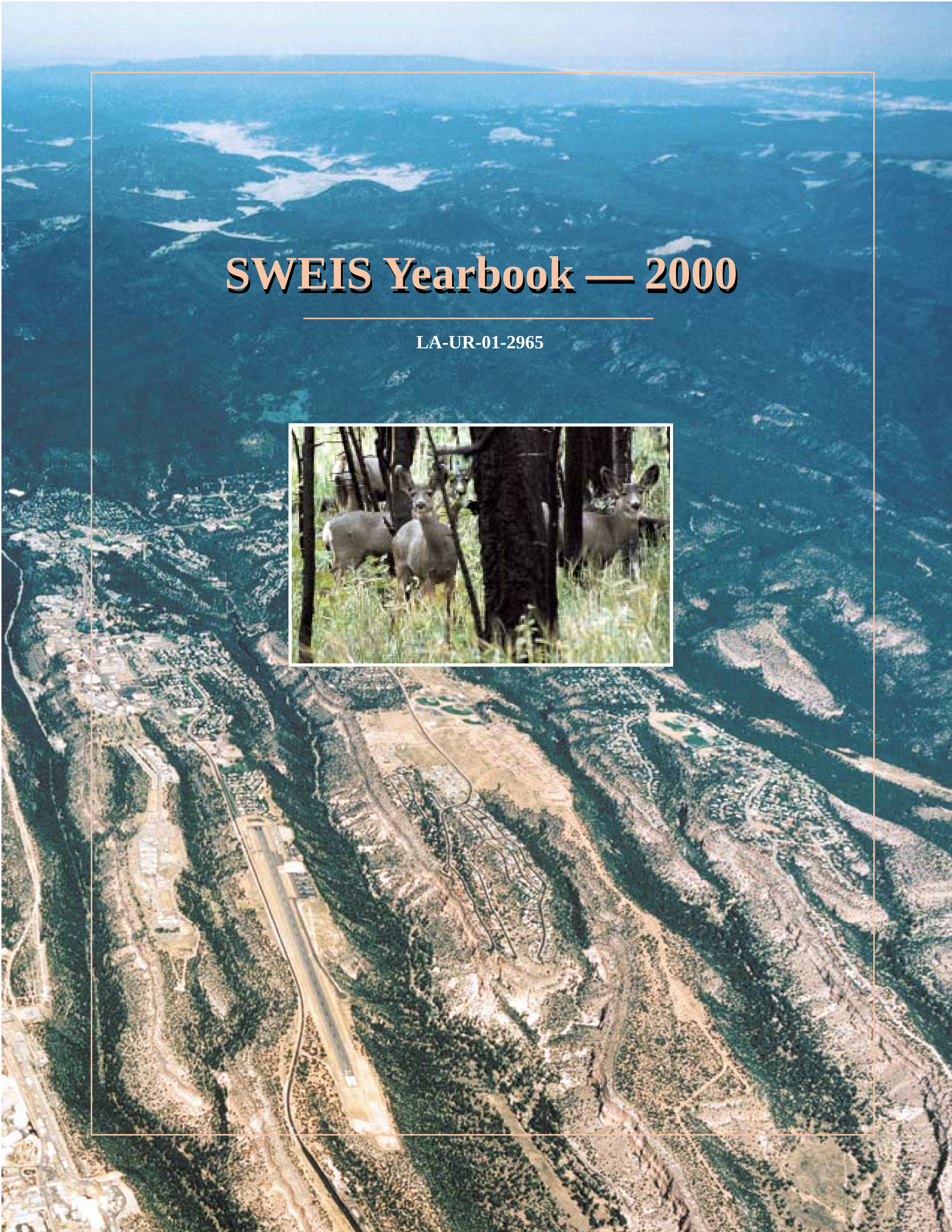

SWEIS Yearbook — 2000

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Title:

SWEIS Yearbook — 2000

Comparison of 2000 Data to Projections of the Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory

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PREFACE

In the Record of Decision for Stockpile Stewardship and Management, the US Department of Energy (DOE)[1] charged LANL with several new tasks, including war reserve pit production. DOE evaluated 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 SWEIS Record of Decision (ROD) issued in September 1999.

The Annual Yearbook compares operational data with projections of the SWEIS for the level of operations selected by the ROD. The SWEIS 1998 Yearbook was issued in December 1999, and 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. The SWEIS Yearbook – 1999 was issued in December 2000. This is the SWEIS Yearbook – 2000. The publication date was moved six months earlier to achieve timely publication of the information. This yearbook includes a special section addressing the effects of the Cerro Grande fire on operations and the environmental setting.

The collective set of Yearbooks will contain data needed for trend analyses, will identify potential problem areas, 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. Since the Cerro Grande fire was one of the most significant events in 2000, the cover photo was chosen to portray some aspect of the fire. The photo selected shows natural recovery in an area burned by the Cerro Grande fire.

These publications are available in electronic format:

SWEIS Yearbook – Wildfire 2000
(http://lib-www.lanl.gov/la-pubs/00393627.pdf)

SWEIS Yearbook – 1998
(http://lib-www.lanl.gov/la-pubs/00460172.pdf)

SWEIS Yearbook – 1999
(http://lib-www.lanl.gov/la-pubs/00393813.pdf)

SWEIS Yearbook – 2000
(http://lib-www.lanl.gov/la-pubs/00818189.pdf)

[1] Congress established the National Nuclear Security Administration (NNSA) within the DOE to manage the nuclear weapons program for the United States. Los Alamos National Laboratory (LANL or Laboratory) is one of the facilities now managed by the NNSA. The NNSA officially began operations on March 1, 2000. Its mission is to carry out the national security responsibilities of the DOE, including maintenance of a safe, secure, and reliable stockpile of nuclear weapons and associated materials capabilities and technologies; promotion of international nuclear safety and nonproliferation; and administration and management of the naval nuclear propulsion program.

EXECUTIVE SUMMARY

In 1999, the US Department of Energy (DOE) published a Site-Wide Environmental Impact Statement for Continued Operation of 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 or Laboratory) implemented a program, the Annual Yearbook, making comparisons between SWEIS ROD 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.

The SWEIS analyzed the potential environmental impacts of scenarios for future operations at LANL. DOE announced in its ROD that it would operate LANL at an expanded level and that the environmental consequences of that level of operations were acceptable. The ROD is not a predictor of specific operations, but establishes boundary conditions for operations. The ROD provides an environmental operating envelope for specific facilities and for the Laboratory as a whole. If operations at LANL were to routinely exceed the operating envelope, DOE would evaluate the need for a new SWEIS. As long as LANL operations remain below the level analyzed in the ROD, the environmental operating envelope is valid. Thus, the levels of operation projected by the SWEIS ROD should not be viewed as goals to be achieved, but rather as acceptable operational levels.

The Yearbooks address capabilities and operations using the concept of "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 2000, the types and levels of operations that occurred during 2000, and the 2000 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 2000, planned construction and/or modifications continued at seven of the 15 Key Facilities. Most of these activities were modifications within existing structures. At the High Explosives Testing Facility, construction of the Dual-Axis Radiographic Hydrodynamic Test facility was finished in 1999. Work continued in 2000 on installation and component testing of the accelerator and its associated control and diagnostics systems. Additionally, four major construction projects were either completed or continued for the Non-Key Facilities. Atlas was completed in September 2000, and major component tests were completed by December 2000. Three projects were in the construction phase: the Los Alamos Research Park, the Strategic Computing Complex, and the Nonproliferation and International Security Center.

The ROD projected a total of 38 facility construction and modification projects for LANL. Fifteen projects have now been completed: six in 1998, seven in 1999, and two in 2000. Seven additional projects were started and/or continued in 2000. The two projects completed in 2000 are

- Atlas facility in parts of five buildings at TA-35 and
- Remodel of Building 16-450 and connection to the Weapons Engineering Tritium Facility.

A major modification project, elimination and/or rerouting of National Pollutant Discharge Elimination System (NPDES) outfalls, was completed in 1999 bringing the total number of permitted outfalls down from the 55 identified by the SWEIS ROD to 20. During 2000, Outfall 03A-199, which will serve the

TA-3-1837 cooling towers, was included in the new NPDES Permit issued by the Environmental Protection Agency (EPA) on December 29, 2000. This brings the total number of permitted outfalls up to 21.

As in 1999, this Yearbook reports chemical usage and calculated emissions (expressed as kilograms per year) for the Key Facilities, based on an improved chemical reporting system. The 2000 chemical usage amounts were extracted from the Laboratory's Automated Chemical Inventory System. The quantities used for this report represent chemicals procured or brought on site in 2000. Information is presented in Appendix for actual chemical use and estimated emissions for each Key Facility. Additional information for 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 2000, although some moved location, some were defined more broadly, and others were further refined. Because of a move, one capability (Computational Biology) that used to be within the Non-Key portion of LANL was moved into a Key Facility (Biosciences), bringing the identified capabilities to 96. This redefinition of a Key Facility was necessary to capture the growing functions within biological and life science research.

During 2000, 91 of the 96 identified capabilities were active. No activity occurred under five capabilities: Fabrication of Ceramic-Based Reactor Fuels at the Plutonium Complex, Diffusion and Membrane Purification at the Tritium Key Facilities, Destructive and Nondestructive Analysis and Fabrication and Metallography at the Chemical and Metallurgy Research Facility, and Other Waste Processing at the Solid Radioactive and Chemical Waste Facility.

As in 1998 and 1999, only three of LANL's facilities operated during 2000 at levels approximating those projected by the ROD—the Materials Science Laboratory (MSL), the Biosciences Facilities (formerly Health Research Laboratory), and the Non-Key Facilities. The two Key Facilities (MSL and Biosciences) are more akin to the Non-Key Facilities and represent the dynamic nature of research and development at LANL. More importantly, 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 airborne emissions from point sources (i.e., stacks) during 2000 totaled approximately 3,100 curies, less than 15 percent of the ten-year average of 21,700 curies projected by the SWEIS ROD. The final dose is estimated to be approximately 0.65 millirem per year (compared to 5.44 projected), with the final dose being reported to the EPA by June 30, 2001. Calculated NPDES discharges totaled 265 million gallons compared to a projected volume of 278 million gallons per year. While the number of outfalls has been reduced from those identified by the SWEIS ROD, the methodology for calculating discharges may result in an overestimate. In addition, the reduction often results from combining flows to a single point so that the total number of outfalls is less, but the overall flow is not reduced. Quantities of solid radioactive and chemical wastes ranged from 35 percent (low-level radioactive waste) to 690 percent (chemical waste) of projections. The extremely large quantities of chemical waste (22.5 million kilograms) are a result of Environmental Restoration Program activities (remediation of old material disposal areas and accelerated cleanup activities resulting from the Cerro Grande fire). Most chemical wastes are shipped offsite for disposal at commercial facilities; therefore, these large quantities of chemical waste will not impact LANL environs.

The workforce was above ROD projections. The 12,015 employees at the end of calendar year 2000 represent 664 more employees than projected. Electricity use during 2000 totaled 381 gigawatt-hours with a peak demand of 65 megawatts compared to projections of 782 gigawatt-hours with a peak demand of 113 megawatts. Water usage was 441 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 2000 was 196 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 projected 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 2000, this expansion had not become necessary. However, construction continued on 30 acres of land that are being developed along West Jemez Road for the Los Alamos Research Park. This project has its own National Environmental Policy Act documentation (an Environmental Assessment), 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 been reduced, water levels show some recovery. No unexplained changes in patterns have occurred in the 1995–2000 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, though operations data mostly fell within projections, this was not a normal year. LANL was shut down for two weeks during the Cerro Grande fire, and many facilities were not fully operational for several months. Operations data that exceeded projections, such as number of employees or chemical waste from cleanup of legacy contamination, either produced a positive impact on the economy of northern New Mexico or resulted in no local impact because these wastes were shipped offsite for disposal. Overall, the 2000 operations data indicate that the Laboratory was operating within the SWEIS 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 (NNSA/AL), Corey Cruz (NNSA/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 Program Office was the primary preparer of this report. Chief contributors were Doris Garvey, Ken Rea, Chris Del Signore, and Tony Grieggs.

Jay Brown provided prompt review of the document for classification issues and helped solve several concerns.

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

Hector Hinojosa provided editorial support, Stacey Perez and Randy Summers served as the designers 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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Radioactive Liquid Waste Treatment Facility	William (Dave) Moss
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Sigma	Larry Austin
Socioeconomics	James VanHecke
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Solid Radioactive and Chemical Waste Facilities	Garry Allen
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Solid Radioactive and Chemical Waste Facilities	Patricia Leyba

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Target Fabrication Facility	Janet Mercer-Smith
Tritium Facilities	Richard Carlson
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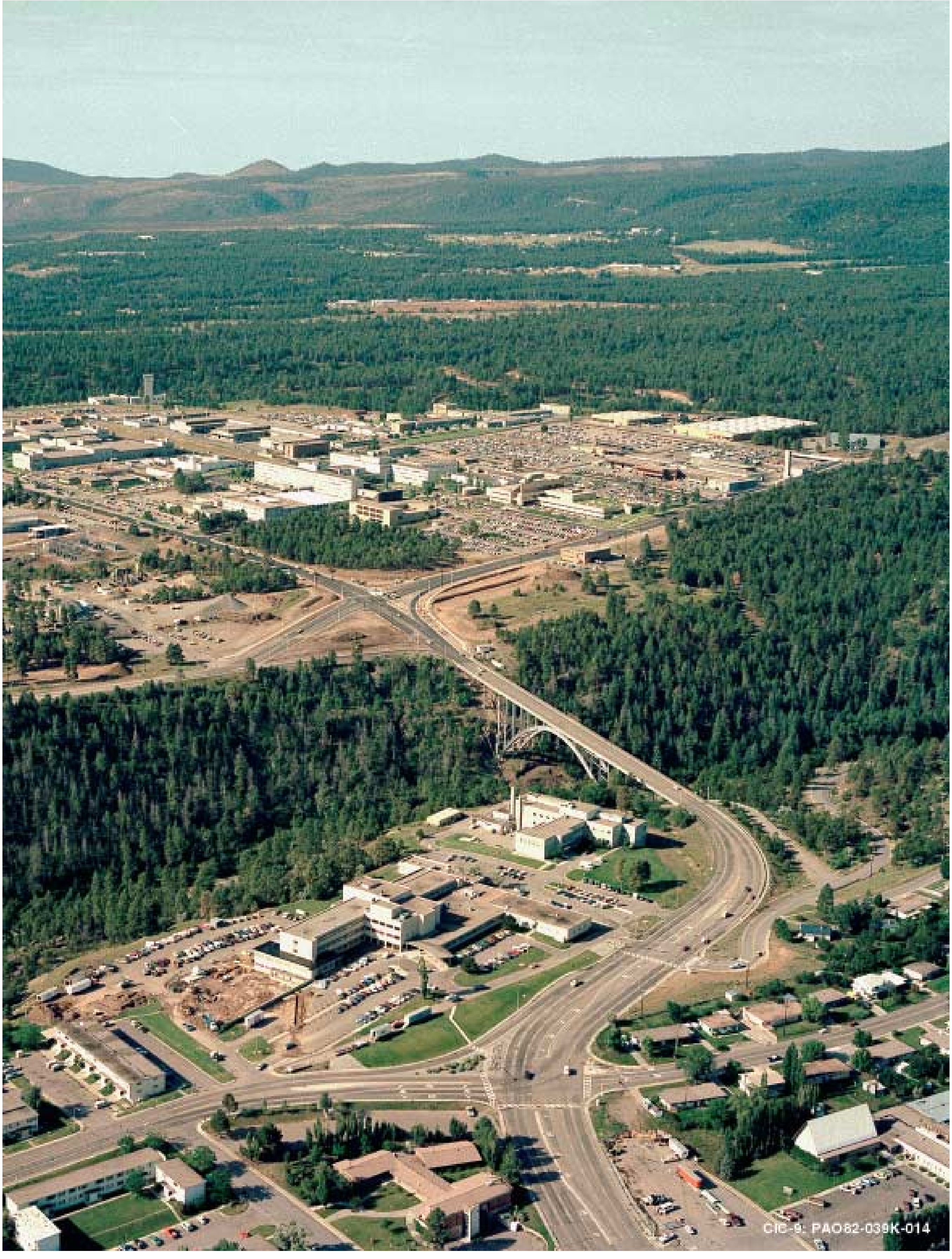
Utilities	Jerome Gonzales
Utilities	Mark Hinrichs
Worker Safety/Doses	Robin Devore
Worker Safety/Doses	Tom Buhl

ACRONYMS

ACIS	Automated Chemical Inventory System
ALARA	as low as reasonably achievable
BIO	Basis for Interim Operations
BMPs	best management practices
CASA	Critical Assembly and Storage Area
CDC	Centers for Disease Control
Ci	curie
CY	calendar year
CMR	Chemical and Metallurgy Research
CSP2000	Comprehensive Site Plan for 2000
DARHT	Dual-Axis Radiographic Hydrodynamic Test (facility)
DOE	US Department of Energy
DX	Dynamic Experimentation (Division)
EPA	Environmental Protection Agency
ER	Environmental Restoration (Project)
ESA	Engineering Sciences and Application (Division)
FTE	full-time equivalent (employee)
FY	fiscal year
HRL	Health Research Laboratory
HVAC	heating, ventilation, and air conditioning (system)
IAEA	International Atomic Energy Agency
IWMT	Interagency Wildfire Management Team
JCNNM	Johnson Controls of Northern New Mexico
LAAO	Los Alamos Area Office
LANL	Los Alamos National Laboratory
LANSCE	Los Alamos Neutron Science Center
LEDA	Low-Energy Demonstration Accelerator

linac	linear accelerator
LIR	Laboratory Implementing Requirement
LLW	low-level radioactive waste
LPSS	Long-Pulse Spallation Source
LWC	Lost Workday Cases Rate
m	meter
MDA	Material Disposal Area
MeV	million electron volts
MGY	million gallons per year
MLLW	mixed low-level radioactive waste
MSL	Materials Science Laboratory
NEPA	National Environmental Policy Act
NFA	no further action
NHC	nuclear hazard classification
NMED	New Mexico Environment Department
NNSA	National Nuclear Security Administration
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
PIDAS	perimeter intrusion detection and assessment system
PRS	potential release site
PTLA	Protection Technology Los Alamos
RCRA	Resource Conservation and Recovery Act
rem	roentgen equivalent man
RLWTF	Radioactive Liquid Waste Treatment Facility
ROD	record of decision
SNM	special nuclear material
SWEIS	Site-Wide Environmental Impact Statement
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
VCA	voluntary corrective action
WCRRF	Waste Characterization, Reduction, and Repackaging Facility
WETF	Weapons Engineering and Tritium Facility
WIPP	Waste Isolation Pilot Plant
WNR	Weapons Neutron Research (facility)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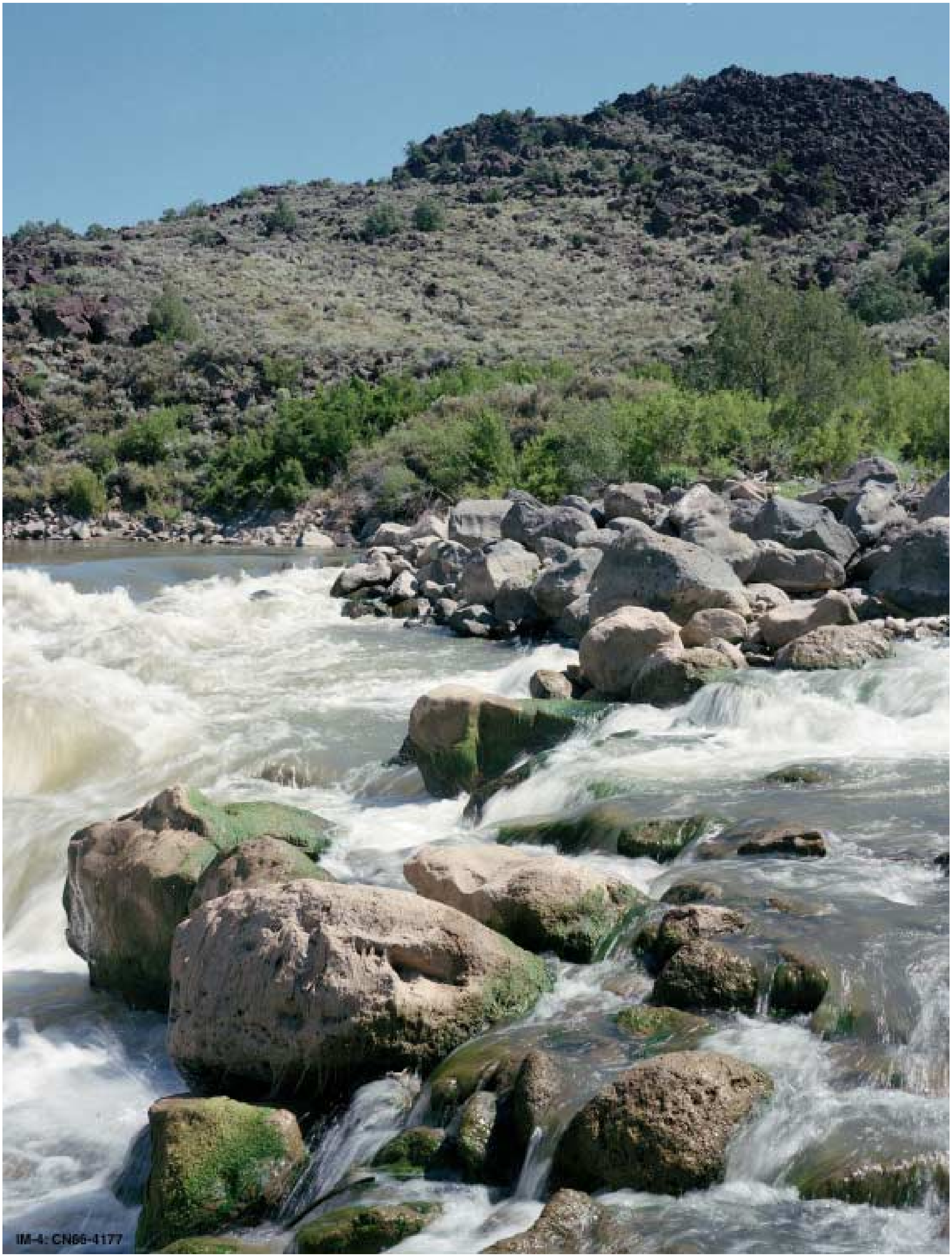
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1.0 Introduction

1.1 The SWEIS

In 1999, the US Department of Energy (DOE)[1] , 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 levels of operation for 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 a program making annual comparisons between SWEIS ROD 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 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 some post-SWEIS activities for which environmental coverage was not provided. 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 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 by the SWEIS ROD (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 Yearbooks 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.

The SWEIS analyzed the potential environmental impacts of scenarios for future operations at LANL. DOE announced in its ROD that it would operate LANL at an expanded level, and that the environmental consequences of that level of operations were acceptable. The ROD is not a predictor of specific operations, but establishes boundary conditions for operations. The ROD provides an environmental operating envelope for specific facilities and for the Laboratory as a whole. If operations at LANL were to routinely exceed the operating envelope, DOE

[1] Congress established the National Nuclear Security Administration (NNSA) within the DOE to manage the nuclear weapons program for the United States. Los Alamos National Laboratory (LANL or Laboratory) is one of the facilities now managed by the NNSA. The NNSA officially began operations on March 1, 2000. Its mission is to carry out the national security responsibilities of the DOE, including maintenance of a safe, secure, and reliable stockpile of nuclear weapons and associated materials capabilities and technologies; promotion of international nuclear safety and nonproliferation; and administration and management of the naval nuclear propulsion program.

would evaluate the need for a new SWEIS. As long as LANL operations remain below the level analyzed in the ROD, the environmental operating envelope is valid. Thus, the levels of operation projected by the SWEIS ROD should not be viewed as goals to be achieved, but rather as acceptable operational limits.

1.3 This Yearbook

The ROD selected levels of operations, and the SWEIS provided projections for these operations. This Yearbook compares data from 2000 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.

2.0 Facilities and Operations

LANL, which is located in northern New Mexico (Figure 2-1), has more than 2,000 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 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 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 percent of all potential radiation doses to the public,
- more than 90 percent of all radioactive liquid waste generated at LANL,
- more than 90 percent of all radioactive solid waste generated at LANL,
- more than 99 percent of all radiation doses to the LANL workforce, and
- approximately 30 percent of all chemical waste generated by LANL.

In addition, the Key Facilities (as presented in the SWEIS) comprised 42 of the 48 Category 2 and Category 3 Nuclear Structures at LANL[1]. Subsequently, DOE published two lists identifying nuclear facilities at LANL [one in 1998 (DOE 1998a) and another in 2000 (DOE 2000a)] that significantly changed the classification of some buildings. A table has been added to each section of this chapter to explain the differences and identify the 41 structures currently listed by DOE as nuclear facilities. Of these 41 structures, all but one reside within a Key Facility. The former tritium research facility (TA-33-0086) is still listed as a Category 2 nuclear facility as it undergoes decontamination and decommissioning.

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 Materials Science Laboratory (MSL), to more than 400 for 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.

This chapter discusses each of the 15 Key Facilities from three aspects—significant facility construction and modifications that have occurred during 2000, types and levels of operations that occurred during 2000, and 2000 operations data. Each of these three aspects is given perspective by comparing them to projections made by the SWEIS ROD. This comparison provides an evaluation of whether or not data resulting from LANL operations

[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 (LLW) 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 (LAAO) as of April 2000 (DOE 2000a).

[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 applied. Examples include modeling (e.g., atmospheric weather patterns) to subatomic investigations (e.g., using the Los Alamos Neutron Science Center [LANSCE] linear accelerator [linac]) to collaborative efforts with industry (e.g., fuel cells for automobiles). Production involves 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.

continue to fall within the environmental envelope established by the SWEIS ROD. It should be noted that construction activities projected by the SWEIS 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 Non-Key Facilities, which include all buildings and structures not part of a Key Facility, or the balance of LANL. Although operations at 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 27,816 acres. The Non-Key Facilities also employ about half the LANL workforce. The Non-Key Facilities include 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 (CMR) Building	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	1,115
High Explosives Testing	TAs 15, 36, 39, 40	8,691
LANSCE	TA-53	751
Biosciences Facilities (Formerly Health Research Laboratory [HRL])	TA-43, 03, 16, 35, 46	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

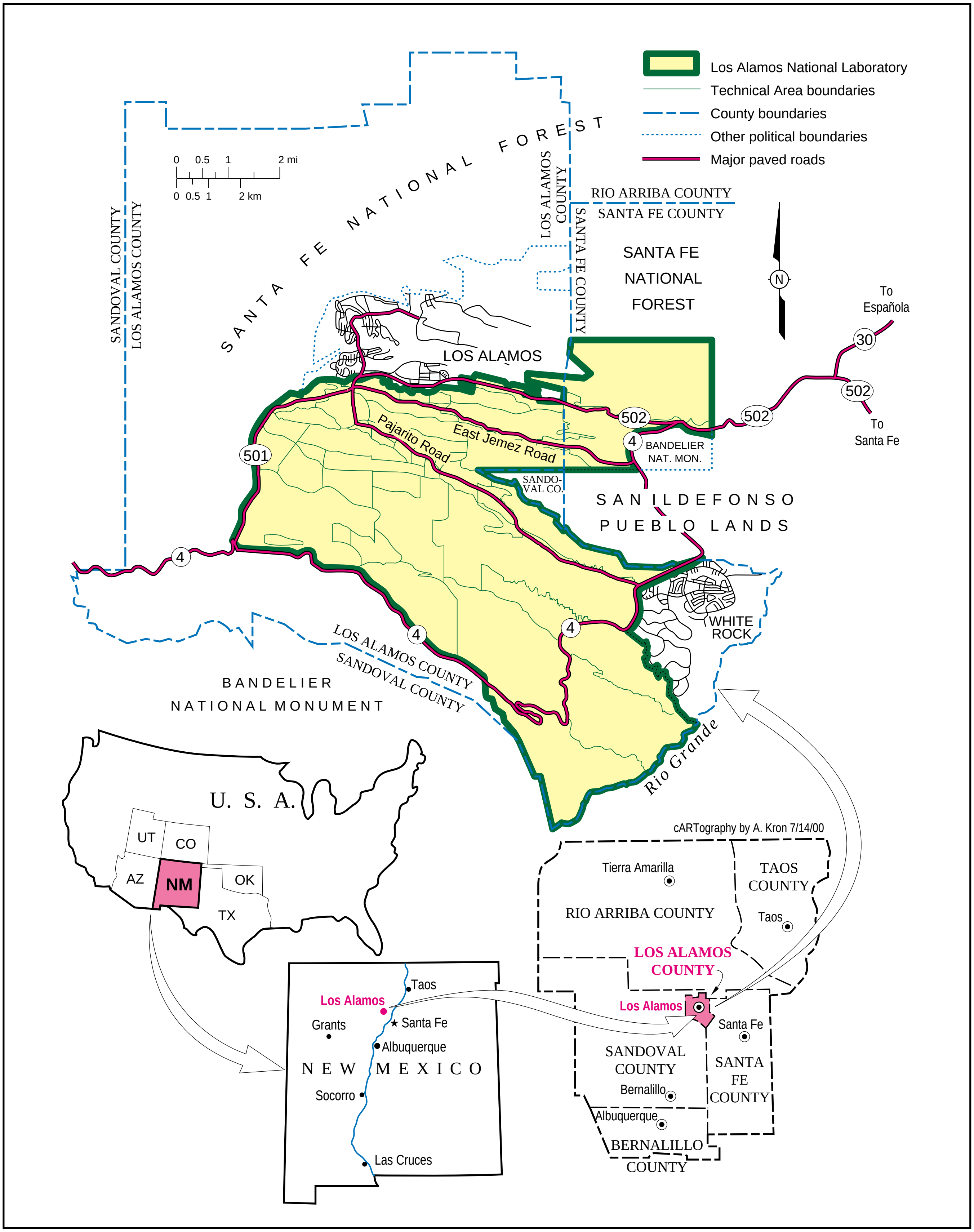


Figure 2-1 Location of LANL

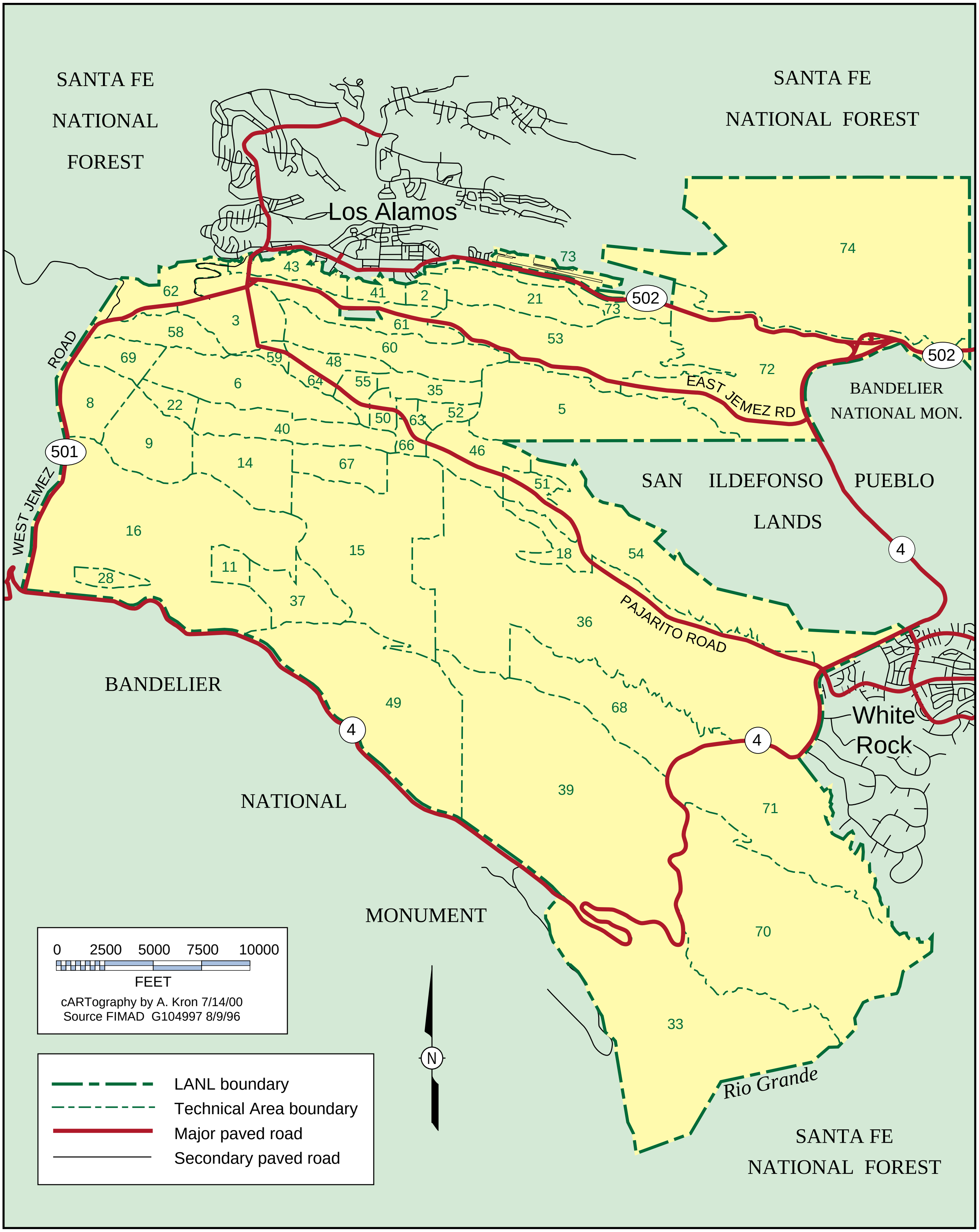


Figure 2-2 Location of Technical Areas

Figure 2-3 Location of Key Facilities

2.1 Plutonium Complex (TA-55)

The Plutonium Complex Key Facility, a 90-acre site, consists of six primary buildings and a number of lesser buildings and structures. As presented in the SWEIS, this Key Facility contained one operational nuclear hazard Category 2 facility (TA-55-4), two Low Hazard chemical facilities (TA-55-3 and TA-55-5), and one Low Hazard energy source facility (TA-55-7).

The DOE listing of LANL nuclear facilities for both 1998 and 2000 retained Building TA-55-4 as a nuclear hazard Category 2 facility as shown in Table 2.1-1.

Table 2.1-1. Plutonium Complex Buildings with Nuclear Hazard Classification

BUILDING	DESCRIPTION	SWEIS ROD	DOE 1998 [a]	DOE 2000 [b]
TA-55-0004	PU-238 Processing	2	2	2
TA-55-0041	Nuclear Material Storage	2		

[a] DOE/LANL list of Los Alamos National Laboratory Nuclear Facilities (DOE 1998a)
[b] DOE/LANL list of Los Alamos National Laboratory Nuclear Facilities (DOE 2000a)

The SWEIS also identified one potential Category 2 nuclear facility (TA-55-41, the Nuclear Material Storage Facility), which was slated for potential modification to bring it into operational status. This was not done, and the DOE removed this facility from its list of nuclear facilities in its April 2000 listing (DOE 2000a). There are currently no plans to use this building for storage of nuclear materials.

2.1.1 Construction and Modifications at the Plutonium Complex

The SWEIS projected four facility modifications:

- renovation of the Nuclear Material Storage Facility (not currently planned to be used to store nuclear materials);
- construction of a new administrative office building (construction completed 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 (CY) 2000, upgrades to maintain existing capacity were continued, including design on replacement of the current main fire protection water line and pump houses. None of the ongoing construction or modifications at the Plutonium Facility resulted in modification to facility hazard categories by close of CY 2000.

2.1.2 Operations at the Plutonium Complex

The SWEIS identified seven capabilities[3] for this Key Facility. No new capabilities have been added, however, one capability, Special Nuclear Materials Storage, Shipping, and Receiving, had planned on using the Nuclear Material Storage Facility. Because of changes in plans, the Nuclear Material Storage Facility will not be used for this activity, and special nuclear material storage, shipping, and receiving will continue to be performed at the plutonium facility (Building 55-4). For all seven capabilities, activity levels were below those projected by the SWEIS ROD. Table 2.1.2-1 presents details.

[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]	2000 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. Two 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 2000. Less than 40 pits were destructively examined as part of the stockpile evaluation program (pit surveillance) in 2000.
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 2000.
	Process neutron sources up to 5,000 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 separation in 2000.
	Perform decontamination of 28 to 48 uranium components per month.	In 2000, 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.

Table 2.1.2-1 (Cont.)

CAPABILITY	SWEIS ROD[a]	2000 OPERATIONS
	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 2000.
	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.	No mixed oxide fuel was manufactured in 2000.
Plutonium-238 Research, Development, and Applications	Process, evaluate, and test up to 25 kilograms/yr plutonium-238. Recycle residues and blend up to 18 kilograms/yr plutonium-238.	Recovered approximately 0.65 kilograms of plutonium-238 and processed approximately 0.75 kilograms of plutonium-238 for heat source fuel in 2000.
Special Nuclear Materials (SNM) Storage, Shipping, and Receiving	Store up to 6,600 kilograms SNM in the Nuclear Material Storage Facility; continue to store working inventory in the vault in Building 55-4; ship and receive SNM as needed to support LANL activities.	Because of changes in plans, the Nuclear Material Storage Facility will not be used for this activity, and SNM storage, shipping, and receiving will continue to be performed at the Plutonium Facility (Building 55-4). Building 55-4 vault levels remained approximately constant at levels identified during preparation of the SWEIS.
	Conduct nondestructive assay on SNM at the Nuclear Material Storage Facility to identify and verify the content of stored containers.	The Nuclear Material Storage Facility is not operational as a storage vault and was not used for nondestructive assay.

