Environment, Health, and Safety Office

Overview

Due to the COVID-19 pandemic, fiscal year 2021 has seen a "new normal" and has been abundant with collaboration, hard work, and innovative solutions. We have seen the MIT community come together to meet the missions of both the Institute and the Environment, Health, and Safety Office (EHS).

Increasing EHS's Agility

Throughout the year, EHS has been working to increase our agility to better serve our stakeholders more quickly, efficiently, and effectively. An in-depth review of our EHS-Management System (EHS-MS) resulted in multiple findings last fiscal year. This year, we have worked tirelessly to ensure there is a thorough and significant response to each finding. These include a revised document management program, restructuring our working committee, launching the EHS Advisory Committee, rolling out a non-employee incident report form, enhanced communications, and increased use of data driven decision-making and reporting, among many other projects.

Additionally, the MIT Audit Division audited our training program and made vital recommendations. We have quickly begun instituting the changes to better serve our stakeholders. We created a new position—the EHS Training Program Manager—which will oversee the EHS Training Program that includes assisting with course curriculum, reviewing delivery systems, developing new training programs, and responding to participants' feedback. We have also rolled out a methodology for implementing the course feedback data. This data, in conjunction with the program manager, will help us develop and improve our training program in the coming years.

The Green Lab Program has been restructured and renamed as the Safe and Sustainable Labs (S2L) Program to integrate safety and sustainability and better align with the MIT Fast Forward: MIT's Climate Action Plan for the Decade. The new program works under the directions of the Safe and Sustainable Labs Steering Committee and Task Force, which is comprised of faculty, staff, postdoctoral researchers, and undergraduate students across departments, labs, and centers (DLCs) and is co-sponsored by the directors of EHS and MIT Office of Sustainability (MITOS).

COVID-19

The pandemic continues to be at the forefront of everyone's mind. EHS has endeavored to ease the minds of the MIT community by being stewards of safe research and work practices. We have been key players in providing guidance as it pertains to personal protective equipment (PPE), face coverings, disinfecting spaces, and assessing building system requirements for heating, ventilation, and air conditioning (HVAC). This effort is ongoing, and we are adapting all policies as needed.

Moving Forward

EHS will always work to continually improve and add to its services. Moving forward, we will strengthen our outreach efforts by continuing to shape and grow our new Advisory Committee and by enhancing collaboration between EHS office staff and DLC EHS coordinators. EHS will also continue our outreach efforts with part-time and collateral duty coordinators. We will grow the new Safe and Sustainable Labs Program alongside the academy. Collaboration is essential to EHS and its mission to instill and support a safety culture across MIT. With this in mind, EHS is always seeking new partnerships in health, safety, and environment. The details of this report highlight EHS's current and ongoing partnerships as well as the specialized projects EHS has led or participated in per EHS program. These efforts are highlighted as vital elements of building and sustaining a community safety culture.

EHS Management System by the Numbers

- Principal Investigators (PIs) and Supervisors: 537
- Registered spaces: 4,042
- Learning experiences: 29,463
- Service tickets: 1,649
- Biological research registrations and radiological authorizations: 958
- Laboratory cleanouts: 34

Biosafety Program

The Biosafety Program (BSP) ensures the safe and responsible conduct of life sciences research and participates in and supports the MIT Committee on Assessment of Biohazards and Embryonic Stem Cell Research Oversight (CAB/ESCRO), Committee on Animal Care that is an Institutional Animal Care and Use Committee (IACUC), and Committee on the Use of Humans as Experimental Subjects (COUHES).

BSP continues to evaluate its programs and find ways to provide services, such as training, in a more flexible, just-in-time manner. Specifically, in this past year, both the course content and user experience were updated for the Autoclave Safety Awareness and Shipping Dry Ice web courses.

Committee on Assessment of Biohazards and Embryonic Stem Cell Research Oversight

The CAB/ESCRO ensures the safe and responsible conduct of biological research at MIT. The scope has changed over time to provide a more consistent and cohesive oversight process for a range of biological research and new technologies.

The CAB/ESCRO registers biological research involving the following:

- Recombinant or synthetic DNA/RNA

- Pathogens
- Human cells and tissues
- Use of biological agents at Biosafety Level 1 (BL1) or greater
- Nanoparticle-based gene delivery systems
- Biological toxins

The Review and Approval Process for research is based on the completion and submission of the Biological Research Registration (BRR) form to BSP. The majority of BRRs (76%) are Biosafety Level 2 (BL2) or BL2+, the highest approved containment level at MIT. This is due to the large number of laboratories that use human materials, various viral vectors, bacteria and/or viruses for researching ways to improve the human condition.

The committee reviewed 365 BRR submissions this fiscal year. They included:

- Rewrites: 73
- Amendments: 165
- Renewals: 111
- Teaching laboratories: 16

Biosafety Program's Upcoming Initiatives

- Continue supporting the Institute and MIT community through the ramp-up to the new normal regarding the COVID-19 pandemic
- Update and launch new courses for shipping biological materials

Environmental Management Program

The Environmental Management Program (EMP) provides environmental oversight, advice, consultation, training, and direct operational services for permitting, data reporting, and responses to air, water and hazardous waste discharge policies and procedures. This encompasses support for MIT main campus and off-site locations, including MIT Endicott House, MIT Haystack Observatory/Millstone Hill Observatory, MIT Wallace Astrophysical Observatory, and MIT Bates Research and Engineering Center (Bates).

Hazardous Waste Program

Research and academic activities, through facility operations and during construction and demolition, generate US Environmental Protection Agency (EPA) and Massachusetts Department of Environmental Protection (MassDEP) regulated chemical wastes. The Hazardous Waste Program is designed to work with MIT stakeholders to ensure that rules are understood and that established management practices are adhered to. The following initiatives were accomplished this year to strengthen the overall program process:

- Transitioned the campus chemical waste disposal program to a newly selected vendor, working through the inherent learning curves and logistical hurdles without negative impacts to the program or MIT customers
- Compiled a master list of likely Satellite Accumulation Area locations—areas where chemical waste is generated—and then visited each of these approximately 1,500 locations to validate and update the list
- Combined data from the latest campus inventories and safety plans so that the annual chemical reporting effort reflected actual conditions and aligned with other inventories and documents
- As part of an ongoing effort to create a safe, compliant and efficient chemical debris waste stream, EMP developed an informational label, which is now present on every container distributed to labs and shops for the collection of chemically contaminated debris
- Created new signage for each Universal Waste collection site with information presented in a concise manner, addressing the most frequently observed findings. Monthly inspections of each of these areas are now conducted with results and findings disseminated to the responsible parties
- Revised the Hazardous Waste Training Plan to reflect current training processes and to include appendices intended to facilitate successful regulator review

