

Environment, Health, and Safety Office

During the past year, there has been a national focus on environment, health, and safety issues at academic institutions. This is the result of several tragedies that occurred at universities in the previous two years: the death of a laboratory researcher at the University of California, Los Angeles, with subsequent criminal charges filed against the university and the principal investigator; the death of an undergraduate student in a departmental machine shop at Yale University; and a laboratory explosion and injury to a graduate student at Texas Tech University. The United States Chemical Safety Board released a report and video this year identifying some of the root causes behind these tragedies and asking universities to review and strengthen their environment, health, and safety programs. In view of these events, the Environment, Health, and Safety Office (EHS) has continued its efforts to review and strengthen the Institute's EHS management system.

Faculty/Principal Investigator Responsibilities

In FY2011, EHS began an initiative to conduct a new faculty/principal investigator EHS orientation. The orientation was expanded to include an overall presentation and discussion for all faculty members in an effort to help them understand their environment, health, and safety responsibilities and become aware of the resources available to assist them. EHS plans to continue this outreach in FY2013.

Working Alone Policy

One of the contributing factors to the death of the Yale University student was that the student was working alone while performing a hazardous operation. With the help of MIT environment, health, and safety committees and input from across the Institute, a comprehensive policy was developed and adopted by the Institute's EHS Council and endorsed by the Academic Council. The objective is to provide clarity and consistency around this issue without hindering research, and to drive faculty, students, and staff to assess the potential hazards of any given operation and determine whether it should be allowed to be performed alone.

Machine Shop Program

The Yale University incident also spurred EHS to do a complete review of its machine shop program. EHS assessed over 70 machine shops at the Institute, convened the Machine Shop Safety Forum of machine shop supervisors and representatives to share and review practices and working-alone policies, and successfully completed a shop safety video contest to engage the community about shop safety. EHS completed a documented inventory of machine tools and their safety features and identified where improvements were needed. A pilot program was conducted to upgrade two machine shops' equipment, to identify the feasibility of upgrades, and to develop an Institute-wide budget assessment.

Comprehensive Laboratory Hazard Assessment

There are currently several programs that assess a specific hazard in a laboratory and/or document conditions in the laboratory. However, there is not a comprehensive assessment of each laboratory based on the complete information available or a review of specific activities performed in the laboratory. EHS piloted a process to collect and collate both existing and new information about laboratory hazards, use that information to assess overall risks, and better allocate resources to those areas that present a greater risk for the Institute. The program will continue to be refined and expanded.

Accident and Injury Reporting System for Students

In collaboration with MIT Medical, EHS expanded the current accident and injury reporting system (required by the Occupational Safety and Health Administration to document and track employee injuries) to include student injuries. This expansion will allow for more thorough follow-up on incidents involving students and for identifying trends and opportunities to intervene in activities in order to eliminate or minimize the risk of accidents and injuries.

Regulatory Challenges

In 2009, the Institute received enforcement from the Federal Aviation Administration for violations of hazardous materials shipping regulations. This resulted in an initiative to develop and implement a more formal hazardous materials shipping program in collaboration with Sourcing and Procurement, Facilities, Risk Management, and the Office of Sponsored Programs (OSP).

EHS also received several notices of non-compliance relating to environmental regulations. In collaboration with Facilities and MIT's research laboratories, EHS is attempting to identify and eliminate the sources of minute amounts of mercury in our wastewater discharge. In collaboration with Facilities, we are upgrading our air monitoring system for the Central Utility Plant (CUP) to assure compliance with all permits.

Accomplishments

During the past year, the EHS Office continued its strong collaboration and service through its interactions with faculty, postdocs, graduate and undergraduate students, and staff. It collaborated closely with other administrative offices, particularly the Department of Facilities and the Division of Student Life, to support their efforts to meet the Institute's mission.

Using the balanced scorecard approach, EHS revisited several initiatives undertaken in the previous two fiscal years and began some new initiatives intended to increase efficiencies, enhance delivery of services, and strengthen partnerships with other administrative units. These initiatives are:

Biowaste project: EHS conducted a successful pilot program in the Department of Biology to determine the feasibility of implementing a new management system for the collections/disposal of biosharps/biowaste. The new waste management system saved waste disposal costs while freeing up valuable research time from the task of autoclaving biological waste. In addition, the pilot program saved considerable energy by eliminating the need for approximately 2,500 autoclave cycles. The program has been well received and EHS expects to expand the service globally to the campus during the next year.

