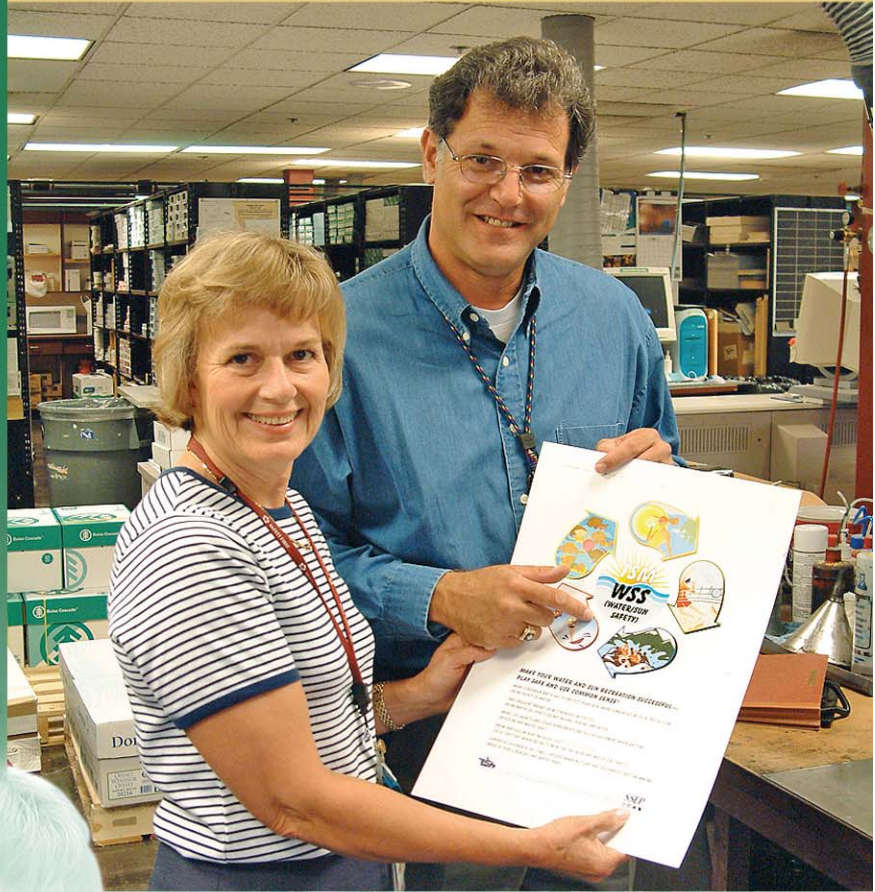


2

Environmental Compliance and Program Summaries



Lawrence Livermore National Laboratory, as stated in LLNL's Environmental Policy signed by LLNL's Director in July 2004, is committed to providing responsible stewardship of environmental resources. Environmental stewardship is integrated into Laboratory strategic planning and decision-making processes and into the management of all work activities through the Integrated Safety Management System.

In support of this policy, LLNL commits to:

- Work to continuously improve the efficient and effective performance of the environmental management system
- Comply with applicable environmental laws and regulations
- Incorporate pollution prevention, waste minimization, and resource conservation into planning and decision-making processes
- Ensure that interactions with regulators, DOE, and the community are based upon integrity, openness, and adherence to national security requirements
- Establish appropriate environmental objectives and performance indicators to guide these efforts and measure our progress

This chapter provides a brief summary of LLNL's compliance with environmental regulations and LLNL's environmental management programs.

COMPLIANCE SUMMARY

Lawrence Livermore National Laboratory participates in numerous activities to comply with federal, state, and local environmental regulations as well as internal requirements and applicable U.S. Department of Energy (DOE) orders. The following describes regulations and guidance applicable to LLNL during 2004, including a summary of permits active in 2004, and inspections of the Livermore site and Site 300 by external agencies. The following summaries also provide references for more information where available.

Environmental Restoration and Waste Management

Comprehensive Environmental Response, Compensation and Liability Act

Ongoing groundwater investigations and remedial activities at the Livermore site and Site 300 are called the Livermore Site Ground Water Project (GWP) and the Site 300 CERCLA Project, respectively. These activities fall under the jurisdiction of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), Title I of the Superfund Amendments and Reauthorization Act (SARA). As part of work on these projects, DOE and LLNL also continued community relations activities. CERCLA compliance activities are summarized in the following sections; program activities and findings are further described in [Chapter 7](#).

Livermore Site Ground Water Project

The Livermore site became a CERCLA site in 1987 when it was placed on the National Priorities List. The GWP at the Livermore site complies with provisions specified in a federal facility agreement (FFA) entered into by the U.S. Environmental Protection Agency (EPA), DOE, the California EPA's Department of Toxic Substances Control (DTSC), and the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB). As required by the FFA, the project addresses compliance issues by investigating potential contamination source areas (such as suspected old release sites, solvent-handling areas, and leaking underground tank systems) through continuous monitoring and by the remediation of soil and groundwater. The primary soil and groundwater contaminants (constituents of concern) are volatile organic compounds (VOCs), primarily trichloroethylene (TCE) and perchloroethylene (PCE).

Significant 2004 Livermore site GWP restoration activities include installing 4 groundwater extraction wells, 2 dual (groundwater and soil vapor) extraction wells, 7 soil vapor extraction wells, and abandoning 1 anode well; conducting 1 hydraulic test; and conducting 24 soil vapor extraction tests. LLNL met all regulatory milestones by activating the Soil Vapor Treatment Facility TFD Helipad (VTFD-HPD) and Soil Vapor Treatment Facility B518 Perched Zone (VTF 518-PZ) on schedule.

Treatment Facilities: In 2004, LLNL operated groundwater treatment facilities in the following treatment facility (TF) areas: A, B, C, D, E, G, 406, 518, and 5475 (see [Figure 7-1](#)). A total of 80 groundwater extraction wells and 16 dual extraction wells supplied water to 26 treatment facilities at a combined average flow rate of about 2236 liters per minute. In 2004, these facilities treated more than 1.2 billion liters of groundwater and removed about 86 kilograms of VOCs compared to 90 kilograms in 2003. The smaller quantity of mass removed in 2004 is partially due to decreasing concentrations in the TFD and TFE areas and declining groundwater extraction well flow rates due to remediation-induced dewatering at the site. Since remediation began in 1989, approximately 9.7 billion liters of groundwater have been treated, resulting in a

mass removal of about 1097 kilograms of VOCs. In addition, LLNL operated four soil vapor treatment facilities (VTFs): VTF5475, VTFE-ELM, VTFD-HPD, and VTF518-PZ. In 2004, these facilities treated about 1.2 million cubic meters of vapor and removed an estimated 133 kilograms of VOCs compared to about 84 kilograms in 2003. The significantly larger quantity of mass removed in 2004 is due to start up of VTFD-HPD and VTF518-PZ, as well as continued operation of VTFE-ELM and VTF5475. Since initial operation, more than 2.6 million cubic meters of vapor have been treated by the VTFs, resulting in a mass removal of more than 681 kilograms of VOCs. The groundwater and soil vapor treatment systems removed 219 kilograms of VOC in 2004, and have removed about 1778 kilograms of VOCs from the subsurface since remediation began in 1989. See [Chapter 7](#) for further information.

Community Relations: Livermore site community relations activities in 2004 included communicating and meeting with neighbors and local, regional, and national interest groups and other community organizations; making public presentations; producing and distributing the Environmental Community Letter; maintaining the information repositories and the administrative record; conducting tours of site environmental activities; and responding to public and news media inquiries. In addition, DOE and LLNL met with members of Tri-Valley Communities Against a Radioactive Environment (Tri-Valley CAREs) and their scientific advisor as part of the activities funded by an EPA Technical Assistance Grant (TAG). Community questions were also addressed via electronic mail, and project documents, letters, and public notices were posted on a public website at www-envirinfo.llnl.gov.

Documentation: In 2004, DOE/LLNL submitted the *LLNL Ground Water Project 2003 Annual Report* (Karachewski et al. 2004) and quarterly self-monitoring reports on schedule. In addition, DOE/LLNL completed all 2004 Remedial Action Implementation Plan (Dresen et al. 1993) milestones ahead of schedule.

Site Evaluations Prior to Construction: LLNL was placed on the National Priorities List in 1987 based on historical contamination of soil and groundwater. The *CERCLA Record of Decision for the Lawrence Livermore National Laboratory Livermore Site* (LLNL 1992) identifies selected remedial actions agreed upon by the EPA, SFBRWQCB, and DTSC. The Record of Decision requires that before any construction begins, the project site must be evaluated to determine if soil or rubble (concrete and asphalt) is contaminated. Soil is sampled and analyzed for potential radioactive and/or hazardous contamination. Depending on the potential for radioactive contamination, rubble may be either surveyed or analyzed for radioactivity. During 2004, soil and/or rubble were evaluated at 70 construction sites. Based on the evaluation, the soil and/or rubble were either reused on site or disposed of according to established procedures.

Site 300 CERCLA Project

Investigations and remedial activities are ongoing at Site 300, which became a CERCLA site in 1990, when it was placed on the National Priorities List. Investigations and remedial activities are conducted under the joint oversight of the EPA, the Central Valley Regional Water Quality Control Board (CVRWQCB), DTSC, and the authority of an FFA for the site. (There are separate FFAs for Site 300 and the Livermore site.) The groundwater contaminants (constituents of concern) for Site 300 vary within the

different environmental restoration operable units at the site. Background information for LLNL environmental characterization and restoration activities at Site 300 can be found in the *Final Site-Wide Remedial Investigation Report, Lawrence Livermore National Laboratory Site 300* (Webster-Scholten 1994) and *Final Site-Wide Feasibility Study for Lawrence Livermore National Laboratory Site 300* (Ferry et al. 1999).

Treatment Facilities and Field Investigations: VOCs (primarily TCE) are the main contaminants at Site 300. High explosives, tritium, depleted uranium, organosilicate oil, nitrate, and perchlorate are also found in the groundwater. Sixteen treatment facilities operated during 2004. Twenty-five wells that extract groundwater only, 7 wells that extract soil vapor only, and 24 wells that extract both groundwater and soil vapor operated during 2004, treating about 17.6 million liters of groundwater. The 24 wells that extract both vapor and groundwater and the 7 wells that extract only vapor together removed 212,106 m³ of vapor. In 2004, the Site 300 treatment facilities removed approximately 58 kilograms of VOCs, 0.072 kilograms of perchlorate, 705 kilograms of nitrate, 1 kilogram of RDX high explosive compound, and 0.58 grams of organic silicate oil. Since remediation efforts began in 1990, more than 994 million liters of groundwater and approximately 4.5 million m³ of vapor have been treated, to yield about 292 kilograms of removed VOCs. See [Chapter 7](#) for further information.

