

# ENVIRONMENTAL PROGRAM INFORMATION

## Introduction

Lawrence Livermore National Laboratory is committed to operating in a manner that preserves the quality of the environment. The Environmental Protection Department (EPD) leads this effort in the areas of environmental compliance and accountability. This chapter begins with a brief description of LLNL's integrated Environment, Safety, and Health (ES&H) Management System, Work Smart Standards (WSS), and the missions and activities of EPD and its three divisions. Performance measures (PMs) used by the U.S. Department of Energy (DOE) to evaluate the Laboratory's environmental protection efforts are then summarized. The bulk of the chapter is devoted to an account of LLNL's activities and progress in waste minimization and pollution prevention in 2001. Following descriptions of current issues and actions in the environmental program arena, this chapter concludes with a brief discussion of spill response.

## Integrated Environment, Safety, and Health Management System

In accordance with the requirements of the University of California's (UC's) Prime Contract W-7405-ENG-48, Clause 6.7, LLNL has implemented an Integrated Safety Management System (ISMS). The LLNL ISMS is designed to ensure the systematic integration of ES&H considerations into management and work practices so that missions are accomplished safely. "Safety," used in

this context, is synonymous with environment, safety, and health to encompass protection of the public, workers, and the environment (including pollution prevention and waste minimization). The core requirements of ISMS are based on the DOE's Seven Guiding Principles and Five Core Functions.

The Seven Guiding Principles can be summarized as: (1) line management is responsible for ensuring the protection of employees, the public, and the environment; (2) clear roles and responsibilities for ES&H are established and maintained; (3) personnel competence is commensurate with their responsibilities; (4) resources are effectively allocated to address ES&H, programmatic, and operational considerations with balanced priorities;





(5) safety standards and requirements are established that ensure adequate protection of the employees, the public, and the environment; (6) administrative and engineering controls to prevent and mitigate ES&H hazards are tailored to the work being performed; and (7) operations are authorized.

The Five Core Functions that describe how LLNL manages and performs work are summarized as:

(1) define the scope of work; (2) identify and analyze the hazards associated with the work; (3) develop and implement hazards controls; (4) perform work within the controls; and (5) provide feedback on the adequacy of the controls for continuous improvement.

The implementation of a management system based on these principles and functions results in accountability at all levels of the organization, project planning with protection in mind, and excellence in program execution. The ISMS Program at LLNL employs a process of assessing hazards and the environmental implications of work; designing and implementing standards-based methods intended to control risks; and complying with applicable ES&H requirements. This process is implemented using a graded approach, which increases the level of risk management as hazards increase. The complete description of LLNL's ISMS can be found in *Integrated Safety Management System Description* (Clough 2000). This description was most recently revised in September 2001, to incorporate references to the National Nuclear Security Administration and add clarity to the document.

DOE initiated a verification review of LLNL's implementation of ISMS on November 29, 1999, and the results of the verification were presented on December 9, 1999. DOE recommended approval of the LLNL ISMS description after the

completion of several action items. The Verification of the LLNL Institutional ISMS was successfully completed in September 2000.

## Work Smart Standards

Work Smart Standards (WSS) are an integral part of an ISMS, whereby safety professionals identify ES&H hazards and establish standards of operation appropriate for a particular work environment.

The WSS process requires an understanding of the work, an analysis of the hazards associated with the work, and the selection of standards from which hazard controls are developed. This process empowers the Laboratory and the local DOE staff, through consensus, to focus on the work being performed and to select sitewide ES&H standards based on the actual work being conducted and its associated hazards and threats to the environment.

WSS are approved at the management level closest to and with the most expertise in the work. The LLNL Director and DOE/OAK Manager approved the initial complete set of sitewide standards on August 5, 1999, after they were confirmed by an independent panel of external experts in March 1999.

The WSS set was essentially considered part of the UC contract once it was signed by the LLNL Director and the DOE/OAK Manager. Reaching these agreements with DOE on new work-based standards aligns the Laboratory with industry practice, establishes common ES&H expectations for DOE and UC, and facilitates the tailoring of requirements to streamline and increase the effectiveness of management at the Laboratory. LLNL's existing ES&H methodologies and documentation have been modified to incorporate the newly identified set of standards and to reflect the requirements of ISMS. These standards are continually reviewed and revised through the change



control process as either new DOE Orders are issued or regulations are adopted. In addition, the Laboratory undertakes periodic review of all the requirements to assure that the WSS set is current and complete.

The WSS set currently identified to satisfy the ES&H needs of the LLNL work environment are in the UC contract, Appendix G and can be viewed at: <http://labs.ucop.edu/internet/wss/wss.html>. The DOE orders applicable to the environment that are included in the WSS are listed in Appendix B of this report.

Meeting new expectations for integrated ES&H management at the Laboratory will take several years, but the WSS approach, coupled with enhanced, integrated management, continues to promise further safety improvements and lower costs.

