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WASTE VOLUME FORECAST

Revision 0

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Los Alamos
NATIONAL LABORATORY

CONTENTS

ACRONYM LIST

ATS	Aurora Technical Services
BUS	Business Operations Division
C	Chemistry Division
AAC	Actinide Analytical Chemistry
CFR	Code of Federal Regulations
CMR	Chemistry and Metallurgy Research
D&D	Decommissioning and Demolition
DOE	Department of Energy
DX	Dynamic Experimentation Division
EES	Earth and Environmental Sciences Division
EIP	e-p Instability Program
EM	Environmental Management
EPA	Environmental Protection Agency
ER	Environmental Remediation
ESA	Engineering Sciences and Applications Division
ESH	Environment Safety and Health Division (now HSR Division)
FWO	Facilities and Waste Operations Division
FY	Fiscal Year
HLW	High-Level Waste
HSR	Health, Safety, Radiation Division
LANL	Los Alamos National Laboratory
LANSCE	Los Alamos Neutron Science Center Division
LIR	Laboratory Implementing Requirement
LLW	Low-Level Waste
LPY	Liters per Year
MLLW	Mixed Low-Level Waste
MST	Materials Science and Technology Division
NARS	Nitric Acid Recycle System
NMED	New Mexico Environment Department
NMT	Nuclear Materials Technology
OSR	Off-Site Source Recovery
OSRP	Off-Site Source Recovery Project
P	Physics Division
P2	Pollution Prevention
PCB	Polychlorinated Biphenyl
PM	Project Management
R&D	Research and Development
RCA	Radiological Control Area
RCRA	Resource Conservation and Recovery Act
RLW	Radioactive Liquid Waste
RLWTF	Radioactive Liquid Waste Treatment Facility

ACRONYM LIST (cont)

RRES	Risk Reduction and Environmental Stewardship
RRES-R	Risk Reduction and Environmental Stewardship—Remediation
SWEIS	Site-Wide Environmental Impact Statement
SWO	Solid Waste Operations
TA	Technical Area
TRU	Transuranic
TSCA	Toxic Substances Control Act
TSTA	Tritium Systems Test Assembly
WIPP	Waste Isolation Pilot Plant

1.0 INTRODUCTION

This report presents a 10-year forecast of Los Alamos National Laboratory (LANL) hazardous and radioactive waste volumes. The waste volume forecast was prepared to support strategic planning for waste management operations and facilities. Knowledge of expected waste volumes will aid waste generators, program managers, and waste management operational organizations in long-term planning and will help ensure that the Laboratory has the right capabilities in place to support programmatic operations. This information will also aid the Laboratory in targeting activities for waste minimization opportunities.

Laboratory Implementing Requirement (LIR) 404-00-02.3 requires that waste generators provide waste forecasts on request for any treatment, storage, and disposal facility to which they discharge waste. The Department of Energy (DOE) also requires waste forecasts for the Integrated Database and the Baseline Environmental Management Report.

Aurora Technical Services (ATS) and Abaxial Technology, Inc., on behalf of the Readiness in Technology Base and Facilities Program Office and in cooperation with LANL technical divisions, prepared this report. Waste management and program/project representatives from Nuclear Materials Technology (NMT), Materials Science and Technology (MST), the Los Alamos Neutron Science Center (LANSCE), Facilities and Waste Operations (FWO), Chemistry (C), and Risk Reduction and Environmental Stewardship (RRES) divisions provided information for this report. The Decommissioning and Demolition (D&D), Environmental Remediation (ER), Off-Site Source Recovery (OSR), and Transuranic (TRU) Waste Characterization (2010) projects also provided input to the report.

This report describes the approach and process used in developing the volume forecasts and then presents a discussion of the volume forecast data and any potential impacts to LANL activities. The appendix includes additional details and assumptions for each of the waste categories based on the program/project interviews.

Projections were made based on historical data combined with both near- and long-term program plans. It should be noted that the 10-year forecast is based on many assumptions. The near-term forecasts rely on relatively good information from managers directing currently funded programs/projects. The long-term forecasts were based on program/project manager expectations of long-range potential future funding. Forecasting is uncertain by nature, and thus, users are cautioned when using out-year forecasts. The near-term forecasts are likely to be more reliable than the longer-term forecasts. The data will be updated annually, and over time, the uncertainties should decrease and the usefulness of the information should improve. An attempt was made to tie projected waste generation to major programs within each division. The actual volumes will vary from this estimate; however, the forecasts provide a good basis for planning decisions.

The approach used in this study was to identify the organizations, programs, and projects that are responsible for the majority (>80%) of the waste by type. These activities were selected for detailed inquiry and modeling. The remaining 20% were simply extended based on historical trends. Projections for ER and D&D wastes have been included where appropriate. In most cases, reductions for waste minimization activities have not been factored into the totals. These contributions will be recognized as they occur in future updates to this report.

2.0 FORECASTING

2.1 DATA COLLECTION

Data were collected from the LANL divisions, programs, and projects by ATS analysts familiar with environmental/WM practices at LANL. An initial query of existing data sources was performed to identify historical generation and to identify the divisions that generate most of the waste. Data sheets were prepared with historical trends and a preliminary forecast developed from existing sources such as the FWO-solid waste operations (SWO) waste database, LANL Site-Wide Environmental Impact Statement (SWEIS) data, Environmental Management (EM) Integrated Planning and Budgeting System data, Waste Management Facility Strategic Plan, and other sources.

ATS analysts initially conducted interviews with division waste management personnel to review the data sheets and the preliminary forecasts. The waste management representatives validated the historical data and identified the key programs/projects (or groups) responsible for the majority of the waste. The waste management representatives assigned a portion of the total division volume to each of the key programs/projects based on process knowledge or records where they exist. Generally, detailed records of waste volumes generated by program or project do not exist, and this assignment required judgment by the waste management professionals.

After the waste generating activities were identified and a baseline volume was established, program/project contacts were identified. The responsible managers for each key program/project then were interviewed regarding their vision of the next 10 years. Based on these interviews, relative values (delta factors) of program-waste-generating activity were developed. These values measured future program activity relative to the baseline year.

This approach is not perfect; however, it does provide a reasonable way to formulate waste volumes based on out-year program plans. Generally, the waste management professionals understand the historical volumes, but they do not have a good idea of what the programs are planning. On the other hand, the program managers understand the future of their activities, but their understanding of the waste volumes to be generated is limited. This approach combined the best information from both sources.

2.2 DATA STRUCTURE

The data were collected by division but are reported by waste type. The waste types of interest include transuranic (TRU) waste, radioactive liquid waste (RLW), low-level waste (LLW), mixed low-level waste (MLLW), and chemical/hazardous waste. The data for each division are reported by key program/project. Additional data are supplied to document the program/project forecasts (delta factors). The notes and assumptions also have been included in the report details.

3.0 WASTE PROJECTIONS

3.1 TRU WASTE

3.1.1 Definition and Scope

TRU waste contains >100 nCi of alpha-emitting TRU isotopes per gram of waste having half-lives >20 yr (atomic number greater than 92), except for (1) high-level waste (HLW); (2) HLW waste that the DOE has determined, with the concurrence of the Administrator of the Environmental Protection Agency (EPA), does not need the degree of isolation required by Code of Federal Regulations (CFR) 40 CFR 191; or (3) waste that the United States Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR 61. TRU waste is generated during research, development, and nuclear weapons production.

The TRU waste volumes reported by year in this projection include routine, nonroutine, newly generated, and legacy TRU wastes; thus, totals will not agree with TRU waste generation volumes periodically reported in the annual Pollution Prevention Roadmap and elsewhere. Two reasons exist for the data discrepancies between this report and the quarterly and annual pollution prevention (P2) reports. First, the P2 reports record waste in the year in which it was generated, whereas this report records waste in the year in which it was processed for disposal. Second, the P2 reports contain only routine waste data. Routine waste is defined as waste produced from any type of production operation, analytical, and/or research and development (R&D) laboratory operations; treatment, storage, and disposition facility operations; “work for others”; or any other periodic or recurring work that is considered ongoing in nature. Nonroutine waste is defined as one-time operations waste: wastes produced from environmental restoration program activities, including primary and secondary wastes associated with retrieval and remediation operations; legacy wastes; and D&D/transition operations.

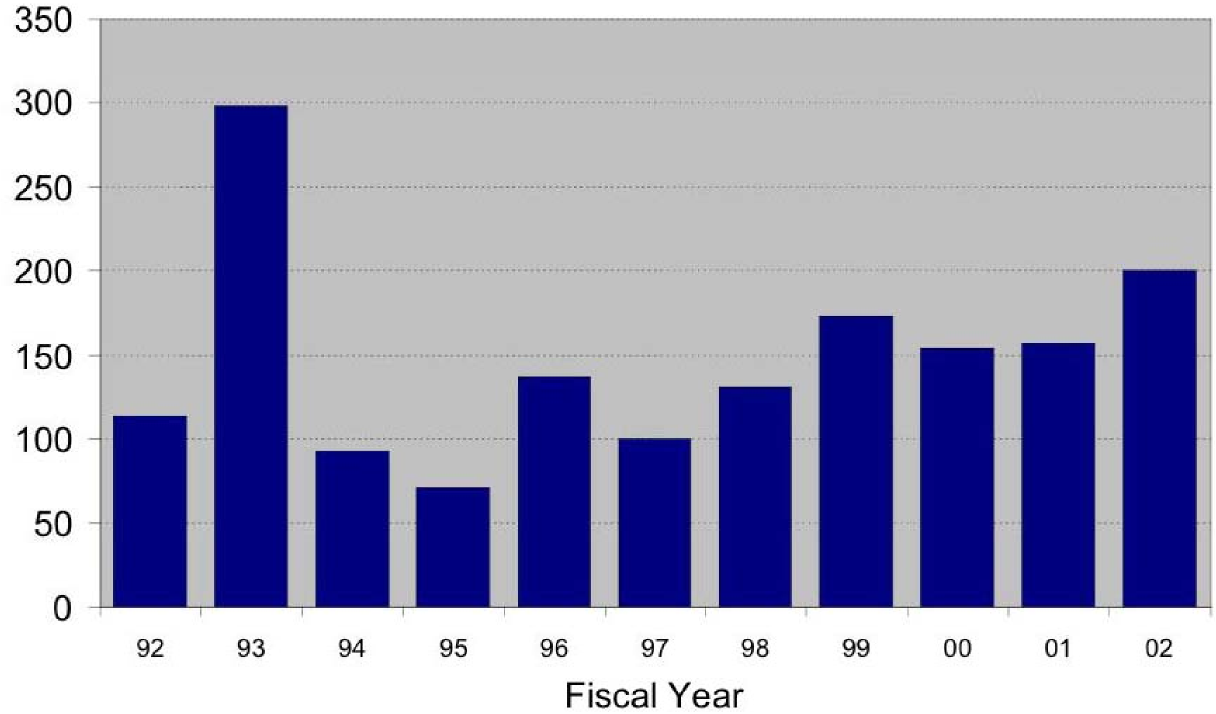
3.1.2 Historical Trends

The average generation of TRU waste over the past 11 years has been 148 cm^3/yr. Volumes have been trending higher for the past decade as the Laboratory’s nuclear materials mission at Technical Area (TA)-55 has expanded and as legacy waste is processed.

The historical generation of TRU waste is shown by fiscal year in Fig. 3-1.

3.1.3 Generator Divisions

NMT, FWO, and RRES are the key divisions responsible for generating most of the TRU waste at LANL (see Fig. 3-2). Small amounts have been generated by C Division in the past; however, they are not expected to generate significant waste in the future. The FWO and RRES wastes are related to NMT program activities.



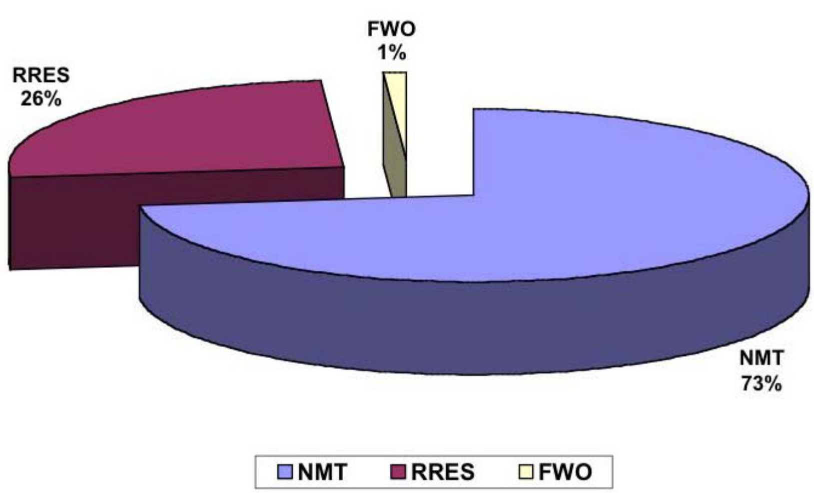


Fig. 3-1. Past TRU waste generation.

Fig. 3-2. TRU waste-generating divisions.

3.1.4 Key Program/Projects

Key programs/projects that were responsible for generating TRU waste during FY02 have been identified and are described in Table 3-1.

Table 3-1. TRU Waste Generation by Division and Project

Organization	Program/Project	Volume FY02 (m^3)	Percentage
NMT	Various Projects	4	
NMT-1	Actinide Analytical Chemistry (AAC)	1	
NMT-2	Nuclear Material Stabilization and Packaging	38	
NMT-2	Actinide Processing and Recovery	15	
NMT-5	Pit Fabrication	24	
NMT-9	^{238}Pu Operations	5	
NMT-9	^{238}Pu Heat Sources	13	
NMT-6, 11	Plutonium R&D Support	13	
NMT-11	EM Technology Support	5	
NMT-11	Energy Programs	1	
NMT-15	Material Disposition	3	
NMT-15	Nonproliferation Technologies	1	
NMT-16	Pit Surveillance	1	
NMT-3,4,7,8,13	Infrastructure	4	
NMT	Nonroutine TRU Waste	17	
	NMT Subtotal	**129**	**73%**
RRES-WD	Off-Site Source Recovery Project	48	
RRES-WD	Project 2010	0*	
RRES-ER	Environmental Restoration	0	
	RRES Subtotal	**48**	**26%**
FWO-WFM	Radioactive Liquid Waste Treatment Facility	**2**	
	FWO Subtotal	**2**	**1%**
	Total	**179**	**100%**

*Project 2010 repackages drums that are logged into the database; however, the majority of these drums are not new waste.

