

Environment, Health, and Safety Office

The [Environment, Health, and Safety Office](#) (EHS) is an institutional compliance office as well as a service and operations department. It supports the Institute's environment, health, and safety mission associated with education, research, and the operation of MIT's endeavors in Cambridge, at Lincoln Laboratory, and worldwide.

During the past year, there continued to be a national focus on environment, health, and safety issues at academic institutions. This was partly the result of several tragedies that occurred at universities in the previous five years: the death of a laboratory researcher at the University of California, Los Angeles, with subsequent criminal charges settled with the university and the principal investigator (PI); the death of an undergraduate student in a departmental machine shop at Yale University; the laboratory explosion and injury to a graduate student at Texas Tech University; and the loss, and improper handling, of anthrax at several government and university laboratories. The US Chemical Safety Board released a report and video identifying some of the root causes behind these tragedies and asking universities to review and strengthen their EHS programs. In 2014, the National Academy of Sciences published a study, *Establishing and Promoting a Culture of Safety in Academic Laboratory Research*, that emphasized the responsibilities of all university community members for the safety and health of their colleagues as well as themselves. In view of these events, EHS has continued its efforts to review and strengthen the Institute's EHS Management System (EHS-MS).

To reduce the risks that are inherent to new and innovative research, EHS must be able to guide the Institute in early risk assessments to embed mitigation practices and designs into research proposals. EHS programs have helped to identify predictive indicators that mean the Institute could be put at risk if the research being assessed is not done carefully, with safety considered in the planning stages. Over the past few years, for example, there have been significant increases in battery research, which typically uses highly reactive and energetic materials, and in the conversion of traditional machine shops to digital fabrication studios (so-called makerspaces) that present new types of hazards to shop users.

EHS has a history of planning for safety by following the scientific literature, tracking where funding is originating and research trends, interacting with EHS's peers, and interacting with MIT's leading faculty members. For example, EHS recognized 10 years ago that nanotechnology was a growing area; eight years ago, that synthetic biology was a growing area. In both cases, EHS developed the necessary safeguards before regulatory agencies promulgated rules. More recent trends have seen engineering moving into the biological sciences and undergraduate students conducting more hands-on activities with hazardous materials and equipment. This requires EHS to reevaluate design requirements for engineering facilities and the training needs of engineers and students.

Enabling MIT's Mission

Development of Safety Culture for Laboratories

Laboratories at MIT have unique cultures with one common theme: they are places of academic and research excellence. A subset of this theme of excellence is superior safety performance, although many times this aspect is not explicit. Clarifying the importance of a strong culture supporting safety has been mentioned in at least two departmental visiting committee reports. EHS is launching programs to increase both safety performance and awareness, including campaigns, awards, awareness-building events, and a commitment by department, laboratory, and center leaders to a high awareness of safety.

Systems Approach

EHS is exploring a systems approach to laboratory operations and the link between laboratory quality and productivity and laboratory safety. These management aspects are taught at MIT's Sloan School of Management and EHS is receiving guidance from various Sloan faculty members in this effort. Along with understanding laboratory operations in the context of various systems, EHS sees a strong link between quality and productivity and safety at MIT, and EHS can help laboratories to improve their performance in these areas. EHS is pilot-testing some approaches, such as "5-S" techniques and the application of an "A-3" improvement framework, in both EHS programs and laboratories at MIT. EHS plans to increase the number and impact of these programs going forward.

Faculty Members' and Principal Investigators' Responsibilities

In FY2011, EHS began to conduct orientation sessions for new faculty members and PIs. This was later expanded to include an overall presentation and discussion for all faculty members in an effort to help faculty understand their EHS responsibilities and become aware of the resources available to assist them. The presentation and discussion can take place either at departmental faculty meetings or in one-on-one meetings. This has been completed by 179 out of 437 PIs (41%) whose work involves hazards listed in the EHS Space Registration database. In FY2016, EHS plans to continue this outreach.

Emergency Preparedness Planning

In FY2015, EHS made significant strides, verifying that approximately 95% of MIT's departments, laboratories, and centers (DLCs) have a completed emergency preparedness plan (EPP). EHS used a new model for all-hazards EPPs to be used by DLCs across the Institute in collaboration with the Security and Emergency Management Office. EHS used an all-hazards [emergency preparedness plan template](#) that consolidates evacuation procedures, communications protocols, shelter-in-place measures, and Occupational Safety and Health Administration fire prevention requirements into a five-worksheet Excel document. This is an improvement over conventional EPPs, which tend to be Word documents of 25 to 30 pages. The new template has been designed to be eventually imported into a database or web-enabled platform.

Machine Shop Program

The Yale fatality also spurred EHS to do a complete review of MIT's machine shop program. To date, EHS has assessed approximately 70 individual machine shops at the Institute, convened a Machine Shop Safety Forum of machine shop supervisors or representatives that meets quarterly to share and review practices and policies on working alone, and successfully completed a shop safety video contest to engage the community about shop safety. EHS documented approximately 573 machine tools, assessed their safety features, and identified where improvements were needed (in approximately 80%). Upgrades have been completed in 56 shops (511 tools; approximately 90% complete). EHS expects to complete work in the remaining six shops in FY2016. The Office of the Executive Vice President and Treasurer and the affected departments have co-funded these upgrades.

