

3. Environmental Program Information

Heather Ottaway

Lawrence Livermore National Laboratory (LLNL) is committed to enhancing its environmental stewardship and reducing any impacts its operations may have on the environment. This chapter describes LLNL's Environmental Management System (EMS) and Pollution Prevention/Sustainability Program (P2S).

3.1 Environmental Management System

LLNL continues to enhance its EMS through systematic process improvements and increased focus on establishing specific environmental objectives and performance measures contained in Environment, Safety & Health (ES&H) Action Plans. Progress toward goals is regularly measured and provided to senior management and other interested parties through a variety of means, including periodic senior management reports and the yearly update of this Environmental Report. The Laboratory's EMS has successfully maintained its International Organization for Standardization (ISO) 14001 registration since 2009 and is audited annually by a third-party internationally recognized ISO registrar for continued conformance and certification. In Fiscal Year (FY) 2018, the Laboratory successfully migrated to the revised 2015 ISO 14001 standard and continued its certification under this standard in FY2020.

3.1.1 ES&H Action Plans

ES&H Action Plans are established each year to detail the objectives and track progress toward meeting environmental goals focused on decreasing climate impacts, conserving water, and reducing waste. Each ES&H Action Plan is championed by a senior manager who is responsible for developing objectives, assigning a process owner to lead the project successfully to meet objectives, providing adequate resources such as team members and data, holding the team accountable to goals and objectives, and presenting interim reviews to the senior management team. All ES&H Action Plans are reviewed and approved by the Laboratory Deputy Director. Senior managers championed nine ES&H Action Plans during FY2020. **Table 3-1** lists the six ES&H Action Plans that address environmental aspects along with progress made in FY2020 toward meeting the objectives (three other ES&H Action Plans address health & safety issues). The Action Plans in place also help to ensure that related U.S. Department of Energy (DOE) sustainability goals are addressed. LLNL's status toward meeting the DOE sustainability goals, along with planned actions (including ES&H Action Plans) to ensure continued progress toward attaining these goals can be found in the *LLNL FY2020 Site Sustainability Plan* in **Appendix C**.

Table 3-1. ES&H Action Plan summary

Action Plan	Related DOE SSP Goal Category	Objectives	FY2020 Progress
AP-01 Meet all Site Sustainability Plan (SSP) Goals	All	In the annual SSP, goals are evaluated for high, medium, or low risk of non-attainment as follows: Low risk – high feasibility goal will be met Medium risk – medium feasibility goal will be met High risk – low feasibility goal will be met.	All SSP goals except energy and water intensity are attainable or trending positively in that direction.
AP-02 Develop a Municipal Waste Reduction Strategy	Waste Management	Continue working toward diversion of 100% of recyclable and compostable waste.	Main objectives met including implementation plan, communications plan, and roll out to 511 complex, therefore this plan was archived. Program will be rolled out if funded to additional buildings under Action Plan 1 FY2021 objectives.
AP-03 Implement Smart Labs Initiative	Energy Management, Water Management, Waste Management	Using available data and modeling, estimate the baseline annual kWh/ft ² and water/ft ² and identify opportunities for reduction, reuse, or recycling for in-scope Laboratory buildings.	Associated objectives have been incorporated into Action Plan 1 for FY2021, therefore this plan was archived.
AP-07 Operational Stewardship	Waste Management	Address safety and environmental risks associated with closed facilities and trailers and surrounding areas that may contain hazardous and/or radioactive materials and equipment, and other potential hazards.	Demolished T43XX Complex and T1736. Completed T&D characterization and mobilizing demo for B175. Contract planning initiated for several buildings.
AP-08 Management Commitment	All	Demonstrate management commitment to ES&H through various reports, communications, and activities.	Director introduced ES&H briefing; new Take 5 for Safety, Security, and Environment videos were released.
AP-10 Hazardous Waste Compliance	Waste Management	Inspect identified high-risk areas and satellite accumulation areas (SAA) on a routine basis. Principal Directorates (PDs) will continue to inspect high-risk areas and SAAs at least quarterly. Implement institutional SAA/waste accumulation area (WAA) tracking software in Engineering and Physics and Life Sciences (PLS) Directorates. Develop outreach tools to educate waste generators (e.g., Take 5 for Safety & Security video, one page checklist for work areas). Develop a communication strategy for ES&H and RHWM to provide timely feedback to PDs regarding hazardous waste compliance issues.	Conducted a Management Self-Assessment (MSA) to evaluate hazardous waste generation and satellite accumulation activities. MSA found 37 deficiencies, 5 observations, and 5 strengths. Continue to implement.