Energy conservation: EHS continues to collaborate with Facilities Operations and with Campus Planning and Design, Engineering, and Construction to identify energy saving opportunities. The focus this year has been on laboratory ventilation and identifying ways to reduce the ventilation without compromising safety.

International agreements: EHS's major efforts this year were to support the Singapore-MIT Alliance for Research and Technology (SMART) and the Skolkovo Institute of Science and Technology and MIT Initiative (SKTech) agreements. Support for SMART has focused on the design of and move into the new facility in Singapore, in the last quarter of FY2012, and to assist in customizing and implementing the EHS Management System for adoption by SMART. Support for SKTech has included advising on the design of the new campus, and developing strategies for identifying the components of the EHS Management System and building an environment, health, and safety program for SKTech. In addition, EHS has developed a generic plan for assuring that environment, health, and safety issues are identified and addressed in future international agreements.

Hazardous waste: Hazardous waste volumes stayed relatively constant this year. The cost of waste as expressed in dollars per pound of waste disposed was reduced from \$1.72 in FY2004 to \$1.25 in FY2012. No increased costs associated with laboratory closures and moves were seen in FY2012.

Training: Development and delivery of environment, health, and safety training remains a major effort as a regulatory requirement and as a risk reduction leading indicator.

Core courses training completion metrics: Some departments, laboratories, and centers (DLCs) have a lab-specific training that is DLC-wide. EHS added this training as a metric in FY2011 and, as expected, these have better completion rates compared with the classroom version, which is more difficult to administer. All other metrics remained steady compared to last year.

Table 1. Training Completion Rates for Common EHS Courses, by Fiscal Year

Course	Completion Rate FY2010 (Total trainees)	Completion Rate FY2011 (Total trainees)	Completion Rate FY2012 (Total trainees)
General Chemical Hygiene and Hazard Communication	98% (4,760)	97% (4,541)	98% (4,994)
Lab-specific Chemical Hygiene and Hazard Communication	87% (3,847)	85% (2,843)	88% (3,794)
DLC Lab-specific Training	N/A	93% (980)	94% (1,393)
Bloodborne Pathogens	92% (1,329)	91% (1,401)	92% (1,461)
General Biosafety	96% (2,357)	97% (2,358)	97% (2,626)
Radiation Safety	94% (783)	94% (706)	96% (706)
Laser Safety	95% (1,181)	93% (934)	94% (1,091)
Managing Hazardous Waste	90% (4,878)	90% (4,221)	91% (5,621)

Note: All those needing specific training prior to working with hazardous materials and equipment have completed training. The data does not reflect those who left MIT and have not been archived, nor those who signed up to take a course out of interest or future needs but have not yet taken it.

Overall EHS Training Metrics

Table 2. Number of Participants (Seats) Trained, by Fiscal Year

	FY2010	FY2011	FY2012
Total EHS web courses completed (includes Lincoln Laboratory)	7,506	8,211	8,532
Total EHS classroom participants (includes Lincoln Laboratory)	16,533	16,986	18,264
Total EHS web and classroom participants (includes Lincoln Laboratory)	24,039	25,197	26,796

Some trends in environment, health, and safety training during FY2012 were:

- The number of web and classroom participants increased 6.3%, after a 4.8% increase in FY2011
- The number of EHS classroom participants increased 7.5%, compared with a 2.7% increase in FY2011
- EHS classroom attendance for FY2012 averaged 24 students
- The number of web-based participants increased 3.9%, after a 9.8% increase last year;
- The percentage of web delivery of EHS sessions stayed relatively constant, at 32%
- The cost per student for web-based training was \$13.70, compared with \$15.49 per student in FY2010

Injury and Illness Report

The EHS Office continues to work with 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 Facilities management, EHS Office staff, and DLC environment, health, and safety coordinators.

The incidence rate of total recordable injury and illness cases for calendar year 2011 was 1.7%. This rate showed a slight decrease (0.2%) from the previous year but is well below the CY2010 (latest available data) national incidence rate for private industry (3.8%) and the Massachusetts rate (3.6%), and is less than the national incidence rate for colleges and universities (2.2%). In collaboration with DLCs, EHS has developed and implemented programs such as training, inspections, and accident investigations, which contribute to keeping injury rates low.

