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Title: SWEIS Yearbook — 1999

Comparison of 1999 Data to Projections of the Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory

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Los Alamos
NATIONAL LABORATORY

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CONTENTS

LIST OF TABLES

APPENDIX

LIST OF FIGURES

PREFACE

In the Record of Decision for Stockpile Stewardship and Management, the US Department of Energy (DOE) charged Los Alamos National Laboratory (LANL or Laboratory) with several new tasks, including war reserve pit production. DOE evaluated the potential environmental impacts of these assignments in the Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory (DOE 1999a). This Site-Wide Environmental Impact Statement (SWEIS) provided the basis for DOE decisions to implement these new assignments at LANL through the Record of Decision (ROD) issued in September 1999.

The Annual Yearbook compares operational data with the projections of the SWEIS for the level of operations selected by the ROD. The SWEIS 1998 Yearbook was issued in December 1999. A special edition of the SWEIS Yearbook, "Wildfire 2000," was issued in August 2000, comparing the wildfire accident analysis of the SWEIS with the Cerro Grande fire that occurred in May 2000. This is the SWEIS Yearbook for 1999. The SWEIS Yearbook for 2000 will include the effects of the Cerro Grande fire on operations and the environmental setting.

The Yearbooks will contain the data needed for trend analyses, will compare projections and actual operations, and will enable decision-makers to determine when and if an updated SWEIS or other National Environmental Policy Act analysis is necessary.

As with the special "Wildfire 2000" edition, the cover of this and future Yearbooks will include an insert photograph depicting an important event that happened during the calendar year under review. The photo selected for this cover highlights LANL's initial shipments of transuranic waste for disposal at the Waste Isolation Pilot Plant.

EXECUTIVE SUMMARY

In 1999, the US Department of Energy (DOE) published a Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory (DOE 1999a). DOE issued a Record of Decision (ROD) for this document in September 1999 (DOE 1999b).

To enhance the usefulness of this Site-Wide Environmental Impact Statement (SWEIS), DOE and Los Alamos National Laboratory (LANL) implemented an assessment tool, the annual yearbook, making comparisons between SWEIS projections and actual operations. Each yearbook focuses on operations during one calendar year and specifically addresses the following:

- facility and/or process modifications or additions,
- types and levels of operations during the calendar year,
- operations data for the Key Facilities, and
- site-wide effects of operations for the calendar year.

This Yearbook addresses capabilities and operations using the concept of the "Key Facility" as presented in the SWEIS. The definition of each Key Facility hinges upon operations (research, production, or services) and capabilities and is not necessarily confined to a single structure, building, or technical area (TA). Chapter 2 discusses each of the 15 Key Facilities from three aspects—significant facility construction and modifications that have occurred during 1999, the types and levels of operations that occurred during 1999, and the 1999 operations data. Chapter 2 also discusses the "Non-Key Facilities," which include all buildings and structures not part of a Key Facility, or the balance of LANL.

During 1999, planned construction and/or modifications continued at eight of the fifteen Key Facilities. Most of these activities were modifications within existing structures. At the High Explosives Testing Facility, construction continued on the Dual-Axis Radiographic Hydrodynamic Test facility. Installation and component testing of the accelerator and its associated control and diagnostics systems began in 1999. Additionally, five major construction projects were started or continued for the "Non-Key Facilities." Four projects were in the construction phase: Atlas, the Industrial Research Park, the Strategic Computing Complex, and the Nonproliferation and International Security Center. The other project, the Central Health Physics Calibration Laboratory, was in the design phase.

The ROD projected a total of 38 facility construction and modification projects for LANL. Thirteen projects have now been completed: seven in 1999 and six in 1998. Ten additional projects were started and/or continued in 1999. The seven projects completed in 1999 are

- replacement of the graphite collection systems at Sigma,
- modification of the industrial drain system at Sigma,
- replacement of electrical components at Sigma,
- relocation of the Weapons Components Testing Facility at High Explosives Processing,
- making the Low-Energy Demonstration Accelerator operational,
- bringing the new ultra-filtration and reverse osmosis process on-line at the Radioctive Liquid Waste Treatment Facility (RLWTF), and
- bringing the nitrate reduction equipment on-line at RLWTF.

A major modification project, elimination and/or rerouting of National Pollutant Discharge Elimination System (NPDES) outfalls, continued. During 1999, 16 additional outfalls were eliminated leaving LANL with only 20 outfalls on its NPDES permit.

This edition of the Yearbook is reporting chemical usage and calculated emissions (expressed as kilograms per year) for the Key Facilities, based on an improved chemical reporting system. The 1999 chemical usage amounts were extracted from the Laboratory's Automated Chemical Inventory System. The quantities used for this report represent all chemicals procured or brought on site in 1999. The chemical comparison indicates that the number of chemicals used in 1999 at each of the Key Facilities and across the Laboratory was substantially less than that number evaluated by the ROD. These changes are believed to be a result of more accurate chemical data collection. Information is presented in the Appendix related to actual chemical use and estimated emissions for each Key Facility. Additional information related to chemical use and emissions reporting can be found in "Emissions Inventory Report Summary, Reporting Requirements for the New Mexico Administrative Code, Title 20, Chapter 2, Part 73 (20 NMAC 2.73) for Calendar Year 1999" (LANL 2000a).

Capabilities across LANL did not change during 1999 although some were defined more broadly while certain operations within a given capability were further refined. During 1999, 90 of the 95 identified capabilities were active. No activity occurred under five capabilities: Fabrication and Metallography at the Chemical and Metallurgy Research Building, Accelerator Transmutation of Wastes at the Los Alamos Neutron Science Center (LANSCE), Medical Isotope Production at LANSCE, Other Waste Processing at the Solid Radioactive and Chemical Waste Facility, and Size Reduction at the Solid Radioactive and Chemical Waste Facility.

As in 1998, only three of LANL's facilities operated during 1999 at levels approximating those projected by the ROD—the Materials Science Laboratory, the Health Research Laboratory, and the Non-Key Facilities. None of these facilities are major contributors to the parameters that lead to significant potential environmental impacts. The remaining 13 Key Facilities all conducted operations at or below projected activity levels.

Radioactive air emissions totaled about 1900 curies compared to 21,700 projected by the ROD. This results in a hypothetical maximum dose to a member of the public of 0.32 millirem (compared to 5.44 projected). Calculated NPDES discharges totaled 317 million gallons compared to a projected volume of 278 million gallons per year. While the number of outfalls has been reduced, the methodology for calculating the discharges changed, and may now result in an overestimate. In addition, the reduction often results from combining flows so that the total number of outfalls is less, but the overall flow is not reduced and exits from a single discharge point. Quantities of solid radioactive and chemical wastes ranged from 3% (mixed low-level radioactive waste) to 475% (chemical waste) of projections. The extremely large quantities of chemical waste (15.4 million kilograms) are a result of Environmental Restoration Program activities (remediation of a former material disposal area). Most chemical wastes are shipped off-site for disposal at commercial facilities; therefore, these large quantities of chemical waste will not impact LANL environs.

Workforce data were above ROD projections. The 12,412 employees at the end of calendar year 1999 represent 1061 more employees than projected. Electricity use during 1999 totaled 369 gigawatt-hours with a peak demand of 68 megawatts compared to projections of 782 gigawatt-hours with a peak demand of 113 megawatts. Water usage was 453 million gallons (compared to 759 million gallons projected), and natural gas consumption totaled 1.43 million decatherms (compared to 1.84 projected). The collective Total Effective Dose Equivalent for the LANL workforce during 1999 was 131 person-rem, which is considerably lower than the workforce dose of 704 person-rem projected by the ROD.

Measured parameters for ecological resources and groundwater were similar to ROD projections, and measured parameters for cultural resources and land resources were below ROD projections. For land use, the ROD projects the disturbance of 41 acres of new land at TA-54 because of the need for additional disposal cells for low-level radioactive waste. As of 1999, this expansion had not yet started. However, groundbreaking did occur on 30 acres of land that are being developed along West Jemez Road for the Industrial Research Park. This project has its own National Environmental Policy Act documentation, and the land is being leased to Los Alamos County for this privately owned development.

Cultural resources remained protected, and no excavation of sites at TA-54 or any other part of LANL has occurred. (The ROD projected that 15 prehistoric sites would be affected by the expansion of Area G into Zones 4 and 6 at TA-54.)

As projected by the ROD, water levels in wells penetrating into the regional aquifer continue to decline in response to pumping, typically by several feet each year. In areas where pumping has slowed or ceased, water levels show some recovery. No unexplained changes in patterns have occurred in the 1995–1999 period, and water levels in the regional aquifer have continued a gradual decline that started in about 1977. In addition, ecological resources are being sustained as a result of protection afforded by DOE ownership of LANL. These resources include biological resources such as protected sensitive species, ecological processes, and biodiversity.

In conclusion, operations data mostly fell within projections. Exceptions were number of employees, which produces a positive impact on the economy of northern New Mexico, and quantities of chemical wastes, which largely resulted from restoration of a former material disposal area. Overall, the operations data indicate that the Laboratory was operating within the SWEIS environmental envelope.

ACKNOWLEDGMENTS

The concept of an Annual Yearbook was developed soon after the SWEIS Project Office was established and is described in the 1995 Quality Management Plan as "making recommendations regarding the ongoing evaluation of Laboratory operations and the environmental envelope established by the SWEIS process." Ann Pendergrass (LANL), Connie Soden (DOE/AL), Corey Cruz (DOE/AL), and Doris Garvey (LANL) were the creators of this concept and watched over its development. Their oversight and guidance were critical in moving the concept to reality. Without their involvement, the Yearbook would not have happened.

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The Site-Wide Issues Office was the primary preparer of this report. Chief contributors were Doris Garvey, Ken Rea, Chris Del Signore, Allen Valentine, Tony Grieggs, and Julie Meadows.

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Pauline McCormick provided administrative support to the Site-Wide Issues Office, keeping impeccable records so that information would not be lost.

Hector Hinojosa provided editorial support, and Randy Summers served as the designer using text and photographs for a final product.

Many individuals assisted in the collection of information and review of drafts. Data and information came from many parts of the Laboratory, including facility and operating personnel and those who monitor and track environmental parameters. The Yearbook could not have been completed and verified without their help. Though all individuals cannot be mentioned here, the table below identifies major players from each of the Key Facilities and other operations.

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Utilities	Jerome Gonzales
Utilities	Gilbert Montoya
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ACRONYMS

ACIS	Automated Chemical Inventory System
ALARA	as low as reasonably achievable
ATW	accelerator transmutation of wastes
BTF	Beryllium Technology Facility
Ci	curie
CMR	Chemical and Metallurgy Research
DARHT	Dual-Axis Radiographic Hydrodynamic Test (facility)
DMR	discharge monitoring report
DOE	Department of Energy
DVRS	Decontamination and Volume Reduction System
DX	Dynamic Experimentation (Division)
EPA	Environmental Protection Agency
ER	Environmental Restoration (Project)
ESA	Engineering Sciences and Application (Division)
FTE	full-time equivalent (employee)
GWH	gigawatt-hours
HEWTF	High Explosives Wastewater Treatment Facility
HMP	Habitat Management Plan
HRL	Health Research Laboratory
IRP	Industrial Research Park
JCNNM	Johnson Controls of Northern New Mexico
KW	kilowatt
LANL	Los Alamos National Laboratory
LANSCE	Los Alamos Neutron Science Center
LAPP	Los Alamos Power Pool
LEDA	Low-Energy Demonstration Accelerator
LIDAR	light detection and ranging
LIFT	Los Alamos International Facility for Transmutation
linac	linear accelerator
LLW	low-level radioactive waste
LPSS	Long-Pulse Spallation Source
LWC	Lost Workday Case Rate
m	meter
MDA	material disposal area
MEI	maximally exposed individual
MeV	million electron volts
MGY	million gallons per year
MLLW	mixed low-level radioactive waste
MSL	Materials Science Laboratory
MW	megawatt
NEPA	National Environmental Policy Act
NISC	Nonproliferation and International Security Center

NMED	New Mexico Environment Department
NMSF	Nuclear Materials Storage Facility
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
PNM	Public Service Company of New Mexico
PRS	potential release site
PTLA	Protection Technology Los Alamos
RCRA	Resource Conservation and Recovery Act
rem	roentgen equivalent man
RFI	RCRA facility investigation
RLW	radioactive liquid waste
RLWTF	Radioactive Liquid Waste Treatment Facility
ROD	record of decision
SCC	Strategic Computing Complex
SNM	special nuclear material
SWEIS	Site-Wide Environmental Impact Statement
SWS	Sanitary Wastewater System
TA	technical area
TEDE	total effective dose equivalent
TFF	Target Fabrication Facility
TRI	Total Recordable Incident Rate
TRU	transuranic
TSFF	Tritium Science and Fabrication Facility
TSTA	Tritium System Test Assembly (facility)
TWISP	Transuranic Waste Inspectable Storage Project
UC	University of California
UF/RO	ultrafiltration/reverse osmosis
WCRRF	Waste Characterization, Reduction, and Repackaging Facility
WETF	Weapons Engineering and Tritium Facility
WIPP	Waste Isolation Pilot Plant
WNR	Weapons Neutron Research (facility)

1.0 Introduction

1.1 The SWEIS

In 1999, the US Department of Energy (DOE) published a Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory (DOE 1999a). DOE issued its Record of Decision (ROD) on this Site-Wide Environmental Impact Statement (SWEIS) in September 1999 (DOE 1999b). The ROD identified the decisions DOE made on the levels of operation for Los Alamos National Laboratory (LANL) for the foreseeable future.

1.2 Annual Yearbook

To enhance the usefulness of this SWEIS, a National Environmental Policy Act (NEPA) document, DOE and LANL implemented an assessment tool that makes annual comparisons between SWEIS projections and actual operations via an annual Yearbook. The Yearbook's purpose is not to present environmental impacts or environmental consequences, but rather to provide data that could be used to develop an impact analysis. The annual Yearbook focuses on

- Facility and process modifications or additions (Chapter 2). These include projected activities, for which NEPA coverage was provided by the SWEIS, and certain other activities for which environmental coverage was not provided in the SWEIS. In the latter case, the Yearbook identifies the additional NEPA analyses (i.e., categorical exclusions and environmental assessments) that were performed.
- The types and levels of operations during the calendar year (Chapter 2). Types of operations are described using the capabilities defined in the SWEIS. Levels of operations are expressed in units of production, numbers of researchers, numbers of experiments, hours of operation, and other descriptive units.
- Operations data for the Key Facilities, comparable to data projected in the SWEIS (Chapter 2). Data for each facility include waste generated, air emissions, liquid effluents, and number of workers.
- Site-wide effects of operations for the calendar year (Chapter 3). These include measures such as number of workers, radiation doses, workplace incidents, utility requirements, air emissions, liquid effluents, and solid wastes. These effects also include changes in the regional aquifer, ecological resources, and other resources for which the DOE has long-term stewardship responsibilities as an owner of federal lands.

Data for comparison come from a variety of sources, including facility records, operations reports, facility personnel, and the annual Environmental Surveillance Report. The focus on operations rather than on programs, missions, or funding sources is consistent with the approach of the SWEIS.

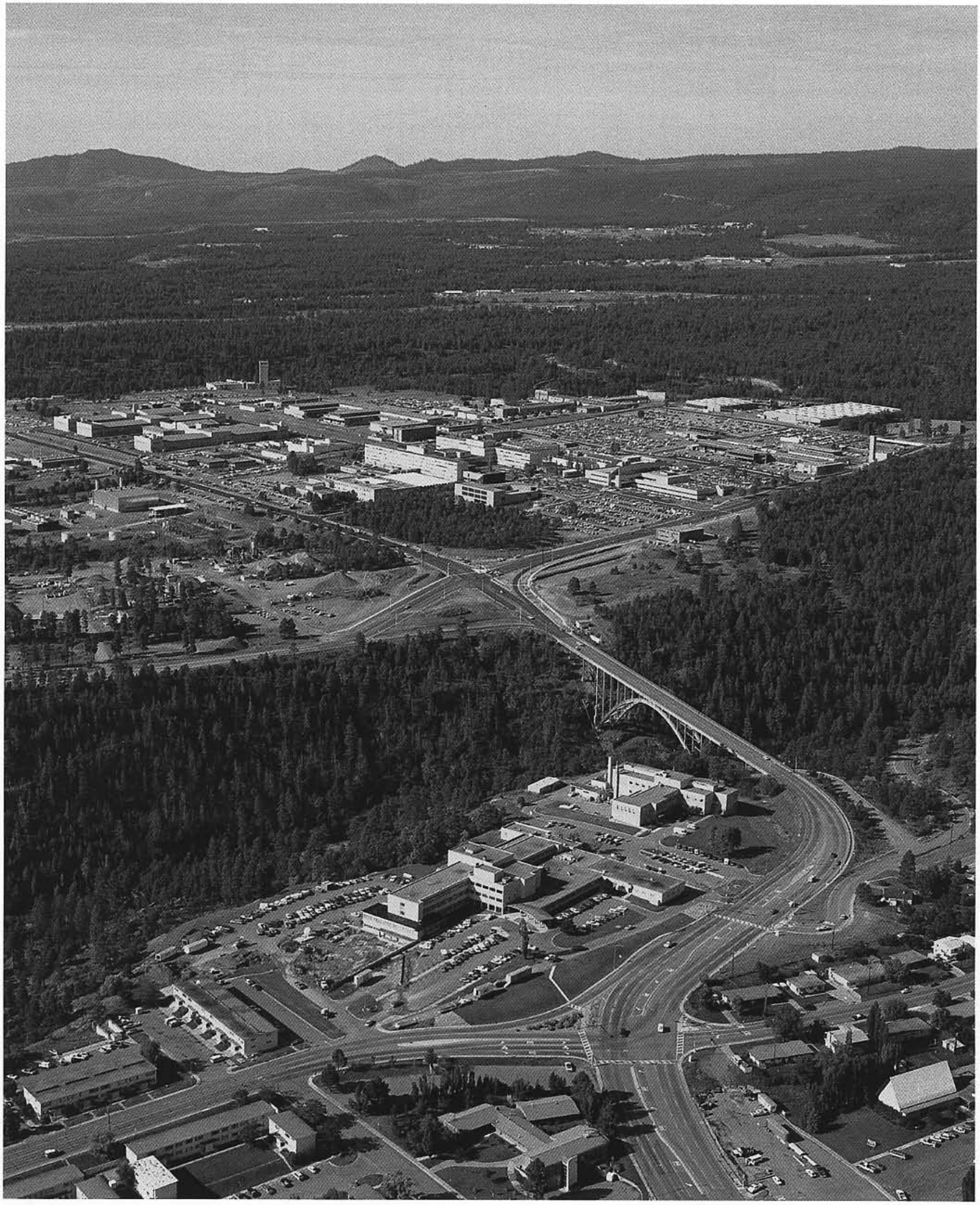
The annual Yearbooks provide DOE with information needed to evaluate adequacy of the SWEIS and will enable DOE to make a decision on when and if a new SWEIS is needed. The Yearbook will also be a guide to facilities and managers at the Laboratory in determining whether activities are within the SWEIS operating envelope. The report does not reiterate the detailed information found in other LANL documents, but rather points the interested reader to those documents for the additional detail. The Yearbook serves as a guide to environmental information collected and reported by the various groups at LANL.

1.3 This Yearbook

The ROD selected the levels of operations, and the SWEIS provided projections for these operations.This Yearbook compares data for calendar year 1999 to the appropriate SWEIS projections. Hence, this report uses the phrases "SWEIS ROD projections," "SWEIS ROD," or "ROD" to convey this concept, as appropriate.

The collection of data on facility operations is a unique effort. The type of information developed for the SWEIS is not routinely collected at LANL. Nevertheless, this information is the heart of the SWEIS and the Yearbook. Although this requires a special effort, the description of current operations and indications of future changes in operations is believed to be sufficiently important to warrant an incremental effort.

This Yearbook also presents the concept of additive analysis (Chapter 4). Though only two years of data exist, the concept is introduced and the groundwork laid for discussion in future years.



2.0 Facilities and Operations

LANL,which is located in northern New Mexico (Figure 2-1), has more than 2000 structures with approximately eight million square feet under roof, spread over an area of 43 square miles. In order to present a logical and comprehensive evaluation of LANL's potential environmental impacts, the SWEIS developed the Key Facility concept. Fifteen facilities were identified that were both critical to meeting mission assignments and

- housed operations that have the potential to cause significant environmental impacts, or
- were of most interest or concern to the public (based on comments in the SWEIS public hearings), or
- would be more subject to change because of DOE programmatic decisions.

The remainder of LANL was called "Non-Key," not to imply that these facilities were any less important to the accomplishment of critical research and development, but because they did not fit the above criteria (DOE 1999a, p. 2-17).

Taken together, the 15 Key Facilities represent the great majority of environmental risks associated with LANL operations. Specifically, the Key Facilities contribute

- more than 99% of all potential radiation doses to the public,
- more than 90% of all radioactive liquid waste (RLW) generated at LANL,
- more than 90% of the radioactive solid waste generated at LANL,
- more than 99% of all radiation doses to the LANL workforce, and
- approximately 30% of all chemical waste generated by LANL.

In addition, the Key Facilities comprise 42 of the 48 Category 2 and Category 3 nuclear facilities at LANL[1]. Several changes have been made to the status of nuclear facility classifications. However, these changes were not incorporated in the December 1998 DOE List of Los Alamos National Laboratory Nuclear Facilities and therefore are not reported here. Once the DOE list is updated, those changes will be reflected in the appropriate LANL SWEIS yearbook.

The definition of each Key Facility hinges upon operations[2], capabilities, and location and is not necessarily confined to a single structure, building, or technical area (TA). In fact, the number of structures comprising a Key Facility ranges from one, the Material Sciences Laboratory (MSL), to more than 400 for the Los Alamos Neutron Science Center (LANSCE). Key Facilities can also exist in more than a single TA, as is the case with the High Explosives Processing and High Explosives Testing Key Facilities, which exist in all or parts of five and seven TAs, respectively.

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[1] DOE Order 5480.23 (DOE 1992a) categorizes nuclear hazards as Category 1, Category 2, or Category 3. Because LANL has no Category 1 nuclear facilities (usually applied to nuclear reactors), definitions are presented for only Categories 2 and 3:
Category 2 Nuclear Hazard – has the potential for significant onsite consequences. DOE-STD-1027-92 (DOE 1992b) provides the resulting threshold quantities for radioactive materials that define Category 2 facilities.
Category 3 Nuclear Hazard – has the potential for only significant localized consequences. Category 3 is designed to capture those facilities such as laboratory operations, low-level radioactive waste handling operations, and research operations that possess less than Category 2 quantities of material. DOE-STD-1027-92 (DOE 1992b) provides the Category 3 thresholds for radionuclides.
The identification of nuclear facilities is based upon the official list maintained by DOE Los Alamos Area Office as of December 1998 (DOE 1998a).

[2] As used in the SWEIS and this Yearbook, facility operations include three categories of activities—research, production, and services to other LANL organizations. Research is both theoretical and practical. Examples include modeling (e.g., atmospheric weather patterns) to subatomic investigations (e.g., using the LANSCE linear accelerator [linac]) to collaborative efforts with industry (e.g., fuel cells for automobiles). Production involves the delivery of a product to a customer, such as radioisotopes to hospitals and the medical industry. Examples of services provided to other LANL facilities include utilities and infrastructure support, analysis of samples, environmental surveys, and waste management.

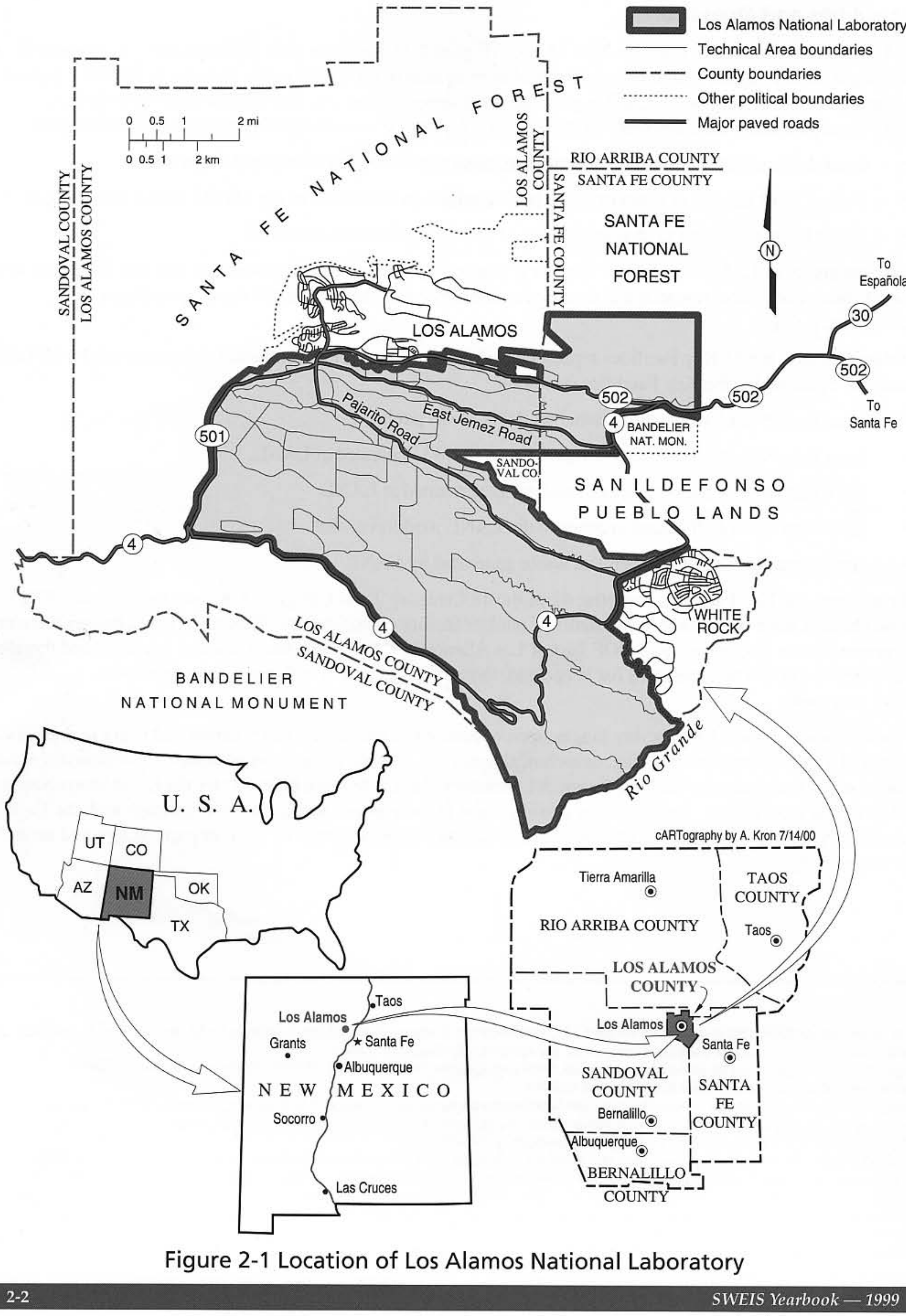


Figure 2-1 Location of Los Alamos National Laboratory

This chapter discusses each of the 15 Key Facilities from three aspects—significant facility construction and modifications that have occurred during 1999, types and levels of operations that occurred during 1999, and the 1999 operations data. Each of these three aspects is given perspective by comparing them to projections made by the ROD. This comparison provides an evaluation of whether or not data resulting from LANL operations continue to fall within the environmental envelope established by the ROD. It should be noted that construction activities projected by the ROD were for the ten-year period 1996–2005. All construction activities will not be complete and projected operations may not reach maximum levels until the end of the ten-year period.

This chapter also discusses the Non-Key Facilities, which include all buildings and structures not part of a Key Facility, or the balance of LANL. Although operations at the Non-Key Facilities do not contribute significantly to radiation doses or generation of radioactive wastes, the Non-Key Facilities represent a significant fraction of LANL. The Non-Key Facilities comprise all or the majority of 30 of LANL's 49 TAs (Figure 2-2), and approximately 15,500 of LANL's 27,820 acres. The Non-Key Facilities also employ about half the LANL workforce. This category includes such important buildings and operations as the Central Computing Facility, the Atlas Facility, the TA-46 sewage treatment facility, and the Main Administration Building. Table 2.0-1 identifies and compares the acreage of the 15 Key Facilities and the Non-Key Facilities, and Figure 2-3 shows the locations of the key facilities.

Table 2.0-1. Key and Non-Key Facilities

FACILITY	TECHNICAL AREAS	~SIZE (ACRES)
Plutonium Complex	TA-55	93
Tritium Facilities	TA-16 & TA-21	312
Chemical and Metallurgy Research Building (CMR)	TA-03	14
Pajarito Site	TA-18	131
Sigma Complex	TA-03	11
MSL	TA-03	2
Target Fabrication Facility (TFF)	TA-35	3
Machine Shops	TA-03	8
High Explosives Processing	TAs 08, 09, 11, 16, 22, 28, 37	1115
High Explosives Testing	TAs 15, 36, 39, 40	8691
LANSCE	TA-53	751
Health Research Laboratory (HRL)	TA-43	4
Radiochemistry Facility	TA-48	116
Radioactive Liquid Waste Treatment Facility (RLWTF)	TA-50	62
Solid Radioactive and Chemical Waste Facilities	TA-50 & TA-54	943
Subtotal, Key Facilities		12,256
Non-Key Facilities	30 of 49 TAs	15,560
LANL		27,816

2.1 Plutonium Complex (TA-55)

The Plutonium Complex Key Facility, a 93-acre site, consists of six primary buildings and a number of lesser buildings and structures. As presented in the SWEIS, this Key Facility contains one operational Category 2 nuclear facility (TA-55-4) and one potential Category 2 nuclear facility (TA-55-41), the Nuclear Material Storage Facility (NMSF), which was undergoing modification to bring it into operational status. In addition, the facility contains two Low Hazard chemical facilities (TA-55-3 and TA-55-5) and one Low Hazard energy source s facility (TA-55-7).