The team also collaborated and assisted in implementing and updating the following project-based initiatives:

- Set up a dedicated program for identifying and collecting regulated pharmaceutical wastes from the MIT Medical pharmacy and the laboratory animal facility
- Worked with MIT Department of Facilities (DOF) to characterize and profile the spent air filters from the campus rifle range and to establish a process of efficiently and safely collecting, containerizing, and shipping them off-site for proper disposal
- Worked with Occupational and Construction Safety Program (OCSP) and Industrial Hygiene Program (IHP) colleagues and campus project managers to characterize and dispose of a wide variety of polychlorinated biphenyl contaminated articles and building materials as part of a building renovation
- Managed a large volume of contaminated wastewater piping generated during the Building NW14 wastewater project, including sampling and segregation, volume estimation, and successful management according to site-specific limitations and rules
- Worked with the Nano Building EHS Team to revise the chemical waste management process in clean rooms in order to better comply with the regulations governing chemical waste transportation and storage

- Cleared out large stores of unwanted chemicals and fertilizers from the Bates campus, maintaining compliance with restrictive chemical waste rules applicable to that facility

Regulatory Compliance Permits and Oversight

Permits and reports are submitted annually to state and regulatory agencies as required. These routine requirements are also outlined in the EHS Regulatory Compliance Calendar. EMP continues to work closely with DOF to update and refine the complex environmental air and water regulatory roles and responsibilities for each area to assure compliance.

Below is an overview of specific oversight requirements and special projects managed by EMP:

- **Air Permitting Program:** EMP coordinates and tracks new projects, equipment additions, and emission units added across campus, along with requirements for off-campus locations, to the Title V permit and communicates with MassDEP. The current Title V Permit renewal application has been under review by MassDEP since 2012. Special projects this year include managing the process and coordinating with MIT.Nano staff in regard to their MIT.Nano Air Quality Plan and working with DOF Campus Construction to meet regulatory design and construction requirements for the emergency generator.
- **MassDEP Permitted Underground Storage Tanks:** MIT's Central Utilities Plant (CUP) has three underground storage tanks (USTs). USTs for the storage of #2 diesel oil are subject to the MassDEP UST Program which regulates the registration, installation, operation, maintenance, inspection, and closure of petroleum fuel and hazardous substance UST systems.
    - As part of CUP Upgrade Project, EMP filed the final closure permit for the #6 heavy oil with greater than 200,000 gallon USTs
    - All three remaining #2 diesel oil USTs were inspected this year for it's triennial inspection by UST Inspection Systems Inc.—a MassDEP-certified third-party inspector (TPI)
    - EMP addressed TPI action items by updating: the corrosion control plan, installation and inspection dates for spill buckets, training records, and insurance certificate documentation to meet compliance deadlines
- **Water Program:** EMP assists in regulatory compliance, advises on drinking water system improvements, and manages the Massachusetts Water Resources Authority (MWRA) permits issued to MIT for wastewater discharge principally covering main campus laboratories and the CUP. These permits establish specific conditions under which wastewater can be discharged. MWRA requires monthly, quarterly, and semi-annual sampling of wastewater discharge. Prior to the CUP and laboratory wastewater discharge, a pH neutralization system is required to treat all wastewater. These systems are operated by DOF with regulatory assistance from CUP and EMP. Water-related projects included the following:

- Working with DOF Campus Construction Systems Renewal and Facilities Engineering to remove and replace all Building NW13 laboratory wastewater piping and planning efforts in FY2021 for Building NW14 laboratory wastewater piping, which will be removed in FY2022. EMP also worked with CUP to enhance wastewater quality at the facility. Both are part of a MWRA main campus permit/CUP permit water quality enhancement project
- Working with the CUP and DOF Renewal Systems on the removal and replacement of key equipment in the CUP wastewater system
- Evaluating, reorganizing, and submitting the MWRA annual photo processing report.
- Working with MWRA, Division of Student Life (DSL) and DOF Systems Renewal to install flow monitoring and sampling equipment at the two permitted commercial laundry locations
- Working with DOF Campus Construction on the MWRA permitting of new laboratory spaces, including the Schwartzman Computing Center, the Music Building, the MET Warehouse, Building 37 Cordero Lab, the new MIT Museum, and leased spaces at The Engine
- Working with DSL to gather data, complete, and submit the permit renewal application on behalf of Sea Grant as part of the Department of Mechanical Engineering's five-year low flow pollutant permit. MWRA approved and renewed the permit
- Working with the Millstone facility staff and Lincoln Laboratory (LL) project management to coordinate the regulatory aspects of the water supply system upgrades to assure compliance with MassDEP regulations
- Managing and submitting the closure plan for the Open Ag MassDEP Class V Underground Injection Control (UIC) Well on behalf of the Media Lab Open Ag Hydroponic Operation
- Organizing and hosting monthly wastewater compliance team meetings to communicate and coordinate concerns and best practices
- Working with and assisting Endicott House in management of the 10-year Weld Pond Dam safety inspection and report to be completed in FY2022

- **Spill Countermeasure and Control Plan (SPCC) Plan:** EPA Oil Pollution Prevention Regulations require that any facility that meets certain oil storage thresholds have a SPCC Plan. MIT developed three plans: a campus-wide plan to deal with oil spills that may reach the Charles River, the Haystack facility plan, and the Bates facility plan.

Upcoming Initiatives

- Develop a multiyear EMP improvement plan based on the future challenges and conformance assessment of air and water quality programs
- Support MWRA permitting for new construction
- Provide increased support to Haystack Observatory, Millstone Observatory, and Wallace Observatory to address environmental concerns and regulatory requirements
- Implement the improved Hazardous Waste Program with the new vendor to better anticipate regulatory and operational issues and pilot PI level waste generation data for campus

Industrial Hygiene Program

The Industrial Hygiene Program (IHP) anticipates, recognizes, evaluates, and controls workplace conditions by limiting exposures to chemicals and addressing the control of other potential stressors such as noise, heat, repetitive motion, and indoor air quality. IHP accomplishes this through a hazard assessment to identify the severity of the risk and to implement appropriate controls, including engineering, administrative, and PPE.