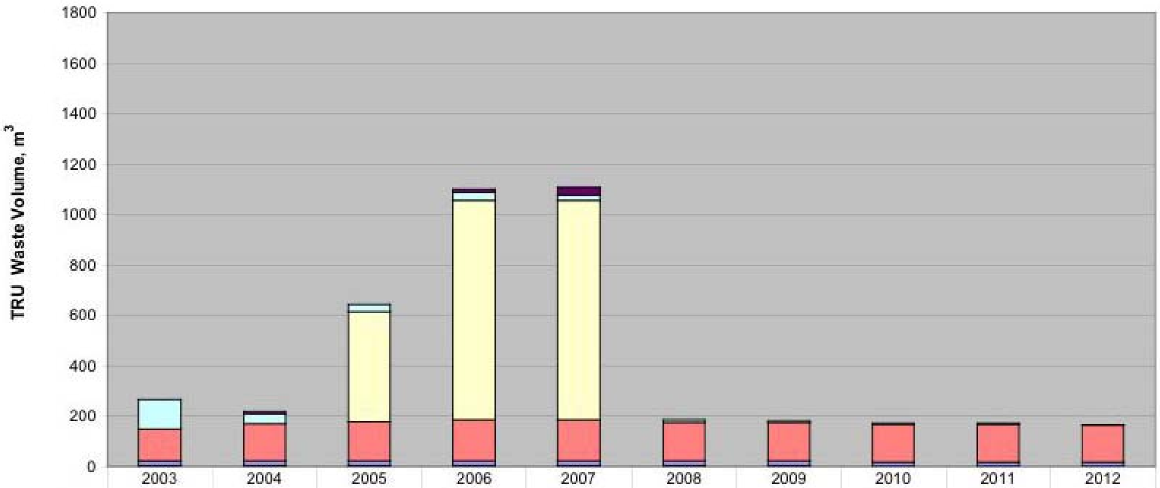
3.1.5 Forecast

TRU waste generation is not predicted to change significantly over the next 10 years. The dominant activity that will drive changes in the volume of waste sent for disposition is the EM waste disposal project that will retrieve ~1800 m^3 of legacy waste currently located below ground at TA-54. The OSR Project will continue to retrieve sealed sources from around the country in preparation for treatment and disposal. The nuclear material stabilization project will see increasing activity through the middle of the decade and then a tapering off in the second half. Pit manufacturing, heat sources, and energy programs are expected to see a 40% increase in activity over the next several years and then continue at elevated levels through the remainder of the decade. Volumes of TRU waste will be increased by the cleanout of legacy waste from the NMT vault. The older vault material has a high curie content and thus will require a greater packaging volume, which will add to the overall volume increase. These increases will be offset partially by reductions in the EM technology program and by increased waste minimization activities. Projected TRU volumes are shown in Fig. 3-3.

3.1.6 Analysis

The primary issue related to TRU waste volumes is the limited above-ground storage capacity at LANL. From FY05 to FY07, large quantities of legacy TRU waste are scheduled to be retrieved from underground storage for processing, repackaging, and shipment to the Waste Isolation Pilot Plant (WIPP). It is not expected that this waste will impact LANL storage facilities significantly because the waste will not be retrieved until sufficient storage space has been created by TRU shipping operations. Further, the schedule is flexible, and although it is projected to begin in FY05 and take 3 years to complete, it can be delayed or extended or both to adjust to the availability of storage space. However, retrieving the legacy waste will require new and modified capabilities for the retrieval operation itself because this waste is located deeper underground than waste previously retrieved and because it is packaged in various containers of unknown integrity.

The general short-term trend is toward increased waste volumes due to expanded NMT program activities; thus, LANL and NMT will need to find additional opportunities for waste minimization. The DOE Secretary’s goal for waste minimization requires overall reductions in the quantity of newly generated routine TRU waste sent to TA-54 by 2005.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total, cubic meters	264	218	643	1,100	1,108	185	179	172	171	165
RRES-ER	0	9	0	13	31	0	0	0	0	0
RRES-OSRP	116	40	30	30	20	10	5	5	5	3
RRES-2010	0	0	437	873	873	0	0	0	0	0
NMT Routine	126	148	156	163	163	154	154	150	149	145
NMT Nonroutine	17	17	17	17	17	17	17	17	17	17
FWO	5	3	4	4	4	4	4	0	0	0

Fig. 3-3. TRU waste forecast.

3.2 RADIOACTIVE LIQUID WASTE

3.2.1 Definition and Scope

For the purposes of this forecast, RLW is defined as all waste influent to the Radioactive Liquid Waste Treatment Facility (RLWTF) located at TA-50. The RLWTF has been treating aqueous low-level wastewaters from LANL facilities since 1963. The plant is capable of treating in excess of 20,000,000 liters per year (LPY) of wastewater. Some 1800 drains and other sources attached to the RLW industrial collection system connect 15 TAs, 13 facility management units, and 62 buildings to the TA-50 plant. TAs 54, 21, and 16 do not have direct connections to the main RLW industrial waste line, and any wastes from these areas are trucked to the TA-50 plant. The remainder of the Laboratory's TAs discharge wastewater directly to RLWTF through the plant's main industrial line. Much of the wastewater discharged to the RLWTF industrial wastewater line is not radioactive. In addition to the main industrial wastewater line, two smaller lines connect TA-55 with TA-50 and exclusively carry acid and caustic radioactive wastes.

3.2.2 Historical Trends

The average generation of RLW waste over the past 11 years has been ~20 million liters per year (LPY). Volumes have been trending lower for the past 4 years because the Laboratory's waste minimization program has removed nonradioactive sources from the RLW collection system. These trends are shown in Fig. 3-4.

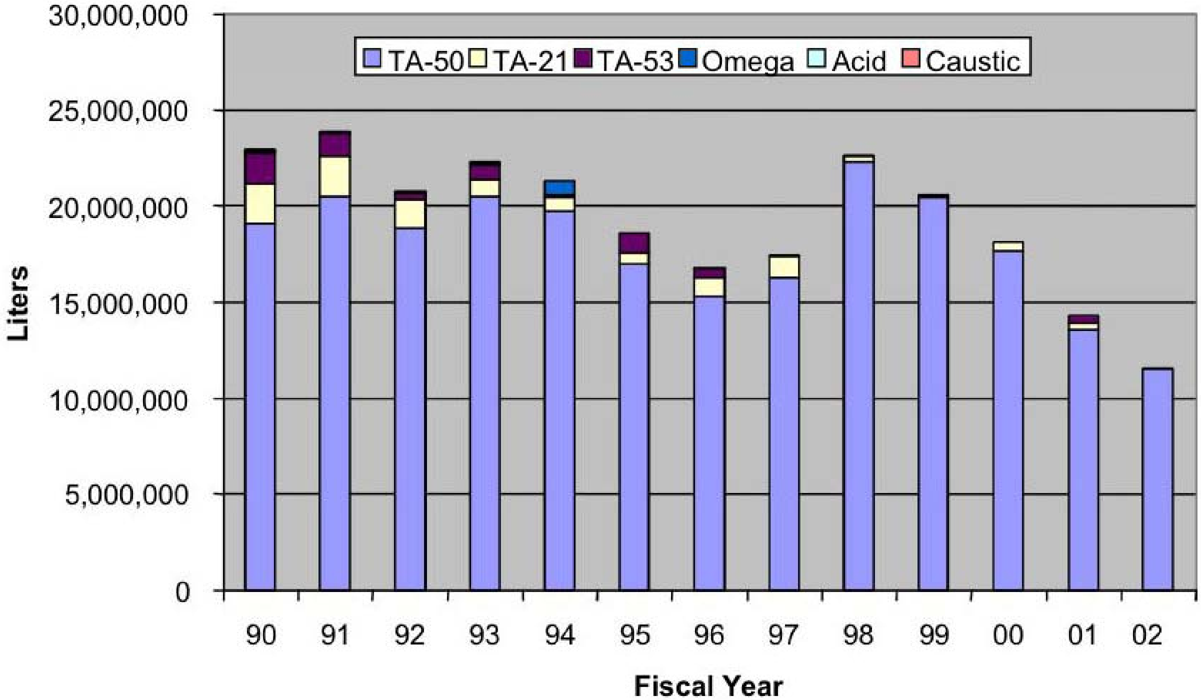


Fig. 3-4. Past generation of radioactive liquid waste.

3.2.3 Generator Divisions

NMT, C, and MST divisions produced the majority of RLW at LANL in FY02. Small quantities of RLW were produced by other divisions, including Engineering Sciences and Applications (ESA), Dynamic Experimentation (DX), and RRES-ER (see Fig. 3-5).

3.2.4 Key Program/Projects

Key programs/projects that were responsible for generating RLW waste during FY02 have been identified and are described in Table 3-2.

3.2.5 Forecast

RLW waste generation is not predicted to change significantly over the next 10 years. The dominant activities that will drive any change include the waste minimization program and continuing efforts to divert nonradioactive liquid wastes currently being sent to the RLWTF. The nuclear materials programs at TA-48 and TA-55 and at the TA-03 Chemistry and Metallurgy Research (CMR) and Sigma facilities will continue to drive future generations. The planned increase in activity in the pit-manufacturing and other NMT programs is expected to increase RLW flows in the same degree as the predicted increases in TRU waste volumes.

Figure 3-6 presents the predicted RLW volumes through FY12.

3.2.6 Acid and Caustic Waste

TA-55 generates both acidic and caustic wastes that are transferred to the RLWTF through waste lines. These lines are separate from the industrial waste line through which the bulk of the TA-55 RLW is transferred.

Caustic liquid waste results from the final hydroxide precipitation step in the aqueous chloride process. Feedstocks for this process typically are anode heels, chloride salt residues, and other materials having a relatively high chloride content. Efforts are underway to upgrade the throughput capabilities of the aqueous chloride process to handle the increased quantities of chloride residues that will result from the work off of legacy waste under the 94-1 Residue Stabilization Program. Caustic process liquids are transferred to the TA-50 RLWTF, Room 60,

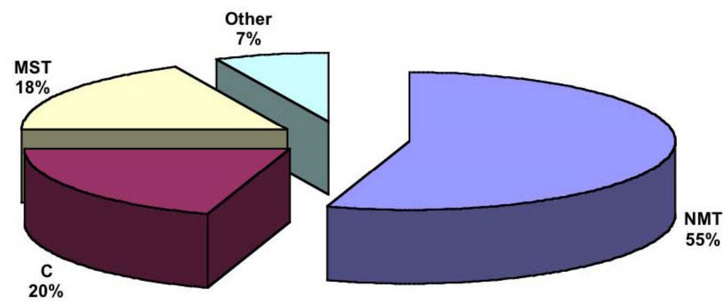
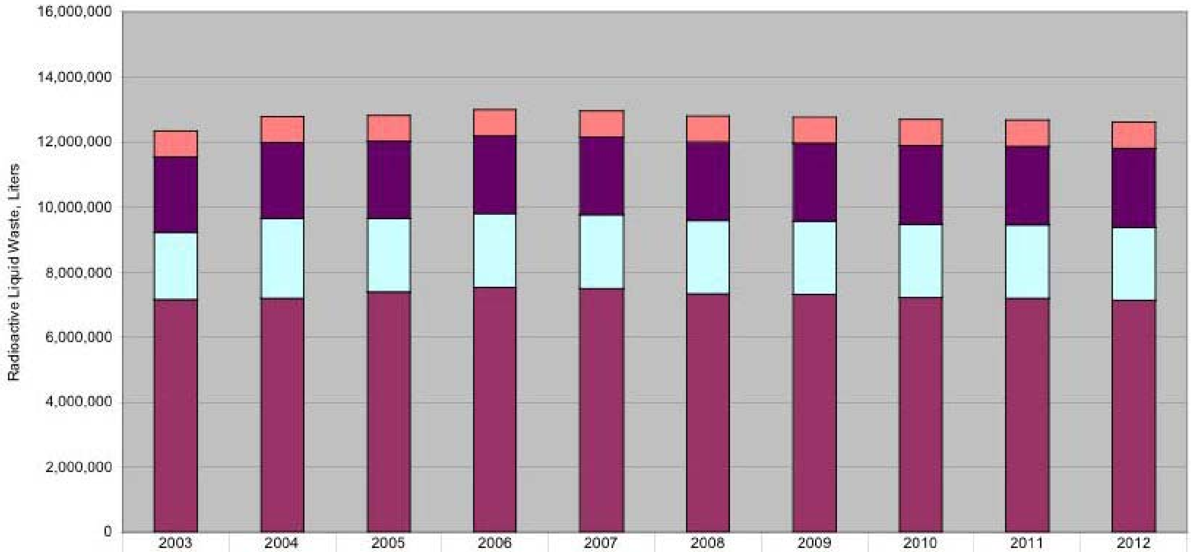


Fig. 3-5. Radioactive liquid waste generators.

Table 3-2. Radioactive Liquid Waste Generation by Division and Program

Organization	Program/Project	Volume FY02 (liters)	Percentage
NMT-1	AAC	379,137	
NMT-2	Nuclear Material Stabilization and Packaging	530,792	
NMT-2	Actinide Processing and Recovery	227,482	
NMT-5	Pit Fabrication	821,464	
NMT-9	^{238}Pu Operations	56,871	
NMT-9	^{238}Pu Heat Sources	132,698	
NMT-6, 11	Plutonium R&D Support	960,480	
NMT-11	EM Technology Support	252,758	
NMT-11	Energy Programs	50,552	
NMT-15	Material Disposition	284,353	
NMT-15	Nonproliferation Technologies	31,595	
NMT-16	Pit Surveillance	442,327	

NMT-3,4,7,8,13	Infrastructure	2,148,443	
	NMT Subtotal	**6,318,950**	**55%**
C-INC	Isotope and Nuclear Chemistry	1,102,944	
C-SIC	Structural Inorganic Chemistry	1,194,856	
	C (TA-48) Subtotal	**2,297,800**	**20%**
Superconductivity Technology Center	Superconductivity R&D	20,680	
National High Magnetic Field laboratory	Magnetic Field R&D	20,680	
MST-6	Materials Technology: Metallurgy	1,240,812	
MST-7	Polymer Coatings	413,604	
MST-8	Structure/Property Relations	124,081	
MST-10	Condensed Matter and Thermal Physics	124,081	
MST-11	Electronic and Electrochemical Materials	124,081	
	MST Subtotal	**2,068,020**	**18%**
HSR[a] & C-ACS	Occupational Health and Analytical Chemistry	626,200	
ESA-TSE	Tritium Systems Test Assembly (TSTA)	125,240	
ESA-TSE	Weapons Engineering Tritium Facility	62,620	
RRES	ER—D&D	62,620	
	Other Subtotal	**804,230**	**7%**
	Total	**11,489,000**	**100%**



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total, liters	12,345,735	12,780,160	12,824,431	12,987,238	12,959,685	12,799,887	12,772,334	12,695,425	12,664,428	12,606,567
Other	804,230	804,230	804,230	804,230	804,230	804,230	804,230	804,230	804,230	804,230
C	2,320,778	2,343,756	2,366,734	2,389,712	2,389,712	2,400,741	2,400,741	2,412,690	2,412,690	2,412,690
MST	2,068,020	2,439,502	2,262,415	2,262,413	2,262,413	2,262,413	2,262,413	2,262,413	2,262,413	2,262,413
NMT	7,152,707	7,192,672	7,391,052	7,530,882	7,503,330	7,332,502	7,304,950	7,216,092	7,185,095	7,127,234

Fig. 3-6. Radioactive liquid waste forecast.

for final processing via the caustic waste line. Over the next 3 to 5 years, throughput quantities are expected to increase modestly. Table 3-3 summarizes the expected production of caustic waste over the next 10 years. The Nuclear Material Stabilization and Packaging Project and the Actinide Processing and Recovery Project produce most of the caustic waste.

