3. Environmental Program Information

LLNL is committed to enhancing its environmental stewardship and to reducing any impacts its operations may have on the environment. This chapter described the lead organizations that support the LLNL's environmental stewardship and describes LLNL's Environmental Management System (EMS) and Pollution Prevention (P2) program.

3.1 Environmental Protection Program

Three organizations lead the environmental protection program and provide environmental expertise to the Laboratory: Environmental Protection Department (EPD), Radioactive and Hazardous Waste Management (RHWM) Division and Environmental Restoration Department (ERD). Spill response is also a key component of environmental protection.

3.1.1 Environmental Protection Department

EPD is responsible for environmental monitoring and environmental regulatory interpretation and implementation guidance in support of LLNL's programs. EPD prepares and maintains environmental plans, reports, and permits; maintains the environmental portions of the *Environment, Safety, and Health* (*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; develops and provides institutional environmental training; and assesses the effectiveness of pollution control programs. 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 impact and that is in compliance with regulatory requirements. The EPD Department Head also serves as the LLNL EMS Coordinator and leads the EMS task force.

3.1.2 Radioactive and Hazardous Waste Management Division

RHWM manages all hazardous, radioactive, and mixed wastes generated at LLNL facilities 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 (WAAs), 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 (DOT) 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 in support of its mission including those required by regulation and various guidance and management plans.

RHWM meets regulations for the treatment of LLNL's mixed waste in accordance with the requirements of the FFCA. The schedule for this treatment is negotiated with California and involves developing new on-site treatment options as well as finding off-site alternatives.

3.1.3 Environmental Restoration Department

ERD evaluates and remediates soil and groundwater contaminated by past hazardous materials handling and disposal practices and from leaks and spills that have occurred at the Livermore site and Site 300 prior to and during LLNL operations. ERD conducts field investigations at both sites 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 decontamination, decommissioning, and demolition of closed facilities in a manner that prevents environmental contamination and completes the facility life cycle. As part of its responsibility for 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.

3.1.4 Response to Spills and Other Environmental Emergencies

LLNL has an active spill response program to investigate and evaluate all spills and leaks (releases) at LLNL that are potentially hazardous to the environment. During working hours incidents can be reported to the EPD environmental analysts supporting program areas, or the LLNL Fire Dispatch for investigation and response. Off-hour incidents are reported to Fire Dispatch who notifies the Environmental Duty Officer (EDO) and the on-site Fire Department if required. The EDO, who is available 24 hours a day, seven days a week, maximizes efficient and effective emergency environmental response. The EDO and environmental analysts also notify and consult with LLNL management and have seven-day-a-week, 24-hour-a-day access to the Office of Laboratory Counsel for questions concerning regulatory reporting requirements.

3.2 Environmental Management System

LLNL established its EMS to meet the requirements of International Organization for Standardization (ISO) 14001:1996 in June 2004. In 2006, LLNL upgraded its EMS to meet the requirements of ISO 14001:2004, and developed a number of Environmental Management Plans (EMPs) that address lab-wide significant aspects. During FY07 these EMPs were under review to be updated, completed, or eliminated as part of the ongoing EMS process, and to better reflect Executive Order 13423 goals. In late 2006, the EMS was extended to the directorate level.

3.2.1 Multi-Directorate Consortium

In 2007, a Multi-Directorate Consortium (MDC) was formed, consisting of directorate EMS representatives and the members of the P2 Team. The purpose of the MDC was to provide a forum for sharing ideas and identifying common environmental issues that can be worked as a group.

The P2 Team presented MDC sessions on office paper use and reduction, shared chemical usage, and energy topics during 2007. An EMP for office paper usage reduction and recycling was developed by the MDC and adopted by four of the directorates.

3.2.2 Environmental Management Plans

EMS representatives from each program area were tasked with identifying directorate-specific significant aspects and developing directorate EMPs and associated objectives and targets. The review of directorate aspects resulted in significant aspects consistent with those identified previously as having lab-wide significance. Directorates selected aspects to pursue based on which ones they could reasonably affect, based on budget and mission. During 2007, six directorates completed one or more directorate EMP (see **Table 3-1**).

