# 3. Environmental Program Information

*Heather Ottaway • Carlos Velilla*

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 Environmental Management Plans (EMPs). 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.

### 3.1.1 Environmental Management Plans

EMPs are designed and implemented to address the Laboratory's most significant environmental effects (aspects) and to achieve environmental objectives and performance measures that substantively reduce such effects. EMPs are updated annually to incorporate new initiatives and effectively demonstrate LLNL's commitment to continuous improvement. **Table 3-1** lists the eight EMPs for FY2017, along with the significant environmental aspects each address, the Lab-wide environmental objectives, and the related U.S. Department of Energy (DOE) sustainability goals. LLNL's status toward meeting each of the DOE sustainability goals listed in **Table 3-1**, along with planned actions to ensure continued progress toward attaining these goals can be found in the *LLNL FY17 Site Sustainability Plan* in **Appendix D**.

**Table 3-1.** Environmental Management Plans (EMPs) and Related DOE Sustainability Goals.

| Title | Significant Environmental Aspect(s) Addressed | EMP Objective(s) | Related DOE Sustainability Goal(s) |
|---|---|---|---|
| Sustainable Acquisition | • Nonhazardous Materials Use<br>• Municipal Waste Generation | Promote Lab-wide Site Sustainability Goal 6.1 and support DOE in meeting its sustainable acquisition requirements by including necessary provisions and clauses to affect new purchases, such as ensuring a procurement preference for EPEAT-registered electronic products. | 6.1: Procurements meet sustainability requirements and include sustainable acquisition clause (95% of applicable contracts each year).<br>9.1: Purchases—95% of eligible acquisitions each year are EPEAT-registered products.<br>9.3: Automatic duplexing—100% of eligible computers and imaging equipment have automatic duplexing enabled. |
| Municipal Waste Reduction | • Municipal Waste Generation | Divert at least 50% of non-hazardous solid waste; divert at least 50% of construction and demolition debris to meet Site Sustainability Goals 7.1 and 7.2 and increase recycling. | 7.1: Divert at least 50% of nonhazardous solid waste, excluding construction and demolition debris.<br>7.2: Divert at least 50% of construction and demolition materials and debris.<br>2.6a: Net Zero Buildings: 1% of the site's existing buildings above 5,000 gross square feet intended to be energy, waste, or water net-zero buildings by FY2025.<br>9.4: End of Life—100% of used electronics are reused or recycled using environmentally sound disposition options each year. |
| Greenhouse Gas (GHG) Reduction | • GHG Emissions<br>• Fossil fuel consumption | Reduce Scope 1 & 2 GHG by 50% from the FY2008 baseline by FY2025 (Site Sustainability Goal 1.1).<br>Reduce Scope 3 GHG by 25% from the FY2008 baseline by FY2025 (Site Sustainability Goal 1.2). | 1.1: 50% Scope 1&2 GHG reduction by FY2025 from an FY2008 baseline<br>1.2: 25% Scope 3 GHG reduction by FY2025 from an FY2008 baseline.<br>5.1: 30% reduction in fleet-wide per-mile greenhouse gas emissions reduction by FY2025 from an FY2014 baseline.<br>5.2: 20% reduction in annual petroleum consumption by FY2020 relative to an FY2005 baseline; maintain 20% reduction thereafter.<br>5.3: 10% increase in annual alternative fuel consumption by FY2015 relative to an FY2005 baseline; maintain 10% increase thereafter.<br>5.4: 75% of light duty vehicles acquisitions must consist of alternative fuel vehicles (AFV).<br>5.5: 50% of passenger vehicle acquisitions consist of zero emission or plug-in hybrid electric vehicles by FY2025. |