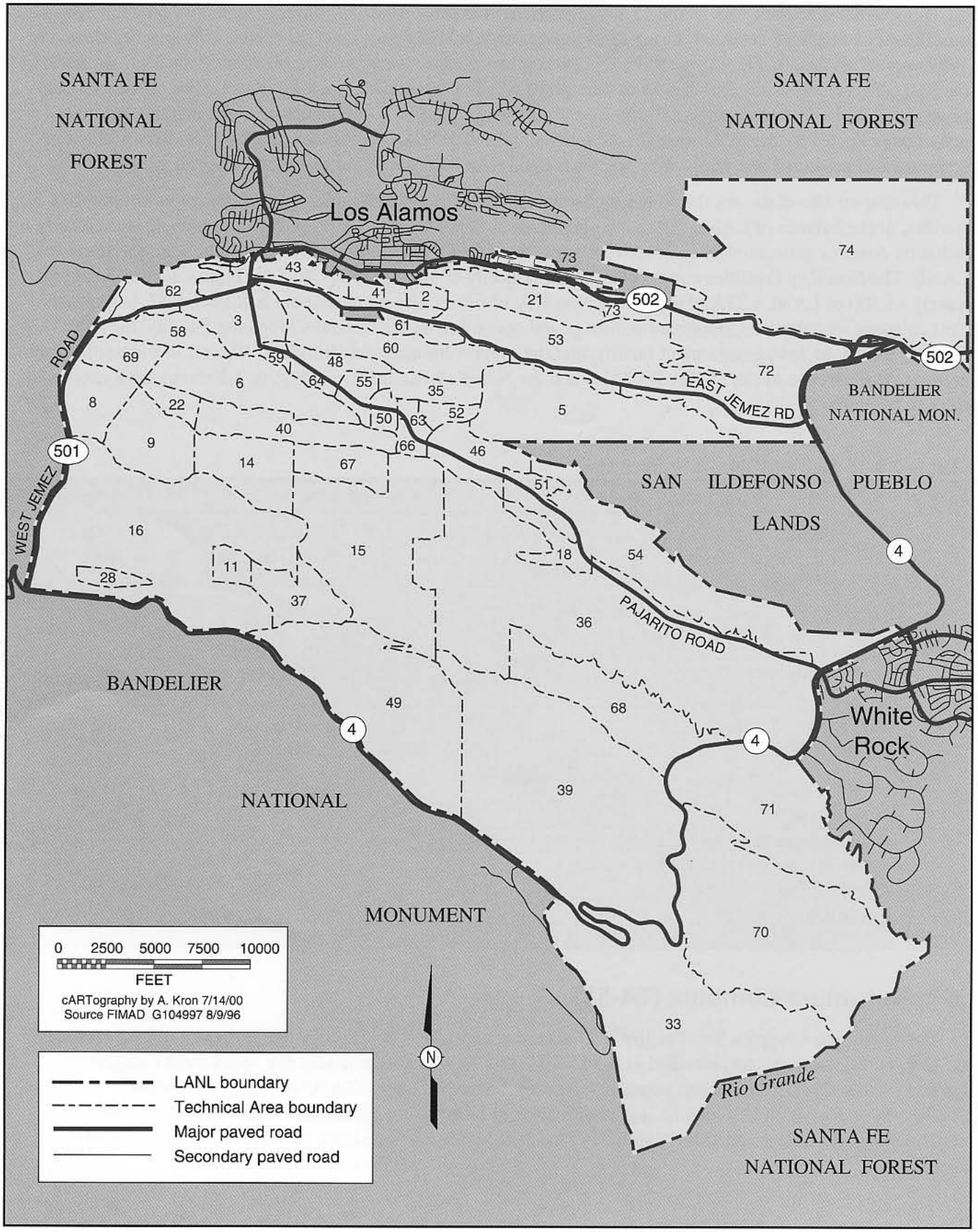


Figure 2-2 Location of Technical Areas

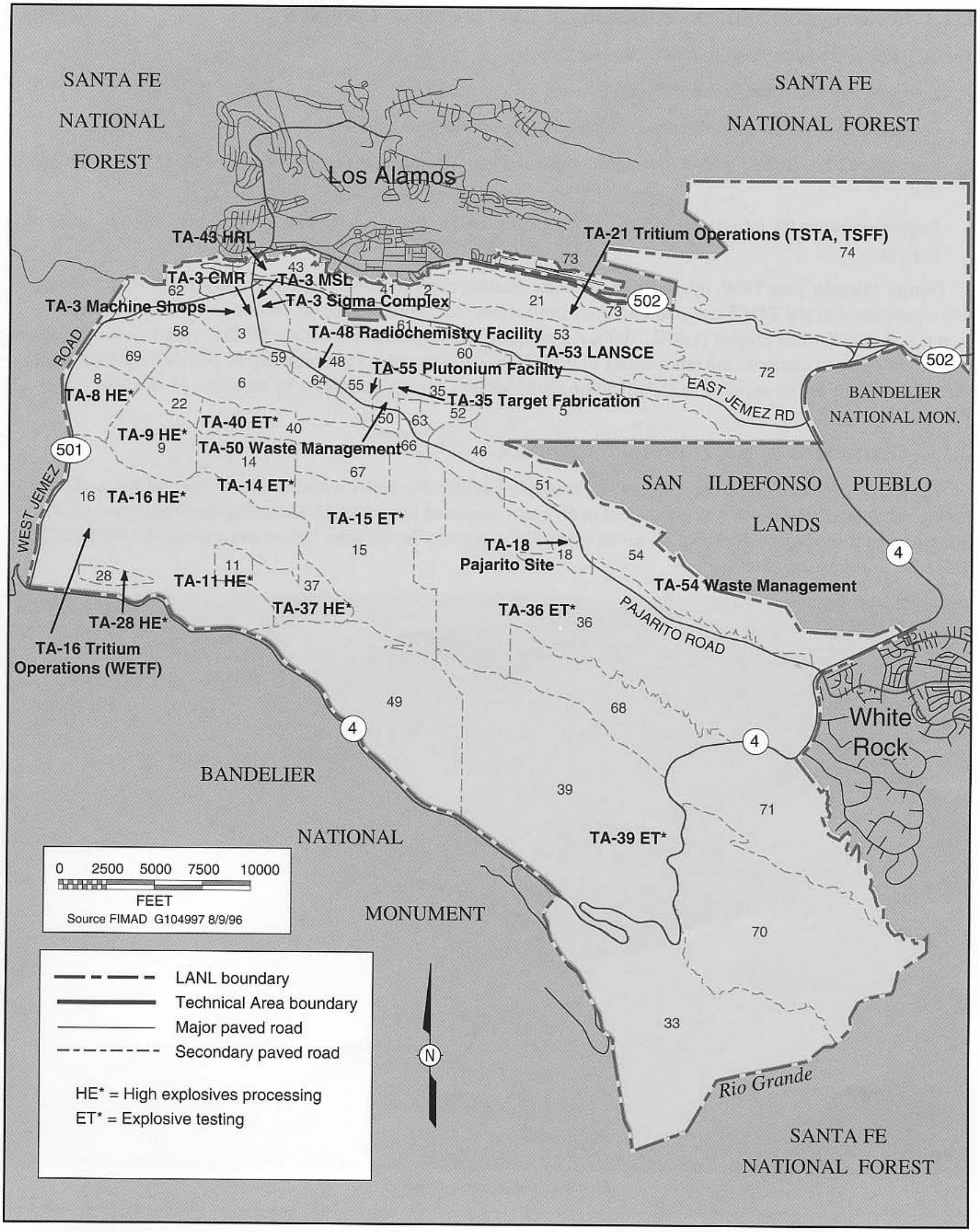


Figure 2-3 Location of Key Facilities

2.1.1 Construction and Modifications at the Plutonium Complex

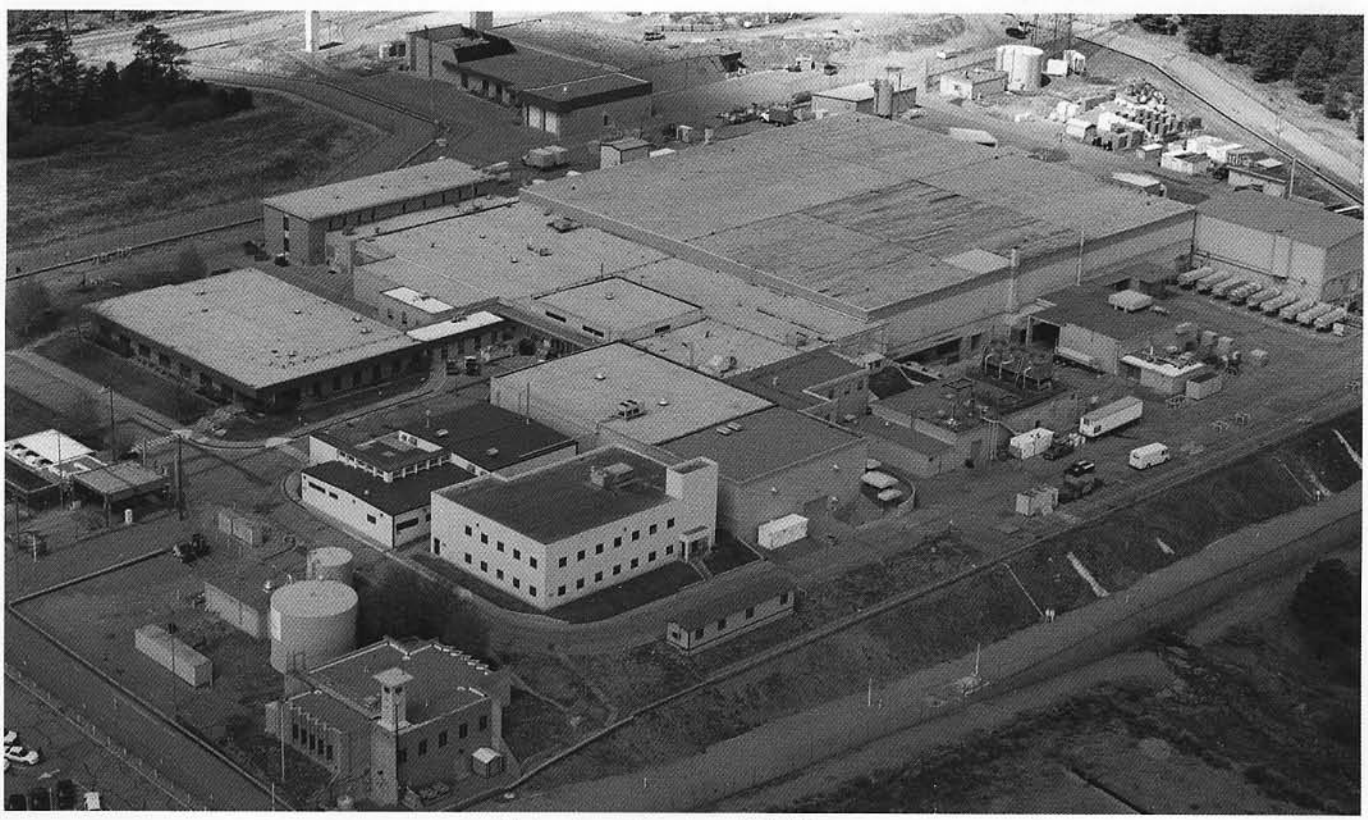
The ROD projected four facility modifications:

- renovation of the NMSF (currently not in use);
- construction of a new administrative office building (constructed in 1999);
- upgrades within Building 55-4 to support continued manufacturing at the existing capacity of 14 pits per year; and
- further upgrades for long-term viability of the facility and to boost production to a nominal capacity of 20 pits per year.

During calendar year 1999, upgrades to maintain existing capacity were continued and a new office building was constructed at the TA-55 site (the Facilities Improvement Technical Support building). A categorical exclusion was issued for this project (LANL 1998a). Design efforts for renovation of the NMSF were halted. There are no current plans to continue the renovations of NMSF. None of the ongoing construction or modifications at the Plutonium Key Facility resulted in modification to the facility hazard categories by the close of calendar year 1999.

2.1.2 Operations at the Plutonium Complex

The ROD identified seven capabilities[3] for this Key Facility. No new capabilities have been added, and none have been deleted. Research was conducted in all areas projected by the ROD, including the preparation of 10 kilograms of mixed oxide fuel. For all seven capabilities, activity levels were below those projected by the ROD. Table 2.1.2-1 presents details.



Plutonium Complex at TA-55

[3]As defined in the SWEIS, a capability refers to the combination of buildings, equipment, infrastructure, and expertise necessary to undertake types or groups of activities and to implement mission assignments. Capabilities at LANL have been established over time, principally through mission assignments and activities directed by DOE Program Offices.

Table 2.1.2-1. Plutonium Complex/Comparison of Operations

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
Plutonium Stabilization	Recover, process, and store the existing plutonium inventory in eight years.	Highest priority items have been stabilized. The implementation plan is being modified between DOE and the Defense Nuclear Facilities Safety Board with a longer completion schedule.
Manufacturing Plutonium Components	Produce nominally 20 war reserve pits/yr. (Requires minor facility modifications.)	There were no war reserve pits produced or accepted by DOE for transfer to the nuclear stockpile. Four development pits were fabricated in preparation for eventual war reserve fabrication.
Surveillance and Disassembly of Weapons Components	Pit disassembly: Up to 65 pits/yr disassembled. Pit surveillance: Up to 40 pits/yr destructively examined and 20 pits/yr nondestructively examined.	Less than 65 pits were disassembled during 1999. Less than 40 pits were destructively examined as part of the stockpile evaluation program (pit surveillance) in 1999.
Actinide Materials and Science Processing, Research, and Development	Develop production disassembly capacity. Process up to 200 pits/yr, including a total of 250 pits (over 4 years) as part of disposition demonstration activities.	Fewer than 200 pits were disassembled/converted in 1999.
	Process neutron sources up to 5000 curies/yr. Process neutron sources other than sealed sources.	Neutron sources are not currently being disassembled and chemically processed.
	Process up to 400 kilograms/yr of actinides.[b] Provide support for dynamic experiments. Process 1 to 2 pits/month (up to 12 pits/yr) through tritium separation.	Less than 400 kilograms/yr of actinides were processed. Support was provided for dynamic experiments. Less than 12 pits/yr were processed through tritium separations in 1999.
	Perform decontamination of 28 to 48 uranium components per month.	In 1999, less than 48 uranium components were decontaminated.
	Research in support of DOE actinide cleanup activities. Stabilize minor quantities of specialty items. Research and development on actinide processing and waste activities at DOE sites, including processing up to 140 kilograms of plutonium as chloride salts from the Rocky Flats Environmental Technology Site.	Research supporting DOE actinide cleanup activities continued at low levels. No plutonium residues from Rocky Flats were processed.
	Conduct plutonium research and development and support. Prepare, measure, and characterize samples for fundamental research and development in areas such as aging, welding and bonding, coatings, and fire resistance.	Sample preparation and characterization continued.

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
Actinide Materials and Science Processing, Research, and Development (Cont.)	Fabricate and study nuclear fuels used in terrestrial and space reactors. Fabricate and study prototype fuel for lead test assemblies.	Minimal terrestrial and space reactor fuel development occurred in 1999.
	Develop safeguards instrumentation for plutonium assay.	Continued support of safeguards instrumentation development.
	Analyze samples in support of actinide reprocessing and research and development activities.	Analysis of actinide samples at TA-55 continued in support of actinide reprocessing and research and development activities.
Fabrication of Ceramic-Based Reactor Fuels	Build mixed oxide test reactor fuel assemblies and continue research and development on fuels.	Manufactured approximately 10 kg of mixed oxide fuel in 1999.
Plutonium-238 Research, Development, and Applications	Process, evaluate, and test up to 25 kg/yr plutonium-238. Recycle residues and blend up to 18 kg/yr plutonium-238.	Recovered approximately 0.5 kg of plutonium-238 and processed approximately 1.0 kg of plutonium-238 for heat source fuel in 1999.
Special Nuclear Materials (SNM) Storage, Shipping and Receiving	Store up to 6600 kilograms SNM in NMSF; continue to store working inventory in the vault in Building 55-4; ship and receive as needed to support LANL activities.	NMSF is not operational as a storage vault and there are no current plans to complete the modifications required to use the facility as a storage vault. Building 55-4 vault levels remained approximately constant at 1996 levels.
	Conduct nondestructive assay on SNM at NMSF to identify and verify the content of stored containers.	NMSF not operational as a storage vault and was not used for nondestructive assay.

[a] Includes renovation of NMSF, construction of new technical support office building, and upgrades to enable the production of nominally 20 war reserve pits per year.

[b] The actinide activities at the CMR Building and at TA-55 are expected to total 400 kilograms/yr. The future split between these two facilities is not known, so the facility-specific impacts at each facility are conservatively analyzed at this maximum amount. Waste projections that are not specific to the facility (but are related directly to the activities themselves) are only projected for the total of 400 kilograms/yr.

2.1.3 Operations Data for the Plutonium Complex

Details of operational data are presented in Table 2.1.3-1. Radioactive air emissions were less than one percent of projections (less than 2 curies in 1999 compared to 1000 curies projected), and quantities of wastes were also less than projected.

Table 2.1.3-1. Plutonium Complex/Operations Data

PARAMETER	UNITS[a]	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
Plutonium-239 [b]	Ci/yr	2.70E-5	1.2E-7
Americium-241	Ci/yr	Not projected [c]	5.4E-8
Tritium in Water Vapor	Ci/yr	7.50E+2	3.1E-1
Tritium as a Gas	Ci/yr	2.50E+2	1.45E+0
Uranium-234	Ci/yr	Not projected [c]	2.0E-8
Uranium-238	Ci/yr	Not projected [c]	5.1E-8
NPDES Discharge [d] 03A181 [e]	MGY	14	8.54

PARAMETER	UNITS[a]	SWEIS ROD	1999 OPERATIONS
Wastes:			
Chemical	kg/yr	8400	2539
LLW [f]	m^3/yr	754 [g]	340
MLLW	m^3/yr	13 [g]	4
TRU/Mixed TRU	m^3/yr	339 [h]	160
TRU	m^3/yr	237 [h]	94
Mixed TRU	m^3/yr	102 [h]	66
Number of Workers	FTEs	1111	589 [i]

[a] Ci/yr = curies per year; MGY = million gallons per year; FTEs = full-time equivalent workers.
[b] Projections for the SWEIS ROD were reported as plutonium or plutonium-239, the primary material at TA-55.
[c] The radionuclide was not projected in the ROD because it was either dosimetrically insignificant or not isotopically identified.
[d] NPDES is National Pollutant Discharge Elimination System.
[e] This outfall discharged all four quarters during calendar year 1999.
[f] LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; TRU = transuranic.
[g] Includes estimates of waste generated by the facility upgrades associated with pit fabrication.
[h] The ROD provided the data for TRU and Mixed TRU wastes in Chapter 3 and Chapter 5 of the SWEIS. However, the projections made had to be modified to reflect the decision to produce nominally 20 pits per year.
[i] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include Protection Technology Los Alamos (PTLA), Johnson Controls Northern New Mexico (JCNNM), and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only University of California (UC) employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 3.6, Socioeconomics) is not appropriate.

2.2 Tritium Facilities (TA-16 and TA-21)

This Key Facility consists of tritium operations at TA-16 and TA-21. The tritium operations are conducted in three buildings: The Weapons Engineering Tritium Facility (WETF, Building TA-16-205), the Tritium Systems Test Assembly (TSTA, Building TA-21-155N), and the Tritium Science and Fabrication Facility (TSFF, Building TA-21-209). Operations involving the removal of tritium from actinide material are conducted at LANL's TA-55 Plutonium Facility; however, these operations are small in scale and were not included as part of the Tritium Facilities in the SWEIS.

The three facilities, (WETF, TSTA, and TSFF) have tritium inventories greater than 30 grams and thus are Category 2 nuclear facilities.

2.2.1 Construction and Modifications at the Tritium Facilities

No major upgrades were added to WETF at TA-16. Several of the existing systems were upgraded to provide additional capabilities. The remodeling of Building TA-16-450 was continued during 1999.

There have been no facility modifications made to the TA-21 facilities. In November 1999, DOE determined that the TSTA facility has completed its mission and the tritium will be removed from TSTA in the next several years. Only a limited experimental program will be carried out in the facility, and this program should be complete by June 2000.

2.2.2 Operations at the Tritium Facilities

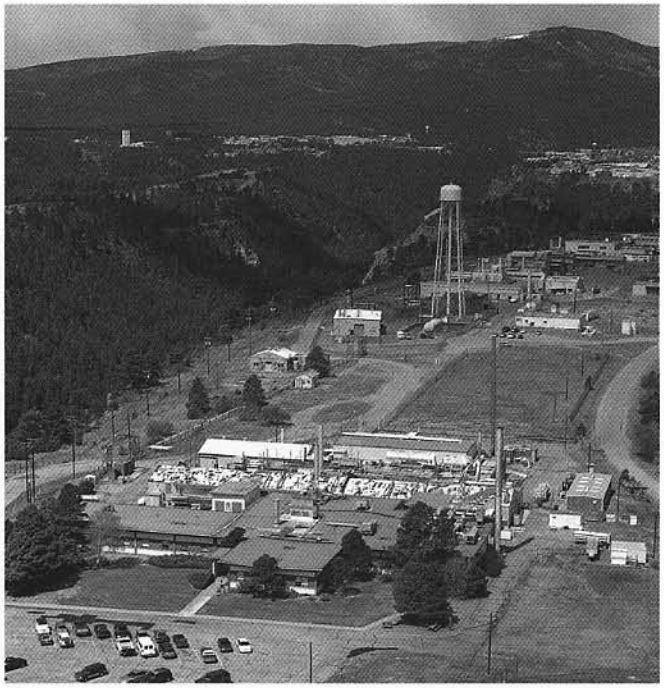
The ROD identified nine capabilities for this Key Facility. No new capabilities have been added, and none have been deleted. Table 2.2.2-1 lists the nine capabilities identified in the SWEIS and presents calendar year 1999 operational data for each of these capabilities. Operations in 1999 were below projections by the ROD and remained within the established environmental envelope. For example, approximately 19 high-pressure gas fill operations were conducted in 1999 (compared to 65 fills projected by the ROD), and approximately 14 gas boost system tests and gas processing operations were performed (compared to 35 projected by the ROD).

Table 2.2.2-1. Tritium Facilities/Comparison of Operations

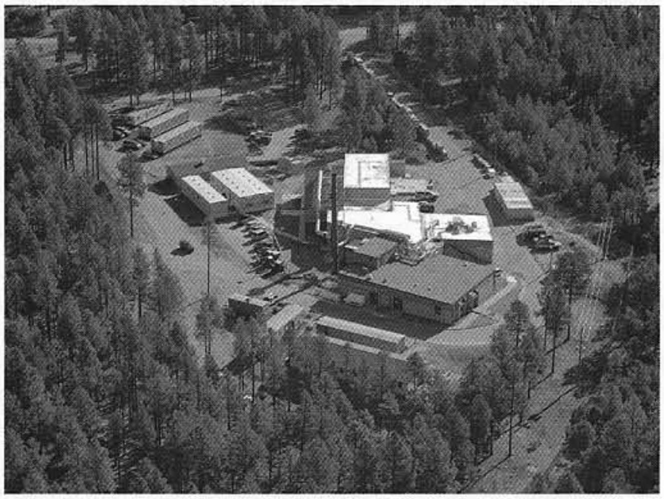
CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
High-Pressure Gas Fills and Processing: WETF	Handling and processing of tritium gas in quantities of up to 100 grams at WETF with no limit on number of operations per year. Capability used approximately 65 times/yr.	Approximately 19 high-pressure gas fills and processing operations.
Gas Boost System Testing and Development: WETF	System testing and gas processing operations involving quantities of up to 100 grams. Capability used approximately 35 times/yr.	Approximately 14 gas boost tests and operations.
Cryogenic Separation: TSTA	Tritium gas purification and processing in quantities up to 200 grams. Capability used five to six times/yr.	One cryogenic separation operation.
Diffusion and Membrane Purification: TSTA, TSFF, WETF	Research on tritium movement and penetration through materials. Expect six to eight experiments/month. Capability also used continuously for effluent treatment.	Approximately zero. Capability not used for continuous effluent treatment.
Metallurgical and Material Research: TSTA, TSFF, WETF	Capability involves materials research including metal getter research and application studies. Small quantities of tritium supports tritium effects and properties research and development. Contributes <2% of LANL's tritium emissions to the environment.	Activities resulted in <1% tritium emissions from each facility.
Thin Film Loading: TSFF (WETF by 2001)	Chemical bonding of tritium to metal surfaces. Current application is for tritium loading of neutron tube targets; perform loading operations up to 3000 units/yr.	Approximately 600 units were loaded. Operations occurred at both TSFF and WETF.
Gas Analysis: TSTA, TSFF, WETF	Analytical support to current capabilities. Operations estimated to contribute <5% of LANL's tritium emissions to the environment.	Continues at all three facilities. No changes in facility emissions from this activity.
Calorimetry: TSTA, TSFF, WETF	This capability provides a measurement method for tritium material accountability. Contained tritium is placed in the calorimeter for quantity measurements. This capability is used frequently, but contributes <2% of LANL's tritium emissions to the environment.	Continues at WETF and TSFF. No changes in facility emissions from this activity.
Solid Material and Container Storage: TSTA, TSFF, WETF	Storage of tritium occurs in process systems, process samples, inventory for use, and as waste. On-site storage could increase by a factor of 10 over 1995 levels, with most of the increase occurring at WETF.	The storage at TSTA and TSFF remained constant. The storage at WETF has increased by approximately 10% over 1995 levels.

[a] Includes the remodel of Building TA-16-450 to connect it to WETF in support of neutron tube target loading.

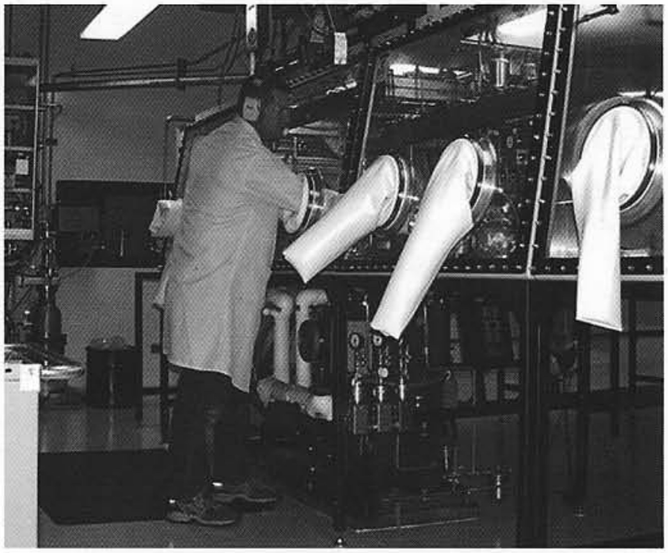
TA-21 Tritium Systems Test Assembly and Tritium Science and Fabrication Facility



Weapons Engineering Tritium Facility



Typical glove box operation



2.2.3 Operations Data for the Tritium Facilities

Data for operations at the Tritium Facilities were below levels projected by the ROD. For example, radioactive air emissions totaled approximately 650 curies compared to 2500 curies projected by the ROD, and a total of 37 cubic meters of LLW were generated, compared to 480 projected. Operational data are summarized in Table 2.2.3-1.

Table 2.2.3-1. Tritium Facilities (TA-16 and TA-21)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
TA-16/WETF, Tritium as a gas	Ci/yr	3.00E+2	2.4E+1
TA-16/WETF, Tritium in water vapor	Ci/yr	5.00E+2	1.4E+2
TA-21/TSTA, Tritium as a gas	Ci/yr	1.00E+2	1.7E+1
TA-21/TSTA, Tritium in water vapor	Ci/yr	1.00E+2	4.9E+1
TA-21/TSFF, Tritium as a gas	Ci/yr	6.40E+2	9.2E+1
TA-21/TSFF, Tritium in water vapor	Ci/yr	8.60E+2	3.3E+2
NPDES Discharge: [a]			
Total Discharges	MGY	0.33	8.97
02A129 (TA-21)	MGY	0.11	8.83
03A158 (TA-21) [b]	MGY	0.22	0.14
Wastes:			
Chemical	kg/yr	1700	51.7
LLW	m^3/yr	480	0
MLLW	m^3/yr	3	0
TRU/Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	123	28 [c]

[a] Outfalls eliminated before 1999: 05S (TA-21), 03A036 (TA-21), 04A091 (TA-16).

[b] This outfall only discharged two quarters during calendar year 1999.

[c] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 3.6, Socioeconomics) is not appropriate.

2.3 Chemistry and Metallurgy Research Building (TA-03)

The CMR Building Key Facility serves as a production, research, and support center for actinide chemistry and metallurgy research and analysis, uranium processing, and fabrication of weapon components. It consists of the main building (TA-3-29) and a pump house for RLW, TA-3-154. The main two-story building has a central corridor and seven wings. It is a Category 2 nuclear facility, primarily because of hot cell activities in Wing 9 and the quantities of nuclear material in the storage vault.

2.3.1 Construction and Modifications at the CMR Building

The ROD projected five facility modifications by December 2005:

- Phase I Upgrades to maintain safe operating conditions for 5 to 10 years;
- Phase II Upgrades (except seismic) to enable operations for an additional 20 to 30 years;
- modifications for production of targets for the molybdenum-99 medical isotope;
- modifications for the recovery of sealed neutron sources; and
- modifications for safety testing of pits in the Wing 9 hot cells.

During1999, there was activity on two of these five, the Phase I Upgrades and the Phase II Upgrades. At the end of 1999, five of the 11 Phase I Upgrades remain to be completed. Projections of completion status for these project activities are shown in Table 2.3.1-1.

Table 2.3.1-1. CMR Upgrade Project/Phase I Status/December 1999

% COMPLETE	STATUS	UPGRADE
100	completed	Continuous air monitors in building wings
80	continuing	Wing electrical systems
70	work stopped[a]	Power distribution system
90	work stopped[a]	Stack monitoring system
90	continuing	Interim improvements to the duct wash down system
40	work stopped[a]	Improvements to acid vents and drains

[a] Work stopped because of a hold put on CMR Phase 1 Upgrades by DOE.

Progress was made on three of the original 13 Phase II Upgrades during 1999. 'Upgrades to the Operations Center' and 'Upgrades to the Fire Protection System' were 25% complete at the end of 1999. The 'Standby Power for the Operations Center' activity was completed in 1999. No work was performed on the remaining 10 Phase II activities.

2.3.2 Operations at the CMR Building

The eight capabilities identified in the SWEIS for the CMR facility are presented in Table 2.3.2-1. For comparison purposes, levels at which these capabilities were operated during 1999 are listed.

Table 2.3.2-1. CMR Building (TA-03)/Comparison of Operations

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
Analytical Chemistry	Sample analysis in support of a wide range of actinide research and processing activities. Approximately 7000 samples/yr.	Approximately 2926 samples were analyzed.
Uranium Processing	Activities to recover, process, and store LANL highly enriched uranium inventory by 2005. Includes possible recovery of materials resulting from manufacturing operations.	Activities to recover and process highly enriched uranium were performed. Three shipments to Y-12 involved packaging and re-packaging.
Destructive and Nondestructive Analysis	Evaluate 6 to 10 secondaries/yr through destructive/nondestructive analysis and disassembly.	Performed nondestructive analysis on less than 10 secondaries.
Nonproliferation Training	Nonproliferation training involving SNM. No additional quantities of SNM, but may work with more types of SNM than in 1995.	Five weeks of SNM nonproliferation training conducted. Two weeks involved Category 2 quantities of SNM.
Actinide Research and Processing[b]	Process up to 5000 Ci/yr plutonium-238/beryllium and americium-241/beryllium neutron sources. Process neutron sources other than sealed sources. Stage up to 1000 plutonium-238/beryllium and americium-241/beryllium sources in Wing 9 floor holes.	No source processing activity.
	Introduce research and development effort on spent nuclear fuel related to long-term storage, and analyze components in spent and partially spent fuels.	No activity.

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
Actinide Research and Processing [b] (Continued)	Metallurgical microstructural/chemical analysis and compatibility testing of actinides and other metals. Primary mission to study long-term aging and other material effects. Characterize about 100 samples/yr. Conduct research and development in hot cells on pits exposed to high temperatures.	Performed microstructural characterization tests on approximately 50 samples containing less than 20 grams of plutonium per sample. No research and development on pits exposed to high temperatures.
	Analysis of TRU waste disposal related to validation of the Waste Isolation Pilot Plant (WIPP) performance assessment models. TRU waste characterization. Analysis of gas generation such as could occur in TRU waste during transportation to WIPP. Performance Demonstration Program to test nondestructive analysis/nondestructive examination equipment. Demonstrate actinide decontamination technology for soils and materials. Develop actinide precipitation method to reduce mixed wastes in LANL effluents.	Final analysis conducted on experiments.
Fabrication and Metallography	Produce 1080 targets/yr, each containing approximately 20 grams uranium-235, for the production of molybdenum-99, plus an additional 20 targets/wk for 12 weeks. Separate fission products from irradiated targets to provide molybdenum-99. Ability to produce 3000 six-day curies of molybdenum-99/wk.[c]	No work performed.
	Support complete highly enriched uranium processing, research and development, pilot operations, and casting. Fabricate metal shapes, including up to 50 sets of highly enriched uranium components, using 1 to 10 kg highly enriched uranium per operation. Material recovered and retained in inventory. Up to 1000 kg annual throughput.	No activity.

[a] Includes completion of Phase I and Phase II Upgrades, except for seismic upgrades, modifications for the fabrication of Molybdenum-99 (Mo-99) targets, modifications for the Radioactive Source Recovery Program, and modification for safety testing of pits.

[b] The actinide activities at the CMR Building and at TA-55 are expected to total 400 kg/yr. The future split between these two facilities is not known, so the facility-specific impacts at each facility are conservatively analyzed at this maximum amount. Waste projections, which are not specific to the facility (but are related directly to the activities themselves), are only projected for the total of 400 kg/yr.

[c] Mo-99 is a radioactive isotope that decays to form metastable Technicium-99, a radioactive isotope that has broad applications in medical diagnostic procedures. Both isotopes are short-lived, with half-lives (the time in which the quantity of the isotope is reduced by 50 percent) of 66 hours and 6 hours, respectively. These short half-lives make these isotopes both attractive for medical use (minimizes the radiation dose received by the patient) and highly perishable. Production of these isotopes is therefore measured in "six-day curies," the amount of radioactivity remaining after six days of decay, which is the time required to produce and deliver the isotope to hospitals and other medical institutions.

2.3.3 Operations Data for the CMR Building

Operations data from research, services, and production activities at the CMR Building were well below those projected by the ROD. Radioactive air emissions were less than one curie (compared to 1645 projected)—principally because processing of irradiated molybdenum-99 targets in the hot cells did not occur in 1999. In addition, only about ten percent of projected LLW were generated. Table 2.3.3-1 provides details of these and other operational data.

Table 2.3.3-1. Chemistry and Metallurgy Research Building (TA-03)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
Total Actinides[a]	Ci/yr	7.60E-4	3.0E-5
Krypton-85	Ci/yr	1.00E+2	Not measured [b]
Xenon-131m	Ci/yr	4.50E+1	Not measured [b]
Xenon-133	Ci/yr	1.50E+3	Not measured [b]
Tritium Water	Ci/yr	Negligible	Not measured [b]
Tritium Gas	Ci/yr	Negligible	Not measured [b]
Technetium-99	Ci/yr	Not projected [c]	9.2E-4
NPDES Discharge:			
03A-021[d]	MGY	0.53	4.45
Wastes:			
Chemical	kg/yr	10,800	6342
LLW	m^3/yr	1820	188.5
MLLW	m^3/yr	19	0.4
TRU/Mixed TRU	m^3/yr	41 [e]	11.1
TRU	m^3/yr	28 [e]	9.2
Mixed TRU	m^3/yr	13 [e]	1.9
Number of Workers	FTEs	367	204 [f]

[a] Includes uranium, plutonium, americium, and thorium.
[b] Potential emissions during the period were sufficiently small that measurement of these radionuclides was not necessary to meet facility or regulatory requirements.
[c] The radionuclide was not projected in the ROD because it was either dosimetrically insignificant or not isotopically identified.
[d] This outfall discharged all four quarters during calendar year 1999.
[e] The ROD provided the data for TRU and Mixed TRU wastes in Chapter 3 and Chapter 5 of the SWEIS. However, the projections made had to be modified to reflect the decision to produce nominally 20 pits per year.
[f] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.4 Pajarito Site (TA-18)

The Pajarito Site Key Facility is located entirely at TA-18. The facility consists of a main building (18-30), three outlying, remote-controlled critical assembly buildings known as kivas (18-23, -32, -116), and a number of additional support buildings, including the hillside vault (18-26). Principal activities are the design and performance of nuclear criticality experiments and detector development in support of emergency response, nonproliferation, and arms control. This Key Facility has five Category 3 nuclear facilities (the hillside vault for nuclear material storage, two kivas, and two additional research buildings) and one Category 2 nuclear facility (Kiva #2).

2.4.1 Construction and Modifications at the Pajarito Site

The ROD projected replacement of the portable linear accelerator (linac). However, this has not been done, nor did any major modifications or new construction projects occur during 1999.

2.4.2. Operations at the Pajarito Site

The SWEIS identified nine capabilities for this Key Facility. No new research capabilities have been added, and none have been deleted. The TA-18 facility experienced normal operations during 1999 and conducted 188 criticality experiments. This total of 188 experiments is approximately a factor of six below the ROD projection of a maximum of 1050 experiments in any given year. In addition, inventory levels remained essentially constant, and there was not a significant increase in nuclear weapons components and materials at the facility. Table 2.4.2-1 provides details.

Table 2.4.2-1. Pajarito Site (TA-18)/Comparison of Operations

ACTIVITIES	SWEIS ROD[a]	1999 OPERATIONS
Dosimeter Assessment and Calibration	Perform up to 1050 criticality experiments per year.	Performed 188 experiments.
Detector Development	Develop safeguards instrumentation and perform research and development for nuclear materials, LIDAR [b] experiments, and materials processing. Increase nuclear materials inventory by 20%, and replace portable linac.	Increased nuclear materials inventory by 5% in 1998, no additional increase in 1999. Did not replace the portable accelerator.
Materials Testing	Perform up to 1050 criticality experiments per year. Develop safeguards instrumentation and perform research and development for nuclear materials, LIDAR experiments, and materials processing.	Performed 188 experiments.
Subcritical Measurements	Perform up to 1050 criticality experiments per year. Develop safeguards instrumentation and perform research and development for nuclear materials, LIDAR experiments, and materials processing. Increase nuclear materials inventory by 20%.	Performed 188 experiments. Increased nuclear materials inventory by 5% in 1998, no additional increase in 1999.
Fast-Neutron Spectrum	Perform up to 1050 criticality experiments per year. Develop safeguards instrumentation and perform research and development for nuclear materials, LIDAR experiments, and materials processing. Increase nuclear materials inventory by 20%, and increase nuclear weapons components and materials.	Performed 188 experiments. Increased nuclear materials inventory by 5% in 1998, no additional increase in 1999. Slight increase in nuclear weapons components and materials in 1998, no additional increase in 1999.
Dynamic Measurements	Perform up to 1050 criticality experiments per year. Develop safeguards instrumentation and perform research and development for nuclear materials, LIDAR experiments, and materials processing. Increase nuclear materials inventory by 20%.	Performed 188 experiments. Increased nuclear materials inventory by 5% in 1998, no additional increase in 1999.
Skyshine Measurements	Perform up to 1050 criticality experiments per year.	Performed 188 experiments.
Vaporization	Perform up to 1050 criticality experiments per year.	Performed 188 experiments.
Irradiation	Perform up to 1050 criticality experiments per year. Develop safeguards instrumentation and perform research and development for nuclear materials, interrogation techniques, and field systems. Increase nuclear materials inventory by 20%.	Performed 188 experiments. Increased nuclear materials inventory by 5% in 1998, no additional increase in 1999.

[a] Includes replacement of the portable linac. [b] Light detection and ranging.

2.4.3 Operations Data for the Pajarito Site

Research activities were well below those projected by the ROD; consequently, operations data were also well below projections. The chief environmental measure of activities at the Pajarito Site is the estimated radiation dose to a hypothetical member of the public, referred to as the maximally exposed individual (MEI). The dose estimated to result from 1999 activities was 2.6 millirem, compared to 28.5 millirem per year projected by the ROD. Chemical waste generation was below projections (1707 kilograms generated in 1999 compared to 4000 projected). Operational data are detailed in Table 2.4.3-1.