Table 3-3. Caustic Waste Forecast

Year	Caustic Waste Volume Liters
2003	10,000
2004	11,000
2005	12,000
2006	12,000
2007	12,000
2008	10,500
2009	10,000
2010	10,000
2011	10,000
2012	10,000

Acidic liquid waste is derived from processing plutonium feedstock using nitric acid for matrix dissolution. Following oxalate precipitation, the effluent is sent to the evaporator, where the overheads are removed and sent via the acid waste line to TA-50 RLWTF, Room 60, for final processing. The acid waste stream must be neutralized before treatment, which requires the addition of NaOH. The total effluent is increased because of the addition of neutralizing NaOH. The acid waste stream is expected to increase dramatically in FY03 and then to decrease sharply beginning in FY04 as the Nitric Acid Recycle System (NARS) comes on line and more acid is recycled. The actinide-processing-and-recovery, pit-fabrication, and mixed-oxide waste programs produce most of the acid waste. Because current plumbing in PF-4 precludes the use of recycled nitric acid in many programs, large volumes currently are being produced. When the NARS upgrade is complete, this volume effectively will be eliminated.

Table 3-4 shows the expected volumes of acid waste over the next 10 years.

3.2.7 Analysis

The general trend in RLW volumes is for steady to slightly increasing waste volumes due to predicted temporary increases in NMT and MST waste volumes. These increases may be offset in whole or in part by waste minimization program activities and the diversion of nonradioactive liquid wastes from the RLWTF. The possible effects of waste minimization are not included in the RLW volume forecast. The RLW program is planning for an eventual transition to zero liquid discharge. To attain zero liquid discharge of RLW, careful planning, new construction, and aggressive influent minimization activity will be required.

Superficially, it would seem that the current facility and strategy for collecting and treating RLW is adequate. In the recent past, the facility has handled ~20 million liters of RLW, about twice the

Table 3-4. Acid Waste Forecast

Year	Acid Waste Volume Liters	NaOH Volume Liters	Total Volume Liters
2003	60,000	33,000	93,000
2004	60,000	33,000	93,000
2005	24,000	8,400	32,400
2006	24,000	8,400	32,400
2007	24,000	8,400	32,400
2008	24,000	8,400	32,400
2009	20,000	7,000	7,000
2010	20,000	7,000	7,000
2011	20,000	7,000	7,000
2012	20,000	7,000	7,000

current volume. The ~20 million liters was processed in a regulatory environment far different from the present environment. With today's more stringent regulatory requirements, the facility is only marginally adequate for current volumes and could operate at former volumes only with very great difficulty. At current volumes there is insufficient effluent tankage at peak periods. It is questionable whether environmental compliance of the RLWTF effluent can be maintained in an aging, inflexible facility in an increasingly stringent regulatory environment, even at current volumes. The inflexible space at the present RLWTF will not accommodate process upgrades easily.

In addition, although the volume of acid and caustic wastes is small in comparison to the total, these waste streams account for about two-thirds of the radioactivity at the RLWTF. These streams are processed in a separate facility, Room 60, which has very limited throughput capability. Current increases in acid waste discharge to the RLWTF have reached the limit of the Room 60 capability, and any further increases could well impact programmatic schedules.

Other issues at the RLWTF are related to the age of the facility. Maintenance costs are increasing, and waste treatment occurs in more than a dozen rooms on multiple levels, raising as-low-as-reasonably achievable issues (for example, co-mingling areas) and leading to operational complexity and inconvenience at the 40-year-old TA-50-01 facility. In addition, operational concerns exist with the existing facility, such as potential concerns resulting from the use of underground single-walled pipes and tanks, outside operation of the evaporator, and over-road shipping of evaporator bottoms from TA-55.

3.3 LOW-LEVEL WASTE

3.3.1 Definition and Scope

LLW is defined as waste that is radioactive and not classified as HLW, TRU waste, spent nuclear fuel, or by-product materials (e.g., uranium or thorium mill tailings). Test specimens of fissionable material irradiated only for R&D and 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.

3.3.2 Historical Trends

The average generation of LLW over the past 10 years has been 2850 m^3/yr. The total volumes have been fluctuating strongly for the past decade, primarily because the nonroutine and ER volumes increase sharply in years in which decontamination, demolition, and remediation activities increase. Routine LLW generation is trending lower over the same time period.

The historical trends in LLW generation are shown in Fig. 3-7.

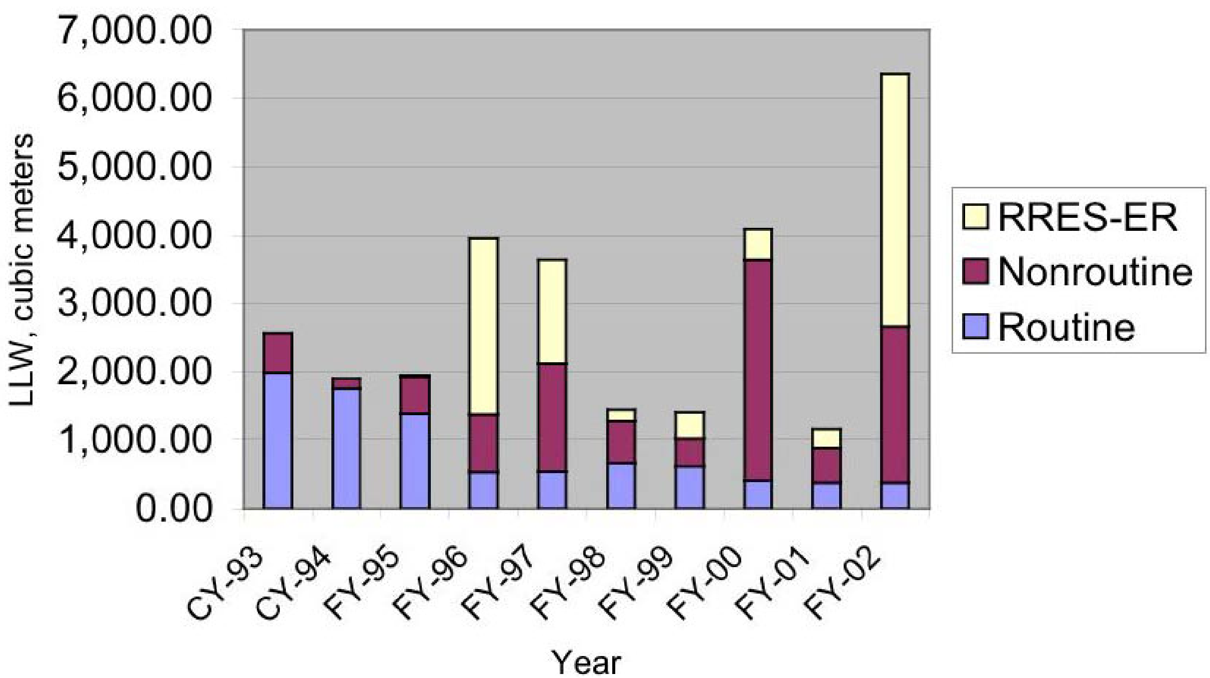


Fig. 3-7. Historical LLW generation.

RRES, NMT, FWO, LANSCE, and MST divisions produced the majority of LLW at LANL in FY02. Small quantities of LLW were produced by other divisions, including ESA, DX, C, Business Operations (BUS), and Health, Safety, Radiation (HSR). This generation of LLW by division is shown graphically in Fig. 3-8.

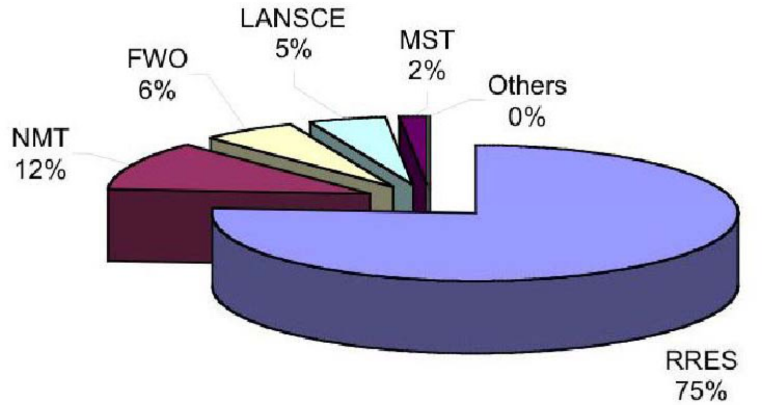


Fig. 3-8. LLW-generating divisions.

3.3.3 Key Program/Projects

Key programs/projects that were responsible for generating LLW during FY02 have been identified and are described in Table 3-5.

Table 3-5. LLW Generation by Division and Project

Organization	Program/Project	Volume FY02 (m^3)	Percentage
RRES-R	Environmental Remediation	5186.4	
RRES-ET	Nuclear Material Characterization	11.2	
RRES-ET	Electronics Sort and Segregate	38.5	
RRES-ET	Other	3.03	
	RRES Subtotal	**5239**	**75%**
NMT-1	AAC	48.2	
NMT-2	Nuclear Material Stabilization and Packaging	67.5	
NMT-2	Actinide Processing and Recovery	28.9	
NMT-5	Pit Fabrication	104.4	
NMT-9	^{238}Pu Operations	7.2	
NMT-9	^{238}Pu Heat Sources	16.9	
NMT-6, 11	Pu R&D Support	122.1	
NMT-11	EM Technology Support	32.1	
NMT-11	Energy Programs	6.4	
NMT-15	Material Disposition	36.1	
NMT-15	Nonproliferation Technologies	4.0	
NMT-16	Pit Surveillance	56.2	
NMT-3,4,7,8,13	Infrastructure	273.1	
	NMT Subtotal	**803**	**12%**
FWO-SWO	Solid Waste Operations	344.3	
FWO RLWTF	Radioactive Liquid Waste	52.7	
	FWO Subtotal	**397**	**6%**
LANSCE	Lagoon Cleanout	229	
LANSCE	EIP	12.5	
LANSCE	Other Programs	100.5	
	LANSCE Subtotal	**342**	**5%**
MST-6	Materials Technology: Metallurgy	8.2	
MST-NHMFL	National High Magnetic Field Laboratory	0.2	
MST-FAC	Facilities and Operations	97.6	
	MST Subtotal	**106**	**2%**
DX-4	Dual-Axis Radiographic Hydrotest Facility	86	
ESA	Various Projects	61	
ESH-17	Environmental Sampling	31	
BUS-4	Legacy Launderables	16	
C	Various Projects	12.2	
Other Projects	Various	29	
	Other Subtotal	**235**	**0%**
	Total	**7123**	**100%**

3.3.4 Forecast

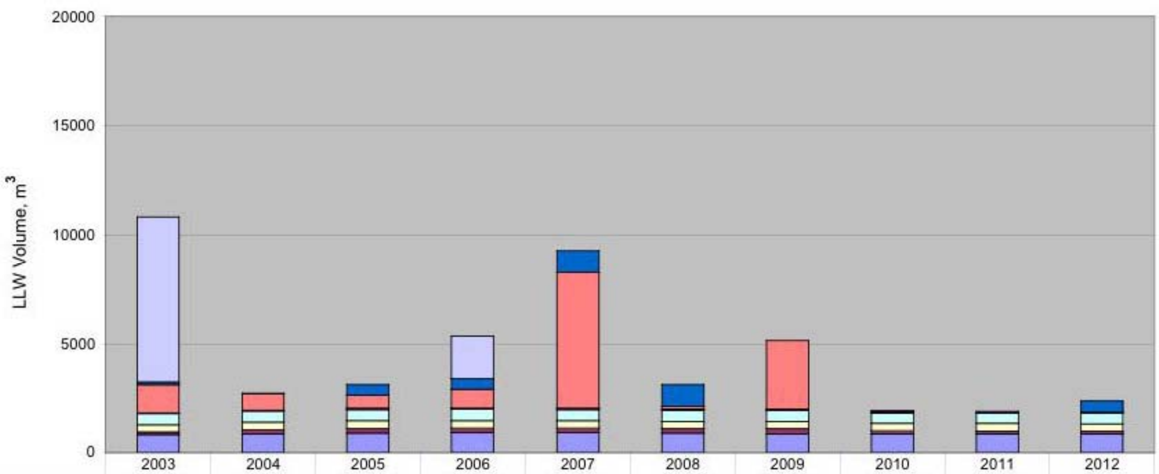
The generation of routine LLW has been trending downward over the past few years, and that trend is expected to continue over the next decade. Total LLW generation is predicted to remain volatile over the next 10 years. The activity that will drive the volatility in total waste volume is the ER project. The volumes of waste generated by the ER project will be substantial through FY08, with peak activity occurring in FY07. Although small changes in non-ER waste generation are projected to occur, the total non-ER waste volume is expected to remain relatively constant.

Figure 3-9 presents the predicted LLW volumes through FY12 by division.

3.3.5 Analysis

Solid LLW generated by the Laboratory's operating divisions is characterized and packaged for disposal at the on-site LLW disposal facility at TA-54, Area G. Area G has a limited useable volume. An FY03 analysis of the LLW landfill at TA-54 indicated that 11,200 m^3 remained for LLW disposal. The ER project plans the generation of very large volumes of contaminated soil waste over the next few years. The estimates range from 10,915 m^3 (projected by John Kelly) to 13,000 m^3 (projected by Skip Natalie of PS-4).