[a] Includes renovation of the Nuclear Material Storage Facility (which is no longer planned for use), 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 10 curies in 2000 compared to 1,000 curies projected), and quantities of wastes were also less than projected. The 2,340 kilograms of chemical waste includes 763 kilograms of industrial solid waste mostly from cleanup following the Cerro Grande fire. The industrial solid waste is nonhazardous and is disposed in local landfills.

Table 2.1.3-1. Plutonium Complex/Operations Data

PARAMETER	UNITS[a]	SWEIS ROD	2000 OPERATIONS
Radioactive Air Emissions:			
Plutonium-239 [b]	Ci/yr	2.70E-5	2.4E-06
Plutonium-238	Ci/yr	Not projected [c]	1.1E-07
Americium-241	Ci/yr	Not projected [c]	3.3E-07
Tritium in Water Vapor	Ci/yr	7.50E+2	3.1E-01
Tritium as a Gas	Ci/yr	2.50E+2	6.1E+0
NPDES Discharge [d] 03A–181 [e]	MGY	14	6.4
Wastes: Chemical LLW [f] MLLW TRU Mixed TRU	 kg/yr m^3/yr m^3/yr m^3/yr m^3/yr	 8,400 754 [g] 13 [g] 237 [h] 102 [h]	 2,340 199 2 54 17
Number of Workers	FTEs	589 [i]	572 [i]

a Ci/yr = curies per year; MGY = million gallons per year; FTEs = full-time equivalent workers.
b Projections for the SWEIS were reported as plutonium or plutonium-239, the primary material at TA-55.
c The radionuclide was not projected in the SWEIS ROD because it was either dosimetrically insignificant or not isotopically identified.
d NPDES is National Pollutant Discharge Elimination System.
e This outfall flowed all four quarters during CY 2000.
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 SWEIS provided data for TRU and mixed TRU wastes in Chapter 3 and Chapter 5. However, projections made had to be modified to reflect the decision to produce nominally 20 pits per year.
i The number shown in the "SWEIS ROD" column is the index number representing CY 1999 (the year the SWEIS ROD was published). The number of employees for 2000 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the SWEIS 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 2000 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 (SWEIS ROD versus the new index) do not represent the same entity, a direct comparison to numbers projected by the SWEIS ROD (see Section 3.6, Socioeconomics) is not appropriate. However, because this index is going to be used in each subsequent yearbook, selecting CY 1999 as the base year establishes an index that can be compared over the ten-year window represented by the SWEIS ROD.

2.1.4 Cerro Grande Fire Effects at the Plutonium Complex

On Monday, May 8, 2000, LANL officially closed because of the Cerro Grande fire. At 1328 hours on May 10, because of worsening fire conditions, Building TA-55-4 was put into off-normal operations status (e.g., normal operations were terminated, some of the facility systems were shut down, and program operations that relied upon those systems required alternative services). In addition, zones 2 and 3 ventilation systems were shutdown to reduce intake ventilation airflow. Ventilation systems in all other support buildings at TA-55 were also shutdown in an effort to mitigate facility damage from heavy smoke and blowing embers. At 2130 hours, because of fire encroaching on the fenced perimeter intrusion detection and assessment systems (PIDAS) area surrounding TA-55, Building TA-55-4 was completely shutdown and entombed (e.g., all massive vault-type doors were shut and locked). Shortly thereafter at 0010 hours on May 11, Operations Center personnel were ordered to evacuate. PTLA continued to perform rounds to ensure that the security envelope at TA-55 remained intact. On May 12, a limited number of facility operations personnel returned to TA-55 for an initial condition assessment. Power was partially restored to recover security and fire suppression systems. Upon entry into Building TA-55-4, it was found to be stable with no indication of contamination. The uninterruptable power supply system, Operations Center ventilation, and vault cooling system were re-energized. A Facility Recovery Plan was written, approved, and implemented in the days that followed. On May 15, the facility again resumed around-the-clock manning of the Operations Center. On May 22, all Building TA-55-4 systems were operable and Building TA-55-4 was again placed in full operations status.

Although fire encroached on the fenced PIDAS area surrounding TA-55, none of the buildings suffered fire damage.

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

This Key Facility consists of tritium operations at TA-16 and TA-21. 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). Limited 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 this operation was 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. Efforts are ongoing at TSTA and TSFF (the TA-21 tritium facilities) to reduce the tritium inventory so that these facilities can be reclassified to Category 3 nuclear facilities and in 2003 to radiological facilities.

As shown in Table 2.2-1, the nuclear hazard classification (NHC) of these three facilities has remained constant. However, WETF was separated into its three component buildings in the SWEIS.

Table 2.2-1. Tritium Buildings with Nuclear Hazard Classification

BUILDING	DESCRIPTION	NHC SWEIS ROD	NHC DOE 1998 [a]	NHC DOE 2000 [b]
TA-16-0205	WETF	2	2	2
TA-16-0205A	WETF	2		
TA-16-0450	WETF	2		
TA-21-0155	TSTA	2	2	2
TA-21-0209	TSFF	2	2	2

[a] DOE/LANL list of Los Alamos National Laboratory Nuclear Facilities (DOE 1998a)
[b] DOE/LANL list of Los Alamos National Laboratory Nuclear Facilities (DOE 2000a)

In November 1999, DOE determined that TSTA had completed its mission. Therefore, the tritium will be removed from this facility over the next several years. Only a limited experimental program will be carried out in TSTA, and this program will be completed by June 2001.

A formerly used tritium facility also remains at TA-33, the High Pressure Tritium Laboratory. It is not an operational facility and it is in the final stages of deactivation preparatory to final decontamination and decommissioning. The only activities conducted at this facility are removal and packaging of tritium-contaminated equipment.

2.2.1 Construction and Modifications at the Tritium Facilities

There were no major construction activities or building modifications at WETF at TA-16. Several of the existing systems at WETF were upgraded to enhance capabilities. The remodeling of Building TA-16-450 was completed in 2000. The operational readiness review to extend the tritium processing area of WETF into Building 450 will be completed in CY 2001. At that time this area will be integrated into WETF. Modification of Building 450 is to accommodate neutron tube target loading operations and related research. This modification was addressed by the SWEIS ROD, and has its own NEPA coverage via an Environmental Assessment and Finding of No Significant Impact (DOE 1995a).

Upgrade of a part of the WETF roof to meet current seismic requirements was begun in November 2000. This will be completed in March 2001. The modification involves additional structural attachment of the existing roof to the facility walls.

There have been no facility modifications made to the TA-21 facilities.

2.2.2 Operations at the Tritium Facilities

The SWEIS 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 CY 2000 operational data for each of these capabilities. Operations in 2000 were below projections by the SWEIS ROD and remained within the established environmental envelope. For example, zero high-pressure gas fill operations were conducted in 2000 (compared to 65 fills projected by the SWEIS ROD), and approximately 10 gas-boost system tests and gas processing operations were performed (compared to 35 projected).

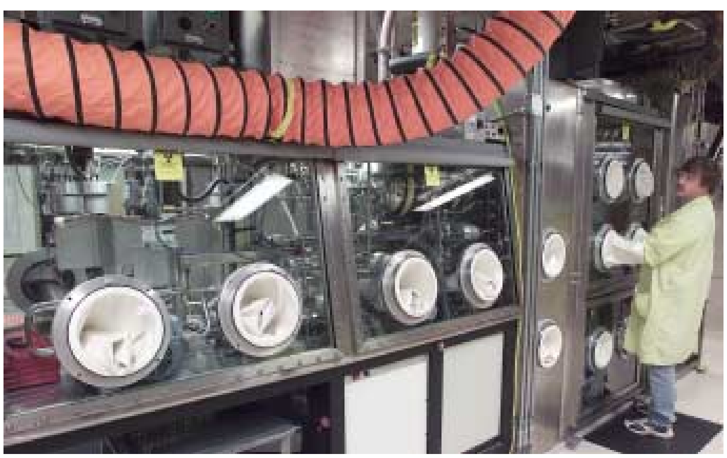
Table 2.2.2-1. Tritium Facilities/Comparison of Operations

CAPABILITY	SWEIS ROD[a]	2000 OPERATIONS
High-Pressure Gas Fills and Processing: WETF	Handling and processing of tritium gas in quantities of up to 100 grams with no limit on number of operations per year. Capability used approximately 65 times/yr.	Approximately 25 high-pressure gas fills/processing operations were conducted in 2000.
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 10 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.	Capability not used in 2000.
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 3,000 units/yr.	Approximately 600 units were loaded. Operations occurred at TSFF.
Gas Analysis: TSTA, TSFF, WETF	Analytical support to current capabilities. Operations estimated to contribute <5% of LANL's tritium emissions to the environment.	Gas analysis operations were continued at all three facilities during 2000. No changes in facility emissions occurred 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.	Calorimetry activities were conducted at WETF and TSFF. No changes occurred 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. Onsite storage could increase by a factor of 10 over levels identified during preparation of the SWEIS, 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 levels identified during preparation of the SWEIS.

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

2.2.3 Operations Data for the Tritium Facilities

Most data for operations at the Tritium Facilities were slightly below levels projected by the SWEIS ROD. For example, radioactive air emissions totaled approximately 1,200 curies compared to 2,500 curies projected by the SWEIS ROD. This number is higher than the previous year because of cleanup activities at TA-21. Some of the tritium operations were being moved to WETF, and decontamination activities associated with removal of apparatus and ductwork results in increases in emissions of tritium. No hazardous wastes (chemical, LLW, MLLW, TRU, or mixed TRU) were generated. However, NPDES outfall discharges from TA-21 were significantly higher than those projected by the SWEIS ROD. This increase is from the methods used for estimating flow. These outfalls discharge on a batch flow basis and one is seasonally out of service. However, the Discharge Monitoring Reports from the Water Quality and Hydrology group are based on infrequent sampling and assume around-the-clock flow, thus substantially overestimating the actual total discharge. As the newly issued NPDES Permit is implemented in 2001, the Water Quality and Hydrology group will attempt to acquire direct flow measurements for all outfalls enabling the use of real data instead of estimates. Operational data are summarized in Table 2.2.3-1.



Top: WETF control center
Above: Function test glovebox used to test weapon components
Right: AMIGOS glovebox with experiment under development

Tritium System Test Assembly (TSTA) facility
Top left: Control room
Top right: Tritium water collection drums
Left center: TSTA experimental area

Tritium Science and Fabrication Facility (TSFF)
Above: Neutron target loading operation
Left: Inertial confinement fuson target research

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

PARAMETER	UNITS	SWEIS ROD	2000 OPERATIONS
Radioactive Air Emissions:			
TA-16/WETF, Elemental tritium	Ci/yr	3.00E+2	3.9E+1
TA-16/WETF, Tritium in water vapor	Ci/yr	5.00E+2	2.2E+2
TA-21/TSTA, Elemental tritium	Ci/yr	1.00E+2	2.5E+1
TA-21/TSTA, Tritium in water vapor	Ci/yr	1.00E+2	1.5E+2
TA-21/TSFF, Elemental tritium	Ci/yr	6.40E+2	2.5E+2
TA-21/TSFF, Tritium in water vapor	Ci/yr	8.60E+2	5.1E+2
NPDES Discharge: [a]			
Total Discharges	MGY	0.3	8.6
02A-129 (TA-21)	MGY	0.1	7.9
03A-158 (TA-21)	MGY	0.2	0.7
Wastes:			
Chemical	kg/yr	1,700	0
LLW	m^3/yr	480	0
MLLW	m^3/yr	3	0
TRU	m^3/yr	0	0
Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	28 [b]	24 [b]

[a] Outfalls eliminated before 1999: 05S (TA-21), 03A-036 (TA-21), 04A-091 (TA-16). Consolidation and removal of outfalls has resulted in projected NPDES volumes underestimating actual discharges from the existing outfalls.

[b] The number shown in the "SWEIS ROD" column is the index number representing CY 1999 (the year the SWEIS ROD was published). The number of employees for 2000 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the SWEIS ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 2000 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers (SWEIS ROD versus the new index) do not represent the same entity, a direct comparison to numbers projected by the SWEIS ROD (see Section 3.6, Socioeconomics) is not appropriate. However, because this index is going to be used in each subsequent yearbook, selecting CY 1999 as the base year establishes an index that can be compared over the ten-year window represented by the SWEIS ROD.

2.2.4 Cerro Grande Fire Effects at the Tritium Facilities

Threat of wildfire caused the Laboratory to close on Monday, May 8, and enter emergency operations. Because the closure was on a Monday, the Tritium Facilities were already in a safe condition from being in safe weekend configuration. During the fire no damage was incurred by the Tritium Facilities. While TA-21 facilities were only remotely threatened by fire, the fire burned up to and around WETF at least three times. Because of previous fuel thinning at TA-16 around the WETF and onsite fire support during the fire, no facility or office structures were damaged.

During the Laboratory closure, Tritium Facilities safety systems remained operational and the facilities remained in safe weekend configuration. The Tritium Facilities were never placed into shutdown mode. Facility Operations personnel responded several times to facility alarms and maintenance needs. No increase in tritium emission from the Tritium Facilities occurred as a result of the fire. Restoration of full operating capabilities (returning to operations) of the Tritium Facilities proceeded without problems or delays.

A lessons learned exercise was conducted after the fire with Tritium Facilities personnel. This resulted in several suggestions for personnel and system improvements that will improve facility safety should a similar incident occur in the future.

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 a main building (TA-3-29) and a radioactive liquid waste pump house, 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.

As shown in Table 2.3-1, CMR has five areas that DOE lists as Category 2 nuclear facilities (DOE 2000a). The SWEIS simply listed the whole CMR Building as a Category 2 nuclear facility.

Table 2.3-1 CMR Buildings with Nuclear Hazard Classification

BUILDING	DESCRIPTION	NHC SWEIS ROD	NHC DOE 1998 [a]	NHC DOE 2000 [b]
TA-03-0019	CMR	2		
TA-03-0029	Radiochemistry Hot Cell		2	2
TA-03-0029	SNM Vault		2	2
TA-03-0029	Nondestructive analysis/nondestructive examination Waste Assay		2	2
TA-03-0029	IAEA Classroom [c]			2
TA-03-0029	Wing 9 (Enriched Uranium)		2	2

[a] DOE/LANL list of Los Alamos National Laboratory Nuclear Facilities (DOE 1998a)
[b] DOE/LANL list of Los Alamos National Laboratory Nuclear Facilities (DOE 2000a)
[c] The IAEA (International Atomic Energy Agency) Classroom was used to conduct Nonproliferation Training. This capability was moved to Pajarito Site (TA-18) and renamed the "Nuclear Measurement School."

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 5–10 years;
- Phase II Upgrades (except seismic) to enable operations for an additional 20–30 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.

In August 1998, DOE approved the CMR Basis for Interim Operations (BIO), and in the fall of 1998, DOE determined that extensive upgrades to CMR would not be cost effective. In 1999, DOE directed the CMR Upgrades Project to re-baseline including only those upgrades needed to ensure compliance with the BIO. These upgrades were required for the facility to be reliable through 2010. The new baseline was approved in October 1999 and included 16 upgrades necessary to ensure worker safety, public safety, environmental compliance, and reliability of services to safety systems. Table 2.3.1-1 identifies these 16 upgrades and their status during 2000.

CMR research laboratory

Table 2.3.1-1. CMR Upgrade Status/December 2000

% COMPLETE	STATUS	UPGRADE
75	in construction	Duct Washdown System Upgrade
100	completed	Heating, Ventilation, and Air Conditioning (HVAC) delta Pressure System Upgrade
65	in construction	Hood Washdown System Upgrade
55	in design	West Bank Hot Cell delta Pressure System Upgrade
40	in design	West Bank Hot Cell Controls Upgrade
100	completed	Stack Monitors Phase A Upgrade
60	in construction	Emergency Personnel Accountability System Upgrade
90	completed	Stack Monitors Phase B Upgrade
80	in construction	Compressor System Upgrade
100	completed	Sprinkler Head Replacement Upgrade
55	in construction	Emergency Lighting System Upgrade
35	in design	Emergency Notification Upgrade
40	in design	Internal Power Distribution Upgrade
0	not started	Operations Center Upgrade
45	in design	Ventilation System Filter Replacement Upgrade
40	in design	Fire Protection System Upgrade

Substantial progress was experienced during 2000, despite a significant disruption in construction activities in late spring and early summer because of a loss of craft labor caused by the Cerro Grande fire recovery. Based on current projections, these upgrades should be complete by Fiscal Year (FY) 2002.

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. No new capabilities have been added, but one capability (Nonproliferation Training) was removed from CMR and relocated back to TA-18.

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

CAPABILITY	SWEIS ROD[a]	2000 OPERATIONS
Analytical Chemistry	Sample analysis in support of a wide range of actinide research and processing activities. Approximately 7,000 samples/yr.	Approximately 2,150 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. Four to five shipments were made to Y-12.
Destructive and Nondestructive Analysis	Evaluate 6 to 10 secondaries/yr through destructive/nondestructive analyses and disassembly.	No activity. Project is no longer active, and capability was not used in 2000.
Nonproliferation Training (moved to Pajarito Site [TA-18] and renamed the Nuclear Measurement School).	Nonproliferation training involving SNM. No additional quantities of SNM, but may work with more types of SNM than present during preparation of the SWEIS.	Training was conducted in August 2000. This capability was moved back to TA-18, and no more training is planned at CMR Building because of a change in status.
Actinide Research and Processing [b]	Process up to 5,000 Curies/yr plutonium-238/beryllium and americium-241/beryllium neutron sources.	No activity.

Table 2.3.2-1 (Cont.)

CAPABILITY	SWEIS ROD[a]	2000 OPERATIONS
Actinide Research and Processing [b]	Process neutron sources other than sealed sources. Stage up to 1,000 Curies/yr plutonium-238/beryllium and americium-241/beryllium sources in Wing 9 floor holes.	No 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.
	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 200 samples containing less than 20 grams of plutonium per sample.
	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.	Decontamination performed on 15 drum scales, and decontamination was started on 34 liter drum scales. This operation is expected to terminate in 2001.
Fabrication and Metallography	Produce 1,080 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 3,000 six-day curies of molybdenum-99/wk.[c]	No activity. Project was terminated.
	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 kilograms highly enriched uranium per operation. Material recovered and retained in inventory. Up to 1,000 kilograms 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 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, which are not specific to the facility (but are related directly to the activities themselves), are only projected for the total of 400 kilograms/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 SWEIS ROD. Radioactive air emissions were less than one curie (compared to 1,645 projected)—principally because processing of irradiated molybdenum-99 targets in the hot cells did not occur in 1999 or in 2000. Of the wastes generated, only TRU waste approximated SWEIS ROD projections; the others remained low, ranging from about 2 percent to about 17 percent of these projections. Table 2.3.3-1 provides details of these and other operational data. NPDES discharge data are overestimated because of the methods used in the discharge monitoring reports that are based on infrequent sampling and assume around-the-clock flow.

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

PARAMETER	UNITS	SWEIS ROD	2000 OPERATIONS
Radioactive Air Emissions:			
Total Actinides[a]	Ci/yr	7.60E-4	1.0E-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]
NPDES Discharge:			
03A–021	MGY	0.53	2.28
Wastes:			
Chemical	kg/yr	10,800	1,837
LLW	m^3/yr	1,820	264
MLLW	m^3/yr	19	0.3
TRU	m^3/yr	28 [c]	25
Mixed TRU	m^3/yr	13 [c]	1
Number of Workers	FTEs	204 [d]	190 [d]

[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 SWEIS provided the data for TRU and mixed TRU wastes in Chapter 3 and Chapter 5. However, the projections made had to be modified to reflect the decision to produce nominally 20 pits per year.

[d] The number shown in the "SWEIS ROD" column is the index number representing CY 1999 (the year the SWEIS ROD was published). The number of employees for 2000 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the SWEIS ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 2000 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers (SWEIS ROD versus the new index) do not represent the same entity, a direct comparison to numbers projected by the SWEIS ROD (see Section 3.6, Socioeconomics) is not appropriate. However, because this index is going to be used in each subsequent yearbook, selecting CY 1999 as the base year establishes an index that can be compared over the ten-year window represented by the SWEIS ROD.

2.3.4 Cerro Grande Fire Effects at the CMR Building

Cerro Grande fire effects on the CMR Building and its associated operations were minimal. Programs did suffer from downtime and loss of productivity during the evacuation. No direct fire damage occurred and recovery was limited to cleaning or replacement of air system filters.

2.4 Pajarito Site (TA-18)

The Pajarito Site Key Facility is located entirely at TA-18. Principal activities are design and performance of nuclear criticality experiments and detector development in support of emergency response, nonproliferation, and arms control.

The SWEIS defined the facility as having a main building (18-30), three outlying, remote-controlled critical assembly buildings then known as “kivas” (18-23, -32, -116), and a number of additional support buildings, including the hillside vault (18-26). During 2000, in response to concerns expressed by two Native American Indian Pueblos (Santa Ana and Picuris), the term “kiva” (which has religious significance to these Native Americans), was replaced with the acronym CASA (Critical Assembly and Storage Area).

The SWEIS defined this Key Facility as having five Category 3 nuclear facilities (the hillside vault for nuclear material storage, two CASAs, and two additional research buildings) and one Category 2 nuclear facility (CASA #2).

As shown in Table 2.4-1, DOE lists this whole Key Facility as a Category 2 facility and identifies seven buildings with NHCs. The four buildings identified in the SWEIS (TA-18-0023, -0026, -0032, and -0116) have remained Category 2 nuclear facilities. The additions represent buildings with inventories meeting the current nuclear facility classification guidelines. It is interesting to note that the IAEA classroom (Building TA-18-0258) represents a capability that was originally at TA-18, transferred to the CMR Building, and then brought back to TA-18 in 2000.

Table 2.4-1. Pajarito Site Buildings with Nuclear Hazard Classification

BUILDING	DESCRIPTION	NHC SWEIS ROD	NHC DOE 1998 [a]	NHC DOE 2000 [b]
TA-18	Site Itself		2	2
TA-18-0023	SNM Vault (CASA 1)	2	2	2
TA-18-0026	Hillside Vault	2	2	2
TA-18-0032	SNM Vault (CASA 2)	2	2	2
TA-18-0116	Assembly Building (CASA 3)	2	2	2
TA-18-0127	Accelerator used for weapons x-ray		2	2
TA-18-0129	Calibration Laboratory		2	2
TA-18-0247	Sealed Sources		3	3
TA-18-0258	IAEA Classroom (Trailer) [c]		2	

[a] DOE/LANL list of Los Alamos National Laboratory Nuclear Facilities (DOE 1998a)
[b] DOE/LANL list of Los Alamos National Laboratory Nuclear Facilities (DOE 2000a)
[c] The IAEA Classroom was moved from CMR to TA-18. The capability was renamed from “Nonproliferation Training” to “Nuclear Measurement School” as part of the move.

No changes were made to the authorization basis documents in 2000. During 2000 a new BIO document was initiated that will supersede the approved safety analysis report when issued in May 2001.

2.4.1 Construction and Modifications at the Pajarito Site

The SWEIS ROD projected replacement of the portable linac. This has not been done, nor have any major modifications or new construction projects taken place during 2000 to directly support operations.

2.4.2. Operations at the Pajarito Site

The SWEIS identified nine capabilities for this Key Facility.

No research capabilities have been deleted. However, the Nuclear Measurement School, which was originally moved from TA-18 to CMR (before the SWEIS), was moved back to TA-18 in 2000. The TA-18 facility experienced normal operations during 2000 and conducted 140 criticality experiments. This total of 140 experiments represents only about 13 percent of the SWEIS ROD projection of a maximum of 1,050 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

CAPABILITIES	SWEIS ROD[a]	2000 OPERATIONS
Dosimeter Assessment and Calibration	Perform up to 1,050 criticality experiments per year.	Performed 140 experiments.
Detector Development	Develop safeguards instrumentation and perform research and development for nuclear materials, light detection and ranging 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, and a 15% increase in 2000. Did not replace the portable linac.
Materials Testing	Perform up to 1,050 criticality experiments per year. Develop safeguards instrumentation and perform research and development for nuclear materials, light detection and ranging experiments, and materials processing.	Performed 140 experiments.
Subcritical Measurements	Perform up to 1,050 criticality experiments per year. Develop safeguards instrumentation and perform research and development for nuclear materials, light detection and ranging experiments, and materials processing. Increase nuclear materials inventory by 20%.	Performed 140 experiments. Increased nuclear materials inventory by 5% in 1998, no additional increase in 1999, and a 15% increase in 2000. The Skua critical assembly was de-fueled at DOE's request and is no longer available for criticality experiments.
Fast-Neutron Spectrum	Perform up to 1,050 criticality experiments per year. Develop safeguards instrumentation and perform research and development for nuclear materials, light detection and ranging experiments, and materials processing. Increase nuclear materials inventory by 20%, and increase nuclear weapons components and materials.	Performed 140 experiments. Increased nuclear materials inventory by 5% in 1998, no additional increase in 1999, and a 15% increase in 2000. Slight increase in nuclear weapons components and materials in 1998, no additional increase in 1999.
Dynamic Measurements	Perform up to 1,050 criticality experiments per year. Develop safeguards instrumentation and perform research and development for nuclear materials, light detection and ranging experiments, and materials processing. Increase nuclear materials inventory by 20%.	Performed 140 experiments. Increased nuclear materials inventory by 5% in 1998, no additional increase in 1999, and a 15% increase in 2000.
Skyshine Measurements	Perform up to 1,050 criticality experiments per year.	Performed 140 experiments.
Vaporization	Perform up to 1,050 criticality experiments per year.	Performed 140 experiments.
Irradiation	Perform up to 1,050 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 140 experiments. Increased nuclear materials inventory by 5% in 1998, no additional increase in 1999, and a 15% increase in 2000.

Table 2.4.2-1 (Cont.)

CAPABILITIES	SWEIS ROD[a]	2000 OPERATIONS
Nuclear Measurement School (relocated from CMR and renamed. At CMR it was called "Nonproliferation Training").	Not in SWEIS ROD (was located in CMR).	This capability was located at TA-18 in years past, but had been moved to CMR. In the effort to reduce the CMR Building to a Category 3 nuclear facility, these operations were moved back to TA-18, necessitating the transfer of additional nuclear material to the facility for use in the classes.

[a] Includes replacement of the portable linac.

2.4.3 Operations Data for the Pajarito Site

Research activities were well below those projected by the SWEIS 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. The dose estimated to result from 2000 activities was 2.5 millirem, compared to 28.5 millirem per year projected by the SWEIS ROD. Chemical waste generation was below projections (410 kilograms generated in 2000 compared to 4,000 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	2000 OPERATIONS
Radioactive Air Emissions:			
Argon-41 [a]	Ci/yr	1.02E+2	8.0E-1
External Penetrating Radiation	mrem/yr	28.5 [b]	2.5
NPDES Discharge	MGY	No outfalls	No outfalls
Wastes:			
Chemical	kg/yr	4,000	410
LLW	m^3/yr	145	14
MLLW	m^3/yr	1.5	0
TRU	m^3/yr	0	0
Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	70 [c]	73 [c]

[a] These values are not stack emissions. The SWEIS ROD projections are from Monte Carlo 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.

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

[c] The number shown in the "SWEIS ROD" column is the index number representing CY 1999 (the year the SWEIS ROD was published). The number of employees for 2000 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the SWEIS ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 2000 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers (SWEIS ROD versus the new index) do not represent the same entity, a direct comparison to numbers projected by the SWEIS ROD (see Section 3.6, Socioeconomics) is not appropriate. However, because this index is going to be used in each subsequent yearbook, selecting CY 1999 as the base year establishes an index that can be compared over the ten-year window represented by the SWEIS ROD.

2.4.4 Cerro Grande Fire Effects at the Pajarito Site

The Cerro Grande fire at TA-18 damaged no facilities. A Facility Recovery Plan was issued on May 22. The Facility Manager implemented this plan by establishing the Facility Recovery Team to perform safety reconnaissance and condition assessment of the facility. The assessment identified no deficiencies or significant environmental, safety, and health issues. Specifically, there was no need for additional oversight by managers or subject matter experts, no need for compensatory measures for facility systems, and no need for interim or unusual operations.

The fire destroyed much of the vegetation in and around TA-18. Because TA-18 is located in a canyon bottom, post-fire flooding became a major concern and a flood contingency plan was designed for protecting personnel, infrastructure, and nuclear material at risk. A plan for personnel safety was issued that included five flood condition warnings with varying responses, including facility evacuation (Condition 5). The infrastructure was protected by construction of earthen berms up-canyon northwest of CASA 1 and the Solution High-Energy Burst Assembly (SHEBA) building and at the bridge crossing the stream channel to CASA 2 and CASA 3. Additional measures included clearing and deepening the stream channel running through the facility and installation of barriers, sandbags, and sheet piling at several locations to channel the flow of potential floods away from key structures. Some portable structures, such as metal sheds used to store radioactive sources, were moved to higher ground. Nuclear material at risk was protected by moving uranium solutions used for critical assembly fuel to storage locations on higher ground. Finally, a flood retention structure was built by the Army Corps of Engineers up Pajarito Canyon from the facility outside of Facility Management Unit 74 boundaries to protect the facility from floods.

Top: Criticality experiment being setup
Bottom: SHEBA is used for criticality testing of nuclear materials in liquid solutions

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 (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. As shown in Table 2.5-1, this Key Facility had two Category 3 nuclear facilities, 03-66 and 03-159 identified in the SWEIS; however, in April 2000, building 3-159 was downgraded from a Category 3 Nuclear Hazard facility to a radiological facility and removed from the nuclear facilities list.

2.5.1 Construction and Modifications at the Sigma Complex

The SWEIS projected significant facility changes for the Sigma Building itself. Three of five planned upgrades are done, one is essentially done, and one remains undone. They are

- replacement of graphite collection systems–completed in 1998,
- modification of the industrial drain system–completed in 1999,
- replacement of electrical components–essentially completed in 2000; however, add-on assignments will continue,
- roof replacement–most of the roof was replaced in 1998 and 1999; however, additional work needs to be done, and
- seismic upgrades–not started.

Although operations have not yet started, construction of the Beryllium Technology Facility, formerly known as the Rolling Mill Building, was completed during 1999. The Beryllium Technology Facility, 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 3,000 square feet will be used for general metallurgical activities. The 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 Beryllium Technology Facility and will include energy- and weapons-related use of beryllium metal and beryllium oxide. As discussed in Section 2.8, Machine Shops, beryllium equipment was moved from the shops into the Beryllium Technology Facility in stages during 2000.

Table 2.5-1. Sigma Buildings with Nuclear Hazard Classification

BUILDING	DESCRIPTION	NHC SWEIS ROD	NHC DOE 1998 [a]	NHC DOE 2000 [b]
TA-03-0066	44 metric tons of depleted uranium storage	3	3	3
TA-03-0159	thorium storage	3	3	

[a] DOE/LANL list of Los Alamos National Laboratory Nuclear Facilities (DOE 1998a)
[b] DOE/LANL list of Los Alamos National Laboratory Nuclear Facilities (DOE 2000a)

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 SWEIS ROD.

Beryllium collection system at the Sigma Complex

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

CAPABILITY	SWEIS ROD [a]	2000 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.	Totals of 227 assignments and 1,070 specimens were characterized.
	Analyze up to 36 tritium reservoirs/yr.	Total of 3 tritium reservoirs analyzed.
	Develop library of aged non-SNM materials from stockpiled weapons and develop techniques to test and predict changes. Store and characterize up to 2,500 non-SNM component samples, including uranium.	Approximately 1,000 non-SNM materials samples and 1,000 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 25 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.	Seven radio-frequency cavities were polished. None were 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.	Less than 10 stainless steel, and no beryllium, components produced.

[a] Includes Sigma Building renovation and modifications for Beryllium Technology Facility.

2.5.3 Operations Data for the Sigma Complex

Levels of research and operations were less than those projected by the SWEIS ROD; consequently, operations data were also below projections. Waste volumes and NPDES discharge volumes were all lower than projected by the SWEIS ROD. The 3,663 kilograms of chemical waste includes 660 kilograms of industrial solid waste caused by cleanup following the Cerro Grande fire. Industrial solid waste is nonhazardous, may be disposed in county landfills, and does not represent a threat to local environs. Table 2.5.3-1 provides details.

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

PARAMETER	UNITS	SWEIS ROD	2000 OPERATIONS
Radioactive Air Emissions: [a]			
Uranium-234	Ci/yr	6.60E-5	Not Measured
Uranium-238	Ci/yr	1.80E-3	Not Measured
NPDES Discharge:			
Total Discharges	MGY	7.3	3.9
03A–022	MGY	4.4	3.9 [b]
03A–024	MGY	2.9	0
Wastes:			
Chemical	kg/yr	10,000	3,663
LLW	m^3/yr	960	52
MLLW	m^3/yr	4	0
TRU	m^3/yr	0	0
Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	101 [c]	99 [c]

[a] Stack monitoring at Sigma was discontinued early in year 2000. This decision was made because the potential emissions from the monitored stack were sufficiently low that stack monitoring was no longer warranted for compliance with Environmental Protection Agency (EPA) or DOE regulations. Therefore, no emissions from monitoring data are available.

[b] This outfall flowed all four quarters during CY 2000.

[c] The number shown in the "SWEIS ROD" column is the index number representing CY 1999 (the year the SWEIS ROD was published). The number of employees for 2000 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the SWEIS ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 2000 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers (SWEIS ROD versus the new index) do not represent the same entity, a direct comparison to numbers projected by the SWEIS ROD (see Section 3.6, Socioeconomics) is not appropriate. However, because this index is going to be used in each subsequent yearbook, selecting CY 1999 as the base year establishes an index that can be compared over the ten-year window represented by the SWEIS ROD.

2.5.4 Cerro Grande Fire Effects at the Sigma Complex

Cerro Grande fire effects on the Sigma Key Facility and its associated operations were minimal. Programs at Sigma did suffer downtime and loss of productivity during the evacuation, initial damage assessment, and recovery and reentry phases. No direct fire damage occurred and recovery was limited to cleaning or replacement of air system filters.

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 Materials Science Laboratory

There were no facility modifications during 2000. The SWEIS identified that completion of the top floor of the MSL was planned and was included in an environmental assessment (DOE 1991), but was not funded. To date, this work remains unscheduled and unfunded.

2.6.2 Operations at the Materials Science Laboratory

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 2000, MSL conducted operations at levels approximating those projected by the SWEIS ROD.

In 2000, there were approximately 109 total researchers and support staff at MSL, about 33 percent more than the 82 projected by the SWEIS ROD[4]. (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 laboratories and reflects the high value placed on the MSL because of its quality lab space. Table 2.6.2-1 compares 2000 operations to projections made by the SWEIS ROD.

Table 2.6.2-1. Materials Science Laboratory (TA-03)/Comparison of Operations

CAPABILITY	SWEIS ROD [a]	2000 OPERATIONS
Materials Processing	Maintain seven research capabilities at levels identified during preparation of the SWEIS: • 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 by the SWEIS ROD.
Mechanical Behavior in Extreme Environment	Maintain two research capabilities at levels identified during preparation of the SWEIS: • 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.
Advanced Materials Development	Maintain four research capabilities at levels identified during preparation of the SWEIS: • New materials • Synthesis and characterization • Ceramics • Superconductors	This capability was maintained as projected by the SWEIS ROD.

[4] This number should not be confused with the FTE index shown in Table 2.6.3-1 (59 FTEs) as the two numbers represent different populations of individuals. The 109 total researchers represent students, temporary employees, and visiting staff from other institutions. The 59 FTEs represents only regular full-time and part-time LANL staff.

Table 2.6.2-1 (Cont.)

CAPABILITY	SWEIS ROD [a]	2000 OPERATIONS
Materials Characterization	Maintain four research capabilities at levels identified during preparation of the SWEIS: • 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 Materials Science Laboratory

The overall size of the MSL workforce has increased from about 57 workers in 1999 to about 59 in 2000 (regular part-time and full-time LANL employees listed in Table 2.6.3-1). However, operational effects have been mixed relative to SWEIS ROD projections. Waste quantities were higher than projected by the SWEIS ROD. The 881 kilograms of chemical waste includes 600 kilograms of industrial solid waste from disposal of several drums of activated alumina, generated as part of routine maintenance and used to remove moisture from the MSL's air control system. Industrial solid waste is nonhazardous, may be disposed in county landfills, and does not represent a threat to local environs. Radioactive air emissions continue to be negligible and therefore were not measured. Table 2.6.3-1 provides details.

Table 2.6.3-1. Materials Science Laboratory (TA-03)/Operations Data

PARAMETER	UNITS	SWEIS ROD	2000 OPERATIONS
Radioactive Air Emissions	Ci/yr	Negligible	Not Measured
NPDES Discharge Volume	MGY	No outfalls	No Outfalls
Wastes:			
Chemical	kg/yr	600	881
LLW	m^3/yr	0	0
MLLW	m^3/yr	0	0
TRU	m^3/yr	0	0
Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	57 [a]	59 [a]

[a] The number shown in the "SWEIS ROD" column is the index number representing CY 1999 (the year the SWEIS ROD was published). The number of employees for 2000 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the SWEIS ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 2000 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers (SWEIS ROD versus the new index) do not represent the same entity, a direct comparison to numbers projected by the SWEIS ROD (see Section 3.6, Socioeconomics) is not appropriate. However, because this index is going to be used in each subsequent yearbook, selecting CY 1999 as the base year establishes an index that can be compared over the ten-year window represented by the SWEIS ROD.

2.6.4 Cerro Grande Fire Effects at the Materials Science Laboratory

Cerro Grande fire effects on MSL and its associated operations were minimal. Programs at MSL suffered downtime and loss of productivity during the evacuation, initial damage assessment, and recovery and reentry phases. No direct fire damage occurred and recovery was limited to cleaning or replacement of air system filters.

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 as a Low Hazard chemical facility. Sanitary wastes are piped to the LANL sewage facility at TA-46, and radioactive liquid wastes are piped to the treatment facility at TA-50. Refer to Sections 2.15 and 3.2 for information on sanitary and liquid waste treatment.

2.7.1 Construction and Modifications at the Target Fabrication Facility

There were no significant facility additions or modifications during 2000. The ROD did not project any facility changes through 2005.