The following is a breakdown of the five types of most commonly recorded incidents at MIT in calendar year 2011:

- 22% - Overexertion in carrying, lifting or pulling objects
- 16% - Injury due to improper handling of object (including foreign objects in the eye)
- 16% - Falls
- 17% - Struck by stationary or falling objects
- 4% - Repetitive motion injuries

Trends for the last six calendar years in numbers of days of restriction/job transfer, number of days away, and total number of injuries at MIT has generally been downward. MIT saved an estimated \$300,000 in 2011, relative to costs of lost productivity if the number of days away had remained the same as the base year 2003, and an estimated \$2.4 million over the past seven years.

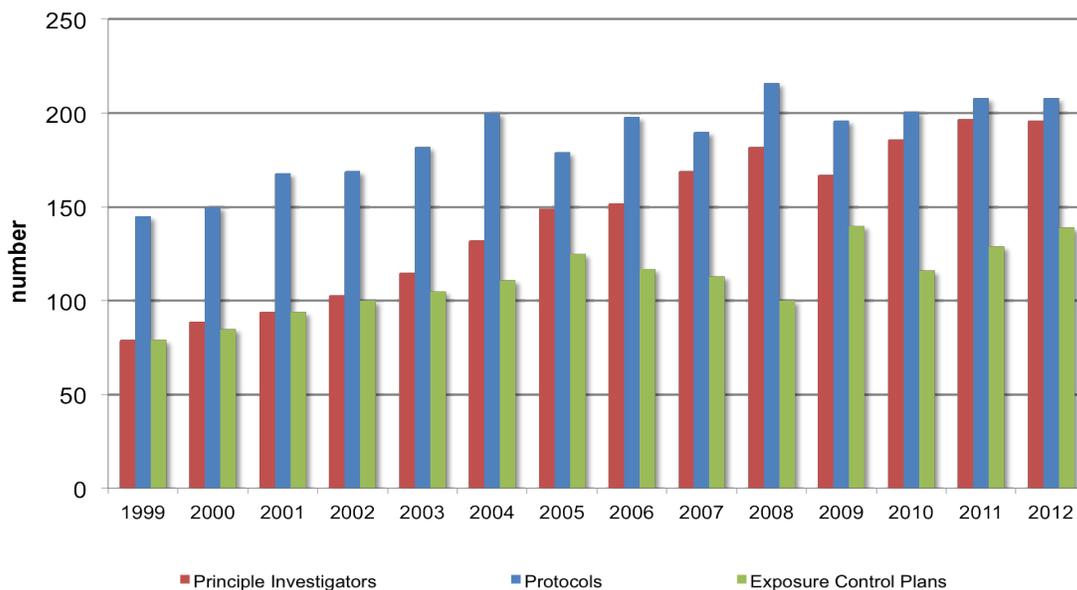
MIT's rate of cases with days away from work edged slightly down from last year's rate and is near the national rate of 0.6% for colleges and universities. If MIT were at that national rate, estimated annual savings would be approximately \$193,000.

Biological Research

Increase in Biological Research at MIT

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

Much of the oversight program is built upon the relationship between EHS staff and the principal investigators and their lab groups. EHS meets with the investigators to discuss their research and the risks inherent in the work and procedures, to assist with registrations, to conduct live trainings at their lab group meetings, and to inspect and visit the laboratories. The intent is for EHS to remain a highly visible and easily approachable resource for researchers.



Biological Research Registrations and Principal Investigators in Science, Engineering, and Vice President for Research: FY1999–FY2012

The new research center for synthetic biology is now well established. Its core members—four new faculty members—are on campus but not yet housed in their final location. In addition, a new faculty member has been hired to establish an induced pluripotent stem cell (iPS) generation core facility at MIT. Once this core facility is up and running, it is expected that additional investigators will enter this area of research.

The oversight program remains well ahead of new regulations, and consequently new regulations have had minimal effect on investigators in the areas of animal biosafety, human embryonic stem cells (hES) and iPS cells, and synthetic biology. EHS is planning on formalizing the program for risk identification and management of “dual use research” so as to be well positioned when final government requirements are published. In addition, EHS is in a position to influence the content of the final regulations.