A number of EMPs were developed to address Lab-wide environmental aspects during 2006 and are still in progress, or contain an ongoing component (see **Table 3-2**).

Table 3-1. LLNL Directorate Environmental Management Plans

Directorate	Aspects addressed	Environmental Management Plan(s)
AHR	• Municipal waste generation • Nonhazardous materials use	• Office Paper Use Reduction and Recycling
COMP	• Nonhazardous materials use	• Establish a Cardboard and Pallet Recycling Program
PAT	• Nonhazardous materials use	• Minimizing Outdoor Equipment Storage
	• Hazardous materials use	• Preventing the Formation of Lead Oxide by Sealing Lead Shielding
	• Radioactive materials use	• Minimizing Radioactive Sealed Sources and Reducing Exposure Hazards
NHI	• Municipal waste generation • Nonhazardous materials use	• Office Paper Use Reduction and Recycling
DO	• Municipal waste generation • Nonhazardous materials use	• Office Paper Use Reduction and Recycling
SEP	• All Environmental Aspects	• EMS Employee Awareness and Involvement
	• Municipal waste generation • Nonhazardous materials use	• Office Paper Use Reduction and Recycling
	• Waste reduction	• Pharmaceutical Inventory Reduction Review
	• Mixed waste generation	• Development of Authorized Limits for ERD GAC Filters
	• Hazardous air pollutants emissions • Hazardous waste generation • Industrial waste generation • Hazardous materials use	• Modified Procedure for the Analysis of Plutonium in Urine Samples

Table 3-2. LLNL Environmental Management Plans for Lab-wide aspects

Significant environmental aspect	Objective summary	Status
Ecological resource disturbance	• Establish an LLNL policy prohibiting the introduction of exotic species • Educate LLNL employees about the consequences of exotic species introduction • Control exotic species, e.g., feral pig, largemouth bass	Ongoing.
Electrical energy use	• Meet the objectives provided in DOE Order 430.2A, Departmental Energy and Utilities Management • Implement President's Initiative for Hurricane Relief (September 2005)	Under revision to incorporate Executive Order 13423.
Fossil fuel consumption/ renewable energy use	• Meet the DOE Vehicle Fleet Efficiency goal, in I.106 DEAR 970.5223-5	An E85 fuel station started operation in May 2007. LLNL has 290 E85 compatible alternative fuel vehicles (AFV) on-site and continues to replace conventional fuel vehicles with AFVs per the General Services Administration (GSA) replacement schedule.
Hazardous materials use	• Prioritize hazardous materials used and perform Pollution Prevention Opportunity Assessment to evaluate potential for reduction or substitution	Under revision.
Mixed waste generation	• Reduce the amount of mixed and California combined solid waste generated from routine LLNL programmatic operations when economically and technologically feasible	Evaluation report prepared and EMP updated.
Municipal waste generation	• Maintain compliance with applicable regulatory requirements • Prevent/reduce waste generation and increase reuse/recycling of routine and nonroutine waste that would otherwise be disposed of at a municipal landfill	Under revision.
Nonhazardous materials use	• Incorporate affirmative procurement site-wide • Increase site-wide use of products with recycled content	Procedure revisions completed February 2007. Remaining training sessions scheduled for Q2 FY08.
Radioactive material use	• Conduct study to evaluate radioactive material impacts at LLNL and identify potential opportunities for reduction	Completed.
Transuranic waste generation	• Conduct a study to review the characterization of transuranic waste to ensure generation of nonconforming waste is minimized and characterization is accurate to maximize the ability to disposition the waste.	Completed.

