

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) supports this effort in the areas of environmental compliance and accountability. This chapter begins with a brief description of LLNL's Integrated Safety Management System (ISMS), 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 LLNL's environmental protection efforts are then summarized. The majority of the chapter then describes LLNL's activities and progress in waste minimization and pollution prevention in 2002. This chapter concludes with a brief discussion of spill response and other environmental programs at LLNL.

Integrated Safety 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) ES&H 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 and environmental aspects associated with the work; (3) develop and implement hazard and aspect 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 description of LLNL's ISMS was initially provided in *Integrated Safety Management System Description* (Clough 2000); the most recent version of the document dated April 9, 2003 (UCRL-AR-132791, Version 6) can be found at the following website:
http://www.llnl.gov/es_and_h/ism/ism-descriptionv6.pdf.

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.

In June 2002, the DOE conducted an independent oversight inspection of safety and emergency management. LLNL's ES&H Program was characterized as a comprehensive Environmental Management System (EMS) program and the environmental element of the program was rated as "Effective Performance."

Work Smart Standards

Work Smart Standards (WSS) are an integral part of an ISMS, whereby ES&H professionals identify hazards and environmental aspects, 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 and the environmental aspects associated with the work, and the selection of standards from which hazard and aspect controls are developed. This process empowers LLNL 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 LLNL 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 LLNL. LLNL's existing ES&H methodologies and documentation have been modified to incorporate the 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. The change control process is managed by the Change Control Board (CCB) with representatives from DOE, UC, and LLNL. In addition, LLNL undertakes periodic review of all the requirements to assure that the WSS set is current and complete.

On January 15, 2003, the DOE issued Order 450.1, "Environmental Protection Program," which requires DOE sites to implement an EMS integrated into their ISMS. The purpose of Order 450.1 is to align the DOE's system for environmental protection with the requirements of Executive Order 13148, "Greening the Government Through Leadership in Environmental Management." In February 2003, the CCB constituted a Standards Identification Team for the purpose of considering the adoption of in whole or part the Contractor Requirements Document of Order 450.1. This process will result in the consideration of all or parts of Order 450.1 for incorporation into the contract as necessary and sufficient under LLNL's current integrated ES&H management system.

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.

The WSS approach, coupled with enhanced, integrated ES&H management, continues to promise further safety and environmental improvements at 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 waste management in support of LLNL'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 LLNL 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, Radioactive and Hazardous Waste Management, and Environmental Restoration.

EPD monitors air, sewerable water, groundwater, surface water, soil, sediment, vegetation, and food-stuff, as well as direct radiation; evaluates possible contaminant sources; and models the impact of LLNL operations on humans and the environment. In 2002, 11,877 samples were taken, and 212,689 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 requirements. EPD helps LLNL programs manage and minimize hazardous, radioactive, and mixed wastes, as well as identify opportunities for pollution prevention, including minimization of nonhazardous waste; 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 the 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 Radioactive and Hazardous Waste Management (RHWM) 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 LLNL 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 environmental 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 (EDO). EDOs are on duty 24 hours a day,

7 days a week, and coordinate emergency response with LLNL's ES&H teams and other first responders and environmental specialists.

Radioactive and Hazardous Waste Management Division

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

As part of its waste management activities, RHWM tracks and documents the movement of hazardous, mixed, and radioactive wastes from waste accumulation areas, which are typically 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 and other regulatory agencies; responds to emergencies; and participates in the cleanup of potential hazardous and radioactive spills at LLNL facilities. RHWM prepares numerous reports, including the annual and biennial hazardous waste reports required by the state and federal environmental protection agencies. RHWM also prepares waste acceptance criteria documents, safety analysis reports, and various waste guidance and management plans.

RHWM 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.

RHWM 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 and soil vapor extraction and treatment, 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 regularly 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; 25 portable groundwater treatment units; 2 catalytic dehalogenation units; and 3 soil vapor extraction facilities (see [Chapter 8](#)). In 2002, ERD operated 27 groundwater treatment facilities and soil vapor treatment units. At Site 300, ERD has designed, constructed, and operated 11 extraction and treatment facilities; 8 of these extract and treat groundwater only and 3 extract and treat groundwater and soil vapor. In addition, ERD has capped and closed 4 landfills and the High Explosives Rinse Water Lagoons and Burn Pits, excavated and closed numerous wastewater 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 LLNL workers the appropriate training support to ensure 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 2002, EPTP provided nearly 12,000 hours of environmental protection training to LLNL workers involved in science related work at LLNL. EPTP also provided an additional 2000 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 LLNL workers during 2002 addressed the requirements of the NEPA, the Resource Conservation and Recovery Act, the Superfund Amendment and Reauthorization Act, the Occupational Safety and Health Administration and other federal and 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 consists of training professionals and technical and administrative personnel familiar with the various environmental regulations and requirements and cognizant in LLNL operations requiring environmental protection training. 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 LLNL 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.

