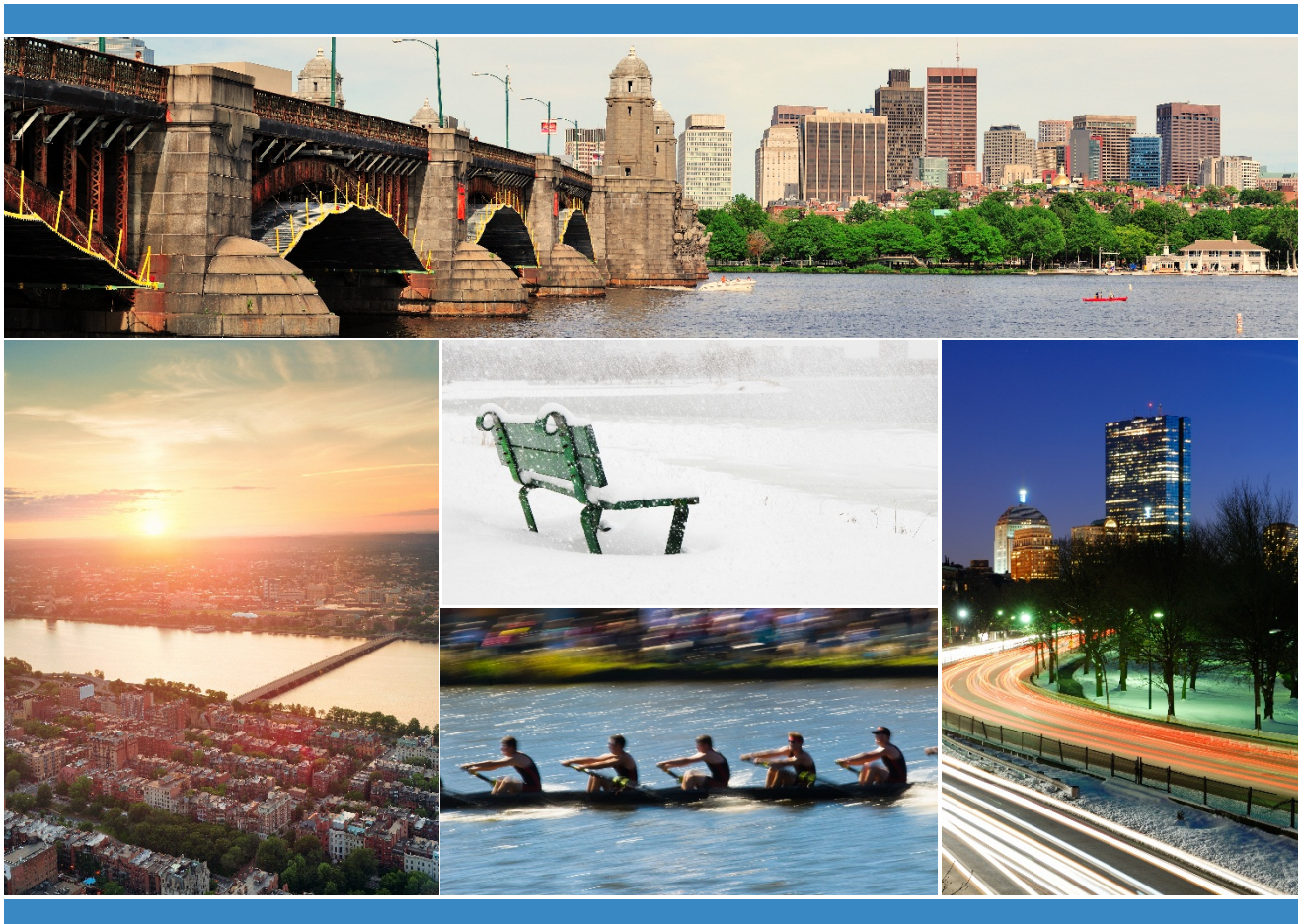


Climate Preparedness in Boston-Area Higher Education Institutions

Prepared by Meister Consultants Group
for the Boston Green Ribbon Commission

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Background

This report summarizes research on the climate change preparedness activities of three Boston-area universities: Harvard University, the Massachusetts Institute of Technology (MIT), and Boston University (BU).

Meister Consultants Group (MCG) conducted interviews with representatives from each institution, including staff focused on emergency preparedness and response; environmental health & safety (EHS); sustainability; and/or facilities, energy, and operations. Interviews and document review focused on addressing the following questions:

- a) What emergency preparedness policies, planning, and other relevant initiatives are in place?
- b) To what degree have climate change risks been integrated into emergency preparedness?
- c) What other disaster and resilience-related planning initiatives are underway?
- d) Are there potential opportunities for cross-institutional collaboration on preparedness?

This research was commissioned by the Higher Education Working Group (HEWG) of the Green Ribbon Commission and is intended to provide a foundation for creating a Climate Adaptation Consortium. Harvard, MIT and BU were selected as the focus of this research because they are core members of the HEWG and they face similar complexities with regards to size, age of buildings and infrastructure, and location along the Charles River.