Office of Sponsored Programs Collaboration on hES and iPS Cell-based Research

The Biosafety Program has effective collaboration with OSP to ensure that copies of all CAB/ESCRO approval letters for use of hES cells are sent to OSP as needed. BSP also includes OSP on state and federal assurance letters. EHS is looking at ways to give OSP viewing access to the central Biological Research Registration database so that it can cross-check CAB/ESCRO approval dates for all biological research registrations. Beyond the need to ensure appropriate funding for hES and iPS cell research, access to the OSP grants database is helpful in understanding future areas of research growth.

Coordination of Research Oversight

CAB/ESCRO, the Institutional Animal Care and Use Committee, and the Committee on the Use of Humans as Experimental Subjects carry federal-level oversight documentation responsibilities, provide assurances to various 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 reviewing several thousand protocols per year and has allowed the deputy director to identify overlap areas and work with the various committees so that one committee takes primary responsibility for oversight, with the other committees developing mutually supporting policies.

Research Using Radiation-producing Materials and Equipment

During the past year, the campus, Bates, and Reactor Radiation Protection Programs continued their strong collaboration by continued implementation of service programs and constant interactions with faculty, postdocs, students, and staff. These interactions are typically initiated by the requirement to perform radiation hazard risk analysis for proposed and continuing uses of licensed material and machine-produced radiation. The demand for Radiation Protection Program (RPP) services remained strong, with a

continued increase for experimental reviews involving higher-powered laser and radio-frequency sources at Lincoln Laboratory and Millstone Hill and the routine and non-routine outages at the nuclear reactor.

Radioactive Material Authorization and Machine Registration Program

The radioactive materials authorization, analytical x-ray machine registration, and laser registration programs remain strong links between the MIT Radiation Protection Committee (RPC), the Radiation Protection Program and the licensed material-user community. The MIT broad scope license remains in effect, with an expiration date of September 2012. The special nuclear material license issued by the US Nuclear Regulatory Commission remains in effect, with an expiration date of 2015. All uses of radioactive material and radiation-producing equipment are reviewed and approved by RPC on a continual basis. There are currently 120 authorizations, of which 54 were renewed or amended during the past year. There were three new applications for radioactive material use. RPP staff conducted biannual audits of research projects during the authorization renewal process and performed a security audit of all licensed material storage locations. RPP professionals also performed the annual program audits for the Whitehead Institute for Biomedical Research and Draper Laboratory.

Analytical X-ray Program

RPP staff performed annual inspections on all 31 analytical x-ray systems currently in use. There were two new units registered during the past year. RPP provides radiation safety training for users and area radiation monitors for these x-ray installations. In addition, RPP audits the medical and dental x-ray installations at MIT Medical and provides dosimeters/training to the x-ray technicians.

Accelerator Safety Program

RPP implemented the updated/revised Accelerator Safety Program. There are currently six accelerators on campus. RPP provides radiation safety training for users and area radiation monitors for these accelerator installations.

Laser Safety Registration Program

RPP continues to take advantage of the information dissemination during, and the results obtained from, the EHS Management System Level II inspection program to continually improve implementation of the regulatory requirements for the safe use of Class 3b and Class 4 lasers. There are approximately 1,300 lasers in the current inventory located on the Cambridge, Lincoln Laboratory, and Bates Accelerator campuses. There were 53 new lasers added to the campus inventory this past year. Registration includes a safety/risk analysis of the laser system by RPP professionals, development of standard operating procedures by the laser users, and training of all laser workers. RPP has developed an online laser safety training program and expects to implement this form of training in 2012. RPP is working with the Sourcing and Procurement and the Property offices to develop an improved system for removing lasers from the inventory when disposed.

At Lincoln Laboratory, RPP staff continues to spend considerable time performing laser hazard analysis and review for projects requesting the use of higher-powered lasers. RPP continues to receive requests for the use of lasers outdoors, propagated from Lincoln Lab buildings to the “hut” on the Lincoln Laboratory flight facility or to other appropriate outdoor locations. Since these lasers traverse normally populated areas both on Lincoln Lab property and Hanscom Air Force Base property, specific standard operating procedures and training are essential for their safe use.

