3. Environmental Program Information

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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 FY2019.

3.1.1 ES&H Action Plans

To better align with the revised 2015 ISO 14001 standard, a significant restructuring of the objectives setting process was implemented in FY2018 and continued in FY2019. In place of past Environmental Management Plans (EMPs), ES&H Action Plans were established 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 ten ES&H Action Plans during FY2019. **Table 3-1** lists the six of the ten ES&H Action Plans that address environmental aspects along with progress made in FY2019 toward meeting the objectives. 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 FY2019 Site Sustainability Plan* in **Appendix D.**

Table 3-1. ES&H Action Plan summary

Action Plan	Related DOE SSP Goal Category	Objectives	FY2019 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.	Program implementation plan developed and ready for roll-out in early 2020.
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.	Increased coordination with Operations and Business to better track projects and incorporate energy & water saving measures.
AP-04 Electric Vehicle Charging Infrastructure	Fleet Management	Provide electric vehicle charging infrastructure to accommodate charging for more government and personally owned employee vehicles; increase scope 3 greenhouse gas emission reductions for both government and personally owned employee vehicles.	All objectives were met, and this action 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.	Many risk reduction projects completed, as well as removal or demolition of several trailers.
AP-10 Hazardous Waste Compliance	Waste Management	Identify high-risk areas and establish a schedule to inspect these areas and satellite accumulation areas (SAA) on a routine basis. Implement institutional SAA/WAA (waste accumulation areas) tracking software. Develop a communication strategy for ES&H and Radioactive and Hazardous Waste Management (RHWM) to provide timely feedback to Directorates regarding hazardous waste compliance issues.	Significant progress made on SAA/WAA tracking software.

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.

3.1.2.1 Internal Assessments and Reviews

In February 2019, 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 November 2019, Senior Management review of the EMS was conducted, reaffirming management commitment to LLNL's environmental policy and stewardship through the implementation of EMS.

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 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 *2018 Annual Yearbook for the LLNL SW/SPEIS* (Quinly 2019).

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, FY2015–2019 (Metric Tons [MT])

Waste Category	FY2015	FY2016	FY2017	FY2018	FY2019
Routine hazardous waste generated	170	142	110	167	155

Table 3-3. Routine transuranic and radioactive waste at LLNL, FY2015–2019 (m^3)

Waste Category	FY2015	FY2016	FY2017	FY2018	FY2019
Routine LLW generated	860	284	318	526	369
Routine mixed LLW generated	19	25.5	14	38	40
Routine TRU/mixed TRU waste generated	0.9	14	3.2	17	22

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 3,101 MT of routine nonhazardous solid waste in FY2019. This volume includes diverted waste (e.g., material diverted through recycling and reuse programs) and landfill waste.

Both sites combined diverted a total 2,204 MT of routine nonhazardous waste in FY2019, which represents a diversion rate of 71%. The portion of routine nonhazardous waste sent to landfill was 897 MT, see **Table 3-4**. In 2019, LLNL recycled 2,992 computers, monitors, laptops, and tablets, which were resold or managed as universal waste. LLNL recycled 25 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. In FY2019 1,170 cell phones and 45 tablets were sold to this vendor.

The comingled recycling and composting program initiated in May 2011 was continued during 2019, diverting an estimated 44 MT of comingled recycling and 66 MT of compostable material from the landfill. To make separation easier for employees and decrease the amount of waste sent

to landfill, the disposable foodservice products in the on-site cafeterias are compostable. Due to worldwide changes in the recycling industry, LLNL was unable to continue its plastics recycling program in 2019.

Table 3-4. Routine municipal waste in FY2019, Livermore Site and Site 300 combined

Destination	Waste Description	Amount in FY2019 (MT)
Diverted	Baled paper	76
	Corrugated cardboard	91
	Cooking grease (including grease traps)	25.5
	Mixed metals	892
	Scrap lead (Pb)	3.5
	Plastic	0
	Office paper	61
	Toner cartridges	9
	Greenwaste (chips, compost, mulch, clean wood)	936
	Comingled recycling	44
	Compost (food scraps, paper towels, food containers)	66
	TOTAL diverted	**2,204**
Landfill	Compacted (landfill)	897
	TOTAL landfill	**897**
	TOTAL routine nonhazardous waste	**3,101**

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 1,276 MT of waste related to construction and demolition activities in FY2019. The two sites combined diverted 996 MT of non-routine nonhazardous solid waste through reuse or recycling, which represents a diversion rate of 78% in FY2019. 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 FY2019, Livermore Site and Site 300 combined

Destination	Waste Description	Amount in FY2019 (MT)
Diverted	Class II cover soil (reused on-site or as landfill cover)	301
	Class II concrete (reused at the landfill for roads, pads, etc. or as cover)	686
	Scrap metals (recycled)	9
	TOTAL diverted	**996**
Landfill	Construction and demolition (non-compacted landfill)	280
	TOTAL landfill	**280**
	TOTAL non-routine non-hazardous waste	**1,276**

3.2.3 Sustainable Acquisition

LLNL has a comprehensive Sustainable Acquisition program that includes preferential purchasing of recycled content and bio-based products. In 2019, the Sustainable Acquisition program continued to include a preference for Electronic Product Environmental Assessment Tool (EPEAT) registered computers and monitors, imaging equipment, and televisions. Eighty five percent of all desktop electronics, imaging equipment, and television purchases in FY2019 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 (1680.1-2009; 1680.2-2012; 1680.3-2012).