Makerspaces

In keeping with MIT's motto, *mens et manus* (mind and hand), several campus initiatives have recently advocated for more hands on-learning at MIT (Future of Education) and better access to shops by students during off-hours and outside the curriculum (Innovation Initiative). These studies, coupled with exciting new developments in digital fabrication, have led several student groups to gain momentum in their requests for student-run shops. One such shop has been completed in Building 35 for the Department of Mechanical Engineering. New House has done considerable work in putting together a governance charter and funding for a space serving three dormitories. The Metropolitan Storage Warehouse project will include a large makerspace. There are several EHS-related challenges that have to be addressed, including supervision, training, access restrictions, working alone, hours of operation, design and layout of shop spaces, and the safety features that are needed.

Comprehensive Laboratory Hazard Assessment

The lack of a comprehensive hazard assessment before starting a procedure has been a causal factor of the tragic incidents that have occurred in universities these past four years. There are currently several programs that assess a specific hazard in a laboratory, or register or document conditions in the laboratory, or both. However, there is not a comprehensive assessment of each laboratory on the basis of the complete information available. Review of specific activities performed in the laboratory is typically limited to those that are required (i.e., biosafety protocol reviews and radiation authorizations). The laboratory hazard assessment (LHA) pilot program conducted in FY2013 was well received and expanded in FY2014 and FY2015. EHS has conducted LHAs in more than 56 PI groups in 12 DLCs to date.

EHS has also reviewed six undergraduate courses for laboratory hazards. In the coming year, EHS is looking to expand the program, with more LHAs done in laboratories, including new DLCs, and hopes to have additional DLCs sign up for LHAs in all of their laboratories. EHS is also working with those responsible for more undergraduate courses to perform hazard assessments and develop tools for faculty members.

Accident and Injury Reporting System for Students

In collaboration with MIT Medical, EHS expanded the current system that documents and tracks employee injuries, required by the US Occupational Safety Health and

Administration (OSHA), to include students. This has allowed EHS to follow up more thoroughly on incidents involving students and to identify both trends and opportunities to intervene in activities to eliminate or minimize the risk of accidents and injuries. In FY2013, there were 41 reported incidents. In FY2014, there were 22 reported incidents. In FY2015, there were 19 reported incidents.

International Agreements

EHS made major efforts this year to support the Singapore–MIT Alliance for Research and Technology (SMART) and the agreement between the Department of Mechanical Engineering and King Fahd University of Petroleum and Minerals (KFUPM). Support for SMART has focused on customizing and implementing the Institute’s EHS Management System for adoption by SMART and providing technical support for some of the more hazardous operations. The efforts with KFUPM resulted in a formal collaboration to help them develop an EHS management system that is consistent with the principles adopted by the Institute’s EHS-MS and to develop EHS training that can be used in KFUPM’s undergraduate engineering curriculum.

EHS has also provided assistance to other collaborators, including the Masdar Institute Cooperative Program and Singapore University of Technology and Design. Further, EHS has provided advice to international colleagues in Brazil, South Korea, and Turkey, who look to MIT as showing an example of a world-class EHS program.

Laying the Foundation for the Future

Significant Laboratory Design Reviews

EHS has been an active design team member during the programming and schematic design phases of [MIT.nano](#), a new center for nanoscience and nanotechnology. EHS considerations are significant for this clean-room building, which will have significant effects on campus during construction and involve significant use of hazardous materials when opened. EHS has been advocating that similar research equipment that uses highly toxic gases be consolidated into the MIT.nano facility so the expensive engineering controls required for these systems can be shared. Laboratory ventilation, hazardous gas monitoring, chemical storage, hazardous waste handling, and waste water treatment are just some of the areas addressed. Minimizing community impact during construction is another area of focus.

In FY2015, the EHS Office began a transition to a new organizational structure that will allow more efficient support of the design review and construction safety process. The addition of two new full-time equivalent (FTE) employees and the repurposing of some of the time of several current employees to support this function has been completed. In FY2016, Campus Engineering and Construction and EHS will finalize the process that will be used to ensure adequate EHS support of campus construction projects.

Updating the Master Plan for Campus Wastewater

EHS has been working with Campus Planning, Campus Engineering and Construction, and Utilities Operations on the FY2012 Notice of Violation for mercury and FY2013 Notice of Noncompliance for copper from the Massachusetts Water Resources Authority. These notices, and the future needs of MIT.nano, have brought all to agree that a study

to update the campus's wastewater master plan is necessary and that expansion of the system may well be necessary. This work, begun in FY2015, will continue in FY2016.

New Central Hazardous Waste Accumulation Facility

A new hazardous-waste facility opened on the ground floor of Building 24 to replace the existing facility in Building 12A. The improved layout of the new facility ensures a more efficient and effective operation and provides some redundancy in critical campus waste-handling facilities that currently does not exist.

Integration of Biological and Radiation Protocol and Authorization Processes

EHS is starting an effort this year to determine the feasibility of, and barriers to, automating and integrating the process of approving and authorizing biological research protocols and the use of radiation in MIT's laboratories. Hundreds of these approvals are currently managed each year through a largely manual process that costs laboratory personnel significant amounts of time.