Due to budgetary constraints, LLNL delayed 2004 FFA milestones for construction of additional treatment facilities and completion of field work at several programmatic areas until 2005. The Site 300 Remedial Project Managers (U.S. EPA Region IV, DTSC, and the RWQCB) agreed to this delay.

Community Relations: The Site 300 CERCLA project maintains continuing communications with the community of Tracy and nearby neighbors. Community relations activities in 2004 included maintenance of information repositories and administrative records; participation in community meetings; off-site, private well-sampling activities; mailings to stakeholders; and interviews with the news media. LLNL hosted TAG meetings with Tri-Valley CAREs. TAG meetings provided a forum for focused discussions on CERCLA activities at the various operable units at Site 300. Tri-Valley CAREs receives the annual TAG grant from EPA to support an environmental consultant to review and comment on Site 300 CERCLA activities.

Documentation: In 2004, LLNL submitted all required documentation to oversight agencies by agreed upon regulatory submission dates. The *Final Remedial Design for the Building 850 Operable Unit* (Taffet et al. 2004a), *Second Draft Final Remedial Investigation/Feasibility Study (RI/FS) for the Pit 7 Complex Operable Unit* (Taffet et al. 2004b), *Annual 2003 Compliance Report for Lawrence Livermore National Laboratory Site 300* (Dibley et al. 2004a), *First Semester 2004 Compliance Report for Lawrence Livermore National Laboratory Site 300* (Dibley et al. 2004b), quarterly reports, and work plans were among the documents submitted.

Agency for Toxic Substances and Disease Registry Assessment

The Agency for Toxic Substances and Disease Registry (ATSDR), part of the Centers for Disease Control of the U.S. Department of Health and Human Services, is responsible for assessing public health impacts at U.S. DOE sites undergoing environmental restoration. In 2004, the ATSDR completed a public health assessment (PHA) of the Livermore site that incorporates the findings of all the PHAs and health consultations conducted over the past ten years by the ATSDR and the California Department of Health Services Environmental Health Investigation Branch. The 2004 PHA found “No Apparent Public Health Hazard” from past and ongoing operations of the laboratory.

According to the PHA, the findings mean

“...that although community exposures of site-related contaminants may have occurred or may be occurring, the resulting doses are unlikely to result in any adverse health effects and are consequently below levels of health concern....The current environmental monitoring program conducted by LLNL is adequate to ensure that future releases of hazardous substances will not present a future public health hazard.” (ATSDR 2004)

The PHA, which was published in June 2004, can be read as a printed copy at the Livermore Public Library or the LLNL Environmental Repository, or viewed at <http://www-envirinfo.llnl.gov/>. On August 11, 2004, the ATSDR held its final public meeting in Livermore to discuss its findings and answer questions.

The 2004 PHA is the latest in a long series of activities to assure that LLNL presents no potential environmental or public health impacts to the community. See **Table 2-1** for examples of the many historic studies on the potential for impacts due to plutonium releases to the city sewer plant in 1967. None of the studies has found a potential for public health impact or harm.

In January 2005, the ATSDR also completed a PHA of Site 300, which concludes:

“... that the environmental contamination related to Site 300 presents No Public Health Hazard based on the fact that exposure to contaminants from Site 300 is not occurring now, has not occurred in the past and is not expected to occur in the future.... Currently off-site residents are not being exposed to contaminated groundwater originating from Site 300....There are no completed past exposure pathways for contaminated groundwater. No contamination from Site 300 has ever been detected in off-site water supply wells.” (ATSDR 2005)

Table 2-1. History of off-site plutonium sampling in soil and sludge

Time	Location(s) ^(a)	Sample Design ^(a,b)	Sample Collection ^(a)	Sample Analysis ^(a)	Regulatory Oversight ^(a)	Sample Type: Sample Range ^(a)	Finding/Reference ^(a)
Surveillance Monitoring 1959–1970	LWRP	LRL	LRL	LRL	USAEC, CDPH-BRH, USDHEW (later USEPA)	soil: 1.5–22 pCi gross alpha/g ^(c) digester sludge: ≤60 pCi gross alpha/g ^(c)	No action required; nothing over guidelines (LRL 1959–1970)
Surveillance Monitoring 1960–1969	LWRP	CDPH-BRH	LWRP	CDPH-BRH	CDPH-BRH	digester sludge: ≤297 pCi gross alpha/g ^(c)	No action required; nothing over guidelines (CDPH-BRH 1960–1969)
Inadvertent plutonium release 5/25–6/15/67	LWRP	LRL, City of Livermore, USAEC, CDPH-BRH	LWRP/LRL	LRL	City of Livermore, USAEC, CDPH-BRH	sewage: ~2 pCi gross alpha/mL ^(c) digester sludge: ≤1205 pCi gross alpha/g ^(c)	Nothing over guidelines; sludge below levels of health concern. No health basis for additional sampling; recommendation of sampling would be irresponsible (ATSDR 2003) ^(d)
Expanded Surveillance Soil Sampling 1971–1972	Valley-wide	LLL	LLL	LLL	USAEC, CDPH-BRH	soil: 27–162 mCi/km ²	Below regulatory levels (Gudiksen et al. 1972; Gudiksen et al. 1973)
1973	3 homes in Livermore with sludge	LLL	LLL	LLL	USAEC, CDPH-BRH	soil: 0.00797–1.84 pCi/g	Below regulatory levels (ATSDR 2000) ^(d)
1973	LWRP lagoon	LLL	LWRP/LLL	LLL	USAEC, CDPH-BRH, City of Livermore	dried sludge: ~2.6 pCi/g	Below regulatory levels (Silver et al. 1974)
1974–1975	LLNL sludge uptake study	LLL	LLL	LLL	USAEC	sludge: 2.2–4.4 pCi/g	No hazard from food grown using sludge; 50 year integrated dose less than 0.002 rem for inhalation and 0.00004 rem for ingestion compared to approximately 15 rem from natural background radiation over same time period. (Myers et al. 1976)
Surveillance Sampling 1973–ongoing	Valley-wide	LLL (later LLNL)	LLL (later LLNL)	LLL (later LLNL)	USAEC/DOE, CDPH-BRH, USEPA	soil: ≤0.106 pCi/g	Below residential USEPA Region 9 Preliminary Remediation Goal of 2.5 pCi/g (Sanchez et al. 2004; Table 5-5)

Table 2-1 History of off-site plutonium sampling in soil and sludge (continued)

Time	Location(s) ^(a)	Sample Design ^(a,b)	Sample Collection ^(a)	Sample Analysis ^(a)	Regulatory Oversight ^(a)	Sample Type: Sample Range ^(a)	Finding/Reference ^(a)
Surveillance Sampling 1973–ongoing	LWRP	LLL (later LLNL)	LLL (later LLNL)	LLL (later LLNL)	USAEC/DOE, CDPH-BRH, USEPA	Highest values: soil (1992) ≤2.96 pCi/g sludge (1987): ≤10.18 pCi/g	Below industrial USEPA Region 9 Preliminary Remediation Goal; then 13 pCi/g, now 10 pCi/g (Sanchez et al. 2004; Table 5-5)
1980	Downwind locations	CDHS	CDHS	CDHS	CDHS, LLNL	soil: 0.0025–0.0312 pCi/g	No significant elevations beyond vicinity of LLNL facility (Toy et al. 1981; Tamplin 1980)
1993	Big Trees Park	USEPA, NAREL	NAREL	NAREL	USEPA	soil: ≤0.164 pCi/g	No health hazard; recommend further sampling only in Big Trees Park (NAREL 1994; Gallegos et al. 1994)
1995	Big Trees Park additional sampling	USEPA, NAREL, LLNL, CDHS-RHB, LWRP, LARPD, Arroyo Seco School, Public input	LLNL	LLNL, USEPA, CDHS-RHB, Lockheed Analytical Services	USEPA, CDHS-RHB	soil: ≤1.02 pCi/g	No unacceptable risk to human health (MacQueen 1995) No further action needed, not a health concern (USEPA 1995)
1998	Big Trees Park	USEPA, CDHS, ATSDR, LLNL, CDHS-RHB, LWRP, LARPD, Public input	LLNL	USEPA, CDHS, ATSDR, General Engineering Laboratory, Georgia Institute of Technology Environmental Resources Center, LLNL	USEPA, CDHS-RHB	soil: ≤0.774 pCi/g	Below levels of health concern set by EPA; no further action required. (ATSDR 2000) ^(d) No health basis for additional sampling; recommendation of soil sampling would be irresponsible. (ATSDR 2003) ^(d)

Note: Through the years covered by this summary table, the names of many of the institutions involved have changed. Lawrence Radiation Laboratory (LR) became Lawrence Livermore Laboratory (LL) and then became Lawrence Livermore National Laboratory (LLNL). The United States Atomic Energy Commission (USAEC) became the Energy Research and Development Administration (ERDA), and then became the Department of Energy (DOE). The California Department of Public Health, Bureau of Radiological Health (CDPH-BRH) became the California Department of Health Services, Radiation Health Branch (CDHS-RHB). The radiological oversight function of the United States Department of Health, Education, and Welfare (USDHEW) transferred to the United States Environmental Protection Agency (USEPA) when the USEPA was established in 1970.

- a See *Acronyms and Abbreviations* for list of acronyms.
- b Based on Federal standards and guidelines.
- c “Gross alpha” represents total detected alpha radiation from all alpha-emitting nuclides. LLNL upgraded monitoring in 1971 to analyze for plutonium-239+240.
- d The 2000 and 2003 ATSDR reports are part of its LLNL public health assessment. ATSDR performs health assessments at all DOE sites conducting environmental restoration under CERCLA. The ATSDR, LLNL’s annual, and other environmental reports may be viewed at <http://www-envinfo.llnl.gov/> or by contacting Bert Heffner at 925/424-4026.

The ATSDR recommended continuing environmental remediation and environmental monitoring. It determined earlier in the PHA process that

“The current environmental monitoring program conducted by LLNL is adequate to ensure that future releases of hazardous substances will not present a future public health hazard.” (ATSDR 2005)

The Site 300 PHA can be viewed at <http://www-envirinfo.llnl.gov/> or read as a printed copy at the Tracy City Library or the LLNL Environmental Repository. The ATSDR held a public meeting on February 24, 2005, in Tracy to discuss its findings and answer questions.