In either case, the ER project could use all of the remaining volume at the LLW disposal trench in a just a few years. When packaged LLW, low-level construction waste, and low-level D&D waste are added to the ER LLW, the planned volume will exceed the remaining disposal volume by FY04–05. Waste produced from D&D and ER projects are low-activity wastes and can be



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total, cubic meters	10,826.61	2,709.23	3,113.37	5,382.37	9,284.00	3,107.90	5,177.37	1,899.35	1,870.25	2,360.73
Const.	7,600.00			2,000.00						
D&D	135.00	20.00	500.00	500.00	1,000.00	1,000.00	0.00	0.00	0.00	500.00
ER	1,274.00	742.00	593.00	839.00	6,262.00	114.00	3,192.00	24.00	0.00	0.00
RLWTF	52.67	52.67	52.67	52.67	52.67	52.67	52.67	52.67	52.67	52.67
FWO	483.14	499.46	508.97	515.67	509.21	501.03	499.71	495.45	493.96	491.19
LANSCE	341.90	354.40	354.40	354.40	341.90	341.90	341.90	341.90	341.90	341.90
MST	105.86	179.43	219.93	219.93	220.73	220.73	216.73	121.33	121.33	121.33
NMT	834.04	861.27	884.40	900.71	897.50	877.58	874.36	864.00	860.39	853.64

Fig. 3-9. LLW generation forecast.

disposed of at the Envirocare site in Utah. Because the SWEIS (through a DOE Record of Decision in the fourth quarter of 1999) has received regulatory approval, construction of additional disposal sites now is allowed. Additional sites for LLW disposal near Area G could provide on-site disposal for many years. However, the preferred option may be to reserve the new burial sites for higher-activity LLW that cannot travel over the highway. This would mean sending most of the LLW to Envirocare for disposal. Cost is the issue with shipping lower-activity LLW off site for disposal.

3.4 MIXED LOW-LEVEL WASTE

3.4.1 Definition and Scope

For waste to be considered MLLW, it must contain Resource Conservation and Recovery Act (RCRA) materials and meet the definition of radioactive LLW. LLW is defined as waste that is radioactive and is not classified as HLW, TRU waste, spent nuclear fuel, or by-product materials (e.g., uranium or thorium mill tailings). Test specimens of fissionable material irradiated only for R&D and 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. Because MLLW contains radioactive components, it is regulated by DOE Order 435.1. Because it contains RCRA waste components, MLLW also is regulated by the State of New Mexico through LANL's operating permit, the Federal Facility Compliance Order/Site Treatment Plan provided by the New Mexico Environment Department (NMED), and the EPA.

Most of the Laboratory's routine MLLW results from stockpile stewardship and management and from R&D programs. Most of the nonroutine waste is generated by off-normal events such as spills in legacy-contaminated areas. ER and waste management legacy operations also produce MLLW.

3.4.2 Historical Trends

The average generation of MLLW over the past 10 years has been $79.2 m^3$/yr. Total volumes have fluctuated for the past decade primarily because of the strong variation in nonroutine and ER volumes. Routine MLLW generation has trended lower over the same time period. MLLW historical generation rates are shown in Fig. 3-10.

3.4.3 Generator Divisions

NMT, RRES, FWO, MST, and LANSCE are the key divisions responsible for generating most of the MLLW waste at LANL. Other divisions generate small volumes, generally $<1 m^3$. These divisions typically include ESA, DX, C, Project Management (PM), and Earth and Environmental Sciences (EES) (see Fig. 3-11).

3.4.4 Key Program/Projects

Key programs/projects that were responsible for generating MLLW during FY02 have been identified and are described in Table 3-6.

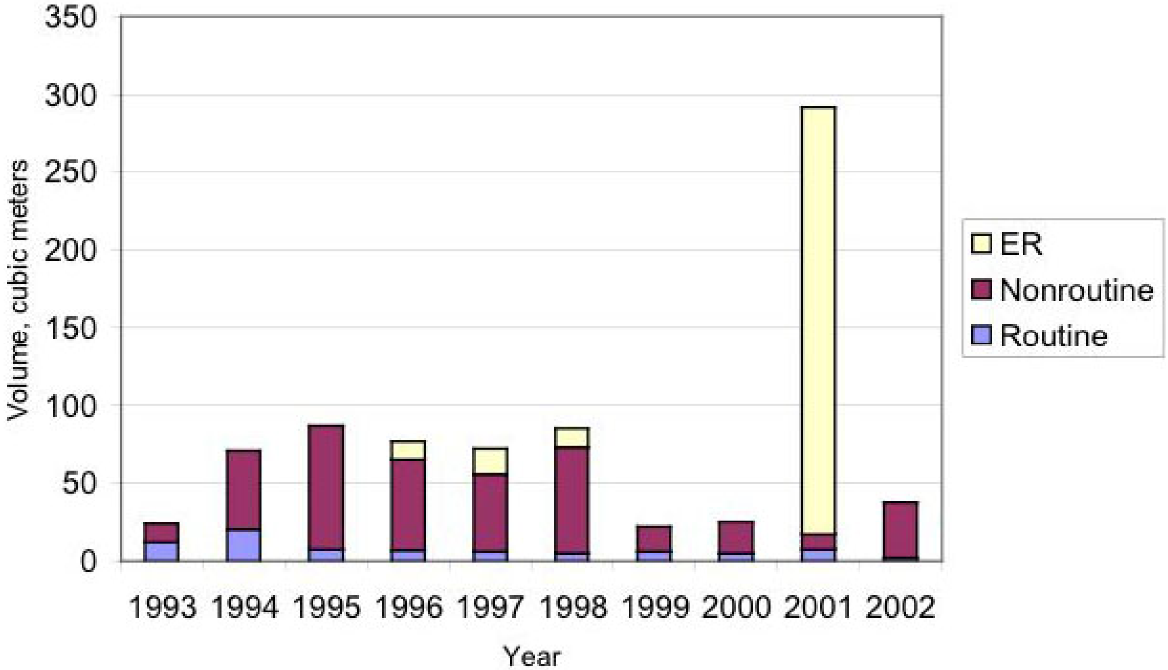


Fig. 3-10. MLLW historical generation.

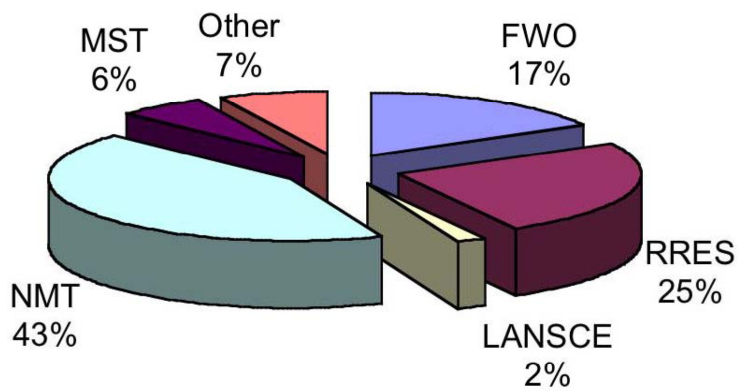


Fig. 3-11. MLLW generator divisions.

3.4.5 Forecast

The generation of routine MLLW has been trending downward over the past few years, and that trend is expected to continue over the next decade. However, the total MLLW generation has been volatile and is predicted to remain somewhat volatile over the next 10 years. The activity that will drive the volatility in total MLLW volume is the ER project. As with LLW, the volumes of waste generated by the ER project will be substantial through FY08, with peak activity occurring in FY07. Although small changes in non-ER waste generation are projected to occur, the total non-ER waste volume is expected to remain relatively constant or to decrease slightly.

Table 3-6. MLLW Generation by Division and Program

Organization	Program/Project	Volume FY02 (m^3)	Percentage
RRES-R	Environmental Remediation	0	
RRES-ET	Nuclear Material Characterization	3.1	
RRES-ET	Electronics Sort and Segregate	4.2	
RRES-ET	Other	2.0	
	RRES Subtotal	**9.3**	**25%**
NMT-1	AAC	2.11	
NMT-2	Nuclear Material Stabilization and Packaging	0.57	
NMT-2	Actinide Processing & Recovery	0.24	
NMT-5	Pit Fabrication	0.16	
NMT-9	^{238}Pu Operations	0.15	
NMT-9	^{238}Pu Heat Sources	0.34	
NMT-6, 11	Plutonium R&D Support	1.07	
NMT-11	EM Technology Support	0.32	
NMT-11	Energy Programs	0.06	
NMT-15	Material Disposition	0.15	
NMT-15	Nonproliferation Technologies	0.02	
NMT-16	Pit Surveillance	0.01	
NMT-3,4,7,8,13	Infrastructure	10.21	
	NMT Subtotal	**16.2**	**43%**
FWO-WFM	Facilities Management	5.4	
FWO RLWTF	Radioactive Liquid Waste	1.0	
	FWO Subtotal	**6.4**	**17%**
LANSCE-FM	Routine Maintenance Debris	0.67	
LANSCE-7	Equipment Upgrade	0.04	
	LANSCE Subtotal	**0.71**	**2%**
MST-6	Materials Technology: Metallurgy, Lab Cleanout	1.27	
MST-10	Condensed Matter Lab Cleanout	0.2	
MST-FAC	Facilities and Operations	0.69	
	MST Subtotal	**2.18**	**6%**
DX-6	Explosives Testing	0.57	
ESA-TSE	Routine Maintenance	0.62	
PM-DS	Distributed Services, Cleanout Waste	0.34	
EES-10	Tritium Tracer Field Studies	0.25	
C-ACT, INC, SIC	Various Projects	0.94	
	Other Subtotal	**2.7**	**7%**
	Total	**37.55**	**100%**

Figure 3-12 presents the predicted MLLW volumes through FY12 by division.

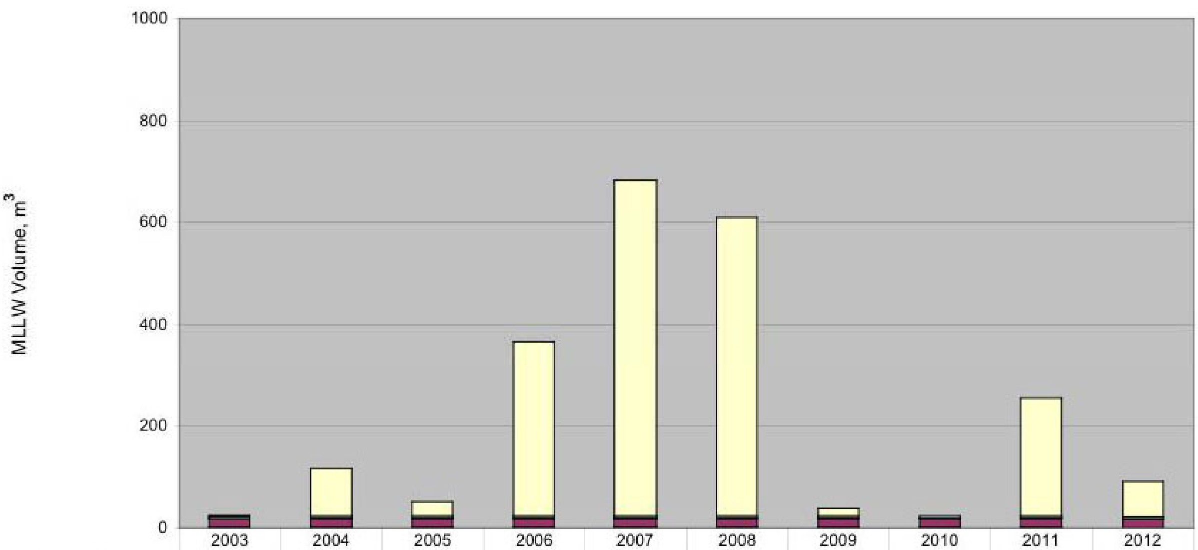
3.4.6 Analysis

Routine MLLW is generated in radiological control areas (RCAs). Hazardous materials and equipment containing RCRA materials, as well as MLLW materials, are introduced into the RCAs as needed to accomplish specific activities. In the course of operations, hazardous materials become contaminated or activated and are designated as MLLW when the item reaches the end of life and is declared waste.

Typically, MLLW is transferred to a satellite storage area after it is generated. Whenever possible, MLLW materials are surveyed to confirm the radiological contamination levels; if decontamination will eliminate either the radiological or the hazardous component, materials are decontaminated and removed from the MLLW category.

Waste classified as MLLW is managed in accordance with appropriate WM and Department of Transportation requirements and shipped to TA-54. From TA-54, MLLW is sent to commercial or DOE treatment and disposal facilities. The waste is treated/disposed of by various processes (e.g., segregation of hazardous components and macroencapsulation or incineration).

Because virtually all MLLW is shipped off site for treatment and disposal, the consequence of increased MLLW generation for the Laboratory is cost. However, the current projections call for nearly stable generation rates except in mid-decade. No significant impact to infrastructures or operations is forecast.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total, cubic meters	24.58	116.12	50.28	366.38	682.34	610.12	38.08	22.99	254.97	89.90
ER	2.00	93.00	27.00	343.00	659.00	587.00	15.00	0.00	232.00	68.00
FWO	4.13	4.21	4.24	4.26	4.25	4.21	4.20	4.18	4.18	4.17
LANSCE	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NMT	16.56	16.91	17.04	17.12	17.09	16.91	16.88	16.81	16.79	16.73
MST	0.89	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00

Fig. 3-12. MLLW volume forecast.

3.5 CHEMICAL/HAZARDOUS WASTE

3.5.1 Definition and Scope

The scope of this section includes both hazardous waste and nonhazardous chemical waste.

Hazardous waste is divided into three waste types: RCRA waste, Toxic Substances Control Act (TSCA) waste, and State special solid waste. For the purposes of reporting the waste minimization, LANL distinguishes between routine and nonroutine waste generation. Routine generation results from production, analytical, and/or other R&D laboratory operations; treatment, storage, and disposal operations; and "work for others" or any other periodic and recurring work that is considered to be ongoing. Nonroutine waste is cleanup stabilization waste and relates mostly to the legacy from previous site operations.