## Environmental Protection Department

As the lead organization at LLNL for providing environmental expertise and guidance on operations at LLNL, EPD is responsible for environmental monitoring, environmental regulatory interpretation and implementation guidance, environmental restoration, environmental community relations, and hazardous waste management in support of the Laboratory's programs. EPD prepares and maintains environmental plans, reports, and permits; maintains the environmental portions of the *ES&H Manual*; informs management about pending changes in environmental regulations pertinent to LLNL; represents the Laboratory in day-to-day interactions with regulatory agencies and the public; and assesses the effectiveness of pollution control programs. These functions are organized into three divisions within

the department: Operations and Regulatory Affairs, Hazardous Waste Management, and Environmental Restoration.

EPD monitors air, sewerable water, groundwater, surface water, soil, sediments, vegetation, and foodstuff, as well as direct radiation; evaluates possible contaminant sources; and models the impact of LLNL operations on humans and the environment. In 2001, 30,736 samples were taken, and 242,418 analytes were tested. The type of samples collected at a specific location depends on the site and the potential pollutants to be monitored; see the specific chapters of this report for discussions of each environmental medium.

A principal part of EPD's mission is to work with LLNL programs to ensure that operations are conducted in a manner that limits environmental impacts and is in compliance with regulatory guidelines. EPD helps LLNL programs manage and minimize hazardous, radioactive, and mixed wastes; determines the concentrations of environmental contaminants remaining from past activities; cleans up environmental contamination to acceptable standards; responds to emergencies in order to minimize and assess any impact on the environment and the public; and provides training programs to improve the ability of LLNL employees to comply with environmental regulations.

LLNL programs are supported by the Hazards Control Department's five ES&H teams and by EPD's five environmental support teams (ESTs). The ESTs are integrated into the ES&H teams through environmental analysts, who also chair the ESTs. Each EST includes representatives from environmental specialties within the Operations and Regulatory Affairs Division (ORAD), the ES&H teams, and a field technician from the Hazardous Waste Management (HWM) Division. Some ESTs also include a representative from the Environmental Restoration Division (ERD) or the



organizations supported by the ESTs. These teams evaluate operations, determine potential environmental impacts, and provide guidance on environmental regulations and applicable DOE orders for existing and proposed projects. ESTs assist programs in planning, implementing, and operating projects and in understanding and meeting their environmental obligations. When permits are obtained from regulatory agencies, ESTs aid the programs in evaluating the permit conditions and implementing requirements.

### **Operations and Regulatory Affairs Division**

ORAD currently consists of seven groups that specialize in environmental compliance and monitoring and provide Laboratory programs with a wide range of information, data, and guidance to make more informed environmental decisions.

ORAD prepares the environmental permit applications and related documents for submittal to federal, state, and local agencies; provides the liaison between LLNL and regulatory agencies conducting inspections; tracks chemical inventories; prepares National Environmental Policy Act (NEPA) documents and conducts related field studies; oversees wetland protection and floodplain management requirements; coordinates cultural and wildlife resource protection and management; facilitates and provides support for the pollution prevention and recycling programs; teaches environmental training courses; coordinates the tank environmental compliance program; conducts compliance and surveillance monitoring; provides environmental impact modeling and analysis, risk assessment, and reporting; and develops new methods and innovative applications of existing technologies to improve environmental practices and assist LLNL in achieving its mission.

ORAD also actively assists in responding to environmental emergencies such as spills. During normal working hours, an environmental analyst from the ORAD Environmental Operations Group (EOG) responds to environmental emergencies and notifies a specially trained Environmental Duty Officer. Environmental Duty Officers are on duty 24 hours a day, 7 days a week, and coordinate emergency response with LLNL's ES&H team and other first responders or environmental specialists.

### **Hazardous Waste Management Division**

All hazardous, radioactive, medical, and mixed wastes generated at LLNL facilities are managed by the HWM Division in accordance with local, state and federal requirements. HWM processes, stores, packages, solidifies, treats, and prepares waste for shipment and disposal, recycling, or discharge to the sanitary sewer.

As part of its waste management activities, HWM tracks and documents the movement of hazardous, mixed, and radioactive wastes from waste accumulation areas (WAAs), which are located near the waste generator, to final disposition; develops and implements approved standard operating procedures; decontaminates LLNL equipment; ensures that containers for shipment of waste meet the specifications of the U.S. Department of Transportation (DOT) and other regulatory agencies; responds to emergencies; and participates in the cleanup of potential hazardous and radioactive spills at LLNL facilities. HWM prepares numerous reports, including the annual and biennial hazardous waste reports required by the state and federal environmental protection agencies (see Appendix C). HWM also prepares waste acceptance criteria documents, safety analysis reports, and various waste guidance and management plans.

