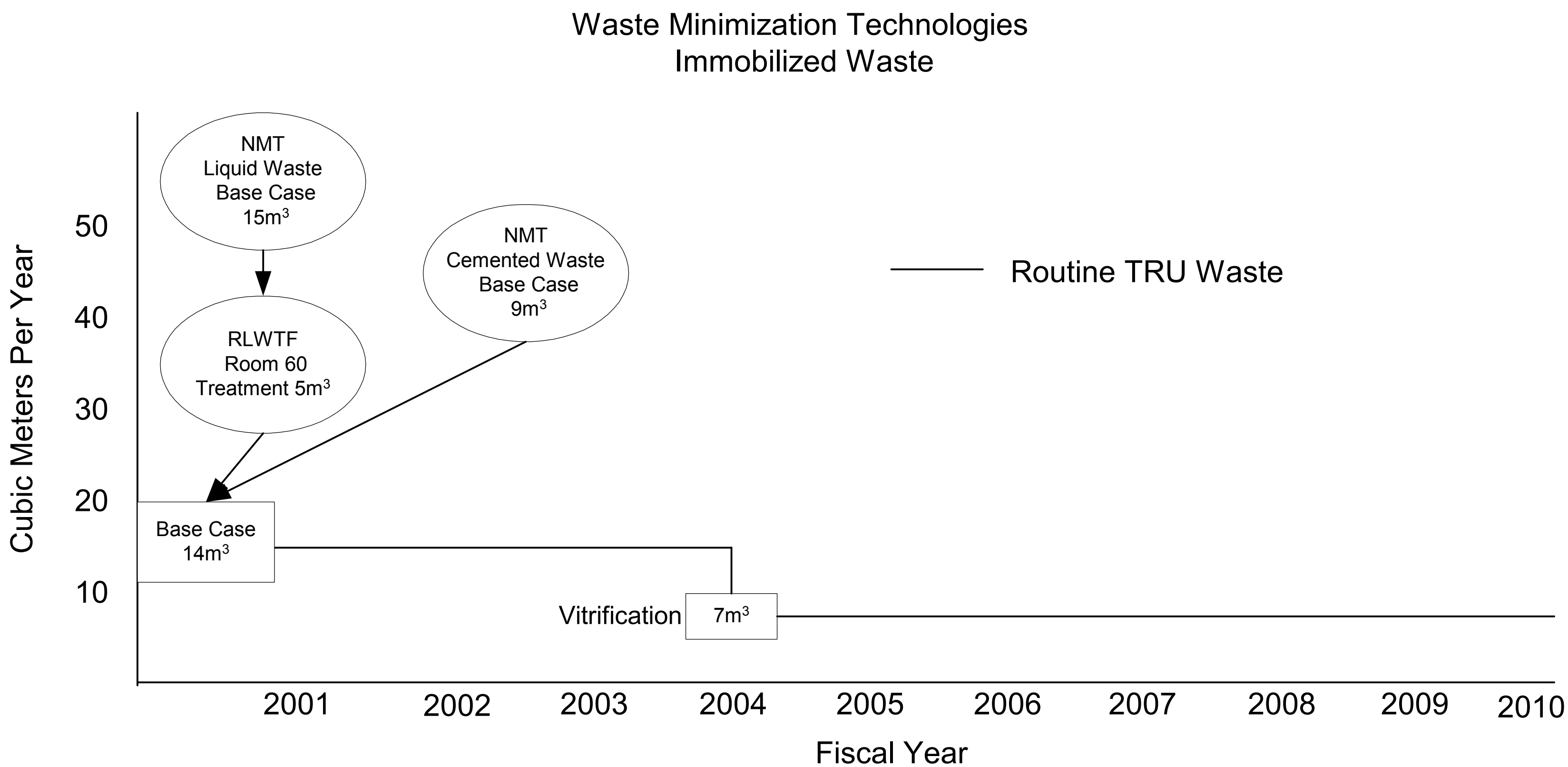

Figure 3. Waste Minimization Technologies Applied to Immobilized Waste

3.1 Nitric Acid Recovery System (NARS) **Contact: Don Mullins, NMT-2**

Description: The TA-55 Nitric Acid Recycling System produces reusable nitric acid by recycling the evaporator distillate that was previously discharged to the TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF).