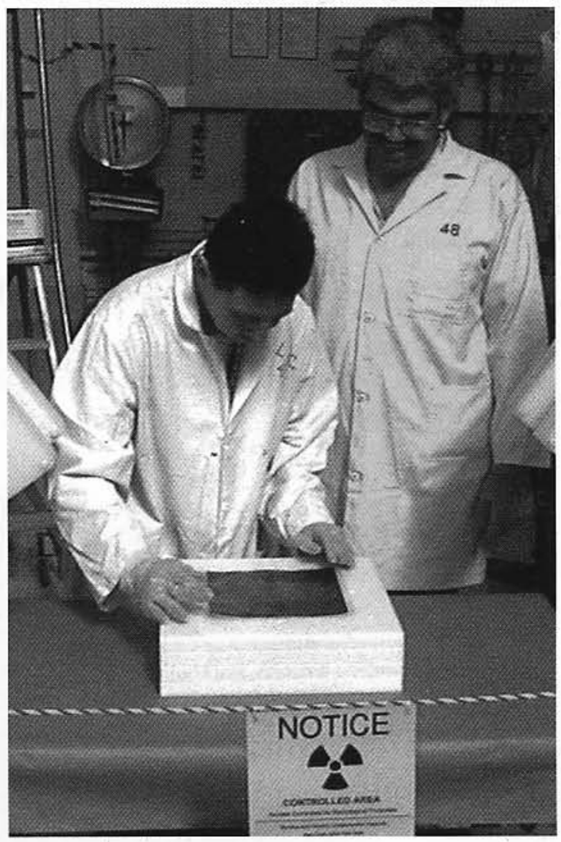
Table 2.4.3-1. Pajarito Site (TA-18)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
Argon-41 [a]	Ci/yr	1.02E+2	4.9E-1
External Penetrating Radiation	mrem/yr	28.5 [b]	2.6
NPDES Discharge	MGY	No outfalls	No outfalls
Wastes:			
Chemical	kg/yr	4000	1707
LLW	m^3/yr	145	31.3
MLLW	m^3/yr	1.5	7.9
TRU/Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	95	70 [c]

[a] These values are not stack emissions. The SWEIS ROD projections are from Gaussian plume dispersion modeling. Values are from the first 394-foot (120-meter) radius. Other isotopes (nitrogen-13 and oxygen-15) are not shown because of very short half-lives. Values for 1999 were estimated by using Monte Carlo modeling.

[b] Page 5-116, Section 5.3.6.1, "Public Health," of the SWEIS.

[c] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time AND part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.



Class in criticality

Pajarito Site (TA-18)

2.5 Sigma Complex (TA-03)

The Sigma Complex Key Facility consists of four principal buildings: the Sigma Building (03-66), the Beryllium Technology Facility (BTF) (03-141), the Press Building (03-35), and the Thorium Storage Building (03-159). Primary activities are the fabrication of metallic and ceramic items, characterization of materials, and process research and development. This Key Facility has two Category 3 nuclear facilities (03-66 and 03-159).

2.5.1 Construction and Modifications at the Sigma Complex

The ROD projected significant facility changes for the Sigma Building itself. Table 2.5.1-1 below indicates that three of five planned upgrades have been completed.

Table 2.5.1-1. Upgrades Planned for Sigma, Building 03-66

DESCRIPTION	COMPLETED?
Seismic upgrades	No
Roof replacement	No [a]
Replacement of graphite collection systems	Yes—1998
Modification of the industrial drain system	Yes—1998
Replacement of electrical components	Yes—1999

[a] Largely completed in 1998; continued into 1999.

In addition, although operations have not yet started, construction of the BTF, formerly known as the Rolling Mill Building, was completed during 1999. The BTF, a state-of-the-art beryllium processing facility, has 16,000 square feet of floor space, of which 13,000 are used for beryllium operations. The remaining 3000 square feet will be used for general metallurgical activities. Mission of the new facility is to maintain and enhance the beryllium technology base that exists at LANL, and to establish the capability for fabrication of beryllium powder components. Research will also be conducted at the BTF, and will include energy and weapons-related use of beryllium metal and beryllium oxide. As discussed in Section 2.8, Machine Shops, beryllium equipment will be moved from the shops into the BTF in stages, and the move should be completed in 2000.

2.5.2 Operations at the Sigma Complex

The SWEIS identified three capabilities for the Sigma Complex. No new capabilities have been added, and none have been deleted. As indicated in Table 2.5.2-1, activity levels for all capabilities were less than levels projected by the ROD.

Table 2.5.2-1. Sigma Complex (TA-03)/Comparison of Operations

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
Research and Development on Materials Fabrication, Coating, Joining, and Processing	Maintain and enhance capability to fabricate items from metals, ceramics, salts, beryllium, enriched uranium, depleted uranium, and other uranium isotope mixtures including casting, forming, machining, polishing, coating, and joining.	Capability maintained and enhanced, as projected.
Characterization of Materials	Maintain and enhance research and development activities on properties of ceramics, oxides, silicides, composites, and high-temperature materials. Characterize components for accelerator production of tritium.	Modest increase in research and development. Totals of 248 jobs and 1300 specimens.
	Analyze up to 36 tritium reservoirs/yr.	Less than 36 tritium reservoirs analyzed.

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
Characterization of Materials (Continued)	Develop library of aged non-SNM materials from stockpiled weapons and develop techniques to test and predict changes. Store and characterize up to 2500 non-SNM component samples, including uranium.	Approximately 500 non-SNM materials samples and 500 non-SNM component samples stored in library.
Fabrication of Metallic and Ceramic Items	Fabricate stainless steel and beryllium components for about 80 pits/yr.	No development pits fabricated.
	Fabricate up to 200 tritium reservoirs per year.	Less than 200 tritium reservoirs fabricated.
	Fabricate components for up to 50 secondaries per year.	Fabricated components for less than 50 secondaries.
	Fabricate nonnuclear components for research and development: about 100 major hydrotests and 50 joint test assemblies/yr.	Fabricated components for less than 100 major hydrotests and for less than 50 joint test assemblies.
	Fabricate beryllium targets.	None produced.
	Fabricate targets and other components for accelerator production of tritium research.	Three radiofrequency cavities produced.
	Fabricate test storage containers for nuclear materials stabilization.	None produced.
	Fabricate nonnuclear (stainless steel and beryllium) components for up to 20 pit rebuilds/yr.	Fabricate nonnuclear (stainless steel and beryllium) components for less than 20 pit rebuilds/yr.

[a] Includes Sigma Building renovation and modifications for BTF.

2.5.3 Operations Data for the Sigma Complex

Levels of research and operations were less than those projected by the ROD; consequently, operations data were also below projections. Waste volumes, radioactive air emissions, and NPDES discharge volumes were all lower than projected by the ROD. Table 2.5.3-1 provides details.

Table 2.5.3-1. Sigma Complex (TA-03)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:[a]			
Uranium-234	Ci/yr	6.60E-5	1.2E-6
Uranium-235	Ci/yr	Not projected [b]	4.5E-8
Uranium-238	Ci/yr	1.80E-3	1.3E-8
Thorium-230	Ci/yr	Not projected [b]	6.4 E-9
NPDES Discharge:			
Total Discharges	MGY	7.3	5.77
03A-022 [c]	MGY	4.4	5.77
03A-024	MGY	2.9	No discharge
Wastes:			
Chemical	kg/yr	10,000	3,208
LLW	m^3/yr	960	61
MLLW	m^3/yr	4	0.3
TRU/Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	284	101 [d]

[a] Only emissions from TA-3-35 were measured using stack sampling. Potential emissions from other Sigma facilities were sufficiently small that measurement systems were not necessary to meet regulatory or facility requirements. (continued)

[b] The radionuclide was not projected in the ROD because it was either dosimetrically insignificant or not isotopically identified.
[c] This outfall discharged all four quarters during calendar year 1999.
[d] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.6 Materials Science Laboratory (TA-03)

The MSL Key Facility is a single laboratory building (03-1698) containing 27 labs, 60 offices, 21 materials research areas, and support rooms. The building, a two-story structure with approximately 55,000 square feet of floor space, was first opened in November 1993. Activities are all related to research and development of materials science. This Key Facility is categorized as a Low Hazard nonnuclear facility.

2.6.1 Construction and Modifications at the MSL

There were no facility modifications during 1999. As indicated in the SWEIS, completion of the second floor is under consideration, but has not yet been funded.

2.6.2 Operations at the MSL

The SWEIS identified four major types of experimentation at MSL: materials processing, mechanical behavior in extreme environments, advanced materials development, and materials characterization. No new capabilities have been added, and none have been deleted. In 1999, similar to 1998, MSL conducted operations at levels approximating those projected in the ROD. This is not surprising since MSL is a new facility that responds to the variability of research and development funding.

There were approximately 105 researchers and support staff at MSL, about 30% more than the 82 projected by the ROD. (The primary measurement of activity for this facility is the number of scientists doing research.) This increase was accomplished by having researchers share offices and labs and reflects the high value placed on the MSL because of its quality lab space. Table 2.6.2-1 compares 1999 operations to projections made by the ROD.

Table 2.6.2-1. MSL (TA-03)/Comparison of Operations

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
Materials Processing	Maintain seven research capabilities at 1995 levels: • Wet chemistry • Thermomechanical processing • Microwave processing • Heavy equipment materials • Single crystal growth • Amorphous alloys • Powder processing Expand materials synthesis/processing to develop cold mock-up of weapons assembly and processing. Expand materials synthesis/processing to develop environmental and waste technologies.	These capabilities were maintained as projected in the ROD.
Mechanical Behavior in Extreme Environment	Maintain two research capabilities at 1995 levels: • Mechanical testing • Fabrication and assembly Expand dynamic testing to include research and development for the aging of weapons materials. Develop a new research capability (machining technology).	Mechanical testing was maintained as projected. Research into materials failure and fracture continued.

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
Advanced Materials Development	Maintain four research capabilities at 1995 levels of research: • New materials • Synthesis and characterization • Ceramics • Superconductors	This capability was maintained as projected in the ROD.
Materials Characterization	Maintain four research capabilities at 1995 levels: • Surface science chemistry • X-ray • Optical metallography • Spectroscopy Expand corrosion characterization to develop surface modification technology. Expand electron microscopy to develop plasma source ion implantation.	Materials characterization continued to be maintained.

[a] Includes completion of the second floor of MSL.

2.6.3 Operations Data for the MSL

The overall size of the MSL workforce has increased from approximately 80 workers in 1995 to about 105 in 1999 (including visiting staff, contractors, and others not included in the regular part-time and full-time LANL employees listed in Table 2.6.3-1) and significantly exceeds the workforce of 82 projected by the ROD. The operational effects of this increased workforce and of increased activity, however, have been smaller than projected. Waste quantities were lower than projected, and radioactive air emissions continue to be negligible and therefore were not measured. Table 2.6.3-1 provides details.

Table 2.6.3-1. MSL (TA-03)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions	Ci/yr	Negligible	Not measured
NPDES Discharge Volume	MGY	No outfalls	No outfalls
Wastes:			
Chemical	kg/yr	600	154
LLW	m^3/yr	0	0
MLLW	m^3/yr	0	0
TRU/Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	82	57[a]

[a] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.7 Target Fabrication Facility (TA-35)

The TFF is a two-story building (35-213) housing activities related to weapons production and laser fusion research. This Key Facility is categorized a Low Hazard chemical facility. Exhaust air from process equipment is filtered before exhausting to the atmosphere. Sanitary wastes are piped to the LANL sewage facility at TA-46, and RLW is piped to the treatment facility at TA-50.

2.7.1 Construction and Modifications at the Target Fabrication Facility

The ROD did not project any facility changes through 2005, and there were none during 1999.

2.7.2 Operations at the Target Fabrication Facility

The SWEIS identified three capabilities for the TFF Key Facility. No new capabilities have been added, and none have been deleted. The primary measurement of activity for this facility is production of targets for research and testing (laser and physics testing). In 1999, approximately 1200 targets and specialized components were fabricated for testing purposes, which is less than the 6100 targets per year projected by the ROD. As seen in the Table 2.7.2-1, other operations at the TFF were also below levels projected by the ROD.

Table 2.7.2-1. Target Fabrication Facility (TA-35)/Comparison of Operations

CAPABILITY	SWEIS ROD	1999 OPERATIONS
Precision Machining and Target Fabrication	Provide targets and specialized components for about 6100 laser and physics tests/yr, including a 20% increase over 1995 levels in high-explosive pulsed-power target operations, and including about 100 high-energy-density physics tests.	Provided targets and specialized components for about 1200 tests. Supported high-explosive pulsed-power tests at 1995 levels. Supported about 25 high-energy-density physics tests.
Polymer Synthesis	Produce polymers for targets and specialized components for about 6100 laser and physics tests/yr, including a 20% increase over 1995 levels in high-explosive pulsed-power target operations, and including about 100 high-energy-density physics tests.	Produced polymers for targets and specialized components for about 600 tests. Supported high-explosive pulsed-power tests at 1995 levels. Supported about 20 high-energy-density physics tests.
Chemical and Physical Vapor Deposition	Coat targets and specialized components for about 6100 laser and physics tests/yr, including a 20% increase over 1995 levels in high-explosive pulsed-power target operations, including about 100 high-energy-density physics tests, and including support for pit rebuild operations at twice 1995 levels.	Coated targets and specialized components for about 600 tests. Supported high-explosives pulsed-power tests at 1995 levels. Supported about 25 high-energy-density physics tests. Provided coatings for pit rebuild operations.

2.7.3 Operations Data for the Target Fabrication Facility

TFF activity levels are primarily determined by funding from fusion, energy, and other research-oriented programs, as well as funding from some defense-related programs. These programs, and hence operations at TFF, were at levels similar to those in 1995 and below levels projected by the ROD. This summary is supported by the current workforce, which is the same size as in 1995, and by 1999 waste volumes, which were less than projected. Table 2.7.3-1 details operations data for 1999.

Table 2.7.3-1. Target Fabrication Facility (TA-35)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radiological Air Emissions	Ci/yr	Negligible	Not measured [a]
NPDES Discharge: [b]	No discharge	0	No outfalls
Wastes:			
Chemical	kg/yr	3800	595
LLW	m^3/yr	10	0
MLLW	m^3/yr	0.4	0
TRU/Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	98	54 [c]

[a] Potential emissions during the period were sufficiently small that measurement systems were not necessary to meet regulatory or facility requirements.

[b] Outfalls eliminated before 1999: 04A127 (TA-35)

[c] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 3.6, Socioeconomics) is not appropriate.

2.8 Machine Shops (TA-03)

The Machine Shops Key Facility consists of two buildings, the Beryllium Shop (Building 03-39) and the Uranium Shop (Building 03-102). Activities consist of machining and fabrication of various materials in support of major LANL operations, principally those related to the processing and testing of high explosives and weapons components. Building 03-39 is categorized as a Low Hazard chemical facility, attributed in part to beryllium operations, while Building 03-102 is categorized as a Low Hazard radiological facility, because of uranium operations.

2.8.1 Construction and Modifications at the Machine Shops

There was no new construction or major modifications to the shops in 1999. In the future, beryllium equipment will be moved from Room 16 in the north wing of Building 03-39 to Building 03-141, the BTF (part of the Sigma Key Facility). The move will be conducted in phases and should be completed in the year 2000.

2.8.2 Operations at the Machine Shops

As shown in Table 2.8.2-1, the SWEIS identified three major capabilities at the shops. These same three capabilities continue to be maintained to support customers at LANL. No new capabilities have been added to this Key Facility, and none have been deleted. All activities occurred at levels well below those projected by the ROD. The workload at the Shops is directly linked with high explosives testing and processing operations. Much of the effort of staff for high explosive testing and processing in 1999 was directed to the development and construction of the Dual-Axis Radiographic Hydrodynamic Test (DARHT) facility. This resulted in a significant decrease in high explosive testing and production, and subsequently, a significant reduction in workload for the Shops.

Machine Shops showing numerical-controlled machines

Table 2.8.2-1. Machine Shops (TA-03)/Comparison of Operations

CAPABILITY	SWEIS ROD	1999 OPERATIONS
Fabrication of Specialty Components	Provide fabrication support for the dynamic experiments program and explosives research studies. Support up to 100 hydrodynamic tests/yr. Manufacture up to 50 joint test assembly sets/yr. Provide general laboratory fabrication support as requested.	Specialty components were fabricated at levels far below those projected in the SWEIS ROD.
Fabrication Utilizing Unique Materials	Continue fabrication utilizing unique and unusual materials.	Fabrication with unique materials was conducted at levels far below those projected by the SWEIS ROD.
Dimensional Inspection of Fabricated Components	Provide appropriate dimensional inspection of above fabrication activities. Undertake additional types of measurements/inspections.	Dimensional inspection was provided for the above fabrication activities. Additional types of measurements and inspections were not undertaken.

2.8.3 Operations Data for the Machine Shops

Since activities were well below projections by the ROD, so too were operations data. Chemical waste generation was less than 0.1% of projected generation (3955 kilograms generated in 1999, compared to a ROD projection of 474,000 kilograms per year). Table 2.8.3-1 provides details.

Table 2.8.3-1. Machine Shops (TA-03)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
Thorium-228	Ci/yr	Not projected [a]	2.5E-9
Thorium-230	Ci/yr	Not projected [a]	7.8E-10
Thorium-232	Ci/yr	Not projected [a]	5.4E-10
Uranium-234	Ci/yr	Not projected [a]	3.0E-7
Uranium-235	Ci/yr	Not projected [a]	1.2E-8
Uranium-238	Ci/yr	1.50E-4	1.3E-8
NPDES Discharge	MGY	No outfalls	No outfalls
Wastes:			
Chemical	kg/yr	474,000	3955
LLW	m^3/yr	606	40.4
MLLW	m^3/yr	0	0.03
TRU/Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	289	81 [b]

[a] The radionuclide was not projected in the ROD because it was either dosimetrically insignificant or not isotopically identified.

[b] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (full-time and part-time regular). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.9 High Explosives Processing (TA-08, TA-09, TA-11, TA-16, TA-22, TA-28, TA-37)

The High Explosives Processing Key Facility is located in all or parts of seven TAs. Building types consist of production and assembly facilities, analytical laboratories, explosives storage magazines, and a facility for the treatment of high explosive contaminated wastewaters. Activities consist primarily of the manufacture and assembly of high explosives components for nuclear weapons and for Science-Based Stockpile Stewardship Program tests and experiments. Production activities are centered in buildings at TA-16, TA-09, and TA-22. Environmental and safety tests are performed at TA-11 and TA-09 while TA-08 houses radiography activities. This Key Facility has four Category 2 nuclear buildings in TA-08 (08-22, -23, -24, -70) and no Category 3 nuclear or Moderate Hazard nonnuclear facilities.

Operations at this Key Facility are performed by two separate Divisions: the Dynamic Experimentation (DX) Division and the Engineering Sciences and Applications (ESA) Division. As a result, information from both Divisions must be combined to completely capture operational parameters for this Key Facility.

2.9.1 Construction and Modifications at High Explosives Processing

The ROD projected four facility modifications for this Key Facility. All four projects were completed before 1999.

Facility changes that occurred during 1999 are described below.

(a) At TA-9, an above ground wastewater storage tank system was placed into service on December 17, 1999. This system collects wastewater that is then moved by truck to the High Explosive Wastewater Treatment Facility (HEWTF) TA-16 for treatment. This project is covered by a separate NEPA document (LANL 1998b).

(b) The real time, small component radiography capability installed in building TA-16-260 was not made fully operational in 1999. When this capability becomes fully operational, buildings TA-16-220, -222, -223, -224, -225, and -226 will be vacated (DOE 1997a).

(c) Planning and modification work at TA-9 has continued to allow consolidation of high explosives formulation operations previously conducted at TA-16-340 with other TA-9 high explosives operations. Closure of building TA-16-340 will follow in fiscal year 2000 (DOE 1999c).

(d) In 1999, explosives stored at TA-28 were moved to TA-37 for storage. Although TA-28 is no longer used for storage, it remains part of the High Explosives Processing Key Facility.

2.9.2 Operations at High Explosives Processing

The ROD identified six capabilities for this Key Facility. No new capabilities have been added, and none have been deleted. Activity levels during 1999 continued below those projected by the ROD. These projections were based on the possibility that LANL would take over high explosives production work being performed at Pantex Plant. DOE has decided, however, to keep high explosives production at the Pantex Plant.

As seen in Table 2.9.2-1, high explosives and plastics development and characterization operations remained below levels projected in the SWEIS ROD. Considerable effort was expended during 1999 in continued development of protocols for obtaining stockpile returned materials, developing new test methods, and procuring new equipment to support requirements for science-based studies on stockpile materials.

Typical nonnuclear high explosive test

Table 2.9.2-1. High Explosives Processing (TA-08, TA-09, TA-11, TA-16, TA-22, TA-28, and TA-37)/Comparison of Operations

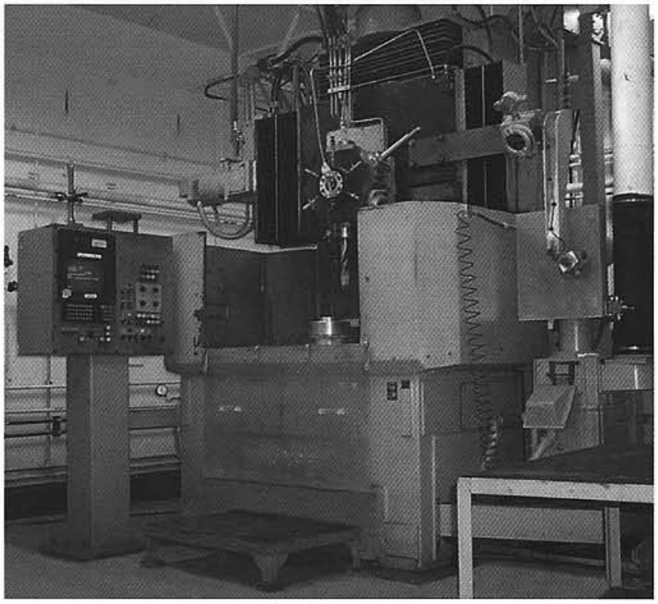
CAPABILITY	SWEIS ROD[a, b]	1999 OPERATIONS
High Explosives Synthesis and Production	Continue synthesis research and development, produce new materials, and formulate explosives as needed. Increase production of materials for evaluation and process development. Produce material and components for directed stockpile production.	The high explosives synthesis and production operations were less than those projected by the SWEIS ROD.
High Explosives and Plastics Development and Characterization	Evaluate stockpile returns. Increase (40%) efforts in development and characterization of new plastics and high explosives for stockpile improvement. Improve predictive capabilities. Research high explosives waste treatment methods.	High explosives formulation, synthesis, production, and characterization operations were performed at levels that were less than those projected by the SWEIS ROD.
High Explosives and Plastics Fabrication	Continue traditional stockpile surveillance and process development. Supply parts to Pantex for surveillance, stockpile rebuilds, and joint test assemblies. Increase fabrication for hydrodynamic and environmental testing.	DX Division fabricated approximate 3000 high explosive parts, and ESA Division fabricated approximately 870 high explosives parts in 1999. Therefore, approximately 3870 parts were fabricated in support of the weapons program including high explosives characterization studies, subcritical experiments, hydrotests, surveillance activities, environmental weapons tests, and safety tests.
Test Device Assembly	Increase test device assembly to support stockpile related hydrodynamic tests, joint test assemblies, environmental and safety tests, and increased research and development. Approximately 100 major assemblies per year.	ESA Division provided 10 major assemblies for hydrodynamic, Nevada Test Site subcritical, and joint environmental test programs.
Safety and Mechanical Testing	Increase (50%) safety and environmental tests related to stockpile assurance. Improve predictive models. Approximately 15 safety and mechanical tests per year.	DX Division performed 13 stockpile related safety and mechanical tests during 1999. ESA Division provided three re-validation and two certification assemblies in 1999.
Research, Development, and Fabrication of High-Power Detonators	Increase operations to support assigned stockpile stewardship management activities; manufacture up to 40 major product lines per year. Support DOE complex for packaging and transportation of electro-explosive devices.	High-power detonator activities by DX Division resulted in the manufacture of 20 product lines in 1999. In addition, ESA Division provided fourteen flux generator assemblies in 1999.

[a] The total amount of explosives and mock explosives used across all activities is an indicator of overall activity levels for this Key Facility. Amounts projected by the ROD are 82,700 pounds of explosives and 2910 pounds of mock explosives. Actual amounts used in 1999 were 15,150 pounds of high explosive (DX Division, 8150 pounds and ESA Division, 7000 pounds), and 5279 pounds of mock high explosive (DX Division, 1750 pounds and ESA Division, 3529 pounds).

[b] Includes construction of the HEWTF, the steam plant conversion, relocation of the Weapons Testing Facility, and outfall modifications.

In 1999, 15,664 pounds of high explosives and 5279 pounds of inert mock high explosives material were used. The level of high explosives usage was significantly below the ROD projection of 82,700 pounds of high explosives, while the usage of mock high explosives was almost twice the projection of 2910 pounds. However, the mock high explosive results in chemical waste that is shipped off-site for disposal and does not result in environmental impacts at LANL.

At the TA-16 Burn Ground, 5225 pounds of high explosives-contaminated materials were flashed, and 7514 pounds of high explosives and 3080 pounds of oil/solvent were open air burned. The HEWTF processed 95,778 gallons of high explosives-contaminated water. Again, these levels were well below those projected by the ROD. Three outfalls from High Explosives Processing remain on the NPDES permit: 03A130, 05A055 (the HEWTF), and 05A097.



Drill press used for machining high explosives

2.9.3 Operations Data for High Explosives Processing

The details of operations data are provided in Table 2.9.3-1. NPDES discharge volume was 118,000 gallons, compared to a projection of 12 million gallons. Waste quantities were similar to projections made by the ROD. Chemical waste volumes were slightly above projections; however, since chemical wastes are shipped off-site for disposal, this is not significant.

Table 2.9.3-1. High Explosives Processing (TA-08, TA-09, TA-11, TA-16, TA-22, TA-28, and TA-37)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
Uranium-238	Ci/yr	9.96E-7	[a]
Uranium-235	Ci/yr	1.89E-8	[a]
Uranium-234	Ci/yr	3.71E-7	[a]
NPDES Discharge: [b]			
Number of outfalls		22	3
Total Discharges	MGY	12.4	0.118
03A130 (TA-11) [c]	MGY	0.04	0.022
05A055 (TA-16)	MGY	0.13	0.096
05A097 (TA-11)	MGY	0.01	No discharge
Wastes:			
Chemical	kg/yr	13,000	13,329
LLW	m^3/yr	16	8.3
MLLW	m^3/yr	0.2	0
TRU/Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	335	96 [d]

[a] No stacks require monitoring; all non-point sources are measured using ambient monitoring.

[b] Outfalls eliminated before 1999: 02A007 (TA-16), 04A070 (TA-16), 04A083 (TA-16), 04A092 (TA-16), 04A115 (TA-8), 04A157 (TA-16), 05A053 (TA-16), 05A056 (TA-16), 05A066 (TA-9), 05A067 (TA-9), 05A068 (TA-9), 05A069 (TA-11), 05A071 (TA-16), 05A072 (TA-16), 05A096 (TA-11), 06A073 (TA-16), 06A074 (TA-8), and 06A075 (TA-8).

[c] This outfall discharged only one quarter during calendar year 1999.

[d] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (full-time and part-time regular). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.10 High Explosives Testing (TA-14, TA-15, TA-36, TA-39, TA-40)

The High Explosives Testing Key Facility is located in all or parts of five TAs, comprises about one-third of the land area occupied by LANL, and has 13 associated firing sites. All firing sites are in remote locations and/or within canyons. Major buildings are located at TA-15 and include the DARHT facility (Building TA-15-312), PHERMEX (TA-15-184), and the TA-15-306 firing site supporting the Ector Multidiagnostic Hydrodynamic Test Facility. Building types consist of preparation and assembly facilities, bunkers, analytical laboratories, explosives storage magazines, and offices. Activities consist primarily of testing high explosives components for nuclear weapons and for Science-Based Stockpile Stewardship Program tests and experiments. This Key Facility has no Category 2 or Category 3 nuclear buildings and no Moderate Hazard nonnuclear facilities.

2.10.1 Construction and Modifications at High Explosives Testing

Construction of DARHT, the only high explosive testing facility projected for construction or modification by the ROD, continued. This facility was evaluated in a separate environmental impact statement (DOE 1995). Installation and component testing of the accelerator and its associated control and diagnostics systems began in 1999.

The Applied Research Optics Electronics Laboratory (TA-15-494) was also under construction in 1999. This is a new office and laboratory building with an adjacent parking lot to consolidate and upgrade existing computer operations at TA-15 and to provide space for visiting scientists. This project has a NEPA categorical exclusion (LANL 1998c).

In addition, outfall 06A106 located at TA-36 was eliminated from the NPDES permit during 1999.

2.10.2 Operations at High Explosives Testing

The ROD identified seven capabilities for this Key Facility. None of these have been deleted, and no new capabilities have been introduced. Levels of research were below those predicted by the ROD and, for some capabilities, below research levels of prior years. Table 2.10.2-1 identifies the operational capabilities discussed in the SWEIS and presents 1999 operational data for comparative purposes. The total amount of depleted uranium expended during testing (all capabilities) is an indicator of overall activity levels at this Key Facility. A total of 67 kilograms were expended in 1999, compared to approximately 3900 kilograms projected by the ROD.

Table 2.10.2-1. High Explosives Testing (TA-14, TA-15, TA-36, TA-39, and TA-40)/Comparison of Operations

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
Hydrodynamic Tests	Conduct up to 100 hydrodynamic tests/yr. Develop containment technology. Conduct baseline and code development tests of weapons configuration. Depleted uranium use of 6900 lb/yr (over all activities).	Hydrodynamic tests were conducted in 1999 at a level far below those projected in the SWEIS
Dynamic Experiments	Conduct dynamic experiments to study properties and enhance understanding of the basic physics of state and motion for materials used in nuclear weapons including some experiments with SNM.	Dynamic experiments were conducted at a level far below those projected in the SWEIS
Explosives Research and Testing	Conduct high explosives tests to characterize explosive materials.	Explosives research and testing were conducted at a level far below those projected in the SWEIS
Munitions Experiments	Continued support of Department of Defense in conventional munitions. Conduct experiments with projectiles and study other effects on munitions.	Munitions experiments were conducted at a level far below those projected in the SWEIS

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
High-Explosives Pulsed-Power Experiments	Conduct experiments and development tests.	Experiments were conducted at a level far below those projected in the SWEIS
Calibration, Development, and Maintenance Testing	Conduct tests to provide calibration data, instrumentation development, and maintenance of image processing capability.	Calibration, development, and maintenance testing were conducted at a level far below those projected in the SWEIS
Other Explosives Testing	Develop advanced high explosives or weapons evaluation techniques.	Other explosives testing were conducted at a level far below those projected in the SWEIS

[a] Includes completion of construction for the DARHT facility and its operation.

2.10.3 Operations Data for High Explosives Testing

Much staff effort for high explosives processing and testing in 1999 was directed to the development and construction of DARHT. This resulted in a significant decrease in high explosives testing and production operations from historical levels. As a result, and as presented in Table 2.10.3-1, operations data indicate that materials used and the effects of research during 1999 were considerably less than projections made by the ROD. For example, only 1015 kilograms of chemical waste were generated in 1999 compared to a projected 35,300 kilograms per year. Only 0.01 cubic meters of LLW was generated compared to the projection of 940 cubic meters. In addition, no other radioactive wastes (MLLW, TRU wastes, or mixed TRU wastes) were generated in 1999.

Table 2.10.3-1. High Explosives Testing (TA-14, TA-15, TA-36, TA-39, and TA-40) Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
Depleted Uranium	Ci/yr	1.5E-1 [a]	[b]
Chemical Usage: [c]			
Aluminum [d]	kg/yr	45,450	688
Beryllium	kg/yr	90	0.5
Copper [d]	kg/yr	45,630	41
Depleted Uranium	kg/yr	3930	67
Lead	kg/yr	240	0.5
Tantalum	kg/yr	300	0.2
Tungsten	kg/yr	300	0
NPDES Discharge:			
Number of outfalls [e]	----	14	2
Total Discharges	MGY	3.6	14.23
03A028 (TA-15) [f]	MGY	2.2	2.81
03A185 (TA-15) [g]	MGY	0.73	11.42
Wastes:			
Chemical	kg/yr	35,300	1015
LLW	m^3/yr	940	0.01
MLLW	m^3/yr	0.9	0
TRU/Mixed TRU [h]	m^3/yr	0.2	0
Number of Workers	FTEs	619	227[i]

[a] The isotopic composition of depleted uranium is approximately 99.7% uranium-238, approximately 0.3% uranium-235, and approximately 0.002% uranium-234. Because there are no historic measurements of emissions from these sites, projections are based on estimated release fractions of the materials used in tests.

(Continued)

[b] No stacks require monitoring; all non-point sources are measured using ambient monitoring. During 1999, a total of 67 kg of depleted uranium was expended during these activities.

[c] Usage listed for the SWEIS ROD includes projections for expanded operations at DARHT as well as the other TA-15 firing sites (the highest foreseeable level of such activities that could be supported by the LANL infrastructure). No proposals are currently before DOE to exceed the material expenditures at DARHT that are evaluated in the DARHT Environmental Impact Statement (DOE 1995).

[d] The quantities of copper and aluminum involved in these tests are used primarily in the construction of support structures. These structures are not expended in the explosive tests, and thus, do not contribute to air emissions.

[e] Outfalls eliminated before 1999: 04A101 (TA-40), 04A139 (TA-15), 04A141 (TA-39), 04A143 (TA-15), 04A156 (TA-39), 06A080 (TA-40), 06A081 (TA-40), 06A082 (TA-40), 06A099 (TA-40), and 06A123 (TA-15).

[f] This outfall discharged during three quarters of calendar year 1999. The annual quantity of discharge was calculated by using the average daily flow and multiplying by 365 days in the year; this results in an overestimate of volume.

[g] This outfall discharged during all four quarters of calendar year 1999. The annual quantity of discharge was calculated by using the average daily flow and multiplying by 365 days in the year; this results in an overestimate of volume.

[h] TRU waste (steel) will be generated as a result of DARHT's Phased Containment Option (see DARHT Environmental Impact Statement [DOE 1995]).

[i] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (full-time and part-time regular). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.11 Los Alamos Neutron Science Center (TA-53)

The LANSCE Key Facility lies entirely within TA-53. The facility has more than 400 buildings, including one of the largest at LANL. Building 53-03 houses the linac. Activities consist of neutron science research, the development of accelerators and diagnostic instruments, and the production of medical radioisotopes. The majority of the LANSCE Key Facility is composed of the 800-MeV linac, a Proton Storage Ring, and three experimental areas: the Manuel Lujan Neutron Scattering Center, the Weapons Neutron Research (WNR) facility, and Experimental Areas A/B/C. Experimental Area C is the location of proton radiography experiments for the Stockpile Stewardship Program. Experimental Area A, formerly used for materials irradiation experiments and isotope production, is currently inactive, and a new isotope production facility will be constructed at Experimental Area A in the near future. Construction of a second accelerator, the Low-Energy Demonstration Accelerator (LEDA), began in 1997. LEDA is currently in the commissioning phase.

This Key Facility has two Category 3 nuclear activities, experiments using neutron scattering by actinides in Experimental Areas ER-1 and ER-2 (Buildings 53-07 and 53-30) and the 1L neutron production target (Building 53-07). There are no Category 2 nuclear facilities and no Moderate Hazard nonnuclear facilities at TA-53.