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 2000, approximately 1,300 targets and specialized components were fabricated for testing purposes, which is less than the 6,100 targets per year projected by the SWEIS ROD. As seen in the Table 2.7.2-1, other operations at the TFF were also below levels projected by the SWEIS ROD.

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

CAPABILITY	SWEIS ROD	2000 OPERATIONS
Precision Machining and Target Fabrication	Provide targets and specialized components for about 6,100 laser and physics tests/yr, including a 20% increase over levels identified during preparation of the SWEIS for high-explosive pulsed-power target operations, and including about 100 high-energy-density physics tests.	Provided targets and specialized components for about 1,300 tests. Supported high-explosive pulsed-power tests at levels identified during preparation of the SWEIS. Supported about 7 high-energy-density physics tests.
Polymer Synthesis	Produce polymers for targets and specialized components for about 6,100 laser and physics tests/yr, including a 20% increase over levels identified during preparation of the SWEIS for 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 levels identified during preparation of the SWEIS. Supported about 7 high-energy-density physics tests.

Table 2.7.2-1 (Cont.)

CAPABILITY	SWEIS ROD	2000 OPERATIONS
Chemical and Physical Vapor Deposition	Coat targets and specialized components for about 6,100 laser and physics tests/yr, including a 20% increase over levels identified during preparation of the SWEIS for high-explosive pulsed-power target operations, including about 100 high-energy-density physics tests, and including support for pit rebuild operations at twice the levels identified during preparation of the SWEIS.	Coated targets and specialized components for about 600 tests. Supported high-explosives pulsed-power tests at levels identified during preparation of the SWEIS. Supported about 7 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 levels identified during preparation of the SWEIS and below levels projected by the SWEIS ROD. This summary is supported by the current workforce and by 2000 waste volumes, which were less than projected. Table 2.7.3-1 details operations data for 2000.

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

PARAMETER	UNITS	SWEIS ROD	2000 OPERATIONS
Radiological Air Emissions	Ci/yr	Negligible	Not Measured [a]
NPDES Discharge:	MGY		
4A-127	MGY	0	No Outfalls
Wastes:			
Chemical	kg/yr	3800	1062
LLW	m^3/yr	10	0
MLLW	m^3/yr	0.4	0
TRU	m^3/yr	0	0
Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	54 [b]	52 [b]

[a] The emissions continue to be sufficiently low that monitoring is not required.

[b] The number shown in the "SWEIS ROD" column is the index number representing CY 1999 (the year the SWEIS ROD was published). The number of employees for 2000 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the SWEIS ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 2000 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers (SWEIS ROD versus the new index) do not represent the same entity, a direct comparison to numbers projected by the SWEIS ROD (see Section 3.6, Socioeconomics) is not appropriate. However, because this index is going to be used in each subsequent yearbook, selecting CY 1999 as the base year establishes an index that can be compared over the ten-year window represented by the SWEIS ROD.

2.7.4 Cerro Grande Fire Effects at the Target Fabrication Facility

Programs at TFF suffered substantial downtime and loss of productivity during the evacuation and initial damage assessment, recovery, and reentry phases. Lost time because of the fire resulted in the TFF being available only about 93 percent of the planned operational days in 2000 while the target assembly area was only available about 88 percent. No direct fire damage occurred; however, some equipment was damaged because of fluctuating power and loss of liquid nitrogen cooling. Additionally, smoke damage to work areas and air handling systems was sufficient to prevent use of the Target Assembly area. The target assembly team relocated to Sandia National Laboratories for a two-week period while their work areas and air handling systems were cleaned and repaired.

2.8 Machine Shops (TA-03)

The Machine Shops Key Facility consists of two buildings, the Nonhazardous Materials Machine Shop (Building 03-39) and the Radiological Hazardous Materials Machine Shop (Building 03-102). Both buildings are located within the same exclusion area. Activities consist of machining and fabrication of various materials in support of major LANL operations, principally those related to 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 that ceased in January 2001, while Building 03-102 is categorized as a Low Hazard radiological facility, because of uranium operations. Even with removal of the beryllium operations, Building 03-39 will remain a Low Hazard chemical facility because of various chemicals used in machining operations.

Machine shops casting and stamping equipment

2.8.1 Construction and Modifications at the Machine Shops

Consistent with SWEIS ROD projections, there were no new construction or major modifications to the shops in 2000. Beryllium equipment was moved from Room 16 in the north wing of Building 03-39 to Building 03-141, the Beryllium Technology Facility (part of the Sigma Key Facility). The move is being conducted in phases and will not be completed before 2001.

2.8.2 Operations at the Machine Shops

As shown in Table 2.8.2-1, the SWEIS identified three capabilities at the shops. These same three capabilities continue to be maintained. No new capabilities have been added to this Key Facility. All activities occurred at levels well below those projected by the SWEIS 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 2000 was directed to the development and instrumentation 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.

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

CAPABILITY	SWEIS ROD	2000 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 below those projected by the SWEIS ROD.
Fabrication Utilizing Unique Materials	Continue fabrication utilizing unique and unusual materials.	Fabrication with unique materials was conducted at levels 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 SWEIS ROD, so too were operations data. Chemical waste generation was less than 0.1 percent of projected generation (887 kilograms generated in 2000, 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	2000 OPERATIONS
Radioactive Air Emissions:			
Thorium-230	Ci/yr	Not projected [a]	1.2E-9
Uranium-234	Ci/yr	Not projected [a]	5.3E-8
Uranium-235	Ci/yr	Not projected [a]	1.9E-9
Uranium-238	Ci/yr	1.50E-4	1.3E-9
NPDES Discharge	MGY	No outfalls	No outfalls
Wastes:			
Chemical	kg/yr	474,000	887
LLW	m^3/yr	606	409
MLLW	m^3/yr	0	0.12
TRU	m^3/yr	0	0
Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	81 [b]	80 [b]

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

[b] The number shown in the “SWEIS ROD” column is the index number representing CY 1999 (the year the SWEIS ROD was published). The number of employees for 2000 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the SWEIS ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 2000 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers (SWEIS ROD versus the new index) do not represent the same entity, a direct comparison to numbers projected by the SWEIS ROD (see Section 3.6, Socioeconomics) is not appropriate. However, because this index is going to be used in each subsequent yearbook, selecting CY 1999 as the base year establishes an index that can be compared over the ten-year window represented by the SWEIS ROD.

2.8.4 Cerro Grande Fire Effects at the Machine Shops

Cerro Grande fire effects on the Machine Shops and associated operations were minimal. Programs at the Machine Shops suffered downtime and loss of productivity during the evacuation, initial damage assessment, recovery, and reentry phases.

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 treatment of high explosive contaminated wastewaters. Activities consist primarily of manufacture and assembly of high explosives components for nuclear weapons and for Science-Based Stockpile Stewardship Program tests and experiments. Environmental and safety tests are performed at TA-11 and TA-09 while TA-08 houses radiography activities.

As identified in the SWEIS, this Key Facility had four Category 2 nuclear buildings in TA-08 (08-22, -23, -24, and -70) and no Category 3 nuclear or Moderate Hazard nonnuclear facilities (Table 2.9-1). Based on the new DOE list, two buildings (TA-08-24, and -70) were delisted, and one building in TA-16 (16-0411) was added.

Table 2.9-1. High Explosives Processing Buildings with Nuclear Hazard Classification

BUILDING	DESCRIPTION	NHC SWEIS ROD	NHC DOE 1998 [a]	NHC DOE 2000 [b]
TA-08-0022	Radiography facility	2	2	2
TA-08-0023	Radiography facility	2	2	2
TA-08-0024	Isotope Building	2		
TA-08-0070	Experimental Science	2		
TA-16-0411	Intermediate Device Assembly		2	2

[a] DOE/LANL list of Los Alamos National Laboratory Nuclear Facilities (DOE 1998a)
[b] DOE/LANL list of Los Alamos National Laboratory Nuclear Facilities (DOE 2000a)

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 production of high explosives. To assist the reader, this information is presented both in separate and combined forms.

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 2000. Facility changes that occurred during 2000 are described below.

(a) The real time, small component radiography capability installed in Building TA-16-260 was not made fully operational in 2000. When this capability becomes fully operational, Buildings TA-16-220, -222, -223, -224, -225, and -226 will be vacated (DOE 1997a).

(b) Planning and modification work at TA-9 continued to allow consolidation of high explosives formulation operations previously conducted at TA-16-340 with other TA-9 high explosives operations (DOE 1999c). Building TA-16-340 was closed in the second quarter of FY 2000.

(c) The incinerator underwent Resource Conservation and Recovery Act (RCRA) clean-closure late in the summer of 2000 and was dismantled and scrapped during the fourth quarter of 2000.

(d) RCRA closure activities continued for two units, the TA-16-387 flash pad and the TA-16-394 burn tray that belong to ESA Division. ESA upgraded one of the other burn units improving capacity and efficiency and minimizing environmental impacts. Approximately 545 cubic meters of hazardous wastes were removed during closure of the flash pad, and approximately 114 cubic meters of hazardous waste were removed during closure of the burn tray.

2.9.2 Operations at High Explosives Processing

The SWEIS ROD identified six capabilities for this Key Facility. No new capabilities have been added, and none have been deleted. Activity levels during 2000 continued below those projected by the SWEIS ROD. These projections were based on the possibility that LANL would take over high explosives production work being performed at Pantex Plant. DOE decided, however, to keep high explosives production at Pantex Plant. However, the projections for high explosive processing were retained because DOE intends to keep LANL available as a back-up capability for Pantex Plant.

Nonnuclear test explosion

As seen in Table 2.9.2-1, high explosives and plastics development and characterization operations remained below levels projected in the SWEIS. Efforts continued in 2000 to develop protocols for obtaining stockpile returned materials, develop new test methods, and procure new equipment to support requirements for science-based studies on stockpile materials.

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]	2000 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 2,000 high explosive parts, and ESA Division fabricated approximately 578 high explosives parts in 2000. Therefore, approximately 2,578 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.

CAPABILITY	SWEIS ROD[a, b]	2000 OPERATIONS
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 2000. ESA Division provided three re-validation and two certification assemblies in 2000.
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 2000. In addition, ESA Division provided 14 flux generator assemblies in 2000.

[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 SWEIS ROD are 82,700 pounds of explosives and 2,910 pounds of mock explosives. Actual amounts used in 2000 were 15,150 pounds of high explosive (DX Division, 8,150 pounds and ESA Division, 7,000 pounds), and 5,279 pounds of mock high explosive (DX Division, 1,750 pounds and ESA Division, 3,529 pounds).

[b] Includes construction of the High Explosives Wastewater Treatment Facility, the steam plant conversion, relocation of the Weapons Testing Facility, and outfall modifications.

In 2000, 15,150 pounds of high explosives (8,150 from DX Division and 7,000 from ESA Division), and 5,279 pounds of inert mock high explosives material (1,750 from DX Division and 3,529 from ESA Division) were used in the fabrication of test components. 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 2,910 pounds. However, the mock high explosive results in chemical waste that is shipped offsite for disposal and does not result in environmental impacts at LANL.

At the TA-16 Burn Ground, 5,225 pounds of high explosives-contaminated materials were flashed, and 7,514 pounds of high explosives and 3,080 pounds of high explosives-contaminated oil/solvent were open air burned. The High Explosives Wastewater Treatment Facility processed 95,778 gallons of high explosives-contaminated water. Again, these levels were well below those projected by the SWEIS ROD. Three outfalls from High Explosives Processing remain on the NPDES Permit: 03A-130, 05A-055 (the High Explosives Wastewater Treatment Facility), and 05A-097.

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 about 86,000 gallons, compared to a projection of 12 million gallons. Waste quantities were well below projections made by the SWEIS ROD.

Bunkers at S-Site were singed but undamaged by the Cerro Grande fire

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	2000 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	0.086
03A–130 (TA-11)	MGY	0.04	0.001
05A–055 (TA-16)	MGY	0.13	0.085
05A–097 (TA-11)	MGY	0.01	No discharge
Wastes:			
Chemical	kg/yr	13,000	9,680
LLW	m^3/yr	16	3
MLLW	m^3/yr	0.2	0
TRU	m^3/yr	0	0
Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	96 [c]	92 [c]

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

[b] Outfalls eliminated before 1999: 02A-007 (TA-16), 04A-070 (TA-16), 04A-083 (TA-16), 04A-092 (TA-16), 04A-115 (TA-8), 04A-157 (TA-16), 05A-053 (TA-16), 05A-056 (TA-16), 05A-066 (TA-9), 05A-067 (TA-9), 05A-068 (TA-9), 05A-069 (TA-11), 05A-071 (TA-16), 05A-072 (TA-16), 05A-096 (TA-11), 06A-073 (TA-16), 06A-074 (TA-8), and 06A-075 (TA-8).

[c] The number shown in the "SWEIS ROD" column is the index number representing CY 1999 (the year the SWEIS ROD was published). The number of employees for 2000 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the SWEIS ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 2000 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers (SWEIS ROD versus the new index) do not represent the same entity, a direct comparison to numbers projected by the SWEIS ROD (see Section 3.6, Socioeconomics) is not appropriate. However, because this index is going to be used in each subsequent yearbook, selecting CY 1999 as the base year establishes an index that can be compared over the ten-year window represented by the SWEIS ROD.

2.9.4 Cerro Grande Fire Effects at High Explosives Processing

On May 7, the High Explosives Processing Key Facility Emergency Control Center was activated, TA-16 (S-Site) was evacuated, and all buildings were placed into a safe closed condition. Personnel began bulldozing a fire line around WETF. By May 12, TA-16 was on fire. On May 14, several emergency entries to TA-16 were made to assure that WETF was adequately maintained to keep its authorization basis active.

By May 15, Management started planning for reentry, and procedures were established. On May 17, TA-16 was reentered according to procedures, and personnel started to assess buildings and perform cleanup following the fire. Care had to be taken to avoid hotspots (small fires burning in tree roots, stumps, etc.) that were a real danger to persons walking across the land. By May 19, over 298 structures had been assessed for damage, and office buildings were reopened so people could return to work. On May 21, Management authorized employees to return to work at TA-16.

Impacts

There were relatively few facilities burned at High Explosives Processing. Some of the exceptions included V-Site (an historic Manhattan Project Era site) where all buildings except one were destroyed. Smoke damage was extensive and resulted in replacement of equipment, filter systems, and furnishings of buildings. Fire damaged roofs, and Material Disposal Area (MDA) R suffered an underground fire that required extensive effort to extinguish. In addition, many utility poles burned and wiring melted requiring extensive efforts to restore electrical utilities. Other damage included flooding in a high bay at TA-46, dead rodents in many buildings, destroyed HVAC systems, and miscellaneous damage to drop towers and substations.

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 16 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. 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 one Moderate Hazard nonnuclear facility (DARHT).

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 SWEIS ROD, was completed in 1999. This facility was evaluated in a separate environmental impact statement (DOE 1995a). Installation and component testing of the accelerator and its associated control and diagnostics system began in 1999 and continued in 2000.

Construction of the Applied Research Optics Electronics Laboratory (TA-15-494) was completed in 2000. 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 1998).

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 SWEIS ROD. Table 2.10.2-1 identifies the operational capabilities discussed in the SWEIS and presents 2000 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 3,900 kilograms projected by the SWEIS ROD. The amount expended in 2000 has not been calculated; however, it should be similar to or below that used in 1999 and, therefore, below projections made in the SWEIS 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]	2000 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 6,900 lb/yr (over all activities).	Hydrodynamic tests were conducted in 2000 at a level below those projected by the SWEIS ROD.
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 below those projected by the SWEIS ROD.
Explosives Research and Testing	Conduct high explosives tests to characterize explosive materials.	Explosives research and testing were conducted at a level below those projected by the SWEIS ROD.
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 below those projected by the SWEIS ROD.

Table 2.10.2-1 (Cont)

CAPABILITY	SWEIS ROD[a]	2000 OPERATIONS
High-Explosives Pulsed-Power Experiments	Conduct experiments and development tests.	Experiments were conducted at a level below those projected by the SWEIS ROD.
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 below those projected by the SWEIS ROD.
Other Explosives Testing	Develop advanced high explosives or weapons evaluation techniques.	Other explosives testing were conducted at a level below those projected by the SWEIS ROD.

[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 2000 was directed to operational start-up of DARHT. This, along with fire aftermath activities, 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 effects of research during 2000 were considerably less than projections made by the SWEIS ROD. No LLW or other radioactive wastes (MLLW, TRU wastes, or mixed TRU wastes) were generated in 2000. A significant amount of chemical waste, 60,437 kilograms, resulted from cleanup following the Cerro Grande fire. Industrial solid waste made up 9,362 kilograms of the chemical waste and, being nonhazardous, was disposed in regular landfills. The remainder was shipped offsite for disposal at an approved hazardous waste disposal facility. Thus, these chemical wastes do not represent environmental impacts at LANL.

Material expended (shown as Chemical Usage in Table 2.10.3-1) has not been calculated for 2000. Because of the Cerro Grande fire and changes in personnel, these reports have been delayed. However, quantities used should be similar to or below those seen during 1999 because the firing sites were shut down for as long as six months after the Cerro Grande fire because of the remedial activities following the fire. The quantities will remain below SWEIS ROD projections and will be reported in the SWEIS Yearbook 2001.

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	2000 OPERATIONS
Radioactive Air Emissions:			
Depleted Uranium	Ci/yr	1.5E-1 [a]	[b]
Chemical Usage: [c]			
Aluminum [d]	kg/yr	45,450	
Beryllium	kg/yr	90	
Copper [d]	kg/yr	45,630	
Depleted Uranium	kg/yr	3,930	
Lead	kg/yr	240	
Tantalum	kg/yr	300	
Tungsten	kg/yr	300	
NPDES Discharge:			
Number of outfalls [e]	----	14	2
Total Discharges	MGY	3.6	16
03A–028 (TA-15) [f]	MGY	2.2	5
03A–185 (TA-15) [f]	MGY	0.73	11

PARAMETER	UNITS	SWEIS ROD	2000 OPERATIONS
Wastes:			
Chemical	kg/yr	35,300	60,437
LLW	m^3/yr	940	0
MLLW	m^3/yr	0.9	0
TRU [g]	m^3/yr	0.2	0
Mixed TRU [g]	m^3/yr	0	0
Number of Workers	FTEs	227 [h]	212 [h]

[a] The isotopic composition of depleted uranium is approximately 99.7 percent uranium-238, approximately 0.3 percent uranium-235, and approximately 0.002 percent 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.

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

[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 1995b). Data for 2000 have not been calculated and will be reported in the SWEIS Yearbook 2001 along with the 2001 data.

[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: 04A-101 (TA-40), 04A-139 (TA-15), 04A-141 (TA-39), 04A-143 (TA-15), 04A-156 (TA-39), 06A-080 (TA-40), 06A-081 (TA-40), 06A-082 (TA-40), 06A-099 (TA-40), and 06A-123 (TA-15). Consolidation and removal of outfalls has resulted in projected NPDES volumes underestimating actual discharges from the exiting outfalls.

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

[h] The number shown in the "SWEIS ROD" column is the index number representing CY 1999 (the year the SWEIS ROD was published). The number of employees for 2000 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the SWEIS ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 2000 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers (SWEIS ROD versus the new index) do not represent the same entity, a direct comparison to numbers projected by the SWEIS ROD (see Section 3.6, Socioeconomics) is not appropriate. However, because this index is going to be used in each subsequent yearbook, selecting CY 1999 as the base year establishes an index that can be compared over the ten-year window represented by the SWEIS ROD.

2.10.4 Cerro Grande Fire Effects at High Explosives Testing

About 3,040 acres of land within the High Explosives Testing Key Facility burned during the Cerro Grande fire. Areas most affected were TAs 14, 15, and 40 and, to a lesser extent, TAs 6, 9, 22, and 36. Fire damage was in excess of $16 million.

Fire Effects on High Explosives Testing

Firing site operations were abruptly halted, and high explosives testing operations were shut down for approximately four months. Restart proceeded cautiously to ensure safety and security of personnel, the public, the environment, and facilities. Safety and security requirements necessitated that operations be restarted using a graded and methodical approach. Because high explosives firing operations may only be conducted when the airspace is closed, restart of high explosives firing operations was delayed because remediation efforts included aerial reseeding of burned areas.

From the end of May through August 2001, facility operations personnel were involved in facility recovery activities (reopening more than 400 buildings and restarting operations within them). These efforts included reestablishing security and safety control of firing site perimeters and other outside work areas, walk-downs of all operations, reauthorization of hazardous operations, and daily escorting of many environmental specialists into the area. No worker injuries were reported during the fire recovery period.

The Cerro Grande fire has had a long-term effect on high explosives testing operations. Management limited high explosives testing at TA-40 to tests within containment vessels because of adjacent steep canyon walls and excess forest fuels. This self-imposed restriction created a hardship because these firing sites are no longer available for smaller experiments requiring open-air tests. Because commitments are not being met, Management is evaluating various possibilities for relocation of these activities.

The Cerro Grande fire directly affected DARHT by costing $6.1 million for compensation of non-LANL workers for the three-month time period where construction of DARHT Axis 2 was stopped. A fraction of the total amount, about $177,000, was attributed to burned and destroyed DARHT equipment, materials, and storage structures.

Fire Effects on High Explosives Processing

The Cerro Grande fire halted high explosives processing by the High Explosives Testing Key Facility for approximately two months; one month while the Laboratory was closed and one additional month to reopen facilities and restart operations. Before the fire, detonator production was ahead of schedule and production commitments were being met. Because of the fire, work on one product line was transferred to Lawrence Livermore National Laboratory to meet testing schedules.

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, which houses the linac, has 315,000 square feet under roof. Activities consist of neutron science research, the development of accelerators and diagnostic instruments, and production of medical radioisotopes. The majority of the LANSCE Key Facility is composed of the 800-million-electron-volt linac, a Proton Storage Ring, and five 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 B is currently used for experiments with ultracold neutrons. Experimental Area A, formerly used for materials irradiation experiments and isotope production, is currently inactive; a new isotope production facility is under construction. A second accelerator, the Low-Energy Demonstration Accelerator (LEDA), is also located at LANSCE.

This Key Facility has three Category 3 nuclear activities (Table 2.11-1): experiments using neutron scattering by actinides in Experimental Area ER-1, the 1L neutron production target in Building 53-07, and the A-6 beam stop in Building 53-03M (DOE 2000a). There are no Category 2 nuclear facilities and no Moderate Hazard nonnuclear facilities at TA-53.

Above:

Above: New cooling towers at LANSCE
Left: At the Lujan Center, mercury contamination was discovered in the drain system and 1,900 feet of drain was inspected and cleaned

Table 2.11-1. LANSCE Buildings with Nuclear Hazard Classification

BUILDING	DESCRIPTION	NHC SWEIS ROD	NHC DOE 1998 [a]	NHC DOE 2000 [b]
TA-53-1L	Manual Lujan Neutron Scattering Center		3	3
TA-53-3M	Experimental Science	3		
TA-53-A-6	Accelerator Production of Tritium target beam stop		3	3
TA-53-ER1	Actinide scattering experiment		3	3
TA-53-P3E	Pion Scattering Experiment		3	

[a] DOE/LANL list of Los Alamos National Laboratory Nuclear Facilities (DOE 1998a)
[b] DOE/LANL list of Los Alamos National Laboratory Nuclear Facilities (DOE 2000a)

2.11.1 Construction and Modifications at Los Alamos Neutron Science Center

Projected: 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 three have been started.

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

DESCRIPTION	SWEIS ROD 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-megawatt target/blanket	2-91-L	No
New 100-MeV Isotope Production Facility	2-92-L	Started [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	3-25-R	No
Exotic Isotope Production Facility	3-27-L	No
Decontamination and renovation of Area A-East	3-27-L	No

[a] Characterization started in 1999 and continued during 2000, in preparation for remediation.
[b] LEDA started high-power conditioning of the radio-frequency quadrupole power supply in November 1998. The first trickle of proton beam was produced in March 1999, and maximum power was achieved in September 1999. It has been designed for a maximum energy of 12 million electron volts, not the 40 million electron volts projected by the SWEIS ROD.
[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 present during preparation of the SWEIS); will increase the Lujan spallation target power to 160 kilowatts (vs. 55 kilowatts present during preparation of the SWEIS); will install brighter in source; and will add five neutron-scattering instruments. Through the end of 2000, the first phase of the Proton Storage Ring upgrade had been completed. Installation of new instruments began in 1999. The upgrade is expected to be completed in 2003 (Lewis 2000).
[d] Preparations began in the spring of 1999 for construction of the new 100-million-electron-volt 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 been replaced by the concept to construct a $1.6 billion Advanced Hydrotest Facility, which is currently in the conceptual phase. Conceptual planning for the Advanced Hydrotest Facility is being done consistent with the Stockpile Stewardship and Management Programmatic Environmental Impact Statement (DOE 1996a) and ROD. Before DOE decides to build and operate the Advanced Hydrotest Facility at LANL or some other site, an environmental impact statement and ROD would be prepared.

Not Projected: In addition to these projected construction activities, a new warehouse was constructed in 1998 to store equipment and other materials formerly stored outside, a new RLWTF was constructed during 1999, and construction of a new cooling tower was completed in 2000. These projects received NEPA review through Categorical Exclusions LAN-98-110 (DOE 1998b), LAN-98-109 (DOE 1998c), and LAN-96-022 (DOE 1999d). The new cooling tower (structure #53-963) replaces cooling tower 53-62, which has been idled. It discharges through Outfall 03A-048, as had tower 53-62 (Graham 2001).

2.11.2 Operations at Los Alamos Neutron Science Center

The SWEIS identified seven capabilities for the LANSCE Key Facility. No new capabilities have been added, and none have been deleted. During CY 2000, LANSCE operated both accelerators and four of the five experimental areas. (Area A has been idle for more than two years.)

The primary indicator of activity for this facility is production of the 800-million-electron-volt LANSCE proton beam as shown in Table 2.11.2-1. These production figures are all less than the 6,400 hours at 1,250 microamps projected by the SWEIS ROD. In addition, there were no experiments conducted for transmutation of wastes. There was also no production of medical isotopes during 2000, although construction of a new isotope production facility began. Table 2.11.2-1 provides details.

Table 2.11.2-1. Los Alamos Neutron Science Center (TA-53)/Comparison of Operations

CAPABILITY	SWEIS ROD[a]	2000 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 (6,400 hrs). Positive ion current 1,250 microampere and negative ion current of 200 microampere.	In 2000, H+ beam was not produced. H- beam was delivered as follows: (a) to the Lujan Center for 1,749 hours at an average current of 100 microamperes (b) to WNR Target 2 for 307 hours in a "pulse on demand" mode of operation, with an average current below 1 femtoampere (c) to WNR Target 4 for 2,024 hours at an average current of five microamperes (d) through Line X to Lines B and C for 806 hours in a "pulse on demand" mode of operation, with an average current below 1 femtoampere.
	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 6,600 hrs/yr.	Continued to operate at full power (100 milliamps and 6.7 million electron volts).
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 were conducted per the projections of the SWEIS ROD.
	Increased power demand for LANSCE linac and LEDA radio-frequency operation.	No developments in 2000.

CAPABILITY	SWEIS ROD[a]	2000 OPERATIONS
Neutron Research and Technology [b]	Conduct 1,000 to 2,000 experiments/yr using Manuel Lujan Center, WNR facility, and LPSS. Establish LPSS in Area A (requires modification).	Less than 200 experiments were conducted at the Lujan Center. 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 kilograms 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 - Some shock wave experiments.
	Provide support for static stockpile surveillance technology research and development.	Support was provided for surveillance research and development.
Accelerator Transmutation of Wastes[c]	Conduct lead target tests for two years at Area A beam stop.	No tests.
	Implement the Los Alamos International Facility for Transmutation (Establish one-megawatt, then five-megawatt Accelerator Transmutation of Wastes target/blanket experiment areas) adjacent to Area A.	Neither the target/blanket experiment nor the Los Alamos International Facility for Transmutation were constructed.
	Conduct five-megawatt experiments for 10 months/yr for four years using about three kilograms of actinides.	No experiments.
Subatomic Physics Research	Conduct 5 to 10 physics experiments/yr at Manuel Lujan Center, WNR facility, and LPSS.	Ultra-cold neutrons ran on 13 days in the "B" line beam tunnel room.
	Conduct proton radiography experiments, including contained experiments with high explosives.	Experiments involving contained high explosives were conducted on 28 days in 2000.
Medical Isotope Production	Irradiate up to approximately 50 targets/yr for medical isotope production.	No production in 2000.
	Added production of exotic, neutron-rich, and neutron-deficient isotopes (requires modification of an existing target area).	No production in 2000.
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, and the LPSS.

[b] Numbers of neutron experiments represent plausible levels of activity. Bounding conditions for the consequences of operations are primarily determined by 1) length and power of beam operation and 2) maintenance and construction activities.

[c] Formerly Accelerator-Driven Transmutation Technology.

Two of the significant accomplishments at LANSCE in CY 2000 were the restart of the Lujan Center after having been closed for eight months and an increase in high explosives limits for proton radiography experiments. At the Lujan Center, ER-1 had been radiologically contaminated on October 13, 1999 from a pressurization of radioactive liquid waste lines. Mercury contamination was subsequently discovered in the drain system beneath ER-1 and ER-2. All drain lines connected to ER-1 and ER-2, ~1,900 feet (LANL 2000b, p. 16), were inspected and cleaned. Beam delivery to the 1L target resumed on June 17, 2000. Also during CY 2000, the Authorization Basis was revised for LANSCE explosives operations including Experimental Area C (Building 53-03P) to increase the Area C limit for high explosives from 750 grams to the ten pounds evaluated by the SWEIS ROD for proton radiography experiments (Graham 2001).

2.11.3 Operations Data for Los Alamos Neutron Science Center

Since both construction activities, which contribute to waste quantities, and levels of operations were less than those projected by the SWEIS ROD, operations data were also less than projected. Radioactive air emissions are a key parameter since LANSCE emissions have historically accounted for more than 95 percent of the total LANL offsite dose. Emissions in 2000, however, totaled only about 850 curies (including diffuse emissions), about 30 percent of total LANL radioactive air emissions. The 2000 total was also significantly less than projections of the ROD of 8,496 curies (Garvey 1996). These small emissions can be attributed to non-use of the Area A beam stop. Waste generation and NPDES discharge volumes were well below projected quantities. Table 2.11.3-1 provides details.

Table 2.11.3-1. Los Alamos Neutron Science Center (TA-53)/Operations Data

PARAMETER	UNITS	SWEIS ROD	2000 OPERATIONS
Radioactive Air Emissions:			
Argon-41	Ci/yr	7.44E+1	2.9E+1
Arsenic-73	Ci/yr	Not projected [a]	2.2E-5
Bromine-76	Ci/yr	Not projected [a]	2.6E-4
Bromine-82	Ci/yr	Not projected [a]	4.2E-3
Carbon-10	Ci/yr	2.65E+0	1.4E-1
Carbon-11	Ci/yr	2.96E+3	6.9E+2
Mercury-193	Ci/yr	Not projected [a]	8.0E-1
Mercury-195m	Ci/yr	Not projected [a]	2.0E-2
Mercury-197	Ci/yr	Not projected [a]	1.0E-1
Nitrogen-13	Ci/yr	5.35E+2	2.8E+1
Nitrogen-16	Ci/yr	2.85E-2	1.7E-2
Oxygen-14	Ci/yr	6.61E+0	4.1E-1
Oxygen-15	Ci/yr	6.06E+2	9.1E+1
Tritium as Water	Ci/yr	Not projected [a]	2.9E+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	30.5
03A-047	MGY	7.1	3.5
03A-048	MGY	23.4	15.6
03A-049	MGY	11.3	9.6
03A-113	MGY	39.8	1.8

PARAMETER	UNITS	SWEIS ROD	2000 OPERATIONS
Wastes:			
Chemical	kg/yr	16,600	1,205 [d]
LLW	m^3/yr	1,085 [e]	28
MLLW	m^3/yr	1	4.9
TRU	m^3/yr	0	0
Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	560 [f]	550 [f]

[a] The radionuclide was not projected by the SWEIS 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: 03A-125 (TA-53), 03A-145 (TA-53), and 03A-146 (TA-53).

[d] About one-half of this waste (590 kilograms) was industrial solid waste (nonhazardous) and may be disposed in regular landfills.

[e] LLW volumes include decommissioning and renovation of Experimental Area A (Building 53-03M).

[f] The number shown in the "SWEIS ROD" column is the index number representing CY 1999 (the year the SWEIS ROD was published). The number of employees for 2000 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the SWEIS ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 2000 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers (SWEIS ROD versus the new index) do not represent the same entity, a direct comparison to numbers projected by the SWEIS ROD (see Section 3.6, Socioeconomics) is not appropriate. However, because this index is going to be used in each subsequent yearbook, selecting CY 1999 as the base year establishes an index that can be compared over the ten-year window represented by the SWEIS ROD.

2.11.4 Cerro Grande Fire Effects at Los Alamos Neutron Science Center

LANSCE was nearly untouched by the fire; a small portion of the roof of one building was damaged. Return to operations was in accordance with the LANL-wide recovery procedure (LANL 2000c). Building 53-882 was established as a recovery command post. The TA-53 Facility Recovery Team was established and performed safety reconnaissance and condition assessment during the second week of the evacuation. (LANL was evacuated from Monday, 05/08, through Sunday, 05/21.) All LANSCE workers were approved to return to their work stations on Tuesday, 05/23. The only other impact to operations was evaluating and restoring the status of accelerator systems since site power was lost during the fire. Systems and equipment were returned to power sequentially instead of simultaneously, and this process required about a month to complete.

2.12 Biosciences Facilities (TA-43, 3, 16, 35, and 46) (Previously Health Research Laboratory [TA-43])

Biosciences has evolved beyond operations addressed in the SWEIS for the HRL, requiring an expanded definition of this Key Facility. Bioscience Division was formed in 1999 from parts of the Life Science Division and existing projects within Chemical Science and Technology, Theoretical, Materials Science and Technology, and Physics Divisions. The Biosciences Key Facility definition now includes the main HRL facility (Buildings 43-1, -37, -45, and -20) plus 13 support buildings located at TA-35-85, 35-02, TA-03-562 and 3-1698, and TA-46-158/161, 217, -218,-80, -24 and -31. Additionally, Biosciences has small operations located at TA-16. Operations at TA-43, TA-35-85 and -02, and TA-46-158/161 have chemical, laser, and limited radiological activities that maintain hazardous materials inventory and generate hazardous wastes. Activities at TA-03-562, 3-1698, and TA-16 have relatively minor impacts because of low numbers of personnel and limited quantities of materials. Biosciences activities at TA-3-1698, the MSL, are accounted for with potential impacts of that Key Facility and are not double-counted here. Biosciences research capabilities focus on the study of intact cells (Biosafety Levels -1 and -2), cellular components (RNA, DNA, and proteins), instrument analysis (laser and mass spectroscopy), and cellular systems (repair, growth, and response to stressors). All activities are classed as Low Hazard nonnuclear in all buildings within this Key Facility, there are no Moderate Hazard nonnuclear facilities or nuclear facilities[5].

[5] DOE/LANL List of Los Alamos National Laboratory Nuclear Facilities, April, 2000

The Biosciences Key Facility is a consolidation of bioscience functions and capabilities that were formerly scattered between the HRL and the Non-Key Facilities. It represents the dynamic nature of the Yearbook, responding to the growth and decline of research and development across LANL.

2.12.1 Construction and Modifications at the Biosciences Facilities (Previously Health Research Laboratory)

Buildings within TA-43 continue to have interior remodeling and rearranging to accommodate new and existing work. In 2000, the principal change in TA-43-1 resulted from relocation of radionuclide materials handling activities from the first floor north wing to the basement. Isotope handling activities that previously occupied over 1,500 square feet now occupy less than 900 square feet. As in the previous year, the volume of radioactive work at HRL has continued to diminish. This decline is attributed to technological advances and new methods of research, 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, the HRL facility has Biosafety Level 1 and Level 2 work, which includes limited work with potentially infectious microbes and low-toxicity biotoxins, as defined by the Centers for Disease Control (CDC). During 2000, Biosciences began investigating potential future needs for a Biosafety Level 3 facility but this activity has not progressed beyond the evaluation phase and no new capabilities have been added. All biosafety activities are regulated by the CDC National Institutes of Health, LANL's Institutional Biosafety Committee, and the Institutional Biosafety Officer.

Growth in the Structural Genomics capability resulted in remodeling of over 1,000 square feet of laboratory and office space at LANL. Biosciences relocated two aspects of Genomics work from TA-43-1 to TA-35-85 to alleviate crowding and allow work to expand. Sequencing instruments were relocated to an undeveloped area of about 800 square feet within Building TA-35-85 that was modified to accept this work. In addition to instruments from TA-43-1, sequencing instruments from the University of New Mexico were also added to TA-35-85. More instruments will be added to TA-35-85 in 2001 to support Genomics capabilities. This project is an international collaboration that provides biosciences resources at LANL to scientists all over the world. Continued growth in this capability is expected.

The addition of Computational Biology to Bioscience in 1999 required remodeling of TA-43-45 to accommodate the growth. This capability requires computing workstations and has impacted available office space at TA-43-1. This is a growth capability and will continue to require additional office space. This capability does not generate wastes nor use hazardous materials.

2.12.2 Operations at Biosciences Facilities (Previously Health Research Laboratory)

Originally, the SWEIS identified eight capabilities for the HRL Key Facility. In 1998, neurobiology research was moved out of HRL into space controlled by the Physics Division, and potential impacts of this capability were accounted for with the Non-Key Facilities. As reported in the SWEIS Yearbook for CY 1999, creation of Biosciences led to definitional changes in the existing capabilities. Three of the existing capabilities were renamed, two were combined at a higher level, and one was further defined into two operations. When formed in late 1999, Biosciences assimilated existing personnel and projects. Reorganization incorporated buildings and laboratory spaces at sites other than TA-43 (these operations were previously part of the Non-Key Facilities). Therefore, some operations within existing capabilities are now more visible and are being reported in this Yearbook for the first time. They are Biologically Inspired Materials and Chemistry, Computational Biology, and Molecular Synthesis. Impacts from these three functions were previously captured in the Non-Key Facilities portion of LANL.