Status: The NARS is installed and began initial operations in March 2001.

Key Milestones	**Date**	**Status**
Complete Installation and Testing.	3/30/2001	▲
Operation of NARS	3/30/2001	▲

Funding by Fiscal Year	FY2001	FY2002	FY2003	FY2004	FY2005
	Ops	Ops	Ops	Ops	Ops

Waste Minimization Assumptions: Because the acid waste line to the RLWTF traditionally discharged 75% of the TRU liquid waste, implementation of NARS will significantly reduce the amount of liquid waste requiring treatment. The impact of NARS on the amount of cemented TRU waste is still being assessed.

Waste Avoided: Implementation of NARS could reduce the amount of the RLWTF cemented waste stream by $10m^3$ annually.

Issues: None.

3.2 TRU Waste Vitrification **Contact: Ron Nakaoka, NMT-2**

Description: This project will replace cementing of TRU waste sludge with a vitrification system. Vitrification will allow larger quantities of TRU waste to be placed in each drum without concern for generation of hydrogen gas. This project includes modifications to TA-55 and submission to the New Mexico Environmental Division (NMED) of a modification to the TA-55 RCRA Part B Permit.

Status: The melter, offgas system, glove box, and the glass-frit delivery system have all been received. The melter and offgas system are being installed in the basement of PF-5 for cold testing. A project team has been formed within NMT-2 to ensure project completion. The project milestones have been revised in accordance with a July 18, 2001 Project Review.

Key Milestones	**Date**	**Status**
Complete cold testing of melter and offgas system.	12/2001	▲
Complete TA-55 Permit Modification	1/2002	▲
Design and Procurement of Inner Can Movement Mechanism	2/2002	▲
Installation Frit Delivery System	2/2002	▲
Install Vitrification System in PF-4	12/2002	▲
Completion of Readiness Assessment	4/2003	▲
Completion of Hot Operational Testing	5/2003	▲
Completion of 1-Year Hot Operations	5/2004	▲

Funding by Fiscal Year	FY2001	FY2002	FY2003	FY2004	FY2005
	$663K	$784K	$441K	Ops	Ops

Waste Minimization Assumptions: Currently 50 liters of evaporator bottoms are placed in each cemented waste drum. Vitrification will avoid 75% of the TA-55 cemented waste stream by allowing 200 liters of evaporator bottoms to be placed in a drum of vitrified waste.

Waste Avoided: $3m^3$ annually.

Issues:
The project milestones have been revised in accordance with a July 18, 2001 Project Review. Previous budget estimates only allocated $500K for FY2002.

3.3 Revision 20, TRUPACT-II SAR **Contact: Phil Gregory, WPO**

Description: TRUPACT-II SAR Changes. Now that Revision 19 of the TRUPACT-II SAR has been approved, submission of draft Revision 20 should occur in a few months. Revision 20 includes changes that allow more waste to be placed in each container thereby reducing the number of waste packages requiring disposal at WIPP. Those changes should include a higher wattage limit for cemented waste.

Status: Revision 19 of the TRUPACT-II SAR has been approved clearing the way for Revision 20 to be submitted.

Key Milestones	Date	Status
Submit proposed of Revision 20 of the TRUPACT II SAR to the NRC	TBD	TBD
Approval of Revision 20 of the TRUPACT II SAR	TBD	TBD

Funding by Fiscal Year	FY2001	FY2002	FY2003	FY2004	FY2005
	NA	NA	NA	NA	NA

Waste Minimization Assumptions: Because revision 20 has yet to be submitted there are no firm assumptions for waste minimization at this time. However approval of Revision 20 should allow a high-wattage of waste to be packed in each individual waste container and should include higher wattage limits for cemented waste. Increasing the wattage limit of cemented waste drums should reduce the amount of cemented TRU waste from the RLWTF.

Waste Avoided: TBD

Issues: None.