Emergency Planning and Community Right-to-Know Act and Toxics Release Inventory Report

Title III of SARA is known as the Emergency Planning and Community Right-to-Know Act (EPCRA). It requires owners or operators of facilities that handle certain hazardous chemicals on site to provide information on the release, storage, and use of these chemicals to organizations responsible for emergency response planning. Executive Order 13148 directs all federal agencies to comply with the requirements of the EPCRA, including SARA Section 313, “Toxics Release Inventory (TRI) Program.”

On June 28, 2004, LLNL submitted to the National Nuclear Security Administration (NNSA)/DOE the TRI Form R for lead detailing environmental release estimates for Site 300. (Form R is used for reporting TRI chemical releases including waste management and waste minimization activities.) A 72% reduction in lead releases was achieved as a result of a continuing effort to substitute nontoxic, nonlead (frangible), and reduced lead containing ammunition where feasible.

EPCRA requirements and LLNL compliance are summarized in [Table 2-2](#).

Resource Conservation and Recovery Act and Related State Laws

The Resource Conservation and Recovery Act (RCRA) provides the framework at the federal level for regulating the generation and management of solid wastes, including wastes designated as hazardous. Similarly, the California Hazardous Waste Control Act (HWCA) and the California Code of Regulations (CCR) Title 22 set requirements for managing hazardous wastes in California. RCRA and HWCA also regulate hazardous waste treatment, storage, and disposal facilities, including permit requirements. Because RCRA program authorization was delegated to the State of California in 1992, LLNL works with DTSC on compliance with federal and state issues and in obtaining hazardous waste permits.

Table 2-2. Compliance with EPCRA

EPCRA requirement ^(a)	Brief description of requirement ^(a)	LLNL action
302 Planning Notification	Notify SERC of presence of extremely hazardous substances.	Originally submitted May 1987.
303 Planning Notification	Designate a facility representative to serve as emergency response coordinator.	Update submitted April 27, 2004.
304 Release Notification	Report releases of certain hazardous substances to SERC and LEPC.	No EPCRA-listed extremely hazardous substances were released above reportable quantities in 2004.
311 MSDS/Chemical Inventory	Submit MSDSs or chemical list to SERC, LEPC, and Fire Department.	Update submitted April 27, 2004.
312 MSDS/Chemical Inventory	Submit hazardous chemical inventory to local administering agency (county).	Business plans and chemical inventory submitted to San Joaquin County (January 13, 2004) and Alameda County (April 1, 2004).
313 Toxics Release Inventory	Submit Form R to U.S. EPA and California EPA for toxic chemicals released above threshold levels.	Form R for lead (Site 300 only) was submitted to DOE June 28, 2004; DOE forwarded it to U.S. EPA and California EPA June 28, 2004.

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

Hazardous Waste Permits

Livermore Site: The hazardous waste management facilities at the Livermore site consist of permitted units (located in Area 612 and Buildings 693 and 695 of the Decontamination and Waste Treatment Facility [DWTF]). The units that were operated under interim status (Area 514 Facility and the Building 233 Container Storage Facility) have been relocated to permitted facilities. Building 233 and Area 514 are currently undergoing RCRA closure. Permitted waste management units include container storage, tank storage, and various treatment processes (e.g., wastewater filtration, blending, and size reduction). During 2003/2004, LLNL also submitted several Class 1 and Class 2 permit modification requests to DTSC; all the requested Class 1 and some Class 2 permit modifications have been approved and implemented. Many of these modification requests are related to as-built changes and consolidation of storage and treatment of hazardous waste at the DWTF complex. On December 29, 2004, DTSC updated LLNL's Hazardous Waste Facility Permit (HWFP).

A final closure plan for the Building 419 Interim Status Facility was submitted to DTSC February 2001. DTSC is continuing its review of this closure plan. LLNL has provided additional information requested by DTSC, including responding to Building 419 Notices of Deficiency (NODs) that DTSC issued in November 2004.

See [Table 2-3](#) for a summary of permits active in 2004. See [Table 2-4](#) for a summary of inspections and [Table 2-7](#) for a description of a Summary of Violations (SOVs) received as a result of a DTSC's Compliance Evaluation Inspection (CEI) conducted during

Table 2-3. Permits active in 2004

Type of permit	Livermore site ^{(a)(b)}	Site 300 ^{(a)(b)}
Hazardous waste	<p>EPA ID No. CA2890012584. Hazardous Waste Facility Permit Number 99-NC-006 (RCRA Part B permit)—to operate hazardous waste management facilities including Buildings 693 and 695, and Area 612. Activities authorized in these areas include treatment and storage of hazardous and mixed wastes subject to the conditions specified in the Part B permit. LLNL is also a Registered Hazardous Waste Hauler and is authorized to transport wastes from Site 300 to the Livermore site.</p> <p>Authorization to mix resin in Unit CE231-1 under a Conditionally Exempt Specified Wastestream permit.</p>	<p>EPA ID No. CA2890090002. Part B Permit—Container Storage Area (Building 883) and Explosives Waste Storage Facility.</p> <p>Part B Permit—Explosives Waste Treatment Facility.</p> <p>Part B Permit—RCRA-Closed Building 829 High Explosives Open Burn Facility, Post-Closure Permit.</p>
Medical waste	<p>Two permits for large quantity medical waste generation and treatment: one covering the Biosciences Directorate, Health Services Department, Forensic Science Center, Medical Photonics Lab, Tissue Culture Lab, and Chemistry and Materials Science Department; the second covering medical waste generation and treatment activities planned for the Biosafety Level 3 (BSL-3) laboratory.</p>	<p>Limited Quantity Hauling Exemption for small quantity medical waste generator.</p>
Air	<p>BAAQMD issued 178 permits for operation of various types of equipment, including boilers, emergency generators, cold cleaners, degreasers, printing press operations, manual wipe-cleaning operations, metal machining and finishing operations, silk-screening operations, silk-screen washers, paint spray booths, adhesives operations, optic coating operations, storage tanks containing VOCs in excess of 1.0%, drum crusher, semiconductor operations, diesel air-compressor engines, groundwater air strippers, soil vapor extraction units, material-handling equipment, sewer diversion system, oil and water separator, fire-test cells, gasoline-dispensing operation, paper-pulverizer system, and firing tanks.</p>	<p>SJVAPCD issued 40 permits for operation of various types of equipment, including boilers, emergency generators, paint spray booth, groundwater air strippers, soil vapor extraction units, woodworking cyclone, gasoline-dispensing operation, explosive waste treatment units, drying ovens, and the Contained Firing Facility.</p>
Storage tanks	<p>Seven operating permits covering 10 underground petroleum product and hazardous waste storage tanks: 111-D1U2 Permit No. 6480; 113-D1U2 Permit No. 6482; 152-D1U2 Permit No. 6496; 271-D2U1 Permit No. 6501; 321-D1U2 Permit No. 6491; 365-D1U2 Permit No. 6492; and 611-D1U1, 611-G1U1, 611-G2U1, and 611-O1U1 Permit No. 6505.</p>	<p>One operating permit covering five underground petroleum product tanks assigned individual permit numbers: 871-D1U2 Permit No. 008013^(c); 875-D1U2 Permit No. 006549^(c); 879-D1U1 Permit No. 006785; 879-G3U1 Permit No. 007967; and 882-D1U1 Permit No. 006530</p>

Compliance Summary

Table 2-3. Permits active in 2004 (continued)

Type of permit	Livermore site ^{(a)(b)}	Site 300 ^{(a)(b)}
Sanitary sewer	Discharge Permit 1250 ^(d) (2003/2004 and 2004/2005 ^(e)) for discharges of wastewater to the sanitary sewer. Permit 1510G (2002/2004 ^(f)) for discharges of groundwater from CERCLA restoration activities to the sanitary sewer.	
Water	WDR Order No. 88-075 for discharges of treated groundwater from Treatment Facility A to recharge basin. ^(g) WDR Order No. 95-174, NPDES Permit No. CA0030023 for discharges of storm water associated with industrial activities and low-threat nonstorm water discharges to surface waters. WDR Order No. 99-08-DWQ, NPDES California General Construction Activity Permit No. CAS000002; Terascale Simulation Facility, Site ID No. 201C317827; Sensitive Compartmented Information Facility, Site ID No. 201C317621; Soil Reuse Project, Site ID No. 201C305529; National Ignition Facility, Site ID No. 201C306762; East Avenue Security Upgrade Project, Site ID No. 201C320036; 5th Street Project, Site ID No. 201C321420; and Central Cafeteria, Site ID No. 201C320518, for discharges of storm water associated with construction activities affecting 0.4 hectares (1 acre) or more. FFA for groundwater investigation/remediation. Regional General Permit 1 for the Arroyo Mocho Fish Passage/Sediment Reduction Project ^(h)	WDR Order No. 93-100 for post-closure monitoring requirements for two Class I landfills. WDR Order No. 96-248 for operation of two Class II surface impoundments, a domestic sewage lagoon, and percolation pits. WDR Order No. 97-03-DWQ, NPDES California General Industrial Activity General Permit No. CAS000001 for discharge of storm water associated with industrial activities. WDR Order No. 97-242, NPDES Permit No. CA0082651 for discharges of treated groundwater from the eastern General Services Area treatment unit. WDR Order No. 5-00-175, NPDES Permit No. CAG995001 for large volume discharges from the drinking water system that reach surface waters. Nationwide Permit 27 for enhancing red-legged frog breeding ponds. Water Quality Certification for red-legged frog breeding ponds, WDID # 5B39CR00047. FFA for groundwater investigation/remediation. 34 registered Class V injection wells

a Numbers of permits are based on actual permitted units or activities maintained and renewed by LLNL during 2004.

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

c These tanks were closed and removed on September 22, 2004.

d Permit 1250 includes wastewater generated at Site 300 and discharged at the Livermore site.

e The Discharge Permit 1250 period is from May 15 to May 14; therefore, two permits were active during the 2004 calendar year.

f Permit 1510G is a two-year (January to December) permit.

g Recharge basins referenced in WDR Order No. 88-075 are located south of East Avenue within Sandia National Laboratories/California boundaries.

h Project location is at the Arroyo Mocho Pump Station. See section on Water Quality and Protection for discussion.