Radio Frequency Sources

There continues to be an increased demand for risk analysis and safety plan reviews for radio frequency sources at Lincoln Laboratory, Millstone Hill, and Haystack Observatory. The Haystack Ultra-wideband Satellite Imaging Radar reconstruction project at Haystack Observatory has continued to require increased measurements/surveys and training by RPP. There continues to be an increase in review of potential radio-frequency hazard projects, including measurements in and around aircraft during the past year.

Waste Management Program

Radioactive waste: RPP continued to collect and process low-level radioactive waste collected from the radiation laboratories. The total waste disposed was 392 cubic feet. This was an increase of 37% from FY2011.

Biosharps waste: RPP continues to implement the regulated medical waste management program and to improve the collection and processing of biosharps containers and biowaste from MIT laboratories. A total of 6,200 biosharps containers and 2,900 bio-boxes were collected and disposed during the year.

Sustainability Program Overview

The Sustainability Program collaboratively develops, strengthens, and realizes MIT’s institutional commitments to integrate principles of sustainability and environmental stewardship into all aspects of MIT’s facilities, activities, and operations.

FY2012 saw the continued progress of the Sustainability Program and sustainability improvements across campus—with a deepening of existing stewardship initiatives, the start of new initiatives focused on energy, and an expansion of partnerships with faculty, students, and staff alike.

FY2012 Sustainability Program Highlights

Enhancing Campus Operations

Recognition: MIT’s campus energy work—focused on energy efficiency and community engagement—was recognized by the following awards:

- First Place in the 2012 MassCommute Bicycle Challenge
- Pinnacle Award for Excellence in Commuter Operations, from the Massachusetts Department of Transportation.

Energy efficiency: From FY2007 through FY2012, MIT has successfully accumulated over 191,000 MMBTU (million BTUs) of annual energy savings from thermal and electrical projects, resulting in over \$4.5M cumulative annual savings. In FY2012, MIT successfully reduced over 5.6M kWh in electricity use. Of the total 160,000 MMBTU saved since FY2007, 30,839 MMBTU were saved in FY2012.

In January 2012, the Institute completed the second year of its three-year collaboration with NSTAR and the Efficiency Forward program. MIT exceeded the first-year energy savings goal of Efficiency Forward by 30%. In the second year of the program, concluding December 31, 2011, the Institute surpassed its cumulative two-year goal of reducing electricity use by 22,000,000 kWh annually. EHS supports this work through collaboration with Facilities on program implementation, outreach, and community engagement.

Sustainable design: In FY2012, the new MIT Sloan School of Management and the David H. Koch Institute for Integrative Cancer Research buildings were awarded a “Gold” rating from the US Green Building Council’s Leadership in Energy and Environmental Design program for their high degree of sustainable design.

The EHS Office’s industrial hygiene program worked closely on the laboratory ventilation design to challenge conventional rules of thumb and maximize energy efficiency while enhancing occupant safety and comfort. This past year, major renovation and restoration projects of Fariborz Maseeh Hall and the historic Arthur D. Little building (E60) were completed and integrated a high degree of sustainable design, including energy efficient mechanical systems, operable windows, efficient lighting, and sustainable finish materials, among other design features.

Improving transportation options: Aggressive transportation demand management programs include subsidized Massachusetts Bay Transportation Authority passes; rideshare, vanpool, and local car-sharing services; and significant investments in bicycle infrastructure. A key metric for measuring transportation program success remained strong in FY2012: MIT’s proportion of single-occupant vehicle trips, or “SOV rate,” is 19%—a rate significantly below the state and national average. The EHS Sustainability Program supports MIT’s alternative transportation programs through promoting best practices and commuter choices via its Green Ambassador Program and other outreach efforts. The EHS Office also jointly administers the Institute-wide biennial transportation survey.

Facilitating the adoption of electric vehicles was a priority of transportation initiatives in FY2012. In addition to piloting one of ZipCar’s first plug-in electric hybrid vehicles, MIT also introduced its first all-electric cargo van for mail services. In FY2012, the Institute also partnered with the City of Cambridge to install two advanced electric vehicle charging stations on campus. MIT also introduced into service a novel, aftermarket gas-electric hybrid system installed on a Facilities van.