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4.0 Combustibles, HEPA Filters, Plastic, Glass, Rubber, and Others Waste Stream

Waste Stream Description: Combustible wastes are comprised of wood, organic chemicals and oils, cheesecloth, gloves, and protective clothing worn by workers. This waste stream includes wood, organic chemicals and oils, cheesecloth, gloves, plastic bags, plastic reagent bottles, plastic-sheet goods used for contamination barriers, laboratory glass wear, glass equipment, and glass glovebox windows, rubber seals, and other miscellaneous waste.

Table 4. Combustibles, HEPA Filters, Plastic, Glass, Rubber and Others Waste Stream Minimization Improvement Projects

Funded/Implemented Minimization Processes	**Status**[a]	**IOC Year**[b]	**Cost**[c]	**Before**[d]	**After**[e]	**% Reduction**[f]
2.3 Sort and Segregation	▲	2001	Ops	$65m^3$	$55m^3$	4%
4.2 TCE Minimization and Reuse	▲	2002	TBD	240L	6.8L	0%
4.3 Hydrothermal (TCE Treatment)	▲	2002	TBD	6.8L	0L	0%
4.4 Revision 19 TRUPACT SAR	▲	2001	NA			TBD
Unfunded Minimization Projects						
4.1 Waste Granulator (formerly MSO)	▲	TBD	TBD			
Waste Not Addressed: None						
Waste Stream Issues: The MSO project has been terminated. A granulator was purchased for treatment of the waste feed for the MSO project. The feasibility of using the granulator for volume reduction of combustible waste items is being assessed.						

[a] Code Description
- ▲ Project is either completed or on schedule with no outstanding issues.
- ● Project is either behind schedule, over budget, or has technical or programmatic issues.
- ▼ Project has been terminated or has unresolved technical or programmatic issues.

[b] Initial Operating Capacity
[c] Currently estimated cost to IOC
[d] Estimated portion of the baseline volume ($205m^3$) to be managed by the minimization process including wastes that may come from another minimization process. No Path Forward waste is $11m^3$.
[e] Estimated portion of the treated baseline volume that remains after application of the minimization process
[f] Percent reduction of the total baseline volume of $205m^3$