Following these changes (see above), there are still eight identified capabilities for the Biosciences Key Facility (see Table 2.12.2-1). The same set of capabilities exist, but some become more visible as research and development in a particular area grows, and some become less visible as research and development in another area declines. This simply reflects the dynamic nature of a research laboratory.

Growth in Biosciences has resulted in addition of new personnel and expanded operations. However, the basic nature of the work has not changed. While there have been increases in volumes of chemicals used and generation of chemical wastes, Biosciences has decommissioned unfunded work. Biosafety Level 2 work was expanded to include use of a vaccine strain of bacillus anthrasis, low-toxicity biotoxins (defined by CDC) and DNA from other infectious microbes. The Institutional Biosafety Committee reviews all of this work. In addition, work with a subset of organisms (select agents) requires registration with the CDC. Biosafety Level 2 work does not generate any infectious wastes. Expansion of sequencing efforts was most noticeable but does not generate new wastes or increased volumes of regulated wastes. Upgrades and remodeling generated construction debris as laboratory areas were cleaned out and equipment was replaced or upgraded. This trend in modernization is expected to continue through 2001. TA-43-1 is at capacity for both office and laboratory activities, and future Biosciences expansion is expected to occur at TA-35-85 and TA-46-158. Biosciences is pursuing a new building at LANL that will consolidate its work and remove activities from TA-43.

Table 2.12.2-1 compares 2000 operations to those predicted by the SWEIS ROD. The table includes the number of FTEs per capability to measure activity levels compared to the SWEIS 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. All but two of the existing capabilities have activity levels greater than those projected by the SWEIS ROD. Neurobiology exists elsewhere at LANL, and Computational Biology was added. Computational Biology was previously part of the Non-Key Facilities, and therefore, not visible in the SWEIS ROD. Computational science is a very active part of the Non-Key Facilities, and this aspect of computational science has been growing and was co-located with biological research to strengthen the collaboration. Major activities in computational science continue to be conducted within the Non-Key Facilities.

Table 2.12.2-1. Biosciences/Comparison of Operations

CAPABILITIES	SWEIS ROD	2000 OPERATIONS
Genomic Studies – Renamed Genomics in 1999	Conduct research at current levels utilizing molecular and biochemical techniques to analyze the sequences of genomes (human and animal). Develop strategies 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 chromosomes. (50 FTEs) [a]	In 2000, 50 FTEs were associated with Genomics.
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. The work includes using isolated cells to investigate DNA repair mechanisms. (35 FTE)	In 2000, 30 FTEs were associated with Molecular Cell Biology
Cytometry, Nuclear Magnetic Resonance, Laser and Mass Spectroscopy	Conduct research utilizing imaging systems to analyze the structures and functions of subcellular systems and components. (40 FTEs)	In 2000, 30 FTEs were associated with Cytometry.
Environmental Effects – Renamed Environmental Biology in 1999.	Research identifies specific changes or differences that occur in DNA, RNA, and proteins in microorganisms, including infectious microbes or ones altered by stressors in the environment. (25 FTEs)	In 2000, 20 FTEs were associated with Environmental Biology.

Table 2.12.2-1 (Cont)

CAPABILITIES	SWEIS ROD	2000 OPERATIONS
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 2000, there were 35 FTEs associated with Structural Biology.
Synthetic Chemistry	Generate biometric organic materials and construct synthetic biomolecules.	In 2000, 10 FTEs.
In-Vivo Monitoring. This is not a Biosciences Division capability; however, it is located at TA-43-HRL-1. Therefore, it is a capability within this Key Facility and is included here.	Perform 3,000 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 1,261 whole-body scans and 718 other counts (detector studies, quality assurance measurements, etc.). In 2000, there were about 3 FTEs associated with this capability.
Computational Biology	Not in SWEIS ROD	Conduct database creation and management and computer modeling in support of Genomics, Structural Biology, Cell Biology, Synthetic Chemistry. In 2000, there were 25 FTEs, expected to grow to 35 FTEs by 2002.

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

2.12.3 Operations Data for Biosciences Facilities (Previously Health Research Laboratory)

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, administrative, and MLLW) has decreased from historical levels and was smaller than projections.

Table 2.12.3-1. Biosciences/Operations Data

PARAMETER	UNITS	SWEIS ROD	2000 OPERATIONS
Radioactive Air Emissions	Ci/yr	Not estimated	Not measured
NPDES Discharge: [a]			
03A-040	MGY	2.5 [b]	Eliminated in 1999
Wastes:			
Chemical	kg/yr	13,000	3,246 [c]
Biomedical Waste	kg/yr	280 [d]	0
LLW	m^3/yr	34	0
MLLW	m^3/yr	3.4	0
TRU	m^3/yr	0	0
Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	98 [e]	110 [e]

[a] Outfall 03A-040 consisted of one process outfall and nine storm drains.
[b] Storm water only.
[c] Represents only the HRL contribution. Wastes from the other buildings were insignificant and are captured in the Non-Key Facilities totals.
[d] Animal colony and the associated waste. The animal colony was eliminated in 1999.
[e] The number shown in the "SWEIS ROD" column is the index number representing CY 1999 (the year the SWEIS ROD was published). The number of employees for 2000 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the SWEIS ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 2000 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers (SWEIS ROD versus the new index) do not represent the same entity, a direct comparison to numbers projected by the SWEIS ROD (see Section 3.6, Socioeconomics) is not appropriate. However, because this index is going to be used in each subsequent yearbook, selecting CY 1999 as the base year establishes an index that can be compared over the ten-year window represented by the SWEIS ROD.

2.12.4 Cerro Grande Fire Effects at the Biosciences Facilities (Previously Health Research Laboratory)

Cerro Grande fire effects on Biosciences facilities and operations included the loss of office transportables containing computers, intellectual property, and data at TA-46. Some computers and data were also lost in homes burned by the fire. Overall, Biosciences, along with other programs at LANL, suffered downtime and loss of productivity during the evacuation and initial damage assessment, recovery, and reentry phases. Smoke damage occurred in several buildings at TA-43 and TA-46-158/161 requiring cleaning or replacement of an air handling system and many replacement air filters. The smoke damaged laser optics requiring their replacement at TA-46-158, -161, and TA-3-1698.

2.13 Radiochemistry Facility (TA-48)

The Radiochemistry Key Facility includes all of TA-48 (116 acres). It is a research facility that fills three roles—research, production of medical radioisotopes, and support services to other LANL organizations, primarily through radiological and chemical analyses 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). As shown in Table 2.13-1, the Radiochemistry Laboratory has remained a Category 3 nuclear facility (DOE 2000a).

Table 2.13-1. Radiochemistry Buildings with Nuclear Hazard Classification

BUILDING	DESCRIPTION	NHC SWEIS ROD	NHC DOE 1998 [a]	NHC DOE 2000 [b]
TA-48-0001	Radiochemistry and Hot Cell	3	3	3

[a] DOE/LANL list of Los Alamos National Laboratory Nuclear Facilities (DOE 1998a)
[b] DOE/LANL list of Los Alamos National Laboratory Nuclear Facilities (DOE 2000a)

2.13.1 Construction and Modifications at the Radiochemistry Facility

The SWEIS projected no facility changes through 2005. Consistent with this projection, only minor maintenance activities occurred during 2000.

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 2000, approximately 170 chemists and scientists were employed, far below the 250 projected by the SWEIS ROD[6]. As seen in Table 2.13.2-1, only three of the ten capabilities were active at levels projected by the SWEIS ROD: Radionuclide Transport Studies, Actinide and TRU Chemistry, and Sample Counting.

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

Capability	SWEIS ROD	2000 Operations
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. (28 to 34 FTEs [a])	Increased level of operations, approximately twice levels identified during preparation of the SWEIS. (36 FTEs [a])
Environmental Remediation Support	Background contamination characterization pilot studies. Performance assessments, soil remediation research and development, and field support. (34 FTEs [a])	Decreased level of operations, approximately half levels identified during preparation of the SWEIS. (10 FTEs [a])
Ultra-Low-Level Measurements	Isotope separation and mass spectrometry. (30 FTEs [a])	Level of operations was approximately the same as levels identified during preparation of the SWEIS. (14 FTEs [a])
Nuclear/Radiochemistry	Radiochemical operations involving quantities of alpha-, beta-, and gamma-emitting radionuclides for non-weapons and weapons work. (44 FTEs [a])	Slightly decreased level of operations, but approximately the same as levels identified during preparation of the SWEIS. (35 FTEs [a])
Isotope Production	Target preparation. High-level beta/gamma chemistry and target processing to recover isotopes for medical and industrial application. (15 FTEs [a])	Slightly increased level of operations, but approximately the same as levels identified during preparation of the SWEIS. (11 FTEs [a])

[6] The 170 chemists and scientists listed cannot be directly compared to the FTEs shown in Table 2.13.3-1, because the two numbers represent two different populations of individuals. The 170 chemists and scientists listed include temporary staff, students, and visiting scientists, whereas, the 124 FTEs only includes full-time and part-time regular LANL staff.

Capability	SWEIS ROD	2000 Operations
Actinide/Transuranic Chemistry	Radiochemical operations involving significant quantities of alpha-emitting radionuclides. (12 FTEs [a])	Increased operations, approximately twice levels identified during preparation of the SWEIS. (14 FTEs [a])
Data Analysis	Re-examination of archive data and measurement of nuclear process parameters of interest to weapons radiochemists. (10 FTEs [a])	Slight increase from levels identified during preparation of the SWEIS to six FTEs [a], 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 (49 FTEs [a] —total for both activities)	Same level of activity (35 FTEs[a]) as levels identified during preparation of the SWEIS, 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. (22 FTEs [a])	Decreased level of operations from levels identified during preparation of the SWEIS, and about one-third of those projected by the SWEIS ROD. (7 FTEs [a])
Sample Counting	Measurement of the quantity of radioactivity in samples using alpha-, beta-, and gamma-ray counting systems. (5 FTEs [a])	Approximately the same as projected by the SWEIS ROD. (6 FTEs [a])

[a] FTEs: full-time-equivalent. It is imperative that these FTE numbers are not confused with the FTEs identified in Table 2.13.3-1. Two different populations of individuals are represented. The FTEs in this table include students, visitors, and temporary staff. The FTEs in Table 2.13.3-1 only include full-time and part-time regular LANL staff.

2.13.3 Operations Data for the Radiochemistry Facility

The overall level of activity at the Radiochemistry Facility was below that projected by the SWEIS ROD. Three of the ten capabilities at this Key Facility were conducted at levels projected by the SWEIS ROD; the others were at or below activity levels identified during preparation of the SWEIS. As a result, operations data were also below those projected by the SWEIS ROD, as shown in Table 2.13.3-1. The large quantity of chemical wastes were industrial solid wastes resulting from the cleanup of Building 48-45 after the Cerro Grande fire (Sloan 2001). These industrial solid wastes are nonhazardous, may be disposed in county landfills, and do not present a threat to the local environs.

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

PARAMETER	UNITS	SWEIS ROD	2000 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]
Arsenic-72	Ci/yr	1.1E-4	None detected [b]
Arsenic-73	Ci/yr	1.9E-4	4.4E-5
Arsenic-74	Ci/yr	4.0E-5	2.8E-5
Beryllium-7	Ci/yr	1.5E-5	None detected [b]
Bromine-77	Ci/yr	8.5E-4	2.8E-5
Germanium-68	Ci/yr	1.7E-5	8.1E-3
Gallium-68	Ci/yr	1.7E-5	8.1E-3
Rubidium-86	Ci/yr	2.8E-7	None detected [b]
Selenium-75	Ci/yr	3.4E-4	1.4E-4
NPDES Discharge:[c]			
Total Discharges	MGY	4.1	No discharge
03A-045	MGY	0.87	Eliminated – 1999
04A-016	MGY	None	Eliminated – 1997
04A-131	MGY	None	Eliminated – 1998
04A-152	MGY	None	Eliminated – 1997
04A-153	MGY	3.2	Eliminated – 1998
Wastes:			
Chemical [d]	kg/yr	3,300	12,461
LLW	m^3/yr	270	57
MLLW	m^3/yr	3.8	1.6
TRU [e]	m^3/yr	0	0
Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	128 [f]	124 [f]

[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] Outfalls eliminated before 1999: 04A-016 (TA-48), 04A-131 (TA-48), 04A-152 (TA-48), and 04A-153 (TA-48).

[d] Approximately 10,959 kilograms of this chemical waste represents industrial solid waste resulting from cleanup following the Cerro Grande fire. The industrial solid waste is nonhazardous and is disposed in regular county landfills.

[e] TRU waste was projected to be returned to the generating facility.

[f] The number shown in the "SWEIS ROD" column is the index number representing CY 1999 (the year the SWEIS ROD was published). The number of employees for 2000 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the SWEIS ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 2000 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers (SWEIS ROD versus the new index) do not represent the same entity, a direct comparison to numbers projected by the SWEIS ROD (see Section 3.6, Socioeconomics) is not appropriate. However, because this index is going to be used in each subsequent yearbook, selecting CY 1999 as the base year establishes an index that can be compared over the ten-year window represented by the SWEIS ROD.

2.13.4 Cerro Grande Fire Effects at the Radiochemistry Facility

Six structures were affected by the Cerro Grande fire. As summarized in Table 2.13.4-1, five suffered only minor effects; activities in these buildings were not affected. Building 48-45, the Advanced Radiochemical Diagnostics Building, however, suffered severe ash, dirt, and soot contamination.

Table 2.13.4-1. Fire-Damaged Structures at TA-48

NO.	STRUCTURE	DAMAGE
48-26	Office Building	Replace filters; needs to be cleaned
48-33	Office trailer	Replace filters; needs to be cleaned
48-45	Advanced Radiochemical Diagnostics	Damaged
48-56	Office trailer	Roof damage
48-57	Office trailer	Roof damage
48-203	Office trailer	North skirt melted; insulation damaged

The only way to return Building 48-45 to service was to gut its interior. Nearly everything is being removed (ceiling tiles, piping, instrumentation, etc.) and disposed as waste. Since this is a laboratory used for sensitive environmental analyses (and hence maintained apart from the other TA-48 lab buildings, which host radiological activities), wastes from this cleanup activity are industrial solid wastes. They were shipped direct from TA-48 to a municipal landfill. The cleanup was not completed in 2000 and will continue into 2001.

Target material from Russia is handled in a hot cell with mechanical manipulators

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 treatment of radioactive liquid wastes generated at other LANL facilities, but decontamination of equipment and waste items is also performed.

As shown in Table 2.14-1, there are currently 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). The SWEIS only identified the RLWTF main building as a nuclear facility and gave it a ranking of Category 2. There are no other nuclear facilities and no Moderate Hazard nonnuclear buildings within this Key Facility (DOE 2000a).

Table 2.14-1. RLWTF Buildings with Nuclear Hazard Classification

BUILDING	DESCRIPTION	NHC SWEIS ROD	NHC DOE 1998 [a]	NHC DOE 2000 [b]
TA-50-0001	Main Treatment Plant	2	3	3
TA-50-0002	LLW Tank Farm		3	3
TA-50-0066	Acid and Caustic Tank Farm		3	3
TA-50-0090	Holding Tank		3	3

[a] DOE /LANL list of Los Alamos National Laboratory Nuclear Facilities (DOE 1998a)
[b] DOE /LANL list of Los Alamos National Laboratory Nuclear Facilities (DOE 2000a)

2.14.1 Construction and Modifications at the Radioactive Liquid Waste Treatment Facility

Projected: The SWEIS ROD projected three modifications to the RLWTF Key Facility, and all three have been completed. The tank farm was upgraded in 1998. The new UF/RO (ultrafiltration and reverse osmosis) process was installed in 1998 and became operational 03/22/99. Nitrate reduction equipment was installed in 1998 and became operational on 03/15/99.

Not Projected: Facility personnel also installed an electrodialysis reversal unit in 1999 and an evaporator in 2000. Both units process the waste stream from the reverse osmosis unit. They received NEPA coverage through Categorical Exclusions #7428, approved 02/23/99, and #7737, approved 10/29/99.

In addition, decontamination operations were relocated during 2000 from Building 50-01 to TA-54. Except for the lead decontamination trailer, decontamination operations were moved to the west end of TA-54. Radioactive liquid wastes generated during decontamination operations will be collected in two holding tanks at TA-54, which will be trucked to the RLWTF at TA-50. The lead decontamination trailer, formerly located between Buildings 50-83 and 50-02, was sent to Area G and will be decommissioned. The quantity of lead that needs decontamination became so small that maintaining this operation was no longer cost effective.

2.14.2 Operations at the Radioactive Liquid Waste Treatment Facility

The SWEIS identified five capabilities for the RLWTF Key Facility. No new capabilities were added in 2000, and none were deleted[7]. The primary measurement of activity for this facility is the volume of radioactive liquid waste processed through the main treatment equipment. In 2000, this volume was 19 million liters of treated radioactive liquid waste 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 SWEIS ROD.

[7] Decontamination operations are projected in the SWEIS and were reported in prior Yearbooks as part of the RLWTF Key Facility. They are also reported under the RLWTF Key Facility in this Yearbook because they were located for most of 2000 in Building 50-01. Decontamination operations will be reported as part of the Solid Radioactive and Chemical Waste Key Facility beginning with Yearbook 2001.

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

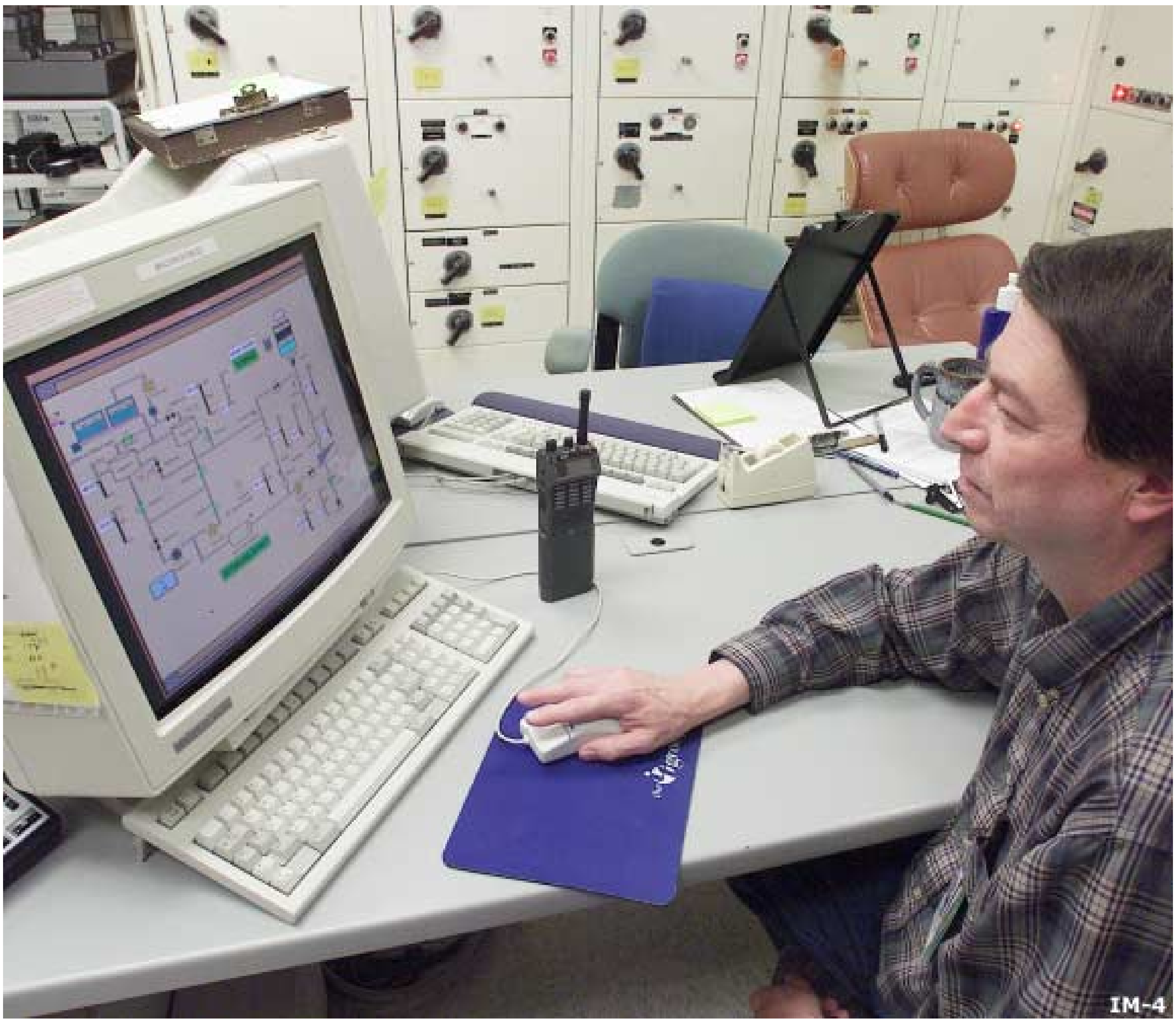
CAPABILITY	SWEIS ROD [a]	2000 OPERATIONS
Waste Characterization	Support, certify, and audit generator characterization programs.	As projected.
Packaging, Labeling	Maintain waste acceptance criteria for radioactive liquid waste treatment facilities.	As projected.
Waste Transport, Receipt, and Acceptance	Collect radioactive liquid waste from generators and transport to TA-50.	As projected.
Radioactive Liquid Waste Pretreatment	Pretreat 900,000 liters/yr of radioactive liquid waste at TA-21.	Pretreated 45,000 liters at TA-21.
	Pretreat 80,000 liters/yr of radioactive liquid waste from TA-55 in Room 60.	Pretreated 9,000 liters in Room 60.
	Solidify, characterize, and package 3 cubic meters/yr of TRU waste sludge in Room 60.	Solidified 5 cubic meters of TRU waste sludge in Room 60.
Radioactive Liquid Waste Treatment	Install UF/RO equipment in 1997. Install equipment for nitrate reduction in 1999.	UF/RO equipment installed 1998 and operational in March 1999. Nitrate reduction equipment installed 1998; operational March 1999.
	Treat 35 million liters/yr of radioactive liquid waste.	Treated 19 million liters of radioactive liquid waste.
	De-water, characterize, and package 10 cubic meters/yr of LLW sludge.	De-watered 48 cubic meters of LLW sludge.
	Solidify, characterize, and package 32 cubic meters/yr of TRU waste sludge.	No TRU waste/sludge was solidified.
Decontamination Operations	Decontaminate LANL personnel respirators for reuse (approximately 700/month).	Decontaminated 450 personnel respirators per month.
	Decontaminate air-proportional probes for reuse (approximately 300/month).	Decontaminated about 125 air-proportional probes per month.
	Decontaminate vehicles and portable instruments for reuse (as required).	Decontaminated six portable instruments per month. No large-item decontamination was performed.
	Decontaminate precious metals for resale (acid bath).	No activity.
	Decontaminate scrap metals for resale (sandblast).	Decontaminated 386 cubic feet of metal and 58 cubic feet of circuit boards for recycle.
	Decontaminate 200 cubic meters of lead for reuse (grit blast).	Decontaminated 0.15 cubic meter of lead.

[a] Includes installation of UF/RO and nitrate reduction processes in Building 50-01 and installation of aboveground tanks for the collection of influent radioactive liquid waste.

2.14.3 Operations Data at the Radioactive Liquid Waste Treatment Facility

Process modifications have improved effluent quality. There were zero violations of the State of New Mexico discharge limit for nitrates (10 milligrams per liter) during 2000, zero violations of NPDES Permit limits, and zero exceedance of the DOE derived concentration guidelines for radioactive liquid discharges. Annual average nitrate discharges were reduced from 360 milligrams per liter in 1993 to less than 10 milligrams per liter in 2000 (Del Signore 2000, p. C-2). Similarly, annual average radioactive discharges were reduced from 570 to 250 picocuries alpha activity per liter during the period 1993–1999 and to 13 picocuries per liter in 2000 (Del Signore 2001a).

The SWEIS ROD did not project the quality of effluent, only quantity. This and other consequences of operation were less than projected in the SWEIS ROD. Radioactive air emissions continued to be negligible (less than one microcurie); NPDES discharge volume was 4.9 million gallons, compared to a projected 9.3 million gallons; and quantities of solid wastes were all less than projected except for MLLW. The three kilograms of MLLW represent the sludge from the treatment facility. Table 2.14.3-1 provides details.



Main computer control room of the Radioactive Liquid Waste Treatment Facility (RLWTF)

Table 2.14.3-1. Radioactive Liquid Waste Treatment Facility (TA-50)/Operations Data

PARAMETER	UNITS	SWEIS ROD	2000 OPERATIONS
Radioactive Air Emissions:			
Americium-241	Ci/yr	Negligible	
Plutonium-238	Ci/yr	Negligible	9.8E-9
Plutonium-239	Ci/yr	Negligible	
Thorium-230	Ci/yr	Negligible	5.3E-8
Uranium-234	Ci/yr	Negligible	
NPDES Discharge:			
051	MGY	9.3	4.9
Wastes:			
Chemical [a]	kg/yr	2,200	384
LLW	m^3/yr	160	132
MLLW	m^3/yr	0	3
TRU	m^3/yr	30	16
Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	62 [b]	58 [b]

[a] Approximately 127 kilograms of the chemical wastes are industrial solid wastes resulting from cleanup following the Cerro Grande fire. Industrial solid waste is nonhazardous, may be disposed in county landfills, and does not represent a threat to local environs.

[b] The number shown in the "SWEIS ROD" column is the index number representing CY 1999 (the year the SWEIS ROD was published). The number of employees for 2000 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the SWEIS ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 2000 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers (SWEIS ROD versus the new index) do not represent the same entity, a direct comparison to numbers projected by the SWEIS ROD (see Section 3.6, Socioeconomics) is not appropriate. However, because this index is going to be used in each subsequent yearbook, selecting CY 1999 as the base year establishes an index that can be compared over the ten-year window represented by the SWEIS ROD.

2.14.4 Cerro Grande Fire Effects at the Radioactive Liquid Waste Treatment Facility

The RLWTF was one of the very few facilities that operated during the Cerro Grande fire. Operations were mandatory because radioactive liquid wastes continued to be generated at a rate of approximately 6,000 to 7,000 gallons per day during the two weeks that LANL was closed because of the fire (McClenahan 2000). These flows would be expected from furnace cooling systems and experiments that required cooling during the stand-down. Subsequent to the wildfire, radioactive liquid waste generation continued below typical rates because other LANL facilities required time to resume normal levels of operations.

Operations at the RLWTF, showing the equipment used in the major steps of the treatment process

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.

It is important to note that the Laboratory's waste management operation captures and tracks data for waste streams (whether or not they go through the Solid Radioactive and Chemical Waste Facilities), regardless of their points of generation or disposal. This includes information on the waste generating process; quantity; chemical and physical characteristics of the waste; regulatory status of the waste; applicable treatment and disposal standards; and the final disposition of the waste. The data are ultimately used to assess operational efficiency, help ensure environmental protection, and demonstrate regulatory compliance.

There are four Category 2 nuclear buildings within this Key Facility: the Radioactive Materials Research Operations and Demonstration Facility (Building 50-37); the Waste Characterization Reduction and Repackaging Facility (WCRRF; Building 50-69); the LLW disposal cells, shafts, and trenches and six fabric domes at Area G; and the Transuranic Waste Inspection Project (TWISP) for the retrieval of TRU wastes, including storage domes 226 and 229–232. There is also one Category 3 nuclear building, the Radioactive Assay and Nondestructive Test Facility, Building 54-38 (DOE 2000a).

As shown in Table 2.15-1, the SWEIS recognized 19 structures as having Category 2 nuclear classification (Area G was recognized as a whole and then individual buildings and structures were also recognized). RAMROD was only a potential nuclear facility in the SWEIS, but subsequently was characterized by DOE. The WCRRF was identified as a Category 2 in the SWEIS, but because of inventories and the newer guidelines, it was downgraded to a Category 3. Area G has remained a Category 2 facility when taken as a whole; however, several of the individual buildings have been downgraded to Category 3.

Table 2.15-1. Solid Waste Buildings with Nuclear Hazard Classification

BUILDING	DESCRIPTION	NHC SWEIS ROD	NHC DOE 1998 [a]	NHC DOE 2000 [b]
TA-50-0037	RAMROD		2	2
TA-50-0069	WCRRF Building	2	3	3
TA-50-0069 Outside	Nondestructive Analysis Mobile Activities			2
TA-50-0069 Outside	Drum Storage			2
TA-54-Area G	LLW Waste Storage/Disposal	2	2	2
TA-54	TWISP		2	2
TA-54-0002	TRU Storage Dome		3	3
TA-54-0033	TRU Drum Preparation	2		
TA-54-0038	RANT	2	3	3
TA-54-0048	TRU Storage Dome	2	3	3
TA-54-0049	TRU Storage Dome	2	3	3
TA-54-0144	Shed	2		
TA-54-0145	Shed	2		
TA-54-0146	Shed	2		
TA-54-0153	TRU Storage Dome	2	3	3
TA-54-0177	Shed	2		
TA-54-0226	Temporary Retrieval Dome	2		
TA-54-0229	Tension Support Dome	2		
TA-54-0230	Tension Support Dome	2		
TA-54-0231	Tension Support Dome	2		

Table 2.15-1 (Cont)

BUILDING	DESCRIPTION	NHC SWEIS ROD	NHC DOE 1998 [a]	NHC DOE 2000 [b]
TA-54-0232	Tension Support Dome	2		
TA-54-0283	Tension Support Dome	2		
TA-54-Pad2	Storage Pad	2		
TA-54-Pad3	Storage Pad	2		
TA-54-Pad4	TRU Storage	2		

[a] DOE/LANL list of Los Alamos National Laboratory Nuclear Facilities (DOE 1998a)
[b] DOE/LANL list of Los Alamos National Laboratory Nuclear Facilities (DOE 2000a)

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

Projected: The SWEIS ROD projected two construction activities for this Key Facility. The construction of four additional fabric domes, for the storage of TRU wastes retrieved from earth-covered pads, was completed in 1998. The expansion of Area G has not yet begun, and is not anticipated to occur for at least another three years.

Not Projected: Construction of the Decontamination and Volume Reduction System began in 1999 and continued during 2000. This is a high-bay metal building with 13,000 square feet under roof. The Decontamination and Volume Reduction System is designed to segregate, decontaminate, and volume-reduce fiberglass-reinforced plywood crates of TRU waste retrieved from the TWISP storage pads. A major fraction of the resulting segregated wastes is anticipated to be de-rated to LLW, which will both (a) allow these wastes to be disposed at Area G and (b) decrease the volume of wastes that must be shipped to WIPP for disposal.

By the end of 2000, the Decontamination and Volume Reduction System was about 80 percent built. Although construction of this facility was not projected by the SWEIS ROD, NEPA coverage was provided through an environmental assessment (DOE 1999e) and subsequent Finding of No Significant Impact in June 1999.

Not Projected: In addition, decontamination operations were relocated during 2000 from the RLWTF, Building 50-01, to TA-54. Except for the lead decontamination trailer, activities were moved to the west end of TA-54. Rooms 103, 104, and 105 of Building 54-1009 will become the center of decontamination activities. Building 54-1014, an office trailer, has also become part of the operations.

To accommodate the relocation, radioactive liquid wastes will be collected in two holding tanks (1,000 gallons each) adjacent to 54-1009; they will be trucked to the RLWTF at TA-50. In addition, two transportainers have been installed. One will become a 90-day storage area for management of hazardous and mixed radioactive waste; the other will be used for storage of supplies. The lead decontamination trailer was removed from service. The trailer is currently stored inside Area G and will be decommissioned.

Not Projected: In order to control storm water run-off from TA-54, check dams were installed during 2000 at Area G and a sediment basin constructed in the canyon below Area G. NEPA review of this action was provided through a Categorical Exclusion #LAN-99-035 (DOE 1999f).

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[8]. The primary measurements of activity for this facility are volumes of newly generated chemical, low-level, and TRU wastes to be managed and volumes of legacy TRU waste and MLLW in storage. A comparison of CY 2000 to projections made by the SWEIS ROD can be summarized as follows:

Chemical wastes: A total of 463 metric tons were shipped for offsite treatment and/or disposal from the Solid Radioactive and Chemical Waste Facility, compared to an average quantity of 3,250 metric tons per year projected

[8] Decontamination operations are projected in the SWEIS and were reported in prior Yearbooks as part of the RLWTF Key Facility. They are also reported under the RLWTF Key Facility in this Yearbook because they were located for most of 2000 in Building 50-01. Decontamination operations will be reported as part of the Solid Radioactive and Chemical Waste Key Facility beginning with Yearbook 2001.

by the SWEIS ROD. (Note that overall LANL quantities of chemical wastes were higher. This is due to the fact that chemical wastes from the Environmental Restoration [ER] Project are nearly all shipped directly from the cleanup site to a commercial treatment and disposal facility. As mentioned earlier, not all wastes require handling through the Solid Radioactive and Chemical Waste Facility. However, the Laboratory's waste management operation captures and tracks data for waste streams [whether or not they go through the Solid Radioactive and Chemical Waste Facilities], regardless of their points of generation or disposal.)

LLW: A total of 4,454 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 SWEIS ROD. This LLW volume is an increase from the prior three years of operations, primarily because of additional wastes created by cleanup after the Cerro Grande fire. 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 need the expansion area for at least another three years.

MLLW: Eleven cubic meters were generated and delivered to TA-54 during 2000, compared to an average volume of 632 cubic meters per year projected by the SWEIS ROD. This quantity is also a decrease from preceding years. (Note that LANL quantities of mixed wastes were much higher. This is due to the fact that mixed wastes from the MDA-P cleanup were shipped directly from the cleanup site to a commercial treatment and disposal facility without being processed through, and thus shipped from, the Solid Radioactive and Chemical Waste Facility.)

TRU wastes: There were no shipments to WIPP during 2000, and the entire quantity of newly generated TRU wastes (213 cubic meters) was added to storage. TWISP continued ahead of schedule. Retrieval of drums from the third and final pad, Pad 2, began on 10/25/00, and more than 800 drums were retrieved from it by the end of December. TWISP operations have recovered 4,315 cubic meters of TRU wastes. The SWEIS ROD projects that TWISP will retrieve all 4,700 cubic meters from underground pads by December 2004.

In summary, chemical and radioactive waste management activities were at levels below those projected by the SWEIS ROD and, with the exception of LLW disposal, also below levels of 1998 and 1999 operations at this Key Facility. These and other operational details appear in Table 2.15.2-1.

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

CAPABILITY	SWEIS ROD[a]	2000 OPERATIONS
Waste Characterization, Packaging, and Labeling	Support, certify, and audit generator characterization programs.	As projected.
	Maintain waste acceptance criteria for LANL waste management facilities.	As projected.
	Characterize 760 cubic meters of legacy MLLW.	Characterized 11 cubic meters of legacy MLLW.
	Characterize 9,010 cubic meters of legacy TRU waste.	No TRU waste was fully characterized in 2000.
	Verify characterization data at the Radioactive Assay and Nondestructive Test Facility for unopened containers of LLW and TRU waste.	Verified characterization data at Radioactive Assay and Nondestructive Test Facility for TRU wastes, but not for LLW.
	Maintain waste acceptance criteria for offsite treatment, storage, and disposal facilities.	As projected.
	Overpack and bulk waste as required.	As projected.

Table 2.15.2-1 (Cont)

CAPABILITY	SWEIS ROD[a]	2000 OPERATIONS
Waste Characterization, Packaging, and Labeling	Perform coring and visual inspection of a percentage of TRU waste packages.	Coring operations were suspended until homogenous analytical capabilities are added to the RAMROD Facility.
	Ventilate 16,700 drums of TRU waste retrieved during TWISP.	Ventilated 622 drums during 2000 and 9,048 drums in total as of Dec. 2000.
	Maintain current version of WIPP waste acceptance criteria and liaison with WIPP operations.	As projected.
Compaction	Compact up to 25,400 cubic meters of LLW.	353 cubic meters compacted into 84 cubic meters LLW.
Size Reduction	Size reduce 2,900 cubic meters of TRU waste at WCRRF and the Drum Preparation Facility.	As proof-of-principle testing for the Decontamination and Volume Reduction System Facility, 100 cubic meters of TRU waste were processed and reduced to 60 cubic meters.
Waste Transport, Receipt, and Acceptance	Collect chemical and mixed wastes from LANL generators & transport to TA-54.	Collected and transported chemical and mixed wastes.
	Begin shipments to WIPP in 1999.	Shipments to WIPP began 3/26/1999.
	Over the next 10 years, ship 32,000 metric tons of chemical wastes and 3,640 cubic meters of MLLW for offsite land disposal restrictions, treatment, and disposal.	450 metric tons of chemical wastes and 11 cubic meters of MLLW were shipped for offsite treatment and disposal.
	Over the next 10 years, ship no LLW for offsite disposal.	No LLW was shipped for offsite disposal.
	Over the next 10 years, ship 9,010 cubic meters of legacy TRU waste to WIPP.	No legacy TRU waste was shipped in 2000.
	Over the next 10 years, ship 5460 cubic meters of operational and environmental restoration TRU waste to WIPP.	No operational or environmental restoration TRU wastes were shipped to WIPP.
	Over the next 10 years, ship no environmental restoration soils for offsite solidification and disposal.	No environmental restoration soils were shipped for offsite solidification and disposal in 2000. [b]
	Annually receive, on average, 5 cubic meters of LLW and TRU waste from offsite locations in 5 to 10 shipments.	There were no LLW or TRU waste receipts from offsite locations.
Waste Storage	Stage chemical and mixed wastes before shipment for offsite treatment, storage, and disposal.	Chemical and mixed wastes before shipment.
	Store legacy TRU waste and MLLW.	Legacy TRU waste and MLLW stored.