Transforming Experiences through Collaboration

e-ShipGlobal Software Project Pilot

After careful evaluation, EHS believes that e-ShipGlobal Software can simplify the shipping process for the MIT community, reduce overall costs, and enhance compliance with shipping rules for hazardous materials and export controls. This effort has been a collaboration between Procurement, Information Services and Technology, the Office of Sponsored Programs (OSP), several DLCs, and EHS. A phased-in implementation has begun in four DLCs; it is expected that e-ShipGlobal will be fully implemented in all DLCs by the end of FY2016. Goals include increased compliance with US Department of Commerce export restrictions and US Department of Transportation hazardous materials regulations. This system will reduce risk to the Institute; added benefits are a simplified shipping process and reduced shipping costs.

Chemical Inventory

During the fall of 2012, the EHS Inventory Team spearheaded the process of identifying a new and improved chemical inventory vendor to replace the current centrally provided platform (ChemTracker). The goal is to offer a platform that better supports laboratories' needs for effective management of their inventories while also giving EHS staff the ability to meet MIT's chemical regulatory reporting and oversight requirements.

Working in close partnership with MIT Sourcing and Procurement, EHS developed the detailed specifications grid, project goals, and platform requirements that were issued to the seven chemical inventory vendors who were invited to respond to the request for proposal. Stakeholder laboratory personnel from seven key DLCs participated in the vendor review and selection process. EHS secured faculty endorsement and FY2015 funding. A vendor (BIOVIA) has been selected and a pilot implementation was conducted in 43 PIs' laboratory groups. More than 750 users were authorized to use the system and more than 25,000 individual containers have been uploaded. The goal is to continue implementation through FY2016.

Outreach

EHS has continued its efforts to reach out to key groups at the Institute in order to communicate emerging EHS issues, obtain feedback regarding barriers to safety, and stay current on how best EHS can help to maintain safe and healthy conditions and compliance with regulations across the Institute. The approach is to identify people at the Institute who face similar EHS challenges and bring them together periodically to discuss the issues. Four groups are now meeting at least quarterly: machine shop supervisors, laboratory managers, DLC EHS coordinators, and Department of Facilities Repair and Maintenance custodial and utilities managers. The meetings have been very effective in establishing two-way communication and solving difficult problems. EHS has begun to explore setting up meetings with facility managers from the DLCs.

Collaboration in Approvals of Biological Work

Many research governance approvals share an approval route through various Institute committees that oversee biological work or research work done with animals or with humans as experimental subjects. Collaboration efforts, such as common questionnaires or previously thought-through formats, could enable a laboratory to prepare one set of approval protocols that could satisfy multiple levels of governance. EHS is further investigating this possibility.

Compliance-Related Activities

The Massachusetts Department of Environmental Protection (MassDEP) audited several Activity Use Limitation (AUL) sites on and off campus. These AUL sites, which are regulated by the Commonwealth of Massachusetts, are used for managing low-risk contamination left in place on properties. Findings from the audit were resolved by EHS, MIT's Office of General Counsel, and the City of Cambridge. No violations or penalties were proposed by MassDEP. MassDEP also conducted a comprehensive multimedia inspection of Lincoln Laboratory in FY2015. No notices of noncompliance were issued.

In preparation for upcoming stricter stormwater regulations, EHS has reviewed the current stormwater system and operations in terms of future state permitting and meeting the needs of the MIT.nano building.

Regulatory Interactions

Recent interactions with OSHA included the following:

- An employee had complained that exposure could occur from exhaust fans located in the fifth-floor mechanical rooms in Building 13. EHS was fined \$5,500 related to electrical violations and has initiated a major project with Facilities to inspect all mechanical spaces on campus and correct any deficiencies.
- An inspection at New House W70, which took place because of a contractor's accident, revealed openings in the electrical panel. This was considered a repeat violation because of the result of the Building 13 inspection. EHS was fined \$9,000 and agreed to expand and accelerate the inspection program.
- There were three occasions when OSHA asked EHS to follow up and report on an issue. One was a ladder accident that caused a Department of Facilities employee to be hospitalized and the other two were anonymous complaints. All were resolved without a visit by OSHA or a fine.

The Nuclear Regulatory Commission’s annual inspection went well, without citations or fines. Cambridge Inspectional Services conducted its routine annual inspection of campus buildings. EHS and Facilities are working to correct the 281 findings identified in 250 buildings or spaces inspected.

Accomplishments

During the past year, EHS continued its strong collaboration with and service to the Institute through its interactions with faculty, postdoctoral associates, graduate students, undergraduate students, and staff. EHS also collaborated closely with other administrative offices, particularly the Department of Facilities, the Division of Student Life, the Office of Sponsored Research, Sourcing and Procurement, the Office of General Counsel, the Office of Risk Management, the Office of International Agreements, and Information Systems and Technology to support their efforts to meet the Institute’s mission.

Waste Management Program

Regulated Medical Waste: The current, relatively new regulated medical waste management program (initiated in FY2013 and fully implemented by the end of FY2014) improves the collection and processing of biosharps containers and biowaste from MIT laboratories. The number of biosharps containers collected was reduced by 59% and the number of bio-burn boxes increased by almost 300%. The new management practices save the Institute money, eliminate the need for 10,000 to 11,000 autoclave cycles per year for in-house waste processing, and eliminate the time spent by researchers in autoclaving waste. The program has met with great acceptance. It reduces both the risk of injuries by eliminating the autoclaving process and the potential for noncompliance.