Keeping MIT's Drinking Water Safe

IHP schedules water sampling based on priority of building usages and ages. Starting this year, a subset of delivery points, instead of all per building, were selected for sampling. If there was an elevated result found in any of the selected delivery points, then all other delivery points in the building were tested. This year, 20 buildings were surveyed with a focus on dining, the Campus Activities Complex, and MIT Medical. All delivery points tested in dining areas met the EPA Primary Drinking Water Standard. Out of 51 total samplings conducted, nine delivery points in total were found with elevated lead levels in Building E23 (Medical), Building W15 (Chapel), and Building W11 (Religious Activities Center). The issues may be due to low usage during the COVID-19 pandemic. These fountains were taken out of service temporarily and will be flushed and re-tested when campus gets back to normal.

Program Updates and Data Management Improvements

- **Asbestos Program:** With the help of EHS Information Technology, IHP made improvements to the asbestos database and online request form for services. IHP also digitized the corresponding abatement paperwork and created auto-generated completion reports that are sent to the requesting party with all relevant data and analysis from the project. These features will streamline the process and improve data management
- **Chemical Hygiene Program:** IHP updated the Chemical Hygiene Plan template with the 12 Principles of Green Chemistry to align with the new Safe and Sustainable Labs Program. The template was updated to also include the

recently revised Nanomaterial Safety and Health training; COVID-19 pandemic responses; hydrofluoric acid emergency procedures; security information; PPE, particularly clothing and footwear; electrical safety; first aid kits; and Hazard Communication. The revised template and the updates were sent to DLC Chemical Hygiene Officers to use for their annual revision

- **Integrated Pest Management (IPM):** IHP conducted a comprehensive review of the IPM Program to update the standard operating procedure (SOP) with the current workflow and improve the effectiveness of the program. Several key issues were identified within the pesticide review process, the program documentation, and service provider's performance, which all impacted the program's effectiveness. These issues were also considered during the Request for Proposal to select a new pest control service provider. The IPM Committee has selected Secured Pest as their pricing and approach were the best fit for MIT's budget and needs

Workplace Health and Safety

As a part of its Workplace Health and Safety initiatives, IHP:

- Suspended the annual audiometric testing during FY2021 due to the COVID-19 pandemic; however, testing has been scheduled for FY2022. During this time, the Hearing Conservation Program was extensively reviewed, and new procedures were developed to meet and exceed Occupational Safety and Health Administration (OSHA) regulations and to align with industry best practices. Other aspects of the program including training, noise surveys, and PPE remained active
- Trained additional team members in anticipation of a return and influx of respirator fit-tests in FY2022. Due to the COVID-19 pandemic, OSHA issued a Temporary Enforcement Guidance which effectively suspended the requirement to fit-test
- Conducted isoflurane exposure assessments for the Division of Comparative Medicine (DCM) in the Koch Institute to evaluate the efficacy of ventilation systems and control measures in place. A new downdraft table with an exhaust fan and filtering system setup was developed to help with situations where house local ventilation is not available. The new control setups have been tested and evaluated successfully for several locations in the facility
- Developed a nanomaterial safety and health course, vetted by the Committee on Toxic Chemicals (CTC), to provide awareness and best practices for working safely with nanomaterials, particularly the use of appropriate controls including ventilation, filtration techniques, laboratory practices, and the required methods for managing nanomaterial waste

Industrial Hygiene Program's Upcoming Initiatives

- Revise the Hearing Conservation Program SOP, conduct a qualitative risk assessment, conduct noise exposure monitoring, and, when MIT lifts COVID-19 pandemic restrictions, arrange for audiometric testing in collaboration with MIT Medical and the testing vendor
- Provide support to the newly formed Safe and Sustainable Labs Team and serve as subject matter experts for projects that involve ventilation and green chemistry
- Continue its work with Facilities Engineering Group on HVAC guidance and plan for and respond to indoor air quality concerns that will arise as campus presence ramps up
- Prepare lead paint awareness guidance documents for the DSL and develop an integrated lead awareness program into Facilities Project Manager's training

Occupational and Construction Safety Program

The OCSP's primary responsibility is to provide oversight of programs for general safety, fire prevention and protection, and construction safety while complying with all relevant regulations. OCSP provides regular updates to the MIT Safety Committee on relevant incident or injury data and relevant projects. In addition, OCSP provides support for the projects and classes that involve minors on campus. The team works with the MIT pK–12 Action Group, as well as other groups, to assess health and safety issues and recommend best practices.

OCSP has continued to evaluate key programs and developed ways to ensure the MIT community is provided with the necessary support, training, and information by updating its documentation and webpages and communicating process changes. OCSP's SOPs, standard operating guidelines, project plans and/or forms were updated and developed specifically for field research safety, fire and life safety, and small unmanned aircraft systems.

OCSP has also developed curriculum for EHS programs, allowing staff to train MIT users instead of hiring external vendors to provide the training or sending users off-site to obtain the training. Specific course content is outlined below:

- The Hot Works Training Program was accepted and approved by the MA Department of Fire Services (DFS); MIT is now a MA DFS accredited trainer and is listed on the MA Hot Work Training Program website
- The Hoist Operator Course and application for approval for an in-service training and licensure program has been submitted to the state. Upon approval, MIT will be able to train all in-house crane and hoist operators and provide them with an MIT-specific hoisting license
- The Fire Extinguisher Training was shortened and made more specific to use in laboratory and residential occupancies. This course is a blended training

containing both a classroom presentation, given virtually, and an in-person, hands-on component

- The Electrical Safety for Researchers web course was launched in October 2020. This course provides an overview of electrical safety topics and a basic level of electrical safety information for researchers

OCSP also collaborates closely and meets routinely with DOF and the Office of Emergency Management (OEM) to align shared programs and projects. This year's collaboration with DOF and OEM have included coordinating a response with DOF to the MIT Audit Division Lock Out/Tag Out (LOTO) Audit, reviewing the system OEM will be using to maintain emergency preparedness plans, and providing input on the preparedness training being developed for MIT students and employees.

Incident Investigation and Reporting

MIT's OSHA incident rate (0.69) of total recordable injury and illness cases for calendar year 2020 is shown in Figure 1, along with the data for the previous four years. The incident rate was at an all-time low for 2020 due to the pandemic. (Please note this is a lagging key risk indicator.)