HWM meets regulations requiring the treatment and disposal of LLNL's mixed waste in accordance with the requirements of the Federal Facility Compliance Act. The schedule for this treatment is negotiated with the State of California and involves developing new on-site treatment options as well as finding off-site alternatives.

HWM is responsible for implementing a program directed at eliminating the backlog of legacy waste (waste that is not at present certified for disposal). This effort includes a large characterization effort to identify all components of the waste and a certification effort that will provide appropriate documentation for the disposal site.

### **Environmental Restoration Division**

ERD was established to evaluate and remediate soil and groundwater contaminated by past hazardous materials handling and disposal processes and from leaks and spills that have occurred at the Livermore site and Site 300, both prior to and during LLNL operations. ERD conducts field investigations at both the Livermore site and Site 300 to characterize the existence, extent, and impact of contamination. ERD evaluates and develops various remediation technologies, makes recommendations, and implements actions for site restoration. ERD is responsible for managing remedial activities, such as soil removal and groundwater extraction, and for assisting in closing inactive facilities in a manner designed to prevent environmental contamination.

As part of its responsibility for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) compliance issues, ERD plans, directs, and conducts assessments to determine both the impact of past releases on the environment and the restoration activities needed to reduce contaminant concentrations to protect human health and the environment. ERD interacts

with the community on these issues through Environmental Community Relations. Public workshops are held each year and information is provided to the public as required in the ERD CERCLA Community Relations Plans.

To comply with CERCLA groundwater remedial actions at the Livermore site, ERD has to date designed, constructed, and operated 5 fixed groundwater treatment facilities and associated pipeline networks and wells, 20 portable groundwater treatment units, 2 catalytic dehalogenation units, and 3 soil vapor extraction facilities (see Chapter 8). In 2001, ERD operated 4 fixed, 19 portable, 2 catalytic reductive dehalogenation, and 2 soil vapor treatment units. ERD also installed an electroosmosis system to improve its ability to remove contaminants from fine grained sediments. At Site 300, ERD has designed, constructed, and operated 3 soil vapor extraction facilities and 11 groundwater extraction and treatment facilities. In addition, ERD has capped and closed 4 landfills and the High Explosives Rinse Water Lagoons and Burn Pits, excavated and closed numerous waste water disposal sumps, and removed contaminated waste and soil to prevent further impacts to groundwater at Site 300.

ERD is actively designing, testing, and applying innovative remediation and assessment technologies to contaminant problems at the Livermore site and Site 300. ERD provides the sampling and data management support for groundwater surveillance and compliance monitoring activities.

### **Environmental Training**

The LLNL Environmental Protection Training Program (EPTP) provides Laboratory workers the appropriate training support to assure that they have the knowledge, skills, and abilities to competently, safely, and effectively carry out the job-related environmental protection responsibilities of



their work assignments. In 2001, EPTP provided nearly 9000 hours of environmental protection training to Laboratory workers involved in science related work at LLNL. EPTP also provided an additional 3000 hours of specialized training to LLNL environmental professionals involved with the management of waste and other environmental protection activities. The environmental training developed and delivered to Laboratory workers during 2001 addressed the requirements of the National Environmental Policy Act, the Resource Conservation and Recovery Act, the Superfund Amendment and Reauthorization Act, the Occupational Safety and Health Administration and other Federal and California State regulatory requirements. Training subjects included hazardous waste management; low-level waste generation and certification; transuranic waste generation and certification; spill prevention, control, and countermeasures; pollution prevention; and other similar environmental protection related topics.

The EPTP staff is supported in the development and delivery of training by environmental protection subject matter experts (SMEs) from the three EPD divisions. In close coordination, the divisions provide the assessment and interpretation of training to be given to Laboratory workers and to internal department environmental protection specialists. In addition, the divisions supply SMEs and personnel who are trained and qualified to be instructors for the EPTP.

The EPTP staff consists of training professionals and technical and administrative personnel familiar with the various environmental regulations and requirements and cognizant in Laboratory operations requiring environmental protection training.

## Performance Measures Summary

Since 1992, UC's contract to manage and operate LLNL for DOE has contained performance objectives, criteria, and measures. Four of these performance measures (PMs) are used to evaluate LLNL's environmental protection activities, and four are used to evaluate LLNL's environmental restoration and waste management activities.

At the end of 2001, DOE gave LLNL an average score of excellent for its environmental performance and an average score of outstanding for its environmental restoration and waste management performance (DOE 2001). DOE scores for individual performance measures are shown in [Table 3-1](#).

## DOE Pollution Prevention Goals

In a memo dated November 12, 1999, the Secretary of Energy issued a new and challenging set of pollution prevention and energy efficiency (P2/E2) goals for the DOE Complex in response to the President's Executive Orders for Greening the Federal Government. The DOE P2/E2 Leadership goals, presented in [Table 3-2](#), have expanded the scope of the P2 goals in place during the 1990s by including the following: building and facility energy efficiency; reduction of releases of toxic chemicals, ozone-depleting substances, and green-house gases; increased vehicle fleet efficiency and use of alternative fuels; and the required purchasing of environmentally preferable products and services. The new P2/E2 goals continue to use 1993 as a baseline for waste reduction goals and have interim measurement points in 2005 and 2010.