Table 2-4. Inspections and tours of Livermore site and Site 300 by external agencies in 2004

Medium	Description ^(a)	Agency ^(a)	Date	Finding ^(a)
Livermore Site				
Waste	Hazardous waste facilities CEI	DTSC	5/27, 5/28, 6/1, 6/2, 6/3	Received inspection reports and SOVs 7/19/04 and 12/7/04. See Table 2-7 for description and resolution.
	Visit of RCRA closure project Building 233 Container Storage Area. This was a tour, not an inspection	DTSC	3/19	Site visit to see the unit undergoing closure
	Medical waste	ACDEH	9/21	No violations
Air	Emission sources	BAAQMD	2/25, 3/16, 7/29, 8/5, 11/30	Received one NOV 3/16/04. See Table 2-7 for description and resolution.
Sanitary sewer	Annual compliance sampling	LWRP	9/7–9/8	No violations
	Categorical sampling		9/7	No violations
	Process evaluation at DWTF		9/8	No violations
Storage tanks	Compliance with underground storage tank requirements and operating permits	ACDEH	10/20 10/27	No violations
Site 300				
Waste	Permitted hazardous waste operational facilities (EWTF, EWSF, Building 883 CSA), RCRA-closed, post-closure permitted facility Building 829 HE Open Burn Facility, Building 883 WAA, Building 802 Space Action Team WAA, Building 814 Space Action Team WAA, Satellite Accumulation Areas, waste generating areas, and a review of hazardous waste-related documentation.	DTSC	10/28/2003–10/29/2003	Received an inspection report 1/20/04 with a violation. See Table 2-7 for description and resolution.
	Compliance with hazardous waste generator regulations.	San Joaquin County—CUPA	8/2	Received three violations. See Table 2-7 for description and resolution.
Air	Emission sources	SJVAPCD	7/8	No violations
Water	Eastern General Services Area Ground Water Treatment System	CVRWQCB	2/9, 2/11	No violations
	Permitted operations		10/25	No violations
Storage tanks	Compliance with underground storage tank requirements and operating permits	SJCEHD	1/27, 9/22 10/20, 10/26	No violations

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

May, June, and July 2004. LLNL has responded to all seven summary of violations (SOVs) issued on July 19 and December 7, 2004, as part of the 2004 CEI.

Site 300: The hazardous waste management facilities at Site 300 consist of three operational RCRA-permitted facilities. The Explosives Waste Storage Facility and Explosives Waste Treatment Facility are permitted to store and treat explosives waste only. The Building 883 Container Storage Area is permitted to store routine facility-generated waste such as spent acids, bases, contaminated oil, and spent solvents. See **Tables 2-3** and **2-4** respectively for a summary of active permits and inspections at Site 300 in 2004. As a follow up to the October 28, 2003, DTSC CEI, DTSC issued a violation to Site 300 on January 20, 2004, for not having a training plan for personnel inspecting the Building 829 post-closure facility. LLNL has contested the violation and is awaiting a response from DTSC. See **Table 2-7** for details.

DTSC did not inspect Site 300 during calendar year 2004. However, annual facility inspections are based on the state fiscal year, which starts on July 1 and ends on June 30. Therefore, it is anticipated that DTSC will conduct the annual CEI on or before June 30, 2005, in order to comply with the requirement for an annual inspection based on the state fiscal year.

The San Joaquin County Environmental Health Department, acting as the Certified, Unified Program Agency (CUPA), found three violations during a hazardous waste generator compliance inspection on August 2, 2004 (see **Table 2-7** for details). LLNL corrected the violations and submitted the Certification of Return to Compliance on September 9, 2004.

Hazardous Waste Reports

LLNL completed two annual hazardous waste reports, one for the Livermore site and the other for Site 300, that addressed the 2004 transportation, storage, disposal, and recycling of hazardous wastes at the respective sites. The 2004 Hazardous Waste Report-Mainsite and 2004 Hazardous Waste Report-Site 300 were submitted to the DTSC by April 1, 2005.

Hazardous Waste Transport Registration

Transportation of hazardous waste over public roads (e.g., from one LLNL site to another) requires DTSC registration (22 CCR 66263.10). DTSC renewed LLNL's registration in November 2004.

Waste Accumulation Areas

LLNL Programs maintain waste accumulation areas (WAAs) in compliance with waste generator requirements specified in 40 Code of Federal Regulations (CFR) part 262, and Title 22 California Code of Regulations (CCR) part 66262.34, for the temporary storage (less than 90 days) of hazardous waste prior to transfer to a treatment, storage, and disposal facility. In January 2004, there were 20 WAAs at the Livermore site. During 2004, four temporary WAAs were put into service, while one temporary WAA was taken out of service. Program representatives conducted inspections at least weekly at all WAAs to ensure that they were operated in compliance with regulatory require-

ments. Approximately 1086 prescribed WAA inspections were conducted at the Livermore site. At Site 300 during 2004, one permanent WAA was in operation; two temporary WAAs were put into service, while one temporary WAA was taken out of service. Program representatives conducted approximately 114 prescribed WAA inspections at Site 300.

California Medical Waste Management Act

All LLNL medical waste management operations comply with the California Medical Waste Management Act, which establishes a comprehensive program for regulating the management, transport, and treatment of medical wastes that contain substances that may potentially infect humans. The program is administered by California Department of Health Services and is enforced by the Alameda County Department of Environmental Health (ACDEH).

LLNL is registered with the ACDEH as a generator of medical waste and has a treatment permit. No violations were issued as a result of the September 2004 ACDEH inspection of buildings at LLNL Health Services, the Biosciences Directorate, and the Medical Photonics Laboratory. (See [Tables 2-3](#) and [2-4](#).)

Radioactive Waste and Mixed Waste Management

LLNL manages radioactive waste and mixed waste in compliance with applicable sections of DOE Order 435.1, as described in LLNL's *ES&H Manual*, Document 36.1, "Hazardous, Radioactive, and Biological Waste Management Requirements." LLNL has also written the *Radioactive Waste Management Basis* (LLNL 2001), which summarizes radioactive waste management controls relating to waste generators and treatment and storage facilities.

Federal Facility Compliance Act

LLNL is continuing to work with DOE to maintain compliance with the Federal Facilities Compliance Act Site Treatment Plan (STP) for LLNL that was signed in February 1997. During 2004, LLNL requested extensions for six of the eleven STP milestones that were due in 2004. DTSC granted the milestone extensions because LLNL had made significant progress towards completion of the milestones and had reduced the overall inventory of mixed waste stored at LLNL. The remaining five milestones for 2004 were completed on time. LLNL also completed seven milestones well in advance of their due dates, which ranged from 2005 to 2010.

In 2004 LLNL reduced the inventory of mixed low-level waste by over 120 cubic meters. LLNL also completed the characterization of the mixed transuranic (TRU) drums that were in inventory and initiated shipments of TRU waste to the Waste Isolation Pilot Plant (WIPP). Reports and certification letters were submitted to DOE as

required. LLNL continued to pursue the use of commercial treatment and disposal facilities that are permitted to accept mixed waste. These facilities provide LLNL greater flexibility in pursuing the goals and milestones set forth in the STP.

Toxic Substances Control Act

The Federal Toxic Substances Control Act (TSCA) and implementing regulations found in 40 CFR Part 700-789 govern the uses of newly developed chemical substances and TSCA-governed waste by establishing the following partial list of requirements: record-keeping, reporting, disposal standards, employee protection, compliance and enforcement, and clean up standards.

In 2004, LLNL generated TSCA-regulated polychlorinated biphenyl (PCB) waste from electrical equipment contaminated with PCBs, liquid PCBs used to calibrate analytical equipment, and asbestos from building demolition or renovation projects.

All TSCA-regulated waste was disposed in accordance with TSCA, state, and local disposal requirements except for radioactively contaminated PCB waste. Radioactive PCB waste is currently stored at one of LLNL's hazardous waste storage facilities until an approved facility accepts this waste for final disposal.

Air Quality and Protection

Clean Air Act

All activities at LLNL are evaluated to determine the need for air permits. Air permits are obtained from the Bay Area Air Quality Management District (BAAQMD) for the Livermore site and from the San Joaquin Valley Air Pollution Control District (SJVAPCD) and/or BAAQMD for Site 300.

LLNL operated 178 permitted air emission sources at the Livermore site in 2004. During an inspection in March 2004, the BAAQMD issued a notice of violation (NOV) for non-compliance with a sampling requirement in the time period of July 28-30, 2003. (see [Table 2-4](#)). LLNL was subsequently assessed a \$650 penalty (see [Table 2-7](#)).

The BAAQMD revised Regulation 2 Rule 2 and Regulation 2 Rule 4 in December 2004, which impacted the site-wide emission limits of LLNL's Synthetic Minor Operating Permit. The revised regulation redefined a "small facility" as well as the accessibility to the Small Facility Bank that provides emission credits for new and modified sources. As a result, LLNL was required to agree to reduce the annual permitted threshold values by 15 tons per regulated pollutant type. As such, our new emission limit for oxides of nitrogen from combustion sources is 35 tons per year rather than the previous 50 tons per year. The same reduction to 35 tons per year from 50 tons per year also applies to emissions of precursor organic compounds from solvent evaporation which occurs in many institutional operations, such as wipe cleaning and painting. As long as the

reduction to 35 tons per year is maintained, LLNL is ensured the opportunity to borrow credits from the Small Facility Bank rather than buy such credits on the open market; buying such credits on the open market is an expensive and time-consuming process. In accordance with permit conditions, on June 29, 2004, LLNL submitted to the BAAQMD an annual report summarizing emissions from July 1, 2003, through June 30, 2004.

In 2004, the SJVUAPCD issued or renewed air permits for 40 air emission sources for Site 300 (see [Table 2-3](#)). There were no violations issued from the 2004 air inspection of Site 300 facilities (see [Table 2-4](#)).

National Emission Standards for Hazardous Air Pollutants, Radionuclides

To demonstrate compliance with the National Emission Standards for Hazardous Air Pollutants (NESHAPs) for radiological emissions, LLNL is required to monitor certain air release points and evaluate all potential sources of radionuclide air emissions to determine the maximum possible dose to the public. These evaluations include modeling (using EPA-sanctioned computer codes) based on radionuclide inventory data, air effluent (source emission) monitoring, and air surveillance monitoring. The *LLNL NESHAPs 2004 Annual Report* (Harrach et al. 2005), submitted to DOE and EPA, reported that the estimated maximum radiological doses to the public were 0.079 μSv (0.0079 mrem) for the Livermore site and 0.26 μSv (0.026 mrem) for Site 300 in 2004. The reported doses include contributions from both point and diffuse sources. The totals were well below the 100 $\mu\text{Sv}/\text{y}$ (10 mrem/y) dose limits defined by the NESHAPs regulations. Additional information on the data are described in [Chapter 6](#).

In 2004, LLNL continuously monitored radionuclide emissions from Building 331 (the Tritium Facility), Building 332 (the Plutonium Building), and portions of five other facilities (see [Chapter 3](#)). There were no unplanned atmospheric releases at the Livermore site or at Site 300 in 2004. Monitoring activities and results related to air are described further in [Chapter 3](#).