2.11.1 Construction and Modifications at LANSCE

The ROD projected significant facility changes and expansion to occur at LANSCE by December 2005. Table 2.11.1-1 below indicates that one project has been completed and that two have been started.

Table 2.11.1-1. Status of Projected Facility Changes at LANSCE

DESCRIPTION	SWEIS REF.	COMPLETED?
Closure of two former sanitary lagoons	2-88-R	Started [a]
LEDA to become operational in late 1998	2-89-R	Yes - 1999 [b]
Short-Pulse Spallation Source enhancements	2-90-L	Started [c]
One-MW target/blanket	2-91-L	No
New 100-MeV Isotope Production Facility	2-92-L	No [d]
Long-Pulse Spallation Source (LPSS), including decontamination and renovation of Area A	3-25-L	No
Dynamic Experiment Lab	3-25-R	No [e]
Los Alamos International Facility for Transmutation (LIFT)	3-25-R	No
Exotic Isotope Production Facility	3-27-L	No
Decontamination and renovation of Area A-East	3-27-L	No

[a] Remediation started in 1999.

[b] LEDA started high-power conditioning of the radio-frequency quadrupole power supply in November 1998. It has been designed for a maximum energy of 12 MeV, not the 40 MeV projected by the ROD. The first trickle of proton beam was produced in March 1999. Maximum power was achieved in September 1999.

(Continued)

[c] Part of the Short-Pulse Spallation Source upgrades have been performed. Upon completion, the project will upgrade the Proton Storage Ring to 200 microamperes and 30 hertz (vs. 70 microamperes and 20 hertz in 1995); will increase the Lujan spallation target power to 160 KW (vs. 55 KW in 1995); and will add five neutron-scattering instruments. Through the end of 1998, the first phase of the Proton Storage Ring upgrade had been completed. Installation of new instruments began in 1999. The complete upgrade is expected in 2002.
[d] Preparations began in the spring of 1999 for construction of the new 100-MeV Isotope Production Facility. Construction started in 2000.
[e] The Stockpile Stewardship Program is currently using Experimental Area C, Building 53-03P, for proton radiography, and the Blue Room, in Building 53-07 for neutron resonance spectroscopy. The concept of combining these experiments in a new Dynamic Experiment Laboratory has not yet materialized.

In addition to these projected construction activities, a new RLW treatment facility was constructed during 1999 and began treating water in December 1999. RLW comes primarily from floor drains and accelerator and magnet cooling water. Water flows by gravity into lift stations constructed adjacent to Experimental Area A (Building 53-03M) and the Lujan Center (Building 53-07). The RLW is pumped from the lift stations through double-walled piping to one of three 30,000-gallon horizontal fiber glass tanks located in new Building 53-945 at the east end of TA-53. The tanks are sized to allow decay of radioisotopes generated by the LANSCE accelerator beam, most of which have short half-lives. After aging, the RLW is pumped to one (the western) of two evaporative basins. Each of the basins is above ground, 75 feet by 75 feet by 3 feet in dimension, with a capacity to hold 125,000 gallons of water. Basins are concrete, have a nonpermeable liner, and are instrumented to detect leaks. In the event of extremely high RLW generation rates, the west basin would overflow to the east basin. The basins are sized, however, such that the east basin is not likely to ever be used.

2.11.2 Operations at LANSCE

The SWEIS identified seven capabilities for the LANSCE Key Facility. No new capabilities have been added, and none have been deleted. LANSCE operated the Lujan Center and the WNR facility in mid-January 1999 through early February 1999; then went into stand-down. WNR came back on-line in mid-summer and ran through the end of the year, while the Lujan Center stayed off-line for the remainder of the year.

The primary indicator of activity for this facility is production of the 800-MeV LANSCE proton beam. In 1999, H^+ beam was not produced. H^- beam was delivered as follows:

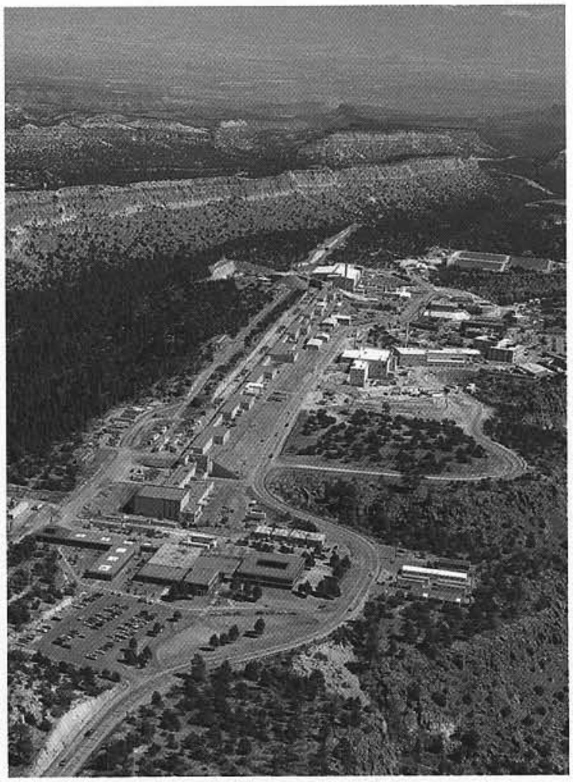
(a) to the Lujan Center for 239 hours at an average current of 93 microamperes,

(b) to WNR Target 2 for 587 hours in a "pulse on demand" mode of operation, with average current too small to measure,

(c) to WNR Target 4 for 1993 hours at an average current of five microamperes, and

(d) through Line X to Lines B and C in a "pulse on demand" mode of operation, with average current too small to measure.

These production figures are all less than the 6400 hours at 1250 microamperes projected by the ROD. In turn, the reduced beam time meant that those activities reliant upon the 800-MeV beam also were conducted at lower levels. These activities include experiments using neutrons and weapons-related experiments using either protons or neutrons. In addition, there were no experiments conducted for transmutation of wastes. There was also no production of medical isotopes during 1999, although plans for the new Isotope Production Facility neared completion by the end of the year. Table 2.11.2-1 provides details.



Aerial view of TA-53

Table 2.11.2-1. LANSCE/Comparison of Operations

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
Accelerator Beam Delivery, Maintenance, and Development	Deliver LANSCE linac beam to Areas A, B, C, WNR facility, Manuel Lujan Center, Dynamic Experiment Facility, and new isotope production facility for 10 months/yr (6400 hrs). Positive ion current 1250 microampere and negative ion current of 200 microampere.	There was no positive ion beam in 1999. Negative ion beam delivered, at maximum current of 93 microamperes, to Lines B and C (505 hours), WNR facility (1993 hours), and Lujan Center (239 hours). Area A did not receive beam.
	Reconfigure beam delivery and support equipment to support new facilities, upgrades, and experiments.[a]	No major upgrades to the beam delivery complex.
	Commission/operate/maintain LEDA for 10 to 15 yrs; operate up to approximately 6600 hrs/yr.	Full power (100 milliamps and 6.7 MeV) achieved in September 1999.
Experimental Area Support	Full-time remote handling and radioactive waste disposal capability required during Area A interior modifications and Area A-East renovation.	Full-time capability maintained. (Note: Modifications and renovations were not undertaken, however.)
	Support of experiments, facility upgrades, and modifications.	Support activities conducted, per projections of the SWEIS ROD.
	Increased power demand for LANSCE linac and LEDA radio-frequency operation.	A 700-MHz klystron was developed for use with LEDA.
Neutron Research and Technology[b]	Conduct 1000 to 2000 experiments/yr using Manuel Lujan Center, WNR facility, and LPSS. Establish LPSS in Area A (requires modification).	A far fewer number of experiments, since the Lujan Center was idle from February into July. LPSS was not constructed.
	Construct Dynamic Experiment Laboratory adjacent to WNR Facility. Support contained weapons-related experiments: - With small quantities of actinides, high explosives, and sources (up to approximately 80/yr) - With nonhazardous materials and small quantities of high explosives (up to approximately 200/yr) - With up to 4.5 kg high explosives and/or depleted uranium (up to approximately 60/yr) - Shock wave experiments involving small amounts, up to (nominally) 50 grams plutonium.	The Dynamic Experiment Laboratory was not constructed, but weapons-related experiments were conducted: - None with actinides - Some with nonhazardous materials and high explosives - Some with high explosives, but none with depleted uranium. - No shock wave experiments.
	Provide support for static stockpile surveillance technology research and development.	Support was not provided for surveillance research and development.

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
Accelerator Transmutation of Wastes (ATW)[c] (Continued)	Conduct lead target tests for two yrs at Area A beam stop.	No tests.
	Implement LIFT (Establish one-megawatt, then five-megawatt ATW target/blanket experiment areas) adjacent to Area A.	Neither the target/blanket experiment nor LIFT were constructed.
	Conduct five-megawatt experiments for 10 months/yr for four yrs using about three kg of actinides.	No experiments.
Subatomic Physics Research	Conduct 5 to 10 physics experiments/yr at Manuel Lujan Center, WNR facility, and LPSS.	UCN ran on 5 occasions in the Blue Room.
	Conduct proton radiography experiments, including contained experiments with high explosives.	Experiments involving contained high explosives were conducted on 10 days in 1999
Medical Isotope Production	Irradiate up to approximately 50 targets/yr for medical isotope production.	No production in 1999.
	Added production of exotic, neutron-rich, and neutron-deficient isotopes (requires modification of an existing target area).	No production in 1999.
High-Power Microwaves and Advanced Accelerators	Conduct research and development in these areas, including microwave chemistry research for industrial and environmental applications.	Research and development was conducted.

[a] Includes the completion of proton and neutron radiography facilities, the LEDA, the isotope production facility relocation, the Short-Pulsed Spallation Source enhancement, and the LPSS.

[b] Numbers of neutron experiments represent plausible levels of activity. Bounding conbditions for the consequences of operations are primarily determined by i) length and power of beam operation and ii) maintenance and construction activities.

[c] Formerly, Accelerator-Driven transmutation Technology. H(+) = proton (positively charged hydrogen ion), H(-) = negatively charged hydrogen ion

2.11.3 Operations Data for LANSCE

Since levels of operations were less than those projected by the ROD (LANSCE had a safety stand-down for part of the year), operations data were also less than projected. Radioactive air emissions are a key parameter since LANSCE emissions have historically accounted for more than 95% of the total LANL off-site dose. Emissions in 1999, however, totaled only 300 curies, about 15% of total LANL radioactive air emissions. The 1999 total was also significantly less than projections of the ROD (4185 curies). These small emissions can be attributed to non-use of the Area A beam stop.

Waste generation, NPDES discharge volumes, and utility consumption were also all below projected quantities. Table 2.11.3-1 provides details.

A new load frame will allow scientists to measure the effect of compressive or tensile stresses on the structure of materials. Tests of this sort on engineering components allow better predictions of failure modes and lifetimes during actual operation

Table 2.11.3-1. LANSCE/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
Argon-41	Ci/yr	7.44E+1	1.4E+1
Bromine-76	Ci/yr	Not projected [a]	2.3E-4
Bromine-82	Ci/yr	Not projected [a]	6.3E-4
Carbon-10	Ci/yr	2.65E+0	4.2E-2
Carbon-11	Ci/yr	2.96E+3	2.8E2
Cobalt-60	Ci/yr	Not projected [a]	4.0E-6
Mercury-197	Ci/yr	Not projected [a]	1.6E-3
Nitrogen-13	Ci/yr	5.35E+2	1.6E+0
Nitrogen-16	Ci/yr	2.85E-2	1.50E-2
Oxygen-14	Ci/yr	6.61E+0	1.0E-1
Oxygen-15	Ci/yr	6.06E+2	1.9E+1
Tritium as Water	Ci/yr	Not projected [a]	2.3E+0
LEDA Projections (8-yr average):			
Oxygen-19	Ci/yr	2.16E-3	Not measured [b]
Sulfur-37	Ci/yr	1.81E-3	Not measured [b]
Chlorine-39	Ci/yr	4.70E-4	Not measured [b]
Chlorine-40	Ci/yr	2.19E-3	Not measured [b]
Krypton-83m	Ci/yr	2.21E-3	Not measured [b]
Others	Ci/yr	1.11E-3	Not measured [b]
NPDES Discharge: [c]			
Total Discharges	MGY	81.8	37.2
03A047	MGY	7.1	3.4
03A048	MGY	23.4	19.7
03A049	MGY	11.3	10.8
03A113	MGY	39.8	3.3
Wastes:			
Chemical	kg/yr	16,600	11,060
LLW	m^3/yr	1085 [d]	70
MLLW	m^3/yr	1	0.5
TRU/Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	856	560 [e]

[a] The radionuclide was not projected in the ROD because it was either dosimetrically insignificant or not isotopically identified.
[b] Potential emissions from LEDA were sufficiently small that measurement systems were not necessary to meet regulatory or facility requirements.
[c] Outfalls eliminated before 1999: 03A125 (TA-53), 03A145 (TA-53), and 03A146 (TA-53).
[d] LLW volumes include decommissioning and renovation of Experimental Area A (Building 53-03M).
[e] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.12 Health Research Laboratory (TA-43)

The HRL Key Facility includes the main HRL (Building 43-01) and 13 support buildings also located at TA-48. Research focuses on the study of intact cells, cellular components (RNA, DNA, and proteins), and cells and cellular systems (repair, growth, and response to stressors). There are several Low Hazard nonnuclear buildings within this Key Facility, but no Moderate Hazard nonnuclear facilities and no nuclear facilities.

2.12.1 Construction and Modifications at HRL

In calendar year 1999, HRL eliminated the entire animal colony. Outfall 03A040 was eliminated from the NPDES permit on January 11, 1999. The discharge from this outfall was redirected to the Los Alamos County sewage treatment plant in Bayo Canyon in 1998.

Research activities involving radioactive material were moved into the space previously occupied by the animal colony. The volume of radioactive work at HRL has significantly diminished from previous years. This is attributed to technological advances and new methods, such as the use of laser-based instrumentation and chemiluminescense, which do not require the use of radioactive materials. For instance, DNA sequencing predominantly uses laser analysis of fluorescent dyes hooked onto DNA bases instead of radioactive techniques.

Currently, HRL has Biosafety Level 1 and Level 2 work, which will include in the next one to two years limited work with potentially infectious microbes and low-toxicity biotoxins. These activities are regulated by the Centers for Disease Control, LANL's Institutional Biosafety Committee, and the Biosafety Officer.

2.12.2 Operations at HRL

The SWEIS identified eight capabilities for the HRL Key Facility. In 1998, neurobiology research was moved to another facility (the Physics Building at TA-03). In 1999, as part of the establishment of the Bioscience Division, three of the capabilities were renamed, two were combined at a higher level, and one was further defined into two operations as shown below:

- Genomic Studies was renamed Genomics
- Environmental Effects was renamed Environmental Biology
- Structural Cell Biology was renamed Structural Biology
- Cell Biology and DNA Damage and Repair were combined to form Molecular Cell Biology
- Cytometry was further defined as operations in Measurement Science and operations in Diagnostics and Medical Applications

The Bioscience Division developed three other operations in 1999 (Biologically Inspired Materials and Chemistry, Computational Biology, and Molecular Synthesis). These activities were just started and will be covered in the 2000 Yearbook. Since the development of information for the SWEIS, Bioscience Division has grown beyond its single facility, HRL. Therefore, the 2000 Yearbook will handle Bioscience Division similar to other Key Facilities where its various parts are in multiple buildings or TAs.

Table 2.12.2-1 compares 1999 operations to those predicted by the ROD. The table includes the number of FTEs per capability to measure activity levels to the ROD. These FTEs are not measured the same as the index shown in Table 2.12.3-1 and these numbers cannot be directly compared. Three of the existing capabilities currently have activity levels greater than those projected by the ROD, and the other four are conducted at levels equal to or lower than those projected by the ROD.

Table 2.12.2-1. Health Research Laboratory (TA-43)/Comparison of Operations

CAPABILITIES	SWEIS ROD	1999 OPERATIONS
Genomic Studies – Renamed Genomics in 1999	Conduct research utilizing molecular and biochemical techniques to analyze the genes of animals, particularly humans. Develop strategies at current levels to analyze the nucleotide sequence of individual genes, especially those associated with genetic disorders, and to map genes and/or genetic diseases to locations on individual chromosomes. Part of this work is to map each nucleotide, in sequence, of each in all 46 chromosomes. (50 FTEs) [a]	In 1999, 61 FTEs were associated with Genomics. This exceeds the SWEIS ROD of 50 FTEs and is an increase of 56% over 1995 levels.

CAPABILITIES	SWEIS ROD	1999 OPERATIONS
Cell Biology and DNA Damage and Repair – Combined into Molecular Cell Biology in 1999	Conduct research at current levels utilizing whole cells and cellular systems, both in-vivo and in-vitro, to investigate the effects of natural and catastrophic cellular events like response to aging, harmful chemical and physical agents, and cancer. (35 FTEs) Conduct research using isolated cells to investigate DNA repair mechanisms. (35 FTEs)	In 1999, 30 FTEs were associated with Molecular Cell Biology. This is less than half of the 70 FTEs projected in the ROD. In 1995, a total of 50 FTEs were associated with Cell Biology and DNA Damage and Repair.
Cytometry	Conduct research utilizing laser imaging systems to analyze the structures and functions of subcellular systems. (40 FTEs)	In 1999, 25 FTEs were associated with Measurement Science and Diagnostics a specialized application of cytometry, microscopy, spectroscopy, and other techniques for molecular detection and diagnosis. In 1999, 10 FTEs were associated with Medical Applications utilizing laser based molecular analysis techniques to develop tools for clinical diagnosis of disease. The 35 total FTEs in Cytometry is below the 40 FTEs projected in the ROD.
Environmental Effects – Renamed Environmental Biology in 1999.	Research identifies specific changes that occur in DNA and proteins in certain microorganisms after events in the environment. (25 FTEs)	In 1999, 25 FTEs were associated with Environmental Biology. This equals the SWEIS ROD and is an increase of 25% over 1995 levels.
Structural Cell Biology – Renamed Structural Biology in 1999.	Conduct research utilizing chemical and crystallographic techniques to isolate and characterize the properties and three-dimensional shapes of DNA and protein molecules. (15 FTEs)	In 1999, there were 60 FTEs associated with this capability. This exceeds the SWEIS ROD of 15 FTEs and is an increase of 500% over 1995 levels.
Neurobiology	Conduct research using magnetic fields produced in active areas of the brain to map human brain locations associated with certain sensory and cognitive functions. Instrumentation in sensitive magnetic detection devices. (9 FTEs)	Not applicable. Relocated to another LANL facility in 1998 (the Physics Building in TA-03).
In-Vivo Monitoring	Perform 3000 whole-body scans per year as a service to the LANL personnel monitoring program, which supports operations with radioactive materials conducted elsewhere at LANL. (5 FTEs)	Conducted 1250 whole-body scans and 1733 other counts (detector studies, quality assurance measurements, etc.). In 1999, there were 3 FTEs associated with this capability.

[a] FTEs: full-time-equivalent scientists, researchers, and other staff supporting a particular research capability.

2.12.3 Operations Data for HRL

Research levels have remained relatively constant from 1998 to 1999. However, the research focus is changing as seen by the changes in capabilities and also the advances in technology.

Table 2.12.3-1 presents the operations data as measured by radioactive air emissions, NPDES discharges, generated waste volumes, and number of workers. The generation of most waste (chemical, biological, and MLLW) has decreased from historical levels and was smaller than projections.

Table 2.12.3-1. Health Research Laboratory (TA-43)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions	Ci/yr	Not estimated	Not measured [a]
NPDES Discharge: [b]			
03A040	MGY	2.5 [c]	Eliminated [d]
Wastes:			
Chemical	kg/yr	13,000	1691
Biomedical Waste	kg/yr	280 [e]	0
LLW	m^3/yr	34	14
MLLW	m^3/yr	3.4	0.01
TRU/Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	250	98 [f]

[a] Potential emissions during the period were sufficiently small that measurement systems were not necessary to meet regulatory or facility requirements.
[b] Outfall 03A040 consisted of one process outfall and nine storm drains.
[c] Storm water only.
[d] Outfall was eliminated 1/11/99.
[e] Animal colony and the associated waste. The animal colony was eliminated in 1999.
[f] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD or FTE numbers by capability (see Section 3.6, Socioeconomic) is not appropriate.

HRL (lower left) adjacent to the Los Alamos Medical Center

3-D Multicellular Spheroid Model, mimics the microenvironment surrounding cells in a solid tumor. Shown here is a technician replenishing the culture medium for the spheroid cells.

2.13 Radiochemistry Facility (TA-48)

The Radiochemistry Key Facility includes all of TA-48 (116 acres). This facility fills three roles—research, production of medical radioisotopes, and support services to other LANL organizations, primarily through radiological and chemical analysis of samples. TA-48 contains five major research buildings: the Radiochemistry Laboratory (Building 48-01), the Isotope Separator Facility (48-08), the Diagnostic Instrumentation and Development Building (48-28), the Advanced Radiochemical Diagnostics Building (48-45), and the Analytical Facility (48-107). The Radiochemistry Laboratory (Building 48-01) is a candidate Category 3 nuclear facility.

2.13.1 Construction and Modifications at the Radiochemistry Facility

The ROD projected no facility changes through 2005. Consistent with this projection, only minor maintenance activities occurred during 1999. For example, there were some office modifications, a chiller was replaced, and some basement ventilation was removed.

In addition, the only remaining NPDES outfall, 03A045, was eliminated from the Laboratory's NPDES permit on December 6, 1999. Industrial sources that had previously discharged to this outfall (a cooling tower and basement floor drains) have been eliminated or redirected. The cooling tower was removed from service in 1996 and the floor drains were either plugged or piped to the Laboratory's sanitary wastewater system (SWS). The elimination of outfalls was evaluated through an environmental assessment (DOE 1996a) and subsequent Finding of No Significant Impact.

2.13.2 Operations at the Radiochemistry Facility

The SWEIS identified ten capabilities for the Radiochemistry Key Facility. No new capabilities have been added, and none have been deleted. The primary measure of activity for this Key Facility is the number of personnel conducting research. In 1999, approximately 170 chemists and scientists were employed, far below the 250 projected by the ROD. As seen in Table 2.13.2-1, only thee of the ten capabilities were active at levels projected by the ROD: radionuclide transport studies, actinide and TRU chemistry, and sample counting. The number of FTEs shown by capability is not calculated the same as the index shown in Table 2.13.3-1, and these numbers cannot be directly compared.

Table 2.13.2-1. Radiochemistry Facility (TA-48)/Comparison of Operations

CAPABILITY	SWEIS ROD [a]	1999 OPERATIONS [a]
Radionuclide Transport Studies	Actinide transport, sorption, and bacterial interaction studies. Development of models for evolution of groundwater. Assessment of performance or risk of release for radionuclide sources at proposed waste disposal sites. Increased level of operations, approximately twice the current (1995) levels. (28 to 34 FTEs)[b]	Increased level of operations, approximately twice 1995 levels. (35 FTEs)
Environmental Remediation Support	Background contamination characterization pilot studies. Performance assessments, soil remediation research and development, and field support. Increased level of operations, approximately twice the current (1995) levels. (34 FTEs)	Decreased level of operations, approximately half 1995 levels. (10 FTEs)
Ultra-Low-Level Measurements	Isotope separation and mass spectrometry. Increased level of operations, approximately twice the current (1995) levels. (30 FTEs)	Level of operations was approximately the same as in 1995. (14 FTEs)

CAPABILITY	SWEIS ROD [a]	1999 OPERATIONS [a]
Nuclear/Radiochemistry	Radiochemical operations involving quantities of alpha-, beta-, and gamma-emitting radionuclides for non-weapons and weapons work. Slight increase over current (1995) levels of operation. (44 FTEs)	Slightly decreased level of operations, but approximately the same as 1995 levels. (35 FTEs)
Isotope Production	Target preparation. High-level beta/gamma chemistry and target processing to recover isotopes for medical and industrial application. Increased level of operations, approximately twice the current (1995) levels. (15 FTEs)	Slightly increased level of operations, approximately the same as in 1995. (11 FTEs)
Actinide/TRU Chemistry	Radiochemical operations involving significant quantities of alpha-emitting radionuclides. Increased level of operations, approximately twice the current (1995) levels. (12 FTEs)	Increased operations, approximately twice 1995 levels. (13 FTEs)
Data Analysis	Re-examination of archive data and measurement of nuclear process parameters of interest to weapons radiochemists. Increased level of operations, approximately twice the current (1995) levels. (10 FTEs)	Slight increase from 1995 to six FTEs, but less than projected by the SWEIS ROD.
Inorganic Chemistry	Synthesis, catalysis, actinide chemistry: - Chemical synthesis of new organo-metallic complexes - Structural and reactivity analysis, organic product analysis, and reactivity and mechanistic studies - Synthesis of new ligands for radiopharmaceuticals Environmental technology development: - Ligand design and synthesis for selective extraction of metals - Soil washing - Membrane separator development - Ultrafiltration Increased level of operations, approximately 50% more than the current (1995) levels. (49 FTEs—total for both activities)	Same level of activity as in 1995 (35 FTEs), but below projections of the SWEIS ROD.
Structural Analysis	Synthesis and structural analysis of actinide complexes at current levels. X-ray diffraction analysis of powders and single crystals at current levels. Increased level of operations, approximately twice the current (1995) levels. (22 FTEs)	Decreased level of operations from 1995, and about 1/3 of those projected by the SWEIS ROD. (8 FTEs)
Sample Counting	Measurement of the quantity of radioactivity in samples using alpha-, beta-, and gamma-ray counting systems. Level of operations, similar to the current (1995) levels. (5 FTEs)	Approximately the same as SWEIS ROD. (6 FTEs)

[a] Projections in the ROD were made as increments to the current level of operations as expressed by the "No Action" alternative for the current (1995) year. Thus, 1999 operations must use increments from 1995 operational levels for comparison purposes.
[b] FTEs: full-time-equivalent scientists, researchers, and other staff supporting a particular research capability.

2.13.3 Operations Data for the Radiochemistry Facility

The overall level of activity at the Radiochemistry Facility was below that projected by the ROD. Three of the ten capabilities at this Key Facility were conducted at levels projected by the ROD; the others were at or below activity levels of 1995. As a result, operations data were also below those projected by the ROD, as shown in Table 2.13.3-1.

Table 2.13.3-1. Radiochemistry Facility (TA-48)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
Mixed Fission Products	Ci/yr	1.4E-4	Not reported [a]
Plutonium-239	Ci/yr	1.1E-5	None detected [b]
Uranium-235	Ci/yr	4.4E-7	None detected [b]
Mixed Activation Products	Ci/yr	3.1E-6	Not reported [a]
Uranium-238	Ci/yr	Not projected [c]	6.0E-10
Arsenic-72	Ci/yr	1.1E-4	None detected [b]
Arsenic-73	Ci/yr	1.9E-4	1.8E-5
Arsenic-74	Ci/yr	4.0E-5	4.5E-5
Beryllium-7	Ci/yr	1.5E-5	None detected [b]
Bromine-77	Ci/yr	8.5E-4	1.2E-5
Germanium-68	Ci/yr	1.7E-5	1.7E-3
Gallium-68	Ci/yr	1.7E-5	1.7E-3
Rubidium-86	Ci/yr	2.8E-7	None detected [b]
Selenium-75	Ci/yr	3.4E-4	3.5E-4
Silicon-32	Ci/yr	Not projected [d]	5.1E-6
NPDES Discharge:[e]			
Total Discharges	MGY	4.1	No discharge
03A-045	MGY	0.87	Eliminated [f]
Wastes:			
Chemical	kg/yr	3300	1513
LLW	m^3/yr	270	40
MLLW	m^3/yr	3.8	0.6
TRI/Mixed TRU [g]	m^3/yr	0	0
Number of Workers	FTEs	248	128 [h]

[a] Emission categories of 'mixed fission products' and 'mixed activation products' are no longer used. Instead, where fission or activation products are measured, they are reported as specific radionuclides, e.g., Cs-137 or Co-60.
[b] Although stack sampling systems were in place to measure these emissions, any emissions were sufficiently small to be below the detection capabilities of the sampling systems.
[c] The radionuclide was not projected in the ROD because it was either dosimetrically insignificant or not isotopically identified.
[d] The Si-32 emissions were not expected. There was a slight process problem that resulted in these emissions. The dose from these emissions was not significant.
[e] Outfalls eliminated before 1999: 04A016 (TA-48), 04A131 (TA-48), 04A152 (TA-48), and 04A153 (TA-48).
[f] This outfall was eliminated from the NPDES permit on 12/6/99.
[g] TRU waste was projected to be returned to the generating facility.
[h] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.14 Radioactive Liquid Waste Treatment Facility (TA-50)

The RLWTF is located at TA-50 and consists of the treatment facility (Building 50-01), support buildings, and liquid and chemical storage tanks. The primary activity is the treatment of liquid wastes generated at other LANL facilities, but decontamination of equipment and waste items is also performed. There are four Category 3 nuclear structures at this Key Facility – the RLWTF itself (Building 50-01), the tank farm and pumping station (50-02), the acid and caustic solution tank farm (50-66), and a 100,000-gallon influent holding tank (50-90). There are no other nuclear facilities, and no Moderate Hazard nonnuclear buildings within this Key Facility. Five capabilities were identified in the SWEIS.

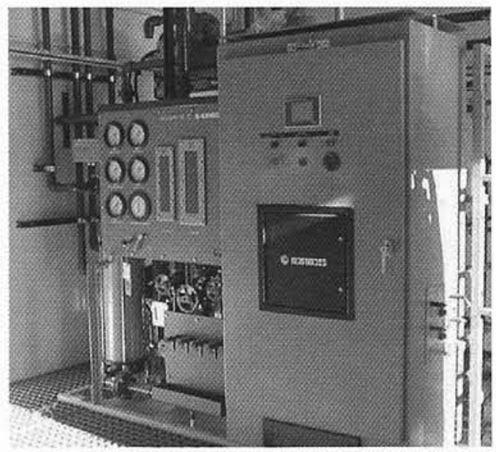
2.14.1 RLWTF Construction and Modifications

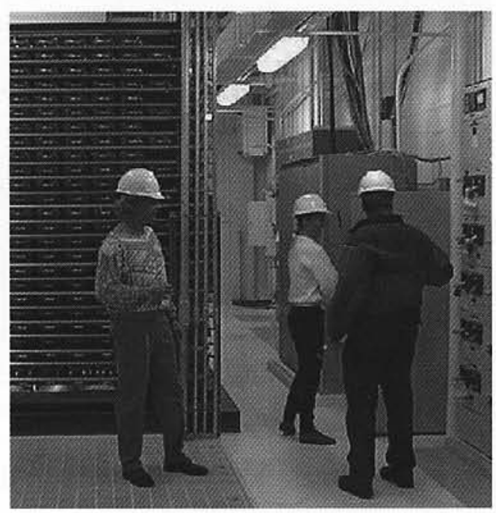
The new UF/RO (ultrafiltration and reverse osmosis) process was installed in 1998 and became operational March 22, 1999. Similarly, nitrate reduction equipment was installed in 1998 and became operational on March 15, 1999. These modifications contributed to improved effluent quality. There were zero violations of the new State of New Mexico discharge limit for nitrates (10 mg/L) from March through the end of 1999. And despite a longer break-in period for the UF/RO equipment, all discharges were below DOE's guidelines for radioactivity beginning December 10, 1999.

While enabling the RLWTF to meet all discharge limits and guidelines, the UF/RO equipment introduced significant process difficulties. In order to overcome the process difficulties, facility personnel installed an electrodialysis reversal unit and began construction of an evaporator in the autumn. Both units are designed to process the waste stream from the reverse osmosis unit. The SWEIS ROD projected neither of these facility modifications. They received NEPA review, however, through Categorical Exclusions (#7428, approved February 23, 1999, and #7737, approved October 29, 1999, respectively).

2.14.2 RLWTF Capabilities

The SWEIS identified five capabilities for the RLWTF Key Facility. No new capabilities were added in 1999, and none were deleted. The primary measurement of activity for this facility is the volume of RLW processed through the main treatment equipment. In 1999, this volume was 20 million liters of treated RLW discharged to Mortandad Canyon, which is less than the discharge volume of 35 million liters per year projected in the SWEIS ROD. As seen in Table 2.14.2-1, other operations at the RLWTF were also below levels projected by the ROD.





Top: Removal of ion exchange column to make room for new membrane treatment processes

Middle: View of the new tubular ultrafilter

Bottom: View of the new tubular ultrafilter and motor control center

Table 2.14.2-1. RLWTF (TA-50)/Comparison of Operations

CAPABILITY	SWEIS ROD [a]	1999 OPERATIONS
Waste Characterization, Packaging, Labeling	Support, certify, and audit generator characterization programs. Maintain waste acceptance criteria for radioactive liquid waste treatment facilities.	As projected. As projected.
Waste Transport, Receipt, and Acceptance	Collect RLW from generators and transport to TA-50.	As projected.
RLW Pretreatment	Pretreat 900,000 liters/yr of RLW at TA-21. Pretreat 80,000 liters/yr of RLW from TA-55 in Room 60. Solidify, characterize, and package 3 m^3/yr of TRU waste sludge in Room 60.	Pretreated 45,000 liters at TA-21. Pretreated less than 80,000 liters/yr of radioactive liquid waste from TA-55 in Room 60. Solidified 5 m^3 of TRU waste sludge in Room 60.
RLW Treatment	Install UF/RO equipment in 1997. Install equipment for nitrate reduction in 1999. Treat 35 million liters/yr of radioactive liquid waste. De-water, characterize, and package 10 m^3/yr of LLW sludge. Solidify, characterize, and package 32 m^3/yr of TRU waste sludge.	UF/RO equipment installed 1998, and operational in March 1999. Nitrate reduction equipment installed 1998; operational March 1999. Treated 20 million liters of RLW. De-watered 37 $m^3$of LLW sludge. No TRU waste sludge was solidified.
Decontamination Operations	Decontaminate LANL personnel respirators for reuse (approximately 700/month). Decontaminate air-proportional probes for reuse (approximately 300/month). Decontaminate vehicles and portable instruments for reuse (as required). Decontaminate precious metals for resale (acid bath). Decontaminate scrap metals for resale (sand blast). Decontaminate 200 m^3 of lead for reuse (grit blast).	Decontaminated 425 personnel respirators per month. Decontaminated 93 faces and 94 bodies per month (air-proportional probes). Decontaminated 26 drill bits, 12 augers, four collars, and six portable instruments per month. Decontaminated platinum from TRU waste to LLW. Decontaminated no scrap metals. Decontaminated 2.3 m^3 of lead.

[a] Includes installation of UF/RO and nitrate reduction processes in Building 50-01 and installation of above ground tanks for the collection of influent RLW.

2.14.3 Operations Data for the RLWTF

Although levels of operation were less than projected in the SWEIS, only some consequences were lower than projected. Radioactive air emissions continued to be negligible (less than one microcurie). NPDES discharge volume was 5.3 million gallons compared to a projected 9.3 million gallons, and chemical waste was one-tenth of projections (201 kilograms/year compared to 2200 kilograms/year). TRU/mixed TRU waste quantities were also less than projected (4.6 cubic meters per year compared to 30 cubic meters per year). However, LLW and MLLW exceeded projections. Table 2.14.3-1 provides details.