3.2.3 Senior Management Review of EMS

ISO 14001:2004 requires senior management reviews of the EMS at least annually. A management review was held in July 2007 based on input prepared by the EMS Coordinator. The following topics were discussed:

- Results of the 2007 HS-64 Independent Oversight inspection
- Review of organizational environmental performance
- Review of existing EMPs and progress toward objectives and targets
- Changing circumstances, new legal or other requirements
- Status of corrective and preventative actions
- EMS improvements implemented since last management review
- Recommendations for improvement

3.3 Pollution Prevention Program

The LLNL P2 Team facilitates LLNL's P2 Program within the framework of the Integrated Safety Management System (ISMS) and EMS and in accordance with applicable laws, regulations, and DOE orders as required by contract. P2 Team responsibilities include P2 Program stewardship and maintenance, waste stream analysis, reporting of waste generation and P2 accomplishments, and fostering of P2 awareness through presentations, articles, and events. The P2 Team supports institutional and directorate P2 activities via environmental teams, including implementation and facilitation of source reduction and/or reclamation, recycling, and reuse programs for hazardous and nonhazardous waste; facilitation of environmentally preferable procurement; preparation of P2 opportunity assessments; and development and management of high return-on-investment (ROI) projects. LLNL's P2 Program is described in the *ES&H Manual,* Document 30.1.

The P2 Program at LLNL strives to systematically reduce solid, hazardous, radioactive, and mixed waste generation, and to eliminate or minimize pollutant releases to all environmental media from all aspects of the operations at the Livermore site and Site 300. These efforts help protect public health and the environment by reducing or eliminating waste, improving resource usage, and reducing inventories and releases of hazardous chemicals. These efforts also benefit LLNL by reducing compliance costs and minimizing the potential for 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), which is applied, where feasible, to all types of waste. The P2 Team tracks waste generation using RHWM's HazTrack database. By reviewing the information in this database, program managers and P2 Team staff can monitor and analyze waste streams to determine cost-effective improvements to LLNL operations. Performance metrics for P2 will be incorporated into any future environmental performance metrics that are developed.

LLNL continues its efforts to phase-out Class I ozone depleting substances (ODSs). These efforts include recovery and recycling activities, refrigerant and coolant substitutions, preventative maintenance, leak detection programs, and equipment replacement. LLNL uses minimal quantities of ODSs for mission-critical laboratory research, under the "laboratory exemption" provided for in 40 CFR Part 82, Subpart A, Appendix G.

3.3.1 Routine Hazardous and Radioactive Waste

Routine waste listed in **Table 3-3** includes waste from ongoing operations produced by any type of production, analysis, and research and development taking place at LLNL. Residues resulting from the treatment of routine waste are not included to avoid double counting.

Table 3-3. Routine hazardous and radioactive waste at LLNL, FY 2004–2007.

Waste category	FY 2004	FY 2005	FY 2006	FY 2007
Routine hazardous waste generated	141.3 MT	127 MT	153 MT	138 MT
Routine low-level waste generated	151.3 m^3	54 m^3	66 m^3	197 m^3
Routine mixed waste generated	18.8 m^3	16 m^3	18 m^3	30 m^3
Routine TRU / mixed TRU waste generated	1.2 m^3	1 m^3	1 m^3	3.1 m^3

The FY07 increase in routine low-level waste was due to container closure and certification of previously generated table shot debris from Site 300 explosives testing. The FY07 increase in routine mixed waste reflects a change in the types of waste included as routine. Starting in FY07, aqueous debris washing and aqueous evaporator cleanout waste was reported as routine mixed waste.

Transuranic (TRU) and TRU mixed waste increased during FY07 due to packaging and support waste generated in support of the de-inventory project to transfer special nuclear materials off-site, the close out of existing TRU waste inventories, and other programmatic activities.

3.3.2 Diverted Waste

LLNL maintains an active waste diversion program, encouraging recycling and reuse of both routine and nonroutine waste.

3.3.2.1 Routine Waste

Together, the Livermore site and Site 300 generated 4051 MT of routine nonhazardous solid waste in FY 2007. This volume includes diverted waste (e.g., material diverted through recycling and reuse programs) and landfill waste.

Both sites combined diverted a total 2521 MT of routine nonhazardous waste in 2007, which represents a diversion rate of 62%. The diverted routine nonhazardous waste includes waste recycled by RHWM and materials diverted through the surplus sales program. The portion of routine nonhazardous waste sent to landfill was 1530 MT. See **Table 3-4**.

In 2007, LLNL also recycled 130.7 MT of electronics, which were managed as universal waste.