OSHA Recordable Incident Rates of Injuries and Illnesses

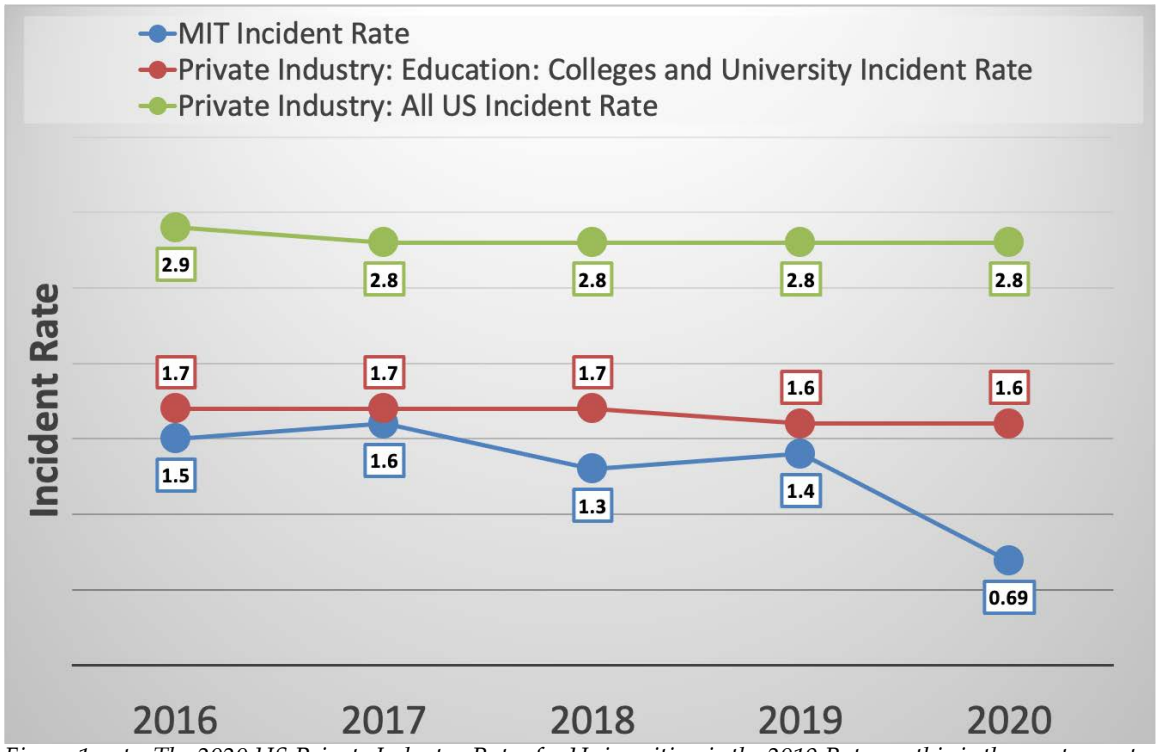


Figure 1 note: The 2020 US Private Industry Rates for Universities, is the 2019 Rates as this is the most recent data. The incidence rate of injuries and illnesses is computed from the following formula: Number of injuries and illnesses multiplied by 200,000, divided by the number of employee hours worked. The 200,000 hours in the formula represents the equivalent of 100 employees working 40 hours per week, 50 weeks per year, and provides the standard base for the incidence rates.

In collaboration with the Office of Insurance, OCSP created a uniform process and reporting form to capture information on non-employees (e.g., unpaid students, interns, visitors or non-affiliated, and volunteers) that experience an incident on campus or off-campus if related to an MIT event or trip. Having a non-employee form better aligns with the information gathered through the Supervisor Injury Report for employees and will streamline the information-gathering process for all parties needing this information at the Institute.

Campus Design and Construction Support

Campus Design and Construction Support (CDCS) provides mitigation, design review, and assistance to the DOF project managers (PMs) for construction and renovation projects on the MIT Campus. This year, CDCS participated in design and/or construction of 75 projects, of which 24 were laboratory design projects. These projects require careful EHS oversight to meet increasingly complex research needs. Out of the 24 laboratory design projects, 11 were completed in the fiscal year spanning across eight different departments, labs, or centers.

The major projects completed this year were the Hayden Library, Vassar Dorm, Zesiger Sports and Fitness Center pools and ice rink, laboratories in Building 4, and the Institute for Medical Engineering and Science Life Lab in Building E25, which also encompassed projects for updated building security and a new outpost for MIT Police.

Subject matter experts (SMEs) from each EHS program provide expertise and guidance as needed for campus construction projects as part of the Design and Construction Service Team. Projects are in collaboration with MIT's Campus Construction and/or Planning. Their initiatives from the past year include:

- Working with PMs, contractors, and state regulators to develop specific work practices for selective asbestos abatement and to identify appropriate training for the Burton Connor dormatory renovation
- Working with CUP and consultant to close out CUP EMH1A Fuel Release; the closure is scheduled for FY2022
- Working with consultant and MIT Office of Campus Planning to remove a Massachusetts Contingency Plan (MCP) Activity and Use Limitation for the West Parking Lot in order to forward future development at the location
- Serving as SMEs for campus construction projects aimed at reducing energy consumption as part of MIT's Greenhouse Gas Initiative; FY2021 saw projects in Buildings 46, 76, 66, and 68
- Working with project team for Music Building construction to pre-characterize soils, treatment of Resource Conservation and Recovery Act (RCRA) regulated lead soils at site, removal of soils, and stormwater Best Management Practices (BMP) plan review
- Working with the project team for the Utility Enabling Project to pre-characterize soils, treatment of RCRA regulated lead soils at site, and National Pollutant

Discharge Eliminiation System Remedial General Permit to support the Schwartzman Computing Center

- Facilitating the MWRA permitting required for the Schwartzman College of Computing and the MET Warehouse
- Working with Haystack Facilities group and DOF management to assess incident, perform preliminary testing and investigate the release to plan for future remediation efforts to achieve compliance with the MassDEP MCP regulations and achieve Permanent Closure status for the Haystack Diesel release
- Revising the MIT Design Standard Specs, providing updated information on waste collection areas, air permit and emission programs, and water programs for the design standards revision effort

Occupational and Construction Safety Program's Upcoming Initiatives

- Assist DSL with issues related to having cohorts of students on campus last year with a broader reoccupation of campus for the fall semester
- Work with DOF on the LOTO Audit response and support
- Continue implementation efforts related to training for crane and hoists programs, electrical safety, and hot work
- Facilitate and gather requirements to meet the new City of Cambridge Flammable Storage License and Permit system

Radiation Protection Program

The Radiation Protection Program (RPP) provides a safe working area for radiation workers, the general public, and environment while allowing creative and breakthrough research to continue. RPP ensures compliance with the regulations set forth by Massachusetts Department of Public Health (MDPH) Radiation Control Program (MRCP) and MIT policy.