The RCRA and 40 CFR 261.3, as adopted by the NMED, define hazardous waste as any solid waste that

> is generally hazardous if not specifically excluded from the regulations as a hazardous waste;
>
> is listed in the regulations as a hazardous waste;
>
> exhibits any of the defined characteristics of hazardous waste (i.e., ignitability, corrosivity, reactivity, or toxicity); or
>
> is a mixture of solid and hazardous waste.

Hazardous waste also includes substances regulated under the TSCA, such as polychlorinated biphenyls (PCBs) and asbestos.

Finally, a material is hazardous if it is regulated as a special waste by the State of New Mexico as required by the New Mexico Solid Waste Act of 1990 (State of New Mexico) and defined by the most recent New Mexico Solid Waste Management Regulations, 20NMAC 9.1 (NMED), or current revisions.

Hazardous waste commonly generated at the Laboratory includes many types of laboratory research chemicals, solvents, acids, bases, 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). Also included are asbestos waste from the abatement program, wastes from the removal of PCB components, contaminated soils, and contaminated wastewaters that cannot be sent to the sanitary wastewater system or wastewater treatment plants.

Some hazardous wastes are disposed of through Duratek Federal Services, a Laboratory subcontractor. This company sends waste to permitted treatment, storage, or treatment storage disposal facilities; recyclers; energy recovery facilities for fuel blending or burning for British-thermal-unit recovery; or other licensed vendors (as in the case of mercury recovery). Much of the hazardous waste is shipped by the generators directly off site for disposal.

Nonhazardous chemical waste is chemical waste that is not hazardous waste, as defined above, but which fails to meet the waste acceptance criteria for sanitary landfill burial or sanitary wastewater treatment.

3.5.2 Historical Trends

The generation of routine chemical/hazardous waste has been trending downward over the past 10 years. Total chemical/hazardous waste volumes have fluctuated for the past decade primarily because of the strong variation in nonroutine and ER volumes. This strong variation is expected to continue in the future. Because the total chemical/hazardous waste generation is dominated by the bulk waste generated by ER, D&D, and construction activities, it is more informative to discuss bulk and other wastes separately. Bulk wastes are mostly contaminated soils, other chemical/hazardous wastes are lower-volume, higher-risk wastes.

The historical generation rate for chemical/hazardous waste is shown in Fig. 3-13.

3.5.3 Generator Divisions

3.5.3.1 Bulk Chemical/Hazardous Waste

RRES and FWO are the key divisions responsible for generating most of the high volume chemical/hazardous waste at LANL (see Fig. 3-14a). These two divisions produce 96% of all chemical/hazardous waste generated at LANL. Most of this waste is in the form of lightly contaminated soils, rubble, sludges or wastewater, and it is shipped directly off site for disposal.

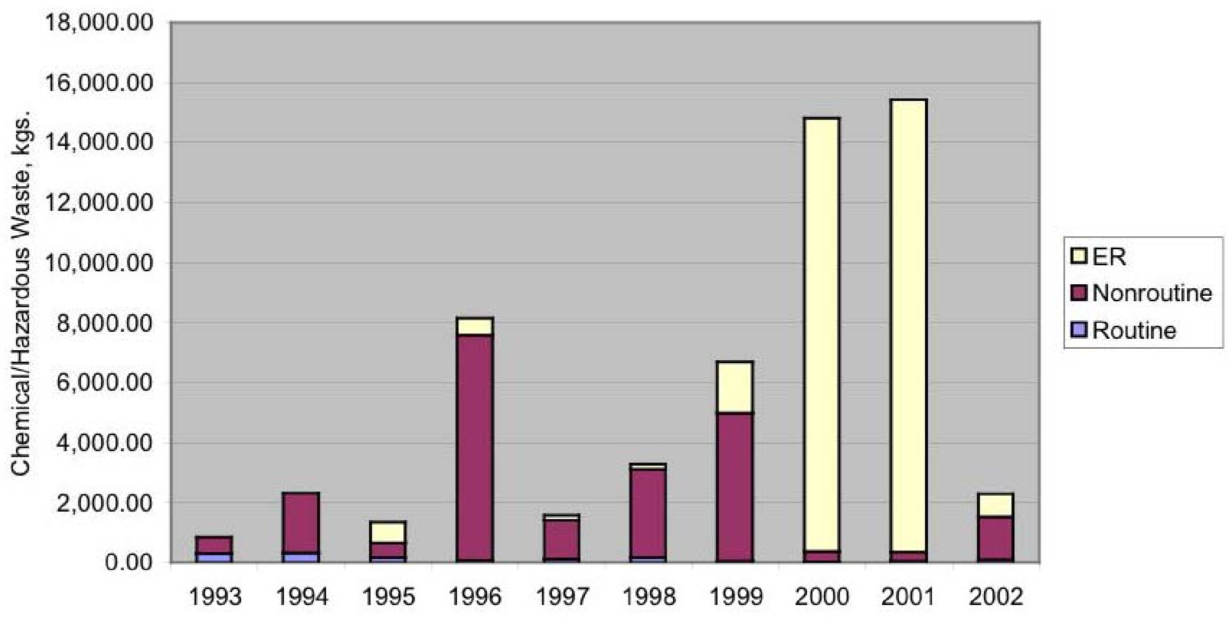


Fig. 3-13. Chemical/hazardous waste volume forecast.

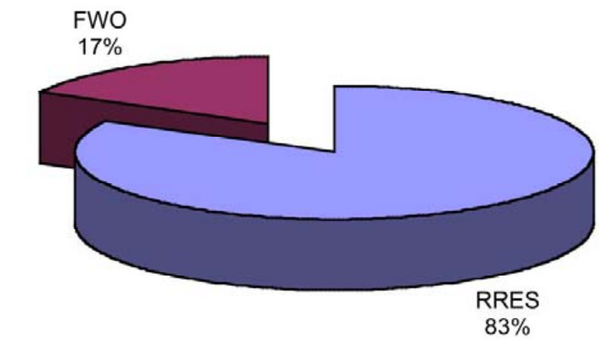


Fig. 3-14a. Bulk chemical/hazardous waste generator divisions.

3.5.3.2 Other Chemical/Hazardous Waste

Other chemical/hazardous waste is generated in the course of Laboratory operations, including routine, nonroutine, and nonhazardous chemical waste. For the purposes of this discussion, these three types of lower volume chemical/hazardous waste have been aggregated.

The Laboratory generates hazardous and nonhazardous chemical waste as a result of research, development, and related operations. These wastes are generated at much lower volumes than the bulk wastes discussed previously. A total of 19 divisions produce such waste. The principal generators of this chemical/hazardous waste are ESA, MST, ESH, Physics (P), BUS, C, and DX divisions, as shown in Fig. 3-14b.

3.5.4 Key Program/Projects

3.5.4.1 Bulk Waste

Key programs/projects that were responsible for generating bulk chemical/hazardous waste during FY02 have been identified and are described in Tables 3-7 and 3-8.

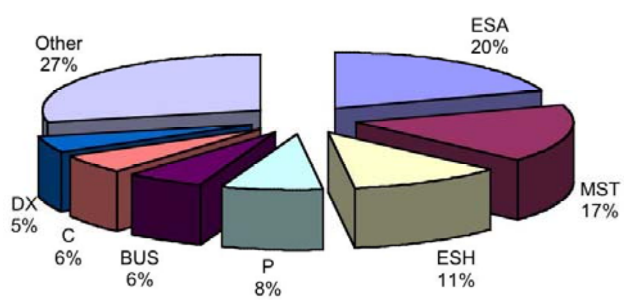


Fig. 3-14b. Other chemical/hazardous waste generator divisions.

Table 3-7. Bulk Chemical/Hazardous Waste by Division and Project

Organization	Program/Project	Weight FY02 (kg)	Percentage
RRES-R	Environmental Remediation	1,707,925.8	
	RRES Subtotal	**1,707,925.8**	**83%**
FWO-WFM	Infrastructure Maintenance and Upgrades	86,753.00	
FWO-SWO	Aggregation of New Mexico Special Soils	112,164.80	
FWO-CGRP	Asbestos Abatement Program	7,506.30	
FWO-UI	Infrastructure Upgrades	151,896.00	
FWO-DF	Infrastructure Maintenance	245.00	
	FWO Subtotal	**358,565.1**	**17%**
	Total	**2,066,490.9**	**100%**

3.5.4.2 Other Chemical/Hazardous Waste

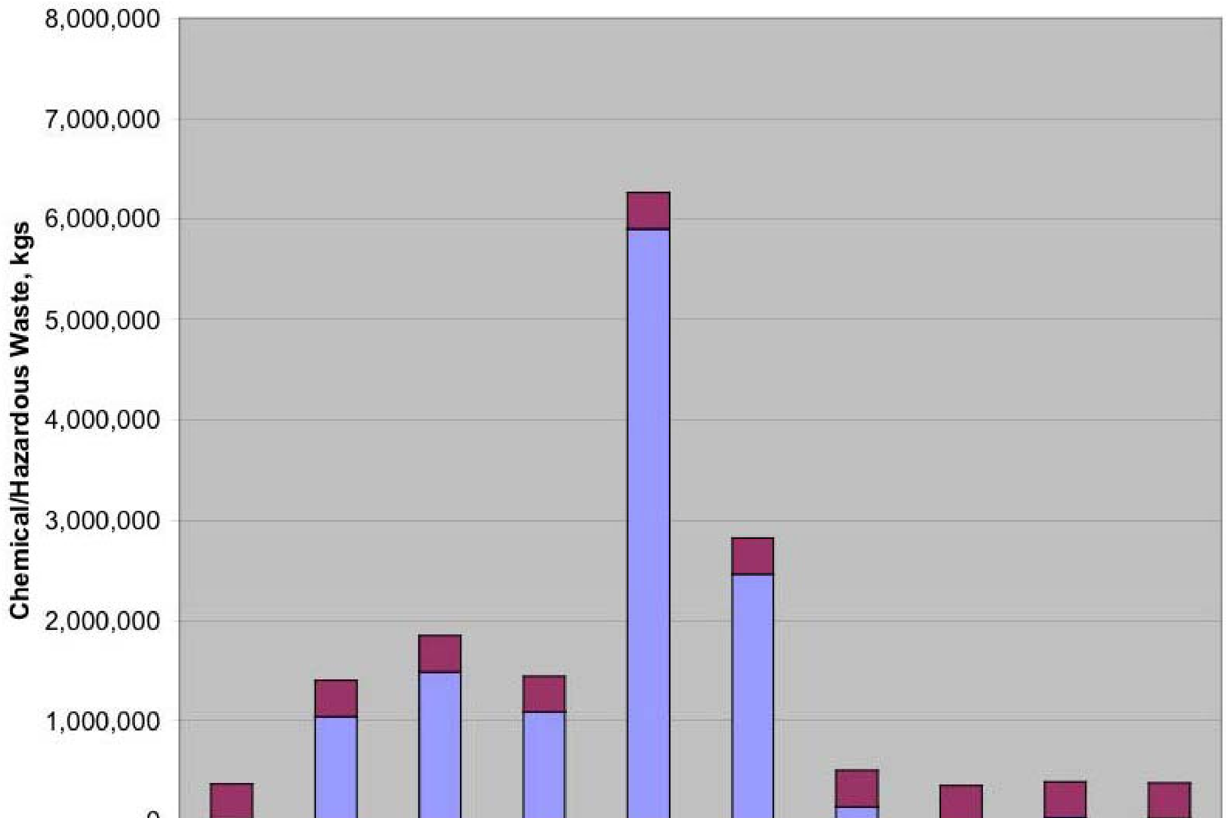
Nearly all divisions at the Laboratory generate chemical/hazardous waste. Specific programs generate some of this waste, but much of the waste is not traceable to specific program activities. For this reason, the non-bulk chemical/hazardous waste has been aggregated by division and not by program. The aggregated totals are shown in Table 3-8.

Table 3-8. Other Chemical/Hazardous Waste by Division and Project

Organization	Program/Project	Weight FY02 (kg)	Percentage
ESA Division			
	ESA Subtotal	**43,992.1**	**20%**
MST Division			
	MST Subtotal	**36,874.7**	**17%**
ESH Division			
	ESH Subtotal	**24,684.7**	**11%**
P Division			
	P Subtotal	**16,628.9**	**8%**
BUS Division			
	BUS Subtotal	**12,732.2**	**6%**
C Division			
	C Subtotal	**12,269.3**	**6%**
DX Division			
	DX Subtotal	**10,302,2**	**5%**
Other Divisions			
	Other Subtotal	**62,649.1**	**27%**
	Total	**220,132.8**	**100%**

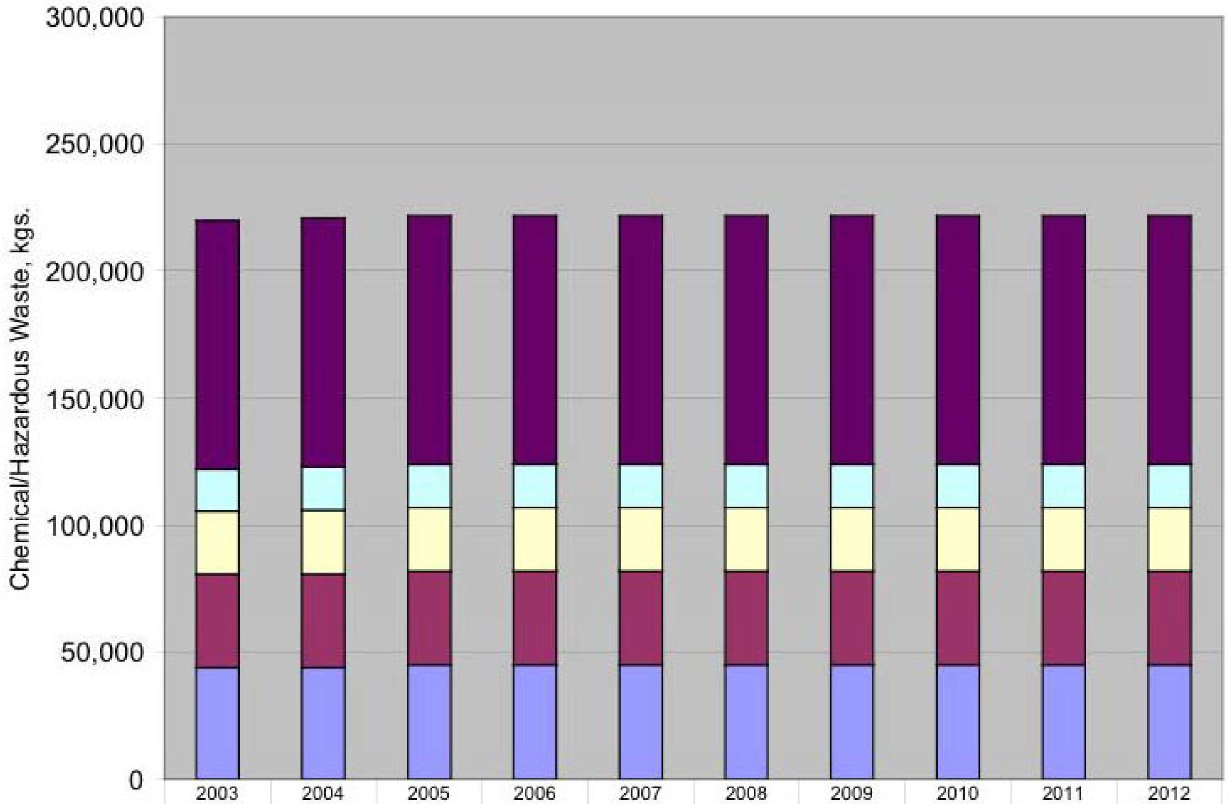
3.5.5 Forecast

With the exception of FY99, the generation of non-bulk chemical/hazardous waste has been steady over the last few years (back to FY96), and that trend is expected to continue over the next decade. Routine waste has been trending downward, but nonroutine waste is somewhat more variable. However, total chemical/hazardous waste generation has been very volatile and is predicted to remain somewhat volatile over the next 10 years. The activity that will drive the volatility in total chemical/hazardous waste volume is the ER project. As with LLW, the volumes of bulk waste generated by the ER project will be substantial through FY08, with peak activity occurring in FY07. The following charts, Figs. 3-15 and 3-16, present the predicted chemical/hazardous waste volumes through FY12 by division or program for bulk and other chemical/hazardous waste, respectively.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total, kgs	375,365	1,405,200	1,851,600	1,448,400	6,266,400	2,828,400	507,600	360,000	398,400	387,600
FWO	358,565	360,000	360,000	360,000	360,000	360,000	360,000	360,000	360,000	360,000
ER	16,800	1,045,200	1,491,600	1,088,400	5,906,400	2,468,400	147,600	0	38,400	27,600