Table 3-4. Routine nonhazardous waste in FY 2007, Livermore site and Site 300 combined.

Destination	Waste description	Amount in FY 2007 (MT)
Diverted	Batteries, small[(a)]	6
	Batteries, lead-acid[(a)]	24
	Beverage containers	3
	Cardboard	65
	Compost	405
	Cooking grease	3
	Engine oils	9
	Fluorescent lights[(a)]	6
	Magazines, newspapers, phone books	29
	Metals	1379
	Paper	250
	Street sweepings	82
	Tires and scrap	13
	Toner cartridges	7
	Wood	240
	TOTAL diverted	**2521**
Landfill	Compacted (landfill)	1530
	TOTAL landfill	**1530**
TOTAL routine nonhazardous waste		**4051**

(a) Batteries and fluorescent lights are managed as universal waste.

3.3.2.2 Nonroutine Waste

Nonroutine nonhazardous solid wastes include excavated soils, wastes and metals from construction, and decontamination and demolition activities. The Livermore site and Site 300 generated a total of 17,461 MT of nonroutine nonhazardous solid waste in 2007.

In FY 2007, the two sites combined diverted 6195 MT of nonroutine nonhazardous solid waste through reuse or recycling, which represents a diversion rate of 35%. Diverted nonroutine nonhazardous solid waste includes soil reused either on site for other projects or as cover soil at Class II landfills, and metals recycled through the metals recycling programs. See **Table 3-5**.

Table 3-5. Nonroutine nonhazardous waste in FY 2007, Livermore site and Site 300 combined.

Destination	Waste description	Amount in FY 2007 (MT)
Diverted	Class II cover (soil reused at landfill)	503
	Asphalt/concrete	5,172
	Nonroutine metals	520
	TOTAL diverted	**6,195**
Landfill	Construction demolition (noncompacted landfill)	8,602
	Class II concrete	2,558
	Industrial (HazTrack[(a)])	64
	Non-friable asbestos	42
	TOTAL landfill	**11,266**
TOTAL nonroutine nonhazardous waste		**17,461**

(a) RHWM Waste Data Management System

3.3.3 Environmentally Preferable Purchasing

LLNL has a comprehensive Environmentally Preferable Purchasing (EPP) program that includes preferential purchasing of recycled content and biobased products.

The EPP program was expanded in 2007 to include a preference for Electronic Product Environmental Assessment Tool (EPEAT) registered products. 98% of all desktop electronics purchases were EPEAT Silver or EPEAT Gold, indicating that the products meet or exceed the Institute of Electrical and Electronics Engineers (IEEE) 1680-2006 environmental performance standard for electronic products.

3.3.4 Pollution Prevention Activities

3.3.4.1 Environmental Stewardship Awards

The P2 Team nominated two LLNL projects in December 2007 that were selected by NNSA/Headquarters to receive 2007 Environmental Stewardship awards.

LLNL's Space Action Team (SAT) received 2007 Environmental Stewardship recognition for their "Assets for Value" process, which gives contractors the opportunity to include the reuse/salvage value of equipment and recyclable materials from a decontamination and demolition area as an offset in their bid. This process, in place since 2002, reduces the cost of the decontamination and decommissioning (D&D) contracts and maximizes reuse and recycling.

SAT D&D activities are critical to the ongoing ability of LLNL to support its mission because for each facility constructed, LLNL must tear down an equivalent amount of legacy facility space.

In 2007, Assets for Value was applied to the demolition and restoration of a large 1950's era laboratory building, reducing the total project cost by 11%, and resulting in reuse or recycling of 89% of the demolition materials. 227 tons of metals and 5976 tons of concrete/asphalt were diverted for reuse or recycling, along with soil, wood, steel and electro-mechanical infrastructure and equipment.

LLNL Fleet Management received 2007 Environmental Stewardship recognition for implementing an E85 alternate fuel station. The E85 Fueling station started operation in May 2007 and dispensed a total of 41,893 gallons of E85 fuel during 2007. LLNL has 290 E85-compatible alternative fuel vehicles (AFVs) onsite, making it the largest AFV fleet in the DOE complex of national laboratories, and possibly the largest E85 fleet in a single location in California. In collaboration with the CARB, the LLNL station will serve as a test bed for E85 operations throughout the state.