CAPABILITY	SWEIS ROD[a]	2000 OPERATIONS
Waste Storage	Store LLW uranium chips until sufficient quantities have accumulated for stabilization.	Two drums of uranium chips are in storage at Area G.
Waste Retrieval	Begin retrieval operations in 1997.	Retrieval begun in 1997.
	Retrieve 4,700 cubic meters of TRU waste from Pads 1, 2, 4 by 2004.	Retrieved 169 cubic meters in 2000. Retrieved 4,315 cubic meters total through Dec. 2000.
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 cubic meters of uranium chips.	No uranium chips were stabilized.
	Provide special-case treatment for 1,030 cubic meters of TRU waste.	None.
	Solidify 2,850 cubic meters of MLLW (environmental restoration soils) for disposal at Area G.	No environmental restoration soils were solidified.
Disposal	Over next 10 years, dispose 420 cubic meters of LLW in shafts at Area G.	13 cubic meters of LLW were disposed in shafts at Area G.
	Over next 10 years, dispose 115,000 cubic meters of LLW in disposal cells at Area G. (Requires expansion of onsite LLW disposal operations beyond existing Area G footprint.)	4,441 cubic meters of LLW disposed in cells. Area G was not expanded.
	Over next 10 years, dispose 100 cubic meters /yr administratively controlled industrial solid wastes in pits at Area J.	5,839 cubic meters solid wastes disposed in pits at Area J.
	Over next 10 years, dispose nonradioactive classified wastes in shafts at Area J.	0.79 cubic meters of classified solid wastes disposed in shafts at Area J.

[a] Includes the construction of four new storage domes for the TWISP.
[b] The ER Project usually ships soils removed in remediation of a potential release site (PRS) directly to an offsite disposal facility. These wastes do not typically require processing at TA-54 and do not go through the TA-54 operations for shipment.

2.15.3 Operations Data at the Solid Radioactive and Chemical Waste Facility

Levels of activity in 2000 were less than projected by the SWEIS ROD and so were air emissions and most secondary wastes. 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	2000 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	[a]
Plutonium-239	Ci/yr	6.80E-7	[a]
Uranium-234	Ci/yr	8.00E-6	[a]
Uranium-235	Ci/yr	4.10E-7	[a]
Uranium-238	Ci/yr	4.00E-6	[a]
NPDES Discharge	MGY	No outfalls	No outfalls
Wastes: [b]			
Chemical	kg/yr	920	806
LLW	m^3/yr	174	13
MLLW	m^3/yr	4	0
TRU	m^3/yr	27	27
Mixed TRU	m^3/yr	0	71
Number of Workers	FTEs	65 [c]	64 [c]

[a] Data for 2000 indicate no measured emissions 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 shown in the “SWEIS ROD” column is the index number representing CY 1999 (the year the SWEIS ROD was published). The number of employees for 2000 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the SWEIS ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 2000 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers (SWEIS ROD versus the new index) do not represent the same entity, a direct comparison to numbers projected by the SWEIS ROD (see Section 3.6, Socioeconomics) is not appropriate. However, because this index is going to be used in each subsequent yearbook, selecting CY 1999 as the base year establishes an index that can be compared over the ten-year window represented by the SWEIS ROD.

2.15.4 Cerro Grande Fire Effects at the Solid Radioactive and Chemical Waste Facility

The Solid Radioactive and Chemical Waste Key Facility was inaccessible for routine operations for two weeks during the wildfire. The impact continued upon re-opening of the Laboratory since the facility was returned to normal operations in phases only upon completion of a series of condition assessment steps. Construction was delayed about five weeks, and routine operations took about four weeks to return to normal levels. A significant fraction of the facility’s heavy earthmoving equipment was used for the wildfire and was not available for some time. The wildfire also impacted operations later in the year because fire-related debris was shipped to Area G for storage and/or disposal.

Operations at the Solid Radioactive Chemical Waste Facilities (TA-54) showing burial pits, storage drums, and storage domes

2.16 Non-Key Facilities

The balance, and majority, of LANL buildings are referred to in the SWEIS as 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 expressed 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).

As shown in Table 2.16-1, the SWEIS identified six buildings within the Non-Key Facilities with NHCs. There is currently only one Category 2 nuclear facility–the High-Pressure Tritium Facility (Building TA-33-86)–and no Category 3 nuclear facilities among the Non-Key Facilities. TA-33-86 is in safe shutdown mode awaiting decontamination and decommissioning, but remains a Category 2 facility because of the inventory of nuclear materials within.

Table 2.16-1. Non-Key Facilities with Nuclear Hazard Classification

BUILDING	DESCRIPTION	NHC SWEIS ROD	NHC DOE 1998 [a]	NHC DOE 2000 [b]
TA-03-0040	Physics Building	3		
TA-03-0065	Source Storage	2		
TA-03-0130	Calibration Building	3		
TA-33-0086	Former Tritium Research	3	2	2
TA-35-0002	Non-American National Standards Institute Uranium Sources	3	3	
TA-35-0027	Safeguard Assay and Research	3	3	

[a] DOE/LANL list of Los Alamos National Laboratory Nuclear Facilities (DOE 1998a)
[b] DOE/LANL list of Los Alamos National Laboratory Nuclear Facilities (DOE 2000a)

2.16.1 Construction and Modifications at the Non-Key Facilities

The SWEIS ROD had projected just one major construction project (Atlas) for the Non-Key Facilities. In contrast, however, 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 (LANL 1999). Major projects are discussed in the following paragraphs.

a) Atlas

Description: Atlas was constructed in parts of five buildings at TA-35 (35-124, 125, 126, 294, and 301). 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 the aging and performance of secondary components of nuclear weapons. 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 1996a).

The facility will require about 5 megawatt hours of electrical energy annually (1 percent to 2 percent of total LANL consumption); will have a peak electrical demand of 12 megawatts (about 12 percent of total LANL demand); and will employ about 15 people. This facility has its own NEPA coverage provided by Appendix K of the Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management (DOE 1996a).

Status: Construction was completed in September 2000. Major testing of the capacitor banks (level of current) was successfully completed in December 2000. There remain only minor pre-start items to complete, and the project team has requested authorization to start operations (Del Signore 2001b).

b) Los Alamos Research Park

Description: As described in the Environmental Assessment, a maximum of 44 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. According to the Research Park Master Plan, up to five buildings and two parking structures may be constructed, with a total floor space of 300,000 square feet and parking for 1,400 cars (DOE 1997b).

If ten buildings were to be constructed, the Research Park would consume an estimated 1.3 megawatts peak electric demand, 4,250 megawatt-hours of electricity, 39 billion BTU of natural gas, and 17 million gallons of water annually. These would represent approximate increases of 1 percent, 5 percent, 4 percent, and 18 percent in these utilities, respectively. The Park could also provide up to 1,500 new jobs and would increase traffic by up to 3,000 vehicle trips per day. Development would convert 30 undeveloped acres to office and light industrial use. This area, less than 0.25 percent of the vegetated landscape at LANL, currently provides a buffer for residential areas. This project has its own NEPA coverage provided by the Environmental Assessment for the Lease of Land for the Development of a Research Park at Los Alamos National Laboratory (DOE 1997b) along with a Finding of No Significant Impact.

Status: Construction of the first building in the Research Park began in February of 2000. Through December 2000, construction of Building #1 had been nearly completed (Del Signore 2001c).

c) Strategic Computing Complex

Description: The Strategic Computing Complex will house the world's fastest supercomputer. It 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-kilovolt substation transformer at the TA-03 Power Plant. Three cooling towers are to be constructed, expandable to six if needed.

The Strategic Computing Complex will require an estimated 63 million gallons of cooling water per year. This water is proposed to come from treated waters from the sewage facility, which total more than 100 million gallons annually. The Strategic Computing Complex is projected to have a maximum electricity load requirement of seven megawatts, or about 7 percent of total LANL demand. This project has its NEPA coverage provided by the Environmental Assessment for the Proposed Strategic Computing Complex, Los Alamos National Laboratory, Los Alamos, New Mexico (DOE 1998c). This proposal was an allowable interim action, and the NEPA review proceeded separately from the SWEIS. Based on the Environmental Assessment, DOE issued a Finding of No Significant Impact in December 1998.

Status: Construction of this new building got underway in 1999 and continued on schedule through 2000.

d) Nonproliferation and International Security Center

Description: The Nonproliferation and International Security Center will be a four-story building plus basement of 164,000 square feet with a capacity to house 465 people. It is being constructed adjacent to the new

Strategic Computing Complex within 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.

Strategic Computing Complex with excavation for the Nonproliferation and International Security building in foreground

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. To accommodate both the Strategic Computing Complex and Nonproliferation and International Security Center, nearby parking lots are to be expanded to accommodate an additional 800 to 900 vehicles. NEPA coverage for this project was provided by the Environmental Assessment for Nonproliferation and International Security Center (DOE 1999g) and a Finding of No Significant Impact.

Status: Design of the building began in 1999 and continued through 2000.

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 2000, no new capabilities were added to the Non-Key Facilities and none of the eight were deleted.

The 12,015 employees at the end of CY 2000 are 664 more employees than SWEIS ROD projections of 11,351. SWEIS ROD projections were based on 10,593 employees identified for the index year (employment as of March 1996). About 60 percent of this increase is in the Non-Key Facilities as a result of increases in research and development, services, and administration.

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 superconducting 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.
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).

2.16.3 Operations Data for the Non-Key Facilities

Even though the Non-Key Facilities occupy more than half of LANL and employ more than half the workforce, activities in these facilities typically contribute less than 10 percent of most operational effects. For example, the 10 cubic meters of MLLW constituted only 2 percent of the LANL total MLLW volume. Table 2.16.3-1 presents details.

Radioactive air emissions from stacks at the Non-Key Facilities (1,150 curies in 2000) were slightly above SWEIS ROD projections. This represents off-gassing from inactive facilities and represents less than 7 percent of the 21,700 curies projected by the SWEIS ROD.

NPDES discharges were the only parameter to exceed projections made by the SWEIS ROD. The 192 million gallons of cooling water is attributed to the decision by facility managers to increase the use of once-through cooling water to reduce the potential for concentrating contaminants during recirculation that might exceed NPDES Permit discharge parameters upon release. Contaminants are leached from treated wood used in the cooling towers, and these contaminants concentrate in the water when recycled. The combined flows of the sanitary waste treatment plant and the TA-3 Steam Plant account for almost 90 percent of the total discharge from Non-Key Facilities and about 64 percent of all water discharged by the Laboratory. Section 3.2 has more detail.

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

PARAMETER	UNITS	SWEIS ROD	2000
Radioactive Air Emissions: [a]			
Tritium	Ci/y	9.1E+2	1.15E+3
Plutonium	Ci/y	3.3E-6	None measured
Uranium	Ci/y	1.8E-4	None measured
NPDES Discharge:			
Total Discharges	MGY	142	192
001	MGY	114	170
013	MGY	[b]	[b]
03A-027	MGY	5.8	8.7
03A-160	MGY	5.1	14
03A-199	MGY	---	[c]
22 others	MGY	17	[d]
Wastes:			
Chemical [e]	kg/yr	651,000	379,065
LLW	m^3/yr	520	578
MLLW	m^3/yr	30	10
TRU	m^3/yr	0	3
Mixed TRU	m^3/yr	0	3
Number of Workers	FTEs	4,601 [f]	4,501 [f]

[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 non-point sources.

[b] Outfall 013 is from the TA-46 sewage plant. Instead of discharging to Mortandad Canyon, however, treated waters are pumped to TA-3 for re-use and ultimate discharge through Outfall 001 into Sandia Canyon. This transfer of water has resulted in projected NPDES volumes underestimating actual discharges from the exiting outfall.

[c] New Outfall 03A-199 was permitted by the EPA on 12/29/00. It had no discharge during 2000.

[d] The Non-Key Facilities formerly had 28 total outfalls (DOE 1999a, p. A-5). Twenty-two of these, with projected total flow of 17 million gallons per year, were eliminated from LANL's NPDES Permit during 1998 and 1999.

[e] Approximately 73,449 kilograms of the chemical wastes are industrial solid wastes resulting from cleanup following the Cerro Grande fire. Industrial solid waste is nonhazardous, may be disposed in county landfills, and does not represent a threat to local environs.

[f] The number shown in the "SWEIS ROD" column is the index number representing CY 1999 (the year the SWEIS ROD was published). The number of employees for 2000 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the SWEIS ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 2000 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers (SWEIS ROD versus the new index) do not represent the same entity, a direct comparison to numbers projected by the SWEIS ROD (see Section 3.6, Socioeconomics) is not appropriate. However, because this index is going to be used in each subsequent yearbook, selecting CY 1999 as the base year establishes an index that can be compared over the ten-year window represented by the SWEIS ROD.

employees (regular full-time and part-time). Because the two sets of numbers (SWEIS ROD versus the new index) do not represent the same entity, a direct comparison to numbers projected by the SWEIS ROD (see Section 3.6, Socioeconomics) is not appropriate. However, because this index is going to be used in each subsequent yearbook, selecting CY 1999 as the base year establishes an index that can be compared over the ten-year window represented by the SWEIS ROD.

2.16.4 Cerro Grande Fire Effects at the Non-Key Facilities

The Non-Key Facilities received significant fire damage. The Cerro Grande fire impacted 86 structures or buildings, damaged 31 structures or buildings, and destroyed 10 structures or buildings. Like the rest of LANL, operations were shut down during the emergency, and these programs suffered lost work time. Access was restricted in several of the more severely burned areas at LANL, and employees who occupied the damaged or destroyed structures had to be housed in new locations. In addition, the fire destroyed data, work-in-progress, and work production at many locations, delaying some of the programs.

2.17 Environmental Restoration Project

Cleanups performed by the ER Project may generate a significant amount of waste, and therefore, the ER Project is included as a section of Chapter 2. The SWEIS ROD forecast that the ER Project would contribute 60 percent of the chemical wastes, 35 percent of the LLW, and 75 percent of the MLLW generated at LANL over the 10 years from 1996–2005. The ER Project will also affect land resources in and around LANL.

DOE established the ER Project in 1989 to characterize and remediate over 2,100 PRSs known, or suspected, to be contaminated from historical operations. Many of the sites remain under DOE control; however, some have been transferred to Los Alamos County or to private ownership (locations within the townsite). Remediation and cleanup efforts must be coordinated with the New Mexico Environment Department (NMED) and/or DOE.

In 2000, ER Project activities included drafting several characterization/remediation reports for NMED, conducting characterization/remediation fieldwork on numerous sites, and formally tracking all work performed.

Cleanups included, but were not limited to

- MDA-P;
- activities, including source removal, at TA-16 PRSs;
- voluntary corrective actions (VCAs)[9] at such locations as the former central wastewater treatment plant in the Los Alamos townsite, a storage area in TA-3, and the DOE LAAO; and
- source removals at the TA-53 lagoon.

2.17.1 Operations of the Environmental Restoration Project

The ER Project originally identified 2,124 PRSs, consisting of 1,099 PRSs administered by NMED and 1,025 PRSs administered by DOE. By the end of 2000, only 883 discrete PRSs remained. Of the 1,241 units eliminated, over 270 units were removed during the annual unit audit consolidations of FY 1999 and FY 2000. In addition, approximately 800 units were approved for no further action (NFA)[10], over 120 units were removed from the permit, and 47 units are currently in public comment or are proposed for NFA.

[9] A VCA is a cleanup performed without being required by the administrative authority (NMED or DOE). These are considered prudent to do and are elective on the part of LANL.

[10] NFA means that the site is considered “clean” for its intended purpose. An industrial site would not be cleaned up to the same level as a residential site.

During 2000, a new PRS was identified, and 10 additional PRSs were created when PRS 16-017 was divided. Public comment was pending on NFA recommendations for 30 PRSs, and the ER Project had recommended 17 additional PRSs for NFA to the NMED.

Continued cleanup of TA-16, MDA-P, was a major assignment undertaken by the ER Project during 2000. MDA-P, a landfill, received debris from material and equipment flashed (burned in a fire to remove high explosive contamination) at the TA-16 Burning Grounds from 1950 until 1984 and contained a variety of hazardous wastes. Detonatable high explosives and residual high explosive contamination were encountered. Other hazardous materials included barium; soil contaminated with barium, lead, and other listed metals; and asbestos. In addition to detonatable high explosives, containers with unknown contents also posed a significant hazard. More than 840 of these containers were removed from the MDA-P landfill. The landfill also contained demolition debris from World War II–era buildings.

A remote operated excavator was used to uncover burning debris at TA-16 after the Cerro Grande fire

The ER Project completed excavation of waste and debris from MDA-P on May 3, 2000. Excavation of soil under the landfill, contaminated by leachate containing barium and high explosive constituents, began when the site was reoccupied following the Cerro Grande fire. By the end of 2000, over 32,708 cubic meters of soil, debris, recycled materials, and other waste had been removed from the MDA-P landfill. Activity highlights include

- 17,508 cubic meters of soil and debris were excavated;
- 15,230 cubic meters of waste and recycled materials were disposed of
  - hazardous waste–9,985 cubic meters shipped offsite for disposal;
  - fill material–3,180 cubic meters of soil and 1,376 cubic meters of concrete shipped to MDA-J at TA-54 for capping. A closure plan for MDA-J was submitted to NMED in 1999. However, after the Cerro Grande fire, it became evident that LANL required disposal capacity for the solid wastes generated from rehabilitation. Through negotiation, NMED agreed to allow MDA-J to continue to accept waste until late spring 2001;
  - scrap metal–688 cubic meters shipped offsite for recycling;
  - 260 pounds of high explosives materials were returned to the TA-16 Burning Ground for disposal;
  - 2,605 pounds of asbestos were disposed of offsite; and
  - 5,300 pounds of barium nitrate were disposed of by the Laboratory's Solid Waste group.

Closure activities continued at the TA-16-387 flash pad and at the TA-16-394 burn tray. Approximately 545 cubic meters of hazardous wastes were removed during the closure of the flash pad and were shipped offsite for disposal. Approximately 22 cubic meters of hazardous waste were removed during the closure of the burn tray and shipped offsite for disposal. An additional 92 cubic meters of industrial waste were removed during the burn tray closure. This waste is being held in waste containers at the site pending disposal at an industrial landfill during 2001.

ER Project personnel did significant work at PRS 16-021(c)-99, located adjacent to Building 16-260, the Laboratory's conventional high explosive machining facility. From 1951 to 1996, 13 sumps discharged high explosive contaminated wastewater through the 16-260 outfall. PRS 16-021(c)-99 includes the sumps and drain

RECRA technicians test samples for volatiles and organic compounds. Photo by RECRA ENvironmental Inc.

lines that lead to the outfall, as well as the outfall itself, a pond, and a drainage channel. This cleanup is significant because the PRS is believed to be the major source of high explosive and barium contamination in Cañon de Valle. High explosive concentrations ranged to levels greater than 20 percent total high explosive in soil. During FY 2000, ER Project personnel removed the majority of the high explosive- and barium-contaminated soil and rock at PRS 16-021(c)-99. Approximately 1,150 cubic meters of material from within the outfall area were excavated using both conventional and robotic excavation techniques.

The ER Project worked on several VCAs during 2000, including the following:

PRS 03-56(c) was a storage area located northeast of the JCNNM Utility Shop in TA-3. Electrical cable, used and unused dielectric oils, polychlorinated biphenyl (PCB)-containing transformers, capacitors, and oil-filled drums were stored at this site. ER Project personnel completed an expedited cleanup at this site in 1995, removing 765 cubic meters of soils. Verification sampling indicated PCBs at concentrations greater than the EPA prescribed cleanup level of less then one part per million. During FY 2000, ER Project personnel initiated VCA activities to remove soil that contained greater than one part per million PCBs, and by the end of December, over 1,750 cubic meters of PCB-contaminated soil and sediment had been excavated and stored onsite in 142 roll-off bins. Eleven of the bins contained PCBs at concentrations greater than 50 parts per million and were shipped to a Toxic Substances Control Act–approved offsite disposal facility.

PRS 00-003-99, the DOE LAAO Land Transfer Site, is part of the work required for transferring the LAAO parcel from DOE to Los Alamos County. This area was part of the Western Steam Plant and is adjacent to the parking lot at the current LAAO building. During FY 2000, ER Project personnel completed a VCA that

- removed and disposed of approximately 150 linear feet of vitrified clay pipe,
- removed and recycled an underground process tank from the Western Steam Plant,
- collected supplemental samples to define the nature and extent of contamination, and
- collected confirmatory samples.

The ER Project also worked on removing the source of contamination at PRS 53-002(b), the southern lagoon at LANSCE. The lagoon was constructed in 1985 and received excess wastewater from the northern lagoons from 1985 to 1992. It also received radioactive liquid discharges from 1992 to the end of 1998, the year it was taken out of service. During FY 2000, ER Project personnel

- removed and disposed of approximately 126 cubic meters of radioactive sludge;
- removed and disposed of approximately 23 cubic meters of the lagoon's liner;
- pumped 5,000 gallons of rain water from the lagoon that is awaiting disposal; and
- drilled 14 boreholes at the bottom of the south lagoon to 15 feet deep and collected samples to determine if contaminants are present below the liner.

2.17.2 Operations Data for the Environmental Restoration Project

Waste quantities generated during 2000 are shown in Table 2.17.2-1. Though the ER Project generated 27,208,678 cubic meters of chemical waste in 2000, almost all of this waste (27,196,978 cubic meters) was a result of emergency cleanup following the Cerro Grande fire. Most of this was industrial solid waste that was nonhazardous, and did not present an environmental hazard. When corrected for these fire-related wastes, the ER Project only generated 11,700 cubic meters of chemical wastes, far below the projections made by the SWEIS ROD.

The same holds true for both the LLW and MLLW. When adjusted for fire-related wastes caused by emergency cleanups following the Cerro Grande fire, the LLW quantity is 172 cubic meters, and the MLLW quantity is 2.5 cubic meters. These quantities are below projections made by the SWEIS ROD.

Table 2.17.2-1. Environmental Restoration Project/Operations Data

WASTE TYPE	UNITS	SWEIS ROD	2000 OPERATIONS
Chemical [a]	m^3/yr	2,000,000	27,208,678
LLW [b]	m^3/yr	4,260	2,467
MLLW [c]	m^3/yr	548	577
TRU	m^3/yr	11	0
Mixed TRU	m^3/yr	0	0

[a] The chemical waste volume includes 27,196,978 cubic meters of industrial solid waste and other chemical waste generated during recovery efforts from the Cerro Grande fire. These wastes are not part of normal ER Project activities. When adjusted for these off-normal quantities, the routine chemical waste generated by the ER Project during 2000 is 11,700 cubic meters.

[b] The LLW volume includes 2,295 cubic meters of LLW generated as a result of emergency cleanups following the Cerro Grande fire. When adjusted for these off-normal quantities, the routine LLW generated by the ER Project during 2000 is 172 cubic meters.

[c] The MLLW volume includes 574.5 cubic meters of MLLW generated as a result of emergency cleanups following the Cerro Grande fire. When adjusted for these off-normal quantities, the routine LLW generated by the ER Project during 2000 is 2.5 cubic meters.

2.17.3 ER Project/Cerro Grande Fire

The major concern following the Cerro Grande fire was the threat of erosion at burned over PRSs and the movement of contaminants downstream. The ER Project began an assessment of the 600 PRSs within the burn area to accomplish the following.

- Evaluate and stabilize sites touched by fire. The PRS Assessment Team determined that over 300 PRSs were touched by fire. Assessments for these PRSs were completed by May 23, 2000, and, as shown in Table 2.17.3-1, erosion control measures (called best management practices [BMPs]) were needed for 91 of the 300 PRSs. These BMP installations were completed on July 15, 2000, and included contour raking, placement of water barriers (straw wattles), diversion of stream channels, and other measures to divert surface water from the PRS.
- Conduct baseline sampling to characterize post-fire, pre-flood conditions (i.e., before monsoon season rains) in fire-impacted watersheds. The Contaminant Transport Team completed a Baseline Characteriza tion Sampling Plan on June 24, 2000. Pre-flood fieldwork, including collection of sediment, surface water, and alluvial groundwater samples, was completed on July 14, 2000. Post-flood fieldwork was carried out in August and September, as necessary.
- Evaluate, stabilize, or remove sites subject to flooding. The Accelerated Actions Team identified 77 PRSs in fire-impacted canyons that were potentially vulnerable to post-fire flooding. The majority of these sites were in Los Alamos Canyon (TA-2 and TA-41) and Pajarito Canyon (TA-18 and TA-27) and included outfalls, storm drains, septic systems, and other structures (including those associated with the Omega

West Reactor at TA-2). Few of the sites assessed actually required corrective actions except for several in TA-2 where excavation, soil removal, and site restoration activities were completed during July and August 2000.

In addition, one flood-impacted sediment deposition area and five fire-impacted sites were identified that required corrective actions to remove debris or contaminated soils. ER Project personnel completed accelerated actions at the following sites:

- Los Alamos Canyon, "Garden Plot": excavation of 765 cubic meters of low-level radioactively contaminated soil, waste removal, and site restoration,
- TA-16, MDA-R: excavation and waste removal,
- TA-15, R-44 firing site surface disposal area: debris removal,
- TA-36 surface disposal area: debris removal,
- TA-40 surface disposal area: debris removal, and
- TA-16 "silver" outfall: removal of contaminated soil and stabilization of drainage channel.

Table 2.17.3-1. Evaluated and Stabilized PRSs following the Cerro Grande Fire

NO. OF PRSs	PRS LOCATIONS	START DATE	COMPLETION DATE
10	TA-11	5/21/00	5/24/00
29	TA-6, 9, 14, 15, 22, 36, 40, 49	6/14/00	7/15/00
34	TA-16, 46, 15, (R-44)	5/29/00	7/15/00
18	TA-4, 5, 42, 48	6/27/00	7/15/00

MDA-R

MDA-R (a 2.25-acre site) is located in TA-16, north of TA-16-260 (high explosives machining building) and south of Cañon de Valle. It lies on level terrain with a moderate-to-steep slope to the north, dropping off 80 feet into the canyon. MDA-R ignited during the Cerro Grande fire and continued to burn for over two weeks.

Historically, MDA-R was a burning ground and waste disposal site for S-Site's weapons experiments from the mid-1940s until the early 1950s, probably 1951. Initially, waste materials were burned in an open field at MDA-R; later, three U-shaped bermed pits (75 feet by 75 feet) were constructed for burning. High explosives scrap was collected, broken up, and burned in these pits. When the 260 Line was constructed, the berms and the surface soil at MDA-R were graded northward into Cañon de Valle. A 1992 inspection of MDA-R revealed the presence of oil cans, glass vials, metal structures, and coaxial cables below MDA-R on the south side of the canyon.

During the week of May 15, 2000, LANL personnel observed that MDA-R was smoldering, noting that tree roots, tree trunks, railroad ties, and cabling were burning. Over the next two weeks emergency personnel attempted to extinguish the fire; first with fire-suppression foam, and later with water. However, the site continued to burn beneath the surface. Ultimately, it was decided that the fire could only be extinguished by excavation of the burning material. Using a remote excavator (a remotely controlled, fully functioning back hoe with mounted television survey cameras) burning material was uncovered and extinguished using a low-pressure water stream from a fire hose. The remote excavator was required because of the possibility that unexploded high explosives were present in MDA-R. The last embers in MDA-R were extinguished on August 31, 2000.

MDA-R was prioritized for accelerated corrective action because of concerns that erosion might lead to contaminant migration. Wastes removed from the site included approximately 1,960 cubic yards of soil, 175 pounds of barium nitrate pieces, and 300 pounds of friable asbestos. Erosion control activities included stabilization of spoils piles, stabilization of canyon slopes, and redirection of a small drainage arroyo that previously conducted surface water runoff through the landfill. For more information regarding this activity see the ER Project's *Project Completion Report for the Accelerated Action at TA-16, MDA R* (LANL 2001).

LA Canyon Cleanup

In late June 2000, a cleanup of contaminated sediment was conducted in Los Alamos Canyon following the Cerro Grande fire to address the potential for these sediments to be eroded and transported during possible large floods resulting from high-intensity summer precipitation. The sediments removed were situated within three discrete areas immediately below the confluence with DP Canyon. The contamination within these sediments consisted primarily of cesium-137 with lesser amounts of strontium-90, amercium-241, and plutonium. The contamination, at the remediation site and elsewhere in Los Alamos Canyon, is related predominantly to releases of effluent from Buildings 21-35 and 21-257 at TA-21 during the years 1952 to 1985. The location of the discharges is currently known as PRS 21-011(k). The contaminated sediments at the remediation site were deposited by floods that occurred during the early period of releases from PRS 21-011(k) (Katzman 2000).

The cleanup activity was triggered by several factors:

- the area of contaminated sediments was relatively susceptible to flooding and erosion under the hydrologic conditions caused by the fire,
- the contaminant concentrations in the remediation were significantly higher than surrounding sediments, and
- the area was easily accessible by heavy equipment necessary to remove the sediment.

A total of 720 cubic yards of material was removed from three discrete sub-areas within the remediation site. The waste was transported to TA-54, Area G, for disposal as LLW. Following remediation, this site was restored by back filling the excavation with clean fill material brought in from the Los Alamos County landfill. The area was then covered with jute matting and reseeded (Katzman 2000).

3.0 Site-Wide 2000 Operations Data

The Yearbook's role is to provide data that could be used to develop an impact analysis. However, in two cases, worker dose and dose from radioactive air emissions, the Yearbook specifically addresses impacts as well. In this chapter, the Yearbook summarizes operational data at the site-wide level. These impact assessments are routinely undertaken by LANL, using standard methodologies that duplicate those used in the SWEIS; hence, they have been included to provide 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, including 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 by the SWEIS ROD resulted only from 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 2000 totaled approximately 3,100 curies, less than 15 percent of the ten-year average of 21,700 curies projected by the ROD. These low emissions result from operations at the Key Facilities not being performed at projected levels and from the conservative nature of the emissions calculations performed for the SWEIS.

As in 1999, 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 1,200 curies and from Non-Key Facilities were slightly less at about 1,150 curies. Tritium emissions from the Key Facilities were dominated by emissions from TA-21-209. The emissions from this facility, approximately 750 curies, generally resulted from cleanup activities. Tritium emissions from the Non-Key Facilities were dominated, as in 1999, by increased off-gassing from TA-33. The emissions from this facility totaled approximately 1,150 curies.

Emissions of activation products from LANSCE continued to be small for 2000. The total point source emissions were approximately 700 curies. This low level of emissions is attributable to a lack of operations at the Area A beam stop.

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 generally small compared to stack emissions. For example, non-point air emissions from LANSCE were less than 150 curies. Additional detail about radioactive air emissions will be provided in the Laboratory's annual compliance report to the EPA on June 30, 2001, and in the 2000 Environmental Surveillance Report.

Maximum offsite dose will continue to be small for 2000. The final dose is estimated to be approximately 0.65 millirem/yr, with the final dose being reported to the EPA by June 30, 2001.

3.1.2 Non-Radioactive Air Emissions

Emissions of Criteria Pollutants

Criteria pollutants include nitrogen oxides, sulfur oxides, carbon monoxide, and particulate matter. LANL, in comparison to industrial sources and power plants, is a relatively small source of these non-radioactive air pollutants. As such, the Laboratory is required to estimate emissions, rather than perform actual stack sampling. With one exception (as shown in Table 3.1.2-1), calculated emissions for criteria pollutants during 2000 were less than amounts assumed for the SWEIS. Calculated sulfur oxide emissions generated in 2000 were significantly higher than SWEIS ROD projections, an order of magnitude higher than recent annual emissions, and resulted from the main steam plant burning fuel oil during the Cerro Grande fire. Burning fuel oil generates significantly greater amounts of sulfur oxides than does burning natural gas (the fuel typically used at the main steam plant). Use of the alternative fuel was necessary because natural gas supplies to the area were cut off during the fire.

Table 3.1.2-1. Emissions of Criteria Pollutants

POLLUTANTS	UNITS	SWEIS ROD	2000 OPERATIONS
Carbon monoxide	Tons/year	58	26
Nitrogen oxides	Tons/year	201	80
Particulate matter	Tons/year	11	3.8
Sulfur oxides	Tons/year	0.98	4.0

In September 2000, LANL received a permit from NMED to modify the main steam plant. The construction permit allows for the installation of flue gas recirculation equipment on the steam plant boilers to reduce emissions of nitrogen oxides from the boilers up to 70 percent. In addition, the permit allows the main power plant to burn up to 500,000 gallons/yr of fuel oil. The maximum sulfur emissions from the permitted fuel limits (for natural gas and fuel oil) were estimated at 13.8 tons/yr. Dispersion modeling results for the permit application indicated no ambient air quality standards would be exceeded.

TA-3 Power Plant

Criteria pollutant emissions from LANL's fuel burning equipment are reported in the annual Emissions Inventory Report as required by the New Mexico Administrative Code, Title 20, Chapter 2, Part 73 (20 NMAC 2.73). The report provides emission estimates for the steam plants, nonexempt boilers, the asphalt plant, and the water pump. In addition, emissions from the paper shredder, rock crusher, degreasers, and permitted beryllium machining operations are reported. For more information, refer to Los Alamos National Laboratory's 1999 and 2000 Emissions Inventory Report (Hurtle 2001).

Chemical Usage and Emissions

The 1999 edition of the Yearbook proposed to report chemical usage and calculated emissions for Key Facilities obtained from the Laboratory's Automated Chemical Inventory System (ACIS). The quantities presented in this approach represent all chemicals procured or brought on site in the respective calendar year. This methodology is identical to that used by the Laboratory for reporting under Section 313 of the Emergency Planning Community Right-to-Know Act and for reporting regulated air pollutants estimated from research and development operations in the annual Emissions Inventory.

Because of the dynamic nature of Laboratory operations, a number of chemicals used in 1999 were not used in 2000 and vice versa. Table A-1 (Appendix) lists, by TA, the number of chemicals used in 1999 but not used in 2000 and the number of chemicals used in 2000 but not used in 1999.

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 1999 Yearbook. First, usage of listed chemicals was summed by facility. It was then estimated that 35 percent of the chemical used was released to the atmosphere. Emission estimates for some metals, however, were based on an emission factor of less than one percent. This is appropriate because these metal emissions are assumed to result from cutting or melting activities. Fuels such as propane and acetylene were assumed to be completely combusted; therefore, no emissions are reported.

There are some substantial differences between the 2000 data, the 1999 Yearbook data, and data presented in the SWEIS. The current data are believed to be more accurate and up-to-date for two reasons. First, in 1999 a wall-to-wall inventory of chemicals at the Laboratory was completed. Results of this inventory were used to update ACIS. Second, in 1999 the Laboratory published a Chemical Management Laboratory Implementing Requirement (LIR) (LIR402-510-01.0) that requires LANL personnel to maintain a current chemical inventory in ACIS.

Information on total volatile organic compounds and hazardous air pollutants estimated from research and development operations is shown in Table 3.1.2-1. Projections by the SWEIS ROD for volatile organic compounds and hazardous air pollutants were expressed as concentrations rather than emissions; direct comparisons cannot be made, and, therefore, projections from the SWEIS ROD are not presented. Hazardous air pollutant estimates for 1999 were presented in the annual Emissions Inventory for the first time, and, therefore, are presented here. The volatile organic compound emissions reported from research and development activities reflect quantities procured in each calendar year. The hazardous air pollutant emissions reported from research and development activities generally reflect quantities procured in each calendar year. In a few cases, however, procurement values and operational processes were further evaluated so that actual air emissions could be reported instead of procurement quantities. The table shows that volatile organic compounds and hazardous air pollutants decreased by 50 percent from 1999 to 2000. This decrease could be a result of increased attention to house keeping and management of chemicals.

Table 3.1.2-2 Emissions of Volatile Organic Compounds and Hazardous Air Pollutants

POLLUTANT	EMISSIONS (TONS/YEAR)	
	1999	2000
Hazardous Air Pollutants	13.6	6.5
Volatile Organic Compounds	20	10.7

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 265.4 million gallons in CY 2000, compared to 278.0 million gallons projected by the SWEIS ROD. Details on all non-compliance are provided in the 2000 Annual Environmental Surveillance Report. Key Facilities accounted for approximately 72.9 million gallons of that total. This flow can be examined by watershed (Table 3.2-1) and by facility (Table 3.2-2) to understand differences from projections.

A major modification project, elimination and/or rerouting of NPDES outfalls, was completed in 1999, bringing the total number of permitted outfalls down from the 55 identified by the SWEIS ROD to 20[1] During 2000, Outfall 03A-199, which will serve the TA-3-1837 cooling towers, was included in the new NPDES Permit issued by EPA on December 29, 2000; however, the effective date of the permit is February 1, 2001. This brings the total number of permitted outfalls up to 21. This new outfall (03A-199) will discharge to an unnamed tributary of Sandia Canyon and will be included in future totals for the Non-Key Facilities. While the volume of water discharged by the Laboratory in CY 2000 was reduced overall, the largest apparent reductions were primarily attributed to fewer outfalls being reported under the Laboratory's NPDES Permit[2] coupled with more accurate record keeping.

[1] For some facilities, recorders installed at the end of the pipe determine flows. This was the case for outfalls at the Sanitary Wastewater System, High Explosive Wastewater Treatment Facility, RLWTF, the Power Plant, and LANSCE. For all other outfalls, annual totals were calculated from discharge monitoring reports provided by the Laboratory's Water Quality and Hydrology group. This latter method substantially overestimates quantity of wastewater discharged because it is based on infrequent sampling and assumes around-the-clock flow for all outfalls.

[2] The number of outfalls listed in the NPDES Permit had decreased by 16, to 20, at the end of 1999. 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. See Section 3.2 of the SWEIS Yearbook for CY 1999 for a complete discussion of NPDES outfall reduction.