Table 2.14.3-1. RLWTF (TA-50)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
Americium-241	Ci/yr	Negligible	1.3E-7
Plutonium-238	Ci/yr	Negligible	3.4E-8
Plutonium-239	Ci/yr	Negligible	1.8E-8
Thorium-230	Ci/yr	Negligible	3.7E-8
Uranium-234	Ci/yr	Negligible	None detected [a]
NPDES Discharge:			
051	MGY	9.3	5.3
Wastes:			
Chemical	kg/yr	2200	201
LLW	m^3/yr	160	176
MLLW	m^3/yr	0	3.2
TRU/Mixed TRU	m^3/yr	30	4.6
TRU	m^3/yr	30	0
Mixed TRU	m^3/yr	0	4.6
Number of Workers	FTEs	110	62 [b]

[a] Although stack sampling systems were in place to measure these emissions, any emissions were sufficiently small to be below the detection capabilities of the sampling systems.

[b] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.15 Solid Radioactive and Chemical Waste Facilities (TA-50 and TA-54)

The Solid Radioactive and Chemical Waste Key Facility is located at TAs 50 and 54. Activities are all related to the management (packaging, characterization, receipt, transport, storage, and disposal) of radioactive and chemical wastes generated at other LANL facilities.

The Solid Radioactive and Chemical Waste Facilities have numerous nuclear facilities on site. According to the DOE "List of Los Alamos National Laboratory Nuclear Facilities," December 1998, there are eight Category 2 nuclear buildings: the Radioactive Materials Research Operations and Demonstration Facility (Building 50-37); the liquid waste tank (Structure 50-190) at the Waste Characterization, Reduction, and Repackaging Facility (WCRRF); and six fabric domes at TA-54 for the storage of retrieved TRU wastes (Domes 226, 229–232, and 375).

There are also six Category 3 nuclear buildings within this Key Facility: the Radioactive Assay and Nondestructive Test Facility (Building 54-38); WCRRF itself (Building 50-69); and four fabric domes for the storage of TRU wastes (Domes 54-048, -049, -153, and -283).

In addition, the LLW disposal cells, shafts, and trenches are listed in the December 1998 DOE list as a Category 2 "facility." There are no Moderate Hazard nonnuclear buildings within this Key Facility.

Several changes were made to the status of nuclear facility classifications, and several nuclear facilities were added to this Key Facility. However, these changes were not incorporated in the December 1998 DOE List of Los Alamos National Laboratory Nuclear Facilities and therefore are not reported here. Once the DOE list is updated, those changes will be reflected in the appropriate SWEIS Yearbook.

2.15.1 Construction and Modifications at the Solid Radioactive and Chemical Waste Facility

The construction of a new TRU waste storage dome (54-375) was completed in calendar year 1999. In addition, construction of the Decontamination and Volume Reduction Systems (DVRS) began in calendar year 1999. The DVRS is designed to segregate, decontaminate, and volume-reduce old TRU waste packages thereby resulting in efficient, WIPP-compliant TRU packages. As an added benefit, a major fraction of the historical waste packaging and secondary waste is anticipated to be LLW, and thus will not need to be shipped to WIPP for disposal. An environmental assessment was prepared (DOE 1999d) and a Finding of No Significant Impact was issued on June 25, 1999.

2.15.2 Operations at the Solid Radioactive and Chemical Waste Facility

The SWEIS identified eight capabilities for this Key Facility. No new capabilities have been added, and none have been deleted. The primary measurements of activity for this facility are the volumes of newly generated chemical, low-level, and TRU wastes to be managed and the volumes of legacy TRU waste and MLLW in storage. A comparison of calendar year 1999 to projections made by the ROD can be summarized as follows:

Chemical wastes: A total of 882 metric tons were shipped for off-site treatment and/or disposal, compared to an average quantity of 3250 metric tons per year projected by the ROD.

LLW: A total of 1320 cubic meters were placed into disposal cells and shafts at Area G, compared to an average volume of 12,230 cubic meters per year projected by the ROD. No new disposal cells were constructed, and disposal operations did not expand into either Zone 4 or Zone 6 at TA-54. Operations are not expected to expand for at least another three years.

MLLW: A total of 96 cubic meters (13 newly generated and 83 legacy) were shipped for off-site treatment and/or disposal, compared to an average volume of 632 cubic meters per year projected by the ROD. The ROD projected that the inventory of legacy mixed wastes would be reduced to zero by 2006.

TRU wastes: In calendar year 1999, 192 cubic meters of newly generated TRU wastes were added to storage. Additionally, 244 cubic meters have also been added to storage because of the Transuranic Waste Inspectable Storage Project (TWISP). In March of 1998, TWISP completed retrieving drums from Pad 1. The project started retrieving drums from Pad 4 in December 1998 and finished retrieval in December 1999. Retrieval of drums from Pad 2 is expected to start in calendar year 2000. In 1999, TWISP operations recovered 2195 cubic meters, and as of December 1999, a total of 4146 cubic meters had been recovered. The ROD projects that TWISP will retrieve all 4700 cubic meters from underground pads by December 2004.

Legacy TRU waste shipments to WIPP began on March 26, 1999. In calendar year 1999 there were 17 shipments of TRU waste to WIPP. The amount of material that was removed from LANL inventory was equivalent to 30 drums. However, because of the wattage of the material, the 30 drums were repackaged into 102 drums. Each of the 102 drums was then placed into a standard waste box. Each of the 17 shipments consisted of six standard waste boxes.

In summary, chemical and radioactive waste management activities were at levels below those projected by the ROD. These and other operational details appear in Table 2.15.2-1. The one anomaly that should be mentioned is the 4003 cubic meters of solid wastes disposed in pits at Area J. These administratively controlled wastes resulted from Environmental Restoration (ER) Project remedial activities at Material Disposal Area (MDA) P, and far exceeded the projections of 100 cubic meters per year. However, this material was nonhazardous wastes, soil, concrete rubble, and debris placed in MDA-J as fill in preparation of capping (1999 Annual Report Questionnaire for the Los Alamos National Laboratory, Technical Area 54, Area J Landfill).

Table 2.15.2-1. Solid Radioactive and Chemical Waste Facilities (TA-54 and TA-50) / Comparison of Operations

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
Waste Characterization, Packaging, and Labeling	Support, certify, and audit generator characterization programs. Maintain waste acceptance criteria for LANL waste management facilities. Characterize 760 m^3 of legacy MLLW. Characterize 9010 m^3 of legacy TRU waste. Verify characterization data at the Radioactive Assay and Nondestructive Test Facility for unopened containers of LLW and TRU waste. Maintain waste acceptance criteria for off-site treatment, storage, and disposal facilities. Overpack and bulk waste as required. Perform coring and visual inspection of a percentage of TRU waste packages. Ventilate 16,700 drums of TRU waste retrieved during TWISP. Maintain current version of WIPP waste acceptance criteria and liaison with WIPP operations.	Activities were as projected in the SWEIS ROD with the following differences: Characterized 83 m^3 of legacy MLLW in 1999. Characterized 6.25 m^3 of legacy TRU waste during 1999. Verified characterization data at Radioactive Assay and Nondestructive Test Facility for TRU wastes, but not for LLW. Six drums were cored and inspected in calendar year 1999. Ventilated 8426 drums as of December 1999.
Compaction	Compact up to 25,400 m^3 of LLW.	280 m^3 compacted into 77 m^3 LLW.
Size Reduction	Size reduce 2900 m^3 of TRU waste at WCRRF and the Drum Preparation Facility.	Size reduction was not performed in 1999.
Waste Transport, Receipt, and Acceptance	Collect chemical and mixed wastes from LANL generators and transport to TA-54.	Collected and transported chemical and mixed wastes.
	Begin shipments to WIPP in 1999. Over the next 10 years: Ship 32,000 metric tons of chemical wastes and 3640 m^3 of MLLW for off-site land disposal restrictions, treatment, and disposal. Ship no LLW for off-site disposal. Ship 9010 m^3 of legacy TRU waste to WIPP. Ship 5460 m^3 of operational and environmental restoration TRU waste to WIPP. Ship no environmental restoration soils for off-site solidification and disposal.	Shipments to WIPP began 3/26/1999. Shipments in 1999: 882 metric tons of chemical wastes and 96 m^3 of MLLW for off-site treatment and disposal. No LLW for off-site disposal. 6.25 m^3 of legacy TRU waste was shipped in 1999. No operational or environmental restoration TRU wastes shipped to WIPP. No environmental restoration soils for solidification and disposal.

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
Waste Transport, Receipt, and Acceptance (Cont.)	Annually receive, on average, 5 m^3 of LLW and TRU waste from off-site locations in 5 to 10 shipments.	No LLW or TRU waste receipts from off-site locations.
Waste Storage	Stage chemical and mixed wastes before shipment for off-site treatment, storage, and disposal.	Chemical and mixed wastes staged before shipment.
	Store legacy TRU waste and MLLW.	Legacy TRU waste and MLLW stored.
	Store LLW uranium chips until sufficient quantities have accumulated for stabilization.	LANL still generates this waste; however, TA-54 no longer accepts them for storage. The generator is required to process this waste to make it acceptable for disposal at TA-54.
Waste Retrieval	Begin retrieval operations in 1997.	Retrieval begun in 1997.
	Retrieve 4700 m^3 of TRU waste from Pads 1, 2, 4 by 2004.	Retrieved 2195 m^3 in calendar year 1999. Retrieved 4146 m^3 total through Dec. 1999.
Other Waste Processing	Demonstrate treatment (e.g., electrochemical) of MLLW liquids.	No activity.
	Land farm oil-contaminated soils at Area J.	No oil-contaminated soils were land-farmed.
	Stabilize 870 m^3 of uranium chips.	No uranium chips stabilized in 1999.
	Provide special-case treatment for 1030 m^3 of TRU waste.	None.
	Solidify 2850 m^3 of MLLW (environmental restoration soils) for disposal at Area G.	No environmental restoration soils solidified.
Disposal	Over next 10 years: Dispose of 420 m^3 of LLW in shafts at Area G. Dispose of 115,000 m^3 of LLW in disposal cells at Area G. (Requires expansion of on-site LLW disposal operations beyond existing Area G footprint.) Dispose of 100 m^3/yr administratively controlled industrial solid wastes in pits at Area J. Dispose of nonradioactive classified wastes in shafts at Area J.	During 1999: 23 m^3 of LLW were disposed in shafts at Area G. 1320 m^3 of LLW disposed in cells. Area G was not expanded. 4003 m^3 solid wastes disposed in pits at Area J.[b] 0.28 m^3 of classified solid wastes disposed in shafts at Area J.

[a] Includes the construction of four new storage domes for the TWISP.

[b] This volume exceeds projections because of excavation of MDA-P by the ER Project.

2.15.3 Operations Data for the Solid Radioactive and Chemical Waste Facility

Levels of operation in 1999 were less than projected by the ROD for air emissions and most wastes. However, TRU/mixed TRU waste quantities were higher than those projected. Table 2.15.3-1 provides details.

Table 2.15.3-1. Solid Radioactive and Chemical Waste Facilities (TA-54 and TA-50) Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions: [a]			
Tritium	Ci/yr	6.09E+1	[a]
Americium-241	Ci/yr	6.60E-7	[a]
Plutonium-238	Ci/yr	4.80E-6	9.9E-11
Plutonium-239	Ci/yr	6.80E-7	[a]
Uranium-234	Ci/yr	8.00E-6	1.7E-8
Uranium-235	Ci/yr	4.10E-7	[a]
Uranium-238	Ci/yr	4.00E-6	2.3E-9
NPDES Discharge	MGY	No outfalls	No outfalls
Wastes: [b]			
Chemical	kg/yr	920	30
LLW	m^3/yr	174	21
MLLW	m^3/yr	4	0
TRU/Mixed TRU	m^3/yr	27	40
TRU	m^3/yr	27	40
Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	225	65 [c]

[a] Data for 1999 are for stacks monitored at WCRRF and the Radioactive Materials Research, Operations, and Demonstration facility at TA-50. No stacks require monitoring at TA-54. All non-point sources at TA-50 and TA-54 are measured using ambient monitoring.

[b] Secondary wastes are generated during the treatment, storage, and disposal of chemical and radioactive wastes. Examples include repackaging wastes from the visual inspection of TRU waste, high-efficiency particulate air filters, personnel protective clothing and equipment, and process wastes from size reduction and compaction.

[c] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular part-time and full-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.16 Non-Key Facilities

The balance, and majority, of LANL buildings are referred to in the SWEIS as the Non-Key Facilities. Non-Key Facilities house operations that do not have potential to cause significant environmental impacts. These buildings and structures are located in 30 of LANL's 49 TAs and comprise approximately 15,500 of the LANL's 27,820 acres. As discussed in Section 2.16.2 below, activities in the Non-Key Facilities encompass seven of the eight LANL direct-funded activities (DOE 1999a, page 2-2).

There are five Category 3 nuclear facilities among the Non-Key Facilities:

- Calibration Building (TA-03, Building 130)
- Physics Building (TA-03, Building 40)
- High-Pressure Tritium Facility (TA-33, Building 86)
- Nuclear Safeguards Research Building (TA-35, Building 02)
- Nuclear Safeguards Laboratory (TA-35, Building 27)

Four of these buildings hold only sealed radioactive sources. The High-Pressure Tritium Facility is in safe shutdown mode awaiting decontamination and decommissioning.

2.16.1 Construction and Modifications at the Non-Key Facilities

LANL plans for the next ten years call for the construction or modification of many buildings that are not included in the 15 Key Facilities. These changes are discussed in the following paragraphs.

a) Atlas: Atlas will be used for research and development in the fields of physics, chemistry, fusion, and materials science that will contribute to predictive capability for aging and performance of secondary components of nuclear weapons. The facility will require about 5 MWH of electrical energy annually (1% to 2% of total LANL consumption); will have a peak electrical demand of 12 megawatts (about 12% of total LANL demand); and will employ about 15 people. The heart of the Atlas facility is a pulsed-power capacitor bank that will deliver a large amount of electrical and magnetic energy to a centimeter-scale target in less than ten microseconds. Each experiment will require extensive preparation of the experimental assembly and diagnostic instrumentation (DOE 1996b).

Atlas is being constructed in parts of five buildings at TA-35:

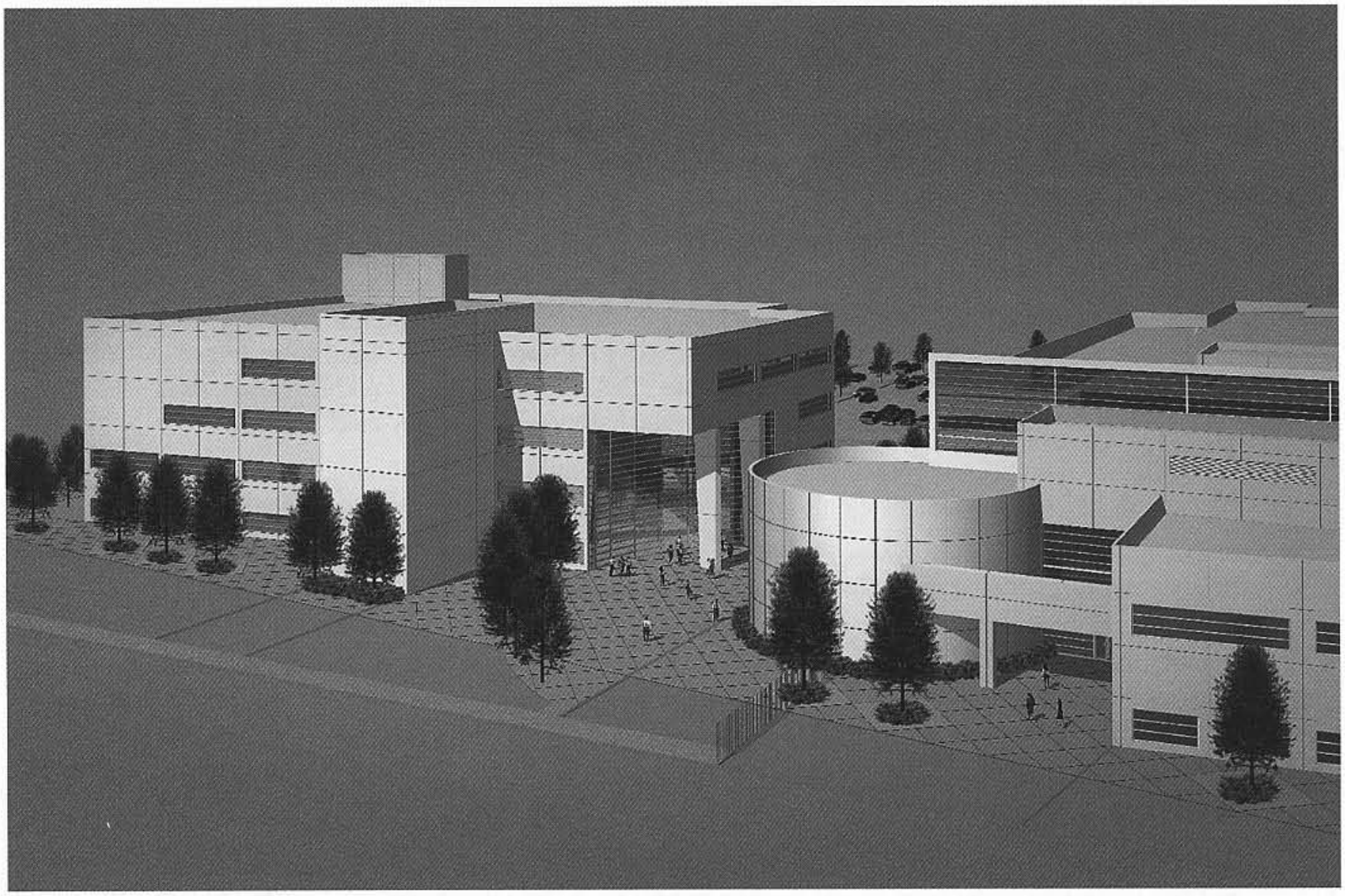
- 35-124/125, Experimental Area, Control Room, and Coordination Center
- 35-126, Mechanical Services Building
- 35-294, Power Supply Building
- 35-301, Generator Building

Through 1999, $36 million had been spent. Another $13 million, budgeted for 2000 and 2001, will complete the facility (LANL 1999a).

b) Industrial Research Park (IRP): Construction of the IRP started in 1999. A maximum of 30 acres will be developed along West Jemez Road, across from Otowi Building and the Wellness Center, and along West Road, in the vicinity of the ice rink. Up to ten buildings may be constructed, with a total floor space of 300,000 square feet and parking for 1400 cars (DOE 1997b). The IRP is a private development on DOE land leased to Los Alamos County. Because the land still belongs to DOE, land-use impacts must be considered in the Yearbook.

c) Strategic Computing Complex (SCC): Construction of this new building, to house the world's fastest supercomputer, also got underway in 1999. The SCC will be a three-story structure with 267,000 square feet under roof. About 300 designers, computer scientists, code developers, and university and industrial scientists will occupy the building. The building will be connected to existing sewer, water, and natural gas lines, but will require a new 115/13.8 kV substation transformer at the TA-03 Power Plant. Six cooling towers are to be constructed, requiring an estimated 63 million gallons of cooling water per year. This water will be derived, however, from treated waters from the sewage facility, which total more than 100 million gallons annually. The SCC is projected to have a maximum electricity load requirement of seven megawatts, or about 7% of total LANL demand (DOE 1998b). Through the end of 1999, $4 million had been spent on this $107-million construction project (LANL 1999a).

d) Nonproliferation and International Security Center (NISC): Construction of this new building also began in 1999. The NISC will be a four-story building plus basement, will have 164,000 square feet under roof, and will have a capacity to house 465 people. It is being constructed adjacent to the new SCC within the heart of TA-03. The building will have laboratories, a machine shop for fabrication of satellite parts, a high-bay fabrication area, an area for the safe handling of sealed radioactive sources, and offices. Building heating and cooling will be by closed-loop water systems. Because all occupants are to be relocated from other LANL buildings, there is no expected increase in quantities of sewage, solid wastes, or chemical wastes, nor should there be increased demand for utilities. In order to accommodate both the SCC and NISC, nearby parking lots are to be expanded to fit an additional 800 to 900 vehicles (DOE 1999e). Through the end of 1999, $2 million had been spent on this $63-million construction project (LANL 1999a).



Top: Conceptual drawing of NISC (left) and SCC
Above: Industrial Research Park
Right: Construction site

e) Central Health Physics Calibration Laboratory: A new Central Health Physics Calibration Laboratory was approved for line-item funding in calendar year 1999. The new facility, to be located at TA-36, will consolidate existing health physics calibration, maintenance, and repair functions into one location. Currently, these functions are undertaken in three separate structures in TA-3. Construction activities will include renovation of an existing building and a 500-square-foot addition to a second existing building. TA-36 is remote from densely populated areas of the Laboratory, is served by paved roads, and is located in a secure area. The proposal was categorically excluded from further NEPA review.

f) NPDES Outfall Project: During 1999, 13 outfalls from Non-Key Facilities were eliminated from the NPDES permit (Sandoval 2000). Responsibility for nine of the 13 was transferred to Los Alamos County when the County assumed ownership of water supply wells, pumping stations, storage tanks, and piping. Discharges from the remaining four outfalls were eliminated when the source activities were eliminated and were associated with water supply wells that were removed from service. Table 3.2-3 in Section 3.2, Liquid Effluents, shows the final disposition for all of the eliminated outfalls and the drainage basins to which they discharged.

Coupled with the 10 outfalls deleted during 1997 and 1998, a total of 24 of 27 outfalls from the Non-Key Facilities have now been eliminated. The only remaining outfalls for Non-Key Facilities are the following:

- 001 at TA-03-22 serves the Power Plant. The outfall, which discharges daily into a tributary of Sandia Canyon receives effluent from boiler blowdown, neutralized demineralizer regeneration brine, once-through cooling water from the sample cooling heat exchanger, blowdown from cooling towers, and floor washings from a floor drain and sink drain in the chlorine building. Also, treated effluent from the sanitary wastewater treatment plant at TA-46 is piped to the Power Plant for use in the cooling towers or to be discharged through 001.
- 13S serves the sanitary wastewater treatment plant at TA-46 but is piped to, and discharged through, outfall 001 at TA-3.
- 03A027 also discharges into a tributary of Sandia Canyon. This outfall receives treated cooling water and fire protection water from an old cooling tower (TA-3-285) that functions as a "back-up" to the cooling towers that serve refrigerant condensers for 4 to 8 chillers located at the TA-3 Laboratory Data Communications Center and Central Computing Facility. The 03A027 outfall discharges very infrequently and any discharge is usually a result of cooling tower maintenance or testing of the fire protection system. Testing of the fire protection system generally occurs up to six times per year.
- 03A160 from Building 35-124, the Antares Target Hall, discharges into Mortandad Canyon.

2.16.2 Operations at the Non-Key Facilities

Non-Key Facilities are host to seven of the eight categories of activities at LANL (DOE 1999a, pp. 2-2 through 2-9) as shown in Table 2.16.2-1 below. The eighth category, environmental restoration is discussed in Section 2.17. During 1999, no new capabilities were added to the Non-Key Facilities, and none of the above seven were deleted.

Table 2.16.2-1. Operations at the Non-Key Facilities

CAPABILITY	EXAMPLES
1. Theory, modeling, and high performance computing	Modeling of atmospheric and oceanic currents. Theoretical research in areas such as plasma and beam physics, fluid dynamics, and super-conducting materials.
2. Experimental science and engineering	Experiments in nuclear and particle physics, astrophysics, chemistry, and accelerator technology. Also includes laser and pulsed-power experiments (e.g., Atlas).
3. Advanced and nuclear materials research and development and applications	Research and development into physical and chemical behavior in a variety of environments; development of measurement and evaluation technologies.

CAPABILITY	EXAMPLES
4. Waste management	Management of municipal solid wastes. Sewage treatment. Recycle programs.
5. Infrastructure and central services	Human resources activities. Management of utilities (natural gas, water, electricity). Public interface.
6. Maintenance and refurbishment	Painting and repair of buildings. Maintenance of roads and parking lots. Erecting and demolishing support structures.
7. Management of environmental, ecological, and cultural resources	Research into, assessment of, and management of plants, animals, cultural artifacts, and environmental media (groundwater, air, surface waters).

The LANL workforce increased by 404 employees during 1999 bringing the total workforce up to 12,412 employees or 1061 more employees than were anticipated under the ROD. Approximately 27% of these new employees were either JCNNM (17%) or PTLA (10%). This reflects the new construction going on at LANL and the increased efforts in security upgrades as LANL moves forward with its assignments for Stockpile Stewardship and Management. Approximately 40% of these new employees are regular (full-time and part-time) UC employees, of which about 60% are assigned to the Key Facilities. This increase in employment at the Key Facilities during 1999 reflects the increase in Defense Program-related activities.

2.16.3 Operations Data for the Non-Key Facilities

Even though the Non-Key Facilities occupy more than half of LANL and employ about half the workforce, activities in these facilities contribute less than 10% of most operational effects. The 286 cubic meters of LLW constituted only 17% of the LANL total LLW volume. Table 2.16.3-1 presents details. Radioactive emissions from these facilities show 950 curies of tritium from off-gassing, which is slightly higher than the 910 curies projected by the ROD and about 50% of total emissions. Chemical waste also exceeds projections made by the ROD, and was driven by ER Project clean up of potential release sites (PRSs). Most chemical waste is shipped off-site for disposal and therefore will not result in environmental impacts at LANL. See Section 3.3 for a more detailed description of waste management activities at LANL.

Table 2.16.3-1. Non-Key Facilities/Operations Data

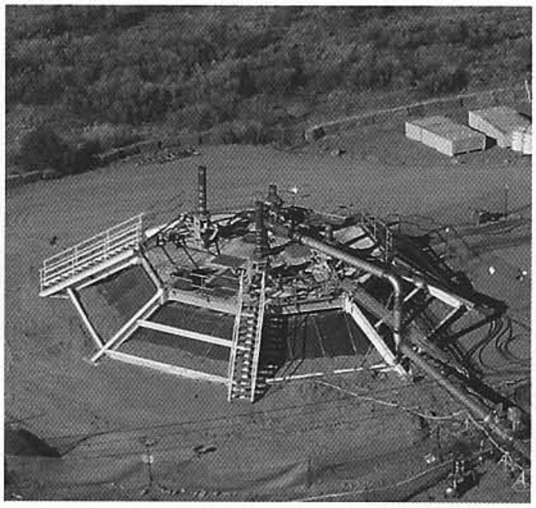
PARAMETER	UNITS	SWEIS ROD	1999
Radioactive Air Emissions: [a]			
Tritium	Ci/y	9.1E+2	9.5E+2
Plutonium	Ci/y	3.3E–6	No data [b]
Uranium	Ci/y	1.8E–4	No data [b]
NPDES Discharge	MGY	142	232
Wastes:			
Chemical	kg/yr	651,000	765,000
LLW	m^3/yr	520	286
MLLW	m^3/yr	30	3
TRU/Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	6579	4601 [c]

[a] Stack emissions from previously active facilities (TA-33 and TA-41); these were not projected as continuing emissions in the future. Does not include nonpoint sources.

[b] Most of the stacks in the Non-Key Facilities are not sampled for radioactive airborne emissions because the potential emissions from these stacks are sufficiently small that measurement systems are not necessary to meet regulatory or facility requirements.

[c] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.17 Environmental Restoration Project



In-situ vitrification demonstration project

The ER Project may be a major contributor to LANL's environmental effluents, and therefore, is included as a section of Chapter 2. The ROD forecast that the ER Project would contribute 60% of the chemical wastes, 35% of the LLW, and 75% of the MLLW generated at LANL over the ten years from 1996–2005. The ER Project will also affect land resources in and around LANL.

The DOE established the ER Project in 1989 to characterize and remediate sites that were known or suspected to be contaminated from historical operations. An assessment in the late 1980s resulted in the identification of over 2100 potential release sites (PRSs). Many of the sites identified remain under DOE control; however, some have been transferred into private ownership. In 1999, ER Project activities included remedial site assessments and site cleanups. Assessment resulted in the submission of eight Resource Conservation Recovery Act (RCRA) facility investigation (RFI) reports to the New Mexico Environment Department (NMED) and continuing RFI fieldwork on numerous other sites. Cleanup entailed seven sites including an inactive firing site, septic tanks, and areas with contaminated soil.

By the end of 1999, LANL was in some phase of characterization of 1206 PRSs. The ER Project had remediated 130 sites and recommended 792 sites to the regulatory authority for no further action by the end of 1999 (Bertino 2000).

2.17.1 Operations of the ER Project

To date, the total number of PRSs removed from the permit remains at 102. Of the 102 PRSs that have been removed from the permit, three were removed during the period 1989–1998 and an additional 99 were removed during 1998. During 1999, the ER Project recommended an additional 47 PRSs for no further action. These recommendations are in various stages of NMED review and public comment.

As a result of an annual audit conducted by NMED in 1999, 388 PRSs were consolidated with other PRSs for the purpose of investigation and remediation. This consolidation was also conducted to correct a faulty numbering scheme imposed on the ER Project in the early 1990s. The total number of discrete sites that are continuing to be investigated by the ER Project has been reduced to 1206.

2.17.2 Operations Data for the ER Project

Waste quantities generated during 1999 are shown in Table 2.17.2-1 below. Only chemical waste is above the quantity predicted in the SWEIS because of the disposal of extensive amounts of soil for the MDA-P project. See Section 3.3, Solid and Chemical Wastes, for a more detailed discussion of wastes generated by the ER Project.

Cleanup activities also generated solid wastes, which were disposed at the County landfill.

Table 2.17.2-1. ER Project/Operations Data

WASTE TYPE	UNITS	SWEIS ROD	1999 OPERATIONS[a]
Chemical	kgs/yr	2,000,000	14,547,936
LLW	m^3/yr	4260	407
MLLW	m^3/yr	548	1.25
TRU	m^3/yr	11	0
Mixed TRU	m^3/yr	0	0

[a] Memo, J.C. Del Signore to K.H. Rea, 10/3/2000

Table 2.11.3-1. LANSCE/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
Argon-41	Ci/yr	7.44E+1	1.4E+1
Bromine-76	Ci/yr	Not projected [a]	2.3E-4
Bromine-82	Ci/yr	Not projected [a]	6.3E-4
Carbon-10	Ci/yr	2.65E+0	4.2E-2
Carbon-11	Ci/yr	2.96E+3	2.8E2
Cobalt-60	Ci/yr	Not projected [a]	4.0E-6
Mercury-197	Ci/yr	Not projected [a]	1.6E-3
Nitrogen-13	Ci/yr	5.35E+2	1.6E+0
Nitrogen-16	Ci/yr	2.85E-2	1.50E-2
Oxygen-14	Ci/yr	6.61E+0	1.0E-1
Oxygen-15	Ci/yr	6.06E+2	1.9E+1
Tritium as Water	Ci/yr	Not projected [a]	2.3E+0
LEDA Projections (8-yr average):			
Oxygen-19	Ci/yr	2.16E-3	Not measured [b]
Sulfur-37	Ci/yr	1.81E-3	Not measured [b]
Chlorine-39	Ci/yr	4.70E-4	Not measured [b]
Chlorine-40	Ci/yr	2.19E-3	Not measured [b]
Krypton-83m	Ci/yr	2.21E-3	Not measured [b]
Others	Ci/yr	1.11E-3	Not measured [b]
NPDES Discharge: [c]			
Total Discharges	MGY	81.8	37.2
03A047	MGY	7.1	3.4
03A048	MGY	23.4	19.7
03A049	MGY	11.3	10.8
03A113	MGY	39.8	3.3
Wastes:			
Chemical	kg/yr	16,600	11,060
LLW	m^3/yr	1085 [d]	70
MLLW	m^3/yr	1	0.5
TRU/Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	856	560 [e]

[a] The radionuclide was not projected in the ROD because it was either dosimetrically insignificant or not isotopically identified.
[b] Potential emissions from LEDA were sufficiently small that measurement systems were not necessary to meet regulatory or facility requirements.
[c] Outfalls eliminated before 1999: 03A125 (TA-53), 03A145 (TA-53), and 03A146 (TA-53).
[d] LLW volumes include decommissioning and renovation of Experimental Area A (Building 53-03M).
[e] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.12 Health Research Laboratory (TA-43)

The HRL Key Facility includes the main HRL (Building 43-01) and 13 support buildings also located at TA-48. Research focuses on the study of intact cells, cellular components (RNA, DNA, and proteins), and cells and cellular systems (repair, growth, and response to stressors). There are several Low Hazard nonnuclear buildings within this Key Facility, but no Moderate Hazard nonnuclear facilities and no nuclear facilities.

2.12.1 Construction and Modifications at HRL

In calendar year 1999, HRL eliminated the entire animal colony. Outfall 03A040 was eliminated from the NPDES permit on January 11, 1999. The discharge from this outfall was redirected to the Los Alamos County sewage treatment plant in Bayo Canyon in 1998.

3.0 Site-Wide 1999 Operations Data

The role of the Yearbook is not to present environmental impacts or environmental consequences. The Yearbook's role is to provide data that could be used to develop an impact analysis. In this chapter, the Yearbook summarizes operational data at the site-wide level. In some cases, the Yearbook does include impacts for very specific areas—worker doses and doses from radioactive air emissions. These impact assessments are routinely undertaken by LANL, using standard methodologies that duplicate those used in the SWEIS; hence, they have been included for the sake of providing the base for future trend analysis.

This chapter of the Yearbook compares actual operating data to projected effects for about half of the parameters discussed in the SWEIS. These include effluent, workforce, regional, and long-term environmental effects. Some of the parameters used for comparison had to be derived from information contained in both the main text and appendices of the SWEIS. Many parameters cannot be compared because data are not routinely collected. In these cases, projections made in the SWEIS resulted only from the expenditure of considerable special effort, and such extra costs were avoided when preparing the Yearbook.

3.1 Air Emissions

3.1.1 Radioactive Air Emissions

Radioactive airborne emissions from point sources (i.e., stacks) during 1999 totaled approximately 1900 curies, less than 10% of the ten-year average of 21,700 curies projected by the ROD,[4] These low emissions result from operations at the Key Facilities not being performed at projected levels. LANL is still gearing up to initiate its new assignments. In addition, a major source of these emissions (the Area A beam stop at LANSCE) was not used.

The two largest contributors to radioactive air emissions were tritium from the Tritium Facilities (both Key and Non-Key) and activation products from LANSCE. Stack emissions from the Tritium Key Facilities were about 650 curies, and tritium emissions from the Non-Key Facilities were 950 curies. This 950 curies represents off gassing from operations no longer in use at TA-33 (High Pressure Tritium Facility) and TA-41 (Tritium Laboratory). LANSCE emissions totaled 300 curies and accounted for about 15% of the LANL total, but were only about 2% of the projected ten-year average of about 16,800 curies for LANSCE.

Non-point sources of radioactive air emissions are present at LANSCE, Area G, TA-18, and other locations around the Laboratory. Non-point emissions, however, are small compared to stack emissions. For example, non-point air emissions from LANSCE were less than 20 curies. Additional detail about radioactive air emissions is provided in the Laboratory's annual compliance report to the Environmental Protection Agency (EPA; Jacobson 2000) and in Chapter 4 of the 1999 Environmental Surveillance Report (LANL 2000b).