Water Quality and Protection

Clean Water Act and Related State Programs

Preserving clean water is an objective of local, state, and federal regulations. The National Pollutant Discharge Elimination System (NPDES) under the federal Clean Water Act (CWA) establishes permit requirements for discharges into waters of the United States. In addition, the State of California, under the Porter-Cologne Water Quality Control Act, requires permits, known as Waste Discharge Requirements (WDRs), for any waste discharges affecting the beneficial uses of waters of the state. These permits, as well as water quality certifications for discharges authorized under Section 401 of the CWA, are issued by local Regional Water Quality Control Boards

(RWQCBs) and the State Water Resources Control Board. RWQCBs enforce both the regional and state issued permits. Section 401 state certifications are required when the Army Corps of Engineers issues permits under Section 404 of the CWA. Several other agencies issue other water-related permits. The Livermore Water Reclamation Plant (LWRP) requires permits for discharges to the city’s sanitary sewer system. The California Department of Fish and Game (CDFG), under the Fish and Game Code, requires streambed alteration agreements (SAAs) for any work that may disturb or impact rivers, streams, or lakes. The Safe Drinking Water Act requires registration with the EPA and management of injection wells to protect underground sources of drinking water.

Water-related permits and inspections from outside agencies are summarized in [Tables 2-3](#) and [2-4](#), respectively. LLNL received one NOV in 2004 for the Terascale Simulation Facility for the failure to pay an NPDES permit annual fee, but the NOV was later withdrawn (see [Table 2-5](#)). LLNL identified an administrative nonconformance with permit conditions for failure to document formal storm water inspections at the Sensitive Compartmented Information Facility, which is permitted by NPDES permit number CAS000002. This instance is discussed in the required annual compliance certification.

Table 2-5. Water-related permit nonconformance

Permit No ^(a)	Nonconformance ^(a)	Date(s) of nonconformance	Description–solution ^(a)
1250, LWRP sanitary sewer permit	Excursion below pH permit limit of 5; approximately 250 gallons of effluent discharged to the LWRP with a pH of 4.63.	3/7/04	Remainder of effluent captured and contained on site by Sewer Diversion Facility. LLNL received no enforcement action from the LWRP.
CAS000002 WDID No. 201C317827	NOV issued for failure to pay permit fee for the Terascale Simulation Facility	8/19/04	NOV was withdrawn after the fee was paid and because the agency sent the invoices to the wrong address.
CAS000002, WDID No. 201C317621 ALP	Sensitive Compartmented Information Facility—Failure to document required storm water inspections.	12/24/03– 6/30/04 ^(b)	Incidents were identified to project management and noted in the annual compliance certification dated 6/29/04.

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

^b These dates reflect the construction reporting period of June 2003 through May 2004.

In 2004, LLNL obtained coverage under Regional General Permit 1 for Fish Passage/Sediment Reduction Projects at Water Crossings from the Army Corps of Engineers. This permit authorized LLNL to remove an existing, at-grade creek crossing in the upper reaches of the Arroyo Mocho, which prevented steelhead and resident trout migration, and replace the creek crossing with a clear-span bridge. The bridge is used regularly by LLNL staff to access the Arroyo Mocho Pump Station. See the [Arroyo Mocho Road Improvement and Anadromous Fish Passage Project](#) section of Chapter 5 for details.

LLNL received no enforcement action from the LWRP during 2004. See [Table 2-5](#) for a summary of nonconformance with water-related permits. Monitoring activities and results related to water permits are described in [Chapter 4](#).

Tank Management

The CWA and California Aboveground Petroleum Storage Act require facilities meeting specific storage requirements to have and implement Spill Prevention Control and Countermeasure plans for aboveground, oil-containing containers, including equipment and tanks. ACDEH and San Joaquin County Environmental Health Department (SJCEHD) also issue permits for operating underground storage tanks containing hazardous materials or hazardous waste as required under the California Health and Safety Code.

LLNL manages its underground and aboveground storage tanks through the use of underground tank permits, monitoring programs, operational plans, closure plans and reports, leak reports and follow-up activities, and inspections. At LLNL, permitted underground storage tanks contain diesel fuel, gasoline, and used oil; aboveground storage tanks contain fuel, insulating oil, and process wastewater. Some non-permitted wastewater tank systems are a combination of underground storage tanks and aboveground storage tanks. [Table 2-6](#) shows the status of in-service tanks at the Livermore site and Site 300 as of December 31, 2004. All permitted underground storage tanks were inspected by the regulating agencies in 2004. No violations were noted during the inspections. See [Table 2-4](#) for summary of inspections.

Other Environmental Statutes

National Environmental Policy Act

The National Environmental Policy Act (NEPA) is our country's basic environmental charter. NEPA requires the federal government to do two things when they consider a proposed project or action: 1) consider how the action will affect the human environment, and 2) inform the public and involve them in the decision making process. LLNL is not a federal agency, but LLNL activities are generally funded by the federal government; therefore, the activities must comply with the requirements of NEPA.

Federal agencies meet the first NEPA requirement by studying the impact a project would have on the human environment. The agency studies the components of the human environment that may be affected by the project, which may or may not include: air, water, soil, biological resources, socioeconomics, aesthetics, noise, or cultural resources. The results of their studies are written in a "NEPA document." Federal agencies meet the second requirement (inform the public) by distributing the NEPA documents. NEPA documents are made available in public reading rooms, on the

Table 2-6. In-service tanks in 2004

Tank type	Livermore site		Site 300	
	Permitted	Permits not required	Permitted	Permits not required
Underground storage tanks				
Diesel fuel	7	0	2	0
Gasoline	2	0	1	0
Used oil	1	0	0	0
Process wastewater	0	45	0	11
Subtotal	10	45	3	11
Aboveground storage tanks				
Diesel fuel	0	24	0	7
Insulating oil	0	1	0	3
Process wastewater	9 ^(a)	58	0	16
Miscellaneous non-waste tanks	0	11	0	2
Subtotal	9	94	0	28
Total	19	139	3	39

^a Nine tanks are located at Building 695, the Decontamination and Waste Treatment Facility.

internet, and sometimes are directly mailed to interested parties. Federal agencies often involve the public in their decisions about proposed projects by holding public meetings and asking for comments on their NEPA documents.

There are two types of NEPA documents: environmental impact statements and environmental assessments (EAs). Environmental impact statements are prepared for major federal actions that significantly affect the quality of the human environment. In contrast, EAs are prepared for federal actions that will not have a significant impact on the environment. The federal agency decides which type of document to prepare after studying the impact to the environment.

Some projects do not require the preparation of either an environmental impact statement or an environmental assessment. These projects fit into categories of activities that are well understood and known to have no impact on the human environment. After an agency studies the environmental impacts of a project and determines that the project fits into one of these categories, no further documentation is required. Nonetheless, some federal agencies, including DOE at LLNL, choose to write a memorandum that describes the project and explains why it meets the criteria for being categorically excluded. These memoranda are referred to as CXs, Cat Xs, and Categorical Exclusions—technically, they are not actual NEPA documents.

The paragraphs that follow provide details about the NEPA documents and Categorical Exclusions that have been prepared for LLNL projects this year.

There were no LLNL projects in 2004 that required DOE EAs. Sixteen categorical exclusion recommendations were approved by DOE, and there were no proposed actions at LLNL that required separate DOE floodplain or wetlands assessments under DOE regulations in 10 CFR 1022.

In 2004, DOE published the draft *Site-wide Environmental Impact Statement for the Continued Operation of Lawrence Livermore National Laboratory and Supplemental Stockpile Stewardship and Management Programmatic Environmental Impact Statement (LLNL SW/SPEIS)*. The draft *LLNL SW/SPEIS* was issued for a 90-day public comment period (February 27 to May 27, 2004). Three public hearings were held in 2004: April 27 in Livermore, April 28 in Tracy, and April 30 in Washington, D.C.

The final *LLNL SW/SPEIS* is scheduled to be complete, and a Record of Decision filed, in summer 2005. The final *LLNL SW/SPEIS* will replace the *1992 Final Environmental Impact Statement and Environmental Impact Report for Continued Operation of Lawrence Livermore National Laboratory and Sandia National Laboratories, Livermore (1992 EIS/EIR)* (U.S. DOE and UC 1992a,b) and its March 1999 Supplement Analysis.

Since November 1992, the University of California (UC) and LLNL have implemented mitigation measures identified by the *1992 EIS/EIR*. An addendum to the *1992 EIS/EIR* was prepared in 1997. The measures are being implemented in accordance with the approved 1992 Mitigation Monitoring and Reporting Program associated with the *1992 EIS/EIR*. The 2000 mitigation monitoring report was published in 2003. The 2001, 2002, and 2003 mitigation monitoring reports will be published in 2005.

National Historic Preservation Act

The National Historic Preservation Act (NHPA) applies to historically important places and to the preservation of prehistoric and historic resources of the United States. LLNL resources subject to NHPA consideration range from prehistoric archeological sites to remnants of LLNL's own history of scientific and technological endeavor. The responsibility to comply with the provisions of NHPA rests solely with DOE as a federal agency. LLNL and UC as its contractor operator support DOE NHPA responsibilities. LLNL does so with direction from DOE.

The two primary NHPA sections that apply to LLNL are Sections 106 and 110. Section 106 requires federal agencies to take into account the effects their undertakings may have on historic properties. The agencies must allow and consider comments of the federal Advisory Council on Historic Preservation. The Section 106 regulations outline a five-step review process that is conducted for individual federal actions. Section 110 sets forth broad affirmative responsibilities to balance agency missions with cultural values. Its purpose is to ensure full integration of historic preservation into federal agency programs.

LLNL has taken two approaches to streamline historic preservation efforts and focus on important historic properties under its management. First, DOE, UC, and the State Historic Preservation Officer (SHPO) reached an agreement in July 2003 that governs historic preservation program activities until resource inventory and assessment activities specified in the agreement are complete. The goal is to reduce the amount of paperwork necessary to ensure protection of important historic properties by reaching a consensus on where and how to effectively focus LLNL's efforts. Second, as is specified in the agreement, is to complete within a reasonable timeframe an inventory of places (prehistoric and historic, archeological, and architectural) that meets a statutory threshold of historic importance. LLNL is on schedule with this inventory and assessment effort. During 2004, LLNL completed significance assessments for all known archeological sites as well as prepared an historic context statement. LLNL also completed all work necessary to support future National Register of Historic Places determinations for buildings, structures, and objects at the Livermore site and Site 300. Formal National Register determinations will be made by DOE in consultation with the SHPO in 2005.