Table 3.2-1. NPDES Discharges by Watershed (Millions of Gallons)

WATERSHED	# OUTFALLS (SWEIS ROD)	# OUTFALLS (2000) [a]	DISCHARGE (SWEIS ROD)	DISCHARGE (2000)
Cañada del Buey	3	1 [b]	6.4	0
Guaje	7	0	0.7	0
Los Alamos	8	5	44.8	37.4
Mortandad	7	5	37.4	31.6
Pajarito	11	0	2.6	0
Pueblo	1	0	1.0	0
Sandia	8	5 [c]	170.7	180.2 [b]
Water	10	5[d]	14.2	16.2 [d]
Totals	55	21 [c]	278.0	265.4

[a] Twenty-one outfalls were permitted to discharge during 2000. See footnote c below.
[b] Includes Outfall 13S from the Sanitary Wastewater Systems Consolidation, which is registered as a discharge to Cañada del Buey. The discharge is actually piped to TA-3 and ultimately discharged to Sandia Canyon via Outfall 001.
[c] Includes new Outfall 03A-199 (permit issued 12/29/2000), which had no discharge in CY 2000.
[d] Includes 05A-055 discharge to Cañon de Valle, a tributary to Water Canyon.

Table 3.2-2 compares NPDES discharges by facility. The Non-Key Facilities showed the largest differences between CY 2000 discharges and SWEIS ROD projections (192.5 million gallons versus 142.1 million gallons, respectively). For the Non-Key Facilities, discharges from the TA-3 power plant (Outfall 001) remained significantly higher (169.8 million gallons) than the projected discharge (114 million gallons). Approximately 90.2 million gallons of the discharge from Outfall 001 at the power plant are attributable to sanitary effluent piped from Outfall 13S at TA-46 to TA-3 to be used as "makeup water" in the cooling towers. While the volume contributed from 13S is approximately 16 million gallons less than what it was for 1999, the total discharged through Outfall 001 has increased by about 3.2 million gallons. The apparent increase of about 19 million gallons of cooling water is attributed to the decision by facility managers to increase the use of once-through cooling water to reduce the potential for concentrating contaminants during recirculation that might exceed NPDES Permit discharge parameters upon release. Contaminants are leached from treated wood used in the cooling towers. The combined flows of the sanitary waste treatment plant and the TA-3 Steam Plant account for almost 90 percent of the total discharge from Non-Key Facilities and about 64 percent of all water discharged by the Laboratory.

For Key Facilities, LANSCE discharged approximately 30.5 million gallons for 2000, about 6.6 million gallons less than in 1999 (LANL 2000d), accounting for almost 42 percent of the total discharges from all Key Facilities, see Table 3.2-2. The reduced volume is attributed to overall reduced activity and fewer hours of "beam time" than anticipated. See Section 2.11 for more information.

LANL has three principal wastewater treatment facilities—the sewage plant (sanitary wastewater system) at TA-46, the RLWTF at TA-50, and the High Explosives Wastewater Treatment Facility at TA-16. As discussed above, the sewage treatment plant at TA-46 processed about 90.15 million gallons of treated wastewater and sewage during 2000, all of which was pumped to the TA-3 power plant to provide make up water for the cooling towers or to be discharged directly into Sandia Canyon via Outfall 001.

The RLWTF, Building 50-01, Outfall 051, discharges into Mortandad Canyon. During 2000, about 4.9 million gallons of treated radioactive liquid waters were released to Mortandad Canyon, compared to 9.3 million gallons projected by the SWEIS ROD. The TA-16 High Explosives Wastewater Treatment Facility discharged about 0.1 million gallons compared to 12.4 projected by the SWEIS ROD.

Table 3.2-2. NPDES Discharges by Facility (Millions of Gallons)

FACILITY	# OUTFALLS (SWEIS ROD)	# OUTFALLS (2000)	DISCHARGE (SWEIS ROD)	DISCHARGE [a] (2000)
Plutonium Complex	1	1	14.0	6.5
Tritium Facility	2	2	0.3	8.6
CMR Building	1	1	0.5	2.3
Sigma Complex	2	2	7.3	3.9
High Explosives Processing	11	3	12.4	0.1
High Explosives Testing	7	2	3.6	16.1
LANSCE	5	4	81.8	30.5
HRL	1	0	2.5	0
Radiochemistry Facility	2	0	4.1	0
RLWTF	1	1	9.3	4.9
Pajarito Site	None	0	0	0
MSL	None	0	0	0
TFF	None	0	0	0
Machine Shops	None	0	0	0
Waste Management Operations	None	0	0	0
Non-Key Facilities	22	5 [a]	142.1	192.5
Totals	55	21 [a]	278.0	265.4

[a] Includes new Outfall 03A-199 (permit issued 12/29/2000), which had no discharge in CY 2000.

Treated wastewater released from the Laboratory's NPDES outfalls rarely leaves the site. However, the NPDES Permit program also regulates storm water discharges from certain activities. During CY 2000, LANL operated about 58 stream-monitoring and partial-record storm water monitoring stations located in 12 watersheds. Data gathered from these stations show that surface water, including storm water, occasionally flows off of DOE property. Flow measurements and water quality data for surface water are detailed in the Laboratory's annual reports, *Environmental Surveillance at Los Alamos* (an example is LANL 2000a) and *Surface Water Data at Los Alamos National Laboratory* (an example is LANL 2000e).

Extremely dry conditions during CY 2000 accounted for minimal storm water flow and surface runoff and created conditions conducive to wildfire. In May 2000, the Cerro Grande fire burned extensive tracts of forest on DOE and surrounding property, significantly altering the surface hydrology and creating a substantial threat of catastrophic flash floods. However, dry conditions persisted through the summer and early fall of CY 2000 and only moderate flooding occurred. See Section 5.0 for a more detailed discussion on the effects of the Cerro Grande fire.

3.3 Solid Radioactive and Chemical Wastes

Because of the complex array of facilities and operations, the Laboratory generates a wide variety of waste types including solids, liquids, semi-solids, and contained gases. These waste streams are variously regulated as solid, hazardous, low-level radioactive, transuranic, or wastewater by a host of State and Federal regulations. The institutional requirements relating to waste management at the Laboratory are located in a series of documents that are part of the LIRs. The LIRs specify how all process wastes and contaminated environmental media generated at the Laboratory are managed. Wastes are managed from planning for waste generation for each new project through final disposal or permanent storage of those wastes. This ensures that LANL meets all requirements including DOE Orders, Federal and State regulations, and Laboratory permits.

The Laboratory's waste management operation captures and tracks data for waste streams, regardless of their points of generation or disposal. This includes information on the waste generating process; quantity; chemical and physical characteristics of the waste; regulatory status of the waste; applicable treatment and disposal standards; and the final disposition of the waste. The data are ultimately used to assess operational efficiency, help ensure environmental protection, and demonstrate regulatory compliance.

LANL generates radioactive and chemical wastes as a result of research, production, maintenance, construction, and environmental restoration activities as shown in Table 3.3-1. Waste generators are assigned to one of three categories—Key Facilities, Non-Key Facilities, and the ER Project. Waste types are defined by differing regulatory requirements. No distinction has been made between routine wastes, those generated from ongoing operations, and non-routine wastes such as those generated from the decontamination and decommissioning of buildings.

Table 3.3-1. LANL Waste Types and Generation

WASTE TYPE	UNITS	SWEIS ROD	2000
Chemical	10^3 kg/yr	3,250	27,687
LLW	m^3/yr	12,200	4,216
MLLW	m^3/yr	632	598
TRU	m^3/yr	333	125
Mixed TRU	m^3/yr	115	89

As shown in Table 3.3-1, quantities of MLLW and mixed TRU wastes were in line with projections made by the SWEIS ROD, quantities of LLW and TRU wastes were appreciably below projections, and chemical waste quantities were far above projections.

Nearly all quantities of chemical waste and MLLW wastes resulted from the remediation of MDA-P. This major project, in its second year, resulted in 26.2 million kilograms of chemical wastes and 575 cubic meters of MLLW, or 95 percent and 96 percent of LANL totals for these two waste types, respectively. Section 2.17 provides more information about this project, which will be completed in 2001.

Another significant contributor to LANL waste totals during CY 2000 were cleanups following the Cerro Grande fire. For example, the Advanced Radiochemical Diagnostics Building at TA-48 incurred severe ash, dirt, and soot contamination. The only way to return Building 48-45 to service was to gut its interior. This project generated 11 metric tons of chemical waste in 2000 in the form of industrial solid waste. (Industrial solid waste is nonhazardous, may be disposed in county landfills, and does not represent a threat to local environs.) Similarly, post-wildfire cleanup of MDA-R at TA-16 generated approximately 1,020 tons of chemical wastes, primarily soils contaminated with high explosives and/or barium.

In general, waste quantities from operations at the Key Facilities were below ROD projections for nearly all waste types at all Key Facilities, reflecting both reduced levels of operations at the Key Facilities and the interruption of operations caused by the Cerro Grande fire.

3.3.1 Industrial Solid Wastes

As projected by the SWEIS ROD, chemical waste includes not only industrial solid wastes, but also all other non-radioactive wastes passing through the Solid Radioactive and Chemical Waste Facility. In addition, industrial solid wastes are a component of those chemical wastes sent directly to offsite disposal facilities that do not pass through the Solid Radioactive and Chemical Waste Facility. For CY 2000, industrial solid wastes were a major component of the total chemical waste because of ER Project cleanup activities and industrial solid wastes generated from cleanup following the Cerro Grande fire. Industrial solid wastes are disposed in solid waste landfills under regulations promulgated pursuant to Subtitle D of RCRA. (Note: Hazardous wastes are regulated pursuant to Subtitle C of RCRA.)

3.3.2 Chemical Wastes

Because of industrial solid wastes, chemical waste generation in 2000 exceeded waste volumes projected by the SWEIS ROD by a factor of about seven. Examination of the generator categories (Table 3.3.2-1) sheds some light on the differences.

Table 3.3.2-1. Chemical Waste Generators and Quantities

WASTE GENERATOR	UNITS	SWEIS ROD	2000
Key Facilities	10^3 kg/yr	600	99
Non-Key Facilities	10^3 kg/yr	650	379
ER Project	10^3 kg/yr	2,000	27,209
LANL	10^3 kg/yr	3,250	27,687

ER Project cleanup at MDA-P generated approximately 20,900 metric tons of chemical wastes, nearly all in the form of barium-contaminated soils that were shipped offsite for treatment and disposal as RCRA waste. Another ER Project remediation, PRS 3-056(c) at the upper end of Sandia Canyon in TA-03, generated 1,050 tons of chemical wastes, primarily in the form of PCB-contaminated soils. Finally, an accelerated cleanup at MDA-R generated 1,023 tons of chemical wastes in the form of contaminated soils. The MDA-R cleanup was not scheduled for 2000, but was accelerated after the Cerro Grande fire because of concerns that erosion might lead to contaminant migration since vegetation had been burned away.

Chemical analysis being performed on an unknown substance

Chemical waste generation by the Key Facilities was only 8 percent of the 600 metric tons projected by the ROD, an indication of reduced levels of activity in the aftermath of the Cerro Grande fire.

3.3.3 Low-Level Radioactive Wastes

LLW generation in 2000 was approximately one-third of waste volumes projected by the SWEIS ROD. As can be seen in Table 3.3.3-1, Key Facilities accounted for most of the departure from projections.

Table 3.3.3-1. LLW Generators and Quantities

WASTE GENERATOR	UNITS	SWEIS ROD	2000
Key Facilities	m^3/yr	7,450	1,172
Non-Key Facilities	m^3/yr	520	578
ER Project	m^3/yr	4,260	2,467
LANL	m^3/yr	12,230	4,217

Large differences occurred at nearly all of the Key Facilities, another indication of reduced levels of activity in the aftermath of the Cerro Grande fire. Significant differences occurred at the CMR Building (264 cubic meters versus 1,820 cubic meters per year projected by the SWEIS ROD), the Sigma Complex (960 cubic meters projected versus 52 actual), and High Explosives Testing (940 cubic meters projected versus zero actual). In addition, LANSCE generated lower volumes than projected (1,085 cubic meters projected versus 28 actual) because decommissioning and renovation of Experimental Area A did not occur. Low workloads accounted for low waste volumes at the other Key Facilities.

3.3.4 Mixed Low-Level Radioactive Wastes

Generation in 2000 approximated MLLW volumes projected by the SWEIS ROD. Table 3.3.4-1 examines these wastes by generator categories.

Of the MLLW generated during 2000, 575 cubic meters, or nearly all, resulted from the remediation of MDA-P.

Table 3.3.4-1. MLLW Generators and Quantities

WASTE GENERATOR	UNITS	SWEIS ROD	2000
Key Facilities	m^3/yr	54	11
Non-Key Facilities	m^3/yr	30	10
ER Project	m^3/yr	548	577
LANL		632	598

3.3.5 Transuranic Wastes

Generation in 2000 approximated one-third of the TRU waste volumes projected by the SWEIS ROD. As projected in the SWEIS, TRU wastes are expected to be generated almost exclusively in four facilities (the Plutonium Facility Complex, the CMR Building, the RLWTF, and the Solid Radioactive and Chemical Waste Facility) and by the ER Project. Table 3.3.5-1 examines these wastes by generator categories.

Table 3.3.5-1. Transuranic Waste Generators and Quantities

WASTE GENERATOR	UNITS	SWEIS ROD	2000
Key Facilities	m^3/yr	322	122
Non-Key Facilities	m^3/yr	0	3
ER Project	m^3/yr	11	0
LANL		333	125

The ER Project did not produce any TRU wastes in 2000, and operations at the four facilities producing TRU wastes were curtailed because of the closure caused by the Cerro Grande fire.

3.3.6 Mixed Transuranic Wastes

Generation in 2000 was about three-fourths of the mixed TRU waste volumes projected by the SWEIS ROD. As projected, mixed TRU wastes are expected to be generated at only two facilities – the Plutonium Facility Complex and the CMR Building. Table 3.3.6-1 examines these wastes by generator categories.

Table 3.3.6-1. Mixed Transuranic Waste Generators and Quantities

WASTE GENERATOR	UNITS	SWEIS ROD	2000
Key Facilities	m^3/yr	115	89
Non-Key Facilities	m^3/yr	0	0
ER Project	m^3/yr	0	0

Both the Plutonium Facility Complex (17 cubic meters actual versus 102 cubic meters per year projected by the SWEIS ROD) and the CMR Building (13 cubic meters projected versus one actual) produced less mixed TRU waste than projected because production of war reserve pits had not begun, and because operations were curtailed because of the Cerro Grande fire. At the Solid Radioactive and Chemical Waste Facility, TWISP generated 63 cubic meters of mixed TRU wastes, which caused this Key Facility to exceed SWEIS projections (zero cubic meters projected versus 71 actual).

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 Yearbook goal of using routinely collected data, this information is presented by fiscal year. Water data, however, are routinely collected and summarized by calendar year.

3.4.1 Gas

Table 3.4.1-1 presents gas usage by LANL for FY 2000. Approximately 90 percent 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 is 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 FY 2000 was less than projected by the SWEIS ROD. During FY 2000, 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.

Table 3.4.1-2 presents steam production at LANL for FY 2000.

Table 3.4.1-1. Gas Consumption (decatherms[a]) at LANL/Fiscal Year 2000

SWEIS ROD	TOTAL LANL CONSUMPTION	TOTAL USED FOR ELECTRIC PRODUCTION	TOTAL USED FOR HEAT PRODUCTION	TOTAL STEAM PRODUCTION
1,840,000	1,427,914	352,126	1,075,788	Table 3.4.1-2

[a] A decatherm is equivalent to 1,000 to 1,100 cubic feet of natural gas.

Table 3.4.1-2. Steam Production at LANL/Fiscal Year 2000

TA-3 STEAM PRODUCTION (klb [a])	TA-21 STEAM PRODUCTION (klb)	TOTAL STEAM PRODUCTION (klb)
634,758 [b]	27,840	662,598

[a] klb: Thousands of pounds

[b] TA-3 steam production has two components: that used for electric production (334,791 klb in 2000) and that used for heat (299,967 klb in 2000).

3.4.2 Electricity

LANL is supplied with electrical power through a partnership arrangement with Los Alamos County, known as the Los Alamos Power Pool, 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 Los Alamos Power Pool resources, less losses, is 105 megawatts and 83 megawatts (summer and winter seasons, respectively). The transmission import capacity is contractually limited to 105 megawatts and 83 megawatts (summer and winter seasons, respectively).

The ability to accept additional power into the Los Alamos Power Pool 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 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. Another limitation to additional power is contractual rights held by the Los Alamos Power Pool 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 federal FY 2000. 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 megawatt hours with 437,000 megawatt hours being used by LANSCE and about 345,000 megawatt hours 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 Public Service Company of New Mexico system have caused blackouts in northern New Mexico and elsewhere.

The Cerro Grande fire affected energy consumption at LANL during the month of May 2000. Energy consumption attributed to the three-week shutdown of LANL resulted in a reduction of 10,000 megawatt-hours in usage during the month of May. In addition, fire damage to the two 115-kilovolt lines feeding Los Alamos resulted in a number of total power outages to LANL, the Los Alamos townsite, and White Rock (See Section 5.0).

Table 3.4.2-1. Electric Peak Coincident Demand/Fiscal Year 2000

CATEGORY	LANL BASE	LANSCE	LANL TOTAL	COUNTY TOTAL	POOL TOTAL
SWEIS ROD	50,000[a]	63,000	113,000	Not projected	Not projected
FY2000	45,104	20,343	65,447	15,176	80,623

[a] All figures in kilowatts.

Table 3.4.2-2. Electric Consumption/Fiscal Year 2000

CATEGORY	LANL BASE	LANSCE	LANL TOTAL	COUNTY	POOL TOTAL
SWEIS ROD	345,000[a]	437,000	782,000	Not projected	Not projected
FY2000	263,970	117,183	381,153	112,216	493,369

[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 5,541.3 acre-feet/year or about 1,806 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 1,200 acre-feet/year of San Juan-Chama Transmountain Diversion Project water. The lease agreement is effective for three years until September 8, 2001, although the County can exercise an option to buy sooner than three years. DOE expects to convey 70 percent of the water rights to Los Alamos County and lease the remaining 30 percent 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 to LANL in excess of the 30 percent 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 percent of the total water used, and Los Alamos County used the remaining 62 percent, for the 100 percent total. However, this water use did not use 100 percent of the water rights. LANL used only 27 percent of the water rights, while Los Alamos County used 44 percent of the water rights, leaving 29 percent 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 1,662 acre-feet/year (542 million gallons/year) nor necessarily limited to 1,662 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 purging 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 being added at selected facilities/equipment and trunk lines to monitor specific use at LANL.

Table 3.4.3-1 shows water consumption in thousands of gallons for CY 2000. 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 2000 was about 300 million gallons less than the projected consumption and 99 million gallons less than the 542 million gallons/year under the agreement with the County. The calculated NPDES discharge of 265 million gallons was about 60 percent of the total LANL usage of 441 million gallons.

Table 3.4.3-1. Water Consumption (thousands of gallons) for Calendar Year 2000

CATEGORY	LANL	LOS ALAMOS COUNTY	TOTAL
SWEIS ROD	759,000	Not Available [a]	Not Available [a]
Calendar Year 2000	441,000	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.

3.4.4 Cerro Grande Fire Effects

The Cerro Grande fire had an immediate effect on utilities (e.g., electric, water, gas, steam, and sewer systems) where damage to one system impacted another. Proactive steps were taken to cut off or turn on systems as required, but damage finally became so severe that most systems had to be completely shut down, especially electric services.

When both 115-kilovolt transmission lines that supply power to LANL and Los Alamos County tripped (automatically shut down) because of fire damage, there was total blackout in the Laboratory and the townsite. Fortunately, LANL was able to isolate the TA-3 power plant from the power grid and power service to critical areas and emergency service was restored. To ensure an uninterrupted power supply from this plant, steam boilers were operated with diesel fuel kept for emergency operations. Continuous deliveries of additional diesel fuel to the Laboratory were arranged and delivery trucks escorted onsite. An emergency generator was maintained at the Ski Hill to power radio antennae transmitting signals to maintain water production after the power lines burned down.

Long-term effects may be measured in terms of ongoing utility restoration work. Repairs and replacements of damaged utility equipment and systems are expected to continue through 2002. Seventy-three electric poles and ten transformers were burned. Switchgear and substations sustained smoke and short circuit damages. Spare poles, cables, transformers, circuit breakers, and other hardware were burned at the Sigma Mesa storage yard. Gas valves, pressure release valve stations, water hydrants, and some pipes were either directly damaged by the fire or run over by moving equipment. In addition, guardrails all over the Laboratory were heavily damaged by moving equipment and vehicles.

In anticipation of potential flooding following the fire, various flood damage control measures were installed to provide protection to electric power pole structures and other utility structures (such as electric substations, gas lines, water lines, wells and chlorination stations, sewage lift stations, and telephone and communication structures).

Overall effects of the fire on LANL are discussed in Chapter 5.

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, and several other major facilities are also under construction for which separate NEPA documentation was prepared. 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 during CY 2000 continue to be small as shown in Table 3.5.1-1. These rates correlate to 200 reportable injuries and illnesses during the year, or less than 50 percent of the 507 cases projected by the SWEIS 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
2000	1.53	0.62	1.97	0.94

[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 CY 2000 are summarized in Table 3.5.2-1. The collective Total Effective Dose Equivalent, or collective TEDE, for the LANL workforce during 2000 was 196 person-rem, considerably lower than the workforce dose of 704 person-rem projected for the ROD.

Individual and collective external radiation doses were the lowest in the history of the Laboratory because of the work that was not done while the Laboratory was recovering from the Cerro Grande fire. However, because of an incident in March 2000, we recorded several high individual internal doses.

These reported doses in Table 3.5.2-1 for 2000 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 196 person-rem collective TEDE reported for 2000, external radiation and tritium exposure accounted for 86 person-rem. The remaining 110 person-rem is from internal exposure, of which 109 person-rem are attributable to the incident in March.

Table 3.5.2-1. Radiological Exposure to LANL Workers

PARAMETER	UNITS	SWEIS ROD	VALUE FOR 2000
Collective TEDE (external + internal)	person-rem	704	196
Number of workers with non-zero dose	number	3,548	1,316
Average non-zero dose:			
external + internal	millirem	Not projected	149
external only	millirem	Not projected	65

The highest individual doses from external radiation in CY 2000 were 1.048 and 1.013 rem. All other individual doses were less than one rem. These doses are well below the 5 rem legal limit and the 2 rem performance metric goal. This stands in contrast to the 87 rem, 11.5 rem, and 9.37 rem internal doses from Pu-238 inhalation resulting from the March incident.

Comparison with the SWEIS Baseline. The collective TEDE for 2000 is slightly less than the 208 person-rem of 1993–1995 used as the baseline in the ROD. Several offsetting factors were responsible for this, the more important of which include

March 16, 2000, TA-55 incident: Several workers incurred doses from inhalation of Pu-238, which accounted for 109 of the 110 person-rem from internal exposure and increased the collective TEDE for 2000. This was a non-routine exposure that was not included in the dose estimates for baseline operations made for the SWEIS. This increase in the collective TEDE for CY 2000 over the SWEIS baseline estimate was offset by reductions in the three areas discussed below.

Work and Workload: Changes in workload and types of work from 1993–1995 have resulted in a decreased collective TEDE. The Cerro Grande fire significantly altered the type and amount of work that was done during CY 2000. The 86 person-rem collective effective dose equivalent from external radiation was the lowest ever recorded at LANL because of the work that was not done as a result of the fire.

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.)

In subtracting the 109 person-rem from the March 16 incident from the 196 person-rem collective TEDE, the remaining 87 person-rem collective TEDE for CY 2000 continued the decrease from previous years (87 person-rem in 2000 versus 131 person-rem in 1999). In particular, radiation doses incurred from restarting the Laboratory after the Cerro Grande fire in May 2000 were not significant.

Top: Dosimeter worn by LANL employees. Bottom: Personnel Contamination Monitors

Comparison with the Projected TEDE in the ROD. In addition to being slightly less than the collective TEDE levels in 1993–1995, the collective TEDE for 2000 is less than the TEDE projected in the ROD. Because the ROD was not signed until September 1999, the implementation of war reserve pit manufacture has not become fully operational at LANL. Secondly, the Cerro Grande fire in May 2000 interrupted operations at key LANL facilities for several months following the fire. These events also contributed to lower doses than projected in the SWEIS.

Collective TEDEs for Key Facilities. In general, collective 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, the group working at TA-18 is well defined, and the 2000 collective TEDE for the Pajarito Site Key Facility is 0.7 person-rem.

Many of the groups working at TA-55 have been reorganized to include workers at other facilities. However, approximately 95 percent of the collective TEDE that these groups incur is estimated to come from operations at TA-55. The total collective TEDE for these groups in CY 2000, plus the estimated collective TEDE for the health physics personnel and JCNNM personnel working at TA-55, is 167 person-rem, which is 85 percent of the total Laboratory TEDE of 196 person-rem.

3.6 Socioeconomics

The LANL-affiliated workforce continues to include UC employees and subcontractors. As shown in Table 3.6-1, the number of employees has exceeded SWEIS ROD projections. The 12,015 employees at the end of CY 2000 are 664 more employees than SWEIS ROD projections of 11,351. SWEIS ROD projections were based on 10,593 employees identified for the index year (employment as of March 1996). However, the 12,015 employees reflect 397 less employees than the 12,412 total employees at the end of CY 1999 as reported in the 1999 Yearbook (LANL 2000d). This is the first year since 1996 that LANL has not shown an increase in number of employees (see Section 4.0).

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 2000	8861	1010	200	1430	514	12,015

[a] Total number of employees was presented in the SWEIS, the breakdown had to be calculated based on the percentage distribution shown in the SWEIS for the base year.
[b] Data were not presented for non-technical contractors or consultants.

These employees have 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 2000 economic contribution was similar to the three years analyzed for DOE.

The residential distribution of UC employees reflects the housing market dynamics of three counties. As seen in Table 3.6-2, more than 90 percent of the UC employees continued 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]	4,279	1,762	1,678	671	8,390	350	8,740
CY 2000	4,663	1,509	1,778	510	8,460	401	8,861

[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 SWEIS, the breakdown had to be calculated based on the percentage distribution shown in the SWEIS 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 (see Section 4.0). CY 1999 was selected as the reference year for this index because it represents the year the SWEIS ROD was published.

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

KEY FACILITY	REFERENCE YEAR 1999 [b]	CALENDAR YEAR 2000
Plutonium Complex	589	572
Tritium Facilities	28	24
CMR	204	190
Pajarito Site	70	73
Sigma Complex	101	99
MSL	57	59
Target Fabrication	54	52
Machine Shops	81	80
High Explosive Testing	227	212
High Explosive Processing	96	92
LANSCE	560	550
HRL	98	110
Radiochemistry Laboratory	128	124
Waste Management – Radioactive Liquid Waste	62	58
Waste Management – Radioactive Solid and Chemical Waste	65	64
Rest of LANL	4,601	4,501
Total Employees	7,021	6,860

[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. A similar index does not exist in the SWEIS, which used a very time-intensive method to calculate this index.

[b] Calendar year 1999 was selected as the reference year for this index because it represents the year the SWEIS ROD was published.

3.7 Land Resources

LANL finished 2000 with the same land acreage it had at the start the year, 27,816 acres. However, land resources were impacted by the Cerro Grande fire, which burnt across approximately 7,500 acres or 27 percent of the Laboratory's land. Of the 332 structures affected by the fire, 236 were impacted, 68 damaged, and 28 destroyed (ruined beyond economic repair). Fire mitigation work such as flood retention facilities modified less than 50 acres of undeveloped land.

A number of projects are continuing to move forward, such as the Strategic Computing Complex, the Nonproliferation and International Security Center, several General Plant Projects, and the related but non-Laboratory Los Alamos Research Park. Most of these projects are on previously developed or disturbed land (LANL 2000d). However, the Research Park occupies about 44 acres of previously undeveloped land along West Jemez Road.

During 2000, LANL's new Comprehensive Site Plan (CSP2000) was completed. CSP2000 is LANL's guide for land development. The CSP2000 geographic information system identified approximately 18,500 acres, or two-thirds, of LANL's land resources as undesirable for development because of physical and operational constraints. Of the remaining 9,300 acres (about one-third of the Laboratory's land) over 5,500 acres have been developed leaving about 4,000 acres as undeveloped. The majority of this undeveloped land is located in TAs 58, 70, 71, and 74. Due to the remote locations and adjacent land uses of TAs 70, 71, and 74, they are not considered prime developable lands for Laboratory activities.

The ER Project is unique from a land use standpoint. Rather than using land for development, the project cleans up legacy wastes and makes land available for future use. Through these efforts, several large tracts of land will be made available for use by the Laboratory, Los Alamos County, or other adjacent landowners. For example, under Public Law 105-119, the DOE was directed to transfer to Los Alamos County and the Pueblo of San Ildefonso lands not required to meet the national security mission of DOE. Several tracts of land were identified for transfer, and pending cleanup by the ER Program, will be made available for their future use.

3.8 Groundwater

Water levels have been measured in wells tapping the regional aquifer since the late 1940s when the first exploratory wells were drilled by the U.S Geological Survey (McLin et al. 1998). The annual production and use of water increased from 231 million gallons in 1947 to a peak of 1,732 million gallons in 1976. Water use has declined since 1976 to 1,286 million gallons in 1997 (McLin et al. 1997; McLin et al. 1998). Trends in water levels in the wells reflect a plateau-wide decline in regional aquifer water levels in response to municipal water production. The decline is gradual and does not exceed 1 to 2 feet per year for most production wells (McLin et al. 1998). When pumping stops in the production wells, the static water level returns in about 6 to 12 months. Hence, these long-term declines are not currently viewed as a threat to the water supply system (McLin et al. 1998).

Sampling and analysis of water from water supply wells indicate that water in the regional aquifer beneath the Pajarito Plateau is generally of high quality and meets or exceeds all applicable water supply standards. In 2000, the Laboratory conducted additional sampling of water supply wells for four contaminants of concern: strontium-90, perchlorate, tritium, and high explosives. The frequency of monitoring varies from annual to monthly depending on the contaminant and sampling location. The results of this special testing are (Nylander et al. 2001):

- Strontium-90: All Los Alamos water supply wells were sampled quarterly for strontium-90 in 2000; this sampling will continue in 2001. In 2000, strontium-90 was initially detected in PM-1, Otowi-1, and G-3A. A sample collected from water supply well PM-1 by NMED's DOE Oversight Bureau resulted in an apparent detection of strontium-90. In contrast, a split sample collected by LANL yielded no detection of strontium-90, with a detection limit below the analytical result for NMED's sample. Of the 15 measurements tabulated, only one, the NMED DOE Oversight Bureau sample, identifies an analytical detection of strontium-90. The PM-1 strontium-90 data, taken over a 25-year period, do not make a case for presence of strontium-90 in this well. The detection for Otowi-1 occurred in a laboratory duplicate analysis; the original analysis did not yield a detection. Reanalysis of the original samples from Otowi-1 and G-3A and subsequent sampling at both wells has not confirmed either of the detections of strontium-90.
- Perchlorate: Perchlorate was detected in water supply well Otowi-1. Concentrations in the Otowi-1 well ranged from 2 to 3.5 parts per billion in four separate samples taken between June 21 and July 6. The EPA has not established a drinking water standard for perchlorate. The State of California, which has perchlorate contamination in drinking water supplies in some areas, has established a perchlorate water-supply action level for concentrations greater than 18 parts per billion. The State of New Mexico has not established an action level or regulatory standards for perchlorate.
- Tritium: Tritium was found in Otowi-1 in a June 21, 2000, sample at a concentration of 38.3 +/- 1.3 picocuries/L. This concentration is 500 times lower than the federal drinking water standard, but is above background concentrations that can be found in groundwater around the Laboratory. Otowi-1 is now sampled monthly for tritium. Tritium also has been seen in the deep aquifer in Test Well 1 (TW-1) several hundred yards downstream from the Otowi-1 supply well. The concentration of tritium in TW-1 was 360 picocuries/L in 1993.
- High Explosives: All water supply wells are sampled annually for high explosives compounds. The three wells nearest to TA-16 (PM-2, PM-4, and PM-5), where high explosives were found in groundwater in characterization well R-25, are sampled quarterly. There were no detections of high explosives in the water supply wells.

Work underway as part of the Hydrogeologic Characterization Program, and described in the Hydrogeologic Workplan, provided new information on the regional aquifer and details of the hydrogeologic conditions. By the end of 2000, one well was completed in the perched intermediate saturated zones in Los Alamos Canyon and four wells were completed in the regional aquifer. In Los Alamos Canyon, well R-9i was completed in the two intermediate perched saturated zones encountered in well R-9. Water from the screened zones in R-9i contained tritium, but did not contain uranium, which had been detected in the borehole sample of a lower perched intermediate zone in R-9.

Well R-31 was completed in the southeastern portion of the Laboratory, in the north fork of Ancho Canyon. This was an area of the Laboratory with no existing hydrologic information from wells. R-31 encountered one intermediate perched saturated zone in the Cerros del Rio basalt at an elevation of 5,925 feet above sea level and the regional aquifer also in the Cerros del Rio basalt at an elevation of 5,853 feet above sea level. The location of the well was selected to provide data in a hydrologically-unknown area of the Laboratory, not because contaminants were expected. No contaminants were detected in R-31, but geologic data from R-31 has significantly changed the understanding of the relationship between the Puye Formation and the Totavi lentil.

Two wells were installed to help delineate the extent of high explosives that were observed in well R-25. Well R-19 was completed near TA-36 on the mesa above Threemile and Potrillo canyons. Sampling of the water in the R-19 well detected high explosives in the lower of two intermediate perched saturated zones, but that detection may be the result of interference with drilling additives. Perchlorate was detected in both the lower intermediate perched saturated zone and the regional aquifer. No other contaminants have been detected in R-19. Well CdV-15-3 is located in TA-15 on the mesa above Cañon de Valle. TNT by-products were detected in a perched intermediate saturated zone and no contaminants were detected in the regional aquifer.

Well R-22 was drilled on Mesita del Buey, just outside the eastern boundary of MDA-G. The primary purpose of the well was to determine if groundwater quality has been affected by the MDAs in TA-54. No perched zones were encountered in R-22. Water from the regional aquifer in the R-22 borehole was sampled and tritium was detected at 109 picocuries/L. No other contaminants were detected. The potential sources of tritium in the regional aquifer detected in R-22 are being investigated.

Data collected from these wells have been incorporated into models of the vadose zone and regional aquifer. Modeling is the primary tool for interpreting data from wells installed across the Laboratory. Work continues under the Hydrogeologic Workplan to increase understanding of the hydrogeologic conditions and to ensure safety of the drinking water supply.

3.9 Cultural Resources

LANL has a large number of diverse archaeological sites. Approximately 70 percent of LANL lands have been systematically surveyed and approximately 1,600 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 3,668 inventoried resources. These resources included 1,295 prehistoric resources (BC 4000–1600 AD), 87 historic homesteading and commercial resources (1600–1942 AD), 2,232 World War II-Late Cold War era buildings and facilities (1943–1989 AD), and 54 locations within LANL identified by consulting communities (Native American pueblos and tribes and local Hispanic communities) as having traditional cultural properties. Since the SWEIS, LANL surveys have identified 151 additional 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 SWEIS 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 FY 2000[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 ROD	Not reported	Not Reported	3,668	1,092	23
2000	119.38	19,428	3,819	1,307	6

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

Many prehistoric sites remain undetected on LANL lands. Vegetative cover and thick duff layers under trees obscure them from view. The Cerro Grande fire removed this material increasing the visibility of previously undetected sites.

The Cultural Resources Management Team started conducting fire damage assessments of the approximately 7,500 acres of LANL property burned during the Cerro Grande fire. It is estimated that 519 archeological sites will be visited during the ongoing assessment activities. The assessments include photography, evaluation of fire impacts, global positioning system recording of site locations, site rehabilitation, and long-term monitoring. Preliminary results of the first phase of assessments indicate that Homestead Period wooden structures were most severely damaged by fire. A number of homestead cabins have been completely destroyed. Reassessments of NRHP eligibility will be required at these sites.

The fire also destroyed most of the V-Site structures that remained from the Manhattan Project Era. V-Site was typical of the clapboard wooden laboratories built at LANL during World War II, and V-Site was among the last vestiges of the Manhattan Project at LANL. In these buildings, scientists worked on the "Gadget" (Trinity Device), the world's first successful nuclear explosive, which was the prototype for the bomb that was detonated over Nagasaki, Japan, on August 9, 1945.

As in 1999, the Laboratory and National Park Service continued their long-term monitoring program at the prehistoric pueblo of Nake'muu. This is the only pueblo within LANL that has standing walls. To date, the monitoring program indicates that 1.2 percent of the chinking stones and 0.4 percent of the masonry blocks are falling out of the walls on an annual basis. Projecting this rate of failure over the next ten years indicates that substantial changes to the site can be expected. Ongoing discussions are underway with culturally affiliated Pueblos on stabilization options.

3.10 Ecological Resources

LANL is located in a region of diverse landform, elevation, and climate—features that contribute to producing diversified plant and animal communities. Plant communities range from urban and suburban areas to grasslands, wetlands, shrublands, woodlands, and mountain forest. These plant communities provide habitat for a variety of animal life.

The SWEIS ROD projected no significant adverse impacts to biological resources, ecological processes, or biodiversity (including threatened and endangered species). Data collected for 2000 support this projection. These data are reported in the Environmental Surveillance Report. During 2000, the greatest impact to ecological resources was the Cerro Grande fire.

The Cerro Grande fire burned approximately 43,150 acres in total, and about 7,500 acres within LANL. Preliminary results indicate that about 34 percent of the total acres were burned with low severity (burn severity relates to the fire's impact on soil features), 8 percent with moderate severity, and about 58 percent with high severity. The fire created a habitat mosaic that is dynamic and will offer changing opportunities for plant and animal communities.