**Table 3-1. (cont.)** Environmental Management Plans (EMPs) and Related DOE Sustainability Goals.

| Title | Significant Environmental Aspect(s) Addressed | EMP Objective(s) | Related DOE Sustainability Goal(s) |
|---|---|---|---|
| Hazardous Materials Use and Hazardous Waste Generation | • Hazardous Materials Use<br>• Hazardous & Radioactive Waste Generation | Reduce the use and inventory of hazardous materials. Chemical reduction efforts should be closely coordinated with ChemTrack inventory efforts to provide greater efficiency.<br><br>Minimize the generation of routine hazardous, mixed low-level, and/or low-level radioactive waste. | n/a |
| Ecological Resources Disturbances | • Ecological Resource Conservation | Protect native species, preserve wetland areas, and prohibit the release of invasive species in support of DOE/NNSA's compliance and long-term natural resource stewardship responsibilities. | n/a |
| Energy Conservation | • Electrical Energy Use<br>• Greenhouse Gas Emissions | Reduce energy intensity (BTU per gross square foot) as described in the Site Sustainability Plan in support of the Executive Order goal of reducing Federal Agency use by 25% by FY2025 from the FY2015 baseline (Site Sustainability Plan Goal 2.1). | 2.1: 25% energy intensity (BTU per gross square foot) reduction in goal-subject buildings, achieving 2.5% reductions annually, by FY2025 from an FY2015 baseline.<br>2.2: EISA Section 432 energy and water evaluations.<br>2.3: Meter all individual buildings for electricity, natural gas, steam and water, where cost-effective and appropriate.<br>2.4: 17% of existing buildings greater than 5,000 gross square feet (GSF) to be compliant with the Guiding Principles (GPs) of HPSB by FY2025, with progress to 100% thereafter.<br>2.6a: Net Zero Buildings: 1% of the site's existing buildings above 5,000 gross square feet intended to be energy, waste, or water net-zero buildings by FY2025.<br>2.6b: Net Zero Buildings: All new buildings (over 5000 GSF) entering the planning process designed to achieve energy Net Zero beginning in FY2020.<br>3.1: "Clean Energy" requires that the percentage of an agency's total electric and thermal energy accounted for by renewable and alternative energy shall be not less than: 10% in FY2016-2017, working toward 25% by FY2025.<br>3.2: "Renewable Electric Energy" requires that renewable electric energy account for not less than 10% of a total agency electric consumption in FY2016-2017, working toward 30% of total agency electric consumption by FY2025.<br>9.2: Power management –100% of eligible PCs, laptops, and monitors have power management enabled.<br>9.5: Establish a power usage effectiveness target in the range of 1.2-1.4 for new data centers and less than 1.5 for existing data centers. |

**Table 3-1. (cont.)** Environmental Management Plans (EMPs) and Related DOE Sustainability Goals.

| Title | Significant Environmental Aspect(s) Addressed | EMP Objective(s) | Related DOE Sustainability Goal(s) |
|---|---|---|---|
| Water Conservation | • Water Use | Reduce potable water intensity (gallons per gross square foot) as described in the Site Sustainability Plan in support of the Executive Order goal of reducing Federal Agency use by 36% by FY2025 from the FY2007 baseline (Site Sustainability Goal 4.1). | 4.1: 36% potable water intensity (gallons per gross square foot) reduction by FY2025 from an FY2007 baseline.<br>4.2: 30% water consumption (gal) reduction of industrial, landscaping, and agricultural (ILA) water by FY2025 from an FY2010 baseline.<br>2.6a: Net Zero Buildings: 1% of the site's existing buildings above 5,000 gross square feet intended to be energy, waste, or water net-zero buildings by FY2025. |
| Water Discharges | • Discharges to ground<br>• Discharges to the storm drain system | Minimize storm water quality impacts from outdoor metal and equipment storage. Reduce accidental releases of water onsite due to failed infrastructure. | n/a |

### 3.1.2 EMS Audits and Reviews

The Laboratory successfully completed one external third-party independent audit of its ISO 14001 EMS program (May 2017) with recommendations from the auditor to re-certify LLNL's ISO 14001 registration. This independent audit was conducted by NSF International Strategic Registrations and validated the Laboratory's solid commitment to environmental stewardship.

#### *3.1.2.2 Internal Assessments and Reviews*

In October 2017, Senior Management Reviews of the EMS were conducted, reaffirming management commitment to the Lab's environmental policy and stewardship through the implementation of EMS. In February of 2017, an internal audit (Joint Functional Area Line Management Assessment [JFLMA]) was performed to assess if LLNL continues to meet the requirements of the standard. This audit uses a management assessment model to ensure objectivity and impartiality is 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 Pollution Prevention/Sustainability (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 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. Waste generation is tracked using Radioactive and Hazardous Waste Management's (RHWM's) HazTrack database. By reviewing the information in this database, program managers and P2S Program staff can monitor and analyze waste streams 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 *2017 Annual Yearbook for the LLNL SW/SPEIS* (Quinly 2018).

### 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, FY2013–2017.

| Waste category | FY2013 | FY2014 | FY2015 | FY2016 | FY2017 |
|---|---|---|---|---|---|
| Routine hazardous waste generated Metric Tons (MT) | 131 | 202 | 170 | 142 | 110 |

**Table 3-3.** Routine transuranic and radioactive waste at LLNL, FY2013–2017.

| Waste category | FY2013 | FY2014 | FY2015 | FY2016 | FY2017 |
|---|---|---|---|---|---|
| Routine LLW generated ($m^3$) | 741 | 896 | 860 | 284 | 318 |
| Routine mixed waste generated ($m^3$) | 32 | 31 | 19 | 25.5 | 14 |
| Routine TRU/mixed TRU waste generated ($m^3$) | 7.5 | 9.5 | 0.9 | 14 | 3.2 |

### 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 2,948 MT of routine nonhazardous solid waste in FY2017. This volume includes diverted waste (e.g., material diverted through recycling and reuse programs) and landfill waste.