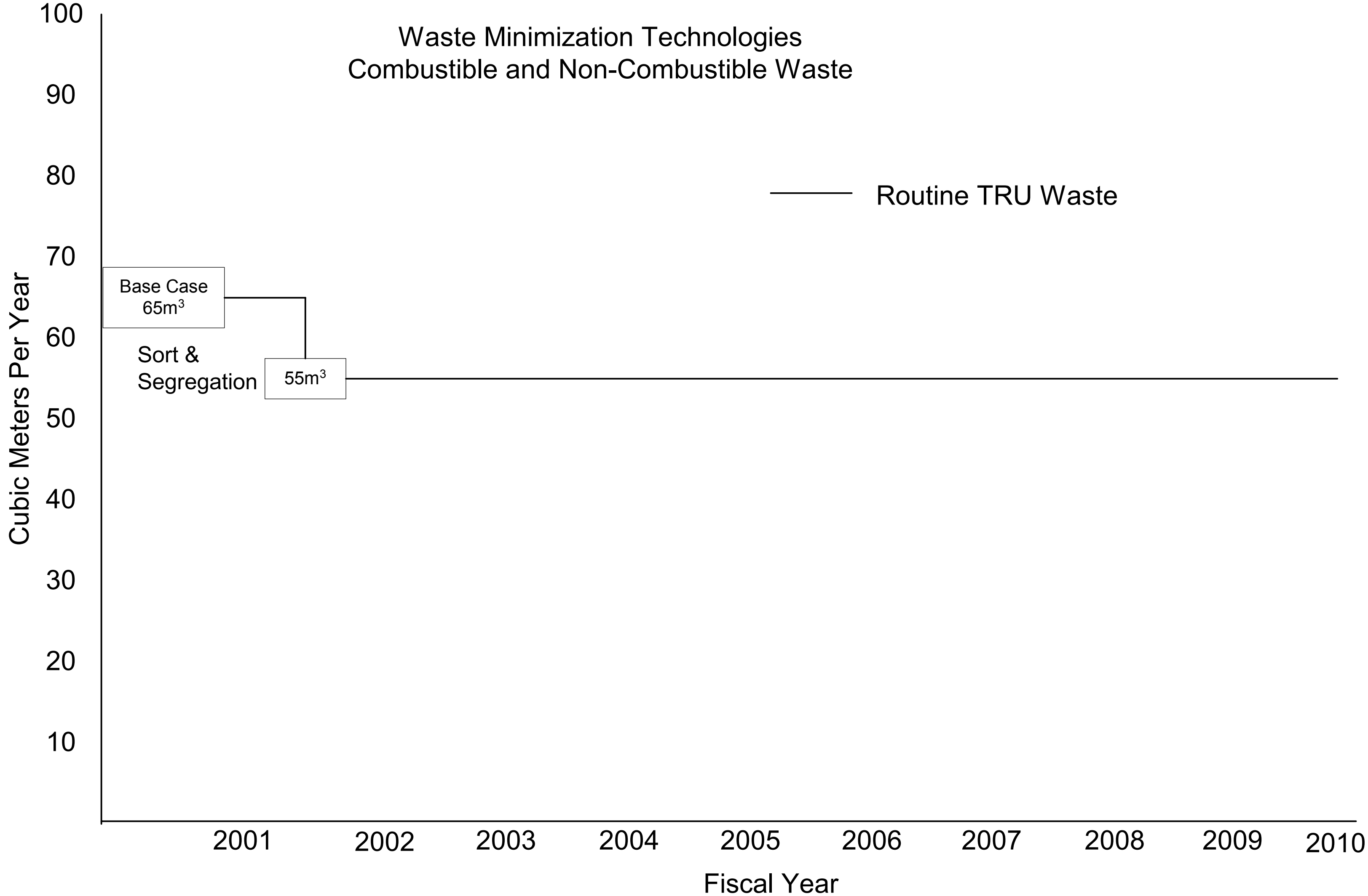

Figure 4. Waste Minimization Technologies Applied to Combustible and Non-Combustible Waste

4.1 Waste Granulator (Formerly Molten Salt Oxidation)

Contact: Kevin Ramsey, NMT-15

Description: The Molten Salt Oxidation Process System (MSO) project has been terminated. A granulator and its custom designed glove box were originally purchased to process plastic and other combustible feed materials for the MSO project. Many combustible waste items such as plastic bottles and tubing have a large volume in relation to the actual amount of material present. Granulation destroys the shape of the item and will allow more waste to be packaged in each drum.

Status: The approximately 100 lbs of combustible materials have been size reduced with the granulator. On July 5th NMT-15 successfully demonstrated a granulator for size reduction of combustible waste items typically found in the NMT TRU waste stream. The demonstration included non-leaded glovebox gloves, PVC bag-out bags, and 1-liter low-density and high-density polyethylene bottles. The demonstration was the first step in determining the feasibility of installing the granulator in PF-4. The feasibility of implementing the granulator is being evaluated by NMT-15, 4 and 7. The actual installation of the granulator has not been funded.

Key Milestones	**Date**	**Status**
Submit plan for feasibility study	9/2001	▲
Submit plan for installation of granulator (if feasible)	3/2002	TBD
Install granulator	TBD	TBD
Operation of granulator	TBD	TBD

Funding by Fiscal Year	FY2001	FY2002	FY2003	FY2004	FY2005
	$150K	$275K	TBD	TBD	TBD

Waste Minimization Assumptions: Combustible waste accounts for approximately 25% of the NMT TRU waste stream and use of the granulator could reduce that stream by $12m^3$ per year. The volume reduction and cost savings of reducing the plastic waste stream is significant (approximately $400K) and may be applicable to other TRU waste materials like glass and ceramic materials.

Waste Avoided: Approximately $12m^3$ per year.

Issues: The feasibility study will address many issues. It may not be beneficial to reduce the volume of plastic items if the drum cannot be filled to capacity due to the waste exceeding the wattage limit. In addition, filling a drum with granulated materials may reduce the accuracy of the NDA and holdup and release of radioactive materials within the granulator may reduce the SNM of one drum while increasing the SNM content of another. If it is feasible to use the granulator, funding for installation of the granulator will have to be prioritized against other waste minimization needs.