Antiquities Act

Provisions of the Antiquities Act provide for recovery of paleontological remains. After the discovery of mammoth remains in conjunction with the National Ignition Facility construction in 1997, LLNL has remained vigilant for other fossil finds. No remains subject to the provisions of the Antiquities Act were identified in 2004.

Endangered Species Act and Sensitive Natural Resources

Requirements of the U.S. Endangered Species Act, the California Endangered Species Act, the Eagle Protection Act, the Migratory Bird Treaty Act, and the California Native Plant Protection Act are met as they pertain to endangered or threatened species and other special-status species, their habitats, and designated critical habitats that exist at the LLNL sites. For example, DOE consults with the U.S. Fish and Wildlife Service (USFWS) when activities will result in an impact to federally endangered or threatened species, surveys for the presence of species of special concern, and follows mitigation requirements in biological opinions. A biological assessment (BA) for the implementation of the Arroyo Seco Management Plan was prepared and submitted to USFWS on August 14, 2003, and the USFWS issued a biological opinion for this project on June 10, 2005. USFWS is currently reviewing the BA. A BA for the implementation of the Arroyo Mocho road improvement and anadromous fish passage project was prepared and submitted to USFWS on November 6, 2003. USFWS responded with their biological opinion for the Arroyo Mocho project on February 10, 2004. In 2004, two BAs were submitted to the USFWS for LLNL activities. A BA for the Livermore site and Site 300 regarding the *Site-wide Environmental Impact Statement for the Continued Operation of Lawrence Livermore National Laboratory and Supplemental Stockpile Stewardship and Management Programmatic Environmental Impact Statement* was prepared and submitted to USFWS on April 9, 2004. On December 13, 2004, a BA was submitted to the USFWS for closure of the Site 300 Class II High Explosives Impoundments. The USFWS is currently reviewing both BAs. Biological surveys for special-status species and monitoring results are described in [Chapter 5](#).

Environmental Occurrences

In 2004, notification of environmental occurrences was required under a number of environmental laws and regulations as well as DOE Order 231.1A and DOE Manual 231.1-2. The orders and manual provide guidelines to contractor facilities regarding categorization and reporting of environmental occurrences to DOE and divides occurrences into categories.

LLNL's response to environmental occurrences is part of the larger on-site emergency response organization that includes representatives from Hazards Control (including the LLNL Fire Department), Health Services, Plant Engineering, Public Affairs, Safeguards and Security, and Environmental Protection. In 2004, four environmental incidents, summarized in [Table 2-7](#), were reportable under DOE Order 232.1A and were categorized as Significance Category 4 reportable occurrences under Group 9, Noncompliance Notifications according to DOE Order 232.1A. DOE was notified of these incidents. Other regulatory agencies involved are described in [Table 2-7](#) for each of the incidents. No occurrences were reportable under Group 5, Environmental.

PROGRAM SUMMARY

Integrated Safety Management System

LLNL implements an Integrated Safety Management System (ISMS) designed to ensure the systematic integration of environment, safety, and health (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. LLNL regards protection of the environment as an essential component in its overall safety management system.

The core requirements of ISMS are based on DOE's Seven Guiding Principles 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. How LLNL manages and performs work can be described by the Five Core

Program Summary

Table 2-7. Environmental Occurrences reported under the Occurrence Reporting System in 2004

Date ^(a)	Occurrence category/group	Description ^(b)
January 20	Significance Category SC4 Occurrence under Group 9(2)	DTSC issued a class II minor violation to Site 300 for failing to have a training plan as part of the post-closure permit application for the Building 829 RCRA-closed facility. LLNL contested the violation in a letter dated March 17, 2004, and has requested that DTSC rescind the violation. As of April 2005, DTSC has not responded to the request. OR-2004-0001
March 16	Significance Category SC4 Occurrence under Group 9(2)	LLNL received an NOV from BAAQMD for a single violation of a sampling requirement for Source #3646 (MTU #2), a groundwater stripping system. BAAQMD Regulations 8-47-501.1 and 8-47-601 require three consecutive days of influent water analysis when a groundwater stripping system is started up. The logbook for Source #3646 shows that a sample was taken on 7/28/03 and 7/30/03, but there was no record of a sample taken on 7/29/03. LLNL paid a civil penalty of \$650. OR 2004-0015
July 19	Significance Category SC4 Occurrence under Group 9(2)	<p>LLNL received SOVs from DTSC for two alleged violations observed during the 2004 CEI of permitted hazardous waste handling operations.</p> <ul style="list-style-type: none"> • Treatment of hazardous waste in an unauthorized unit (using steel metal pan/sorting table with the Debris Washer unit). Although LLNL contends the violation was invalid, LLNL prepared and DTSC approved a Class 1 permit modification authorizing the use of sorting tables. • Commingling incompatible wastes in the same container. An LLNL researcher placed hazardous waste solvents (methanol, ethanol, acetone, and water) and 70% nitric acid in a 5-gallon poly container, causing the incompatible wastes to react and generate nitrous oxide gases. LLNL has made sure that wastes are compatible with each other and containers and personnel have been trained. On December 17, LLNL received amended SOVs from DTSC for five alleged violations observed during the same CEI. • Certifying and shipping prohibited waste for land disposal without meeting treatment standards. LLNL submitted proof of proper management and disposal of this waste by an off-site TSD in March 2005. Waste treatment and disposal occurred on January 31, 2005. • Storage more than one year. LLNL stored mixed waste for more than one year in Area 612-1A, without authorization. LLNL will submit to DTSC all requests for continued storage of mixed wastes meeting LDR standards at least 30 days prior to reaching the one year allowable limit in the HWFP. • Failure to comply with labeling requirements. LLNL failed to comply with the following container labeling requirements: <ol style="list-style-type: none"> a. On or about May 27, 2004 at Area 612-5, two boxes containing mixed wastes were labeled as hazardous wastes. The waste was shipped as hazardous waste to Envirocare of Utah on June 9, 2004. b. On or about May 28, 2004, at Area 612-2, the date of acceptance at the hazardous waste management unit was not marked on the label of a 5-gallon container of mixed waste aqueous acid solution, corrosive. This violation was corrected during the inspection.

Table 2-7. Environmental Occurrences reported under the Occurrence Reporting System in 2004

<p>July 19 (continued)</p>	<p>Significance Category SC4 Occurrence under Group 9(2)</p>	<p>c. On or about May 27, 2004, at Building 695's Reactive (Room 1023), mixed waste bottles and bags contaminated with beryllium had a label marked 5/25/04, which was the date the waste was removed from its container. The date on the label should have been 9/27/98, which was the original TSDF acceptance date on the container. This waste has been treated and DTSC requires no further action.</p> <ul style="list-style-type: none"> • Failure to follow the Waste Analysis Plan. In Area 612-2, two containers (one 5-gal and one 30-gal) of hazardous mixed waste aqueous acid solution, toxic, corrosive wastes were accompanied by the incorrect WDRs. DTSC requires no further action. • Failure to accurately record observations in an inspection log. LLNL failed to accurately record observations noted during an inspection. DTSC requires no further action. <p>OR 2004-0028.</p>
<p>August 2</p>	<p>Significance Category SC4 Occurrence under Group 9(2)</p>	<p>LLNL received an NOV from the San Joaquin County Environmental Health Department—CUPA for improper handling of hazardous waste at two Site 300 facilities and deficient hazardous waste training for one employee.</p> <ul style="list-style-type: none"> • A container (bucket) filled with crushed oil filters was found in Building 875 without a lid. The bucket is used to move the filters from the crusher to the hazardous waste drum. In this case, workers used the bucket as interim storage instead of emptying the contents into the drum at the end of their shift. Management will re-educate workers and re-emphasize hazardous waste handling procedures. • A worker in Building 879 stated that used fuel filters were disposed of as municipal solid waste; however, used fuel filters are to be disposed as hazardous waste. EPD will characterize the hazard constituents and fuel filters will be disposed as hazardous waste. • A paint shop employee in Building 872 signed a waste generation requisition and was not current in the hazardous waste generator refresher class (EP0006-HZRW). The employee completed the on-line course and documentation was provided to the inspector at the close-out inspection the same day. <p>OR 2004-0034.</p>

a The date indicated is the date when the occurrence was categorized, not the date of its discovery.

b See Acronyms and Abbreviations for list of acronyms.

Functions: (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. LLNL's ISMS in 2004 is detailed in *Integrated Safety Management System Description* (LLNL 2003a) which can be found at the following website: http://www.llnl.gov/es_and_h/ism/ism-descriptionv6.pdf.

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. They are LLNL's ES&H requirements (i.e., applicable laws, regulations, DOE orders, etc.). The necessary and sufficient process was utilized to develop WSS requirements. This was accomplished through review and recommendation by the LLNL subject matter experts and their DOE counterparts. 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 Board (CCB), with representatives from DOE, UC, and LLNL, manages the change control process. In addition, LLNL undertakes periodic review of all the requirements to ensure that the WSS set is current and complete.

The WSS set currently identified to satisfy the ES&H needs of the LLNL work environment is in Appendix G of the UC contract, and can be viewed at: <http://labs.ucop.edu/internet/wss/wss.html>.

Environmental Management System

In July 2004, LLNL adopted the International Organization for Standardization (ISO) 14001 standard as a WSS. LLNL's approach is to build on its existing ISMS to develop an Environmental Management System (EMS) that meets the requirements of ISO 14001. The EMS

- Promotes responsible environmental stewardship practices that are protective of the air, water, land, and other natural and cultural resources
- Complies with applicable environmental regulations in a cost-effective manner
- Focuses on continuous improvement of LLNL environmental performance

LLNL has committed to achieve continuous improvement in operational and environmental performance through Pollution Prevention (P2) and other sustainable business tools.

The ISO 14001 standard uses the identification, determination of significance, and mitigation of "environmental aspects" to drive and measure environmental protection improvements within work activities, facilities, and the institution. An environmental aspect is an element of an organization's activities, products, or services that can interact with the environment. Significant environmental aspects are those that are both feasible to address, and when acted upon, result in marked environmental performance improvement. In 2004, LLNL identified the environmental aspects listed in **Table 2-8**.