Radioactive Waste: The Radiation Protection Program continued to collect and process low-level radioactive waste collected from radiation laboratories. The total waste managed has remained constant this past year (Figure 1).

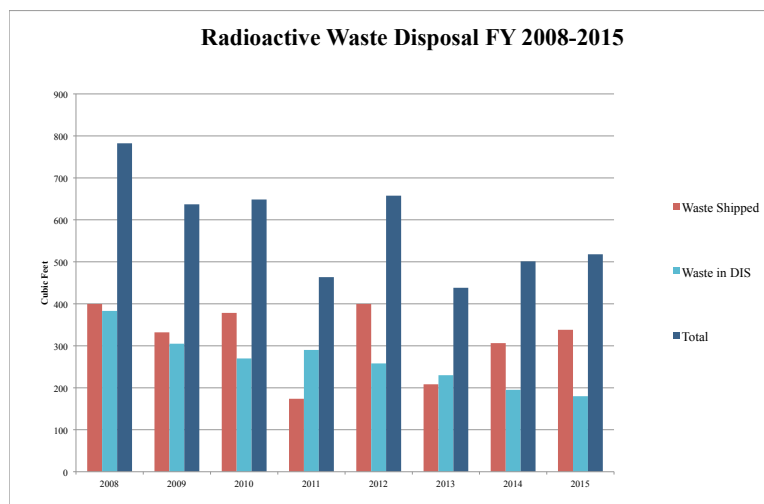


Figure 1. Radioactive Waste Disposal 2008-2015

Note: Units are cubic feet. The chart above represents the total low level radioactive waste (LLRW) volumes collected and disposed over the past six years. The LLRW shipped represents dry active waste and liquid scintillation waste contaminated with long half lived radionuclides. The decay-in-storage (DIS) waste represents dry active waste and radioactive sharps that were contaminated with short half lived radionuclides and were managed in-house.

Hazardous Chemical Waste: Hazardous waste volumes stayed relatively constant over the past five years even with the increase in research and chemical use. The cost of waste, expressed in dollars per pound of waste disposed, was reduced from \$1.72 in FY2004 to \$.99 in FY2015 (Figure 2). EHS continues to seek operational changes that will reduce costs and increase regulatory compliance.

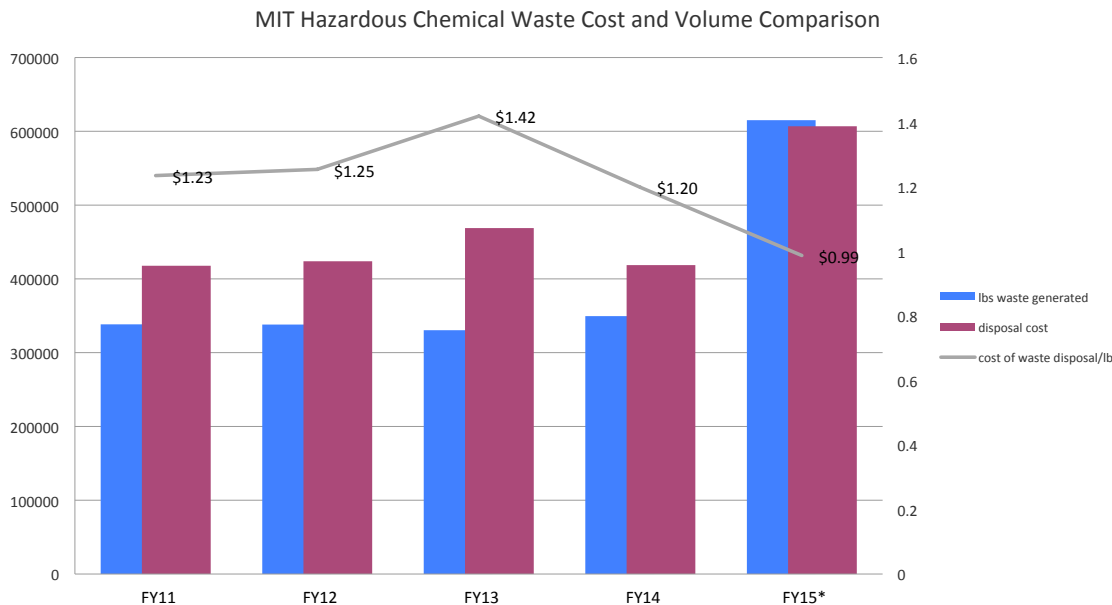


Figure 2. Hazardous Chemical Waste Disposal Spending & Waste Generated

Training

Development and delivery of EHS training is a major effort; it is both a regulatory requirement and, more important, a leading indicator of risk reduction. Three new web courses were developed this year on dormitory and fire safety, magnet safety, and cryogenics safety. This brings the total of EHS’s web-based courses to 22. In FY2016, EHS plans to add three more web-based courses.

Core Courses Training Completion Metrics: Some DLCs have a laboratory-specific training that is DLC-wide. EHS added this as a metric in FY2011 and, as expected, there are better completion rates for this kind of training than for the classroom version, which is more difficult to administer. All other metrics remained steady compared with last year.