4.2 TCE Minimization and Reuse **Contact: David Mann - NMT-5**

Description: This project is upgrading the processes that use Tricloroethylene (TCE) for cleaning of metal parts. TA-55 are undergoing a series of upgrades designed to reduce the amount of waste generated, reduce the exposure levels of the operator to both radiation and solvent and to aid in removing any inconsistencies in the level of cleaning due to operator handling or solvent purity. Central to these upgrades is the replacement of the ultrasonic bath currently in use with a mechanical spray washer and installation of a distillation recycle unit in conjunction with a fluorometer and pH meter to monitor the organic contaminant loading and TCE breakdown.

Status: The spray washer cleaning system has been qualified – verified that it cleans as well as the old process. The spray washer has not been installed in PF-4 pending approval of the Design Change Plan (DCP). The DCP is 95% of the way through the approval process. Testing of the recycle system is nearing completion. Additional work on the methods to determine when the TCE needs to be recycled or replaced is ongoing and will continue into FY 2002

Key Milestones	**Date**	**Status**
Installation of Spray Washer in PF-4	9/28/2001	○
Complete testing on recycle system	9/28/2001	▲
Qualify Distillation Unit	2/28/02	▲
Complete FTIR Analytic Methods	7/31/02	▲
Implement TCE recycle/reuse	8/30/02	▲

Funding by	FY2001	FY2002	FY2003	FY2004	FY2005
Fiscal Year	$279K	$325K	NA	NA	NA

Waste Minimization Assumptions: Use of the spray washer and recycling/reuse of the TCE is estimated to reduce the annual volume of TCE waste by greater than 95% (from approximately 240 liters per year to approximately 12 liters per year).

Waste Avoided: Because the initial volume is small, this project will only reduce about $0.2m^3$ of TRU waste each year. This is significant however because there is not a disposal path for TRU waste TCE.

Issues: Installation of the spray washer can not take place until the Design Change Plan (DCP) is approved. Although the DCP is 95% of the way through the approval process it could take several months to schedule craft support for the installation.

4.3 Hydrothermal Processing **Contact Laura A. Worl, NMT-11**

Description: This project would complete the upgrade and installation of a full-scale (8L/day) hydrothermal processing (HTP) system in PF-4 for the destruction of organic wastes. Although this process will initially treat TCE, HTP is a combustible treatment process that can eliminate other combustible organic mixed waste streams by the complete oxidation of the organic (from CO2 to H2O) and reduction of the nitrate components of the waste substances.

Status: Small-scale testing has been completed and was successful. The HTP team is preparing the final paperwork for the Process Hazard Analysis that needs to be completed prior to installing the system into PF-4. Testing of a full scale HTP system (8L/day through put) is underway at TA46. The host glovebox needs to be cleaned out prior to installation but installation is scheduled for FY02.

Key Milestones	**Date**	**Status**
Complete full-scale system testing	9/28/2001	▲
Complete installation in PF-4	9/28/2002	▲

Funding by Fiscal Year	FY2001	FY2002	FY2003	FY2004	FY2005
	Ops	Ops	Ops	Ops	Ops

Waste Minimization Assumptions: Essentially the hydrothermal processing system destroys 100% of the organic materials it processes. Use of the HTP system will reduce the generation of TRU/MTRU waste organic compounds by approximately $0.24 m^3/yr$ if only applied to TCE and if the TCE isn't recycled and reused. Hydrothermal processing can be applied to aqueous/organic mixtures, pure organic liquids, or combustible solids such as ion exchange resins, plastics and rags.

Waste Avoided: $0.24 m^3/yr$ if only applied to TCE.

Issues: Distillation and reuse of TCE will significantly reduce the amount of newly generated materials requiring destruction by the Hydrothermal Processing System. However the HTP system can treat a variety of materials and wastes.