Table 2-8. LLNL environmental aspects

Category	Aspects	Aspect identified in 2005 as significant
Biological materials/waste	Biological material use	
	Medical/biological waste generation	
Regulated air emissions	Criteria pollutant emissions	
	Radioactive air emissions	
	Greenhouse gas emissions	
	Hazardous air pollutants emissions	
Ecological resources	Ecological resources disturbance	X
Land use/land management	Land use/land management	
Discharges to ground, storm, and surface waters	Discharges to ground	
	Discharges to storm drain system	
	Discharges to the arroyo/surface waters	
Sanitary sewers	Discharges to the sanitary sewer system	
Energy emissions	Energy emissions	
Energy use	Electrical energy use	X
	Renewable energy use	X
	Fossil fuel consumption	X
Hazardous materials/waste	Hazardous materials use	X
	Hazardous waste generation	
Municipal, industrial, and nonhazardous materials/waste	Municipal waste generation	X
	Industrial waste generation	
	Nonhazardous materials use	X
Radioactive material/waste	Radioactive material use	X
	Low-level radioactive waste generation	
	Transuranic waste generation	X
	Mixed waste generation	X
Other air emissions (odors, etc.)	Other air emissions (odors, etc.)	
Water use	Water use	
Cultural resources disturbance	Cultural resources disturbance	
Environmental noise	Environmental noise	

Table 2-8 also indicates the aspects that LLNL identified during the beginning of 2005 as significant using criteria based on the following environmental and business factors:

- Existing laws, regulations, or standards to address the impacts of the environmental aspect
- Perceptions of interested parties (either positive or negative)
- Ability of engineered or administrative controls to mitigate the impacts of the environmental aspect
- Scale of the impacts of the environmental aspect is localized or can be contained within LLNL
- Severity and duration of the impact of the environmental aspect
- Frequency and probability of the environmental aspect to occur
- Reuse and recycling opportunities available for the environmental aspect
- Operational and technical information to manage the impacts of the environmental aspect is readily available
- Ability and cost to change the impacts of the environmental aspect

For each of these significant aspects, LLNL has developed objectives to meet LLNL's environmental policy with respect to that particular environmental aspect. LLNL has also identified environmental targets to achieve these objectives. Where appropriate, LLNL's approach is to utilize activities and programs that are already in place. For significant environmental aspects without existing programs, LLNL is proposing studies to first better understand how the impacts of the significant environmental aspect can be most efficiently and effectively affected. As part of the continuous improvement integral to ISO 14001, LLNL will review annually its significant environmental aspects, and their respective objectives and targets.

Environmental Protection Department

As the lead organization at LLNL for providing environmental expertise and guidance on operations at LLNL, the Environmental Protection Department (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. EPD has also taken the leadership role in the decommissioning and decontamination (D&D) of facilities at LLNL to adapt to changes in programs resulting from the end of

the Cold War. EPD's Space Action Team tactically implements LLNL's institutional D&D activities. Since 1994, 155 real property facilities encompassing 408,000 gross square feet have been removed from LLNL.

EPD monitors air, sewerable water, groundwater, surface water, rain, soil, sediment, vegetation, and foodstuff, as well as direct radiation; evaluates possible contaminant sources; and models the impact of LLNL operations on humans and the environment. These monitoring activities in 2004 are presented in the remaining chapters of this report.

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. These functions are organized into three divisions within the department: Operations and Regulatory Affairs (ORAD), Radioactive and Hazardous Waste Management (RHWM), and Environmental Restoration (ERD).

Operations and Regulatory Affairs Division

The Operations and Regulatory Affairs Division (ORAD) consists of six 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 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 interacts with the community on these issues through Environmental Community Relations. 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 other first responders and environmental specialists.

Radioactive and Hazardous Waste Management Division

The Radioactive and Hazardous Waste Management (RHWM) Division 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, 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 California and U.S. 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 of LLNL's mixed waste in accordance with the requirements of the Federal Facilities 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 also 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 program to identify all components of the waste and a certification effort that provides appropriate documentation for the disposal site.

Environmental Restoration Division

The Environmental Restoration Division (ERD) was established to evaluate and remediate 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, 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 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. These CERCLA activities

in 2004 are summarized in the “[Environmental Restoration and Waste Management](#)” section earlier in this chapter. ERD’s groundwater remediation activities in 2004 are further described in [Chapter 7](#) of this report.

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 any environmental incidents to an EOG environmental analyst assigned to support their program area. The EOG environmental analyst then notifies the on-duty EDO of the incident, and together with other ORAD staff, the team determines 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.

Pollution Prevention

LLNL has a Pollution Prevention (P2) team whose role it is to help facilitate LLNL’s P2 program within the framework of the ISMS and in accordance with applicable laws, regulations and DOE orders as required within the UC Contract. Responsibilities include P2 program stewardship and maintenance, P2 analysis and reporting of waste generation, P2 opportunity assessment and high return-on-investment follow through, implementation of recycling, reuse and waste minimization programs for hazardous as

well as nonhazardous waste, and coordination of P2 programs and activities with other energy efficiency and resource conservation efforts at LLNL. The P2 team supports P2 efforts and activities through environmental teams. In addition, the P2 team undertakes coordination of the affirmative procurement program and provides awareness presentations, articles, events, and other materials.

DOE Pollution Prevention Goals

In 1999, DOE developed pollution prevention and energy efficiency leadership goals for DOE facilities in response to presidential executive orders for the Greening of the Federal Government. These goals are compared in **Table 2-9** with LLNL's quantities of routine waste generated in 1993 (i.e., LLNL's baseline), its 2005 target, the actual amount of waste generated in 2004, and the percent reduction in 2004 compared with the baseline. Routine waste described in **Table 2-9** includes waste from ongoing operations produced by any type of production, analysis, and/or research and development taking place at the Laboratory. Periodic laboratory or facility clean-outs and spill cleanups that occur as a result of these processes are also considered normal operations.

The following five energy efficiency goals were included in the leadership goals. The bottom section of **Table 2-9** lists the goals, baseline quantities, the 2005 targets when applicable and provides a verbal description of the status for each goal.

- Reduce energy consumption per gross square foot by 20% by 2005 and 25% by 2010 relative to 1990.
- Increase the use of clean energy sources (renewable and low greenhouse gas energy).
- Retrofit or replacement of 100% of chillers with capacity greater than 150 tons that use class I refrigerants by 2005.
- Eliminate the use of Class I ozone-depleting substances.
- Reduce greenhouse gas emissions attributed to facility energy use through life-cycle cost-effective measures by 4% by 2005 and 30% by 2010, using 1990 as a baseline.

In 2004, because so many of the original goals will be met by 2005, DOE and NNSA began to develop a revised set of P2 goals that will be approved in 2005.

In 2001, LLNL revised the method by which it calculates waste to better identify future P2 opportunities and to eliminate categories of wastes that would otherwise be counted twice under the RHWM Division's Total Waste Management System (TWMS) database, which was replaced in FY 2004 with a new database called HazTrack. The quantities for hazardous waste, low-level radioactive waste, and mixed low-level waste reported in HazTrack now include all wastes generated under requisition.

Table 2-9. Pollution prevention and energy efficiency leadership goals at LLNL

Goal	Item	1993 baseline quantity	2005 target based on DOE leadership goal ¹	2005 LLNL target commitment	2004 actuals	Percent reduction since 1993	Percent of 2005 target
Pollution Prevention Goals							
1	Hazardous Wastes Generated (90% of 1993 baseline)	1054 MT ^(a)	105.4 MT	105.4 MT	141.3 MT	87	97
1	Mixed Waste Generated (80% of 1993 Baseline)	26 m ³	5.2 m ³	5.2 m ³	18.8 m ³	28	35
1	Low-level Waste Generated (80% of 1993 baseline)	346 m ³	69.2 m ³	69.2 m ³	151.3 m ³	56	70
1	TRU/Mixed TRU Waste Generated (80 % of 1993 baseline)	12.0 m ³	2.4 m ³	2.4 m ³	1.2 m ³	90	1.13
3	Sanitary Waste Generated (75% of 1993 baseline)	5873 MT	1468 MT	1468 MT	4596 MT	22	29
4	Sanitary Wastes Recycled (45% of waste generated)	N/A	45%	45%	2921 MT	64	142
6	Purchases of EPA-designated items with Recycled Content (100% by cost of recycled versus nonrecycled)	N/A	100%	— ^(b)	\$1.147M/ \$2.136M	53	53
2	TRI Chemical Releases (90% of 1993 Baseline)	3983.3 lb ^(c)	398.3 lb	398.3 lb	605.2lb	85	94
10	Eliminate use of Class 1 ozone-depleting substances by 2010	NA	0	The current schedule based on life-cycle cost-effective use of existing chillers and one halon fire-suppression unit shows five chillers and up to three fire-suppression units being replace after 2010.			
Energy Efficiency Goals							
7	Unit Energy Consumption (20% of 1990 baseline for lab and industrial facilities)	289,600 BTU/gross ft ²	231,700 BTU/gross ft ²	As of FY 2000, LLNL has met the goal. The current schedule based on life-cycle cost-effective use of existing equipment shows eight chillers and one fire-suppression unit being replaced by 2015.			
8	Request for bid packages for energy supply with clean energy provisions (100% of requests with provisions versus those without)	N/A	100%	Because NNSA purchases LLNL's electricity, LLNL cannot commit to meeting this goal.			
8	Purchase of electricity from less greenhouse gas-intensive sources (% of electricity from less greenhouse gas sources to total consumption)	N/A	100% of all future DOE competitive solicitations for electricity	Because NNSA purchases LLNL's electricity, LLNL cannot commit to meeting this goal.			

Table 2-9. Pollution prevention and energy efficiency leadership goals at LLNL (continued)

Goal	Item	1993 baseline quantity	2005 target based on DOE leadership goal ¹	2005 LLNL target commitment	2004 actuals	Percent reduction since 1993	Percent of 2005 target
9	Replacement of chillers (100% of total 150 ton [or larger] pre-1984 units with class I refrigerants replaced)	7 (number of units in use in 1999)	0				
				The current schedule based on life-cycle cost-effective use of existing equipment shows three chillers being replaced by 2007.			
11	Greenhouse gas emission from energy use (25% of greenhouse gas emission reduced relative to 1990 baseline)	117,414.49 tons	112,717.9 tons				
				Because NNSA purchases LLNL's electricity, LLNL cannot commit to meeting this goal.			

a MT = metric ton

b LLNL cannot meet this goal by 2005.

c In 2004, lead was the only toxic chemical that had exceeded the TRI reporting threshold at LLNL. In just three years, from 2001 to 2004, Site 300 reduced the amount of TRI-reportable lead from 3983 lbs to 605.2 lbs, a reduction of 84.8%.

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, 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 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 team tracks waste generation using the HazTrack database. By reviewing the information in this database, program managers and P2 staff can monitor and analyze waste streams to determine cost effective improvements to LLNL operations.