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) have been used to evaluate LLNL's environmental protection activities, and four have been used to evaluate LLNL's environmental restoration and waste management activities.

For 2002, DOE gave LLNL an average score of excellent for its environmental protection performance and an average score of outstanding for its



environmental restoration and waste management performance. DOE scores for individual performance measures are shown in **Table 3-1**. New PMs are being implemented for FY 2003, which began October 1, 2002. These will be discussed in the 2003 environmental report.

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 pollution prevention (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.

The DOE P2/E2 Leadership Goals are set to establish a Department-wide achievement standard. DOE field offices, such as the Livermore Site Office, have the responsibility to adapt, develop, and incorporate these goals into annual performance agreements for their sites. For LLNL in FY 2002, DOE P2/E2 goals for routine hazardous, low-level radioactive and mixed waste are part of the UC Contract PM (1.2.f). The LLNL PM 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. In the case that a waste reduction goal had already been achieved at a specific DOE facility, guidance associated with the Secretary of Energy indicates that the DOE facility should pick a more progressive goal to encourage further development. Hence, the LLNL PM goal was set at achieving a diversion of 66.7% of sanitary wastes by 2005.

Pollution Prevention Reporting

UC contract PM 1.2.f requires LLNL to provide an annual review of its waste generation. The review focuses on P2 opportunities and proposes implementation projects. The Permits and Regulatory Affairs Group (PRAG) of ORAD provided PM data at the end of each of the first three quarters, which included projections for year-end waste generation totals. In October 2002, PRAG submitted the UC Performance Measure Report for 4th Quarter, 2002 to the LLNL UC/DOE Contract ES&H Compliance Manager, which included all cumulative waste generation data required for Reporting on Contract 48 PM 1.2.f. LLNL received an "Excellent" rating for progress towards meeting the waste reduction goals for 2005. Cumulative waste data for this report is found in **Table 3-3**.

In December 2002, LLNL submitted data for the *Fiscal Year (FY) 2002 Annual Report on Waste Generation and Pollution Prevention Progress*. The report outlined waste generation data for FY 2002 and provided a progress report for the ongoing P2 activities on site.



Table 3-1. UC Contract 48 environmental protection and environmental restoration and waste management performance measures, FY 2002^(a)

PM designator	Performance measure synopsis	Location in <i>Environmental Report</i>	Score
Performance Area: Environmental Protection			
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 2002 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 LLNL 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, Tables 2-3 and 2-8	Excellent
1.2.h	Environmental releases LLNL controls and reduces the number of occurrences of environmental releases and the number of releases that result in violations.	Chapter 2, Compliance Summary, Table 2-8	Outstanding
Performance Area: Environmental Restoration and Waste Management			
1.1.a	Waste management productivity LLNL will collect data on the volume of waste received and volume of waste shipped	Chapter 3, section on Radioactive and Hazardous Waste Management Division	Outstanding
1.1.b	Waste Management Treatment and Disposal LLNL will reduce low-level and mixed waste inventories through treatment and disposal activities.	Chapter 3, section on Radioactive and Hazardous Waste Management Division	Outstanding
1.2.a	Advancement of the Environmental Management Program LLNL will advance the state of the art technologies by implementing their usage at LLNL and other DOE sites.	Chapter 3, section on Environmental Protection Department Chapter 8, Groundwater Investigation and Remediation	Outstanding
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	Good

a FY 2002 is the DOE and LLNL fiscal year of October 1, 2001, to September 30, 2002.

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

Goal ^(a)	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 LLNL 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



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, improving resource usage, and reducing inventories and releases of hazardous chemicals. These efforts also benefit LLNL by reducing compliance costs and minimizing potential civil and criminal liabilities under environmental laws. In accordance with Environmental Protection Agency (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 RHWM Division's Total Waste Management System (TWMS) database. By reviewing this database, directorate managers and the P2 staff can monitor waste streams for P2 purposes. With the purpose to track and report waste minimization/P2 efforts, LLNL compares current waste generation against the baseline year, 1993, waste generation quantities. The routine waste generation for the 1993 baseline year and for 2002 and the percent reductions in routine waste generation since 1993 are presented in **Table 3-3**. Routine waste described in this table includes waste from normal (ongoing) operations produced by any type of production, analytical, and/or research and development laboratory operations. Periodic laboratory or facility clean-outs and spill cleanups which occur as a result of these processes are also considered normal operations. Since 2001, LLNL has revised the method by which it calculates waste

generated for the purposes of tracking and reporting on P2 efforts. The reason for this change is to include additional categories of wastes to better identify future P2 opportunities and to eliminate categories of wastes that would otherwise be counted twice under the new tracking system. The reported waste quantities for hazardous waste, low-level radioactive waste (LLW), and mixed low-level waste (MIXED) now include wastes that are shipped off site, waste treated and sewerered on site, as well as 50% of wastes that are 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.