The calculated dose to the MEI by the air pathway for 1999 was 0.32 millirem, including contributions from stack emissions and non-point sources such as Area G and the firing sites.

The calculated MEI dose attributable to LANSCE was less than 0.1 millirem. These values are less than one-tenth of the 5.44 millirem projected by the ROD and are well below the EPA emission standard of 10 mrem/yr.

3.1.2 Non-Radioactive Air Emissions

3.1.2.1 Emissions of Criteria Pollutants

Criteria pollutant emissions (oxides of nitrogen, sulfur oxides, carbon monoxide, and particulate matter) from fuel burning equipment are reported in the "Emissions Inventory Report Summary, Reporting Requirements for the New Mexico Administrative Code, Title 20, Chapter 2, Part 73 (20 NMAC 2.73) for Calendar Year 1999" (LANL 2000a). The report provides emission estimates for the Laboratory's steam plants, nonexempt boilers, asphalt plant, and the water pump. In addition, emissions from the paper shredder, rock crusher, degreaser, and beryllium machining operations are reported. Information on total volatile organic compounds released from painting and research and development operations is presented.

[4] These values represent a summation of the data presented in the data tables, Chapter 3, of the SWEIS.

LANL, in comparison to industrial sources and power plants, is a relatively small source of non-radioactive air pollutants. As such, the Laboratory is required to estimate emissions, rather than perform actual stack sampling. Calculated emissions for criteria pollutants during 1999 were less than amounts assumed for the ROD as shown in Table 3.1.2.1-1 below.

Table 3.1.2.1-1 Emissions of Criteria Pollutants

POLLUTANTS	UNITS	SWEIS ROD	1999
Carbon monoxide	Tons/year	58	32
Nitrogen oxides	Tons/year	201	88
Particulate matter	Tons/year	11	4.5
Sulfur oxides	Tons/year	0.98	0.55

Since the analysis of ROD emissions of criteria pollutants indicated no adverse air quality impacts, this same conclusion can be drawn for 1999 emissions.

3.1.2.2 Chemical Usage and Emissions

The SWEIS contained projections for toxic air pollutants, based on chemical use at each TA, rather than at each Key Facility; these projections were then compared to a screening level. Emissions from only one Key Facility, High Explosive Testing, exceeded the screening level of the analysis. Therefore, chemical use (the relevant parameter) was only included in the table of parameters for this Key Facility. However, usage of non-radioactive materials in firing site operations was also well below the amounts projected. Therefore, estimated air concentrations for 1999 were less than projected by the ROD.

This edition of the Yearbook is proposing to report chemical usage and calculated emissions for the Key Facilities, based on an improved chemical reporting system. The 1999 estimates of chemical usage were obtained from the Laboratory's Automated Chemical Inventory.

System (ACIS). The quantities used for this report represent all chemicals procured or brought on site in 1999. This methodology is the same as that used by the Laboratory for reporting under the Superfund Amendments and Reauthorization Act, specifically Section 313 of the Emergency Planning Community Right-to-Know Act.

An overview of the 1995 data used for the SWEIS compared to the 1999 data shows some substantial differences. The 1999 data are believed to be more accurate and up-to-date for two reasons. First, in 1998 the Laboratory instituted a chemical management standard. The standard requires that all chemicals appear on ACIS. Secondly, in 1998-1999, a wall-to-wall inventory of the Laboratory was conducted to update ACIS.

Air emissions shown in Tables A-2 through A-16 of the Appendix are divided into emissions by Key Facility. Emission estimates (expressed as kilograms per year) were performed in the same manner as that reported in the ROD. First, the usage of the listed chemicals was summed by facility. It was then estimated that 35% of the chemical used was released to the atmosphere. However, emission estimates for mercury and solid metals were assumed to vent at levels below 1% of the total used. It was presumed that metal emissions would come from cutting, and possibly, melting operations. Fuels such as propane were assumed to be combusted.

As expected, a number of chemicals evaluated in the ROD were not used in 1999 and vice versa. Table A-1 (Appendix) lists, by TA, the number of chemicals used in 1995 but not used in 1999 and the number of chemicals used in 1999 but not used in 1995.

The chemical comparison above indicates that the number of chemicals used in 1999 at each of the Key Facilities was substantially less than that evaluated in the ROD. These changes are believed to be a result of more accurate chemical data collection. Information related to actual chemical use and estimated emissions for each Key Facility is shown in the Appendix.

Overall chemical use and emissions resulting from that use have decreased from that reported in the 1995 ROD. Additional information related to emissions reporting can be found in the "Emissions Inventory Report Summary, Reporting Requirements for the New Mexico Administrative Code, Title 20, Chapter 2, Part 73 (20 NMAC 2.73) for Calendar Year 1999" (LANL 2000a).

3.2 Liquid Effluents

Based on average daily flows as reported by the Laboratory's Water Quality and Hydrology Group and on operational records when available, effluent flow through NPDES outfalls totaled an estimated 317.2 million gallons in 1999, compared to 278 million gallons projected by the ROD.[5] Key Facilities accounted for approximately 84.5 million gallons of that total. This flow can be examined by watershed (Figure 3-1) in Table 3.2-1 and by facility in Table 3.2-2 to understand differences from projections.

Table 3.2-1. NPDES Discharges by Watershed

WATERSHED	# OUTFALLS (SWEIS ROD)	# OUTFALLS[a] (1999)	DISCHARGE[b] (SWEIS ROD)	DISCHARGE[a,b] (1999)
Cañada del Buey	3	3 [c]	6.4	2.6
Guaje	7	6 [d]	0.7	1.7
Los Alamos	8	7	44.8	45.2
Mortandad	7	6	37.4	39.3
Pajarito	11	2 [e]	2.6	0
Pueblo	1	1	1.0	0.9
Sandia	8	6	170.7	213.2 [c]
Water	10	5 [f]	14.2	14.3
Totals	55	36	278.0	317.2

[a] Includes outfalls that were eliminated during 1999, some of which had flow. Twenty outfalls discharged during 1999.
[b] Millions of gallons per year.
[c] Includes effluent from SWS, which is piped to TA-3 and ultimately discharges to Sandia Canyon via outfall 001.
[d] Includes 04A176 discharge to Rendija Canyon, a tributary to Guaje Canyon.
[e] Includes 06A106 discharge to Three-Mile Canyon, a tributary to Pajarito Canyon. See Table 3.2-3.
[f] Includes 05A055 discharge to Valle Canyon, a tributary to Water Canyon.

The number of outfalls listed in the NPDES permit had decreased by 16, to 20, at the end of 1999, see Table 3.2-3. Three of the 16 outfalls eliminated during 1999, 03A040, 03A045, and 06A106, were associated with the HRL, Radiochemistry Laboratory, and High Explosives Testing Key Facilities, respectively; and, each was eliminated after cessation of source activities and processes or redirecting flows to other outfalls, primarily to the sanitary system. Most of the reductions (9 of the 16) during 1999 were the result of transferring the water supply system from the DOE to Los Alamos County. Those outfalls were removed from the Laboratory's NPDES permit and added to the Los Alamos County NPDES permit application. Four other water supply wells were taken out of production, their pumping equipment removed, and their outfalls eliminated. Table 3.2-3 also shows the final disposition for each of the eliminated outfalls and the drainage basins to which they discharged.

Table 3.2-2 compares NPDES discharges by facility. The Non-Key Facilities had the largest differences between 1999 discharges and discharges projected by the ROD. For the Non-Key Facilities, discharges from the outfall at the TA-3 power plant were appreciably higher, 165 million gallons discharged in 1999 compared to a projected discharge of 114 million gallons. Approximately 106 million gallons of the discharge from outfall 001 at the power plant are attributable to sanitary effluent piped from TA-46 to TA-3 to be used as makeup water. The combined flows of the sanitary waste treatment plant and the TA-3 Steam Plant account for about half of the total

[5] For some facilities, flows are determined by recorders installed at the end of the pipe. This was the case for outfalls at the SWS, HEWTF, RLWTF, and the Power Plant. For all other outfalls, annual totals were calculated from discharge monitoring reports (DMRs) provided by the Laboratory's Water Quality and Hydrology Group. This latter method substantially overestimates the quantity of wastewater discharged because it is based on infrequent sampling and the DMRs assume round-the-clock flow for all outfalls.

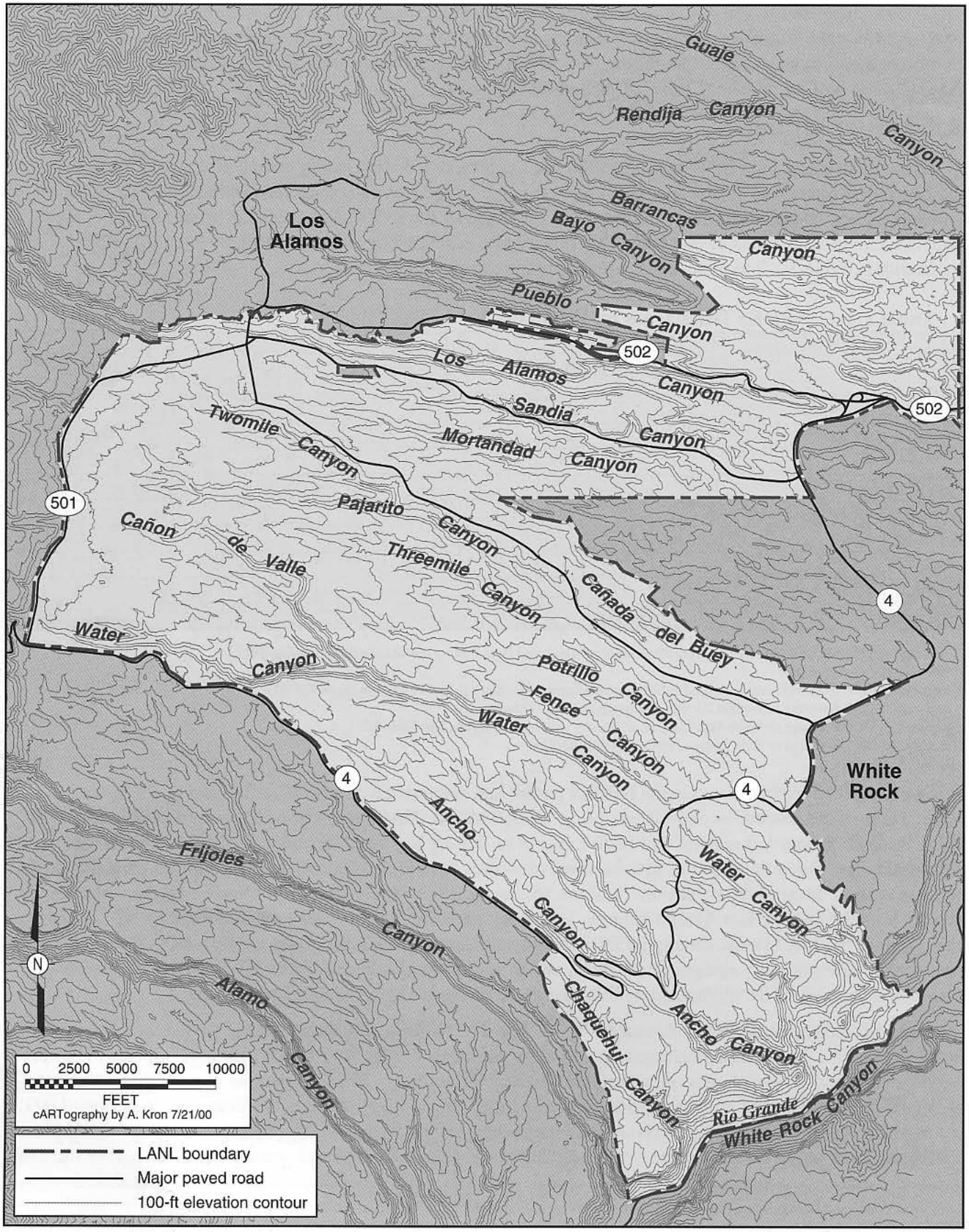
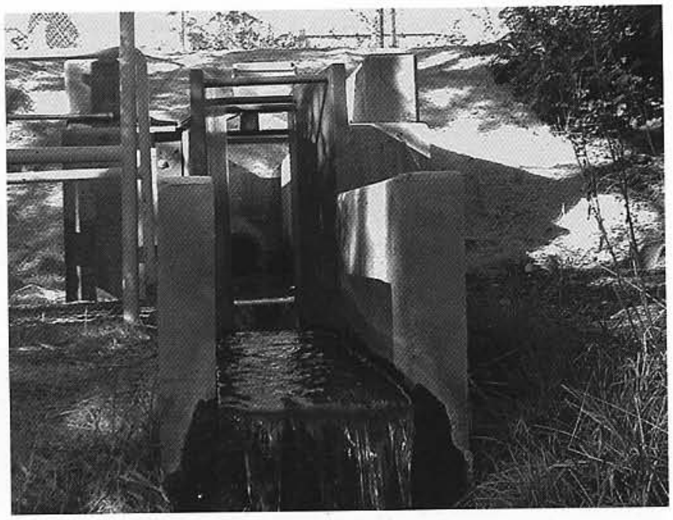


Figure 3-1 Location of Watershed Canyons

discharge from Non-Key Facilities and one-third of the water discharged by the Laboratory. Additionally, flows from two outfalls removed from the permit during 1999 had previously been redirected to the sanitary system, see Table 3.2-3. –For Key Facilities, LANSCE discharged approximately 37.2 million gallons for 1999, accounting for nearly half of the total discharges from all Key Facilities, see Table 3.2-2.

Treated waters released from LANL outfalls rarely leave the site. An indicator of this is provided by stream gage measurements near downstream site boundaries in seven watersheds as reported in "Surface Water Data at Los Alamos National Laboratory; 1999 Water Year" (Shaull et al. 2000).



Typical NPDES-regulated outfall

Table 3.2-2. NPDES Discharges by Facility

FACILITY[a]	# OUTFALLS (SWEIS ROD)	# OUTFALLS[b] (1999)	DISCHARGE[c] (SWEIS ROD)	DISCHARGE[b,c] (1999)
Plutonium Complex	1	1	14.0	8.6
Tritium Facility	2	2	0.3	9
CMR Building	1	1	0.5	4.5
Sigma Complex	2	2	7.3	5.9
High Explosives Processing	11	3	12.4	0.2
High Explosives Testing	7	3	3.6	14.3
LANSCE	5	4	81.8	37.2
HRL	1	1	2.5	0
Radiochemistry Facility	2	1	4.1	0
RLWTF	1	1	9.3	5.3
Pajarito Site		0	0	0
MSL		0	0	0
TFF		0	0	0
Machine Shops		0	0	0
Waste Management Operations		0	0	0
Non-Key Facilities	22	17	142.1	232
Totals	55	36	278.0	317.2

[a] No outfalls for Pajarito Site, MSL, TFF, Shops, and the Solid Radioactive and Chemical Waste Facility.

[b] Includes 16 outfalls that were eliminated during 1999, some of which had flow for part of the year.

[c] Millions of gallons per year.

LANL has three principal wastewater treatment facilities—the sewage plant (SWS) at TA-46, the RLWTF at TA-50, and the HEWTF at TA-16. The sewage treatment plant at TA-46 processed 106 million gallons of treated wastewater and sewage during 1999. From TA-46, treated liquid effluent is pumped to the TA-3 power plant where it is either used to provide make up water for the cooling towers or is discharged directly into Sandia Canyon via outfall 001. For 1999 the reported total discharge from the power plant into Sandia Canyon was approximately 166 million gallons based on averaged daily flows

The RLWTF, Building 50-01, outfall 051 discharges into Mortandad Canyon. Process modifications projected by the ROD were installed during 1997 and 1998, but did not become operational until March of 1999. These modifications are designed to achieve compliance with more stringent NMED effluent limits for nitrates, fluoride, other NPDES permit limits, and DOE Derived Concentration Guidelines for radioactive constituents released to the environment. During 1999, 5.3 million gallons of treated radioactive liquid waters were released to Mortandad Canyon, compared to 9.3 million gallons projected by the ROD.

The TA-16 HEWTF, discharged a total of 0.096 million gallons compared to 0.13 projected in the ROD. Effluent quality was similar to that of recent years. Details on all non-compliance situations are provided in the 1999 Annual Environmental Surveillance Report (LANL 2000b).

Table 3.2-3. NPDES Outfalls Deleted in 1999

OUTFALL	LOCATION	DRAINAGE	DATE	FINAL DISPOSITION
03A-040	TA-43-1	Los Alamos	1/11/99	Seven sub-basement floor drains discharging cooling water blowdown were re-routed to the sanitary waste line on 3/6/97. Thirteen roof drains and two sub-basement floor drains continue to discharge storm water through the existing outfall piping.
03A-045	TA-48-1	Mortandad	12/6/99	Cooling water blowdown discharging to a basement floor sink drain was re-routed to the sanitary waste line on 12/10/96. Twenty-six roof drains continue to discharge storm water through the existing outfall piping.
04A-118 04A-161 04A-163 04A-164 04A-165 04A-166 04A-172 04A-177 04A-186	Pajarito #4 Otowi #1 Pajarito #1 Pajarito #2 Pajarito #3 Pajarito #5 Guaje #1A Guaje Booster Otowi #4	Cañada del Buey Pueblo Sandia Pajarito Sandia Cañada del Buey Guaje Guaje Los Alamos	10/13/99	The nine water wells and associated NPDES-Permitted outfalls are part of the Los Alamos Municipal Water Supply System. The U.S. DOE leased the water supply system on 9/8/98 to the Los Alamos County. The nine outfalls associated with these water supply wells were deleted from the Laboratory's NPDES permit following the submittal of an NPDES Application by the County.
04A-171 04A-175 04A-176	Guaje #1 Guaje #5 Guaje #6	Guaje Guaje Guaje	8/23/99	These three water supply wells and outfalls are no longer operational. Pumping equipment has been removed and well house structures have been demolished.
04A-173	Guaje #2	Guaje	9/21/99	The water supply well and associated outfall are no longer in operation. Pumping equipment has been removed and the well house structure has been demolished.
06A-106	TA-36-1 [a]	Three Mile	1/11/99	All drains in Rooms 7 and 8 associated with the photo-processing lab were plugged and the process equipment has been removed.

[a] Key Facility, Three-Mile Canyon is a tributary to Pajarito Canyon.

3.3 Solid Radioactive and Chemical Wastes

LANL generates radioactive and chemical wastes as a result of research, operations, maintenance, construction, and environmental restoration activities. These wastes are categorized as one of five types. The management of each type has different regulatory requirements. Waste generators can be assigned to one of three categories—Key Facilities, Non-Key Facilities, and the ER Project.

Comparisons of 1999 waste quantities to projections made by the ROD are made in the following paragraphs on the basis of waste type, generator category, or both. No distinction has been made between routine wastes (such as those generated from ongoing operations) and non-routine wastes (such as those generated from the decontamination and decommissioning of buildings). A summary of this comparison appears in Table 3.3-1 below.

Table 3.3-1. LANL Waste Types and Generation

WASTE TYPE	UNITS	SWEIS ROD	1999	% OF ROD	REASONS FOR 1999 DIFFERENCES
Chemical	10^3 kg/yr	3250	15,443	475	ER Project
LLW	m^3/yr	12,200	1710	14	ER Project, High Explosives
MLLW	m^3/yr	632	21	3	ER Project
TRU/Mixed TRU	m^3/yr	448	215	48	Pits
TRU	m^3/yr	333	143	43	Pits
Mixed TRU	m^3/yr	115	72	63	Pits

Projections in the ROD and actual quantities generated in 1999 differed significantly for three of the five waste types. The ER Project played a significant role in differences for all three types. Large quantities of chemical waste, primarily contaminated soil, were generated by the ER Project from remediation of MDA-P. On the other end of the spectrum, MLLW generation was significantly lower than projected in the ROD because the ER Project generated only one cubic meter (versus 548 projected). Finally, LLW generation continued to be significantly lower than projections because CMR, Sigma, and the High Explosives Facilities (Shops, Processing, and Testing) had lower-than-projected levels of activity. Combined, these five facilities generated just 325 cubic meters of LLW versus 4342 cubic meters projected by the ROD.

3.3.1 Chemical Wastes

Chemical waste generation in 1999 exceeded waste volumes projected by the ROD by a factor of five. These large quantities of chemical waste will not result in as significant an on-site environmental impact as the waste volume suggests because most chemical waste is shipped to commercial disposal facilities. Examination of the generator categories (Table 3.3.1-1) sheds some light on where these large quantities are generated.

Table 3.3.1-1. Chemical Waste Generators and Quantities

WASTE GENERATOR	UNITS	SWEIS ROD	1999
Key Facilities	10^3 kg/yr	600	129
Non-Key Facilities	10^3 kg/yr	650	765
ER Project	10^3 kg/yr	2000	14,548
LANL	10^3 kg/yr	3250	15,443

As can be seen in Table 3.3.1-1, cleanup efforts of the ER Project accounted for the large waste volumes, almost 95% of the total. While the ER Project generated wastes from investigation and remediation of several sites, most of the 14.5 million kilograms of chemical waste generated by the ER Project resulted from remediation of PRSs at TA-16, particularly MDA-P. MDA-P is being exhumed as part of a clean-closure under the RCRA. The bulk of the material removed from MDA-P was soil overburden and soil beneath the scrap metal and other wastes that had been disposed in the site. Soil, scrap metal, containers, and miscellaneous equipment and debris that were characterized as hazardous waste were shipped off-site for treatment and disposal since LANL has no on-site capacity for disposal of hazardous waste. Some nonhazardous wastes, soil, concrete rubble, and debris were disposed in MDA-J at TA-54, a solid waste landfill undergoing closure. Approximately 4.7 million kilograms of soil and concrete rubble from MDA-P were placed in MDA-J as fill in preparation for capping (1999 Annual Report Questionnaire for the Los Alamos National Laboratory, Technical Area 54, Area J Landfill). Substantial quantities of scrap metal exhumed from MDA-P were decontaminated on-site at TA-16 and subsequently shipped off-site to scrap metal recyclers.

Overall, the Laboratory generated approximately 4.5 million kilograms of hazardous and mixed wastes during 1999 (LANL 2000c). Again, nearly 3.9 million kilograms were generated by the ER Project while investigating and remediating solid waste management units. The ER Project is discussed in more detail in Section 2.17. The remainder of the chemical waste was generated by a variety of organizations and activities associated with research, decommissioning and decontamination, and facilities maintenance.

Four of the Key Facilities also had substantial departures from projections. The Machine Shops generated less than 1% of the projected waste quantity for the Expanded Alternative (474,000 kilograms projected compared to 3955 actual). The lower than expected waste generation at the Shops resulted from a combination of waste minimization efforts and a much lower workload than projected in the SWEIS. Additionally, the workload at the Shops is directly linked with high explosives testing and processing operations. Chemical waste volumes also differed from projections for the High Explosives Testing Facility (35,300 kilograms projected compared to 1015 actual). Finally, the High Explosives Processing Key Facility generated larger quantities of chemical wastes (13,000 kilograms projected compared to 95,184 actual). However, approximately 81,855 kilograms were generated from the updating or closure of filter beds and open burning sites (TA-16-401, -406, -388, -399, -394) used to treat waste high explosives.

3.3.2 Low-Level Radioactive Wastes

LLW generation in 1999 was less than 15% of waste volumes projected by the ROD. As can be seen in Table 3.3.2-1, cleanup efforts of the ER Project generated only about 10% of projected LLW volumes. Key Facilities account for most of the departure from projections, however. Large differences occurred at the CMR Building (1820 cubic meters projected compared to 189 actual), LANSCE (1085 cubic meters projected compared to 70 actual), the Sigma Complex (960 cubic meters projected compared to 61 actual), the Machine Shops (606 cubic meters projected compared to 40 actual), and High Explosive Testing (940 cubic meters projected compared to zero actual). LANSCE generated lower volumes than projected because decommissioning and renovation of Experimental Area A did not occur. Low workloads accounted for low waste volumes at the other four Key Facilities.

Table 3.3.2-1. LLW Generators and Quantities

WASTE GENERATOR	UNITS	SWEIS ROD	1999
Key Facilities	m^3/yr	7450	1017
Non-Key Facilities	m^3/yr	520	286
ER Project	m^3/yr	4260	407
LANL	m^3/yr	12,230	1710

3.3.3 Mixed Low-Level Radioactive Wastes

Generation in 1999 was less than 5% of MLLW volumes projected by the ROD. Table 3.3.3-1 examines these wastes by generator categories.

Table 3.3.3-1. MLLW Generators and Quantities

WASTE GENERATOR	UNITS	SWEIS ROD	1999
Key Facilities	m^3/yr	54	17
Non-Key Facilities	m^3/yr	30	3
ER Project	m^3/yr	548	1
LANL	m^3/yr	632	21

As can be seen in the table, small waste quantities from the ER Project account for nearly all the difference between SWEIS projections and 1999 actual generation of MLLW.

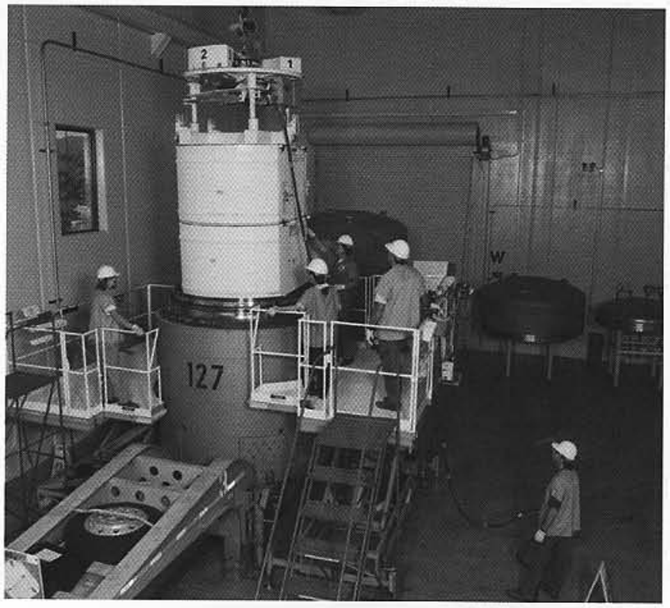
3.3.4 Transuranic/Mixed Transuranic Wastes

Generation of TRU/mixed TRU waste in 1999 was less than half of volumes projected by the ROD. As projected, TRU wastes are expected to be generated in five facilities (the Plutonium Facility Complex, the CMR Building, the High Explosive Testing Facilities, the RLWTF, and the Solid Radioactive and Chemical Waste Facility) and by the ER Project. Mixed TRU wastes are only expected from two facilities (the Plutonium Facility Complex and the CMR Building). Table 3.3.4-1 examines these wastes by generator categories.

Table 3.3.4-1. 1999 Transuranic/Mixed Transuranic Waste Generators and Quantities

CATEGORY	UNITS	KEY FACILITIES	NON-KEY FACILITIES	ER PROJECT	LANL
SWEIS ROD (TRU/Mixed TRU)	m^3/yr	437	0	11	448
SWEIS ROD (TRU)	m^3/yr	322	0	11	333
SWEIS ROD (Mixed TRU)	m^3/yr	115	0	0	115
1999 TRU/Mixed TRU	m^3/yr	215	0	0	215
1999 TRU	m^3/yr	143	0	0	143
1999 Mixed TRU	m^3/yr	72	0	0	72

The departure from projections in 1999 is almost entirely accounted for in two Key Facilities–the Plutonium Complex and the RLWTF. The Plutonium Complex was projected at 339 cubic meters and only produced 160 cubic meters of TRU/mixed TRU waste. The RLWTF was projected at 30 cubic meters and only produced 4.6 cubic meters. These differences exist because manufacture of war reserve pits had not begun at the Plutonium Complex and configuration of the new membrane treatment process at the RLWTF was slightly different than originally designed.



Personnel loading a Transuranic Packaging Transporter Model 2 (TRUPACT II) for shipping waste to the pilot plant

3.4 Utilities

Ownership and distribution of utility services continues to be split between DOE and Los Alamos County. DOE owns and distributes most utility services to LANL facilities, and the County provides these services to the communities of White Rock and Los Alamos. Routine data collection for both gas and electricity are done on a fiscal year basis, and keeping with the goal of using routinely collected data, this information is presented by fiscal year in the Yearbook. Water data, however, are routinely collected and summarized by calendar year.

3.4.1 Gas

There was a change in ownership to the DOE Natural Gas Transmission Line in August 1999. DOE sold 130 miles of gas pipeline and metering stations to the Public Service Company of New Mexico (PNM). This gas pipeline transverses the area from the Kutz Canyon Processing Plant south of Bloomfield, New Mexico, to Los Alamos. Approximately 4 miles of the gas pipeline are within LANL. Table 3.4.1-1 presents gas usage by LANL for fiscal year 1999. Approximately 90% of the gas used by LANL continued to be used for heating (both steam and hot air). The remainder was used for electrical production. The electrical generation was used to fill the difference between peak loads and the electric contractual import rights.

As shown in Table 3.4.1-1, total gas consumption for fiscal year 1999 was less than the projected use in the ROD. During fiscal year 1999, less natural gas was used for heating because of the warmer than normal weather pattern, but more natural gas was used for electric generation at the TA-03 Power Plant. In addition, as shown in Table 3.4.1-2, the TA-16 steam production plant was shut down in 1997 when the new heating systems for TA-16 became fully operational.

Table 3.4.1-1. Gas Consumption (decatherms[a]) at LANL/Fiscal Year 1999

SWEIS ROD	TOTAL LANL CONSUMPTION	TOTAL USED FOR ELECTRIC PRODUCTION	TOTAL USED FOR HEAT PRODUCTION	TOTAL STEAM PRODUCTION
1,840,000	1,428,568	241,490	1,187,078	Table 3.4.1-2

[a] A decatherm is equivalent to 1000-1100 cubic feet of natural gas.

Table 3.4.1-2. Steam Production at LANL/Fiscal Year 1999

TA-3 STEAM PRODUCTION (klb [a])	TA-16 STEAM PRODUCTION (klb)	TA-21 STEAM PRODUCTION (klb)	TOTAL STEAM PRODUCTION (klb)
576,548 [b]	Eliminated Feb 1997 [c]	29,468	606,016

[a] klb: Thousands of pounds

[b] TA-3 steam production has two components: that used for electric production (262,100 klb in 1999) and that used for heat (312,448 klb in 1999).

[c] Steam production at the TA-16 central steam plant ceased in February 1997 when new heating systems became operational.

3.4.2 Electricity

LANL is supplied with electrical power through a cooperative arrangement with Los Alamos County, known as the Los Alamos Power Pool (LAPP), which was established in 1985. The DOE Albuquerque Operations Office and Los Alamos County have entered into a 10-year contract known as the Electric Coordination Agreement whereby each entity's electric resources are consolidated or pooled. The capacity rating of LAPP resources, less losses, is 110 megawatts and 88 megawatts (summer and winter seasons, respectively). The transmission import capacity is contractually limited to 95 megawatts and 73 megawatts (summer and winter seasons, respectively).

The ability to accept additional power into the LAPP grid is limited by the regional electric import capability of the existing northern New Mexico power transmission system. In recent years, the population growth in northern New Mexico, together with expanded industrial and commercial usage, has greatly increased the power demands on the northern New Mexico regional power system. Several proposals for bringing additional power into the region have been considered. Power line corridor locations remain under consideration, but it is uncertain when any new regional power lines would be constructed and become serviceable. An additional limitation to additional power is the contractual rights held by the LAPP for importing power from the regional transmission network.

Table 3.4.2-1 shows peak demand and Table 3.4.2-2 shows annual use of electricity for fiscal year 1999. LANL's electrical energy use remains below projections in the ROD. The ROD projected peak demand to be 113,000 kilowatts with 63,000 kilowatts being used by LANSCE and about 50,000 kilowatts being used by the rest of the Laboratory. In addition, the ROD projected annual use to be 782,000 megawatts with 437,000 megawatts being used by LANSCE and about 345,000 megawatts being used by the rest of the Laboratory. Actual use has fallen below these values, and the projected periods of brownouts have not occurred. However, on a regional basis, failures in the PNM system have caused blackouts in northern New Mexico and elsewhere.

Table 3.4.2-1. Electric Peak Coincident Demand/Fiscal Year 1999

CATEGORY	LANL BASE	LANSCE	LANL TOTAL	COUNTY TOTAL	POOL TOTAL
SWEIS ROD	50,000[a]	63,000	113,000	Not projected	Not projected
FY1999	43,976	24,510	68,486	14,399	82,885

[a] All figures in kilowatts.

Table 3.4.2-2. Electric Consumption/Fiscal Year 1999

CATEGORY	LANL BASE	LANSCE	LANL TOTAL	COUNTY	POOL TOTAL
SWEIS ROD	345,000[a]	437,000	782,000	Not projected	Not projected
FY1999	255,562	113,759	369,321	106,547	475,868

[a] All figures in megawatt-hours.

3.4.3 Water

Before September 8, 1998, DOE supplied all potable water for LANL, Bandelier National Monument, and Los Alamos County, including the towns of Los Alamos and White Rock. This water was obtained from DOE's groundwater right to withdraw 5541.3 acre-feet/year or about 1806 million gallons of water per year from the main aquifer. On September 8, 1998, DOE leased these water rights to Los Alamos County. This lease also included DOE's contracted annual right obtained in 1976 to 1200 acre-feet/year of San Juan-Chama Transmountain Diversion Project water. The lease agreement is effective for three years, although the County can exercise an option to buy sooner than three years. DOE expects to convey 70% of the water rights to Los Alamos County and lease the remaining 30% to them. The San Juan-Chama rights will be transferred in their entirety to the County. The agreement between DOE and the County does not preclude provision of additional waters in excess of the 30% agreement, if available. However, the agreement also states that should the County be unable to provide water to its customers, the County shall be entitled to reduce water services to DOE in an amount equal to the water deficit.

The DOE and LANL recognize the need to adhere to the provisions of the lease agreement. However, it is important to make a distinction between water rights and water use. For example, in 1997, LANL used 38% of the total water used, and Los Alamos County used the remaining 62%, for the 100% total. However, this water use did not use 100% of the water rights. LANL used only 27% of the water rights, while Los Alamos County used 44% of the water rights, leaving 29% of the water rights unused. That unused portion of water rights is available for sale, according to the agreement. The future development of the County could, however, increase the County's water use. Thus, the Laboratory is neither guaranteed 1662 acre-feet/year (542 million gallons/year) nor necessarily limited to 1662 acre-feet/year.

In addition, it is also important to understand how the Laboratory water use has been determined. Up to the transfer of the water production system to the County, the Laboratory was responsible for water production. Water usage by the County was metered. The Laboratory water usage was estimated by subtracting the county usage from the known well production. Until the transfer, users such as Bandelier National Monument and others were included in the Laboratory total, as were losses in the supply system, such as would occur from the purging of wells.

Metering of LANL's actual water usage began in October 1998 after Los Alamos County took over the water production system on September 8, 1998. Meters are planned to be added at selected facilities/equipment and trunk lines to begin to determine specific use at LANL.

Table 3.4.3-1 shows water consumption in thousands of gallons for calendar year 1999. Under the expanded alternative, water use for LANL was projected to be 759 million gallons per year with 265 million gallons being used by LANSCE and 494 million gallons being used by the rest of the Laboratory. Actual use by LANL in 1999 was about 300 million gallons less than the projected consumption and 89 million gallons less than the 542 million gallons/year under the agreement with the County. The calculated NPDES discharge of 317 million gallons was about 70% of the total LANL usage of 453 million gallons.