3.1.2 EMS Audits and Reviews

The Laboratory successfully completed one external third-party independent audit of its ISO 14001 EMS program (May 2018) with recommendations from the auditor to continue LLNL's ISO 14001:2015 registration through 2021. This independent audit was conducted by NSF International Strategic Registrations and validated the Laboratory's solid commitment to environmental stewardship. The Laboratory completed a surveillance audit of ISO 14001:2015 in August 2020 to continue its certification to ISO 14001:2015.

3.1.2.1 Internal Assessments and Reviews

In February-March 2020, an internal audit (Joint Functional Area Line Management Assessment [JFLMA]) was performed to assess if LLNL continued to meet the requirements of the standard. This audit used a management assessment model to ensure objectivity and impartiality were maintained during the process.

In accordance with LLNL's EMS, the Laboratory's environmental compliance is regularly evaluated through reviews of internal assessments including Management Self Assessments (MSAs); Management Observations and Inspections (MOIs); regulatory inspections; internal and external monitoring and compliance reports; and facility walk-throughs and work-control assessments. As a result of these reviews, LLNL identified specific practices and recommendations for corrective and preventive measures, demonstrating the Laboratory's commitment to environmental compliance.

3.2 Pollution Prevention/Sustainability Program

LLNL's P2S Program operates within the framework of the Integrated Safety Management System (ISMS) and EMS and in accordance with applicable laws, regulations, and DOE orders as required by contract. It encompasses stewardship and maintenance, waste stream analysis, reporting of waste generation and P2S accomplishments, and fostering of P2S awareness through presentations, articles, and events. The P2S Program supports institutional and directorate P2S activities via environmental teams and includes implementation and facilitation of source reduction and/or reclamation, recycling, and reuse programs for hazardous and nonhazardous waste; facilitation of sustainable acquisition; and preparation of P2S opportunity assessments.

The P2S Program at LLNL strives to systematically reduce all types of waste generated and eliminate or minimize pollutant releases to all environmental media from all aspects of the operations at the Livermore Site and Site 300. These efforts help protect public health and the environment by reducing or eliminating waste, improving resource usage, and reducing inventories and releases of hazardous chemicals. These efforts also benefit LLNL by reducing compliance costs and minimizing the potential for civil and criminal liabilities under environmental laws. In accordance with United States Environmental Protection Agency (EPA) guidelines and DOE policy, the P2S Program uses a hierarchical approach to waste reduction (i.e., source elimination or reduction, material substitution, reuse and recycling, and, lastly, treatment and disposal), which is applied to all types of waste. Radioactive and hazardous waste

generation is tracked using Radioactive and Hazardous Waste Management’s (RHWM’s) HazTrack database (a system used to track all waste managed by RHWM). By reviewing the information in this database, program managers and P2S Program staff can monitor and analyze waste streams managed by RHWM to determine cost-effective improvements to LLNL operations. The P2S Program efforts primarily focus on opportunities to reduce routine waste from ongoing operations and non-routine waste from construction and demolition activities. Data on non-routine hazardous, transuranic, and radioactive waste can be found in the *2019 Annual Yearbook for the LLNL SW/SPEIS* (Quinly 2020).

3.2.1 Routine Hazardous, Transuranic, and Radioactive Waste

Routine waste listed in **Tables 3-2** and **3-3** includes waste from ongoing operations produced by any type of production, analysis, and research and development taking place at LLNL.

Table 3-2. Routine hazardous waste at LLNL, FY2016–2020 (Metric Tons [MT])

Waste Category	FY2016	FY2017	FY2018	FY2019	FY2020
Routine hazardous waste generated	142	110	167	155	111

Table 3-3. Routine transuranic and radioactive waste at LLNL, FY2016–2020 (m³)

Waste Category	FY2016	FY2017	FY2018	FY2019	FY2020
Routine LLW generated	284	318	526	369	297
Routine mixed LLW generated	25.5	14	38	40	28
Routine TRU/mixed TRU waste generated	14	3.2	17	22	5

3.2.2 Diverted Waste

LLNL maintains an active waste-diversion program, encouraging recycling and reuse of both routine and non-routine waste, which prevents waste from going to the landfill. Site sustainability goals require separate accounting for construction/demolition and municipal solid wastes as reflected in **Tables 3-4** and **3-5**.