Overall EHS Training Metrics

Some trends in EHS training are:

- Average EHS classroom attendance for FY2015 was 20 students, compared with 21 in FY2014 and 19 in FY2013. This is a metric that EHS uses to measure efficiency of delivery.
- The number of total training seats for the core courses has remained relatively stable, but overall training seats have increased by 3% as EHS has added some new courses and conducted outreach to potential users of some of the more narrowly focused courses.

- 30.1% percent of EHS sessions were web delivered in FY2015 (the average for the past three years is 30.7%).
- There are no external costs for web course hosting as everything is hosted internally.
- Time spent on training: The total time for EHS trainers (EHS Office only) was 1,046 sessions x 3 hours/class = 3,138 hours; 3,138 hours/1,920 hours/FTE = 1.6 FTE for FY2015, compared with 1.5 FTE in FY2014.
- 77% of the courses completed in the MIT Learning Center are EHS courses.

Table 1. Training Completion Rate for Common EHS Courses Over the Past Five Years

Course	Completion Rate FY2011 (Total trainees)	Completion Rate FY2012 (Total trainees)	Completion Rate FY2013 (Total trainees)	Completion Rate FY2014 (Total trainees)	Completion Rate FY2015 (Total trainees)
First-Time Trainees	N/A	1,935	1,683	1,904	2,025
General Chemical Hygiene and Hazard Communication	97% (4,541)	97% (4,994)	97% (5,741)	97% (5,243)	98% (5,728)
Lab-Specific Chemical Hygiene and Hazard Communication	85% (2,843)	88% (3,794)	84% (3,236)	85% (3,592)	85% (3,241)
DLC Lab-Specific Training	93% (980)	94% (1,393)	87% (1,825)	88% (1,508)	87% (1,803)
Bloodborne Pathogens	91% (1,401)	92% (1,461)	92% (1,298)	93% (1,220)	92% (1,292)
General Biosafety	97% (2,358)	97% (2,626)	99% (2,806)	97% (3,111)	98% (2,814)
Radiation Safety	94% (706)	96% (706)	95% (767)	95% (765)	94% (638)
Laser Safety	93% (934)	94% (1,091)	96% (1,651)	94% (1,364)	95% (1,535)
Managing Hazardous Waste	90% (4,221)	91% (5,621)	87% (5,219)	89% (5,210)	90% (5,115)

Note: All those who need specific training prior to work with hazardous materials and equipment have completed training. The data does not reflect those who have left MIT and whose records have not yet been archived, or those who signed up to take a course out of interest or future need but have not taken it yet.

Course	Completion Rate FY2011 (Total trainees)	Completion Rate FY2012 (Total trainees)	Completion Rate FY2013 (Total trainees)	Completion Rate FY2014 (Total trainees)	Completion Rate FY2015 (Total trainees)
Percentage of PIs Completed Hazardous Waste Training	N/A	75%	67%	77%	73%
Total EHS Web and Classroom (Includes Lincoln Laboratory)	25,197	26,796	25,553	29,050	29,883

Note: All those who need specific training prior to work with hazardous materials and equipment have completed training. The data does not reflect those who have left MIT and whose records have not yet been archived, or those who signed up to take a course out of interest or future need but have not taken it yet.

Injury and Illness Report

Incident Reporting and Investigations

The EHS Office continues to encourage DLCs to use the incident reporting and investigation system, which centralizes and electronically links all information related to an incident, facilitates data handling, and provides online access to reports on injuries to Department of Facilities management, EHS Office staff, and DLCs' coordinators. This provides for more effective follow-up of incidents and initiation of corrective actions. A new program was established using an updated reporting form to record undergraduate students' injuries and provide reports.

The incidence rate of total recordable injury and illness cases for calendar year (CY) 2013, 1.8, is shown in Figure 3, along with data for the previous 10 years. This rate is the same as the rate in CY2012 but is well below the CY2011 (latest available data) incidence rate for private industry (3.4) and Massachusetts (2.5). It is the same as the incidence rate for colleges and universities (1.8). The Department of Facilities contributes about a third of MIT's injuries and illnesses and represents a significant opportunity for improvement.