Both sites combined diverted a total 2,244 MT of routine nonhazardous waste in FY2017, which represents a diversion rate of 76%. The portion of routine nonhazardous waste sent to landfill was 704 MT, see **Table 3-4**. In 2017, LLNL recycled 3,406 computers, monitors, and laptops, which were resold or managed as universal waste. LLNL recycled 27 MT of large and small batteries, which were also managed as universal waste and recycled. LLNL also established a take back program for cell phones in which usable phones are refurbished for reuse and broken or otherwise

unusable phones are shredded for recycling. In FY2017, LLNL sent 270 old cell phones through this program.

LLNL continued to expand recycling opportunities for plastics beyond the comingled recycling program. In 2017, 11 MT of plastics were recycled despite a declining plastics recycling market. The comingled recycling and composting program initiated in May 2011 was continued during 2017, diverting an estimated 45 MT of comingled recycling and 68 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.

**Table 3-4.** Routine municipal waste in FY2017, Livermore Site and Site 300 combined.

| Destination | Waste description | Amount in FY2017 (MT) |
|---|---|---|
| Diverted | Baled paper | 62 |
| | Corrugated cardboard | 69 |
| | Cooking grease (including grease traps) | 20 |
| | Mixed metals | 805 |
| | Scrap lead (Pb) | 0 |
| | Plastic | 11 |
| | Office paper | 60 |
| | Toner cartridges | 11 |
| | Greenwaste (chips, compost, mulch) | 1,093 |
| | Wood | 0 |
| | Comingled recycling | 45 |
| | Compost (food scraps, paper towels, food containers) | 68 |
| | **TOTAL diverted** | **2,244** |
| Landfill | Compacted (landfill) | 704 |
| | **TOTAL landfill** | **704** |
| | **TOTAL routine nonhazardous waste** | **2,948** |

### *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 1,988 MT of waste related to construction and demolition activities in FY2017. The two sites combined diverted 1,537 MT of non-routine nonhazardous solid waste through reuse or recycling, which represents a diversion rate of 77% in FY2017. 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 FY2017, Livermore Site and Site 300 combined.

| Destination | Waste description | Amount in FY2017 (MT) |
|---|---|---|
| Diverted | Class II cover soil (reused on-site or as landfill cover) | 300 |
| | Class II concrete (reused at the landfill for roads, pads, etc. or as cover) | 1,229 |
| | Scrap metals (recycled) | 8 |
| | **TOTAL diverted** | **1,537** |
| Landfill | Construction and demolition (non-compacted landfill) | 451 |
| | **TOTAL landfill** | **451** |
| | **TOTAL non-routine non-hazardous waste** | **1,988** |

### 3.2.3 Sustainable Acquisition

LLNL has a comprehensive Sustainable Acquisition program that includes preferential purchasing of recycled content and bio-based products. In 2017, 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 two percent of all desktop electronics, imaging equipment, and television purchases in FY2017 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 FY17 Site Sustainability Plan* in **Appendix D**.

### 3.2.4 Pollution Prevention/Sustainability Activities

#### *3.2.4.1 Environmental Stewardship Accomplishments and Awar*ds

Each year, the P2S Program submits nominations for the 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.

LLNL submitted two award nominations to NNSA and DOE for work performed in FY2016. One nomination was submitted in the waste reduction and pollution prevention category for a newly installed three-dimensional printer system that uses significantly less resources and generates less waste than the previous electronics prototyping process. The other nomination was submitted in the renewable energy category for an onsite solar electrical generation system, which is expected to generate approximately 6,300 MWh annually and supply approximately 5% of the

Laboratory's electrical demand at peak power. In early 2017 LLNL received Best-In-Class awards from NNSA for both of these nominations.

LLNL was one of five Bay Area federal facilities recognized for improving efficiency, saving resources and reducing costs as part of the Federal Green Challenge (FGC). LLNL has participated in the FGC since its inception in 2011, achieving reductions in municipal waste, sustainable purchasing, sustainable electronics, and transportation categories. This is the first year that LLNL has been recognized at the regional level, for outstanding achievements in sustainable purchasing.

LLNL has made steady incremental reductions in office paper usage since FY09 through initiatives such as managed print services, double-sided printing, and moving to online and email for approvals and report submittals. All of this adds up to an overall reduction in paper purchases of over 40 percent and ink/toner purchases of nearly 50 percent.

In addition to the savings associated with purchasing over 22,300 reams (56 tons) less paper, there are even bigger savings associated with the ink and toner cartridges used for printing (**Figure 3-1**).