Diverted Waste

Together, the Livermore site and Site 300 generated 4596 metric tons of routine nonhazardous solid waste in 2004. This volume includes diverted waste (for example, material diverted through recycling and reuse programs) and landfill wastes. LLNL generated 13,827 metric tons of nonroutine nonhazardous solid waste in FY 2004. This includes waste that is reused as cover soil at Class II landfills or is recycled through the nonroutine metals recycling programs. Nonroutine nonhazardous solid wastes include wastes from construction, and decontamination and demolition activities. In FY 2004, the portion of nonhazardous waste (routine and nonroutine) sent to landfill was 2850 metric tons. The routine portion was 1675 metric tons and the nonroutine portion was 1175 metric tons. The breakdown for routine and nonroutine nonhazardous waste that was sent to landfills in FY 2004 is shown in [Table 2-10](#).

Table 2-10. Total nonhazardous waste sent to landfills in FY 2004

Nonhazardous waste	2004 total (metric tons)
Routine	
Compacted (landfill)	1675
Nonroutine	
Construction demolition (noncompacted landfill)	1083
Industrial (TWMS and HazTrack ^(a))	92
Nonroutine subtotal	1175
LLNL total	2850

^a RHWM Waste Management Systems

Together the Livermore Site and Site 300 diverted 2922 metric tons of routine nonhazardous waste in 2004. This represents a diversion rate of 64%. This diversion rate includes waste recycled by RHWM and waste diverted through the surplus sales and pipette box recycling programs. The total routine and nonroutine waste diverted from landfills through LLNL’s comprehensive waste diversion program was 16,748 metric tons in FY 2004 (Table 2-11).

Source Reduction and Pollution Prevention

A water conservation pilot project was implemented at the EPD T5475 facility in 2003. During 2004, based on the success of the pilot project, waterless urinals were retrofitted in several LSO Directorate buildings and the Discovery Center (visitor’s center). Several new buildings were also equipped with the waterless urinals. Water savings is estimated to be up to 20,000 gallons per urinal per year.

Since October 2003, beginning with a pilot program that ended in March 2004, EPD has been participating in the Federal Electronics Challenge (FEC). The FEC is a voluntary partnership program that encourages federal facilities and agencies to purchase greener electronic products, reduce impacts of electronic products during use, and manage obsolete electronics in an environmentally safe way. EPD's participation in the FEC complemented efforts already underway to assess LLNL's management practices for electronic waste (e-waste), including preparation for reporting of the recycle/disposal of cathode ray tubes under SB 20 (Electronic Waste Recycling Act). The FEC recognizes the efforts and achievements of FEC Partners through an optional national awards and recognition program. In 2004, EPD applied for and received a Bronze Award for meeting FEC's mandatory requirements for end-of-life management of electronic equipment as well as meeting several optional activities pertaining to the two other life-cycle phases (acquisition and procurement; operation and maintenance). Winners are posted

Table 2-11. Diverted waste in FY 2004

Waste description	Cumulative 2004 total (metric tons)
Routine	
Batteries (small)	4
Batteries (lead-acid)	35
Beverage containers	5
Cardboard	147
Compost	388
Cooking grease	3
Magazines, newspapers, and phone books	35
Metals	1,461
Paper	329
Pipette box recycling	1
Street sweepings	146
Tires and scrap	17
Toner cartridges	17
Wood pallets	351
Total routine waste diverted	2,939
Nonroutine	
Asphalt/concrete	12,207
Class II Cover	1,233
Miscellaneous	11
Nonroutine metals	235
Offsite daily cover/onsite reuse	140
SAT Freon	0
Total nonroutine waste diverted	13,826
LLNL diversion total	16,765

on the website <http://www.federalelectronicschallenge.net/winners.htm>. Bronze level partners are recognized as “demonstrating significant commitment and achievements in one life-cycle phase.”

In December 2004, DOE NNSA selected two projects at LLNL to receive the DOE Best-in-Class Awards. The first of these was for LLNL’s tilt-pour furnace process, which is used for the pyrochemical processing of plutonium. It is an example of a research project that has pollution prevention value and is important to both LLNL and DOE missions. Traditionally, processing was performed with stationary furnaces and ceramic crucibles that could not be reused and would have to be disposed of as TRU waste after each run. The tilt-pour furnace uses crucibles that can be used for hundreds of runs before replacement is required, substantially decreasing the TRU waste stream generated.

The second project that received a DOE Best-in-Class Award also received a DOE P2 Star Award. For this project, the on-site environmental analytical laboratory instituted a rigorous “up-front” waste characterization program that effectively changed the waste stream generated from hazardous mixed-waste to an approved, certified low-level waste stream. In the 8 months of operating history, 44% of the waste (by mass) has been diverted from mixed to low-level. This will result in significant cost savings and reduction in waste re-handling/personnel exposure.

Both Best-in-Class Awards were presented in 2005.

Return-on-investment Projects

DOE funded three P2 projects in 2004 with DOE High-Return-on-Investment (ROI) funds carried over from 2002. Other ongoing ROI projects are listed in [Table 2-12](#).

Table 2-12. Ongoing High ROI projects in FY 2004

Operation	Project
Mercury Thermometer Exchange	The goal of a pilot project (2003–2004) within the Chemistry & Chemical Engineering Division of the Chemistry & Material Science Directorate was to reduce environmental, health, and safety risk by removing mercury-containing thermometers from use in specified LLNL laboratories. An associated goal was to evaluate how the alternative non-mercury thermometers are received by chemists having specialized temperature measurement needs. Final procurements of the non-mercury thermometers were completed in FY 2004. Chemists have responded positively to the new thermometers, which have met the temperature measurement requirements for their intended uses.
Global Electric Motor-cars (GEM)	A pilot project carried out in 2003 evaluated the integration of electric vehicles (Daimler-Chrysler GEMs) into the LLNL fleet. With the study deemed a success, several Directorates have worked with Fleet Management to purchase the GEM cars for on-site use. Twenty-three new electric vehicles entered service in FY 2004.

- **Biodiesel Project for Medium Service Vehicles**

This project will bring B20, a blend of 20% biodiesel¹ and 80% petroleum diesel, onsite for use in a 6-month pilot project for LLNL's medium duty fleet. Use of B20 significantly reduces vehicle emissions of carbon monoxide (-13%), unburned hydrocarbons (-11%), particulates (-18%), and the greenhouse gas, carbon dioxide (-16%) as compared to petroleum diesel (World Energy; Howell 2003). The pilot is intended to test B20 in a variety of LLNL medium duty vehicles, to evaluate use and maintenance issues, and to build user and management confidence in this alternative fuel.

This project will install a clean 500-gallon tank in the fueling area. A new pump and flowmeter will be installed to dispense the B20 from the 500-gallon tank. LLNL will purchase B20 from their current supplier of diesel fuel. The B20 will arrive at the site pre-blended and ready for dispensing.

Ten medium-duty vehicles (approximately 10% of LLNL's medium duty fleet) have been chosen for the pilot. They represent different models, different manufacturers (Chevrolet, Ford, International), and different age vehicles. Each vehicle in the pilot will have preventative maintenance performed twice during the pilot to monitor for problems, specifically with the fuel system. Vehicle users will complete a questionnaire at the end of the pilot to monitor satisfaction with vehicle performance while using B20.

Under the Energy Policy Act of 1992, use of biodiesel is an option for applicable federal fleets to meet a portion of their annual alternative fuel vehicle (AFV) acquisition requirements. LLNL Fleet Management is committed to making progress in FY05 toward the Vehicle Fleet Efficiency Goals by reducing the use of petroleum-based fuels, acquiring alternative fuel vehicles, and using alternative fuels.

- **Accelerated Solvent Extraction System for Preparation of Semivolatile Organic Compound/Polychlorinated Biphenyl Samples**

LLNL's Chemistry and Materials Science Environmental Services (CES) routinely analyzes radioactive waste samples for semivolatile organic compounds (SVOCs) and polychlorinated biphenyl (PCB) compounds; in the process, mixed, radioactive and hazardous solvent wastes are generated. This ROI project involved the purchase and application of an accelerated solvent extraction (ASE) system that uses high temperature and pressures to allow the extraction of SVOCs and PCBs from solid samples in less time and with less volume of solvent. The project will have a payback period of 1.6 years and will result in the diversion of 230 kg of mixed low-level waste and one kg of TRU waste each year.

- **Purchase and Application of a Flow-through Radionuclide Detector**

This project funded the Chemical Biology and Nuclear Science Division's Environmental Radiochemistry Group's purchase of a flow-through radionuclide detector system and accessories to make the equipment fully operational. This

1. Biodiesel is a renewable, domestically produced, and non-toxic diesel fuel substitute. It is a methyl ester most commonly derived from either soy or rapeseed oil.

detector system will be used to detect multiple radionuclide contaminants in a waste stream. This project reduces the generation of mixed waste by 200 kg each year and will have a payback period of a little less than one year. The flow-through radionuclide detector also minimizes personnel exposure to hazardous and radioactive materials.

Review of New Processes, Programs, or Experiments

As part of this effort, the Pollution Prevention Team was tasked to revise LLNL's P2 Plan by incorporating it into the Environmental Management System (EMS) Plan. As previously described, LLNL incorporated ISO 14001 as a WSS and is bringing its ISMS into conformance with this standard.

Pollution Prevention Employee Training and Awareness Programs

In 2004, LLNL conducted a number of activities to promote employee awareness of Pollution Prevention. A key event, the annual Earth Expo, was held in April to coincide with Earth Day. It featured representatives from EPD, businesses with environmentally friendly products, environmental conservation organizations, utilities, environmental agencies, and other organizations with environmental charters and interests. During the course of the year, Pollution Prevention articles appeared in the LLNL newspaper, *Newsline*, and electronic newsletter, *NewsOnLine*. The P2 team conducted training for purchasing staff on EPA requirements for affirmative procurement. The P2 team also placed banners at entry gates for America Recycles Day and National Pollution Prevention Week.

In spring 2003 the P2 team brought a new P2 web site (<http://www-p2.llnl.gov/>) online for LLNL employees. The web site, which was updated in 2004, is a resource for employees regarding pollution prevention, energy efficiency, the 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.

Contributing Authors

Many authors significantly contributed to this large and diverse chapter. We acknowledge here the work of Shari Brigdon, Bruce Campbell, Bob Fischer, Gretchen Gallegos, Allen Grayson, Bert Heffner, Rod Hollister, Susi Jackson, Carol Kielusiak, Albert Lamarre, Sandra Mathews, Bill McConnachie, Katie Myers, Jennifer Nelson-Lee, Barbara Nisbet, Charles Noyes, Lisa Paterson, Lily Sanchez, Michael Taffet, Stan Terusaki, Earl Thomas, Joseph Woods, and Peter Yimbo.