Additional sustainable acquisition highlights can be found in the *LLNL FY2019 Site Sustainability Plan* in **Appendix D.**

3.2.4 Pollution Prevention/Sustainability Activities

3.2.4.1 Environmental Stewardship Accomplishments and Awards

Each year, the P2S Program submits nominations for the National Nuclear Security Administration (NNSA) environmental awards and DOE Sustainability awards programs, which recognize exemplary performance in integrating environmental stewardship practices to reduce risk, protect natural resources, and enhance site operations. P2S also submits nominations for various other awards recognizing excellence in P2S projects.

In 2019, LLNL won an EPA Federal Green Challenge award for its electric vehicle program. LLNL has participated in the EPA's Federal Green Challenge since 2012. Each year as a participating agency LLNL is required to set goals in at least 2 of the 6 target areas, and the goal must be at least a 5% improvement. The 6 target areas are electronics, energy, purchasing, transportation, waste, and water. LLNL won an award for exceeding the goal set in the transportation category to increase the number of electric vehicles by 10%; LLNL exceeded this goal significantly by increasing the number by 200%.

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 CalGreen compliant and six initial building assessments using the DOE High Performance Sustainable Building (HPSB) assessment tool were completed in 2011–2012. The current number of occupied buildings over 5,000 square feet in the enduring inventory is 169, with a total square footage of 6,047,053. LLNL has set a goal of 15% of existing buildings greater than 5,000 gross square feet—which is 25 buildings with a total square footage of 907,058— being compliant with the guiding principles for HPSB by 2025. As of FY2019, 13 buildings had been assessed using the LEED system, HPSB, or are CalGreen compliant—with a total square footage of 424,679. An additional 12 assessments based on building count and an additional 482,379 square feet based on square footage need to be assessed to achieve the 15% goal.

Two new buildings in the Applied Materials and Engineering (AME) complex—the Polymers Capability Facility (Building 223) and the AME office building (Building 224)—are under construction with the goal of achieving LEED Certification-level certification. A third building in the AME complex—the Joining Capabilities and Vapor Disposition Facility (Building 225)—will follow immediately after the construction of B223 and B224, and will also be built to attain LEED Certified-level certification

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 Site 200 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 2019 had approximately 647 high-speed, connected digital processors in 49 buildings with several more installations planned.

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 FY2019 Site Sustainability Plan* in **Appendix D.**

3.2.5 Pollution Prevention/Sustainability Employee Training and Awareness Programs

The P2S Program conducted awareness activities during the year. Articles on pollution prevention were published in Newsline (LLNL's internal online newsletter) and Attune 360, the Environment, Safety, and Health Newsletter; and the P2S Program continued to provide support for implementation of green events. The P2S Program conducts training for purchasing staff on Sustainable Acquisition requirements, and a Green Hotline continues to provide support for employees with questions, suggestions, or ideas regarding LLNL's pollution prevention and waste diversion endeavors, as well as other environmental issues.

The P2S Program also holds events each year to celebrate and bring awareness to Earth Day. In April 2019 an Earth Day celebration was held with neighboring Sandia National Laboratory (SNL/CA). It was a collaborative effort between both Labs, multiple departments within SNL/CA, local city and county agencies who provided information about composting, recycling and water conservation; and local green office product vendors featuring green products and promoting green purchasing practices. Nearly 20 scientific vendors were on-site for LLNL and SNL/CA scientists to connect and share information, problem solve, and collaborate with scientists from companies around the country. There was also electronic waste recycling and paper shredding for both Labs' employees. A wildlife expert conducted a native bird walk throughout the SNL/CA site. Several hundred people attended the event.

In May, LLNL, SNL/CA, and the Livermore Laboratory Employee Services Association (LLESA) (a non-profit employee services group that supports both sites) hosted a joint Bike to Work and Share Your Ride event for the 5th consecutive year. This event is held in conjunction with other cities in the San Francisco Bay Area and helps both sites promote alternative commute options for employees. On the morning of Bike to Work Day LLESA and volunteers from LLNL and SNL/CA set up an energizer station where cyclists check in and enjoyed refreshments, this station is included in the overall San Francisco Bay Area Bike to Work Day outreach and was one of over one hundred stations supported in the region this year. It is in an open area that served local Livermore residents as well. Local agencies were invited to provide local transportation information at the energizer station. The energizer station also provided an opportunity to gather data on the number of employees who commute by bike or ride share.

The P2S Program used this event as an opportunity to gather data on the number of bike commuters, commute distance, number of days per month each bike commuter rides to work, and the number of first-time bike commuters (**Table 3-6**)**.** These data help LLNL calculate Scope 3 GHG reductions realized through employee alternative commuting and to better direct outreach on available alternative commute options.

Table 3-6. Bike to Work Day attendee details

	FY2017	FY2018	FY2019
Total participants	158	174	132
Number of pledges	99	100	103
Pledges who checked in	59 (59%)	67 (67%)	52 (50%)
Number of first-time riders	5	22	10
Total round trip mileage	1,769	1,838	1,489

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