Waste and recycling: The EHS Sustainability Program continued to support progress in waste minimization, recycling, composting, and pollution prevention activities. In CY2012, MIT's recycling rate was 46%.

Supporting Student Educational and Engagement Opportunities

Using the campus as a living laboratory: The EHS Sustainability Program is helping advance MIT's goal of opening campus operations as a living laboratory—via support for Undergraduate Research Opportunity Program projects, special classes, internships, theses, and research projects—to foster students' emerging technical and leadership skills to help define and solve the Institute's energy challenges.

In spring 2012, EHS worked collaboratively with the Campus Energy Task Force, the Energy Education Task Force, and the Department of Urban Studies and Planning to develop and support an Energy Minor subject, 11.S195 Re-energizing MIT. The class is an opportunity for students to make a direct contribution to the Institute's efforts to "walk the talk" on improved energy management. Student teams explored the amount and cost of energy consumed by mini-refrigerators in the undergraduate dormitories, plug load in E62, and an assessment of the potential viability of the conversion of some or all of the MIT vehicle fleet to hybrid-electric or all-electric vehicles.

In FY2012, the EHS Sustainability Program continued to manage, administer, and grow the MIT Energy Initiative Student Campus Energy Project Grant Fund, which awards grants to support innovative student projects on campus that advance campus energy and environmental stewardship goals.

The EHS headquarters office and the Department of Facilities continued to support curricular, project-based learning activities by developing and advising campus energy-related projects. These projects included the Freshman Pre-Orientation Program, which featured a campus energy module; working with researchers in the SENSEable City Lab to test license plate recognition and a Smart Parq smart phone application; supporting campus Mobility Pass research; and assessing campus storm water discharge sources and composition with the Department of Civil and Environmental Engineering.

Building Community Awareness and Engagement

The Green Ambassadors Program: This program was established to create and empower a network of individuals interested in taking action in their own laboratory, office, or dormitory to promote more sustainable practices at MIT; it grew by over 30%, to over 400 staff, faculty, and student volunteers to model and promote the Institute's energy and environmental stewardship objectives.

This year, a new building-level occupant engagement program was started to test a new approach to foster sustainable practices by individuals within buildings. Piloted in the Koch Institute, the program is centered on the development of building-level Green Teams.

Building awareness on and off campus: A key component of the campus sustainability program is building awareness in the community of campus activities to both inform and expand support and input for those activities. In FY2012, several activities reached out to different constituencies on campus and in the community. Some examples include:

- In April, the Institute piloted its first Earth Day Challenge program to engage the entire MIT community in new ways to promote more sustainable practices on campus and in the community. Nearly 100 participants engaged in 32 green action projects, ranging from helping to weatherize a Cambridge home to promoting energy efficiency opportunities on campus.
- EHS members participated in many on-campus outreach activities to share information on activities, including new student orientation, the Transportation Fair, the Earth Day Challenge, the MIT Energy Club Energy Night, and others.
- Recently, EHS and Facilities organized a workshop on Efficiency Forward for the Greater Boston Chamber of Commerce that was attended by 100 people, including Massachusetts undersecretary of energy Barbara Kates-Garnick and Greater Boston Chamber of Commerce president Paul Guzzi.
- As a member of mayor Thomas Menino's Boston Green Ribbon Commission, MIT continues to share its experience and to support implementation efforts of the Boston Climate Action Plan. EHS supports MIT's participation in this program.
- On the invitation of the City of Cambridge, MIT hosted the only New England installation of the Das Haus pavilion, a building showcase of renewable energy and efficiency construction technologies.
- In January 2012, the EHS Sustainability Program developed and submitted the Institute's second annual Global University Leaders Forum Sustainable Campus Charter progress report to share MIT's activities with the global community.

William VanSchalkwyk, Managing Director, Environmental Health and Safety Programs

Lou DiBerardinis, Director Environment, Health, and Safety Office

Pam Greenley, Associate Director, Environmental Management Program

Claudia Mickelson, Deputy Director and Special Advisor to the Vice President for Research

Mitch Galanek, Associate Director, Radiation Protection Program

Peter Bochnak, Deputy Director, Safety Program

Gerry Fallon, Deputy Director, Bates Radiation Protection Program

William McCarthy, Deputy Director, Reactor Radiation Protection Program

Steven Lanou, Deputy Director, Environmental Sustainability