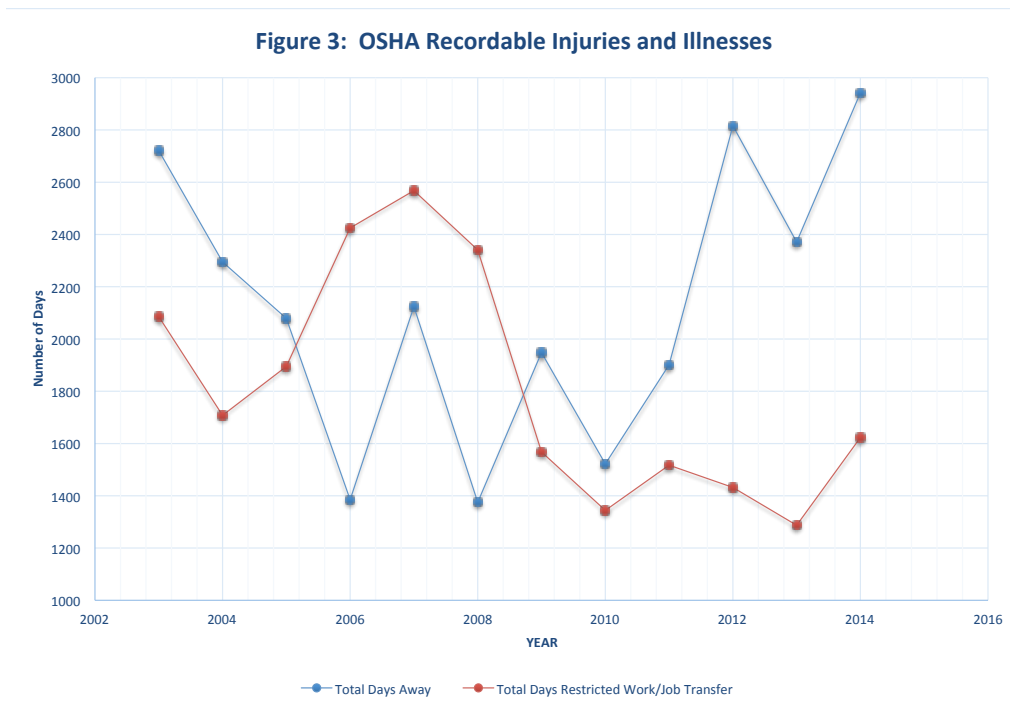


Figure 3. OSHA Recordable Incident Rates of Recordable Injuries and Illnesses

Table 2. MIT 2014 Injury and Illness Data Compared with 2014 Bureau of Labor Statistics Data

Case Type	MIT	Universities, All US
Total Rate (Total recordable injury and illness cases)	2.1	2.0
Days Away Rate (Cases involving days away from work)	1.1	0.5
Job Transfer/Restriction Rate (Cases involving job transfer or restricted work activity)	0.4	0.3
Days away, Restricted, and/or Transferred Rate (Cases involving days away from work, days of restricted work activity, and/or job transfer)	1.5	0.8

Note: The incidence rate of injuries and illnesses is computed from the following formula: number of injuries and illnesses X 200,000/employee hours worked = incidence rate. 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.

Following is a breakdown of the top five most commonly recorded incidents at MIT in 2014:

- 22% — Overexertion in carrying, lifting or pulling objects (52)
- 17% — Falls (40)
- 13% — Injury from improper handling of object (including foreign objects in the eye) (30)
- 11% — Struck by stationary or falling objects (26)
- 8% — Bending, climbing, crawling, reaching, twisting (20)

Table 3 shows an estimated \$2.3 million in savings over the past 10 years relative only to the costs of the lost productivity, if the number of days away from work at MIT had remained the same as in CY2003.

Table 3. Cost Savings from Reduction in Lost Time from Injuries and Illnesses

Year	Number of Days Away Due to Injury or Illness	Number of FTEs	Cost of FTEs	Cost if Days Away Equal to 2003	Cost Savings	Assumed Compensation per FTE	Assumed Average Annual Salary Increase
2003	2,721	13.0	\$777,429	\$777,429	\$0	\$60,000	
2004	2,295	10.9	\$672,107	\$796,864	\$124,757	\$61,500	2.5%
2005	2,079	9.9	\$623,700	\$816,300	\$192,600	\$63,000	2.4%
2006	1,385	6.6	\$427,371	\$839,623	\$412,252	\$64,800	2.9%
2007	2,124	10.1	\$671,791	\$860,613	\$188,822	\$66,420	2.5%
2008	1,375	6.5	\$445,765	\$882,129	\$436,364	\$68,081	2.5%
2009	1,948	9.3	\$647,316	\$904,182	\$256,866	\$69,783	2.5%
2010	1,522	7.2	\$518,401	\$926,787	\$408,386	\$71,527	2.5%
2011	1,901	9.1	\$663,678	\$949,956	\$286,278	\$73,315	2.5%
2012	2,816	13.4	\$1,007,701	\$973,705	(\$33,996)	\$75,148	2.5%
2013	2,371	11.3	\$865,427	\$993,179	\$127,752	\$76,651	2.0%
2014	2,942	14.0	\$1,095,322	\$1,013,043	(\$82,279)	\$78,184	2.0%
Total	25,479	121.3	\$8,416,008	\$10,733,810	2,317,802		

Biological Research 2014

Increase in Biological Research at MIT

This year saw the retirement of Claudia Mickelson, who had been the EHS biosafety officer for the past 19 years. EHS's new biosafety officer, Marissa Cardwell, took this

opportunity to conduct a listening tour of Committee on Assessment Biohazards (CAB) members and PIs and initiated several changes designed to streamline EHS processes and reduce the burden on researchers. Initial implementation of these changes has been highly successful.

Over the past 14 years there has been continued growth in the number of faculty members engaged in biological research and participating in the Biosafety Program and the Committee on Assessment Biohazards/Embryonic Stem Cell Research Oversight (CAB/ESCRO) program at MIT. This growth is a reflection of increased funding in biological research, the fundamental applicability of ongoing MIT bio research, and the use of new technologies in life science research at MIT.

Much of the EHS oversight program is built on the relationship between EHS staff, PIs, and the PIs’ laboratory groups. EHS meets with PIs to discuss their research and the risks inherent in the work and procedures, to assist with registrations, to conduct live trainings at their laboratory group meetings, and to inspect—and just visit—the laboratories. EHS’s intent is to remain a highly visible and easily approachable resource for researchers.