3.3.4.2 Pollution Prevention Accomplishments

The P2 Team documented four additional accomplishments, which were submitted to the DOE Pollution Prevention Tracking Database in December 2007.

Payroll saved paper and associated printing and distribution costs by eliminating 8000 printed monthly leave forms. Employees now access leave and other payroll information online. Eliminating paper forms not only reduced the amount of labor, natural resources, and energy used, but also potentially reduces municipal waste associated with discarded forms.

The LLNL Engineering Records Center provides long-term records retention for various types of data, using film archival to meet 100- to 500-year retention requirements. During 2007, they replaced two chemical-based units with two chemical-free thermal units. This eliminated a 2000 pound/year hazardous photochemical waste stream and improved production throughput as well. Both chemical-based units were sent to salvage, rather than landfill, as an additional environmental measure.

The National Ignition Facility (NIF) Optics Processing Facility made process improvements to extend the useful life of a caustic cleaning solution used in an optics cleaning operation. As a result of their efforts, approximately 900 gallons of hazardous waste were eliminated annually. The reduced frequency of solution changes, along with improved sampling and handling equipment, also increased worker safety.

RHWM implemented streamlined lab pack and bulking operations that resulted in a sixfold increase in operational efficiencies over the previous practice. The change also improved worker safety by eliminating a repackaging step, and significantly reduced the volume and number of waste containers shipped.

3.3.4.3 Pollution Prevention Funding Proposals

ROI projects take into consideration the environmental benefits of a project, and its projected savings, initial investment and ongoing operating costs. ROI project proposals are reviewed by the P2 Team and forwarded to the NNSA Livermore Site Office (NNSA/LSO) for possible funding.

During 2007, one ROI project was selected for funding by the NNSA/LSO. The selected project replaces a Freon vapor degreaser used in the Vacuum Processes Lab with a CO_2 Snow Jet and an ultraviolet ozone (UVO) cleaner. The Freon vapor degreaser was used three to four times a week to clean substrates in preparation for coating. Because Freon is an ozone-depleting substance, an alternative cleaning method was sought. The Snow Jet uses a non-abrasive dust particle removal process to pre-clean the substrate, which is then degreased using the UVO cleaning method. This project resulted in the elimination of approximately 35 gallons of Freon each year. In addition, the new Snow Jet/UVO process is less time consuming, resulting in a 75% savings in labor over the Freon degreaser.

3.3.5 Pollution Prevention Employee Training and Awareness Programs

In 2007, LLNL conducted a number of activities to promote employee awareness of pollution prevention. The annual Earth Expo was held April 16–19 to coincide with Earth Day. The 2007 focus was "Caring for the Environment at Work and at Home." Rather than a single day Expo as in years past, in 2007 the P2 Team held a multi-day lunchtime event at both main site cafeterias and a single day lunchtime event at Site 300. An array of on-site organizations presented posters to increase LLNL staff awareness of the environmental functions carried out by EPD, Fleet, and the Energy Management Program. The LLNL EMS was highlighted at the event, and a recycling survey was conducted to assess employee interest in food and beverage container recycling programs.

The P2 Team conducted other awareness activities during the year. The P2 Team participated in the on-site Environment, Health, and Safety Fair in June. Articles on pollution prevention appeared in *Newsline* (the LLNL newspaper) and *NewsOnLine* (the LLNL electronic newsletter). The P2 Team conducted training for purchasing staff on EPA requirements for affirmative procurement.

The P2 Team maintains an internal P2 website for LLNL employees, which was revamped during 2007. The website is a resource for employees regarding pollution prevention, energy efficiency, reuse and recycling of materials, green building, and other environmental topics. Employees can also use the site to suggest P2 ideas, ask questions about P2 planning and implementation, and find out about P2 current events. The P2 Team also operates the Earth Hotline for employees to call with questions, suggestions, or ideas regarding LLNL's pollution prevention and waste diversion endeavors.

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