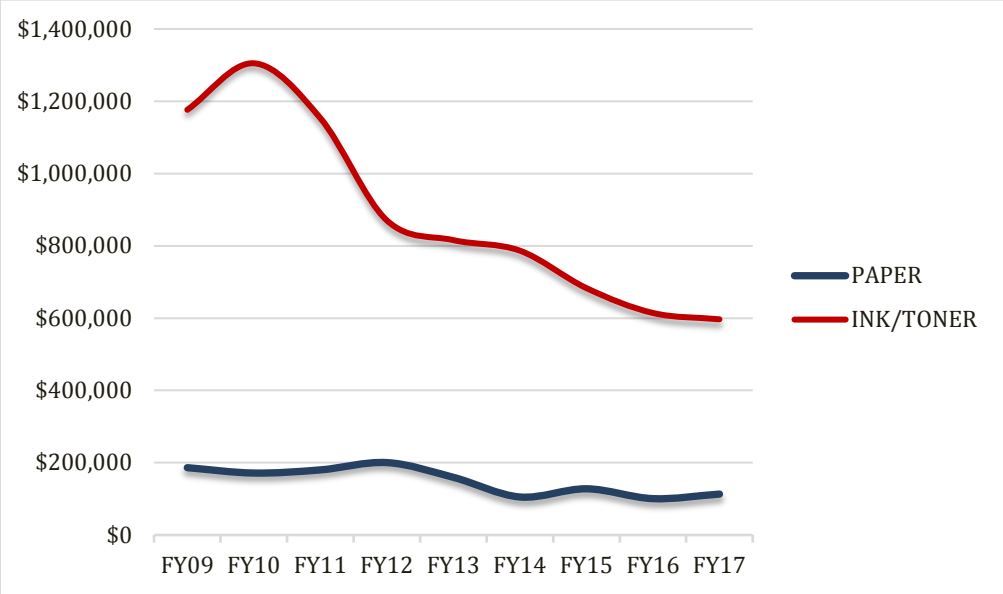


**Figure 3-1.** LLNL Reduction of Printing Paper and Ink/Toner Purchases

### *3.2.4.2 High-Performance Sustainable Buildings and Energy Conservation*

The Operations & Business (O&B) Principal Directorate manages the implementation of DOE Order 436.1 objectives related to sustainable building materials and practices.

Due to the unavailability of funding for the continuation of the High Performance Sustainable Building (HPSB) Assessments in FY2017, no new buildings were studied and assessed using the HPSB Assessment tool. While a list of potential buildings to be studied was compiled, funding

for these building assessments had not been identified for FY2017 and is not probable for FY2018.

One of LLNL's sustainability goals is to meter all individual buildings for electricity, natural gas, and water, where cost-effective and appropriate. LLNL has developed a metering plan that outlines the approach to repair meters and upgrade existing legacy metering. In FY2015, audits to collect vital information necessary to plan and schedule meter replacements and upgrades were conducted.

LLNL has 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 also continues to identify and decommission data centers that are no longer needed.

Additional information on energy conservation goals can be found in the *LLNL FY17 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 continues to conduct 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 2017 Earth Day events included a bike commuting basics workshop; a talk by the founder and CEO of Imperfect Produce, America's leading consumer brand for produce that is perfectly edible but unwanted by markets due to imperfections; and a personal document shredding and recycling event.

In FY2017, LLNL and neighboring Sandia National Laboratory (SNL), celebrated the 3rd annual Bike to Work Day. Employees were encouraged to bike to work on May 10, 2017 and visit an energizer station during the morning commute. 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**). LLNL established an internal webpage providing information on Bike to Work Day including an online form that allowed employees to pledge to bike, use alternative transportation, or share a ride on Bike to Work Day. LLNL received 99 pledges in advance of the event and recorded that 59 (59%) of the pledges checked in at the energizer station to confirm they kept their pledge. The energizer station saw 158

visitors, five of which were first time bike commuters. The total participants represented everyone who registered at the energizer station the day of the event, including the 59 who pledged in advance to participate. When totaled, the people who visited the energizer station logged 1,769 miles of bike commuting for the day.

**Table 3-6.** Bike to Work Day Attendee Details

| | |
|---|---|
| Total participants | 158 |
| Number of pledges | 99 |
| Pledges who checked in | 59 (59%) |
| Number of first time riders | 5 |
| Average round trip mileage | 11.3 |
| Total round trip mileage | 1,769 |
| Average number of bike commuting days per month | 11.8 |

LLNL and SNL also collaborated to hold a monthly Farmers' Market at the Sandia Open Campus, which is open to the public, on the last Tuesday of each month between May and October. The September market was dedicated to sustainability topics outreach.

This page is intentionally left blank.