3.10.1 Threatened and Endangered Species Habitat Management Plan

LANL's Threatened and Endangered Species Habitat Management Plan 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 Threatened and Endangered Species Habitat Management Plan was incorporated into the NEPA, Cultural, and Biological LIR document developed during 1999. During 2000, over 40 people were trained on the proper implementation of the Threatened and Endangered Species Habitat Management Plan as part of a LIR training program.

The results of the Cerro Grande fire will likely not cause a long-term change to the overall number of federally listed threatened and endangered species inhabiting the region. The results of the fire will likely change the distribution and movement of various species, including the Mexican spotted owl. However, it is estimated that 91 percent of the LANL Mexican spotted owl habitat remains suitable. The fire may also have long-term effects to the habitat of several state-listed species, including the Jemez Mountains salamander. Following the fire, LANL continued operating under the current Threatened and Endangered Species Habitat Management Plan guidelines. During 2001, there are plans to modify the Threatened and Endangered Species Habitat Management Plan to reflect post-fire habitat changes.

In 2000, the Laboratory initiated several contaminant studies and continued with risk assessment studies on the food chain for threatened and endangered species inhabiting Laboratory lands. These studies include potential impacts from the Cerro Grande fire and are assessing organic chemical contamination in the food chain for selected endangered species and monitoring the PCBs and organochlorine pesticides in fish of the Rio Grande.

3.10.2 Biological Assessments

During 2000, the Laboratory reviewed approximately 454 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 Department of Game and Fish.

Two floodplain and wetland assessments were conducted during 2000.

4.0 Trend Analysis

The 1999 Yearbook identified a new section that compares SWEIS ROD projections to LANL operations over multiple years. In preparing this section, it became obvious that not all data collected lend themselves to this analysis. First, some data consist mostly of estimates (i.e., NPDES outfall flows) where variations between years may be nothing more than an artifact of the methodology used to make estimates. These data do not depict environmental risk, and any evaluation between years would be meaningless. Second, some data are so far below SWEIS ROD projections (i.e., air quality and high explosive production), that even significant increases in measured quantities would not cause LANL to exceed the risks evaluated in the SWEIS, and such a comparison would serve no practical purpose for the development of a SWEIS in the future. Finally, some data do not represent site impacts, are inherently variable, and do not represent utilization of onsite natural resources (i.e., ER Project exhumed material shipped offsite).

The data conducive to analysis represent real numbers of two distinct types. First, data that demonstrate cumulative effects across years where summed quantities may approach or exceed SWEIS ROD projections or regulatory limits or create negative environmental impacts (i.e., waste generation disposed at LANL). Or second, data that represent, on an annual basis, measured quantities that approach limits established by agreement and/or regulation (i.e., gas, electric, and water consumption).

Where the 1999 Yearbook was restricted to waste data, this Yearbook also includes land use and utilities information. Additional information will be added in the future as more data are collected and trends are identified that lend themselves to discussion.

4.1 Land Use

Land use at LANL is a high-priority issue. Most of the undeveloped land is either required as buffer zones for operations or is unsuitable for development. Therefore, loss of available lands through development or congressionally mandated land transfer has a significant impact on strategic planning for operations. Conversely, increases in available lands through clean-ups performed by the ER Program also affect strategic planning. To date, however, the ER Program has not significantly added to available land.

Though construction and modification usually result in land loss (development of previously undeveloped areas), to date, this has not been the case. Only 30 acres of partially developed land has been altered in this manner (e.g., the Industrial Research Park).

The following information relates to construction and modifications and project cancellations having taken place from 1998 through 2000. This information demonstrates that the land use projections of the SWEIS ROD remain valid.

The SWEIS ROD projected a total of 38 construction and facility modification projects for the 10-year period 1996–2005. As shown in Table 4.1-1, almost half of the projected construction activities are complete (15 completed and 6 started). However, DOE has removed four projects from consideration. Projects no longer considered are

- Renovation of the Nuclear Material Storage Facility,
- Phase I Upgrades to CMR (rebaselined in October 1999),
- Phase II Upgrades to CMR (rebaselined in October 1999), and
- the Dynamic Experiment Laboratory at LANSCE (overtaken by new concept of proton radiography).

These projects received full evaluation for land use impacts within the SWEIS ROD.

Table 4.1-1. Facility Construction and Modifications Projected by SWEIS ROD, 1998–2000

ACTION	ROD	THROUGH 1998	THROUGH 1999	THROUGH 2000
Removed by DOE			1	4
Not yet started		19	16	13
Started, not completed		13	8	6
Completed		6	13	15
Totals	38	38	38	38

Other projects, having separate NEPA review, have been started at LANL. These are summarized in Table 4.1-2. Nine such projects were reviewed and approved through environmental assessments; the balance received categorical exclusions. Some of the more visible examples of these projects are the Strategic Computing Complex, the Industrial Research Park, and the Nonproliferation and International Security Center. Both the Strategic Computing Complex and the Nonproliferation and International Security Center were built on previously disturbed lands (parking lots).

Table 4.1-2. Facility Construction and Modifications with Separate NEPA Review, 1998–2000

ACTION	THROUGH 1998	THROUGH 1999	THROUGH 2000
Started, not completed	6	6	5
Completed	12	22	28
Totals	18	28	33

4.2 Waste Quantities

Wastes have been generated at levels below quantities projected by the SWEIS ROD with the exception of ER Project chemical wastes. ER Project wastes are typically shipped offsite for disposal at EPA-certified waste treatment, storage, and disposal facilities and do not impact local environs. These wastes result from exhumation of materials placed into the environment during the early history of LANL and thus differ from the newly created wastes from routine operations.

Waste projections for the ER Project by the SWEIS ROD are uncertain at best. These projections were developed in the 1996–1997 time period. Estimates were based on the then current Installation Work Plan methodology. The ER Project office kept a continuously updated database of waste projections by waste type for each PRS. Estimates were made for the amount of waste expected to be generated by that PRS for the life of the ER Project. In 1996–1997, it was assumed that the life of the ER Project would be 10 years, but the schedule now projects cleanup will extend to 2020. This demonstrates the legitimate uncertainty in waste estimates and schedules developed for the ER Project caused by changing requirements and newly discovered information.

Waste quantity projections included three kinds of waste: waste generated during the investigation phase, waste generated during the remediation phase, and secondary waste generated during the remediation phase. Secondary waste and investigation phase waste are minimal compared to waste from the remediation phase. Technical staff in each of six field units made these projections, and methodologies varied from one field unit to another. In cases where both nature and extent of contamination were known, projections were based on estimated contaminated soil volume provided the PRS was slated for remediation. If the PRS was expected to be recommended for NFA, it was assumed that no waste would be generated.

In most cases, the nature and extent of contamination were not known. A worst-case scenario was usually developed, using estimated PRS boundaries, and assuming a depth of contamination based on historical operating parameters. Waste type was also projected based on best available historical information about the site.

Because of these uncertainties, adjustments to ER Project waste projections should be expected. One task of the ER Project is to characterize sites about which little is known and to make adjustments in waste quantity estimates based on new information. In addition, even the most rigorous field investigations cannot truly determine waste quantities with a high degree of certainty until remediation has progressed considerably. Remediation can often create more or less waste, or waste that was not anticipated, based on field sampling. Moreover, the administrative authority may not approve an NFA recommendation or may require additional sampling or an alternative corrective action than the one planned. All of these factors lead to waste projections that are highly uncertain.

An example of the latter is MDA-P. The first closure plan for MDA-P was submitted to EPA, and later NMED, in the early 1980s. This plan proposed closure in place, but was never approved. During the mid- to late-1980s, all parties (LANL, DOE, EPA, and NMED) decided that clean-closure was a more appropriate standard and the plan was rewritten to reflect clean-closure. All information in the closure plan, including waste estimates, was based on best available information (a combination of operating group records and data from field investigations). However, when remediation started, it quickly became apparent that early information was not reliable, and that there would be more waste generated than originally anticipated. The ER Project cleanup of MDA-P began in 1999 and will generate an estimated 22,000 cubic yards of chemical wastes, mostly in the form of barium-contaminated soils. These wastes are shipped offsite for treatment and disposal.

As a result of this uncertainty in ER Project waste estimates, the Yearbook presents totals for LANL waste generation both with and without the ER Project. As shown in Tables 4.2-1 through 4.2-5, except for chemical wastes, total generated amounts fall within projections made by the SWEIS ROD.

Table 4.2-1. LANL Low Level Waste Generation (m^3)

CATEGORY	SWEIS ROD	1998	1999	2000
Key Facilities	7,450	1,045	1,017	1,172
Non-Key Facilities	520	36	286	578
Sub-Total	7,970	1,081	1,303	1,750
ER Project	4,260	726	407	2,467
Total	12,230	1,807	1,710	4,217

Table 4.2-2. LANL Mixed Low Level Waste Generation (m^3)

CATEGORY	SWEIS ROD	1998	1999	2000
Key Facilities	54	8	17	11
Non-Key Facilities	30	55	3	10
Sub-Total	84	63	20	21
ER Project	548	9	1	577
Total	632	72	21	598

Table 4.2-3. LANL Transuranic Waste Generation (m^3)

CATEGORY	SWEIS ROD	1998	1999	2000
Key Facilities	322	108	143	122
Non-Key Facilities	0	0	0	3
Sub-Total	322	108	143	125
ER Project	11	0	0	0
Total	333	108	143	125

Table 4.2-4. LANL Mixed Transuranic Waste Generation (m^3)

CATEGORY	SWEIS ROD	1998	1999	2000
Key Facilities	115	34	72	89
Non-Key Facilities	0	0	0	0
Sub-Total	115	34	72	89
ER Project	0	0	0	0
Total	115	34	72	89

Table 4.2-5. LANL Chemical Waste Generation (10^3 kg/yr)

CATEGORY	SWEIS ROD	1998	1999	2000
Key Facilities	600	158	129	74
Non-Key Facilities	650	1,465	765	306
Sub-Total	1,250	1,623	894	380
ER Project	2,000	144	14,548	22,070
Total	3,250	1,767	15,443	22,450

Chemical waste quantities are higher than projections for two reasons: ER Project cleanup activities during 1999 and 2000 and the Legacy Materials Cleanup Project during 1998. The variability in ER Project waste projections is discussed above. The Legacy Materials Cleanup Project, completed in September 1998, required facilities to locate and inventory all materials for which a use could no longer be identified. All such materials (more than 22,000 items) were characterized, collected, and managed. In 1999, the Non-Key Facilities also exceeded projections, and this was attributed to ER Project cleanups of PRSs within the Non-Key Facilities. When comparing the subtotal of Key and Non-Key Facilities, only the Legacy Program in 1998 pushes the quantities over SWEIS ROD projections. Regardless, these wastes (both ER and Legacy Program) were and are shipped offsite, do not impact the local environs, and do not hasten the need to expand the size of Area G.

Table 4.2-2 for MLLW shows a clear spike in 2000. This, too, is because of the MDA-P cleanup. Total LANL MLLW volume for 2000 was 599 cubic meters; 575 of that came from the MDA-P cleanup. The upward trend in TRU and mixed TRU waste volumes is the result of the expected slow, but increasing, levels of activity on pit production and related programs.

4.3 Utility Consumption

Consumption of gas, water, and electricity is not additive in the same context as waste generation. Rather, these commodities are restricted on an annual basis and should be compared to the SWEIS ROD projection for annual use. Table 4.3-1 presents these three sets of data (gas, water, and electricity) and demonstrates that none of these measured utilities exceeded SWEIS ROD projections, except for natural gas in 1993 which is before the ten-year window evaluated by the SWEIS ROD. Based on these data, it appears that utility usage remains within the SWEIS ROD environmental envelope for operations.

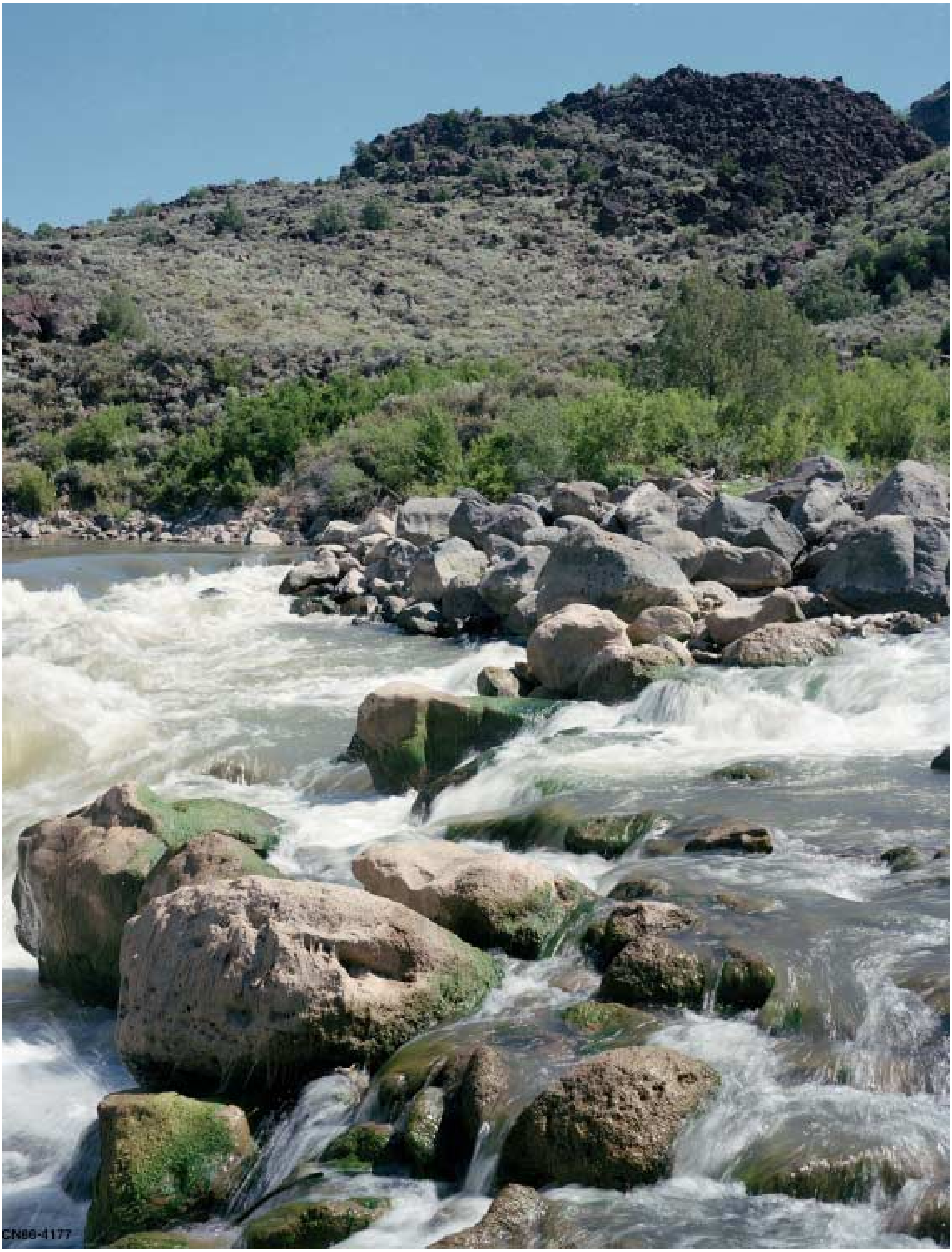
4.4 Long-Term Effects

To date, LANL has continued to operate within the projections made by the SWEIS ROD. None of the measured parameters exceed SWEIS ROD projections or regulatory limits. Thus, long-term effects should remain within the projections made by the SWEIS ROD.

Table 4.3-1. LANL Utilities Consumption

LANL Natural Gas Consumption (decatherms) by Fiscal Year		LANL Water Consumption (thousands of gallons) by Calendar Year	
FISCAL YEAR	LANL TOTAL	CALENDAR YEAR	LANL
SWEIS ROD	1,840,000	SWEIS ROD	759,000
1991	1,480,789	1991	Not Available
1992	1,833,318	1992	547,535
1993	1,843,936	1993	467,880
1994	1,682,180	1994	524,791
1995	1,520,358	1995	337,188
1996	1,358,505	1996	340,481
1997	1,444,385	1997	488,252
1998	1,362,070	1998	461,350
1999	1,428,568	1999	453,094
2000	1,427,914	2000	441,000

LANL Electric Peak Coincident Demand (kilowatts) by Fiscal Year		Electric Consumption (Megawatt/hours) by Fiscal Year	
FISCAL YEAR	LANL TOTAL	FISCAL YEAR	LANL TOTAL
SWEIS ROD	113,000	SWEIS ROD	782,000
1991	75,777	1991	372,213
1992	73,344	1992	381,787
1993	67,534	1993	366,894
1994	65,971	1994	352,468
1995	65,802	1995	372,145
1996	62,598	1996	368,785
1997	62,653	1997	397,715
1998	63,837	1998	327,305
1999	68,486	1999	369,321
2000	65,447	2000	381,153



5.0 Cerro Grande Fire Effects

On May 4, 2000, the National Park Service at Bandelier National Monument set a controlled burn that subsequently became a wildfire. The Cerro Grande fire was the largest in New Mexico State history and burned about 43,000 acres of forest and residential land, including about 7,500 acres across LANL. Although the fire was declared contained on June 6, 2000, it continued to smolder for yet another six weeks before becoming extinguished (LANL 2000f, DOE 2000b).

On Sunday, May 7, spot fires were detected on LANL lands, and LANL closed on Monday, May 8. The fire progressed on LANL property for five days; however, the Laboratory remained closed until May 22 because of closures of the townsite and the need to keep roads free of traffic for firefighters and their equipment. On May 22, the Laboratory partially reopened and started the process of conducting damage assessments and bringing operations back on-line in a safe and efficient manner.

Background

Western forests evolved under a regime of naturally occurring wildfire. Before 1890, surface fires in ponderosa pine forests on the Pajarito Plateau were part of the natural environment with a return interval of between 5 and 15 years. These surface fires spread across forest floors, burning grasses and debris, and only occasionally ignited individual trees. While these surface fires were hot, they generally did not burn deeply into the soil, favored a grassy understory, and kept tree density down (LANL 2000f).

Since 1890, land management practices, such as fire suppression and reduction in tree cutting, led to increases in overall tree density, continuity, and fuel loading with a concomitant decrease in understory cover. The heavily forested areas within and surrounding LANL became overgrown with dense stands of unhealthy trees having excessive amounts of standing and fallen dead material. These areas became an extreme fire hazard from high-intensity wildfires (LANL 2000f).

Over the last 50 years, the Pajarito Plateau has seen five major fires–the Water Canyon fire in 1954, the La Mesa fire in 1977, the Dome fire in 1996, the Oso fire in 1998, and the Cerro Grande fire in 2000. In each case, the fire happened in late spring or early summer when the fire danger was high or extreme. Weather conditions were hot and dry, fuel moisture content was low, and fuel loads were high. These conditions led to development of spectacular crown fires where flames leapt from treetop to treetop and resulted in the death of vegetation from the ground up over large expanses of land (LANL 2000f).

Mitigation

Land management experts from LANL, National Park Service, and Forest Service recognized that these forests were ripe for conflagration. Since the 1996 Dome fire, many activities were undertaken to reduce threat of wildfire to LANL. The Laboratory expedited its routine maintenance of fire roads and improvement to enhance forest accessibility. A fuel break was created along State Road 501 to create a defensible separation between the Santa Fe National Forest and the Laboratory's western perimeter. A fire cache (e.g., a collection of firefighting equipment such as shovels, axes, backpacks, clothing, etc.) and a heliport with an emergency water tank were constructed at TA-49, along LANL's border with Bandelier National Monument (LANL 2000f).

LANL's goal was and continues to be reduction in fuel loading from 400 to 800 trees per acre to 50 to 150 trees per acre within the Laboratory. The primary focus is on areas with ponderosa pine or spruce-fir forests. These areas represent approximately 10,000 acres of LANL's 27,520 acres. By the time of the Cerro Grande fire, approximately 8,000 acres had been treated, primarily around buildings, roads, and parking lots (LANL 2000f).

Trees were cut and thinned at specific facilities. Building vulnerability analyses were used to prioritize mitigation. High-priority areas included the high explosive test and processing areas and nuclear facilities. Tree thinning and brush removal took place at TAs 15, 36, 3, 48, 55, 35, and 59. Landscape maintenance was performed at TA-21 and other locations as deemed appropriate (LANL 2000f).

Two facilities, the LLW disposal site at TA-54 (Area G) and WETF, were given special attention because they were the sources of the majority of the projected public dose in the SWEIS wildfire accident scenario. Approximately 30 acres surrounding WETF were thinned from around structures, roads, and parking areas. At TA-54 (Area G), trees were cut on about 10 acres, and wooden pallets on which waste drums were stacked were replaced with aluminum pallets (LANL 2000f).

In addition, the regional Interagency Wildfire Management Team (IWMT) was formed in 1996 to provide fire control advice and a forum to exchange expertise and information among land stewards in the East Jemez region. The IWMT has representatives from the Laboratory, DOE, Los Alamos County, the Forest Service, the Park Service, the Pueblo of San Ildefonso, the State of New Mexico, and other interested parties. The IWMT fostered consultations between agencies and developed information for evaluating wildfire problems, proposing optimal mitigation strategies, and undertaking implementation. The IWMT collaborated on the fuel break activities along State Road 501 and the fire cache/heliport development at TA-49 (LANL 2000f).

Wildfire Progression

A wildfire similar to Cerro Grande was projected in the SWEIS. Following the fire, a special edition of the SWEIS Yearbook was published, Wildfire 2000, that contrasted the Cerro Grande fire with the accident projections and addressed preliminary estimates of air emissions, acreage burned, fire progression, and immediate post-fire concerns (LANL 2000f).

The Cerro Grande fire was started on May 4, 2000. By day five (Monday, May 8), fires were burning on LANL lands. Slurry bomber activity increased and bulldozer lines were cut within the Laboratory. LANL suspended all programmatic work and was closed to minimize traffic and facilitate use of public roads by firefighters moving equipment. By 9:00 AM, officials also ordered closure of all businesses in Los Alamos townsite. By the end of the day, about 2,000 total acres had burned, mostly on Forest Service land.

On Tuesday, May 9, fires continued to burn at LANL; however, no facilities were threatened. The firebreak continued to hold on Camp May Road, and a mild weather front reduced fire activity.

On Wednesday, May 10, winds increased with sporadic bursts to over 50 miles per hour, and the fire blew up. The fire burned on two fronts: into the townsite and onto LANL at TA-16. The town was evacuated by mid-afternoon as the fire encroached on Los Alamos. The fire continued to burn through the afternoon and night and consumed nearly 20,000 acres.

On Thursday, May 11, the fire moved across LANL, threatening structures at TAs 50, 55, 54, 18, and 3 (the main administrative area of LANL). Estimated total acreage burned was 33,000 acres with about 5,000 acres destroyed on LANL lands.

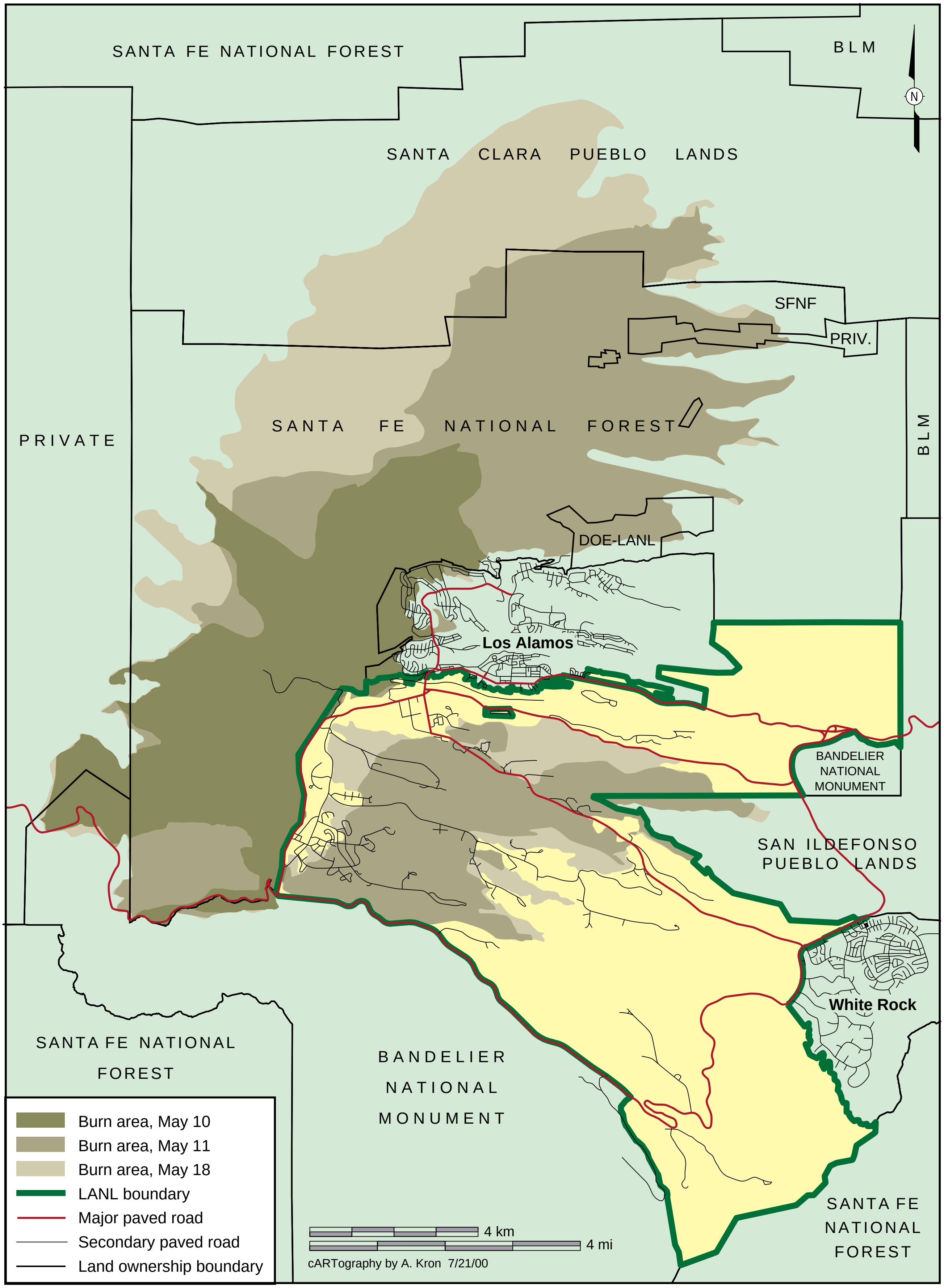
On Friday, May 12, the fire destroyed an additional 2,400 acres at LANL, and by Saturday, May 13, the fire was essentially over at LANL, having destroyed about 7,500 total acres at LANL.

LANL remained closed until May 22, when it partially reopened. LANL had remained closed for 18 days, and the fire destroyed or damaged over 300 structures within the Laboratory and 235 residential structures in the townsite. Though LANL suffered major damage from the fire, the mitigation measures taken by LANL enabled fire personnel to defend critical buildings. None of the Key Facilities were burned, nor were inventories of materials in these buildings released to the environment.

Citizen Concerns

A major concern of local communities during the fire was air emissions. All wildfires, regardless of location, emit radioactive lead-210, bismuth-210, and polonium-210, which are naturally occurring decay products of radon (Lambert et al. 1991, le Cloarec et al. 1995, Nho et al. 1996, Dibb et al. 1999). Radon is a gas, but these decay products are metals that settle to the ground and on plant surfaces. During a fire, these particles become airborne, measurably increasing in concentration.

The Wildfire 2000 edition of the SWEIS Yearbook presents calculated concentrations for polonium-210 and bismuth-210 during the fire. These concentrations were similar to those measured near African wildfires (Lambert


SANTA FE NATIONAL FOREST
BLM
N
SANTA CLARA PUEBLO LANDS
SFNF
PRIV.
SANTA FE NATIONAL FOREST
PRIVATE
BLM
DOE-LANL
Los Alamos
BANDELIER NATIONAL MONUMENT
SAN ILDEFONSO PUEBLO LANDS
White Rock
SANTA FE NATIONAL FOREST
BANDELIER NATIONAL MONUMENT
SANTA FE NATIONAL FOREST
Burn area, May 10
Burn area, May 11
Burn area, May 18
LANL boundary
Major paved road
Secondary paved road
Land ownership boundary
4 km
4 mi
cARTography by A. Kron 7/21/00

et al. 1991). In addition, data from four organizations (LANL, DOE, EPA, and NMED) are also presented that sampled air for radiological emissions during the fire. These data indicate that concentrations of isotopes common to Laboratory operations (plutonium, uranium, and americium-241) were generally consistent with historical data. Furthermore, the uranium appeared to be from natural sources based on isotopic comparison (LANL 2000a).

LANL, NMED, and EPA also sampled for non-radioactive air emissions during the fire. As expected, all sampling networks showed higher-than-normal air concentrations of particulate matter associated with smoke from the fire. The EPA also detected metals and organic compounds, but at concentrations that did not pose a health risk. These compounds may normally be present in the atmosphere or are expected emissions from fires (LANL 2000a).

As a result of the Cerro Grande fire, DOE and LANL identified the need to take several actions (directly or indirectly linked to flood control) on an emergency basis to protect human life and property. DOE recognized that its actions needed to include not only LANL, but adjacent landowners as well. DOE invoked the emergency provisions of its NEPA Implementing Regulations and proceeded to take all actions deemed necessary. Subsequently, DOE prepared a *Special Environmental Analysis for the Department of Energy, National Nuclear Security Administration: Actions Taken in Response to the Cerro Grande Fire at Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE 2000b).

5.1 Operations Restart

Because operations at LANL had been placed into emergency shutdown, a process had to be established to safely reenter and restart operations in each building. The process had to evaluate risks, identify steps to be taken, and ensure that each step was executed in the proper sequence to safely bring operations back on-line. To accomplish this task, LANL implemented a global "Facility Recovery Process" for defining how facilities would return to operations in the aftermath of the Cerro Grande fire (LANL 2000e). This global procedure was used for Key and Non-Key Facilities. Time required to restart operations varied for each facility depending upon complexity of operations and facility damage, if any. Most LANL facilities (~90 percent) had no fire damage, and thus were returned to operations within two weeks after the wildfire.

The recovery process established managers responsible (Facility Recovery Managers) and Facility Recovery Teams for each structure at LANL. For implementation, a Facility Recovery Center was established on May 13 and immediately staffed with LANL and DOE personnel. The Facility Recovery Center's charter was to plan and implement the recovery of LANL facilities from emergency shutdown to their pre-emergency or "facility ready" condition in a safe, secure, systematic, and efficient manner.

Facility Recovery Teams were first tasked with conducting safety reconnaissance of each facility (showing evidence of fire damage) and documenting life-safety issues. Facility Recovery Teams then conducted more detailed condition assessments of each building and structure. Recovery Plans were then developed for damaged facilities, outlining actions necessary to bring the facility back to operational status. These actions ranged from minor (e.g., sterilization and removal of dead mice [possible carriers of hantavirus], replacement of telephone lines, etc.) to moderate (e.g., replacement of high-efficiency particulate air filters) to more significant (e.g., repair of damaged walls or roofs). After recovery actions had been completed, Facility Recovery Teams documented the actions and prepared a Declaration of Facility Readiness. This declaration had to be reviewed and approved by the Facility Recovery Manager before facility operations could resume.

Facility restart was accomplished with minimal downtime and, more importantly, no injuries. More than 80 percent of the Laboratory's 2,000 structures were declared facility ready within two weeks of establishing the Facility Recovery Center, and 90 percent were declared facility ready by the end of May 2000. Each step of the recovery process was documented and approved in real-time by DOE Facility Representatives, the Facility Recovery Manager, and the Senior Executive Team, as appropriate.

Before the Cerro Grande fire and establishment of the Facility Recovery Center, LANL did not have a formal process for facility recovery and readiness declaration following a major catastrophe. Additionally, LANL did not have processes for verifying Technical Safety Requirements/Operational Safety Requirements or for exempting required surveillance missed during facility evacuation. The Facility Recovery Center staff developed and implemented a Quality Management Plan, Integrated Safety Management Plan, and appropriate technical procedures to assure that facility recovery was conducted safely and in compliance with applicable regulations, orders, codes, and standards. They also developed processes that allowed for a graded approach to facility recovery based on facility and hazard type.

5.2 Damaged Structures

No LANL Category 2 or Category 3 nuclear facilities burned nor did the fire release any radioactive materials from these buildings. These facilities were protected from a catastrophic fire by adequate fire breaks and buffers of cleared land.

During the recovery process, all structures at LANL were evaluated for fire damage. Impacted structures were placed into one of six categories:

- Custodial/filter–the structure required ash and soot removal and replacement of filters in the HVAC systems.
- Damaged–the structure had actual fire damage to walls, skirting, windows, doors, or roof that required structural repair.
- Destroyed–the structure was so badly burned that it was not cost-effective to repair the structure.
- Other–the structure had instrumentation or equipment damaged or destroyed that required replacement. The structure itself remained intact.
- Pest control–the structure had been invaded by mice or other pests that had to be removed before reoccupancy.
- Previous–the structure had safety issues that may have preceded the Cerro Grande fire, but were not evident until the post-fire assessment was performed.

For Yearbook reporting purposes, these six categories have been reduced to three: impacted, damaged, or destroyed. Impacted represents the sum of custodial/filter, other, pest control, and previous.

Table 5.2-1 identifies the number of structures in each of these three categories (impacted, damaged, or destroyed) by TA. Though the fire burned across 7,500 acres of the Laboratory, only 28 structures were actually destroyed. As shown in Table 5.2-2, 18, or about two-thirds, of these structures were within areas utilized for High Explosives Processing and High Explosives Testing. Seven of the 28 structures destroyed were more permanent type structures (e.g., 1 bunker, 1 cooling tower, 1 process building, 1 staff shop, 2 storage buildings, and 1 test building). The remainder were mostly trailers and sheds. LANL also lost several vehicles.

Table 5.2-1. Summary of Levels of Damage to Structures by Technical Area

TECHNICAL AREA	IMPACTED	DAMAGED	DESTROYED
0	1		
3	41	5	
6	0	1	1
8	1		
9	25	1	
11	0	4	
14	4		1
15	32	15	10
16	27	6	5
21	1		
22	26	1	
35	1	1	
36	3		
37	3		
39	4		
40	20	6	2
43	1		
46	9	5	7
48	6	2	
49	1		
52	3		1
54	1		
59	20		
60	2	1	
64	2	19	1
69	1	1	
72	1		
Total Structures	236	68	28

5.2-2. Summary of Levels of Damage to Structures by Key Facility

KEY FAC	IMPACTED	DAMAGED	DESTROYED
High Explosives Processing	79	12	5
High Explosives Testing	63	21	13
Biosciences (formerly HRL)	1		
Radioactive Chemistry	6	2	
Machine Shops	0	2	
Solid Radioactive and Chemical Waste Facility	1		
Non-Key	86	31	10
Total Structures	236	68	28

Cultural Resources

In addition to modern structures, the fire also damaged 304 prehistoric and 58 historic (including Manhattan Project) recorded sites at LANL. The total impact to prehistoric sites is not fully known and may never be fully documented. Burned out tree root systems have formed conduits for modern debris and water to mix with subsurface archaeological deposits and provide entry points for burrowing animals (DOE 2000b). In addition, the fire uncovered many previously unknown sites and made them available for looting.

Historic resources within the burned area were severely adversely impacted. Before the fire, LANL's historic homesteads were among the best remaining evidence of this period. The fire destroyed virtually all wooden buildings associated with the Homestead Era and the sites were largely reduced to rubble. On June 28, 2000, an intense rain also produced flooding that destroyed an already deteriorating Homestead Era icehouse structure (DOE 2000b).

The fire also destroyed most of the V-Site structures that remained from the Manhattan Project Era. V-Site was typical of the clapboard wooden laboratories built at LANL during World War II and was among the last vestiges of the Manhattan Project at LANL. In these buildings, scientists worked on the "Gadget" (Trinity Device), the world's first successful nuclear explosive, which was the prototype for the bomb that was detonated over Nagasaki, Japan, on August 9, 1945.

5.3 Potential Flood Control

A major concern facing LANL immediately following the fire was the threat of floods. The fire had removed vegetation, and the rainy season was about to begin. Based on modeling of potential floods, several steps were taken to reduce this risk. The Army Corps of Engineers recommended to DOE that the following fire rehabilitation actions be completed to mitigate potential flooding and erosion:

- weir and sediment trap in Los Alamos Canyon,
- reinforce Los Alamos Reservoir,
- Pajarito Canyon flood retention structure,
- reinforce State Road 501 crossing at Pajarito Canyon,
- reinforce State Road 501 crossing at Two Mile Canyon,
- reinforce Anchor Ranch Road crossing at Two Mile Canyon, and
- reinforce State Road 501 at Water Canyon.

Descriptions of these actions are found in the *Special Environmental Analysis for the Department of Energy, National Nuclear Security Administration: Actions Taken in Response to the Cerro Grande Fire at Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE 2000b).

In addition, burned area rehabilitation for erosion control across LANL included contour felling burned trees, contour raking, seeding by hand and air, mulching, and hydro-mulching. Moderately and severely burned areas were contour raked to break up the soil surface and to redirect and reduce water flow. The ground disturbance from raking was limited to the first few inches of the soil surface. After raking, the areas were seeded by hand, by mechanical spreaders, or by small, low-flying aircraft. After seeding, straw mulch was spread by hand or by mechanical straw blowers.

The installation or replacement of storm water control measures, known as BMPs, were required to protect 91 PRSs that had been burned. Culvert and drainage area clean-out activities were performed at all low-lying areas where storm water runoff was expected and where any inadvertent ponding of storm water might be expected from debris damming. Various flood damage control measures were installed to provide protection to electric power pole structures and other utility structures (such as electric substation, gas lines, water lines, wells and chlorination stations, sewage lift stations, and telephone and communication structures).

These activities required personnel to be in the burned areas and subjected them to risk of injury from falling hazard trees or burning stump holes. To minimize these risks, the Laboratory closed these areas to all but trained personnel.