**Table 3-1. UC Contract 48 environmental protection performance measures for environmental performance in FY2001**

PM designator	Performance measure synopsis	Location in <i>Environmental Report</i>	Score
<b>Performance Area: Environment, Safety, and Health</b>			
1.2.b	Radiation dose to the public Public radiation doses to the maximally exposed individual from DOE operations will be measured or calculated and controlled to ensure that doses are kept as low as reasonably achievable (ALARA).	Chapter 13, Radiological Dose Assessment, section on Results of 2001 Radiological Dose Assessment Chapter 2, Compliance Summary, section on National Emission Standards for Hazardous Air Pollutants, Radionuclides	Outstanding
1.2.f	Waste reduction and recycling) The Laboratory continues to progress toward meeting the DOE pollution prevention goal for the year 2005.	Chapter 3, Environmental Program Information, section on Waste Minimization/Pollution Prevention	Excellent
1.2.g	Environmental violations The rate of validated environmental violations, determined from inspections and reporting requirements from regulatory agencies is kept low.	Chapter 2, Compliance Summary, <b>Tables 2-5 and 2-10</b>	Marginal
1.2.h	Environmental releases The Laboratory controls and reduces the number of occurrences of environmental releases and the number of releases that result in violations.	Chapter 2, Compliance Summary, <b>Table 2-10</b>	Excellent
<b>Performance Area: Environmental Restoration and Waste Management</b>			
1.1.a	Waste management productivity The Laboratory will collect data on the volume of waste received and volume of waste shipped	Chapter 3, section on Hazardous Waste Management Division	Outstanding
1.1.b	Waste Management Treatment and Disposal The Laboratory will reduce low-level and mixed waste inventories through treatment and disposal activities.	Chapter 3, section on Hazardous Waste Management Division	Outstanding
1.1.c	Legacy Waste Management The Laboratory will reduce the legacy waste low-level and mixed waste inventories through treatment and disposal activities.	Chapter 3, section on Hazardous Waste Management Division	Excellent
1.3.a	Environmental Restoration The performance indicator is the ratio of the total contaminant mass removed divided by total budget dollars to the baseline total contaminant mass removed divided by baseline total budget dollars.	Chapter 2, Compliance Summary, section on Comprehensive Environmental Response, Compensation and Liability Act Chapter 8, Groundwater Investigation and Remediation	Outstanding


**Table 3-2. Pollution prevention and energy efficiency leadership goals at Department of Energy facilities**

Goal <sup>(a)</sup>	Detail
Reduce Waste and Recycling	Reduce waste from routine operations by 2005, using a 1993 baseline, for these waste types: Hazardous by 90% Low Level Radioactive by 80% Low Level-Mixed Radioactive by 80% Transuranic (TRU) by 80%
	Reduce releases of toxic chemicals subject to Toxic Chemical Release Inventory reporting by 90% by 2005, using a 1993 baseline.
	Reduce sanitary waste from routine operations by 75% by 2005 and 80% by 2010, using a 1993 baseline.
	Recycle 45% of sanitary wastes from all operations by 2005 and 50% by 2010.
	Reduce waste resulting from cleanup, stabilization, and decommissioning activities by 10% on an annual basis.
Buy Items with Recycled Content	Increase purchases of EPA-designated items with recycled content to 100%, except when not available competitively at a reasonable price or that do not meet performance standards.
Improve Energy Usage	Reduce energy consumption through life-cycle cost effective measures by: 40% by 2005 and 45% by 2010 per gross square foot for buildings, using a 1985 baseline 20% by 2005 and 30% by 2010 per gross square foot, or per other unit as applicable, for Laboratory and industrial facilities, using a 1990 baseline.
	Increase the purchase of electricity from clean energy sources: (a) Increase purchase of electricity from renewable energy sources by including provisions for such purchase as a component of our requests for bids in 100% of all future DOE competitive solicitations for electricity. (b) Increase the purchase of electricity from less greenhouse gas-intensive sources including, but not limited to, new advanced technology fossil energy systems, hydroelectric, and other highly efficient generating technologies.
Reduce Ozone Depleting Substances and Greenhouse Gases	Retrofit or replace 100% of chillers greater than 150 tons of cooling capacity and manufactured before 1984 that use class I refrigerants by 2005.
	Eliminate use of class I ozone depleting substances by 2010, to the extent economically practicable, and to the extent that safe alternative chemicals are available for DOE class I applications.
	Reduce greenhouse gas emissions attributed to facility energy use through life-cycle cost-effective measures by 25% by 2005 and 30% by 2010, using 1990 as a baseline.
Increase Vehicle Fleet Efficiency and Use of Alternative Fuels	Reduce our entire fleet's annual petroleum consumption by at least 20% by 2005 in comparison to 1999, including improving the fuel economy of new light duty vehicle acquisitions and by other means.
	Acquire each year at least 75% of light duty vehicles as alternative fuel vehicles, in accordance with the requirements of the Energy Policy Act of 1992.
	Increase usage rate of alternative fuel in departmental alternative fuel vehicles to 75% by 2005 and 90% by 2010 in areas where alternative fuel infrastructure is available.