3.2.2.1 Municipal Solid Waste

Together, the Livermore Site and Site 300 generated 2,683 MT of routine nonhazardous solid waste in FY2020. This volume includes diverted waste (e.g., material diverted through recycling and reuse programs) and landfill waste.

Both sites combined diverted a total 1,919 MT of routine nonhazardous waste in FY2020, which represents a diversion rate of 72%. The portion of routine nonhazardous waste sent to landfill was 764 MT, see **Table 3-4**. In 2020, LLNL recycled over 3,000 computers, monitors, and laptops, which were resold or managed as universal waste. LLNL recycled 24 MT of large and small

batteries, which were also managed as universal waste. Cell phones and tablets that are no longer needed by LLNL are sold to a vendor who refurbishes the items for reuse.

The comingled recycling and composting program initiated in May 2011 was continued during 2020, diverting an estimated 33 MT of comingled recycling and 33 MT of compostable material from the landfill. In early FY2020, the recycling and composting program was expanded to include the Building 511 complex. Due to China’s continued and stricter National Sword policy, plastics recycling options continue to be very limited. Where possible, LLNL looks for alternatives to disposable plastic items and works with vendors to take back plastic items such as containers and drums that can be reused or recycled.

Table 3-4. Routine municipal waste in FY2020, Livermore Site and Site 300 combined

Destination	Waste Description	Amount in FY2020 (MT)
Diverted	Baled paper	46.5
	Corrugated cardboard	18
	Cooking grease (including grease traps)	12.5
	Mixed metals	876
	Scrap lead (Pb)	9
	Plastic	0
	Office paper	29
	Toner cartridges	1
	Greenwaste (chips, compost, mulch, clean wood)	861
	Comingled recycling	33
	Compost (food scraps, paper towels, food containers)	33
	TOTAL diverted	1,919
Landfill	Compacted (landfill)	764
		TOTAL landfill
	TOTAL routine nonhazardous waste	2,683

3.2.2.2 Construction and Demolition (C&D) Waste

C&D wastes include excavated soils, wastes and metals from construction, decontamination, and demolition activities. The Livermore Site and Site 300 generated a total of 1,381 MT of waste related to construction and demolition activities in FY2020. The two sites combined diverted 1,249 MT of non-routine nonhazardous solid waste through reuse or recycling, which represents a diversion rate of 90% in FY2020. Diverted C&D waste includes soil and concrete reused either on-site for other projects or as cover at Class II landfills. See **Table 3-5**.

Table 3-5. Construction and demolition waste in FY2020, Livermore Site and Site 300 combined

Destination	Waste Description	Amount in FY2020 (MT)
Diverted	Class II cover soil (reused on-site or as landfill cover)	481
	Class II concrete (reused at the landfill for roads, pads, etc. or as cover)	759
	Scrap metals (recycled)	9
	TOTAL diverted	1,249
Landfill	Construction and demolition (non-compacted landfill)	132
	TOTAL landfill	132
TOTAL non-routine non-hazardous waste		1,381

3.2.3 Sustainable Acquisition

LLNL has a comprehensive Sustainable Acquisition program that includes preferential purchasing of recycled content and bio-based products. In 2020, the Sustainable Acquisition program continued to include a preference for Electronic Product Environmental Assessment Tool (EPEAT) registered computers and monitors, imaging equipment, and televisions. Over 90% of all desktop electronics, imaging equipment, television, server and cell phone purchases in FY2020 were EPEAT Bronze, EPEAT Silver or EPEAT Gold, indicating that the products meet or exceed the Institute of Electrical and Electronics Engineers (IEEE) environmental performance standards for electronic products (1680.1-2018; 1680.2-2012; 1680.3-2012).

Additional sustainable acquisition highlights can be found in the *LLNL FY2020 Site Sustainability Plan* in **Appendix C**.