5.4 Biological Effects of Post-fire Activities

This material was taken from *Special Environmental Analysis for the Department of Energy, National Nuclear Security Administration: Actions Taken in Response to the Cerro Grande Fire at Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE 2000b).

Fire suppression activities resulted in transient and long-term effects to biological resources. The clearing of about 130 acres of understory plants and the removal of trees associated with fire suppression temporarily displaced local wildlife. Deer, elk, birds, and small mammals left these sites, and the displacement lasted from a few days to several weeks depending on the species involved. However, wildlife returned to the affected areas and, with anticipated return of plant cover over the next several years, wildlife use and diversity are expected to return to pre-fire conditions.

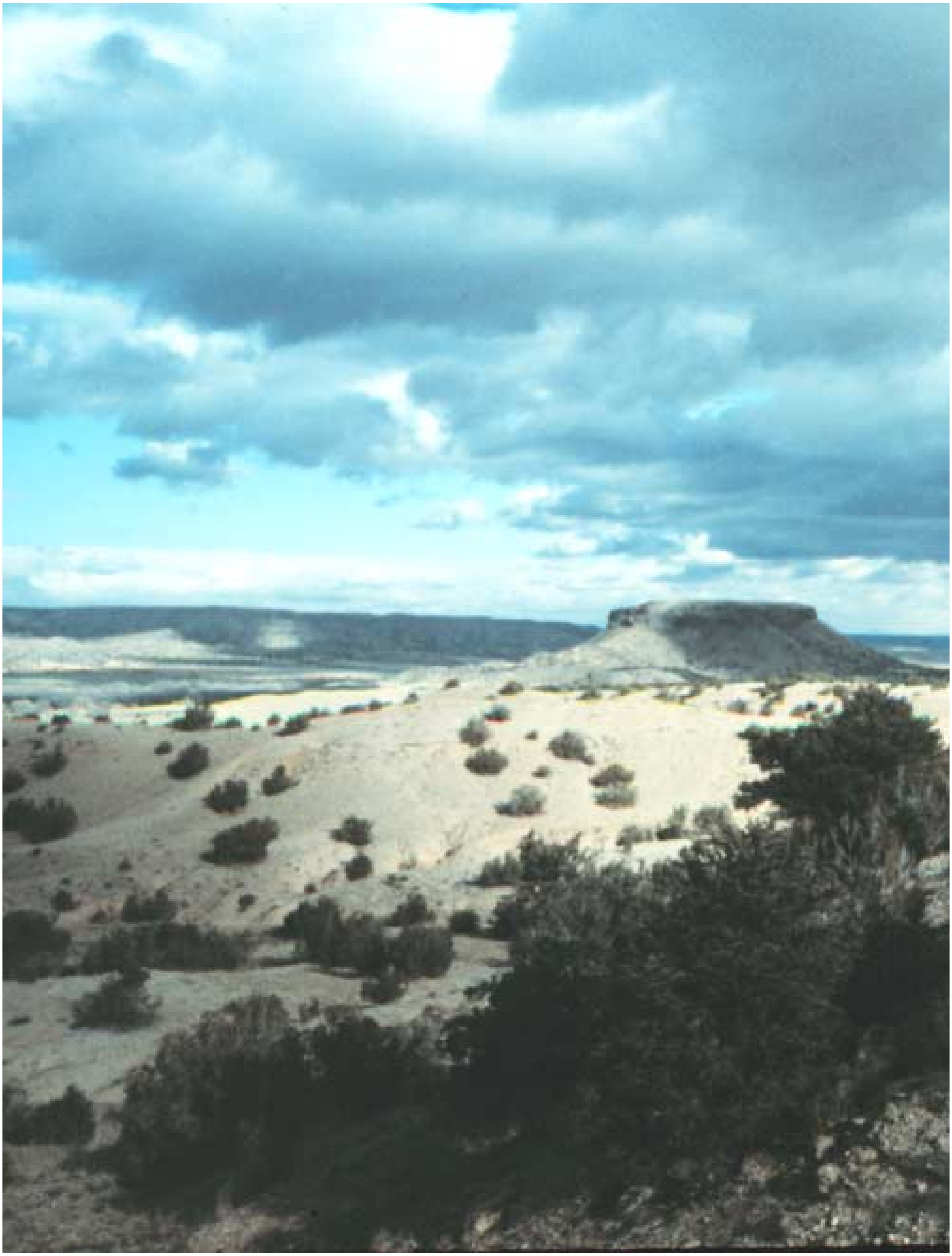
Only one pair of federally listed birds was known to be present at LANL during the fire. Their nesting area was burned and they fled the area in front of the fire. This pair of birds subsequently returned to their nesting area.

Post-fire construction of storm water control and retention structures and implementation of soil erosion control measures produced an array of short- and long-term biological effects. Some of these effects may be considered beneficial and some adverse. The major beneficial effect is the protection of wildlife habitat from further degradation from flooding and the restoration of vegetation on burned areas. Additionally, the activities taken will potentially reduce the transport of contaminants into wildlife habitats. Conversely, construction of storm water control and retention structures destroys small pieces of habitat used by small mammals and other biological organisms, and restoration of vegetation introduces plant species not necessarily native to the area being reseeded.

In general, protection of habitat from flood damage will have beneficial effects on federally listed threatened and endangered species. However, destruction of core nesting and roosting areas in Pajarito Canyon because of construction of the flood retention structures will have a permanent adverse effect on that Mexican spotted owl habitat. The Pajarito Canyon flood retention structure removed up to about 5 percent of the Mexican spotted owl habitat on LANL and will result in wildlife habitat fragmentation for game animals. However, this construction is not expected to have an adverse effect on individual Mexican spotted owls or the overall designated critical habitat for that species.

The cumulative effects from fire suppression and post-fire emergency actions will primarily result in significant beneficial, long-term impacts to biological resources. Examples include decreased soil erosion, restoration of understory vegetation, and minimization of contaminant transport within habitats. The most severe adverse effect will be loss of about 13 acres of habitat for construction of the flood retention structure, the low-head weir, and the Mortandad Canyon sediment trap.

Restoration of understory vegetation by reseeding is likely to be the greatest beneficial impact to the habitat types. Because the seed mixture used contained two nonnative annual species, the species may dominate the initial colonization of the burned area for the first growing season. Perennial species in the seed mix will dominate the burned areas in subsequent years, as the nonnative species should only reseed themselves for one or two years. Vegetative composition and abundance in the burned area will be different than it would have been without the reseeding effort. However, the protection from erosion and runoff provided by the reseeding effort is considered a significant beneficial effect. In the long term, suitable native plants will return to a balanced condition through normal plant succession.



6.0 Summary and Conclusion

6.1 Summary

The 2000 SWEIS Yearbook reviews CY 2000 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 Beryllium Technology Facility), 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.

The ROD projected a total of 38 facility construction and modification projects for LANL. Fifteen projects have now been completed: six in 1998, seven in 1999, and two in 2000. Seven additional projects were started and/or continued in 2000. The two projects completed in 2000 are

- Atlas facility in parts of five buildings at TA-35 and
- remodel of Building 16-450 and connection to WETF.

During 2000, planned construction and/or modifications continued at seven of the 15 Key Facilities. Most of these activities were modifications within existing structures. At the High Explosives Testing Facility, construction of the DARHT facility was finished in 1999. Work continued in 2000 on installation and component testing of the accelerator and its associated control and diagnostics systems. Additionally, four major construction projects were either completed or continued for the Non-Key Facilities. Atlas was completed in September 2000, and major component tests were completed by December 2000. Three projects were in the construction phase: the Los Alamos Research Park, the Strategic Computing Complex, and the Nonproliferation and International Security Center.

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. Capabilities across LANL did not change during 2000, although some moved location, some were defined more broadly, and others were further refined. Because of a move, one capability that used to be within the Non-Key portion of LANL (Computational Biology) was moved into a Key Facility, bringing the identified capabilities to 96. During 2000, 90 of the 96 identified capabilities were active. No activity occurred under five capabilities: Fabrication of Ceramic-Based Reactor Fuels at the Plutonium Complex, Diffusion and Membrane Purification at the Tritium Key Facility, Destructive and Nondestructive Analysis and Fabrication and Metallography at the CMR Building, and Other Waste Processing 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 4,886 hours in 2000, at an average current of 38 microamps, compared to 6,400 hours at 200 microamps projected by the ROD. Similarly, a total of 140 criticality experiments were conducted at Pajarito Site, compared to the 1,050 projected experiments.

As in 1998 and 1999, only three of LANL's facilities operated during 2000 at levels approximating those projected by the ROD—the MSL, the Biosciences Facilities (formerly HRL), and the Non-Key Facilities. The two Key Facilities (MSL and Biosciences) represent the dynamic nature of research and development at LANL and are more akin to the Non-Key Facilities representing the intrinsic dynamics of research and development. 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.

Operations Data and Environmental Parameters: This 2000 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 airborne emissions from point sources (i.e., stacks) during 2000 totaled approximately 3,100 curies, less than 15 percent of the ten-year average of 21,700 curies project by the SWEIS ROD. The final dose is estimated to be approximately 0.65 millirem/yr (compared to 5.44 projected), with the final dose being reported to the EPA by June 30, 2001. Calculated NPDES discharges totaled 265 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. 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 point. For some facilities, outfall flows are recorded on a continuous basis; this was the case for outfalls at sanitary wastewater system, the High Explosives Wastewater Treatment Facility, RLWTF, LANSCE, and the Power Plant. For all other outfalls, annual totals were calculated from average flows documented in the Laboratory's discharge monitoring reports. The latter method substantially overestimates the quantity of wastewater discharged because it is based on infrequent sampling and the discharge monitoring reports assume round-the-clock flow for all outfalls. As in the 1998 and 1999 SWEIS Yearbooks, 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.

While most wastes remained within SWEIS ROD projections, quantities of chemical wastes far exceeded these projections. These extremely large quantities of chemical waste were a result of ER Program activities (remediation of old MDAs and accelerated cleanup activities resulting from the Cerro Grande fire). Most chemical wastes are shipped offsite for disposal at commercial facilities; therefore, these large quantities of chemical waste will not impact LANL environs. Remedial activities at MDA-P resulted in 5,238 tons of industrial solid wastes (nonhazardous soil, concrete rubble, and debris) that were used as fill in preparation of capping MDA-J.

A closure plan for MDA-J was submitted to NMED in 1999. However, after the Cerro Grande fire, it became evident that LANL required disposal capacity for the solid wastes generated from rehabilitation. Through negotiation, NMED agreed to allow MDA-J to continue to accept waste until late spring 2001.

Workforce data were above projections. The 12,015 employees at the end of CY 2000 represent 664 more employees than projected by the ROD. Thus, regional socioeconomic consequences, such as salaries and procurements, also should have exceeded projections.

Electricity use during 2000 totaled 381 gigawatt-hours with a peak demand of 65 megawatts compared to projections of 782 gigawatt-hours with a peak demand of 113 megawatts. Water usage was 441 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 2000 was 196 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 LLW. As of 2000, this expansion had not been determined necessary. However, development continued on 30 acres of land along West Jemez Road for the Los Alamos Research Park. This project has its own NEPA 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 is reduced, water levels show some recovery. No unexplained changes in patterns have occurred in the 1995–2000 period, and water levels in the regional aquifer have continued a gradual decline that started in about 1977.

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.

6.2 Conclusions

In conclusion, though operations data mostly fell within projections, this was not a normal year. LANL was shut down for two weeks during the Cerro Grande fire, and many facilities were not fully operational for several months.

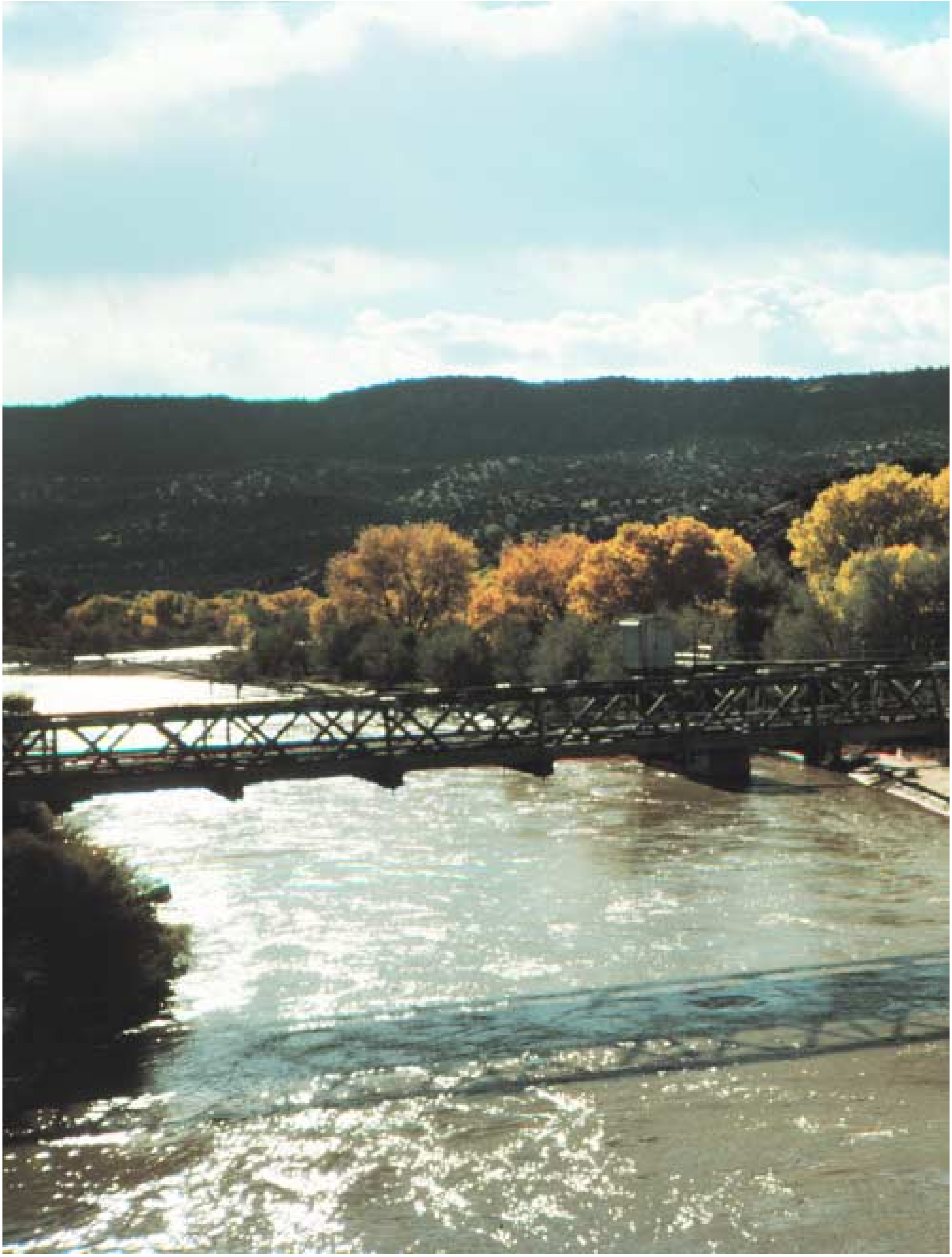
The 2000 data indicate that LANL operations typically remained below levels projected by the SWEIS ROD. In addition to the Cerro Grande fire and the temporary halt of operations, there are two main reasons for this fact. The ROD was not issued until September 1999; consequently, operations were more 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 (1996–2000) would be expected to fall below the maximum.

One purpose of the 2000 Yearbook is to compare LANL operations and resultant 2000 data to the SWEIS ROD to determine if LANL was still operating within the environmental envelope established by the SWEIS and the ROD. Data for 2000 indicate that positive impacts (such as socioeconomics) were greater than SWEIS ROD projections, while negative impacts, such as radioactive air emissions and land disturbance, were within the SWEIS envelope.

6.3 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 2001 Yearbook will follow that developed for the previous Yearbooks—comparison to the SWEIS ROD.

The 2000 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 1999 and 2000.

TECH_AREA	NUMBER OF CHEMICALS USED IN 1999 AND NOT IN 2000	NUMBER OF CHEMICALS USED IN 2000 AND NOT IN 1999
03	38	11
08	3	0
09	28	0
15	5	1
16	18	0
18	4	0
21	9	0
22	0	3
35	34	13
36	0	1
39	1	1
40	4	5
43	25	5
48	34	18
50	19	11
53	20	7
54	3	0
55	3	9

Table A-2. Chemical and Metallurgy Research Building Air Emissions

KEY FACILITY	CHEMICAL NAME	CAS NUMBER	UNITS	2000 ESTIMATED AIR EMISSIONS	2000 USAGE
CMR Building	Acetone	67-64-1	kg/yr	6.10	17.41
	Ethanol	64-17-5	kg/yr	4.01	11.47
	Formic Acid	64-18-6	kg/yr	0.43	1.22
	Hydrogen Bromide	10035-10-6	kg/yr	1.05	3.01
	Hydrogen Chloride	7647-01-0	kg/yr	5.00	14.27
	Hydrogen Fluoride, as F	7664-39-3	kg/yr	0.69	1.98
	Hydrogen Peroxide	7722-84-1	kg/yr	0.30	0.85
	Methyl Alcohol	67-56-1	kg/yr	2.22	6.34
	Methylene Chloride	75-09-2	kg/yr	0.47	1.33
	Nitric Acid	7697-37-2	kg/yr	7.49	21.41
	Nitric Oxide	10102-43-9	kg/yr	2.93	8.36
	Propane	74-98-6	kg/yr	0.00	392.98
	Sulfuric Acid	7664-93-9	kg/yr	6.61	18.90
	Tin numerous forms	7440-31-5	kg/yr	0.01	0.50
	Toluene	108-88-3	kg/yr	0.30	0.87
	Zinc Oxide Fume	1314-13-2	kg/yr	0.01	0.50

Table A-3. Health Research Laboratory Air Emissions

KEY FACILITY	CHEMICAL NAME	CAS NUMBER	UNITS	2000 ESTIMATED AIR EMISSIONS	2000 USAGE
HRL	Acetic Acid	64-19-7	kg/yr	12.36	35.31
	Acetone	67-64-1	kg/yr	0.55	1.58
	Acetonitrile	75-05-8	kg/yr	147.16	420.44
	Chlorodifluoromethane	75-45-6	kg/yr	0.10	0.28
	Chloroform	67-66-3	kg/yr	2.86	8.17
	Ethanol	64-17-5	kg/yr	26.07	74.48
	Formamide	75-12-7	kg/yr	0.20	0.57
	Hydrogen Chloride	7647-01-0	kg/yr	3.96	11.30
	Hydrogen Peroxide	7722-84-1	kg/yr	1.27	3.62
	Isopropyl Alcohol	67-63-0	kg/yr	25.07	71.63
	Methyl Alcohol	67-56-1	kg/yr	18.30	52.30
	Methylamine	74-89-5	kg/yr	0.32	0.90
	n,n-Dimethylformamide	68-12-2	kg/yr	0.33	0.95
	Nitric Acid	7697-37-2	kg/yr	0.27	0.76
	Phenol	108-95-2	kg/yr	0.63	1.80
	Phosphoric Acid	7664-38-2	kg/yr	0.32	0.92
	Potassium Hydroxide	1310-58-3	kg/yr	0.18	0.50
	Sulfuric Acid	7664-93-9	kg/yr	0.65	1.84
	tert-Butyl Alcohol	75-65-0	kg/yr	0.28	0.79
	Thioglycolic Acid	68-11-1	kg/yr	0.23	0.66

Table A-4. High Explosive Processing Air Emissions

KEY FACILITY	CHEMICAL NAME	CAS NUMBER	UNITS	2000 ESTIMATED AIR EMISSIONS	2000 USAGE
HE Processing	Acetone	67-64-1	kg/yr	3.32	9.50
	Ethanol	64-17-5	kg/yr	0.83	2.37
	Hydrogen Chloride	7647-01-0	kg/yr	9.58	27.36
	Isopropyl Alcohol	67-63-0	kg/yr	5.51	15.74
	Phosphoric Acid	7664-38-2	kg/yr	9.65	27.57
	Toluene	108-88-3	kg/yr	0.61	1.74

Table A-5. High Explosive Testing Air Emissions

KEY FACILITY	CHEMICAL NAME	CAS NUMBER	UNITS	2000 ESTIMATED AIR EMISSIONS	2000 USAGE
HE Testing	2-Ethoxyethanol (EGEE)	110-80-5	kg/yr	0.33	0.93
	Acetone	67-64-1	kg/yr	5.26	15.04
	Diethylene Triamine	111-40-0	kg/yr	0.34	0.96
	Ethyl Acetate	141-78-6	kg/yr	1.26	3.61
	Methyl Alcohol	67-56-1	kg/yr	2.22	6.34
	Sulfur Hexafluoride	2551-62-4	kg/yr	146.36	418.18

Table A-6. LANSCE Air Emissions

KEY FACILITY	CHEMICAL NAME	CAS NUMBER	UNITS	2000 ESTIMATED AIR EMISSIONS	2000 USAGE
LANSCE	1,1,2-Trichloroethane	79-00-5	kg/yr	8.09	23.11
	Acetone	67-64-1	kg/yr	3.74	10.69
	Acetylene	74-86-2	kg/yr	0.00	1.32
	Chloroform	67-66-3	kg/yr	3.64	10.40
	Ethanol	64-17-5	kg/yr	61.47	175.62
	Ethyl Bromide	74-96-4	kg/yr	0.26	0.73
	Ethyl Ether	60-29-7	kg/yr	0.25	0.70
	Hydrogen Fluoride, as F	7664-39-3	kg/yr	0.16	0.45
	Isopropyl Alcohol	67-63-0	kg/yr	2.48	7.08
	Mercury numerous forms	7439-97-6	kg/yr	1.60	159.55
	Methyl Alcohol	67-56-1	kg/yr	2.50	7.14
	Potassium Hydroxide	1310-58-3	kg/yr	2.12	6.05
	Propane	74-98-6	kg/yr	0.00	497.34
	Toluene	108-88-3	kg/yr	0.43	1.24
	Trichloroacetic Acid	76-03-9	kg/yr	0.09	0.25
	Trichloroethylene	79-01-6	kg/yr	0.24	0.69

Table A-7. Machine Shops Air Emissions

KEY FACILITY	CHEMICAL NAME	CAS NUMBER	UNITS	2000 ESTIMATED AIR EMISSIONS	2000 USAGE
Machine Shops	Propane	74-98-6	kg/yr	0.00	244.23

Table A-8. Material Science Laboratory Air Emissions

KEY FACILITY	CHEMICAL NAME	CAS NUMBER	UNITS	2000 ESTIMATED AIR EMISSIONS	2000 USAGE
MSL	Acetic Acid	64-19-7	kg/yr	0.18	0.53
	Acetone	67-64-1	kg/yr	9.14	26.12
	Chloroform	67-66-3	kg/yr	0.52	1.49
	Ethanol	64-17-5	kg/yr	2.21	6.33
	Ethyl Ether	60-29-7	kg/yr	0.25	0.70
	Hydrogen Fluoride, as F	7664-39-3	kg/yr	0.18	0.50
	Hydrogen Peroxide	7722-84-1	kg/yr	0.25	0.70
	Isobutyl Alcohol	78-83-1	kg/yr	0.28	0.80
	Isophorone Diisocyanate	4098-71-9	kg/yr	0.09	0.26
	Isopropyl Alcohol	67-63-0	kg/yr	1.38	3.94
	Methyl Alcohol	67-56-1	kg/yr	6.94	19.83
	Methyl Methacrylate	80-62-6	kg/yr	0.17	0.47
	Methylene Chloride	75-09-2	kg/yr	1.86	5.32
	n,n-Dimethylformamide	68-12-2	kg/yr	0.25	0.71
	Phosphoric Acid	7664-38-2	kg/yr	0.64	1.84
	Sulfuric Acid	7664-93-9	kg/yr	3.23	9.22
	Tetrahydrofuran	109-99-9	kg/yr	1.87	5.35
	Trichloroethylene	79-01-6	kg/yr	0.26	0.73

Table A-9. Pajarito Site Air Emissions

KEY FACILITY	CHEMICAL NAME	CAS NUMBER	UNITS	2000 ESTIMATED AIR EMISSIONS	2000 USAGE
Pajarito Site	Isopropyl Alcohol	67-63-0	kg/yr	1.65	4.72
	Propane	74-98-6	kg/yr	0.00	293.07

Table A-10. Plutonium Facility Complex Air Emissions

KEY FACILITY	CHEMICAL NAME	CAS NUMBER	UNITS	2000 ESTIMATED AIR EMISSIONS	2000 USAGE
Plutonium Facility Complex	Acetic Acid	64-19-7	kg/yr	0.92	2.63
	Acetylene	74-86-2	kg/yr	0.00	1.32
	Chlorine	7782-50-5	kg/yr	23.86	68.18
	Ethanol	64-17-5	kg/yr	64.74	184.98
	Hydrogen Chloride	7647-01-0	kg/yr	225.23	643.52
	Hydrogen Fluoride, as F	7664-39-3	kg/yr	2.08	5.95
	Hydrogen Peroxide	7722-84-1	kg/yr	13.07	37.36
	Isopropyl Alcohol	67-63-0	kg/yr	1.10	3.15
	Manganese Dust & Compounds or Fume	7439-96-5	kg/yr	0.25	0.72
	Methyl 2-Cyanoacrylate	137-05-3	kg/yr	0.54	1.53
	Methyl Alcohol	67-56-1	kg/yr	4.44	12.69
	Nitric Acid	7697-37-2	kg/yr	13.38	38.23
	Phosphoric Acid	7664-38-2	kg/yr	0.32	0.92
	Potassium Hydroxide	1310-58-3	kg/yr	125.05	357.29
	Propane	74-98-6	kg/yr	0.00	48.85
	Sulfuric Acid	7664-93-9	kg/yr	0.32	0.92
	Tributyl Phosphate	126-73-8	kg/yr	1.36	3.90
	Trichloroethylene	79-01-6	kg/yr	106.92	305.48

Table A-11. Radiochemistry Site Air Emissions

KEY FACILITY	CHEMICAL NAME	CAS NUMBER	UNITS	2000 ESTIMATED AIR EMISSIONS	2000 USAGE
Radiochemistry Site	1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	kg/yr	4.94	14.10
	1,4-Dioxane	123-91-1	kg/yr	0.36	1.04
	2-Methoxyethanol (EGME)	109-86-4	kg/yr	0.34	0.97
	Acetic Acid	64-19-7	kg/yr	0.91	2.60
	Acetone	67-64-1	kg/yr	62.47	178.50
	Acetonitrile	75-05-8	kg/yr	6.07	17.35
	Aluminum numerous forms	7429-90-5	kg/yr	0.00	0.27
	Ammonium Chloride (Fume)	12125-02-9	kg/yr	0.18	0.50
	Benzene	71-43-2	kg/yr	0.38	1.08
	Beryllium	7440-41-7	kg/yr	0.33	0.94
	Bromine	7726-95-6	kg/yr	0.08	0.23
	Carbon Tetrachloride	56-23-5	kg/yr	1.12	3.19
	Chloroform	67-66-3	kg/yr	4.16	11.89
	Cobalt, elemental & inorg. comp., as Co	7440-48-4	kg/yr	0.02	1.79
	Copper	7440-50-8	kg/yr	0.02	2.28
	Cyclohexanol	108-93-0	kg/yr	0.34	0.96
	Dicyclopentadiene	77-73-6	kg/yr	0.86	2.45
	Diethylamine	109-89-7	kg/yr	0.25	0.70
	Ethanol	64-17-5	kg/yr	4.71	13.45
	Ethyl Acetate	141-78-6	kg/yr	0.32	0.90
	Ethyl Ether	60-29-7	kg/yr	14.12	40.33
	Hexane (other isomers)* or n-Hexane	110-54-3	kg/yr	7.90	22.56
	Hydrogen Bromide	10035-10-6	kg/yr	12.10	34.57
	Hydrogen Chloride	7647-01-0	kg/yr	88.30	252.29
	Hydrogen Fluoride, as F	7664-39-3	kg/yr	1.59	4.55
	Hydrogen Peroxide	7722-84-1	kg/yr	5.94	16.98
	Hydrogen Sulfide	7783-06-4	kg/yr	0.16	0.45
	Isopropyl Alcohol	67-63-0	kg/yr	14.70	42.00
	Isopropyl Ether	108-20-3	kg/yr	1.02	2.90
	Lead, el. & inorg. compounds, as Pb	7439-92-1	kg/yr	0.01	1.13
	Magnesium Oxide Fume	1309-48-4	kg/yr	0.21	0.60
	Methyl Alcohol	67-56-1	kg/yr	7.91	22.60
	Methyl Cyclohexane	108-87-2	kg/yr	0.28	0.80
	Methylene Chloride	75-09-2	kg/yr	13.82	39.48
	Morpholine	110-91-8	kg/yr	0.35	1.00
	n,n-Dimethyl Acetamide or Dimethyl Acetamide	127-19-5	kg/yr	0.66	1.89
	n,n-Dimethylformamide	68-12-2	kg/yr	1.00	2.85
	n-Butyl Alcohol	71-36-3	kg/yr	0.14	0.41
	n-Heptane	142-82-5	kg/yr	1.92	5.48
	Nitric Acid	7697-37-2	kg/yr	450.78	1287.93
	o-Dichlorobenzene	95-50-1	kg/yr	0.23	0.65
	Pentane (all isomers)	109-66-0	kg/yr	0.22	0.63
	Phosphoric Acid	7664-38-2	kg/yr	3.22	9.19

Table A-12. Sigma Complex Air Emissions

KEY FACILITY	CHEMICAL NAME	CAS NUMBER	UNITS	2000 ESTIMATED AIR EMISSIONS	2000 USAGE
Sigma Complex	Acetone	67-64-1	kg/yr	4.43	12.66
Sigma Complex	Diethylene Triamine	111-40-0	kg/yr	0.67	1.92
Sigma Complex	Ethyl Ether	60-29-7	kg/yr	0.25	0.70
Sigma Complex	Hydrogen Chloride	7647-01-0	kg/yr	196.98	562.79
Sigma Complex	Hydrogen Peroxide	7722-84-1	kg/yr	3.21	9.16
Sigma Complex	Isopropyl Alcohol	67-63-0	kg/yr	6.61	18.89
Sigma Complex	Lead, el. & inorg. compounds, as Pb	7439-92-1	kg/yr	0.05	5.01
Sigma Complex	Mercury numerous forms	7439-97-6	kg/yr	0.02	2.27
Sigma Complex	Methyl Alcohol	67-56-1	kg/yr	3.33	9.52
Sigma Complex	n,n-Dimethylformamide	68-12-2	kg/yr	0.17	0.48
Sigma Complex	Nitric Acid	7697-37-2	kg/yr	272.75	779.29
Sigma Complex	Propane	74-98-6	kg/yr	0.00	73.27
Sigma Complex	Sulfuric Acid	7664-93-9	kg/yr	9.68	27.66
Sigma Complex	Zirconium Compounds, as Zr	7440-67-7	kg/yr	0.01	0.50

Table A-13. Target Fabrication Facility Air Emissions

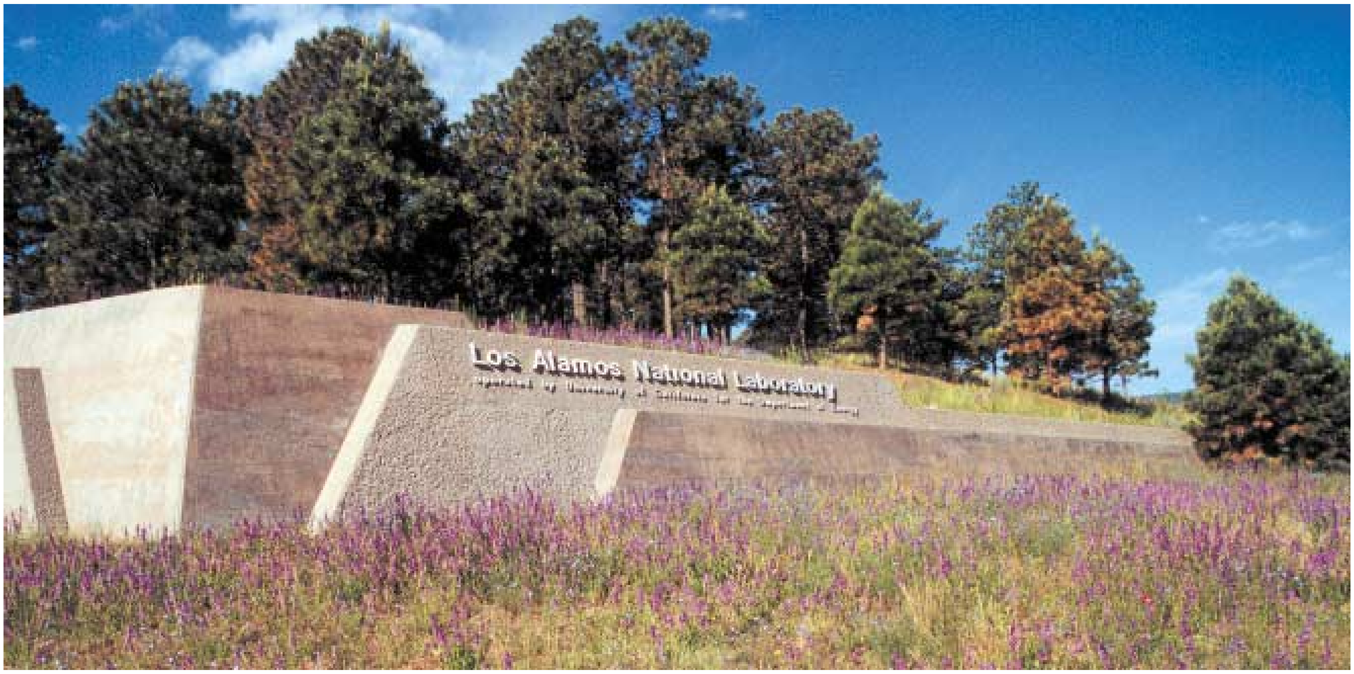
KEY FACILITY	CHEMICAL NAME	CAS NUMBER	UNITS	2000 ESTIMATED AIR EMISSIONS	2000 USAGE
Target Fabrication Facility	Acetone	67-64-1	kg/yr	5.54	15.83
	Benzene	71-43-2	kg/yr	1.08	3.07
	Boron Oxide	1303-86-2	kg/yr	0.35	1.00
	Cyclohexane	110-82-7	kg/yr	0.55	1.56
	Divinyl Benzene	1321-74-0	kg/yr	0.16	0.46
	Ethanol	64-17-5	kg/yr	1.73	4.95
	Ethyl Ether	60-29-7	kg/yr	14.73	42.09
	Ethylene Dichloride	107-06-2	kg/yr	0.43	1.24
	Hexane (other isomers)* or n-Hexane	110-54-3	kg/yr	0.46	1.32
	Isopropyl Alcohol	67-63-0	kg/yr	9.92	28.34
	Methyl Alcohol	67-56-1	kg/yr	14.43	41.24
	Methyl Ethyl Ketone (MEK)	78-93-3	kg/yr	2.26	6.46
	Morpholine	110-91-8	kg/yr	0.35	1.00
	n,n-Dimethylformamide	68-12-2	kg/yr	6.65	19.01
	Nitric Acid	7697-37-2	kg/yr	4.55	13.00
	Pentane (all isomers)	109-66-0	kg/yr	0.44	1.26
	Propyl Alcohol	71-23-8	kg/yr	0.14	0.40
	Sulfuric Acid	7664-93-9	kg/yr	69.38	198.22
	tert-Butyl Alcohol	75-65-0	kg/yr	0.28	0.79
	Tetrahydrofuran	109-99-9	kg/yr	1.25	3.56
	Tungsten as W insoluble Compounds	7440-33-7	kg/yr	0.01	0.50
	VM & P Naphtha	8032-32-4	kg/yr	0.53	1.50
	Xylene (o-,m-,p-Isomers)	1330-20-7	kg/yr	0.91	2.59

Table A-14. Tritium Operations Air Emissions

KEY FACILITY	CHEMICAL NAME	CAS NUMBER	UNITS	2000 ESTIMATED AIR EMISSIONS	2000 USAGE
Tritium Operations	Propane	74-98-6	kg/yr	0.00	97.69

Table A-15. Waste Management Operations Air Emissions

KEY FACILITY	CHEMICAL NAME	CAS NUMBER	UNITS	2000 ESTIMATED AIR EMISSIONS	2000 USAGE
Waste Management Operations	Acetylene	74-86-2	kg/yr	0.00	2.64
	Aluminum numerous forms	7429-90-5	kg/yr	0.00	0.27
	Ammonium Chloride (Fume)	12125-02-9	kg/yr	0.25	0.71
	Antimony and Compounds, as Sb	7440-36-0	kg/yr	0.23	0.67
	Hydrogen Chloride	7647-01-0	kg/yr	3477.22	9934.93
	Hydrogen Fluoride, as F	7664-39-3	kg/yr	1.73	4.95
	Lead, el. & inorg. compounds, as Pb	7439-92-1	kg/yr	0.01	1.13
	Mercury numerous forms	7439-97-6	kg/yr	0.01	1.36
	Molybdenum	7439-98-7	kg/yr	0.36	1.02
	Naphthalene	91-20-3	kg/yr	0.18	0.50
	Nickel, metal (dust) or Soluble & Inorganic Comp.	7440-02-0	kg/yr	0.31	0.89
	Nitric Acid	7697-37-2	kg/yr	28.90	82.58
	Phenol	108-95-2	kg/yr	0.18	0.50
	Propane	74-98-6	kg/yr	0.00	35.52
	Selenium Compounds, as Se	7782-49-2	kg/yr	0.17	0.48
	Stoddard Solvent	8052-41-3	kg/yr	1.02	2.92
	Sulfuric Acid	7664-93-9	kg/yr	2.58	7.38
	Yttrium	7440-65-5	kg/yr	0.16	0.45



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