Table 3.4.3-1. Water Consumption (thousands of gallons) for Calendar Year 1999

CATEGORY	LANL	LOS ALAMOS COUNTY	TOTAL
SWEIS ROD	759,000	Not Available [a]	Not Available [a]
Calendar Year 1999	453,094	Not Available [a]	Not Available [a]

[a] On September 8, 1998, Los Alamos County acquired the water supply system and LANL no longer collects this information.

As a result of the lease, LANL no longer maintains records for total water consumption or usage by Los Alamos County. The County now bills LANL for water, and all future water use records maintained by LANL will be based on those billings. Along with this transfer, Los Alamos County accepted responsibility for all chlorinating stations, and the County now operates these stations. The distribution system remaining under LANL control, and being used to supply water to LANL facilities, now consists of a series of reservoir storage tanks, pipelines, and fire pumps. The LANL system is gravity fed with fire pumps for high-demand situations.

Deep well drilling rig

3.5 Worker Safety

Working conditions at LANL have remained essentially the same as those identified in the SWEIS. DARHT and Atlas—major construction activities—were reflected in the SWEIS analysis. Few other major construction projects have been undertaken, and more than half the workforce remains routinely engaged in activities that are typical of office and computing industries. Much of the remainder of the workforce is engaged in light industrial and bench-scale research activities. Approximately one-tenth of the general workforce at LANL continues to be engaged in production, services, maintenance, and research and development within Nuclear and Moderate Hazard facilities.

3.5.1 Accidents and Injuries

Occupational injury and illness rates for workers at LANL declined during calendar year 1999 as shown in Table 3.5.1-1. These rates correlate to 258 reportable injuries and illnesses during the year, compared to 507 projected by the ROD.

Table 3.5.1-1. Total Recordable and Lost Workday Case Rates at LANL

CALENDAR YEAR	UC WORKERS ONLY		LANL (ALL WORKERS)	
	TRI [a]	LWC [b]	TRI	LWC
1999	2.37	1.24	2.52	1.37

[a] TRI: Total Recordable Incident rate, number per 200,000 hours worked
[b] LWC: Lost Workday Cases, number of cases per 200,000 hours worked

3.5.2 Ionizing Radiation and Worker Exposures

Occupational radiation exposures for workers at LANL during calendar year 1999 are summarized in Table 3.5.2-1. The collective Total Effective Dose Equivalent, or collective TEDE, for the LANL workforce during 1999 was 131 person-rem, considerably lower than the workforce dose of 704 person-rem projected for the ROD.

Table 3.5.2-1. Radiological Exposure to LANL Workers

PARAMETER	UNITS	SWEIS ROD	VALUE FOR 1999
Collective TEDE (external + internal)	person-rem	704	131
Number of workers with non-zero dose	number	3548	1427
Average non-zero dose:			
external + internal	millirem	Not projected	92
external only	millirem	Not projected	90

These reported doses for 1999 could change with time. Estimates of committed effective dose equivalent in many cases are based on several years of bioassay results, and as new results are obtained the dose estimates may be modified accordingly.

Of the 131 person-rem collective TEDE reported for 1999, external radiation and tritium exposure accounted for 128 person-rem. The remainder is from internal exposure. It is not possible to identify a single reason for the decrease in collective TEDE in 1999 from the 208 person-rem of 1993–1995. Rather, the decrease is an aggregation of several reasons, the more important of which include the following:

Work and Workload: Changes in workload and types of work have resulted in a decreased collective TEDE. The SWEIS used the 1993–1995 time frame as its base. For example, at that time the radionuclide power source for the Cassini spacecraft was being constructed at TA-55. This project incurred higher neutron exposure for the workers. After the project was completed in the 1995–1996 time frame, the LANL collective TEDE was reduced.

As Low As Reasonably Achievable (ALARA) Program: Improvements from the ALARA program, such as the continuing addition of shielding at LANL workplaces, have also resulted in lower worker exposures and consequently a reduced collective TEDE for the Laboratory.

Improved personnel dosimeter: An improved personnel dosimeter was introduced on a Laboratory-wide basis in April 1998. The dosimeter's increased accuracy in measuring the external neutron dose removed some conservatism that had been previously used in estimating the dose, which resulted in lower reported doses. (The actual dose did not change, but the ability to measure it accurately improved.)

Internal dose: Finally, the TEDE in 1999 was also lower because the 1999 internal collective effective dose equivalent was lower than that of 1993–1995.

In addition to being less than the TEDE levels in 1993–1995, the TEDE for 1999 is also less than the TEDE projected in the ROD. Because the ROD was not signed until September 1999, the implementation of war reserve pit manufacture was not fully operational at LANL. This also contributed to lower doses than projected in the SWEIS.

Collective TEDEs for Key Facilities In general, TEDEs by Key Facility or TA are difficult to determine because these data are collected at the Group level, and members of many groups and/or organizations receive doses at several locations. The fraction of a group's collective TEDE coming from a specific Key Facility or TA can only be estimated. For example, personnel from the Health Physics Operations Group and JCNNM are distributed over the entire Laboratory, and these two organizations account for a significant fraction of the total LANL collective TEDE. Nevertheless, because the groups working at TA-55 and TA-18 are relatively well defined, an estimate was made of the 1999 collective TEDE for the Plutonium Complex (93 person-rem) and the Pajarito Site (1.8 person-rem) Key Facilities. The estimate for TA-55 demonstrates that approximately two-thirds of the total Laboratory TEDE is a result of operations at the Plutonium Complex.

3.6 Socioeconomics

The LANL-affiliated workforce continues to include UC employees and subcontractors. As shown in Table 3.6-1, there has been a steady growth in number of employees. The 12,412 employees at the end of calendar year 1999 represent 1061 more employees than were anticipated under the ROD, which projected a workforce of 11,351 based on the 10,593 employees identified for the index year (employment as of March 1996) in the SWEIS.

Table 3.6-1. LANL-Affiliated Work Force

CATEGORY	UC EMPLOYEES	TECHNICAL CONTRACTOR	NON-TECHNICAL CONTRACTOR	JCNNM	PTLA	TOTAL
SWEIS ROD [a]	8740	795	Not projected [b]	1362	454	11,351
calendar year 1999	9185	1064	214	1461	488	12,412

[a] Total number of employees was presented in the ROD, the breakdown had to be calculated based on the percentage distribution shown in the ROD for the base year.

[b] Data were not presented for non-technical contractors or consultants.

This increase in employees has had a positive economic impact on northern New Mexico. Through 1998, DOE published a report each fiscal year regarding the economic impact of LANL on north-central New Mexico as well as the State of New Mexico (Lansford et al., 1997, 1998, and 1999). The findings of these reports indicate that LANL's activities resulted in a total increase in economic activity in New Mexico of about $3.2 billion in 1996, $3.9 billion in 1997, and $3.8 billion in 1998. Based on number of employees and payroll, it is expected that LANL's 1999 economic contribution was similar to the previous three years.

The residential distribution of the new UC employees (e.g., the total 240 additional employees in 1999) reflects the housing market dynamics of three counties. As seen in Table 3.6-2, more than 90% of the UC employees continue to reside in the three counties of Los Alamos, Rio Arriba, and Santa Fe.

Table 3.6-2. County of Residence for UC Employees [a]

CALENDAR YEAR	LOS ALAMOS	RIO ARRIBA	SANTA FE	OTHER NM	TOTAL NM	OUTSIDE NM	TOTAL
SWEIS ROD [b]	4279	1762	1678	671	8390	350	8740
calendar year 1999	4833	1523	1805	529	8690	495	9185

[a] Includes both Regular and Temporary employees, including students who may not be at the Laboratory for much of the year.
[b] Total number of employees was presented in the ROD, the breakdown had to be calculated based on the percentage distribution shown in the ROD for the base year.

Laboratory records contain the TA and building number of each employee's office. This information does not necessarily indicate where the employee actually performs his or her work; but rather, indicates where this employee gets mail and officially reports to duty. However, for purposes of tracking the dynamics of changes in employment across Key Facilities, this information provides a useful index. Table 3.6-3 identifies UC employees by Key Facility based on the facility definitions contained in the SWEIS. The employee numbers contained in the category "Rest of LANL," were calculated by subtracting the Key Facility numbers from the calendar year total.

The numbers in Table 3.6-3 cannot be directly compared to numbers in the SWEIS. The employee numbers for Key Facilities in the SWEIS represent total workforce, and include PTLA, JCNNM, and other subcontractor personnel. The new index (shown in Table 3.6-3) is based on routinely collected information and only represents full-time and part-time regular UC employees. It does not include employees on leave of absence, students (high school, cooperative, undergraduate, or graduate), or employees from special programs (i.e., limited-term or long-term visiting staff, post-doctorate, etc.). Because the two sets of numbers do not represent the same entity, a comparison to numbers in the SWEIS is not appropriate. This new index will be used throughout the lifetime of the Yearbook; hence, future comparisons and trending will be possible.

Table 3.6-3. UC Employee[a] Index for Key Facilities

KEY FACILITY	CALENDAR YEAR 1999
Plutonium Complex	589
Tritium Facilities	28
CMR	204
Pajarito Site	70
Sigma Complex	101
MSL	57
Target Fabrication	54
Machine Shops	81
High Explosive Testing	227
High Explosive Processing	96
LANSCE	560
HRL	98
Radiochemistry Laboratory	128
Waste Management – Radioactive Liquid Waste	62
Waste Management – Radioactive Solid and Chemical Waste	65
Rest of LANL	4601
Total Employees	7021

[a] Includes full-time and part-time regular employees; it does not include students who may be at the Laboratory for much of the year nor does it include special programs personnel. This definition was incorrectly stated in the 1998 Yearbook. A similar index does not exist in the ROD, which used a very time-intensive method to calculate this index.

3.7 Land Resources

Land resources (i.e., undeveloped and developed lands) at LANL and the surrounding area had several changes during 1999. Major construction projects included the SCC, NISC, and IRP. Each of these projects had their own NEPA documentation. The SCC and NISC are being constructed in areas previously disturbed for parking lots or other structures. The IRP represents green-field construction and will ultimately result in a loss of about 30 acres.The remainder of the construction was done within existing facilities.

The SWEIS projected a habitat reduction of 41 acres under the Expanded Alternative because of the expansion of Area G. In 1999, this expansion was not undertaken.

In 1999, the only major construction project identified in the ROD outside of existing facilities at LANL was DAHRT. The actual habitat loss and ground breaking activities associated with this project happened during construction start-up in 1992 and 1993 when the land was cleared of vegetation and the "footprint" of this facility was established.

3.8 Groundwater

As projected by the ROD, water levels in supply wells penetrating into the regional aquifer continue to decline in response to pumping, typically by several feet each year. In areas where pumping is reduced, water levels show some recovery. No unexplained changes in patterns have occurred in the 1995–1999 period. Regionally, water levels in the aquifer have continued a gradual decline that started in about 1977.

Well R-25, located near the western boundary of TA-16

Analysis of samples from the production wells showed that water quality continued to meet drinking water standards and continued to indicate no problematic trends. Water quality measurements for test wells, however, continue to show the presence of contamination from the Laboratory at the top of the regional aquifer, but at concentrations mostly below drinking water standards. In 1998, drilling of the characterization well R-25 at TA-16 revealed the presence of high explosives constituents at concentrations that are above the EPA Health Advisory guidance values for drinking water. Although the extent of high explosives constituents in the regional aquifer is presently unknown, continued testing in 1999 shows no high explosives constituents in water supply wells. Nitrate concentrations in TW-1 in Pueblo Canyon have been near the EPA maximum contaminant level since 1980. The source of the nitrate might be infiltration of sewage effluent in Pueblo Canyon, or it might be residual nitrates from the now-decommissioned TA-45 RLWTF that discharged into upper Pueblo Canyon until 1964.

Work underway as part of the Hydrogeologic Workplan provided new information on the regional aquifer and details of hydrogeologic conditions. By the end of 1999, four new wells had been drilled into the regional aquifer. Two were located near the eastern boundary of the Laboratory in Los Alamos Canyon (R-9) and Sandia Canyon (R-12). These two wells encountered several intermediate-depth perched zones of varying hydrologic and chemical quality. Both wells show that minor contamination has infiltrated from the surface into the perched zones and the uppermost regional aquifer.

R-25 was located near the western boundary in TA-16. This well encountered a thick perched zone at an elevation several hundred feet above the top of the regional aquifer. This perched zone was anticipated because of results of an earlier well drilled nearby. Based on preliminary findings in R-25, high explosives contaminants were found throughout the perched zone and also several hundred feet into the regional aquifer. The source of these contaminants is probably the discharge of high explosives wastewater at TA-16 since the late 1940s.

R-15 is located on the floor of Mortandad Canyon, approximately one mile upstream of the eastern Laboratory boundary. The well is downstream of the TA-50 RLWTF effluent discharge point. During drilling, tritium levels of approximately 4000 pCi/L were found in a perched groundwater zone at 646 feet, indicating Laboratory impacts. However, tritium levels of <3 pCi/L in the regional aquifer indicated no contamination. R-15 has been cased and developed.

None of the contaminants found in these new test wells exceed current drinking water standards. However, the uranium concentration in one perched zone in well R-9 is greater than the proposed EPA drinking water maximum concentration level, and TNT and RDX concentrations in well R-25 are greater than EPA Health Advisory values. Following the discovery of high explosives in well R-25, the nearest water supply wells were sampled and no high explosives contamination was detected (LANL 1999b).

These and other findings from the Hydrogeologic Workplan are adding to the understanding of the hydrologic setting at Los Alamos. Findings include (a) recognition of more perched zones above the regional aquifer than previously discovered; (b) confirmation that there is significant groundwater recharge along the flank of the Jemez Mountains;,(c) recognition that there may be more groundwater recharge from canyon bottom alluvial groundwater than previously believed; and (d) the finding of Laboratory contaminants in perched zones and the regional aquifer at predicted locations where wells had not previously been drilled. These findings extend the areas that have been investigated by drilling, rather than change the picture of the hydrological system. Work continues under the Hydrogeologic Workplan to increase understanding of the hydrogeologic conditions and to ensure the safety of the drinking water supply.

3.9 Cultural Resources

The LANL site has a large number of diverse archaeological sites. Approximately 60% of LANL lands have been systematically surveyed and approximately 1600 archaeological sites have been identified in this process. Within LANL's limited access boundaries, there are ancestral villages, shrines, petroglyphs, sacred springs, trails, and traditional use areas that could be identified by Pueblo and Athabascan communities as traditional cultural properties.

The SWEIS reported 3668 inventoried resources. These resources included 1295 prehistoric resources (BC 4000–1600 AD), 87 historic homesteading and commercial resources (1600–1942 AD), 2232 World War II-Late Cold War era buildings and facilities (1943–1989 AD), and 54 areas within LANL identified by consulting communities (Native American pueblos, tribes, and local Hispanic communities) as having traditional cultural properties. Since the ROD, LANL surveys have identified an additional 91 archaeological sites (Table 3.9-1). All of these resources continue to be protected. No excavation of sites at TA-54 (as projected by the ROD) or at any other part of LANL has occurred. The following paragraphs provide details.

Table 3.9-1 Acreage Surveyed, Cultural Resource Sites Recorded, and Cultural Resource Sites Eligible for the National Register of Historic Places at LANL Fiscal Year 1999[a]

FISCAL YEAR	TOTAL ACREAGE SURVEYED	TOTAL ACREAGE SURVEYED TO DATE	TOTAL ARCHAEOLOGICAL SITES RECORDED TO DATE (CUMULATIVE)	NUMBER OF ELIGIBLE & POTENTIALLY ELIGIBLE NRHP[b] SITES	NUMBER OF NOTIFICATIONS TO INDIAN TRIBES
LANL SWEIS	Not reported	Not Reported	3668	1092	23
1999	1074	19,011	3759	1288	12

[a] Source: The Secretary of Interior's Report to Congress on Federal Archaeological Activities. Information on LANL is from DOE/Los Alamos Area Office and LANL Cultural Resources Management Team.
[b] NRHP is National Register of Historic Places.

The Laboratory and National Park Service continued a long-term monitoring program at the prehistoric pueblo of Nake'muu. This is the only pueblo within LANL that has standing walls. The pueblo's architecture has been mapped, photographed, and drawn to provide a baseline for comparison. This information is monitored on an annual basis, with continual assessments made of site condition, rate of deterioration, and possible sources of impact (e.g., vibrations from high explosives testing). An increased frequency in explosive testing at LANL presents a potential for shrapnel impacts and vibration damage to this sensitive cultural resource. Nake'muu will continue to be monitored for all types of deterioration or destruction, including monitoring the effects of explosives vibrations on the pueblo's walls.

Typical Mortandad Canyon cavate petroglyph

Nake'muu—one of the best preserved ruins at LANL

3.10 Ecological Resources

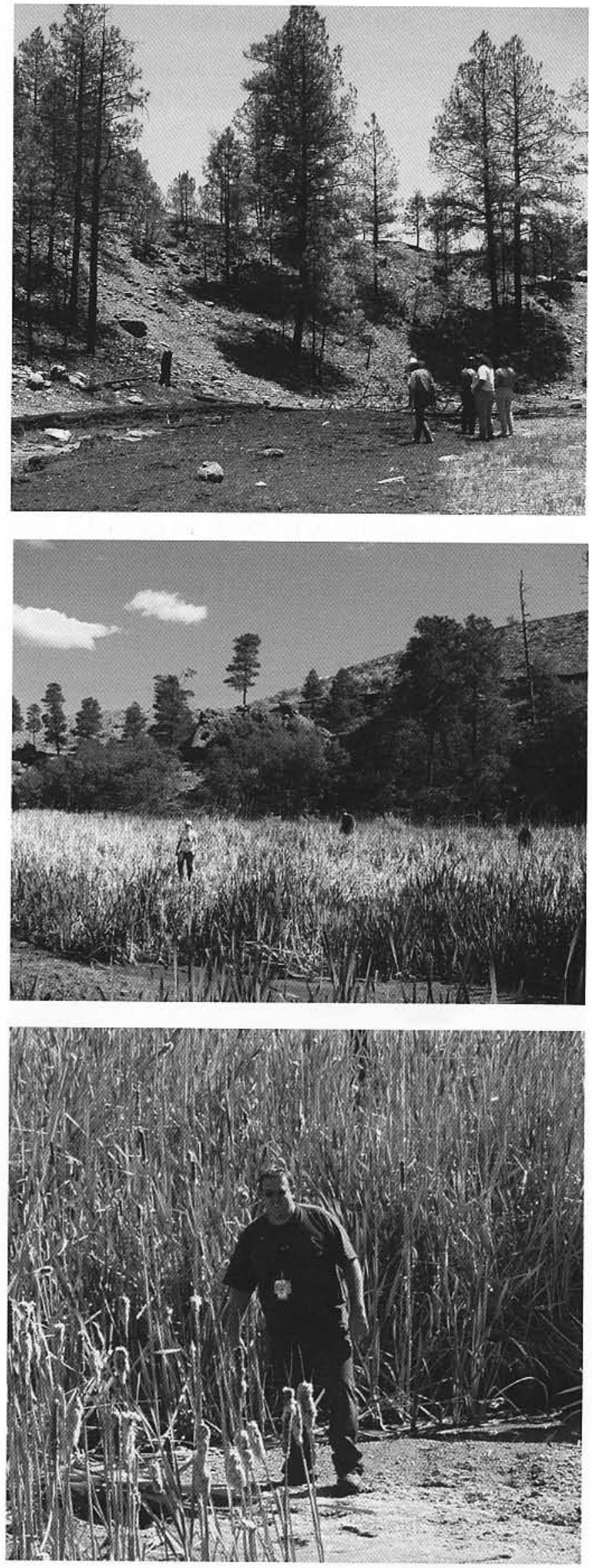
The historic presence of LANL, with its highly restricted access and other unique land use practices, continues to support a rich diversity of natural resources within northern New Mexico.

No significant adverse impacts to biological resources, ecological processes, or biodiversity, including threatened and endangered species, were projected by the ROD. Data collected for 1999 support this projection. These data are reported in the Environmental Surveillance Report for 1999 (LANL 2000b).

3.10.1 Threatened and Endangered Species Habitat Management Plan

The Threatened and Endangered Species Habitat Management Plan (HMP) received US Fish and Wildlife Service concurrence on February 12, 1999. The plan is used in project reviews to provide guidelines to project managers for assessing potential impact to Federally listed threatened and endangered species including the Mexican spotted owl, southwestern willow flycatcher, and bald eagle. The US Fish and Wildlife Service removed the American peregrine falcon from the endangered species list, and the HMP was updated to reflect this change. The HMP was incorporated into the NEPA, Cultural, and Biological Laboratory Implementing Requirements document developed during 1999.

In 1999, the Laboratory completed several contaminant studies and continued risk assessment studies on the food chain for threatened and endangered species inhabiting Laboratory lands. These studies included assessment of organic and metal contamination in the food chain for selected endangered species. Additional studies were done to assess the impact of burrowing animals on the redistribution of buried radioactive waste at Area G.



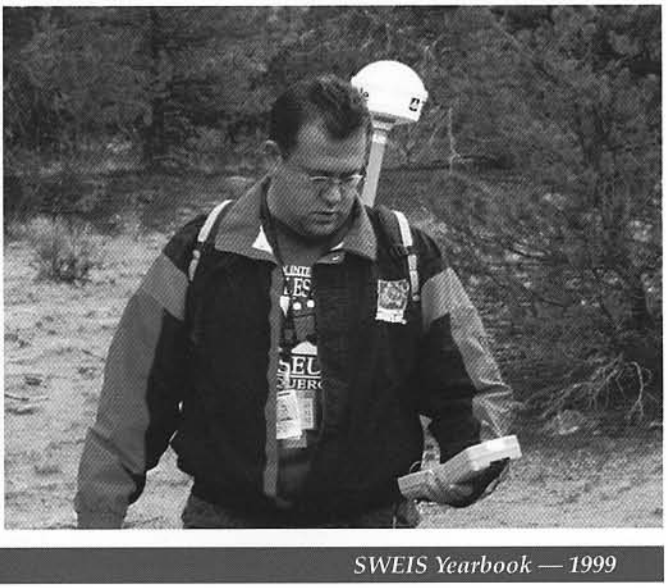
Biological field work

3.10.2 Biological Assessments

In January 1999, DOE submitted an amended biological assessment for the SWEIS to the US Fish and Wildlife Service for concurrence.

No floodplain and wetland assessments were conducted during 1999.

During 1999, the Laboratory also reviewed approximately 475 proposed activities and projects for potential impact on biological resources including Federal or State listed threatened and endangered species. These reviews evaluate the amount of previous development or disturbance at the proposed construction site to determine the presence of wetlands or floodplains in the project area, and to determine whether habitat evaluations or species-specific surveys are needed. The Laboratory adhered to protocols set by the US Fish and Wildlife Service and to permit requirements of the New Mexico State Game and Fish Department.



4.0 Additive Analysis

To enhance the usefulness of the Yearbook, data conducive to an additive analysis (i.e., the annual accumulation of radioactive waste compared to the capacity of Area G) or data that shows annual trends (i.e., decline in worker injuries over time) will be presented here. Full implementation of this section is anticipated in the 2000 Yearbook. The presentation made here is to demonstrate the type of analysis expected for the various parameters to be examined.

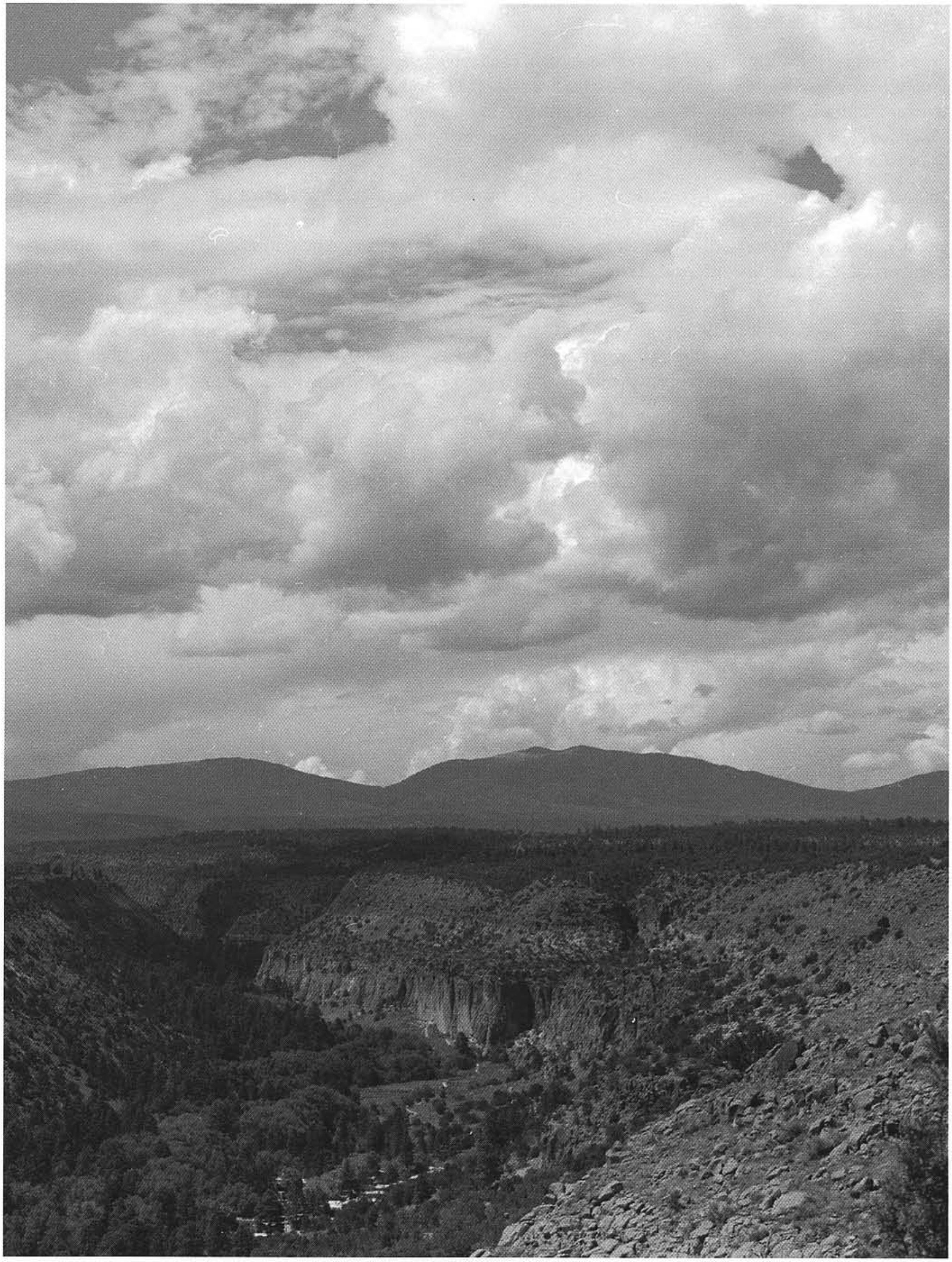
Solid Radioactive and Chemical Waste: Although the ROD identifies LLW and MLLW as the only waste types disposed on-site, LANL also disposes some solid wastes on-site. However, most chemical waste is shipped off-site to commercial treaters, disposers, or recyclers. Certain other wastes are held in storage pending availability of commercial treatment and disposal, development of appropriate technologies, or in the case of TRU and MTRU wastes, shipment to WIPP.

Existing capacity for LLW disposal at Area G was estimated at 36,000 cubic meters, and the Expanded Alternative estimated the need for disposal of 112,000 cubic meters. Thus, the ROD evaluated the need for an expansion of Area G to dispose the projected volume of LLW and identified several options, any of which would handle the estimated volumes of LLW.

As shown in Table 4.0-1, the cumulative waste volume is 3610 cubic meters or about 10% of the existing volume capacity of Area G.

Table 4.0-1 Cumulative LLW and MLLW Volumes

Waste Type	Units	SWEIS ROD	1998	1999	Cumulative Volume
LLW	m^3/yr	12,200	1807	1710	3517
MLLW	m^3/yr	632	72	21	93
Combined	m^3/yr	12,832	1879	1731	3610



5.0 Summary and Conclusion

5.1 Summary

The SWEIS Yearbook for 1999 reviews calendar year 1999 operations for the 15 Key Facilities (as defined by the SWEIS) at LANL and compares those operations to levels projected by the ROD. The Yearbook also reviews the environmental parameters associated with operations at the same 15 Key Facilities and compares this data with ROD projections. In addition, the Yearbook presents a number of site-wide effects of those operations and environmental parameters. The more significant results presented in the Yearbook are as follows:

Facility Construction and Modifications: The ROD projected a total of 38 facility construction and modification projects for LANL facilities. Ten of these projects were listed only in the Expanded Operations Alternative, such as modifications at CMR for safety testing of pits in the Wing 9 hot cells, expansion of the LLW disposal area at TA-54, Area G, and the LPSS at TA-53. These ten projects could not proceed until DOE issued the ROD in September 1999. However, the remaining 28 construction projects were projected in the No Action Alternative. These included facility upgrades (e.g., safety upgrades at the CMR Building and process upgrades at the RLWTF), facility renovation (e.g., conversion of the former Rolling Mill, Building 03-141, to the BTF), and the erection of new storage domes at TA-54 for TRU wastes. Since these projects had independent NEPA documentation, they could proceed while the SWEIS was still in process.

Activities have proceeded on many of the 38 projects. Thirteen projects have now been completed, seven in 1999 and six in 1998. Additionally, another 10 projects were begun or continued in 1999. The seven projects completed in 1999 were

- replacement of the graphite collection systems at Sigma;
- modification of the industrial drain system at Sigma;
- replacement of electrical components at Sigma;
- relocation of the Weapons Components Testing Facility at High Explosives Processing;
- making LEDA operational;
- bringing the new UF/RO process on-line at RLWTF; and
- bringing the nitrate reduction equipment on-line at RLWTF.

In addition to facility modification and construction projects forecast by the ROD, several other projects were started during 1999. Four projects were in the construction phase: Atlas, the IRP, the SCC, and the NISC. The other project, the Central Health Physics Calibration Laboratory, was in the design phase. These are discussed in Chapter 2 of the Yearbook, along with references to the NEPA document (categorical exclusion or environmental assessment) that preceded the project.

Facility Operations: The SWEIS grouped LANL into 15 Key Facilities, identified the operations at each, and then projected the level of activity for each operation. These operations were grouped under 95 different capabilities for the Key Facilities. During 1999, there was activity under 90 of these capabilities. The five not used were Fabrication and Metallography at the CMR, ATW at LANSCE, Medical Isotope Production at LANSCE, Other Waste Processing at the Solid Radioactive and Chemical Waste Facility, and Size Reduction at the Solid Radioactive and Chemical Waste Facility.

While there was activity under nearly all capabilities, the levels of these activities were mostly below levels projected by the ROD. For example, the LANSCE linac generated an H^- proton beam for 2737 hours in 1999, at an average current of 93 microamps, compared to 6400 hours at 200 microamps projected by the ROD. Similarly, a total of 188 criticality experiments were conducted at Pajarito Site, compared to the 1050 projected experiments.

As in 1998, only three of LANL's facilities operated during 1999 at levels approximating those projected by the ROD—the MSL, the HRL, and the Non-Key Facilities. None of these facilities are major contributors to parameters that lead to significant potential environmental impacts. The remaining 13 Key Facilities all conducted operations at or below projected activity levels.

Operations Data and Environmental Parameters: This 1999 Yearbook evaluates the effects of LANL operations in three general areas—effluents to the environment, workforce and regional consequences, and changes to environmental areas for which the DOE has stewardship responsibility as the owner of a large tract of land.

Effluents include air emissions, liquid effluents regulated through the NPDES program, and solid wastes. Radioactive air emissions totaled about 1900 curies compared to 21,700 projected by the ROD. This results in a hypothetical maximum dose to a member of the public of 0.32 millirem (compared to 5.44 projected). Calculated NPDES discharges totaled 317 million gallons compared to a projected volume of 278 million gallons per year. While the number of outfalls has been reduced, the methodology for calculating the discharges may result in an overestimate. For some facilities, outfall flows are recorded on a continuous basis; this was the case for outfalls at SWS, HEWTF, RLWTF, LANSCE, and the Power Plant. For all other outfalls, annual totals were calculated from average flows documented in the Laboratory's DMRs. The latter method substantially overestimates the quantity of wastewater discharged because it is based on infrequent sampling and the DMRs assume round-the-clock flow for all outfalls. As in the SWEIS Yearbook for 1998, operational knowledge relative to water supply wells and pump stations allowed more realistic estimates of flows for those outfalls by eliminating the need to assume 24-hour flow.

Solid radioactive and chemical wastes ranged from 3% (MLLW) to 475% (chemical waste) of projected quantities (see Table 3.3-1). These extremely large quantities of chemical waste are a result of ER Program activities (remediation of old MDAs). Most chemical wastes are shipped off-site for disposal at commercial facilities; therefore, these large quantities of chemical waste will not impact LANL environs. The one anomaly in 1999 is the 4003 cubic meters of solid wastes disposed in pits at Area J. These administratively controlled wastes resulted from ER Project remedial activities at MDA-P and far exceeded the projections of 100 cubic meters per year. However, this material was non-hazardous wastes, soil, concrete rubble, and debris placed in MDA-J as fill in preparation of capping (1999 Annual Report Questionnaire for the Los Alamos National Laboratory, Technical Area 54, Area J Landfill).

Workforce data were above projections. The 12,412 employees at the end of calendar year 1999 represent 1061 more employees than projected by the ROD. Thus, regional socioeconomic consequences, such as salaries and procurements, also should have exceeded projections.

Electricity use during 1999 totaled 369 gigawatt-hours with a peak demand of 68 megawatts, compared to projections of 782 gigawatt-hours and 113 megawatts. Water usage was 453 million gallons (compared to 759 million gallons projected), and natural gas consumption totaled 1.43 million decatherms (compared to 1.84 projected).

The collective TEDE for the LANL workforce during 1999 was 131 person-rem, considerably lower than the projected workforce dose of 704 person-rem.

Parameters of environmental stewardship were similar to (ecological resources and groundwater) or lower than (cultural resources and land use) ROD projections. For land use, the ROD projects the disturbance of 41 acres of new land at TA-54 because of the need for additional disposal cells for LLW. Through 1999, however, this expansion had not begun. Groundbreaking did occur on 30 acres of land that are being developed along West Jemez Road for the IRP. This project has its own NEPA documentation, and the land is being leased to Los Alamos County for this development.

Cultural resources remained protected, and no excavation of sites at TA-54 or any other part of LANL has occurred. (The ROD projected that 15 prehistoric sites would be affected by the expansion of Area G into Zones 4 and 6 at TA-54.)

As projected by the ROD, water levels in wells penetrating into the regional aquifer continue to decline in response to pumping, typically by several feet each year. In areas where pumping is reduced, water levels show some recovery. No unexplained changes in patterns have occurred in the 1995–1999 period, and water levels in the regional aquifer have continued a gradual decline that started in about 1977.

Ecological resources continued to be enhanced as a result of protection afforded by DOE ownership of LANL. These resources include biological resources such as protected sensitive species, ecological processes, and biodiversity.