a From DOE P2/E2 leadership goals, dated November 12, 1999





The DOE P2/E2 Leadership Goals are set to establish a Department-wide achievement standard. DOE field offices, such as the Oakland Field Office, have the responsibility to adapt, develop and incorporate these goals into annual performance agreements for each of their sites. For LLNL, DOE P2/E2 goals for routine hazardous, low-level radioactive and mixed waste are part of the UC Contract performance measures (designator 1.2.f). The LLNL performance measure for sanitary waste differs from the DOE P2/E2 goal, which states that 45% of sanitary wastes from all operations will be recycled by 2005 and 50% by 2010. LLNL performance measures apply only to routine waste. When the DOE P2/E2 goals were established, LLNL already recycled/diverted greater than 45% of routine wastes. Hence the LLNL performance measure goal was set at achieving a diversion of 66.7% of sanitary wastes by 2005.

## Pollution Prevention Reporting

UC contract performance measure 1.2.f requires LLNL to provide an annual review of its waste generation. The review focuses on pollution prevention opportunities and proposes implementation projects.

During 2001, the LLNL P2 staff completed the *1999 Comprehensive Opportunity Assessment for Pollution Prevention, Energy Efficiency, and Water Conservation at Lawrence Livermore National Laboratory, Livermore Site*. The report was submitted to DOE Oakland Operations Office in January 2002. The report identified and cataloged opportunities for pollution prevention throughout the Livermore site using fiscal year 1999 data from routinely generated hazardous, mixed, and radioactive waste; nonhazardous solid waste; and industrial solid waste databases. The report recorded previously evaluated alternatives and current or planned programs for particular waste streams and potential projects in the energy efficiency and water conservation areas. It differed from the previous *1997*

*Comprehensive Opportunity Assessment* (Celeste 1998) report by reviewing only routinely generated wastes.

In February 2001, LLNL submitted the *LLNL Report on Pollution Prevention and Energy Efficiency Leadership Goals*. The report outlines how LLNL intends to accomplish the DOE P2/E2 goals identified by the Secretary of Energy. The P2/E2 report also outlined the resources needed to reach the goals. This report took the place of the required triennial P2 Plan.

In November 2001, LLNL submitted to the DOE Oakland Office the *Fiscal Year (FY) 2001 Annual Report on Waste Generation and Pollution Prevention Progress*. The report outlined waste generation data for FY 2001 and made a progress report for the ongoing pollution prevention activities on site.

## Waste Minimization/Pollution Prevention

The P2 Program at LLNL strives to systematically reduce solid, hazardous, radioactive, and mixed-waste generation and eliminate or minimize pollutant releases to all environmental media from all aspects of the site's operations. These efforts help protect public health and the environment by reducing or eliminating waste management and compliance costs, improving resource usage, reducing inventories and releases of hazardous chemicals, and minimizing civil and criminal liabilities under environmental laws. In accordance with EPA guidelines and DOE policy, the P2 Program uses a hierarchical approach to waste reduction (i.e., source elimination or reduction, material substitution, reuse and recycling, and treatment and disposal) applied, where feasible, to all types of waste.

The P2 staff tracks waste generation using the HWM Division's Total Waste Management System (TWMS) database.



By reviewing this database, the P2 staff can monitor waste streams for pollution prevention purposes. With the purpose to track and report waste minimization/pollution prevention efforts, LLNL compares waste generation against the baseline year, 1993, waste generation quantities.

**Table 3-3** presents the routine waste generation for 1993 baseline year and for 2001; it provides a calculation of percent reductions in routine waste generation. In 2001, LLNL revised the method by which it calculates waste generated for the purposes of tracking and reporting on pollution prevention efforts. The reported waste quantities for hazardous waste, low-level mixed waste, and low-level radioactive waste now include wastes that were shipped off site, those treated and sewerred on site as well as 50% of wastes that were recycled on site. Rather than counting 100% of waste that is recycled as waste generated, 50% of waste recycled on site is counted towards waste generated to encourage on-site recycling. HWM generated wastes are excluded now since they are generated as a result of waste management activities. Previously, reported waste quantities excluded waste treated and sewerred, and recycled, and it included wastes generated at HWM.