The demand for RPP services remained strong with a continued increase for experimental reviews involving class 3b and class 4 lasers, researcher use of irradiator facilities, new projects at the Plasma Science and Fusion Center (PSFC), and Radiofrequency (RF) work at the Haystack/Millstone Hill complex. Reactor RPP (RRPP) services for routine experiments and non-routine outages at the MIT Reactor (MITR), maintained by the Nuclear Reactor Laboratory (NRL), also remained strong. At Bates, a new X-ray experiment and a new proton accelerator were established. There was an increase in the demand for RPP services at both Whitehead Institute for Biomedical Research (WIBR) and the Charles Stark Draper Laboratory Inc. Staff met with faculty and senior research scientists on approximately 150 different occasions.

The following are non-routine accomplishments from the past year:

- Installed an X-ray-based irradiator system in the vivarium in Building 76 as part of the Cesium Irradiator Replacement Program (CIRP).
- Led the development and review of the safety and testing procedures for the Toroidal Field Model Coil (TFMC) testing to be done in August 2021 at the PSFC.
- Recovered the time capsule buried under the cyclotron in former Building 44.
- Evaluated the laboratory physical requirements and processing and handling procedures to handle and store Fluorination of Lithium Fluoride-Beryllium Fluoride (FLiBe) salts for future experiments with molten salts.
- Developed and implemented a new online laser safety training course for campus and Lincoln Laboratory.
- Evaluated and mapped RF exposure potentials associated with the upgrade to 3 MW operating power for the Millstone Hill Radar (MHR).
- Evaluated electromagnetic field levels in the new Area 4 graduate dorm in response to occupant concerns.
- Updated the irradiator security system to align with the new institute-wide Genetec system, including new biometric recognition systems and re-registration of all users.
- Expanded the plastics recycling program to all laboratories.
- Re-established the radioactivity analysis laboratory cross-check program with independent third-party assessments.
- Accommodated a LL project at Bates that required the need to X-ray targets at a distance of up to 600 feet from the X-ray source.
- Decommissioned laboratory spaces to save the Institute time and monies involved in hiring third party service providers.
- RRPP accepted responsibility for the annual update of the MITR decommissioning plan and historical site assessment. Going forward, results will be reported to Vice President for Finance and DOF in June of each calendar year.
- Developed an online radiation safety and emergency response video to fulfill a biennial requirement for training Cambridge Fire Department (CFD) first responders.
- Assisted in the Draper Lab Autonomous Unmanned Aerial Vehicle (UAV) experiments to test the capabilities to detect, identify, and map radioactive sources placed on Briggs Field.

Radiation Protection Committee

The Radiation Protection Committee (RPC) reviews and approves all uses of ionizing and non-ionizing radiation sources through a system of authorization and registration programs, risk assessments, and monitoring programs managed by RPP. RPC has

continued its strong collaborative presence in the academy with the continued implementation of radiation protection service programs and interactions with faculty, postdoctoral researchers, students, and staff. RPP performed radiation hazard risk analysis for proposed and continuing uses of licensed radioactive material and machine-produced radiation. See Table 1 below for more detail.

Table 1: List of Registrations and Devices Monitored by Radiation Protection Program

Program	Registrations	Amount
Radioactive Material	118	n/a
X-ray	28	58 machines
Po-210 Alpha Ionizer (Lincoln Laboratory)	26	226 ionizers
Accelerator	9	9 machines
Class 3B/4 Laser	185	1,421 lasers
Irradiator	37	4 facilities
Radiofrequency (RF)	n/a	75 systems
Superconducting Magnet	10	50 magnets

Gamma Irradiators

RPP updated the access control and physical security systems at the irradiator facilities to comply with the Institute's new Genetec security system. There are currently 37 academic projects registered for use of the irradiator facilities. RPP installed a new Precision 320xi X-Ray irradiator in August 2020 and will be disposing of one gamma irradiator in late 2021.

Routine services to the MIT licensed material user community:

- Reviewed and renewed approximately 39 applications or amendments for use of radioactive materials and presented them to the RPC.
- Trained or retrained 1,109 workers in the safe use of radioactive materials, radiation sources, X-ray machines, lasers, and RF sources on campus and at LL.
- Received, monitored, and delivered approximately 126 radioactive samples. Security of radioactive stock material was audited during each laboratory delivery of new radioactive material.
- RPP monitors 252 workers for external radiation exposures on a quarterly frequency and distributes and collects approximately 152 area monitoring dosimeters on a monthly and quarterly frequency. Also, 91 in vivo whole body, thyroid, and urine burden measurements were performed.
- There are 304 registered low and medium-level radiation labs. RPP staff performed approximately 8,500 regulatory-required operational and decommissioning radiation surveys. The RPP analysis laboratory processed over 20,000 surface, air, and water samples with instrumentation that is calibrated with National Institute of Standards and Technology (NIST) certified standards. RPP completed four radon concentration analyses for members of the community.

- Collected and managed all low-level radioactive waste generated, including 65 requests for radioactive waste collection resulting in 138 containers collected. There were two low level radioactive waste shipments from campus and one waste shipment from the reactor during the year.
- Performed approximately 220 radiation survey instrument calibrations.
- Inventoried approximately 239 sealed radioactive sources that are required to be physically inventoried every six months. Leak-tested approximately 25% of these radioactive sources. RPP staff also conducted the required annual inventory and audit of the special nuclear material (SNM) sources on campus and at the NRL and assisted the NRL in the year-end reporting to the federal government Nuclear Material Management and Safeguards System (NMMSS) and Nuclear Regulatory Commission (NRC).

Lincoln Laboratory

RPP provides services to LL that encompass all aspects of Radiation Protection Programs and reviews outreach activities such as "Science on Saturday," LaserCom Independent Activities Period (IAP), Laser Radar IAP, and Radar IAP. RPP works closely with the Radiofrequency Spectrum Management Office and the Mission Assurance Office along with the various groups and divisions, including the Flight Test Facility. The LL Laser Safety and RF Safety Programs are unique and are summarized separately from the campus report as follows:

Laser Safety Program

RPP continues to manage the LL Laser Safety Program to ensure compliance with regulations.

MIT Lincoln Laboratory Laser Safety Program Statistics for FY2021:

- Total number of registered lasers: 535 (431 active, 104 inactive)
- Total number of registered laser laboratories: 104
- Number of responsible people: 159 (109 persons, 50 PIs)
- Number of identified laser persons-workers: 489
- Total number of Laser Safety Trainings given: 66 participants over 18 courses

During the fiscal year, 15 major laser programs and a host of smaller programs along with laser laboratory designs were reviewed. Of the major programs, several involved coordination with multiple federal government organizations as part of a requirement by the sponsor. These included advanced airborne LIDAR techniques, novel systems, and laser communications involving space borne systems.

Radio Frequency Safety Program

The RF Safety Program requires reviews for any system that exceeds 5 Watts effective isotropic radiated power. RPP staff attend routine Safety Committee meetings for the Haystack/Millstone complex and provides oversite for the RF safety on the "Hill."