3.2.4 Pollution Prevention/Sustainability Activities

3.2.4.1 Sustainability Accomplishments

LLNL's P2S Program assists the site in meeting Site Sustainability Plan goals related to municipal waste reduction, acquisition, and electronic stewardship by conducting and responding to opportunity assessments; these include direct calls from program areas as well as Green Hotline inquiries. During FY2020 the P2S Program assisted with several sustainability projects including participating in a workgroup to identify a scrap metal vendor to recycle 100s of data center cooling nodes, finding opportunities for reusable containers in place of disposing of numerous poly drums, creation of a survey for current and potential electric vehicle drivers, and assistance with the roll out of the recycling and composting program to additional buildings.

3.2.4.2 High-Performance Sustainable Buildings and Energy Conservation

Four Leadership in Energy and Environmental Design (LEED) building certifications (B142, B264, B451, and B453) were completed in 2008–2011, one LEED Gold certification (B655) was completed in 2019, two buildings are CalGreen compliant, six initial building assessments using the DOE High Performance Sustainable Building (HPSB) assessment tool were completed in 2011–2012. In FY2020, one LEED Certified certification facility (B223) and one LEED Silver certification facility (B224) were constructed in the Applied Materials and Engineering (AME) complex.

In FY2020 a Sustainable Design facilities standard was prepared to ensure that new construction and major renovations address the HPSB requirements in DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, implement the Guiding Principles for Sustainable Federal Buildings required in DOE Order 430.1C, *Real Property Asset Management*, and support DOE Order 436.1, *Departmental Sustainability*.

Applying best practices continues to help reduce LLNL's energy intensity and greenhouse gas (GHG) emissions. These best practices include alerting facility managers of excessive use in their facilities, updating and adapting equipment operating schedules to meet the changing requirements of occupants, providing staff with the training and tools they need, and tracking energy use and comparing against expected performance. LLNL's Livermore Site and Site 300 each have a site-wide direct digital control (DDC) system that is used to control temperatures, pressures, and humidity in many buildings. The system is state-of-the-art and as of the end of 2020 had approximately 674 high-speed, connected digital processors in 58 buildings with several more installations planned.

Significant progress was made on installation and replacement of existing site-wide exterior lighting fixtures with LEDs. Approximately 800 LEDs have been installed including the entire site perimeter and high traffic areas at the Livermore Site, and when re-lamping opportunities arise. In addition, exterior LEDs are installed for all new construction and major repairs. Funding in FY2020 allowed for the purchase of additional LEDs for future installation; sodium vapor lamps are no longer purchased unless necessary (<10%).

LLNL has also implemented many on-going sustainability efforts to increase the energy efficiency of data center facilities including the installation of Cold Aisle Containment systems, increasing ambient temperatures and reducing occupancy lighting in several key data center facilities, server consolidation, and server virtualization (i.e., using software to divide one physical server into multiple isolated virtual environments). LLNL continues to identify and decommission data centers that are no longer needed.

Additional information on energy conservation goals can be found in the *LLNL FY2020 Site Sustainability Plan* in **Appendix C**.

3.2.5 Pollution Prevention/Sustainability Employee Training and Awareness Programs

The P2S Program conducted awareness activities during the year, however due to the COVID-19 pandemic many activities normally held were cancelled or converted to virtual platforms. P2S provided outreach materials for the virtual Environment, Safety, Security, and Health fair, and helped create an Earth Day video highlighting LLNL's sustainability and wildlife conservation programs. The video was part of the Department of Energy's virtual Earth Day celebration held in April 2020.

In May, LLNL, Sandia National Laboratories (SNL/CA), and the Livermore Laboratory Employee Services Association (LLESA) (a non-profit employee services group that supports both sites) normally host a joint Bike to Work and Share Your Ride event, however this event was not held in FY 2020 due to COVID-19.

In FY2020 a sustainability map showcasing LLNL's sustainability features across the Livermore Site was created by a P2S Program student intern. The P2S Program continued to conduct training for purchasing staff on Sustainable Acquisition requirements and support the Green Hotline to provide assistance for employees with questions, suggestions, or ideas regarding LLNL's pollution prevention and waste diversion endeavors, as well as other environmental issues.