To incorporate the new waste generation calculations in the baseline year, the baseline quantities have been increased by the percent change observed in actual 2000 waste generation quantities. The baseline quantities were previously calculated by excluding the treated and sewerred and recycled wastes.

### Nonhazardous Solid Waste Minimization

LLNL changed the method by which routine sanitary waste generation is calculated in FY 2001. The amount of sanitary waste generated now includes the wastes that are disposed at landfill and wastes that are diverted. In this category, LLNL has two goals; one is to reduce the routine sanitary waste generation, and the other is to increase the routine sanitary waste diversion.

LLNL's goal is to reduce the generation of routine sanitary waste by 75% of the 1993 baseline year and to do so by year 2005. LLNL generated 4666.9 metric tons of routine sanitary waste in FY 2001, a 21% reduction since 1993. In addition, LLNL generated 10,185.9 metric tons of nonroutine sanitary waste. Nonroutine sanitary wastes include wastes from construction, and decontamination and demolition activities.

**Table 3-3. Routine waste reduction, FY 2001**

Waste category	1993 (baseline)	FY 2001	Reduction 2001 vs. 1993 (%)
Low-level radioactive	346.0 m <sup>3</sup>	267.1 m <sup>3</sup>	23
Mixed	26.2 m <sup>3</sup>	22.6 m <sup>3</sup>	14
Hazardous	1054 MT <sup>(a)</sup>	373.0 MT	65
Sanitary	5873 MT	4666.9 MT	21

Note: In 2001 the units for reporting low-level radioactive and mixed waste became cubic meters and hazardous and sanitary waste became metric tons, consistent with DOE P2 reporting. These units will be used in future UC performance measure reporting.

a MT = metric tons

In FY 2001, the portion of sanitary waste sent to landfill was 4819.8 metric tons. The routine portion was 1825.2 metric tons and the nonroutine portion was 2994.6 metric tons. The breakdown for routine and nonroutine waste is shown in [Table 3-4](#).

**Table 3-4. Total nonhazardous waste sent to landfills, FY 2001**

Nonhazardous waste	2001 total (metric tons)
<b>Routine</b>	
Compacted	1630.2
Industrial (TWMS) <sup>(a)</sup>	195
Routine subtotal	1825.2
<b>Nonroutine</b>	
Construction demolition (noncompacted)	2911.2
Industrial (TWMS)	83.4
Nonroutine subtotal	2994.6
<b>LLNL total</b>	<b>4819.8</b>

<sup>a</sup> TWMS = Total Waste Management System

### Diverted Waste

According to its management contract with UC, LLNL's goal is to divert 66.7% of its annual routine nonhazardous waste generated. LLNL diverted 2848.0 metric tons of routine nonhazardous waste in 2001. This represents a diversion rate of 61% of routine nonhazardous waste in 2001. The total routine and nonroutine waste diverted from landfills in 2001 was 10,038.4 metric tons.

[Table 3-5](#) shows a breakdown of waste diversion categories for 2001, reflecting the variety of diversion programs in place at LLNL. Soil, a major contributor to diversion totals, is reused both on site and at the landfill for daily cover. Asphalt and concrete are reused as road base material at the landfill. No cost-effective on-site reuse strategy for wood waste (created by broken pallets, shipping crates, and demolition or construction scrap) is

available, so LLNL gathers this waste in a collection yard for recycling by a vendor at a cost lower than that of other disposal alternatives. Intact pallets and other reusable wood remain on site for internal reuse.

**Table 3-5. Diverted waste summary, FY 2001**

Waste description	Cumulative 2001 total (metric tons)
Asphalt/concrete	2,800.5
Batteries	18.9
Cardboard	130.0
Compost	466.3
Cooking grease/food	4.4
Diverted soil	4,332.6
Miscellaneous	57.3
Magazines, newspapers, and phone books	27.6
Metals	1,449.36
Paper	262.2
Tires and scrap	24.2
Toner cartridges	1.7
Wood	443.0
Beverage and food containers	20.3
<b>LLNL diversion total</b>	<b>10,038.4</b>

Composting of landscape clippings from the site's lawns, trees, shrubs, and annual plantings provides another waste diversion method. LLNL uses properly aged compost on site as a soil amendment. By generating its own soil builders, LLNL benefits twice: by eliminating an organic waste stream (with no tipping fees or hauling required) and by saving the purchase cost of new material. In one activity



that both reduces waste and helps conserve water, gardeners chip office Christmas trees at the end of the holiday season to create mulch that is used year-round, reducing the amount of dry-season irrigation necessary in tree wells.

Another well-developed and highly visible component of the LLNL recycling effort is the office paper collection and reclamation project. The Laboratory operates a full-site program, with more than 122 facility collection points. Unclassified paper, including newspapers and magazines, is transported to a contract firm, where it is shredded and recycled. Classified paper is preprocessed at the Livermore site using a hammer mill destruction process. These items would otherwise contribute to the solid waste stream.