The MHR is undergoing upgrade from normal operating conditions. Extensive surveys have been conducted and reported on a weekly basis.

Community, and Departments, Labs, and Centers Outreach

- **Nuclear Makerspace (The Nucleus):** EHS continues its partnership with NSE to develop the operations manual and guidelines for managing the Nuclear Makerspace. RPP staff are members of the project review team for the proposed student use of the facility.
- **Toroidal Field Model Coil (TFMC):** RPP was asked to lead the safety review and evaluation of the magnet test plan. The testing is planned from July through August 2021.
- **Knight Science Journalism Program:** RPP was contacted by the Knight Science Journalism Program to determine if they could accept a philanthropic gift of a vial of "Undark" radium-based paint. With approval of the RPC, RPP staff recovered the item and brought it to MIT. RPP and the program are designing a display to showcase the paint.
- **Cambridge Fire Department (CFD) and Cambridge Police Department (CPD):** RPP staff continue to support the CFD and CPD. RPP developed and delivered an online retraining seminar for the CFD in basic radiation safety, radiation measurement, and emergency response protocols to a potential threat to the irradiator facilities in Cambridge. RPP collaborated with the CFD to perform annual calibrations of their radiation detection equipment and personal radiation dosimeters used during emergencies.
- **Cambridge and Somerville Programs for Addiction Recovery (CASPAR):** RPP continues to work with community liaisons to provide radiation safety and emergency response training to the CPD and CFD as requested. In an effort to reduce the risks to the MIT community, RPP has continued to service the needle collection receptacles at the CASPAR facility on Albany Street as part of our Regulated Medical Waste (RMW) program. To date, EHS has removed approximately 400 needles per year from this repository which reduces the risk of a needle stick to the MIT community.

Radiation Protection Program's Upcoming Initiatives

- Work with PSFC faculty—Zachary Hartwig and Dennis G. Whyte—on the planning, authorization, and implementation of radiation EHS programs for the DOE funded FLiBe project.

- Dispose of the GC40 irradiator via the CIRP program.
- Work with NSE faculty to assist in developing the safe use of the Nucleus Makerspace.
- Design a customized Alarm Response Training for the MIT Police, CPD, and CFD.

EHS Integrative Programming

The integrative programs within EHS are comprised of the organizational programs detailed above as well as service teams which, together, oversee a wide variety of initiatives. These initiatives involve cross-program monitoring and measurements to sustain regulatory compliance, proactively assessing risk to the MIT community, and supporting a culture of safety. This year, the following service teams or programs have provided regular, operational support as detailed below:

- **Emergency Preparedness and Response Team (EPRST):** The EPRST provides oversight for the 24-hour emergency response services at MIT and is responsible for the follow-up processes provided by the EHS office. The team works in partnership and aligns with the Institute's Emergency Response Group. The team updated training material and provided retraining to 39 staff and on-call orientation for seven new staff members. The team continued to provide uninterrupted 24-hour emergency response services and responded to 16 after-hour calls and 68 daytime calls. Team members participated in two After Action Reviews, both of which identified potential improvements regarding communications. The team will be reviewing communications as part of the team's upcoming goals, including reviewing the emergency response poster and collaborating with MIT Emergency Management on a communication matrix during and after incidents.
- **Inspections Service Team:** The Level II Inspections are conducted by EHS coordinators semiannually for research laboratory spaces and annually for facility-type spaces. During 2020, half of the year was exempt from inspections due to the COVID-19 pandemic, and, when the campus ramped back up, coordinators were asked to conduct an alternative inspection not tracked in the system. In total, there were 968 findings across 317 reports submitted. The team also reviewed the Level I Inspection Checklist and guidance documents and worked with DOF and DSL to review and updated the Level II Inspection Checklist for their respective areas.
- **Hazardous Shipping Service Team:** The team continued to focus on rolling out eShipGlobal to additional DLCs. There were a total 684 research material shipments consisting of 481 regulated and 203 non-regulated shipments.
- **Regulated Waste Service Team:** The team maintained service for the pick-up of radioactive, regulated medical and chemical waste. The EHS technicians, under the direction of RPP, collected and managed greater than 18,537 containers of biologically contaminated waste. There were three shipments of low-level radioactive waste during the reporting period. The team also managed the sharps disposal for the MIT Flu Clinic and the COVID Vaccination Clinic.

The Hazardous Waste Program, under the direction of EMP, shipped 330,817 pounds of waste, which is a 36% increase from the previous year. This is due mostly to the pandemic's more significant effect on FY2020 operations. Of the waste disposed, 71% (241,496 pounds) is considered hazardous waste. A total of 4,727 chemical waste pickups were generated through the online request form in addition to the many hundreds of containers collected during the weekly cleanouts of Main Accumulation Areas (MAAs) on campus. The Hazardous Chemical Waste Team, also under the direction of EMP, conducted 34 laboratory cleanouts and disposed of approximately 1,700 expired chemical bottles.

Additionally, the following service teams accomplished key organizational initiatives and projects that went beyond routine support.

Safe and Sustainable Labs Service Team

The restructuring of the Safe and Sustainable Labs (S2L) Program has reinvigorated the service team. The team now encompasses partners from the MITOS, DOF, Procurement, and research DLCs. The team redeveloped web content and integrated content from the former stand-alone site into the MIT EHS website. This positioning aligns with providing the research community one location to obtain information about laboratory sustainability. The team's key achievements are:

- MIT and Whitehead Institute was named the 2020 Organizational Winners in the fourth annual International Institute for Sustainable Laboratories International Laboratory Freezer Challenge. Three MIT laboratories participated in the challenge: the Department of Biology's Barbara Imperiali Lab, Department of Biological Engineering's Jacquin Niles Lab, and Department of Biology/ Whitehead Institute for Biomedical Research's David Sabatini Lab. The Niles Lab and the Imperiali Lab are MIT EHS Green Lab Certified. The labs saved an estimated 520 kWh/year.
- In collaboration with researchers and DLC EHS coordinators from Biology and Koch Institute (KI), EHS developed a pilot program for recycling laboratory plastics. The goal was to isolate the pipette tip box waste stream and to recycle with a local start-up. The pilot program was successful, collecting over 9,600 pounds of pipette tip boxes, and will be expanding to all labs with the support of the Vice President for Campus Services and Stewardship.
- The Chemistry Undergraduate Teaching Lab embarked on a fume hood hibernation project for 69 fume hoods. This has resulted in reduction in air change rate when the laboratory is unoccupied from 11 air changes per hour to seven air changes per hour and is projected to save MIT about $21,000 annually.