Fig. 3-15. Bulk chemical/hazardous waste forecast.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total, kgs	220,132	221,000	222,000	222,000	222,000	222,000	222,000	222,000	222,000	222,000
Others	97,952	98,000	98,000	98,000	98,000	98,000	98,000	98,000	98,000	98,000
P	16,629	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000
ESH	24,684	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
MST	36,875	37,000	37,000	37,000	37,000	37,000	37,000	37,000	37,000	37,000
ESA	43,992	44,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000

Fig. 3-16. Other chemical/hazardous waste forecast.

3.5.6 Analysis

Chemical/hazardous waste was previously stored onsite at Area L, TA-54, to await off-site disposal. The Laboratory has taken measures to limit the size of the Area L storage site. The Laboratory has chosen to develop a series of consolidated waste storage facilities where waste can be accumulated for up to 90 days before direct shipment off site for disposal. Currently, four such sites exist at the Laboratory and two more are planned. Over 90% of all chemical/hazardous waste now is shipped directly off site for treatment and disposal, and that fraction is likely to increase in the future. There is no foreseeable impact to Area L from chemical/hazardous waste volume increases. Very large increases in waste volumes could have a small impact on hazardous waste operations at TA-54 in terms of increased record keeping and other administrative efforts. However, a recent reduction in required paper work will minimize the impact on administration.

APPENDICES

Appendix A. Methodology

For each program contributing to TRU waste generation, an FY02 waste volume was determined and converted to the percentage of the total generated waste volume. The data for this waste determination were obtained from division WM coordinators and waste operations team leaders. These data form the baseline for the 10-year projections. These baseline data then were reviewed and validated by division group leaders and project leaders. Once the baseline data were validated, the group management was asked to project funding for the next 10 years. Although these projections will become more speculative in the out years, they represent the best thinking of those responsible for planning future and continuing projects. The projected budget changes then were converted to multiples of the current budgets called delta factors. The delta factors then were used to multiply the baseline waste volumes to obtain estimates of out-year waste volumes. This process implies a linear relationship between budget and waste generation. Although that assumption is probably accurate to the first order, serious caveats to the assumption exist. The assumption does not include known changes within programs; for example, the NMT 10-year vault work-off program will be processing high-curie “aged” metal and the waste volumes will necessarily increase per unit of processed metal relative to newly generated waste. The linear assumption does not account for planned reductions in waste due to minimization activities. For example, the NMT NARS will be expanded to include most of the PF-4 operations; thus, acid waste is expected to drop to very low values in the next few years. Nevertheless, the linear-budget/waste-volume relationship is a good first estimate.

Appendix B. TRU Waste

This appendix presents the data supporting the 10-year TRU waste volume forecast.

The solid TRU waste baseline for the 10-year projections is the FY02 generation profile, which is provided in Table 3-1 of Section 3.1.4.

These baseline data were reviewed and validated by division group leaders and project leaders. The delta factors generated by the methodology of Appendix A are shown for NMT Division in Table B-1.

Table B-1. NMT Division Growth Forecast and Delta Factors

Group	Program	Percentage of Total Items by Group	Allocation Via Program Baseline period Oct 1 01 through Aug 31, 02	Delta Factor 2003	Delta Factor 2004	Delta Factor 2005	Delta Factor 2006	Delta Factor 2007	Delta Factor 2008	Delta Factor 2009	Delta Factor 2010	Delta Factor 2011	Delta Factor 2012
NMT-2	Nuclear Material Stabilization and Packaging (70%)	42%	29.40%	1.1	1.2	1.3	1.4	1.4	1.2	1.2	1.1	1.1	1
	Actinide Processing and Recovery (30%)		12.60%	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
NMT-5	Pit Fabrication	19%	19.00%	1.1	1.2	1.3	1.4	1.4	1.4	1.4	1.4	1.4	1.4
NMT-9	Pu-238 Operations (30%)	14%	4.20%	1	1	1	1	1	1	1	1	1	1
	Pu-238 and Heat Sources (70%)		9.80%	1.1	1.2	1.3	1.4	1.4	1.4	1.4	1.4	1.4	1.4
NMT-6 and 11 (40%)	Plutonium R&D Support	7%	9.80%	1	1	1	1	1	1	1	1	1	1
NMT-11 (60%)	EM Technology Support (50%)	7%	3.50%	1	1	1	0.9	0.8	0.6	0.5	0.5	0.5	0.5
	Energy Programs (10%)		0.70%	1.1	1.2	1.3	1.4	1.4	1.4	1.4	1.4	1.4	1.4
NMT-15	Material Disposition (90%)	3%	2.70%	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.1	1	1
	Non Proliferation Technologies (10%)		0.30%	1	1	1	1	1	1	1	1	1	1
Unclaimed	Unclaimed	3%	3.00%	1	1	1	1	1	1	1	1	1	1
NMT-1	CAAC (to be distributed across programs as per allocations)	1%	1.00%	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
NMT-16	Pit Surveillance	1%	1.00%	1	1	1	1	1	1	1	1	1	1
NMT-3, 4, 7, 8, 13	Infrastructure	3%	3.00%	1	1	1	1	1	1	1	1	1	1
Total	Total	100%	100%										

Application of the delta factors in Table B-1 to the baseline leads to projected waste volumes, in cubic meters, for out years, are shown in Table B-2.

Table B-2. Projected Solid TRU Waste for NMT Division

Group	Program	Percentage of Total Items by Group	Allocation Via Program Baseline period Oct 1 01 through Aug 31, 02	Baseline Volume (129.01)	Incorp. Delta Factor 03	Incorp. Delta Factor 04	Incorp. Delta Factor 05	Incorp. Delta Factor 06	Incorp. Delta Factor 07	Incorp. Delta Factor 08	Incorp. Delta Factor 09	Incorp. Delta Factor 10	Incorp. Delta Factor 11	Incorp. Delta Factor 12
NMT-2	Nuclear Material Stabilization and Packaging (70%)	42%	29.40%	37.93	29.00	45.51	49.31	53.10	53.10	45.51	45.51	41.72	41.72	37.93
	Actinide Processing and Recovery (30%)		12.60%	16.26	17.88	19.51	19.51	19.51	19.51	19.51	19.51	19.51	19.51	19.51
NMT-5	Pit Fabrication	19%	19.00%	24.51	26.96	29.41	31.87	34.32	34.32	34.32	34.32	34.32	34.32	34.32
NMT-9	Pu-238 Operations (30%)	14%	4.20%	5.42	5.42	5.42	5.42	5.42	5.42	5.42	5.42	5.42	5.42	5.42
	Pu-238 and Heat Sources (70%)		9.80%	12.64	13.91	15.17	16.44	17.70	17.70	17.70	17.70	17.70	17.70	17.70
NMT-6 and 11 (40%)	Plutonium R&D Support	14%	9.80%	12.64	12.64	12.64	12.64	12.64	12.64	12.64	12.64	12.64	12.64	12.64
NMT-11 (60%)	EM Technology Support (50%)	7%	3.50%	4.52	4.52	4.52	4.52	4.06	3.61	2.71	2.26	2.26	2.26	2.26
	Energy Programs (10%)		0.70%	0.90	0.99	1.08	1.17	1.26	1.26	1.26	1.26	1.26	1.26	1.26
NMT-15	Material Disposition (90%)	3%	2.70%	3.48	3.83	3.83	4.18	4.18	4.18	4.18	4.18	3.83	3.48	3.48
	Non Proliferation Technologies (10%)		0.30%	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
Unclaimed	Unclaimed	3%	3.00%	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87
NMT-1	CAAC (to be distributed across programs as per allocations)	1%	1.00%	1.29	1.42	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55
NMT-16	Pit Surveillance	1%	1.00%	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29
NMT-3, 4, 7, 8, 13	Infrastructure	3%	3.00%	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87
Total	Total	100%	1	129.01	125.99	148.06	156.01	163.16	162.71	154.22	153.77	149.63	149.28	145.48

The FWO TRU waste generation rate is tied directly to NMT activities. However, the rate also is influenced by NMT waste minimization activities, which reduce RLW influent and cemented TRU solids sent to the TA-50 RLTF. In FY98–99, NMT-generated TRU waste increased, whereas TRU waste from FWO (RLWTF) decreased. These changes occurred because waste minimization activities in NMT reduced evaporator bottoms that were sent to the RLWTF for processing and because of reduced liquid influent to the RLWTF. In the future, full utilization of the NARS process in NMT is expected to reduce the acid waste influent to the RLWTF dramatically. Thus, the FWO TRU waste generation rate is not necessarily linear with NMT activity, and applying NMT delta factors directly to the FWO baseline may not yield the best results. To project the FWO TRU volumes, RLWTF personnel projected future wastes relative to the FY02 baseline, including known process changes and waste minimization efforts. These RLWTF projections then were modified by NMT delta factors. The projected FWO TRU waste generation rate is presented in Table B-3.

RRES Division TRU waste is generated by the ER project and the Off-Site Source Recovery Project (OSRP).

RRES also is engaged in repackaging TRU waste for shipment to WIPP; however, this waste is not newly generated. The repackaging results in the generation of a small secondary TRU waste stream and in an increase in the volume of TRU waste because the density is lowered for shipment. These expanded volumes are not included in the TRU waste totals because the repackaging is done in real time in preparation for immediate shipment to WIPP. The repackaged waste does not impact the availability of storage space.

The RRES project 2010 is a project to retrieve legacy TRU waste buried at TA-54 for characterizing, processing, and repackaging for shipment to WIPP. Very large quantities of TRU waste are involved in this retrieval operation. However, the project is not expected to impact the availability of aboveground storage greatly because the material will be retrieved only as storage becomes available. Storage capacity is expected to increase because of the transfer of previously stored materials to WIPP. The schedule for RRES-2010 is flexible; if necessary, it can be delayed beyond FY05 or extended beyond FY07. The actual schedule will be contingent on the rate at which the storage area becomes available. Although the RRES-2010 project impact is

Table B-3. Projected FWO Division TRU Waste Generation

Year	TRU Waste, m^3
2002	2
2003	5
2004	3
2005	4
2006	4
2007	4
2008	4
2009	4
2010	0
2011	0
2012	0

expected to be small, the project totals are included in the overall projections because these large volumes will have to be accommodated by shipment of previously stored materials to WIPP and because the resource load imposed by retrieval of such large volumes of waste is increased.

The RRES-ER project TRU waste generation by year, as estimated by D. McInroy (RRES-R), is shown in Table B-4.

The RRES-OSRP TRU waste generation by year, as estimated by L. Leonard (RRES-OSRP), is shown in Table B-5.

These TRU waste generation volumes were incorporated into the waste forecast table so that the forecast chart presented in Fig. 3-3 of Section 3.1.5 could be determined. These values represent the best estimate of the future generation of TRU waste and will be updated annually.

Table B-4. RRES-ER TRU Waste Forecast

Baseline	RRES-ER, m^3
2003	0
2004	9
2005	0
2006	13
2007	31
2008	0
2009	0
2010	0
2011	0
2012	0

Table B-5. RRES-OSRP TRU Waste Forecast

Year	OSRP, m^3
2003	116
2004	40
2005	30
2006	30
2007	20
2008	10
2009	5
2010	5
2011	5
2012	3

Appendix C. Radioactive Liquid Waste

This appendix presents the data supporting the 10-year radioactive liquid waste volume forecast.

The RLWTF influent information for the past 5 years was obtained from facility records. The average of the last 2 years was taken as a baseline quantity for forecasting future influent volumes. The years 1998 through 2000 were excluded from the average because in 2001, permanent changes were made to the TA-48 boiler and the TSTA cooling tower that resulted in eliminating their discharge to the RLWTF industrial waste line. That plumbing change resulted in eliminating ~3,5000,000 LPY of nonradioactive influent to the RLWTF. Because this change is permanent, it is inappropriate to average volumes across the time period before the change. In addition to the main industrial waste line to the RLWTF, two separate lines (the acid waste line and the caustic waste line) connect TA-55 with the RLWTF at TA-50: the acid waste line and the caustic waste line. These lines typically carry small volumes of waste relative to the industrial waste line influent. The yearly influent (in liters) for 1998–2002 is shown in Table C-1.

The waste lines are metered by facility so that it is relatively easy to determine the volume produced by each major facility. The actual 2002 influent volumes, listed by facility or TA, are presented in Table C-2.