LLNL continues to look for diversion opportunities. A beverage container recycling program initiated in late 1999 was increasingly successful in 2001. This program, which serves all three on-site cafeterias, collected 20.3 metric tons of aluminum, glass, and plastic containers and steel food cans, which were taken off site for recycling by a local vendor.

### **Source Reduction and Pollution Prevention**

Efforts to identify and implement pollution prevention measures are carried out both by LLNL P2 staff and individuals within the different directorates. Some examples include the Defense Nuclear Technologies Program's Contained Firing Facility at Site 300 that moves explosive tests inside a facility where the debris is contained, the Laser Program's efforts to design the National Ignition Facility to have minimal environmental impact, Engineering's Metal Finishing Group's continuing efforts to reduce waste and substitute less

hazardous chemicals in many of its processes, and the Education Program's efforts to enhance environmental education.

During 2001 a number of directorates were recognized for implementing pollution prevention measures within their operations through nominations for DOE Oakland Operations Office P2 Awards. These measures are summarized in [Table 3-6](#).

### **Current Return-on-Investment Projects**

The DOE funds P2 projects through the High-Return-on-Investment (ROI) P2 Program. LLNL prepared and received funding for five high ROI P2 project proposals in 2001. High ROI projects that received funding during this time period are listed in [Table 3-7](#).

### **Review of New Processes or Experiments**

Many organizations at LLNL use a "front-end" review process that applies to new programs, projects, or experiments that could have a significant impact on the environment. In this review, hazardous materials projected to be used are identified and wastes expected to be generated are estimated. The possibilities for chemical substitution, process changes, and recycling are then addressed. Researchers and project managers are encouraged to implement reasonable P2 opportunities that have been identified.

### **Design for Environment**

Design for environment is a concept that involves developing an understanding of potential environmental impacts over the lifetime of a project, with the goal of minimizing or mitigating those potential impacts through modifications to the project at the design stage.

**Table 3-6. P2 Award Nominations**

LLNL organization	Nomination title/description
Business Services Department—Fleet Management	Implementation of Pollution Prevention Practices at LLNL's Fleet Maintenance Facility
Chemistry & Materials Science Operations	Donation of Excess Laboratory Glassware to Local High Schools
Chemistry & Materials Science Operations	<i>Take-back/buy-back of AVLIS chemicals, materials and equipment</i> —This nomination recognized efforts made to identify parties to either take-back, buy-back, or reuse excess chemicals, materials and equipment, preventing the need for their disposal.
DNT	<i>Contained Firing Facility</i> —This facility supports P2 by reducing the quantities of wastes generated during explosive tests.
DNT	<i>Site 300 Firing Tables</i> —This project substituted reusable steel firing tables instead of wood to minimize waste.
DNT	<i>Tritium recovery and reuse</i> —LLNL's Tritium Facility is recovering tritium from field devices. In addition to providing tritium for reuse by the DOE complex, the U.S. government benefits by realizing a waste avoidance of approximately 7 tons of radioactive waste.
EPD-ERD	<i>Specific Depth Ground Water Sampling</i> —Achieves waste minimization through improved groundwater sampling techniques
EPD-ERD	<i>Application of Passive Above Ground Iron Filings Ground Water Treatment System</i> —Achieves significant reduction in the volume of waste generated at ground water treatment facilities treatment
EPD-ERD	<i>Removing Nitrate and Perchlorate from Ground Water Using a Containerized Wetland System</i> —Reduces in the volume of treatment waste generated by a groundwater treatment system
NIF	<i>Incorporation of P2/E2 in Aqueous Parts Cleaning of Optics Hardware</i> —This nomination recognized the efforts of the teams responsible for the design and implementation of a large aqueous parts cleaner in the NIF Optics Assembly Building

**Table 3-7. High return-on-investment projects, 2001**

Operation	Project
Water Recovery/Drain Down System (FY2001)	This project funded the purchase and conversion of a water-tank trailer to facilitate removal, storage and replacement of chiller water during maintenance operations
Installation of Powder Coating Facilities to replace VOC-containing spray paints at Building 418 (FY2001)	This project funded the installation of powder coating equipment/facilities to replace spray painting operations which involve the use of VOC-containing paints at Building 418.
Aqueous Parts Washer at Building 611 (FY2001)	This project funded the installation of an aqueous spray cabinet washer in the Business Services Automotive Shop at Building 611. This Cabinet Washer will replace some varieties of solvent based cleaning and reduce human exposure and atmospheric release of associated VOCs.
Vehicle Car Wash Recycling System (FY2001)	This project will facilitate the recycling / reuse of vehicle car wash water and will yield savings in water and cleaning chemical consumption.
Photovoltaic Demonstration Project (FY2001)	This project will include the purchase and installation of several configurations of photovoltaic panels, power collection wiring, electric power inverter and grid connection in the vicinity of the LLNL Visitor's Center

In 1997, the Pollution Prevention Team and National Ignition Facility (NIF) project management completed a design-for-environment evaluation of the opportunities within the NIF project. Based on this evaluation, the Laboratory implemented recycling programs during NIF construction, prepared a Pollution Prevention Plan for NIF, and implemented aqueous cleaning concepts in the design for parts and optics cleaning.