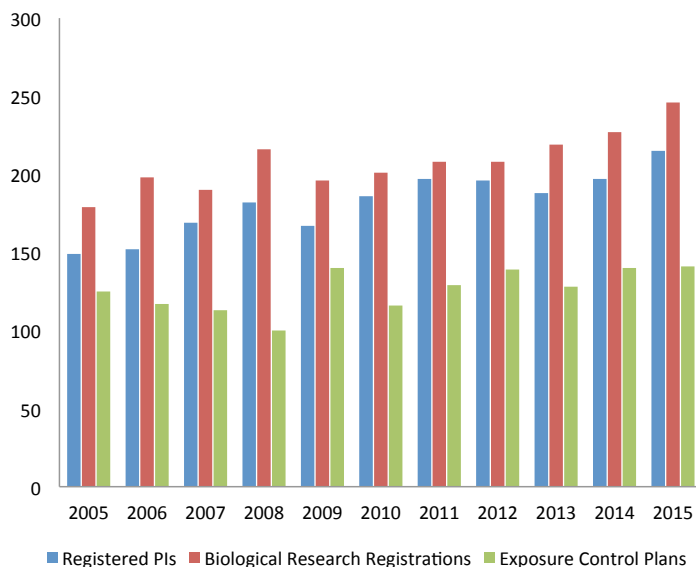


Figure 4. Volume of Biological Research Registered with the CAB/ESCRO by Year

Another indication of the shift in biological research is the shift in the containment level of the biological research at MIT. The number of biological research registrations considered to be research requiring biosafety level 1 containment measures has dropped as a percentage of the reviewed and approved registrations over the past 14 years. Approximately 65% of the biological research conducted at MIT required the higher biosafety level 2 or biosafety level 2+ containment levels; this is probably because of the large number of laboratories that use human materials and the increase in laboratories using various viral vectors, bacteria, or viruses. For the first time, more than 200 PIs have research registrations, a 9% increase that was accompanied by a 9% increase in the number of registrations.

Oversight Programs

As of April 2013, the National Institutes of Health Guidelines were amended to extend the purview of institutional biosafety committees to include responsibility for oversight of research involving synthetic nucleic acids. This is because of the fast-growing nature of the research involving synthetic nucleic acids, the high dual-use potential of this particular area of research, and the fact that this research had not been within the scope of any federally mandated committee. The Biosafety Program brought synthetic nucleic acid research into the CAB/ESCRO review and approval process eight years ago. The change in the regulations did not necessitate any changes in the EHS oversight program.

Biosafety Program and Office of Sponsored Programs Collaboration on Stem-Cell Research

The Biosafety Program and OSP collaborate effectively to ensure that copies of all CAB/ESCRO approval letters for use of human embryonic stem (hES) cells are sent to the Office of Sponsored Programs as needed. The Biosafety Program also includes the Office of Sponsored Programs on state and federal assurance letters. Beyond the need to ensure appropriate funding for hES and induced pluripotent stem cell research, access to the grants database of the Office of Sponsored Programs is helpful in understanding future areas of research growth.

Coordination of Research Compliance

Three committees—CAB/ESCRO, the Institutional Animal Care and Use Committee, and the Committee on the Use of Humans as Experimental Subjects—carry federal oversight and documentation responsibilities; they provide assurances to different agencies and must be registered with those agencies. Their compliance programs involve approvals with various levels of review depending on risk. In several instances, there is overlap in committee responsibilities.

The Biosafety Program deputy director is the only person who is a voting member of all three committees and, as a voting member, reviews all research protocols for all three committees. This amounts to review of several thousand protocols per year. It has allowed the deputy director to identify overlapping areas and work with the various committees to have one take primary responsibility for oversight, with the other committees developing mutually supporting policies.

Trends in Biological Research

The recent upward trend in the number of injuries incurred during work with biological materials has continued. The newest trend in biological research is an increase in artists who want to perform wet laboratory procedures in biology and microbiology. Such projects, while generally on the lower end of the spectrum when it comes to biohazards, do present a challenge in that most of the would-be performers are not equipped to perform such work, have little or no previous experience or training in the necessary techniques, and have developed almost all such projects with the goal of public exhibition.

To address some of these challenges, the Biosafety Program has made efforts to connect artists with trained researchers to build collaborations that offer laboratory space as well

as mentorship in developing the project and the performance of laboratory techniques. Most research groups use their laboratory space to capacity, however, and it is often difficult to find laboratories that are willing to share precious space, especially if the research goals are not clearly aligned. Some design groups (e.g., Dr. Neri Oxman, designer, Media Lab) have gone as far as to build their own biological laboratories.

Although this meets the challenge posed by research groups who need to find appropriate space to perform their work safely, it still leaves the challenge of how to ensure that these researchers have the correct level of training to use their new laboratories safely. In some circumstances, where building a special laboratory is not feasible, the Biosafety Program has offered laboratory space in Building N52 for short-term projects where biosafety level 1 containment is suitable. Biosafety Program staff offer hands-on training as needed in addition to all formal EHS training courses and laboratory-specific training. Development of programs to help train nontraditional laboratory researchers will be needed to meet this meeting of disciplines in the future.