4.4 Revision 19, TRUPACT-II SAR **Contact: Phil Gregory, WPO**

Description: The Nuclear Regulatory Commission (NRC) has approved Revision 19 to the TRUPACT-II SAR. Approval had been expected since April 2001. The impact of Revision 19 hasn't been assessed yet but the draft included changes that allow more waste to be placed in each container thereby reducing the number of waste packages requiring disposal at WIPP. Those changes allow the use of pipe overpacks, filters that diffuse hydrogen at a higher rate and use of Dose-Dependent G-Values. Under the draft Revision 19 a calculated Lower Explosive Limit for the mixture of all flammable gases in the head space of a drum can be used instead of the flammable VOC concentration limit of 500ppm. Testing of headspace VOCs would be allowed to determine compliance for drums that exceed the decay heat limits. Revision 19 should also give credit for combining different shipping categories such that a drum that exceeds the decay heat limit could be shipped with lower wattage drums. Another major proposed change should result in quicker reviews of TRUCON code requests by placing the authority for approving those requests with the TRUPACT II Cognizant Engineer at the CBFO.

Status: The Nuclear Regulatory Commission (NRC) has approved Revision 19 to the TRUPACT-II SAR. The approved version of Revision 19 has not been received for review.

Key Milestones	**Date**	**Status**
Approval of Revision 19 of the TRUPACT II SAR	4/27/2001	Approved on 8/2/2001

Funding by Fiscal Year	FY2001	FY2002	FY2003	FY2004	FY2005
	NA	NA	NA	NA	NA

Waste Minimization Assumptions: The full impact of Revision 19 is still being assessed. However Revision 19 should allow more high-wattage waste to be packed in each individual waste container. The decrease in the number of waste containers requiring disposal at WIPP will depend upon the waste type, use of more efficient filters, and the age of the waste.

Waste Avoided: TBD

Issues: None

5. 0 TRU Waste Source Reduction Project Summaries

5.1 Ion Beam Etching and Polishing of Pu Alloys   Contact: Brad Storey - NMT-16

Description: Plutonium base alloys must be mounted and polished by conventional metallographic procedures including diamond polishing until the surface of the specimen displays a mirror finish. After a final polish is achieved, the specimen surface is chemically treated or electrochemically etched to reveal surface features of interest. The ion etching system will replace much, if not all of the diamond polishing and yield a finished, treated surface, with no additional processing. This will also eliminate the chemical or electrochemical etching steps after polishing.

Status: The ion etching system has been tested outside of PF-4 and it has worked very well.

Key Milestones	Date	Status
Cold Testing of Ion-etching system	Complete	Complete
Installation in PF-4	9/28/2001	

Funding by Fiscal Year	FY2001	FY2002	FY2003	FY2004	FY2005
	$55K	NA	NA	NA	NA

Waste Avoided: Use of the Ion Beam will eliminate or dramatically reduce the Pu contaminated combustible waste from specimen polishing and the mixed acid/Pu waste stream from surface treatments.

Issues: Installation of the equipment within PF-4 is still 3– 6 months away as this project is not core to the present mission. Installation will require running minor utilities to the unit. Before installation a Design Change Plan (DCP) needs to be processed through the Configuration Management system. An Unresolved Safety Question Determination (USQD) and a hazard analysis need to be performed.

5.2 PU Oxidation State Diagnostic for Chloride Line   Contact: John M. Berg - NMT-11

Description: This project will implement a real time, in-line capability to rapidly determine the Pu oxidation state while a batch is in process by monitoring the visible light absorption spectrum of Pu in solution. By providing continuous knowledge of Pu Oxidation State it enable operators to adjust chloride processing line conditions immediately if the oxidation state drifts.

Status: Spectrometer has been tested in a cold lab and has been installed in the NMT-2 process, but the feed line needs to be routed to the equipment and a new manifold needs to be installed. It will probably be another 3 months before the unit is ready to collect data. Once the data is collected it will have to be reviewed to determine if any modifications are necessary.

Key Milestones	**Date**	**Status**
Install feed line to Spectrometer	6/29/2001	○
Review of Operational Data	9/28/2001	○

Funding by Fiscal Year	FY2001	FY2002	FY2003	FY2004	FY2005
	$58K	NA	NA	NA	NA

Waste Avoided: This will eliminate most of the unacceptable batches, reducing operation costs and neutralized TRU liquid waste by 5 to 10% (750 – 1500 L/year).