The *NIF Pollution Prevention and Waste Minimization Plan* (Cantwell and Celeste 1998), which was completed in 1998, included pollution prevention opportunity assessments (PPOAs) on the predicted waste streams identified in the preliminary environmental impact statement. In 2000, a follow up document was completed, the *NIF Pollution Prevention and Waste Minimization 2000 Supplement*, which updated the PPOAs as needed, accounting for two years of design progress and process development. This work continues with the aim of developing and implementing waste minimization options before NIF becomes operational.

## Implementing P2 Employee Training and Awareness Programs

General P2 awareness for LLNL employees is promoted through new employee training and orientation, posters, articles in *Newsline* (LLNL's weekly newspaper), and administrative briefings and memos. P2 information directed at technical employees is found in Document 30.1 of the *ES&H Manual* and is covered in the EPD training course *Hazardous Waste Generation and Certification*. This information is also disseminated to employees at conferences and workshops, and by making formal presentations to groups such as the ES&H Working Group's Environmental Subcommittee.

## ChemTrack

ChemTrack, a computerized chemical inventory and material safety data sheet (MSDS) management system, is designed to ensure that LLNL complies with the Superfund Amendment and Reauthorization Act (SARA) Title III and California Business Plan reporting requirements. In addition, it serves to enhance the overall management of hazardous materials through tracking of specific high-hazard chemicals and other regulated

substances, facilitating chemical sharing, improving emergency response capabilities, and assisting in the preliminary hazard analyses for LLNL facilities. ChemTrack currently contains records of approximately 166,000 chemical containers ranging from 210-L (55-gal) drums to gram-quantity vials.

## Response to Spills and Other Environmental Emergencies

All spills and leaks (releases) at LLNL that are potentially hazardous to the environment are investigated and evaluated. The release response process includes identifying the release, shutting off the source (if it is safe to do so), eliminating ignition sources, contacting appropriate emergency personnel, cordoning off the area containing the released material, absorbing and neutralizing the released material, assisting in cleanup, determining if a release must be reported to regulatory agencies, and verifying that cleanup (including decontaminating and replenishing spill equipment) is complete. Environmental analysts provide guidance to the programs on preventing spill recurrence.

To maximize efficient and effective emergency environmental response, EPD established a 7-day-a-week, 24-hour-a-day, on-call rotational position entitled the Environmental Duty Officer (EDO). Specialized EDO training includes simulated incidents to provide the response personnel with the experience of working together to mitigate an environmental emergency, determine any reporting requirements to regulatory agencies and DOE, and resolve environmental and regulatory issues within the LLNL emergency response organization. The on-duty EDO can be reached by pager or cellular phone at any time.

During normal work hours, Laboratory employees report all environmental incidents to the Environmental Operations Group (EOG) environmental analyst assigned to support their program area. The





EOG environmental analyst then notifies the on-duty EDO of the incident, and together they determine applicable reporting requirements to local, state, and federal regulatory agencies and to DOE. The EDO and the EOG environmental analyst also notify and consult with program management and have 7-day-a-week, 24-hour-a-day access to the office of Laboratory Counsel for questions concerning regulatory reporting requirements.

During off hours, Laboratory employees report all environmental incidents to the Fire Dispatcher, who, in turn, notifies the EDO and the Fire Department, if required. The EDO then calls out additional EPD support to the incident scene as necessary, and follows the same procedures as outlined above for normal work hours.

## **LLNL's Other Environmental Programs**

Integral to LLNL's environmental efforts is the ongoing research and development activities of the Energy and Environment Directorate. This directorate conducts multidisciplinary research to understand the processes by which human activities impact the environment, to assess and mitigate environmental and human risk from natural and man-made hazards and to develop and demonstrate new tools and technologies for environmental restoration. This work primarily involves state-of-the-art groundwater modeling and advanced hydrogeologic tracer studies; in situ environmental remediation using natural and engineered processes; pathway, dosimetry, and risk analysis of radioactive and toxic substances; atmospheric dispersion modeling and dynamics; subsurface imaging and characterization; and seismic processes.

LLNL has implemented a specialized Space Action Team (SAT) for the decommissioning and demolishing of facilities. The SAT has implemented a systematic approach that evaluates all ES&H aspects in order to assure releases, waste generation and personnel exposures are minimized, while regulatory compliance and opportunities for recycling are maximized.

## **Contributing Authors Acknowledgment**

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