5.2 Conclusions

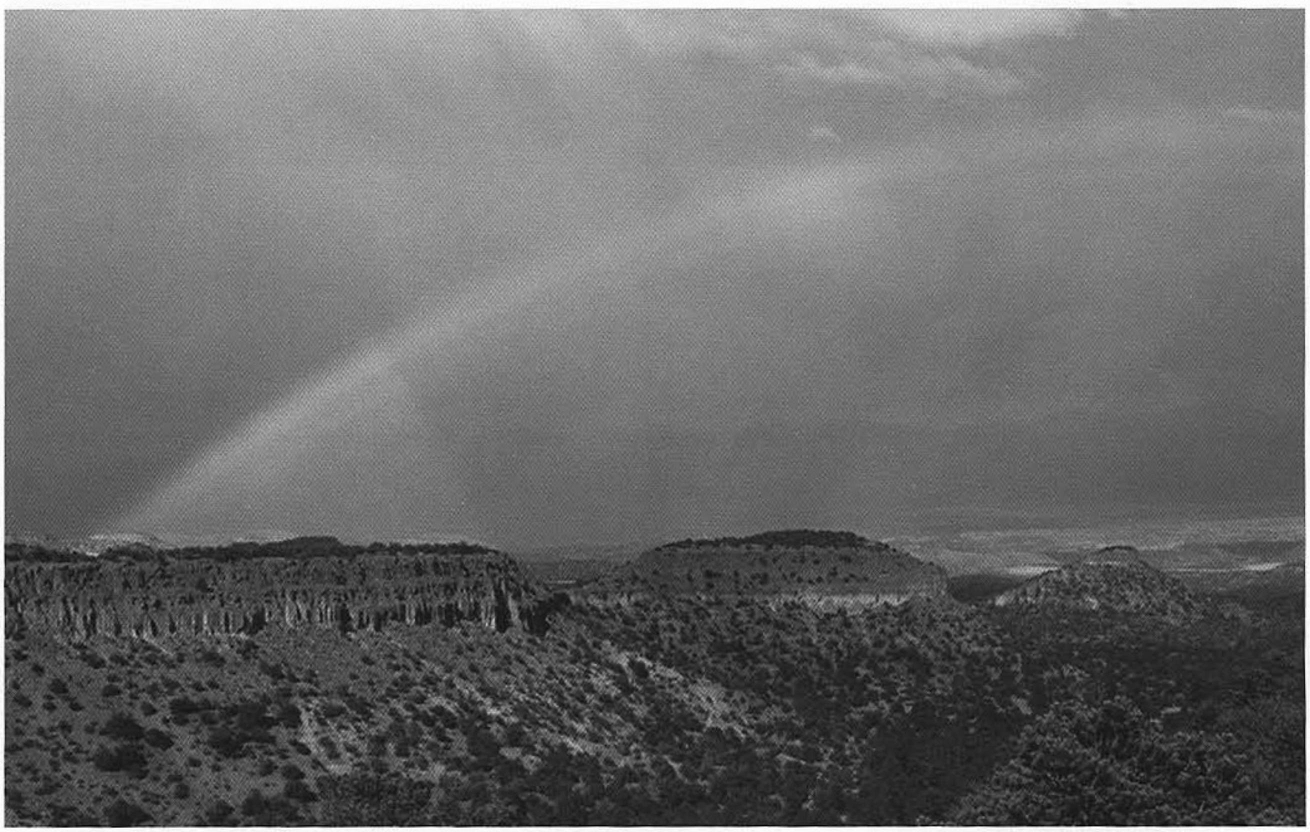
The data for 1999 reveal effects from LANL operations that are below levels projected by the SWEIS ROD. Site-wide, there are two main reasons for this fact. The ROD was not issued until September 1999; consequently operations were more likely to be at levels consistent with pre-ROD conditions. Moreover, data in the SWEIS were presented for the highest level projected over the ten-year period 1996–2005. Thus, the data from early years in the projection period (1999) would be expected to fall below the maximum.

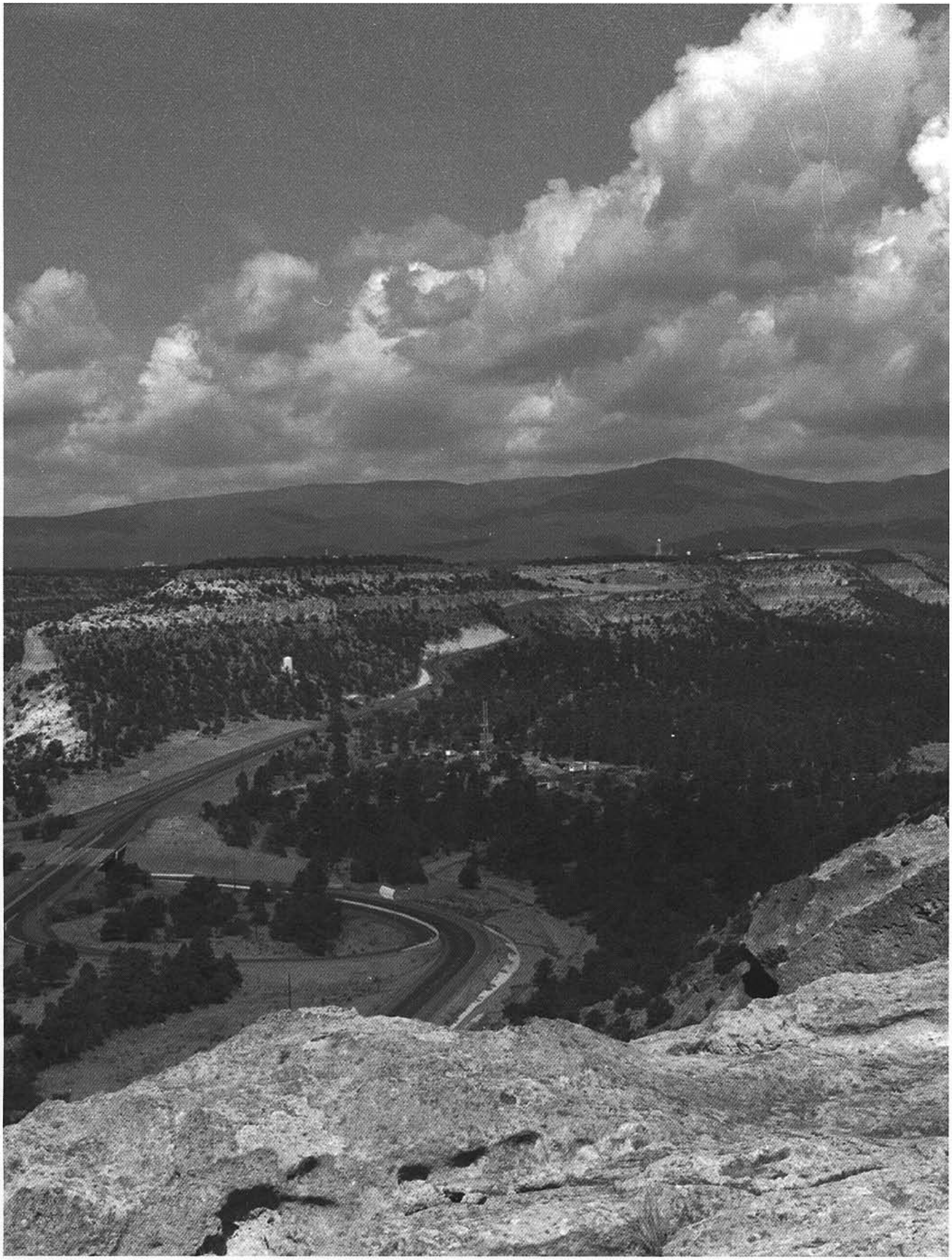
One purpose of the 1999 Yearbook is to compare LANL operations and resultant 1999 data to the SWEIS in order to determine if LANL was still operating within the environmental envelope established by the SWEIS and the ROD. Data for 1999 indicate that positive impacts (such as socioeconomics) were greater than SWEIS projections, while negative impacts, such as radioactive air emissions and land disturbance, were, for the most part, within the SWEIS envelope.

5.3 To the Future

The Yearbook will continue to be prepared on an annual basis, with operations and relevant parameters in a given year compared to SWEIS projections for activity levels chosen by the ROD. The presentation proposed for the 2000 Yearbook will follow that developed for the previous Yearbooks—comparison to the ROD.

The 1999 Yearbook is an important step forward in fulfilling a commitment to make the SWEIS for LANL a living document. Future Yearbooks are planned to continue that role.





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Appendix: Chemical Usage and Estimated Emissions Data

Table A-1. Comparison of Chemicals used in 1995 and 1999

TECHNICAL AREA	NUMBER OF CHEMICALS USED IN 1995 BUT NOT IN 1999	NUMBER OF CHEMICALS USED IN 1999 BUT NOT IN 1995
03	107	8
08	6	3
09	34	11
15	8	2
16	35	9
18	12	4
21	119	3
35	134	8
39	10	0
40	3	3
43	18	19
48	61	22
50	12	13
53	8	0
54	46	0
55	92	1

Table A-2. Chemical and Metallurgy Research Building

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
Chemistry and Metallurgy Research Building				
	Acetic Acid	kg/yr	0.2	0.5
	Acetone	kg/yr	2.5	7.1
	Ammonium Chloride (Fume)	kg/yr	0.3	0.8
	Diethylene Triamine	kg/yr	0.3	1.0
	Ethanol	kg/yr	3.1	9.0
	Formic Acid	kg/yr	10.0	28.7
	Hydrogen Bromide	kg/yr	1.6	4.5
	Hydrogen Chloride	kg/yr	43.2	123.4
	Hydrogen Fluoride, as F	kg/yr	0.3	0.7
	Hydrogen Peroxide	kg/yr	24.1	68.9
	Magnesium Oxide Fume	kg/yr	0.4	1.0
	Methyl Alcohol	kg/yr	0.1	0.4
	n-Amyl Acetate	kg/yr	0.2	0.4
	Phosphoric Acid	kg/yr	9.6	27.5
	Potassium Hydroxide	kg/yr	16.9	48.3
	Propane	kg/yr	0.0	219.3
	Sulfuric Acid	kg/yr	70.8	202.4

A total of 17 of the listed chemicals were used at the CMR in 1999. The amount of propane combusted at the facility totaled 484 pounds (219 kg).

Table A-3. High Explosives Processing Facilities

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
High Explosives Processing Facilities				
	Acetic Acid	kg/yr	14.7	42.0
	Acetone	kg/yr	66.4	189.8
	Acetonitrile	kg/yr	16.2	46.3
	Acetylene	kg/yr	7.7	22.0
	Carbon Black	kg/yr	0.4	1.0
	Chlorodifluoromethane	kg/yr	168.3	480.8
	Chloroform	kg/yr	1.0	3.0
	Chromic acids & chromates	kg/yr	0.2	0.5
	Copper	kg/yr	0.0	0.5
	Cyclohexane	kg/yr	0.1	0.4
	Cyclohexanone	kg/yr	0.3	0.9
	Dichlorodifluoromethane	kg/yr	0.1	0.2
	Ethanol	kg/yr	174.6	498.7
	Ethyl Ether	kg/yr	1.5	4.2
	Ethylene Dichloride	kg/yr	8.6	24.7
	Hydrogen Chloride	kg/yr	11.9	34.1
	Hydrogen Fluoride, as F	kg/yr	0.2	0.4
	Hydrogen Peroxide	kg/yr	15.8	45.0
	Isopropyl Alcohol	kg/yr	5.5	15.6
	Mercury numerous forms	kg/yr	0.3	29.0
	Methyl Alcohol	kg/yr	37.3	106.4
	Methyl Cyclohexane	kg/yr	0.3	0.8
	Methyl Ethyl Ketone (MEK)	kg/yr	169.7	484.9
	Methylene Chloride	kg/yr	7.4	21.2
	n,n-Dimethylformamide	kg/yr	4.0	11.4
	Nitric Oxide	kg/yr	2.7	7.6
	Nitrous Oxide	kg/yr	3.9	11.1
	Phenol	kg/yr	0.4	1.0
	Propane	kg/yr	0.0	4396.2
	Propyl Alcohol	kg/yr	1.4	4.0
	Silver (metal dust & soluble comp., as Ag)	kg/yr	0.1	6.2
	Sulfur Hexafluoride	kg/yr	1.6	4.6
	Sulfuric Acid	kg/yr	2.6	7.4
	Tetrahydrofuran	kg/yr	21.5	61.4
	Thionyl Chloride	kg/yr	0.2	0.5
	Toluene	kg/yr	5.3	15.1
	Turpentine	kg/yr	1.1	3.2
	Xylene (o-,m-,p-Isomers)	kg/yr	0.3	0.8
	Zinc Oxide Fume	kg/yr	0.8	2.3

A total of 39 of the listed chemicals were used in High Explosives Processing in 1999. The amount of propane combusted at the facility totaled 9692 pounds (4396 kg).

Table A-4. High Explosives Testing Facilities

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
High Explosives Testing Facilities				
	Acetone	kg/yr	0.8	2.4
	Acetylene	kg/yr	2.8	7.9
	Ethanol	kg/yr	2.2	6.3
	Methyl Alcohol	kg/yr	1.1	3.2
	Methyl Ethyl Ketone (MEK)	kg/yr	0.3	0.8
	Methylene Chloride	kg/yr	0.5	1.3
	Nitromethane	kg/yr	0.1	0.2
	Propane	kg/yr	0.0	296.9
	Stoddard Solvent	kg/yr	0.3	0.7

A total of 9 of the listed chemicals were used in High Explosives Testing in 1999. The amount of propane combusted at the facility totaled 655 pounds (297 kg).

Table A-5. HRL

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
HRL				
	1,4-Dioxane	kg/yr	0.4	1.0
	2-Methoxyethanol (EGME)	kg/yr	0.2	0.5
	Acetic Acid	kg/yr	4.0	11.5
	Acetic Anhydride	kg/yr	8.4	24.1
	Acetone	kg/yr	10.6	30.4
	Acetonitrile	kg/yr	231.6	661.6
	Acrylamide	kg/yr	0.6	1.6
	Ammonium Chloride (Fume)	kg/yr	0.6	1.6
	Catechol	kg/yr	0.7	2.0
	Chloroform	kg/yr	2.6	7.6
	Chromic acids & chromates	kg/yr	1.3	3.8
	Cyclohexane	kg/yr	0.1	0.4
	Ethanol	kg/yr	94.2	269.1
	Ethanolamine	kg/yr	0.7	2.0
	Ethyl Ether	kg/yr	2.9	8.4
	Ethylene Diamine	kg/yr	4.2	12.0
	Formamide	kg/yr	5.2	14.9
	Hexane (other isomers)* or n-Hexane	kg/yr	0.3	1.0
	Hexylene Glycol	kg/yr	0.1	0.4
	Hydrogen Chloride	kg/yr	2.1	5.9
	Hydrogen Fluoride, as F	kg/yr	0.2	0.5
	Hydrogen Peroxide	kg/yr	0.5	1.4
	Iso-Amyl Alcohol	kg/yr	0.7	2.0
	Isopropyl Alcohol	kg/yr	21.9	62.4
	Mercury numerous forms	kg/yr	0.0	0.5
	Methyl Alcohol	kg/yr	28.5	81.3
	Methylene Chloride	kg/yr	16.9	48.4
	n,n-Dimethylformamide	kg/yr	0.6	1.6
	n-Butyl Alcohol	kg/yr	0.6	1.6
	Paraffin Wax Fume	kg/yr	0.2	0.5
	Phenol	kg/yr	1.9	5.6
	Phosphoric Acid	kg/yr	1.0	3.0
	Potassium Hydroxide	kg/yr	0.2	0.5
	sec-Butyl Alcohol	kg/yr	0.1	0.4
	Sulfuric Acid	kg/yr	1.7	4.8
	Tetrahydrofuran	kg/yr	17.2	49.2
	Tetrasodium Pyrophosphate	kg/yr	0.2	0.5
	Trichloroacetic Acid	kg/yr	4.9	14.0
	Xylene (o-,m-,p-Isomers)	kg/yr	0.2	0.4
	Zinc Chloride Fume	kg/yr	0.4	1.2

A total of 40 of the listed chemicals were used at the HRL in 1999.

Table A-6. LANSCE

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
LANSCE				
	1,1,1-Trichloroethane	kg/yr	97.8	279.4
	2-Butoxyethanol	kg/yr	0.2	0.5
	Acetone	kg/yr	177.0	505.6
	Acetylene	kg/yr	736.5	2104.4
	Benzene	kg/yr	0.3	0.9
	Carbon Disulfide	kg/yr	0.4	1.3
	Carbon Tetrachloride	kg/yr	3.3	9.6
	Chlorodifluoromethane	kg/yr	8440.3	24115.2
	Cyclohexane	kg/yr	0.3	0.8
	Dichlorodifluoromethane	kg/yr	1.5	4.4
	Diethanolamine	kg/yr	0.2	0.5
	Ethanol	kg/yr	197.9	565.4
	Ethylene Dichloride	kg/yr	0.4	1.1
	Iron Oxide Fume, as Fe	kg/yr	0.2	0.5
	Isobutane	kg/yr	19.2	55.0
	Isopropyl Alcohol	kg/yr	7.3	20.8
	Mercury numerous forms	kg/yr	26.1	2612.7
	Methyl Alcohol	kg/yr	3.6	10.3
	Methylene Chloride	kg/yr	0.5	1.3
	n-Butyl Acetate	kg/yr	0.2	0.4
	Phosphoric Acid	kg/yr	0.3	0.9
	Potassium Hydroxide	kg/yr	0.2	0.5
	Propane	kg/yr	0.0	3797.7
	Silver (metal dust & soluble comp., as Ag)	kg/yr	0.0	0.5
	Sulfur Hexafluoride	kg/yr	0.2	0.7
	Sulfuric Acid	kg/yr	1.9	5.5
	Toluene	kg/yr	0.2	0.4
	Tungsten as W insoluble Compounds	kg/yr	7.3	732.5
	Zinc Chromate, as Cr	kg/yr	0.4	1.1

A total of 29 of the listed chemicals were used at LANSCE in 1999. The amount of propane combusted at the facility totaled 8373 pounds (3798 kg).

Table A-7. Machine Shops

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
Machine Shops				
	Isopropyl Alcohol	kg/yr	1.1	3.1
	Propane	kg/yr	0.0	593.8

A total of 2 of the listed chemicals were used at the machine shops in 1999. The amount of propane combusted at the facility totaled 1309 pounds (594 kg).

Table A-8. Material Science Laboratory

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
Material Science Laboratory				
	1,1,2,2-Tetrachloroethane	kg/yr	1.1	3.2
	1,1,2-Trichloro-1,2,2-Trifluoroethane	kg/yr	0.5	1.6
	2-Methoxyethanol (EGME)	kg/yr	0.7	1.9
	Acetic Acid	kg/yr	0.2	0.5
	Acetone	kg/yr	3.6	10.3
	Aluminum numerous forms	kg/yr	0.0	2.2
	Ammonia	kg/yr	0.1	0.3
	Benzene	kg/yr	0.3	0.9
	Biphenyl	kg/yr	0.4	1.0
	Chlorobenzene	kg/yr	1.5	4.4
	Chloroform	kg/yr	1.0	3.0
	Copper	kg/yr	0.1	6.8
	Diethylene Triamine	kg/yr	0.2	0.5
	Ethanol	kg/yr	4.0	11.3
	Ethyl Acetate	kg/yr	1.3	3.6
	Ethylene Chlorohydrin	kg/yr	0.1	0.3
	Hydrogen Bromide	kg/yr	0.2	0.5
	Hydrogen Chloride	kg/yr	0.6	1.8
	Hydrogen Fluoride, as F	kg/yr	0.2	0.7
	Hydrogen Peroxide	kg/yr	0.5	1.4
	Isopropyl Alcohol	kg/yr	4.4	12.6
	Methyl Alcohol	kg/yr	3.3	9.5
	Methylene Chloride	kg/yr	0.5	1.3
	Molybdenum	kg/yr	0.0	0.5
	n,n-Dimethylformamide	kg/yr	0.2	0.5
	n-Butyl Acetate	kg/yr	0.2	0.4
	n-Butyl Alcohol	kg/yr	0.3	0.8
	Phenol	kg/yr	0.2	0.5
	Phosphorus Oxychloride	kg/yr	0.1	0.3
	Potassium Hydroxide	kg/yr	3.5	10.0
	Pyridine	kg/yr	0.7	1.9
	Silica, Quartz	kg/yr	1.3	3.6
	Silver (metal dust & soluble comp., as Ag)	kg/yr	0.0	0.8

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
Material Science Laboratory				
	Styrene	kg/yr	0.3	0.9
	Sulfuric Acid	kg/yr	2.6	7.4
	tert-Butyl Alcohol	kg/yr	0.3	0.8
	Toluene-2,4-diisocyanate (TDI)	kg/yr	0.6	1.6
	Vanadium, Respirable Dust & Fume	kg/yr	0.0	0.5
	Zinc Chloride Fume	kg/yr	0.4	1.0
	Zirconium Compounds, as Zr	kg/yr	0.0	0.3

A total of 40 of the listed chemicals were used at the in 1999.

Table A-9. Pajarito Site

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
Pajarito Site				
	Ethanol	kg/yr	0.1	0.4
	Isopropyl Alcohol	kg/yr	1.6	4.7
	Magnesium Oxide Fume	kg/yr	15.9	45.4
	Phenylphosphine	kg/yr	6.6	18.9
	Propane	kg/yr	0.0	1050.2
	Xylene (o-,m-,p-Isomers)	kg/yr	0.3	0.8

A total of 6 of the listed chemicals were used at Pajarito Site in 1999. The amount of propane combusted at the facility totaled 2315 pounds (1050 kg).

Table A-10. Plutonium Facility Complex

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
Plutonium Facility Complex				
	Acetic Acid	kg/yr	14.7	42.0
	Acetylene	kg/yr	2.8	7.9
	Ethanol	kg/yr	59.0	168.6
	Hydrogen Chloride	kg/yr	311.6	890.3
	Hydrogen Peroxide	kg/yr	45.5	130.1
	Iron Oxide Fume, as Fe	kg/yr	0.1	0.3
	Methyl 2-Cyanoacrylate	kg/yr	0.5	1.5
	Methyl Ethyl Ketone (MEK)	kg/yr	5.3	15.2
	n,n-Dimethylformamide	kg/yr	1.3	3.8
	Potassium Hydroxide	kg/yr	245.5	701.5
	Sulfuric Acid	kg/yr	36.7	104.9
	Trichloroethylene	kg/yr	114.9	328.3

A total of 12 of the listed chemicals were used at the Plutonium Facility Complex in 1999

Table A-11. Radiochemistry Laboratory

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
Radiochemistry Laboratory				
	1,1,1-Trichloroethane	kg/yr	2.3	6.7
	1,1,2-Trichloro-1,2,2-Trifluoroethane	kg/yr	2.2	6.3
	1,3,5-Trimethylbenzene	kg/yr	0.2	0.5
	1,3-Butadiene	kg/yr	5.3	15.0
	1,4-Dioxane	kg/yr	0.4	1.0
	2-Methoxyethanol (EGME)	kg/yr	0.2	0.5
	Acetic Acid	kg/yr	1.9	5.5
	Acetic Anhydride	kg/yr	0.8	2.2
	Acetone	kg/yr	90.9	259.8
	Ammonium Chloride (Fume)	kg/yr	0.8	2.3
	Arsenic, el.&inorg.,exc. Arsine, as As	kg/yr	0.4	1.1
	Benzene	kg/yr	0.8	2.2
	Benzyl Chloride	kg/yr	0.2	0.5
	Bromine	kg/yr	0.3	0.8
	Carbon Tetrachloride	kg/yr	64.5	184.2
	Chlorine	kg/yr	0.3	0.9
	Chloroform	kg/yr	5.5	15.6
	Chromium, Metal &Cr III Compounds, as Cr	kg/yr	0.3	0.7
	Cobalt, elemental & inorg.comp., as Co	kg/yr	0.3	0.9
	Cyclohexylamine	kg/yr	0.3	0.8
	Diethanolamine	kg/yr	2.3	6.7
	Diethylamine	kg/yr	0.5	1.5
	Ethanol	kg/yr	10.0	28.6
	Ethyl Acetate	kg/yr	8.8	25.2
	Ethyl Chloride	kg/yr	0.4	1.0
	Ethyl Ether	kg/yr	4.4	12.6
	Ethylene Diamine	kg/yr	0.2	0.5
	Ethylene Dichloride	kg/yr	0.9	2.5
	Furfural	kg/yr	0.2	0.6
	Hexafluoroacetone	kg/yr	0.3	0.7
	Hexane (other isomers)* or n-Hexane	kg/yr	11.2	32.0
	Hydrogen Bromide	kg/yr	4.3	12.3
	Hydrogen Chloride	kg/yr	211.8	605.0
	Hydrogen Fluoride, as F	kg/yr	3.2	9.0
	Hydrogen Peroxide	kg/yr	11.6	33.1
	Indene	kg/yr	0.1	0.3
	Iron Oxide Fume, as Fe	kg/yr	0.4	1.0
	Isopropyl Alcohol	kg/yr	8.0	22.8

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
	Isopropyl Ether	kg/yr	0.1	0.3
	Kerosene	kg/yr	0.0	3.0
	Magnesium Oxide Fume	kg/yr	0.4	1.1
	Mercury numerous forms	kg/yr	0.0	0.5
	Methyl Alcohol	kg/yr	11.1	31.7
	Methyl Ethyl Ketone (MEK)	kg/yr	0.3	0.8
	Methyl Formate	kg/yr	0.4	1.0
	Methyl Iodide	kg/yr	0.4	1.0
	Methylene Chloride	kg/yr	13.9	39.8
	Molybdenum	kg/yr	0.0	1.0
	n,n-Dimethylformamide	kg/yr	1.0	2.8
	Nitric Oxide	kg/yr	1.5	4.2
	Nitromethane	kg/yr	0.2	0.6
	Nitrous Oxide	kg/yr	0.1	0.2
	p-Phenylenediamine	kg/yr	0.2	0.5
	Pentane (all isomers)	kg/yr	0.9	2.5
	Phosphoric Acid	kg/yr	2.6	7.3
	Phosphorus Trichloride	kg/yr	0.1	0.3
	Potassium Hydroxide	kg/yr	1.7	4.7
	Propane	kg/yr	0.0	1769.7
	Pyridine	kg/yr	0.8	2.4
	Silver (metal dust & soluble comp., as Ag)	kg/yr	0.0	0.4
	Sulfuric Acid	kg/yr	12.2	35.0
	tert-Butyl Alcohol	kg/yr	0.1	0.4
	Tetrahydrofuran	kg/yr	5.6	16.0
	Thionyl Chloride	kg/yr	0.7	1.9
	Toluene	kg/yr	17.7	50.7
	Trichloroethylene	kg/yr	0.3	0.7
	Triethylamine	kg/yr	0.8	2.3
	Uranium (natural) Sol.&Unsol.Comp. as U	kg/yr	0.7	1.9
	Vinyl Acetate	kg/yr	0.3	0.9

A total of 69 of the listed chemicals were used at the Radiochemistry Laboratory in 1999. The amount of propane combusted at the facility totaled 3902 pounds (1770 kg).

Table A-12. Sigma Complex

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
Sigma Complex				
	2-Butoxyethanol	kg/yr	1.3	3.6
	Acetone	kg/yr	8.0	22.9
	Acetylene	kg/yr	11.0	31.6
	Aluminum numerous forms	kg/yr	0.1	11.8
	Ammonia	kg/yr	0.2	0.5
	Cadmium, el.&compounds, as Cd	kg/yr	0.0	0.5
	Chloroform	kg/yr	0.3	0.7
	Chromium, Metal &Cr III Compounds, as Cr	kg/yr	0.0	4.0
	Copper	kg/yr	0.6	56.6
	Diethylene Triamine	kg/yr	0.7	1.9
	Ethanol	kg/yr	15.2	43.5
	Hydrazine	kg/yr	0.1	0.3
	Hydrogen Chloride	kg/yr	5.4	15.4
	Hydrogen Fluoride, as F	kg/yr	64.9	185.4
	Hydrogen Peroxide	kg/yr	1.3	3.7
	Isopropyl Alcohol	kg/yr	9.9	28.3
	Kerosene	kg/yr	0.0	21.4
	Methyl Alcohol	kg/yr	4.6	13.1
	Methyl Ethyl Ketone (MEK)	kg/yr	0.3	0.8
	Methylene Chloride	kg/yr	0.2	0.7
	Molybdenum	kg/yr	3.9	387.1
	Nickel, metal (dust) or Soluble & Inorganic Comp.	kg/yr	0.0	4.0
	Phosphoric Acid	kg/yr	234.3	669.3
	Potassium Hydroxide	kg/yr	0.8	2.3
	Silica, Quartz	kg/yr	0.7	2.0
	Sulfuric Acid	kg/yr	25.5	72.8
	Tantalum Metal	kg/yr	0.3	27.2
	Tin numerous forms	kg/yr	0.0	1.1
	Xylene (o-,m-,p-Isomers)	kg/yr	1.7	4.9
	Zinc Oxide Fume	kg/yr	0.2	0.5
	Zirconium Compounds, as Zr	kg/yr	0.0	1.0

A total of 31 of the listed chemicals were used at the Sigma Complex in 1999.

Table A-13. Target Fabrication Facility

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
Target Fabrication Facility				
	1,1,1-Trichloroethane	kg/yr	4.9	14.1
	1,1,2-Trichloroethane	kg/yr	0.5	1.4
	2-Methoxyethanol (EGME)	kg/yr	0.3	1.0
	Acetone	kg/yr	20.0	57.2
	Acrylic Acid	kg/yr	0.2	0.6
	Acrylonitrile	kg/yr	0.3	0.8
	Ammonia	kg/yr	1483.5	4238.6
	Ammonium Chloride (Fume)	kg/yr	0.4	1.0
	Aniline & Homologues	kg/yr	0.2	0.5
	Chlorine	kg/yr	6.9	19.7
	Cyclohexane	kg/yr	0.5	1.6
	Dibutyl Phthalate	kg/yr	0.7	2.1
	Diethanolamine	kg/yr	0.2	0.5
	Diethyl Phthalate	kg/yr	0.1	0.4
	Diethylene Triamine	kg/yr	0.3	1.0
	Ethanol	kg/yr	9.1	25.9
	Ethyl Acetate	kg/yr	1.3	3.6
	Ethylene Diamine	kg/yr	0.2	0.4
	Ethylene Dichloride	kg/yr	2.4	6.8
	Hydrogen Chloride	kg/yr	3.9	11.0
	Hydrogen Fluoride, as F	kg/yr	0.3	1.0
	Hydrogen Peroxide	kg/yr	0.2	0.7
	Isopropyl Alcohol	kg/yr	6.9	19.6
	Methyl Alcohol	kg/yr	12.1	34.7
	Methyl Cyclohexane	kg/yr	0.3	0.8
	Methyl Isobutyl Ketone	kg/yr	0.1	0.4
	Methylene Chloride	kg/yr	1.9	5.3
	n,n-Dimethyl Acetamide or Dimethyl Acetamide	kg/yr	0.3	0.9
	n,n-Dimethylformamide	kg/yr	12.3	35.1
	n-Amyl Acetate	kg/yr	0.3	0.9
	n-Butyl Acetate	kg/yr	0.2	0.4
	n-Heptane	kg/yr	1.0	2.7
	Nitrous Oxide	kg/yr	19.3	55.0
	Osmium Tetroxide, as Os	kg/yr	0.1	0.2
	Phosphoric Acid	kg/yr	0.4	1.0
	Potassium Hydroxide	kg/yr	0.4	1.0
	Propane	kg/yr	0.0	45.4
	Propyl Alcohol	kg/yr	0.3	0.8
	Silicon Tetrahydride	kg/yr	3.1	8.9
	Styrene	kg/yr	1.7	4.9
	Sulfur Hexafluoride	kg/yr	9.7	27.7
	Sulfuric Acid	kg/yr	4.8	13.8
	Tetrahydrofuran	kg/yr	0.3	0.9
	Toluene	kg/yr	1.2	3.5

A total of 44 of the listed chemicals were used at the Target Fabrication Facility in 1999. The amount of propane combusted at the facility totaled 100 pounds (45 kg).

Table A-14. Tritium Facility

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
Tritium Facilities				
	Ammonia	kg/yr	0.8	2.4
	Copper	kg/yr	0.0	0.5
	Ethanol	kg/yr	0.3	0.7
	Hydrogen Chloride	kg/yr	0.4	1.2
	Methyl Alcohol	kg/yr	0.3	0.8
	Phenylphosphine	kg/yr	0.3	0.9
	Propane	kg/yr	0.0	73.4
	Sulfur Hexafluoride	kg/yr	14.2	40.6

A total of 8 of the listed chemicals were used at the Tritium Facilities in 1999. The amount of propane combusted at the facility totaled 162 pounds (73 kg).

Table A-15. Waste Management Operations: Radioactive Liquid Waste Treatment Facility

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
Waste Management Operations: Radioactive Liquid Waste Facility				
	1,1,2-Trichloro-1,2,2-Trifluoroethane	kg/yr	1.4	4.0
	Acetic Acid	kg/yr	17.7	50.5
	Acetone	kg/yr	0.8	2.4
	Acetonitrile	kg/yr	0.3	0.8
	Acetylene	kg/yr	6.9	19.7
	Ammonium Chloride (Fume)	kg/yr	0.2	0.7
	Cadmium, el.&compounds, as Cd	kg/yr	0.2	22.7
	Carbon Black	kg/yr	0.6	1.6
	Hexane (other isomers)* or n-Hexane	kg/yr	1.8	5.3
	Hydrogen Chloride	kg/yr	88.0	251.4
	Hydrogen Fluoride, as F	kg/yr	0.7	2.0
	Hydrogen Peroxide	kg/yr	11.8	33.8
	Magnesium Oxide Fume	kg/yr	0.2	0.5
	Methyl 2-Cyanoacrylate	kg/yr	0.1	0.3
	Methyl Alcohol	kg/yr	1.9	5.5
	Oxalic Acid	kg/yr	0.2	0.5
	Phenol	kg/yr	0.7	2.0
	Phosphorus	kg/yr	0.2	0.6
	Potassium Hydroxide	kg/yr	3.3	9.5
	Propane	kg/yr	0.0	12340.9
	Propyl Alcohol	kg/yr	0.1	0.4
	Silica, Quartz	kg/yr	1.1	3.0

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
	Silver (metal dust & soluble comp., as Ag)	kg/yr	0.0	1.1
	Sulfuric Acid	kg/yr	152.6	435.9
	Tin numerous forms	kg/yr	0.0	0.7
	Trichloroacetic Acid	kg/yr	0.2	0.5
	Zinc Chloride Fume	kg/yr	0.2	0.5

A total of 27 of the listed chemicals were used in Waste Management Operations in 1999. The amount of propane combusted at the facility totaled 27207 pounds (12341 kg).

Table A-16. Waste Management Operations: Solid Radioactive and Chemical Waste Facilities

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
WMO: solid rad and chem				
	Diethanolamine	kg/yr	0.2	0.5
	Ethanol	kg/yr	14.9	42.6
	Hydrogen Chloride	kg/yr	6.9	19.6
	Methyl Alcohol	kg/yr	1.4	4.0
	Propane	kg/yr	0.0	1675.0
	Sulfuric Acid	kg/yr	0.6	1.8

A total of 6 of the listed chemicals were used in WMO in 1999. The amount of propane combusted at the facility totaled 3693 pounds (1675 kg).