The FY 2002 totals reported in the UC Performance Measures report for both LLW and MIXED were smaller than the FY 2001 totals and are indicative of progress towards the 2005 goals. The LLW total for FY 2002 actually meets the 2005 goal, which is 80% less than the FY 1993 baseline. The MIXED waste total represents a 57% reduction which is still short of the 80% goal for FY 2005. The hazardous waste total for FY 2002 is higher than it was FY 2001 and shows an increase in hazardous waste generation over the past two years. This increase is presently being reviewed and evaluated.

Nonhazardous Solid Waste Minimization

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

Table 3-3. Routine waste reduction, FY 2002

Waste category	1993 (baseline)	FY 2002	Reduction 2002 since 1993 (%)
Low-level radioactive	346 m ³	70 m ³	80
Mixed	26 m ³	11 m ³	57
Hazardous	1054 MT ^(a)	421 MT	60
Sanitary (nonhazardous solid waste)	5873 MT	5819 MT	1

a MT = metric tons

LLNL's goal is to reduce the generation of routine nonhazardous solid waste by 75% of the 1993 baseline year by year 2005. Together, the Livermore site and Site 300 generated 5819 metric tons of routine nonhazardous solid waste in FY 2002, a 1% reduction since 1993. This volume includes diverted waste (for example, material diverted through recycling and reuse programs) and landfill wastes.

LLNL generated 21,832 metric tons of nonroutine nonhazardous solid waste in FY 2002. This volume includes waste that is reused as cover soil at Class II landfills and through the nonroutine metals recycling programs. Nonroutine nonhazardous solid wastes include wastes from construction, and decontamination and demolition activities.

In FY 2002, the portion of nonhazardous waste sent to landfill was 5287 metric tons. The routine portion was 1803 metric tons and the nonroutine portion was 3484 metric tons. The breakdown for routine and nonroutine nonhazardous waste that was sent to landfills in FY 2002 is shown in

Table 3-4.

Diverted Waste

According to its management contract with UC, LLNL's goal for annual routine nonhazardous waste generated is to divert 66.7% of the 1993 base-

Table 3-4. Total nonhazardous waste sent to landfills, FY 2002

Nonhazardous waste	2002 total (metric tons)
Routine	
Compacted	1803
Nonroutine	
Construction demolition (noncompacted)	3282
Industrial (TWMS) ^(a)	202
Nonroutine subtotal	3484
LLNL total	5287

a TWMS = Total Waste Management System

line amount. Together the Livermore site and Site 300 diverted 4012 metric tons of routine nonhazardous waste in 2002. This represents a diversion rate of 69% of routine nonhazardous waste in FY 2002. This diversion rate includes waste recycled by RHW and waste diverted through the surplus sales and pipette box recycling programs. The total routine and nonroutine waste diverted from landfills in FY 2002 was 18,649 metric tons.

Table 3-5 shows a breakdown of waste diversion categories for FY 2002, reflecting the variety of diversion programs in place at LLNL. Soil, a major contributor to diversion totals, is reused both on site and at a landfill for daily cover. Asphalt and



concrete are reused as road base material at a land-fill. No cost-effective on-site reuse strategy for wood waste (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 2002

Waste description	Cumulative 2002 total (metric tons)
Asphalt/concrete	1,865.9
Batteries	21.6
Beverage and food containers	8.2
Cardboard	146.5
Compost	704.4
Cooking grease/food	2.8
Diverted soil (includes Class II Cover)	11,987.6
Magazines, newspapers, and phone books	30.4
Metals	1,290.1
Miscellaneous	1.6
Nonroutine metals	778.9
Paper	302.7
Pipette box recycling	1.0
RHWM recycled	234.1
Surplus sales	699.4
Tires and scrap	27.1
Toner cartridges	1.5
Wood	545.5
LLNL diversion total	18,649.3

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 in two ways: by eliminating an organic waste stream and associated tipping fees (hauling costs) and by saving the purchase cost of new material. In another 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. This practice also reduces 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. LLNL 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 FY 2002. This program, which serves all three on-site cafeterias, collected 8.2 metric tons of aluminum, glass, and plastic containers and steel food cans. The collected material was 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 and

Nuclear Technologies Program's Contained Firing Facility at Site 300 that moves explosive tests inside a facility where the debris is contained; the National Ignition Facility Programs' efforts to design the National Ignition Facility (NIF) to have minimal environmental impact; and the Education Program's efforts to enhance environmental education.