Table C-1. RLWTF Influent by Year

Influent (Liters)	CY 1998	CY 1999	CY 2000	CY 2001	CY 2002	Average
RLW Influent, industrial waste line	22,307,000.00	20,465,000.00	17,858,000.00	13,559,000.00	11,489,000.00	12,524,000.00
Caustic Waste Treated in Rm-60	0.00	7,931.00	3,816.00	11,607.00	1,684.00	6,259.50
Acid Waste Treated in Rm 60	41,930.00	40,364.00	11,847.00	15,500.00	33,719.00	28,672.00

Table C-2. TA-50 RLW Baseline

TA50 RLW Influent (Baseline)		
Facility	Facility Allocation	Flow, Liters
CMR	30%	3,757,200
TA-55 (industrial waste line)	25%	3,131,000
TA-48	20%	2,504,800
Target Fab/SM-66/MSL	18%	2,254,320
TA-59	5%	626,200
TA-21	1%	125,240
TA-16	0.5%	62,620
ER-D&D	0.5%	62,620
Total Flow	100%	12,524,000

Because the site generating RLW is usually known, it is sometimes possible to segregate the waste by division at sites where groups from only one division are present; however, in some cases, groups from more than one division are present at a site. Because the effluent from the entire site is metered, it is not possible to absolutely determine the contributions of the various divisions at the site. In those cases, estimates based on operational experience are made. For example, both NMT and C divisions contribute to the CMR RLW total; however, because the C Division contribution is small compared with the NMT total, all CMR waste is assigned to NMT. In cases where estimates can be made reasonably regarding waste volumes by division, they have been made. The resulting FY02 allocation of RLW by division is shown in Table C-3.

The baseline value for estimating future RLW volumes was obtained by averaging FY01 and FY02 volumes. Where the actual 2002 division allocation is applied to baseline quantity, the results are shown in Table C-4.

These division allocations form the basis of forecasting out-year volumes by division. As with the TRU waste stream, contributions by group and program were estimated by the WM coordinators and the division waste operations team leaders for each of the three major divisions. To forecast out-year volumes, delta functions were applied to the baseline volume. The delta functions were estimated by group and project leaders based on the estimated budget growth for the out-year period. The assumption was that change in waste generation is linear with budget change. Factors such as process change and waste minimization activities will cause a departure from the linear projection, but they are expected to be small. A potentially greater change is the elimination of nonradioactive sources of influent to the RLWTF. There have been several such sources identified but not yet eliminated. The elimination of identified sources is not considered in this forecast.

The forecast tables for NMT, C, and MST divisions are shown in Tables C-5 through C-7.

Table C-3. TA-50 FY02 Influent by Division

TA50 RLW Influent (2002 actual)		
Division	Flow, liters	%
NMT	6,318,950	55
C	2,297,800	20
MST	2,068,020	18
Other	804,230	7
Total Flow	11,489,000	100

Table C-4. TA-50 Baseline Influent

TA50 RLW Influent (baseline)		
Division	Flow, liters	%
NMT	6,888,200.00	55
C	2,504,800.00	20
MST	2,254,320.00	18
Other	876,680.00	7
Total Flow	12,524,000	100

NMT Division:

Table C-5. RLW Generation Forecast for NMT Division

Group	Program	% of Total Items	Allocation	Volume (L)	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12
NMT-2	Nuclear Material Stabilization and Packaging (70%)	12%	8.40%	578,609	636,470	694,331	752,191	810,052	810,052	694,331	694,331	636,470	636,470	578,609
	Actinide Processing and Recovery (30%)		3.60%	247,975	272,773	297,570	297,570	297,570	297,570	297,570	297,570	297,570	297,570	297,570
NMT-5	Pit Fabrication	13%	13.00%	895,466	985,013	1,074,559	1,164,106	1,253,652	1,253,652	1,253,652	1,253,652	1,253,652	1,253,652	1,253,652
NMT-9	Pu-238 Operations (30%)	3%	0.90%	61,994	61,994	61,994	61,994	61,994	61,994	61,994	61,994	61,994	61,994	61,994
	Pu-238 and Heat Sources (70%)		2.10%	144,652	159,117	173,583	188,048	202,513	202,513	202,513	202,513	202,513	202,513	202,513
NMT-6 and	Plutonium R&D Support	12%	15.20%	1,047,006	1,047,006	1,047,006	1,047,006	1,047,006	1,047,006	1,047,006	1,047,006	1,047,006	1,047,006	1,047,006
NMT-11	EM Technology Support (50%)	8%	4.00%	275,528	275,528	275,528	275,528	247,975	220,422	165,317	137,764	137,764	137,764	137,764
	Energy Programs (10%)		0.80%	55,106	60,616	66,127	71,637	77,148	77,148	77,148	77,148	77,148	77,148	77,148
NMT-15	Material Disposition (90%)	5%	4.50%	309,969	340,966	340,966	371,963	371,963	371,963	371,963	371,963	340,966	309,969	309,969
	Non Proliferation Technologies (10%)		0.50%	34,441	34,441	34,441	34,441	34,441	34,441	34,441	34,441	34,441	34,441	34,441
Unclaimed	Unclaimed	0%	0.00%	-	-	-	-	-	-	-	-	-	-	-
NMT-1	CAAC	6%	6.00%	413,292	454,621	495,950	495,950	495,950	495,950	495,950	495,950	495,950	495,950	495,950
NMT-16	Pit Surveillance	7%	7.00%	482,174	482,174	482,174	482,174	482,174	482,174	482,174	482,174	482,174	482,174	482,174
NMT-3, 4, 7	Infrastructure	34%	34.00%	2,341,988	2,341,988	2,148,443	2,148,443	2,148,443	2,148,443	2,148,443	2,148,443	2,148,443	2,148,443	2,148,443
	Total	100%	100%	6,888,200	7,152,707	7,192,672	7,391,052	7,530,882	7,503,330	7,332,502	7,304,950	7,216,092	7,185,095	7,127,234

C Division:

Table C-6. RLW Generation Forecast for C Division

Program	Allocation	Volume (L)	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12
Isotope and Nuclear Chemistry	48%	1,102,944	1,113,973	1,125,003	1,136,032	1,147,062	1,147,062	1,158,091	1,158,091	1,158,091	1,158,091	1,158,091
		-	-	-	-	-	-	-	-	-	-	-
Structural Inorganic Chemistry	52%	1,194,856	1,206,805	1,218,753	1,230,702	1,242,650	1,242,650	1,242,650	1,242,650	1,254,599	1,254,599	1,254,599
		-	-	-	-	-	-	-	-	-	-	-
Total	100%	2,297,800	2,320,778	2,343,756	2,366,734	2,389,712	2,389,712	2,400,741	2,400,741	2,412,690	2,412,690	2,412,690

MST Division:

Table C-7. RLW Generation Forecast for MST Division

Allocation by Group	Allocation	RLW	FY 03	FY 04	FY 05	FY 06	FY 07	FY 08	FY 09	FY 10	FY 11	FY 12
Superconductivity Technology Center	0.01	20680	20,680	12,408	5,552	5,552	5,552	5,552	5,552	5,552	5,552	5,552
National High Magnetic Field Laboratory	0.01	20680	20,680	12,408	5,552	5,552	5,552	5,552	5,552	5,552	5,552	5,552
Center for Integrated Nanotechnologies	0.00	0	-	-	-	-	-	-	-	-	-	-
Materials Integration Science Laboratory	0.00	0	-	-	-	-	-	-	-	-	-	-
MST-6: Materials Technology: Metallurgy	0.60	1240812	1,240,812	1,943,177	2,040,336	2,040,336	2,040,336	2,040,336	2,040,336	2,040,336	2,040,336	2,040,336
MST-7: Polymers and Coatings	0.20	413604	413,604	248,162	111,039	111,039	111,039	111,039	111,039	111,039	111,039	111,039
MST-8: Structure/Property Relations	0.06	124081	124,081	74,449	33,312	33,312	33,312	33,312	33,312	33,312	33,312	33,312
MST-10: Condensed Matter and Thermal Physics	0.06	124081	124,081	74,449	33,312	33,312	33,312	33,312	33,312	33,312	33,312	33,312
MST-11: Electronic and Electrochemical Materials and Devices	0.06	124081	124,081	74,449	33,312	33,312	33,312	33,312	33,312	33,312	33,312	33,312
MST-OPS: Operational Support	0.00	0	-	-	-	-	-	-	-	-	-	-
MST-DO: MST Division Office	0.00	0	-	-	-	-	-	-	-	-	-	-
Non-Routine	0	0	-	-	-	-	-	-	-	-	-	-
Total	1.00	2,068,020	2,068,020	2,439,502	2,262,415	2,262,413	2,262,413	2,262,413	2,262,413	2,262,413	2,262,413	2,262,413

The “Other” category includes RLW from TA-59, TA-16, TA-21, and other small-quantity generators. The baseline volume assigned to “Other” is 804,230 LPY. This RLW volume was held constant, although an overall decrease in volume of as much as 10% is expected in the 10-year forecast period.

The above out-year projections were combined to produce the forecast shown in Fig. 3-6 of Section 3.2.5.

In addition to the industrial waste line, two other lines transfer RLW to the RLWTF: the acid line and the caustic line. The projections for the acid and caustic lines were obtained from RLWTF personnel and validated by the TA-55 waste operations team leader. The acid-line waste projections are presented in Table C-8. The sharp drop in the acid-line volume is due to full implementation of the NARS.

The forecasted caustic-line volumes were generated using the same protocol and are shown in Table C-9. The increases are due to the expected increased throughput of the aqueous chloride line as the 94-1 legacy waste is worked off.

Table C-8. Room 60 Acid Waste Forecast

Year	Acid Waste Volume Liters	NaOH Volume Liters	Total Volume Liters
2003	60,000.00	33,000.00	93,000.00
2004*	60,000.00	33,000.00	93,000.00
2005	24,000.00	8,400.00	32,400.00
2006	24,000.00	8,400.00	32,400.00
2007	24,000.00	8,400.00	32,400.00
2008	24,000.00	8,400.00	32,400.00
2009**	20,000.00	7,000.00	7,000.00
2010***	20,000.00	7,000.00	7,000.00
2011	20,000.00	7,000.00	7,000.00
2012	20,000.00	7,000.00	7,000.00

Table C-9. Caustic Waste Forecast

Year	Caustic Waste Volume Liters
2003	10,000
2004	11,000
2005	12,000
2006	12,000
2007	12,000
2008	10,500
2009	10,000
2010	10,000
2011	10,000
2012	10,000

Appendix D. Low-Level Radioactive Waste

This appendix presents the data supporting the 10-year LLW volume forecast.

The LLW baseline for the 10-year projections is the FY02 generation profile and is shown in Table 3-5 of Section 3.3.4.

These baseline data were reviewed and validated by division group leaders and project leaders.

The RRES-R LLW waste generation is not driven by budget as much as by the remediation schedule. The remediation schedule must be coordinated with the decommissioning and demolition schedule for excess structures to achieve the maximum efficiency and best cost performance. Therefore, the RRES-R estimates were developed in conversations with remediation project management. The estimates are provided in Table D-1.

NMT Division has found a strong correlation between the volume of TRU waste and the volume of LLW. Because the volumes of TRU waste were developed using the delta factors shown in Appendix B, it is appropriate to use those same delta factors to develop the LLW volumes. Application of these NMT delta factors to the LLW baseline leads to the projected out-year waste volumes shown in Table D-2.

Table D-1. RRES-R LLW Forecast

Low-Level Radioactive Waste	
Fiscal Year	ER Waste Volume (in Cubic Meters)
03	587
04	1538
05	497
06	290
07	6331
08	1617
09	31
10	11
11	5
12	0

Table D-2. NMT LLW Forecast

Group	Program	Percentage of Total Items by Group	Allocation Via Program Baseline period Oct 1 01 through Aug 31, 02	Baseline Volume (803.2 m3)	Incorp. Delta Factor 03	Incorp. Delta Factor 04	Incorp. Delta Factor 05	Incorp. Delta Factor 06	Incorp. Delta Factor 07	Incorp. Delta Factor 08	Incorp. Delta Factor 09	Incorp. Delta Factor 10	Incorp. Delta Factor 11	Incorp. Delta Factor 12
NMT-2	Nuclear Material Stabilization and Packaging (70%)	12%	8.40%	67.47	74.22	80.96	87.71	94.46	94.46	80.96	80.96	74.22	74.22	67.47
	Actinide Processing and Recovery (30%)		3.60%	28.92	31.81	34.70	34.70	34.70	34.70	34.70	34.70	34.70	34.70	34.70
NMT-5	Pit Fabrication	13%	13.00%	104.42	114.86	125.30	135.74	146.18	146.18	146.18	146.18	146.18	146.18	146.18
NMT-9	Pu-238 Operations (30%)	3%	0.90%	7.23	7.23	7.23	7.23	7.23	7.23	7.23	7.23	7.23	7.23	7.23
	Pu-238 and Heat Sources (70%)		2.10%	16.87	18.55	20.24	21.93	23.61	23.61	23.61	23.61	23.61	23.61	23.61
NMT-6 and 11 (40%)	Plutonium R&D Support	12%	15.20%	122.09	122.09	122.09	122.09	122.09	122.09	122.09	122.09	122.09	122.09	122.09
NMT-11	EM Technology Support (50%)	8%	4.00%	32.13	32.13	32.13	32.13	28.92	25.70	19.28	16.06	16.06	16.06	16.06
	Energy Programs (10%)		0.80%	6.43	7.07	7.71	8.35	9.00	9.00	9.00	9.00	9.00	9.00	9.00
NMT-15	Material Disposition (90%)	5%	4.50%	36.14	39.76	39.76	43.37	43.37	43.37	43.37	43.37	39.76	36.14	36.14
	Non Proliferation Technologies (10%)		0.50%	4.02	4.02	4.02	4.02	4.02	4.02	4.02	4.02	4.02	4.02	4.02
Unclaimed	Unclaimed	0%	0.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NMT-1	CAAC (to be distributed across programs as per allocations)	6%	6.00%	48.19	53.01	57.83	57.83	57.83	57.83	57.83	57.83	57.83	57.83	57.83
NMT-16	Pit Surveillance	7%	7.00%	56.22	56.22	56.22	56.22	56.22	56.22	56.22	56.22	56.22	56.22	56.22
NMT-3, 4, 7, 8, 13	Infrastructure	34%	34.00%	273.09	273.09	273.09	273.09	273.09	273.09	273.09	273.09	273.09	273.09	273.09
Total	Total	100%	100%	803.20	834.04	861.27	884.40	900.71	897.50	877.58	874.36	864.00	860.39	853.64

The FWO LLW waste generation arises from two primary sources: the TA-54 solid waste operation and the RLWTF. The solid waste operation is influenced by several factors, including activity in other Laboratory divisions, reclassification of waste formerly handled as TRU, and generation of secondary waste streams from repackaging operations. The RLW LLW volume is driven primarily by the activity in NMT Division. Overall, the FWO solid waste operation LLW is, as with TRU waste, forecasted to increase in the near term and to be followed by a gradual reduction. The RLW is assumed, somewhat conservatively, to remain constant for the next decade. The projected FWO LLW waste generation rate is presented in Table D-3.