Issues: The equipment is installed in the NMT-2 process, but the fiber-optic feed through lines need to be routed to the equipment and a new manifold needs to be installed.

5.3 Glow Discharge Mass Spectrometer **Contact: John Huang - NMT-5**

Description: This project will restore glovebox GB353 and install an inline Glow Discharge Mass Spectrometer (GDMS) to support plutonium foundry operations. The GDMS allows real-time analysis of metal feeds and castings.

Status: The old equipment under glovebox GB353 has been removed and the old equipment inside the glovebox is being removed. After removal of the old equipment the glovebox will require modification. The GDMS will soon be moved to TA-48 for some additional pre-installation testing.

Key Milestones	**Date**	**Status**
Removal of equipment from glovebox	6/28/2001	○
Installation of GDMS	9/28/2001	○

Funding by Fiscal Year	FY2001	FY2002	FY2003	FY2004	FY2005
	$50K	NA	NA	NA	NA

Waste Avoided: Use of the GDMS will not only enhance the process efficiency in the plutonium foundry, but it will also reduce the number of samples sent offsite for analysis, the waste generated from processing those samples and the reprocessing cost of process materials.

Issues: Removal of the old equipment in the glovebox is underway but is two months behind schedule. Although it is possible the GDMS could be installed before the end of September 2001, it is not probable.

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TRU Waste Management Issues

No path forward wastes. When testing and material recovery are complete, the large diameter test spheres do not have a defined path forward because they are too large for the currently approved shipping containers. Smaller diameter spheres may fit inside the TRUPACT III that is currently in the planning stages. Large diameter spheres will require size reduction. The shear/baler at the DVRS is not designed to handle thick-walled metal items like the spheres.

Progress

The DVRS building is complete. While initially the DVRS will only be able to process TRU that is less than the Category 3 radiological limits, there are approximately 125 Fiberglass Reinforced Plywood (FRP) boxes that meet that requirement. Processing of those containers will open up needed storage space at TA-54 Area G. The DVRS is expected to process $300m^3$ per year and that rate far exceeds any projected rate of newly generated large metal TRU items.

Three NMT projects, the Ion Beam Etching and Polishing of Pu Alloys, the Glow Discharge Mass Spectrometer and the real-time PU Oxidation State Diagnostic for the Chloride Line are moving towards completion. While most of the projects covered in this report improve the management of TRU waste after it is produced, each of these three projects reduces a source of the TRU waste stream.

The NARS is operational and is performing well. NARS is eliminating the nitric acid discharge to the RLWTF and provides a higher quality acid for dissolution operations. In addition to reducing the volume and activity of TRU liquid waste, NARS enables the TA-50 RLWTF to meet nitrate discharge limits.

TRU Waste Minimization References

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Strategic Planning for an Integrated Transuranic Waste Minimization and Pollution Prevention Program, Roger L. Hutchton, LANL, March 2001

A Vision for Environmentally Conscious Plutonium Processing, Larry R. Avens and P. Gary Eller, Challenges in Plutonium Science, Volume II, Los Alamos Science, Number 26, 2000, P 436.

Systematic Evaluation of Options to Avoid Generation of Noncertifiable Transuranic (TRU) Waste at Los Alamos National Laboratory, Waste Management Symposia 98', Jeremy M. Boak, Stanley T. Kosiewicz, Inés Triay, Kathleen Gruetzmacher, Andrew Montoya, LANL, 1998

A Waste Minimization Plan for NMT Division, A Presentation to the Nuclear Materials Technology Division Review Committee, Larry R. Avens, LANL, May 1998

LA-UR-97-3399, Implementing Waste Minimization At An Active Plutonium Processing Facility: Successes and Progress at Technical Area 55 of the Los Alamos National Laboratory, James J. Balkey, Mark A. Robinson, Jeremy Boak, LANL

LA-UR-95-1977, Cost/Benefit Analysis for Selected Waste Minimization Technologies at TA-55, Stephen T. Boerigter, LANL, September 1, 1995

LA-UR-95-1403, TA-55 Waste Minimization and Pollution Prevention Plan, Nuclear Materials Technology Division, Los Alamos National Laboratory, C. L. Foxx, LANL, May 15, 1995