In the case of the Contained Firing Facility (CFF), new waste streams are being managed because the detonations are completely contained within the firing chamber and not open to the atmosphere as in the past. CFF is in the process of developing new operational source reduction measures. The net result will be greater protection for the environment and greater programmatic flexibility.

Current Return-on-Investment Projects

DOE has traditionally funded P2 projects through the High-Return-on-Investment (ROI) P2 Program. However, in FY 2002, ROI funding was severely limited. One new ROI project, an electric vehicle pilot program, was funded in FY 2002 (see [Table 3-6](#)). Other ROI-related work occurring in FY 2002 was associated with projects carried over from FY 2001 (also described in [Table 3-6](#)). The Water Recovery/Drain Down System project, funded in FY 2001, was the recipient of both a FY 2002 Federal Energy and Water Management Award, and a 2002 DOE Departmental Energy Management Award.

Review of New Processes, Programs, or Experiments

Whenever feasible, many organizations at LLNL will use a "front-end" review process for P2 opportunities of new programs, projects, or experiments that could have a significant impact on the environment. For small-scale activities, such a review includes an assessment of the hazardous materials

Table 3-6. High return-on-investment projects, FY 2002

Operation	Project ^(a)
Global Electric Motorcars (GEM) Pilot Study (FY 2002)	This project funded the purchase of a limited number of Daimler-Chrysler GEMs for a pilot study by the Fleet Management Group. The study, scheduled for early 2003, will evaluate the integration of electric vehicles into the LLNL fleet.
Water Recovery/Drain Down System (begun in FY 2001)	This project funded the purchase and conversion of a water-tank trailer to facilitate removal, storage and replacement of chiller water during maintenance operations. It received two federal water conservation awards.
Aqueous Parts Washer at Building 611 (begun in FY 2001)	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 Wash Water Recycling System (begun in FY 2001)	This project installed a wash water reclamation system at the LLNL Fleet Maintenance vehicle wash facility. The reclamation system conserves water, reduces the quantity of chemicals used for cleaning, and improves the trapping of oils and greases.
Photovoltaic (PV) Demonstration Project (begun in FY 2001)	This demonstration project installed three types of photovoltaic arrays at the LLNL Discovery Center to demonstrate different PV technologies and deployment scenarios.

a See [Acronyms and Abbreviations](#) for list of acronyms

to be used and estimate of the associated wastes. This allows possibilities for chemical substitution, process changes, and recycling to be addressed.



Once P2 opportunities are identified, researchers and project managers are encouraged to implement them to the extent practicable.

For large processes or new programs, a more extensive review using a tool such as Design for Environment (DfE) may be carried out. A DfE review involves developing an understanding of potential environmental impacts throughout the lifetime of a project (including construction, operations, and decommissioning life-cycle stages), with the goal of minimizing or mitigating those impacts by modifying the project design. The NIF is an example of a program that has successfully implemented a variety of options identified during a DfE review. Examples of these options include implementation of recycling programs during NIF construction, the design and use of aqueous cleaning systems for parts and optics used during NIF operations, and the implementation of a number of facility design features that will help minimize wastes when NIF is decommissioned.

Green building is another “front-end” concept that can be applied to new construction at LLNL. It emphasizes the design of buildings that are efficient in their use of materials, energy, and other natural resources throughout their life cycle, and incorporates consideration of human health, the natural environment, and the built environments of site and community. During 2002, EPD and Plant Engineering jointly sponsored a Leadership in Energy and Environmental Design training session to help familiarize staff from LLNL, Sandia/California, and Lawrence Berkeley National Laboratory (LBNL) with green building concepts.

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*. This information is also disseminated to employees by making informal and 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 identification 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 168,000 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. ORAD staff also provide guidance to the programs on preventing spill recurrence.

As previously described, the EDO is available 24 hours a day, 7 days a week to maximize efficient and effective emergency environmental response. 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, LLNL employees report all environmental incidents to the EOG staff, or 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, LLNL 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 are the ongoing research and development activities of the Chemistry and Materials Science Directorate and the Energy and Environment Directorate. These directorates conduct basic and applied 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 isotopic 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 also 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.

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