The LANSCE generation of LLW has been nearly constant over the past few years. With one exception, it is projected to remain nearly constant. The exception is the Mo99 project, which is scheduled to run for 3 years, between FY04 and FY06. The two other projects that regularly generate LLW are the lagoon cleanout project and the EIP project. The balance of LANSCE operations produces ~100 m^3 of LLW per year. The forecast for LANSCE LLW production is shown in Table D-4.

MST generates LLW as a result of activities in MST-FAC, facilities operations, the National High Magnetic Field Laboratory, and MST-6. The baseline generation rate for LLW in MST Division is based on historical waste generation data. The facility representative reviewed the data to ensure that all buildings generating waste in the MST Division were covered. The baseline for LLW was the average of FYs 98, 99, 00, and 01. Group and project leaders were interviewed to determine the likely growth of projects and thus the waste generation in their areas. The resulting baseline is shown in Table D-5.

Table D-3. FWO LLW Forecast

Low-Level Radioactive Waste	
Fiscal Year	FWO Waste Volume (in Cubic Meters)
2003	483
2004	499
2005	509
2006	516
2007	509
2008	501
2009	500
2010	495
2011	494
2012	491

Table D-4. LANSCE LLW Forecast

	Low-Level Radioactive Waste				
Fiscal Year	LANSCE Waste Volume (in Cubic Meters)				
	Lagoons	EIP	Mo99	Other Programs	
2003	229.4	12.5		100	341.9
2004	229.4	12.5	12.5	100	354.4
2005	229.4	12.5	12.5	100	354.4
2006	229.4	12.5	12.5	100	354.4
2007	229.4	12.5		100	341.9
2008	229.4	12.5		100	341.9
2009	229.4	12.5		100	341.9
2010	229.4	12.5		100	341.9
2011	229.4	12.5		100	341.9
2012	229.4	12.5		100	341.9

Table D-5. RRES-R LLW Baseline

Low-Level Radioactive Waste	
MST Groups/Projects	Volume, m^3
Superconductivity Technology Center	0.00
National High Magnetic Field Laboratory	0.00
Center for Integrated Nanotechnologies	0.20
Materials Integration Science Laboratory	0.00
MST-6: Materials Technology: Metallurgy	8.06
MST-7: Polymers and Coatings	0.00
MST-8: Structure/Property Relations	0.00
MST-10: Condensed Matter and Thermal Physics	0.00
MST-11: Electronic and Electrochemical Materials and Devices	0.00
MST-OPS: Operational Support	97.60
MST-DO: MST Division Office	0.00
Nonroutine	0.00

The MST waste projections based on the above baseline and the projected project activity are presented in Table D-6.

Table D-6. MST LLW Forecast

Group	FY 03	FY 04	FY 05	FY 06	FY 07	FY 08	FY 09	FY 10	FY 11	FY 12
	LLW Projections, m^3									
Superconductivity Technology Center	0.00									
National High Magnetic Field Laboratory										
Center for Integrated Nanotechnologies	0.20	0.00	1.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Materials Integration Science Laboratory	0.00	1.03	0.39	1.03	1.03	1.03	1.03	1.03	1.03	1.03
MST-6: Materials Technology: Metallurgy	8.06	10.00	16.00	16.00	16.00	12.00	12.00	12.00	12.00	12.00
MST-7: Polymers and Coatings	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MST-8: Structure/Property Relations	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MST-10: Condensed Matter and Thermal Physics	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MST-11: Electronic and Electrochemical Materials and Devices	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MST-OPS: Operational Support	97.60	168.40	201.60	203.70	203.70	203.70	108.30	108.30	108.30	108.30
MST-DO: MST Division Office	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Various other organizations contribute to the generation of LLW, including ESA, ESH, BUS, C, and DX divisions. These divisions contribute ~3% of the total LLW volume in a given year and are likely to appear and disappear at unpredictable intervals. They are not considered in this forecast.

Appendix E. Mixed Low-Level Waste

This appendix presents the data supporting the 10-year MLLW volume forecast. These data were reviewed and validated by group leaders and project leaders.

The FY02 generation profile is shown in Table 3-2 of Section 3.4.4.

The RRES-R MLLW waste generation is not driven by budget as much as by the remediation schedule. As with RRES-R-generated LLW, the RRES-R MLLW estimates were developed in conversations with remediation project management. The estimates (provided by John Kelly of RRES-R) are shown in Table E-1.

NMT Division has found a significant correlation between the volume of TRU waste and the volume of MLLW. Because the volumes of TRU waste were developed using the delta factors shown in Appendix B, it is appropriate to use those same delta factors to develop the LLW volumes. Application of these NMT delta factors to the LLW baseline leads to projected waste volumes for out years, as shown in Table E-2.

Table E-1. RRES-R MLLW Volume Forecast

Mixed Low-Level Waste

Fiscal Year	ER Waste Volume (in Cubic Meters)
03	2
04	93
05	27
06	343
07	659
08	587
09	15
10	0
11	232
12	68

Table E-2. NMT Division MLLW Forecast

Group	Program	Percentage of Total Items by Group	Allocation Via Program Baseline period Oct 1 01 through Aug 31, 02	Baseline Volume (13.3 m3)	Incorp. Delta Factor 03	Incorp. Delta Factor 04	Incorp. Delta Factor 05	Incorp. Delta Factor 06	Incorp. Delta Factor 07	Incorp. Delta Factor 08	Incorp. Delta Factor 09	Incorp. Delta Factor 10	Incorp. Delta Factor 11	Incorp. Delta Factor 12
NMT-2	Nuclear Material Stabilization and Packaging (70%)	5%	3.50%	0.57	0.62	0.68	0.74	0.79	0.79	0.68	0.68	0.62	0.62	0.57
	Actinide Processing and Recovery (30%)		1.50%	0.24	0.27	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
NMT-5	Pit Fabrication	1%	1.00%	0.16	0.18	0.19	0.21	0.23	0.23	0.23	0.23	0.23	0.23	0.23
NMT-9	Pu-238 Operations (30%)	3%	0.90%	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
	Pu-238 and Heat Sources (70%)		2.10%	0.34	0.37	0.41	0.44	0.48	0.48	0.48	0.48	0.48	0.48	0.48
NMT-6 and 11 (40%)	Plutonium R&D Support	9%	6.60%	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
NMT-11 (60%)	EM Technology Support (50%)	4%	2.00%	0.32	0.32	0.32	0.32	0.29	0.26	0.19	0.16	0.16	0.16	0.16
	Energy Programs (10%)		0.40%	0.06	0.07	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09
NMT-15	Material Disposition (90%)	1%	0.90%	0.15	0.16	0.16	0.17	0.17	0.17	0.17	0.17	0.16	0.15	0.15
	Non Proliferation Technologies (10%)		0.10%	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Unclaimed	Unclaimed	0%	0.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NMT-1	CAAC (to be distributed across programs as per allocations)	13%	13.00%	2.11	2.32	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53
NMT-16	Pit Surveillance	5%	5.00%	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
NMT-3, 4, 7, 8, 13	Infrastructure	63%	63.00%	10.21	10.21	10.21	10.21	10.21	10.21	10.21	10.21	10.21	10.21	10.21
Total	Total	100%	100%	16.20	16.56	16.91	17.04	17.12	17.09	16.91	16.88	16.81	16.79	16.73

The FWO MLLW waste generation arises primarily from facilities and maintenance operations and includes such items as activated fluorescent bulbs and lead-soldered copper joints from RCAs. This level of waste generation is predicted to continue into the next decade with some decrease due to the replacement of mercury-containing bulbs. The projected FWO MLLW waste generation rate is presented in Table E-3.

MST generates MLLW primarily as a result of activities in MST-FAC (facilities operations). The baseline generation rate for LLW in MST Division is based on historical waste generation data. The facility representative reviewed the data to ensure that all buildings generating waste in MST Division were covered. The baseline for MLLW was the average of FYs 98, 99, 00, and 01. Group and project leaders were interviewed to determine the likely growth of projects and thus the waste generation in their areas.

The MST waste projections based on the above baseline and the projected project activity are displayed in Table E-4.

The generation of MLLW at LANSCE has been small and somewhat variable over the past few years. Most of the MLLW is the result of routine maintenance and periodic equipment upgrades. Because these activities are basic to the operation of the facility, LANSCE MLLW is projected for continued generation of ~1 m^3/yr. These data were provided by Ben Poff (LANSCE) and are shown in Table E-5.

Table E-3. FWO Division MLLW Forecast

Mixed Low-Level Radioactive Waste	
Fiscal Year	FWO Waste Volume (in Cubic Meters)
2003	4.13
2004	4.21
2005	4.24
2006	4.26
2007	4.25
2008	4.21
2009	4.20
2010	4.18
2011	4.18
2012	4.17

Table E-4. MST Division MLLW Forecast

Group	MLLW Projections, m^3									
	FY 03	FY 04	FY 05	FY 06	FY 07	FY 08	FY 09	FY 10	FY 11	FY 12
Superconductivity Technology Center	0	0	0	0	0	0	0	0	0	0
National High Magnetic Field Laboratory	0	0	0	0	0	0	0	0	0	0
Center for Integrated Nanotechnologies	0	0	0	0	0	0	0	0	0	0
Materials Integration Science Laboratory	0	0	0	0	0	0	0	0	0	0
MST-6: Materials Technology: Metallurgy	0	0	0	0	0	0	0	0	0	0
MST-7: Polymers and Coatings	0	0	0	0	0	0	0	0	0	0
MST-8: Structure/Property Relations	0	0	0	0	0	0	0	0	0	0
MST-10: Condensed Matter and Thermal Physics	0	0	0	0	0	0	0	0	0	0
MST-11: Electronic and Electrochemical Materials and Devices	0	0	0	0	0	0	0	0	0	0
MST-OPS: Operational Support	0	0	0	0	0	0	0	0	0	0
MST-DO: MST Division Office	0	0	0	0	0	0	0	0	0	0
Non-Routine	1	1	1	1	1	1	1	1	1	1

Table E-5. LANSCE MLLW Forecast

LANSCE MLLW	
Year	MLLW
	m3
2003	1
2004	1
2005	1
2006	1
2007	1
2008	1
2009	1
2010	1
2011	1
2012	1

In most years, a total of 1.5 to 3.0 m^3 of MLLW is produced by a combination of divisions. The divisions change from year to year, but the total remains relatively stable. In FY02, the divisions were C, EES, ESA, PM, and DX and the total quantity generated was 2.7 m^3. This total is part of the baseline value but is not specifically projected into out years.

Appendix F. Chemical/Hazardous Waste

This appendix presents the data supporting the 10-year chemical/hazardous waste volume forecast.

The FY02 generation profile is shown in Section 3.5. That waste profile serves as the baseline for the 10-year projection.

Bulk Chemical/Hazardous Waste

Over 90% of the chemical/hazardous waste generated at the Laboratory is bulk waste generated by the ER Project and FWO Division. This waste predominantly comprises lightly contaminated soils, sludges and nonhazardous chemical wastes from the sanitary wastewater plant. These wastes are shipped directly off site for disposal.

The RRES-R chemical/hazardous waste generation is driven by the remediation schedule. As with RRES-R-generated LLW and MLLW, the estimates for chemical/hazardous waste volumes were developed in conversations with remediation project management. The estimates are shown in Table F-1.

FWO Division generates chemical/hazardous waste as a result of ongoing infrastructure maintenance, upgrades, and cleanouts and as a result of the operation of the sanitary wastewater plant. The waste predominantly comprises contaminated soils, wastewater, and sludges. The operations that produce these wastes are likely to continue at essentially the current level for the foreseeable future. Therefore, the forecast is for essentially constant volumes of FWO bulk chemical/hazardous waste (see Table F-2).

Table F-1. RRES-R Bulk Chemical/Hazardous Waste Forecast

Chemical/Hazardous Waste	
Fiscal Year	ER Waste (kg)
03	16,800
04	1,045,200
05	1,491,600
06	1,088,400
07	5,906,400
08	2,468,400
09	147,600
10	0
11	38,400
12	27,600

Table F-2. FWO Bulk Chemical/Hazardous Waste Forecast

Chemical/Hazardous Waste	
Fiscal Year	FWO Waste (kg)
03	358,565
04	360,000
05	360,000
06	360,000
07	360,000
08	360,000
09	360,000
10	360,000
11	360,000
12	360,000

Other Chemical/Hazardous Waste

Less than 10% of the chemical/hazardous waste generated at LANL is non-bulk waste. However, many of these wastes are much more hazardous than the lightly contaminated bulk wastes. These wastes are generated as a result of R&D and laboratory operations and contain chemicals that are toxins, acute toxins, persistent bioaccumulative toxins, carcinogens, and teratogens. Approximately 48% of these wastes are nonhazardous chemical substances. Nonhazardous chemicals are substances that are not classified as hazardous by the EPA or the state but do not meet waste acceptance criteria for disposal at sanitary landfills or sanitary wastewater plants. The Hazardous Operations team in FWO-SWO disposes of these chemical wastes. The non-bulk chemical/hazardous waste is projected by division, and the forecast for nearly constant generation is shown for the major generating divisions in Table F-3.

Table F-3. Non-Bulk Chemical/Hazardous Waste Forecast by Division

Chemical/Hazardous Waste Volumes					
Fiscal Year	ESA	MST	ESH	P	Others
	kg	kg	kg	kg	kg
2003	43,992	36,875	24,684	16,629	62,649
2004	44,000	37,000	25,000	17,000	63,000
2005	45,000	37,000	25,000	17,000	64,000
2006	45,000	37,000	25,000	17,000	65,000
2007	45,000	37,000	25,000	17,000	65,000
2008	45,000	37,000	25,000	17,000	65,000
2009	45,000	37,000	25,000	17,000	65,000
2010	45,000	37,000	25,000	17,000	65,000
2011	45,000	37,000	25,000	17,000	65,000
2012	45,000	37,000	25,000	17,000	65,000