Communication Service Team

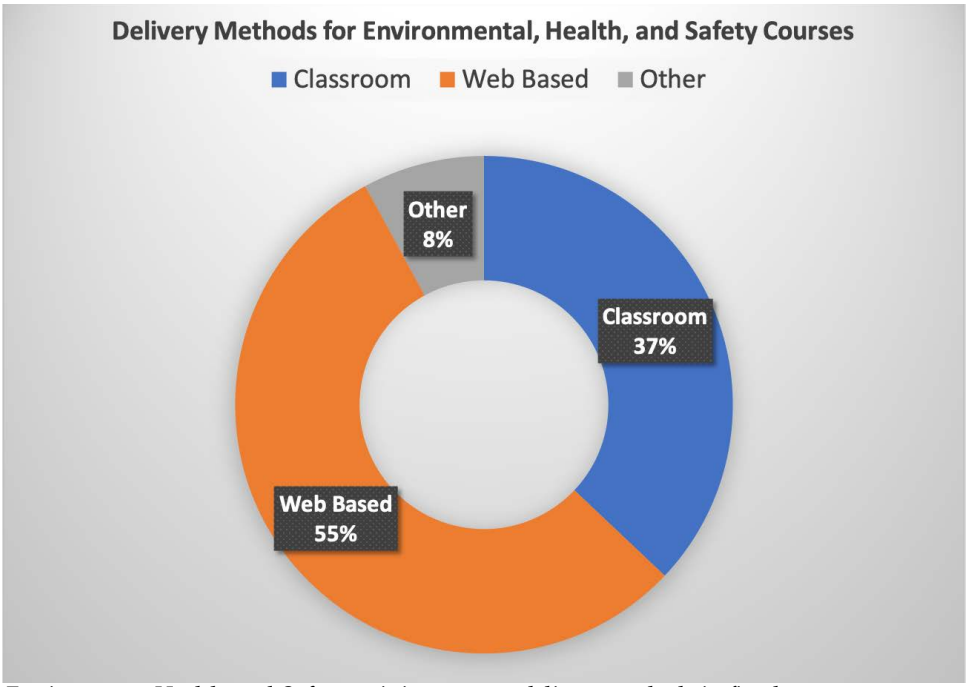
The Communication Service Team (CST) works to achieve effective and timely communication among all EHS stakeholders across the Institute and MIT community to improve EHS performance. The team continued to lead and support EHS efforts with providing information and resources to EHS office, DLC EHS coordinators, and the MIT community. This year's CST initiatives included:

- Delivered weekly updates to EHS office and DLC EHS coordinators through a department newsletter, the EHS NewsBolt, coordinating over 42 issues with a 57% overall average open rate
- Launched an online, interactive, and searchable EHS timeline. The timeline highlights significant historical events from EHS and MIT throughout the years and is a visual resource for exploring and recording EHS history
- Developed and deployed a new intranet, EHSNET, for the EHS office. The site serves as a "one-stop-shop" for organizational resources and tools for staff
- Assisted with the migration of web content for the S2L by integrating the Program's information into the EHS main site and positioning S2L prominently
- Supported and hosted a weekly EHS office and DLC EHS coordinator virtual coffee hour.
- Planned and coordinated with MIT Audio Video Production a video about EHS in lieu of a 20th Anniversary in-person celebration of the EHS organization

Training Services Team

The Training Services Team (TST) provides oversight for all EHS training needs and assists in the development of EHS training courses. Courses offered meet regulatory requirements and provide general awareness and best practices. In FY2021, TST delivered 33,988 learning experiences, and the chart below shows the methods of delivery. The Other method encompasses medical and signature forms. In total, 11,809 unique individuals completed an EHS training.

Delivery Methods for Environment, Health, and Safety Courses



Environment, Health, and Safety training courses delivery methods in fiscal year 2021, categorized as classroom offering, web based offering, and other, which emcompasses medical and signature forms.

Overall, there was a slight increase in web course participation. The team continues to support efforts with converting classroom-based training into web-based training as this offers a flexible option for the MIT research community to complete training conducive to their schedule. Four web-based training courses were launched this year: Ergonomics and Safety for Report Work, Electrical Safety Awareness, Laser Safety (P1 and P2), and Nanomaterials Safety and Health. The team also updated and revised the following web-based courses: Autoclave Safety Training, Shipping Dry Ice/Non-Regulated Materials, Managing Hazardous Waste, and EHS COVID-19 Lab Safety Reorientation.

As part of EHS office's continuation of optimizing and evaluating the EHS Training Program, MIT's Audit Division conducted an internal review of the Training Program. Participation of this internal review consisted of members of the Training Team, EHS office staff, DLC EHS coordinators, EHS representatives, PI/faculty, and members of the MIT HR Learning Center Support Team. The audit report was provided to EHS management in October 2020 and resulted in two audit findings and three audit observations. The Training Team worked with EHS management to draft an initial response and develop an EHS Management Action Plan to address the findings and observations.

TST implemented the action plan in early 2021. The action plan was completed by June 2021, and the results were sent to the auditors prior to the July 2021 deadline.

EHS Information Technology

EHS Information Technology (EHS IT) provides operational support to the EHS office and manages EHS Management System (EHS-MS) information, applications, reporting. and analytics used by the EHS organization. As EHS onsite staffing increased, EHS IT's technology support for hardware, software, and communications platforms helped EHS staff ensure research and academic studies resumed safely. This required the rapid transformation of EHS technology infrastructure and information management to a new hybrid onsite and offsite campus model while continuing to support routine and special projects. Below is a list of key projects conducted during the past year:

- Acquired and provisioned new hardware and audio-visual peripherals essential to effective Zoom presentations and meetings
- Provided trainings to EHS staff about collaborative tools enabled by the Office 365 platform and Dropbox integration
- Managed and provided oversight for the EHS-MS Manual review and Document Control Program (DCP)
- Provided continued support in developing EHS Representative Orientation training specifically to develop awareness for EHS representatives on their EHS-MS role and responsibilities
- Facilitated and provided hands-on support for Annual Chemical Reporting
- Developed surveys to assist with planning laboratory support during the phased return to campus and polled DLCs on methods used to inform EHS representatives about their EHS-MS role and responsibilities

Awards and Development

DLC Performance Awards

DLC Performance Awards are based on training and inspection metrics; therefore, due to the constraints with the pandemic and limited access to campus, the awards were not presented in 2021.

EHS Infinite Mile Awards

The Infinite Mile Awards are given to individuals or teams in recognition of their exceptional contributions to health, safety and environmental stewardship at the Institute.