Public exhibition of biological projects adds another layer of risk. Exhibition requires the transporting of materials, the building and maintaining of laboratory-like environments outside the laboratory, and the introduction of a new population (the public) that is less tightly controlled than trained research staff. Risk assessments for the few instances of public exhibitions to date have included case-by-case analysis of risks and of what might possibly go wrong. MIT Medical and Occupational Medicine Services and the Office of General Counsel are consulted as necessary. Future development of laboratories with glass walls or windows that allow projects to be viewed without having to be transported or to involve direct interaction with the public may be a desirable design consideration.

Research Using Radiation Producing Materials and Equipment

During the past year, the campus, Bates, and Reactor Radiation Protection Programs (RPPs) continued their strong presence in the Institute with the continued implementation of numerous service programs and interactions with faculty, postdoctoral associates, students, and staff. RPP staff performed radiation hazard risk analysis for proposed and continuing uses of licensed material and machine-produced radiation in programs for radioactive materials authorization, analytical x-ray machine registration, accelerator registration, experimental use and operations of the MIT research reactor, laser registration and safety, and radio frequency (RF) source registration and safety. The demand for RPP services remained strong, with an increased need for experimental reviews involving higher-powered laser and RF sources at the Lincoln Laboratory and Haystack/Millstone Hill Observatory, and routine and nonroutine outages at the nuclear reactor. RPP professionals met with faculty and senior research scientists on approximately 110 different occasions and continued to serve the academy in leadership positions within the EHS-MS.

RPP continues the quarterly security and alarm testing program for the four gamma irradiator facilities. RPP works in collaboration with MIT Police, the Security and Emergency Management Office, and the Facilities Operations Center to manage these secure facilities and implement new federal requirements promulgated this year. RPP also continues to provide radiation safety and emergency response training to the Cambridge Police and Fire Department.

In the ionizing radiation protection programs, RPP staff have worked closely with faculty and staff in the Koch Institute for Integrative Cancer Research and the Whitehead Institute for Biomedical Research to design and implement a new positron emission tomography facility in the Koch Institute’s animal facilities. EHS anticipates that this facility will be used extensively in the coming years. For the Kavli Institute for Astrophysics and Space Research, RPP staff built the radioactive reference sources that are integral to the spectrometer that will be launched into space as part of a landing on an asteroid. There has been an increase in the use of high-energy accelerators in several northwest campus facilities, with the addition of three new accelerators during the past year. RPP worked closely with staff from the Department of Nuclear Science and Engineering and the Plasma Science and Fusion Center in refurbishing the Building NW13 basement accelerator facility with shielding and dose assessment calculations. RPP refurbished the x-ray irradiator system in Building 6-017 for use by the academic community.

The safety culture at the MIT Nuclear Reactor Laboratory continues to be strong. Two safety culture training courses were developed and delivered to the laboratory staff and to users of the facility. The trainings covered the basics of safety culture and offered examples of good and bad safety culture at MIT and across industry.

As part of its agreement with the Department of Energy, the Bates Linear Accelerator Center continued its clean-up of those accelerator systems not required for the Bates mission in the future. The Bates RPP staff assisted in the planning and monitoring of the removal and segregation for future disposal of approximately 150 tons of surplus hardware from these areas. These efforts resulted in an estimated savings of \$200,000 for the laboratory.

Table 4. Summary of Authorizations and Reviews for All Radiation Sources Conducted in FY2015

Total	Radiation Materials		Analytical X-Rays		Accelerators		Class 3B + 4 Lasers		RF Sources	
	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
Authorizations or Approvals		117		44		9		1500	—	—
New in FY2014		4	4	4	2	2	55	45	—	—
Renewed or Amended or Processed		48	—	—	—	—		40	25	25

Note: Authorizations and approvals require a risk assessment, experimental review, completion of radiation safety training, and routine inspections by the RPP.

Major Initiatives for FY2016

1. Review and assessment of the EHS-MS.
2. Support the dramatic increase in design and construction projects.
3. Roll out the e-ShipGlobal Program.
4. The initial portion of the full phased rollout of the e-ShipGlobal software starting in the fall of 2015 will be to DLCs that represent the full cross section of the community at MIT: chemical- and biological-intensive shippers, international and US research collaborators, and mail-intensive and every-day shippers. The next phase of the project, in 2016, will be to remaining DLCs assembled in groups to facilitate ease of implementation.
5. Roll out the Chemical Inventory Program (this is currently in the pilot phase).
6. Increase support to Lincoln Laboratory and other offsite facilities.
7. Develop new and update existing EHS training courses.
8. Developing and communicating standard operating procedures; this includes streamlining existing documents and developing new laboratory safety procedures.
9. Support the increased requirements by funding agencies for EHS review and input into funding proposals.
10. Assess EHS requirements for international campus activities.
11. Systems analysis of quality, productivity, and safety in MIT laboratories.
12. Develop talent management roadmaps to support the EHS staff's professional development.
13. Develop new initiatives to enhance and add to MIT's culture of safety.
14. Develop capability to develop new ideas and refresh current EHS programs.
15. Continue and expand engagement with groups who have similar responsibilities within the DLCs, including machine shop supervisors, laboratory managers, facility managers, DLC EHS representatives, and student groups.

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