The recipients for the 2021 awards were:

- **Distinguished Service Award:** Phyllis Carter, Joe MacLeod, and Fred McWilliams
- **Service Award:** Wei Lee Leong, Kyle McGovern, Steve Younis, Lu Zhong, Carolyn Colonero, Jeff Goupil, Brian McAnneny, and Matt Wah
- **Positive Attitude Award:** Dan Alexander
- **Distinguished Service Team Award:** awarded to EHS technicians John Collins, Diane Cormier, Mike DeBerio, Bob Farley, Mark Linehan, Hamid Moazeni, Beth Rice, Rosario Silvestri, Ron Stoute, and David Pavone

Organization and Professional Development

EHS hired seven staff members. Due to travel restrictions, staff participated in virtual conferences when possible and maintained certifications as required.

MIT News and EHS Articles

The following are articles about EHS work published on MIT News or EHS website:

- How MIT built its own Covid-19 testing trailer
- MIT's Environment, Health & Safety Office is offering resources, training, and support for Remote Work during the COVID-19 Pandemic
- MIT begins testing wastewater to help detect Covid-19 on campus
- MIT labs win top recognition for sustainable practices in cold storage management

MIT EHS Regulatory Compliance Calendar FY2021

Due to the pandemic, some regulatory requirements were adjusted based on state-wide closure mandates and direction from regulatory agencies.

July 2020

- Bacterial testing at MIT pools
- MassDEP and EPA excess emissions report

- MassDEP Title V semi-annual compliance certifications
- MWRA CUP wastewater testing and pH/flow report
- MWRA main campus quarterly wastewater testing and pH/flow log reports (seven locations)
- MWRA main campus semiannual wastewater testing and pH/flow log report (four locations)

August 2020

- Accelerator registrations renewal
- Analytical X-ray registration renewal
- CAB/ESCRO meeting
- Low Level Radioactive Waste (LLRW) renewal
- MRCP license renewal
- MWRA CUP wastewater testing and pH/flow report

September 2020

- CAB/ESCRO meeting
- City of Cambridge Inspectional Services: Certificates of Occupancy Inspection
- Cambridge Public Health Department ice skating rink certificate
- Functionality testing of accelerator and irradiator interlock and security systems
- Radiation Protection Committee meeting
- MWRA CUP wastewater testing and pH/flow report
- MassDEP CUP UST financial responsibility statement

October 2020

- Bacterial testing at MIT pools
- CAB/ESCRO meeting
- MassDEP and EPA excess emissions report
- National Institutes of Health Office of Science Policy report
- MassDEP CUP UST: Third party inspection report; Overfill Protection System test; Line Monitoring System test
- MWRA wastewater testing and pH/flow report
- MWRA main campus quarterly wastewater testing and pH/flow log reports (seven locations)

November 2020

- Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) explosives user certificate
- NMMSS reconciliation report for SNM receipt and transfer
- MWRA CUP wastewater testing and pH/flow report

December 2020

- Accelerator registration renewal
- Analytical X-ray registration renewal
- CAB/ESCRO meeting
- Functionality testing of accelerator and irradiator interlock and security systems
- MassDEP rideshare submittal
- NRC inspections
- Radiation Protection Committee meeting
- Reactor Safeguards Committee meeting
- Site accelerator registration renewal
- EPA Westgate monitoring report
- Superfund Amendments and Reauthorization Act (SARA) tier II inventory
- MWRA CUP wastewater testing and pH/flow report

January 2021

- Bacterial testing at MIT pools
- CAB/ESCRO meeting
- Human embryonic stem cell research report to MDPH
- MassDEP and EPA NOx excess emissions report
- MWRA photo processing report
- MassDEP Title V annual and semi-annual compliance certifications
- Review of MIT Security Plan for irradiator facilities
- Review of Memorandum of Agreement with CPD and CFD for irradiator emergency response plans
- MWRA CUP wastewater testing and pH/flow report

- MWRA main campus quarterly wastewater testing and pH/flow log reports (seven locations)
- MWRA main campus semiannual wastewater testing and pH/flow log report (four locations)
- MWRA CUP oil water separator report

February 2021

- Cambridge Biosafety Permit renewal
- FM Global insurance inspection
- LLRW report
- MRCP inspection of "Increased Control" security program
- OSHA 300 and 300A log
- Report from the CAB/ESCRO to the City of Cambridge
- MWRA CUP wastewater testing and pH/flow report

March 2021

- CAB/ESCRO meeting
- Cambridge stormwater inspection report
- EPA and MassDEP greenhouse gas report
- Flammable liquid permits and licenses renewals
- Functionality testing of accelerator and irradiator interlock and security systems.
- Laser inventory
- NRC—calendar year report and review of RRP Programs
- Radiation Protection Committee meeting
- SARA tier II report
- MWRA CUP wastewater testing and pH/flow report

April 2021:

- CAB/ESCRO meeting
- LLRW report
- MassDEP and EPA excess emissions report
- EPA greenhouse gas report
- MassDEP source registration/emission statements for Haystack

- NRC inspections
- RPP program audit
- MWRA CUP wastewater testing and pH/flow report
- MWRA main campus quarterly wastewater testing and pH/flow log reports (seven locations)

May 2021

- Audit of MIT/WIBR radiation protection programs
- MWRA CUP wastewater testing and pH/flow report
- MassDEP source registration/emission statements and greenhouse gas report for main campus

June 2021

- CAB/ESCRO meeting
- US Department of Transportation hazmat registration
- Functionality testing of accelerator and irradiator interlock and security systems
- MassDEP UST compliance certification
- Radiation Protection Committee meeting
- MWRA CUP wastewater testing and pH/flow report

Intermittent

- ATF explosives inspection (triennially)
- Massachusetts Department of Conservation and Recreation Office of Dam Safety—Endicott House Weld Pond Dam Phase 1 safety inspection and report (every 10 years)
- MassDEP source registration for Haystack Observatory (triennially)
- MassDEP CUP UST third party inspection report (triennially)
- MassDEP CUP UST self inspection report (every 18-months)
- MassDEP air operating permit (every five years)
- MDPH human embryonic stem cell research permit renewal (triennially)
- MRCP inspection of irradiator security program (biennially)
- MRCP inspection of broad scope license activities (triennially)
- MWRA main campus permit (biennially)
- MWRA CUP permit (biennially)

- MWRA Sea Grant low flow/low pollutant permit (every five years)
- NRC special nuclear materials inspection (every five years)
- NRC special nuclear materials license renewal: SNM-986 (every 10 years)
- RCRA biennial report (biennially)

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