Integration of Climate Change

Harvard, MIT, and BU all have extensive emergency preparedness and management plans in place which address a range of man-made, technological, and natural disaster risks. Emergency preparedness personnel at each university showed substantial awareness of the types of impacts climate change would bring to the Boston area and how those could affect existing vulnerabilities across their campuses. The importance of preparing for those impacts was also clearly recognized.

Explicit mention of climate change, however, was infrequent among disaster preparedness documents and initiatives. Staff viewed climate change as a factor that would likely exacerbate environmental and weather risks already being addressed through existing disaster preparedness plans and initiatives. Climate change was thus viewed as implicitly integrated into existing preparedness planning.

In a few cases climate change was the explicit focus of a particular planning initiative. For example, the Climate Preparedness Summit held in September 2013 was of a series of thematically-based inter-institutional preparedness exercises, in this case centered around a super storm similar to Hurricane Sandy. Harvard also has formed a Climate Preparedness Working Group which is in the process of preparing recommendations of climate change considerations to be integrated into the university's strategic planning process. In addition, the universities are each increasingly focusing on impacts known to be tied to climate change, such as flooding and extreme heat. In particular, BU mentioned coastal flooding as a future focus area, and MIT is looking at relocating energy infrastructure above projected flood levels.

Existing Collaboration

The existing close collaboration and communication between the three universities was a strong theme emphasized by all interviewees. Preparedness and emergency management staff collaborate largely through informal contact, as well as through formal channels such as events and membership in local, regional, and international associations and working groups.

Informal channels

Emergency preparedness staff at each university emphasized the frequent contact, multiple lines of communication, and good working relationships between counterparts at each area institution. Collaboration on emergency management has been largely facilitated by such relationships between staff and has led to a number of handshake agreements, including mutual aid arrangements in the event one institution is disproportionately affected by a major disruption. The open lines of communication also become more active prior to and during storms and other disruptive events. Interviewees emphasized the value of these connections and the high degree of knowledge sharing and learning that they facilitate. The relationships also provide strong foundations for building more formal collaborations when such opportunities emerge.

Associations and working groups

Preparedness staff participate in a number of inter-institutional working groups, collaborations with public sector agencies, and international associations.

- **Boston Consortium for Higher Education.** Emergency preparedness personnel from Consortium members have been meeting regularly since the early 2000s through a sub-committee managed by June Kevorkian of the Boston Consortium. Members coordinate to host exercises, share best practices, and exchange lessons learned from trainings and other exercises. Harvard, BU, and MIT all participate in this working group.
- **International Association of Emergency Managers Universities and Colleges Caucus (IAEM-UCC).** This network serves as a community of practice for emergency managers from colleges and universities around the U.S.
- **FEMA Region 1 Higher Education Center of Excellence.** The Center works to build relationships among higher education institutions, develop partnerships with public and private sector, and promote best practices from within the region.

Joint training exercises

Preparedness exercises, such as the September 2013 Climate Preparedness Summit, provide other opportunities for staff to share resources, exchange knowledge, and collaboratively address challenges.

Collaboration with public sector agencies

In addition to coordinating with each other, all three institutions also coordinate with utilities, city officials and emergency response personnel in Cambridge and Boston, and other area institutions to understand how climate and disaster resilience implications are being addressed for the local and regional systems on which each university depends. They have also had conversations with officials in New York City to understand specific responses to Hurricane Sandy and identify preparatory steps they can take.

Opportunities for Cross-Institutional Collaboration

Overall, interviewees expressed a high degree of satisfaction with existing levels and types of collaboration with higher education institutions on emergency preparedness. However, a number of potential opportunities emerged which could form the foundation for further collaboration around climate resilience and disaster preparedness.

Opportunities identified

Interviewees expressed a need for better data and visual information on the potential impacts climate change could bring. Maps showing flooding risks under different scenarios were deemed particularly useful. There have been some initial discussions regarding a potential joint approach to conducting climate vulnerability assessments. Harvard, MIT, and BU each face similar climate threats: riverside location, numerous facilities, aging infrastructure, and the need to protect high-value assets which may be located in flood zones. Collaboration could help realize economies of scale that lower total costs for each institution. At the very least, stakeholders expressed a desire for a unified set of assumptions, metrics, and methodologies to ensure that findings are comparable even if they are developed through parallel initiatives. This will better enable future discussion and collaboration.

Bulk purchasing of emergency supplies was also mentioned as an area where institutions could potentially collaborate to reduce costs. For example, Harvard's Longwood Campus is evaluating the possibility to share purchasing of emergency cots and blankets.

Challenges identified

Collaboration can require significant effort to coordinate, particularly among large universities which are themselves complex networks of schools, offices, and departments. For example, Harvard is a large institution with many linked but largely independent schools and even internal collaborations require significant coordination effort. Moving forward with any future collaborative efforts on climate resilience and disaster preparedness would require additional research to determine if the transaction costs associated with coordination are offset by the financial savings associated with bulk purchasing or joint implementation.

Conclusions

In general, climate change is informally and implicitly integrated into the many disaster preparedness efforts underway at Harvard, BU, and MIT. Likewise, collaboration happens mostly through informal collaborations and communication channels. Based on the input from interviewees, MCG recommends that more formal coordination on emergency preparedness for climate-specific impacts should be assessed on the basis of several criteria:

1. Will collaboration improve the desired outcome?
2. Is there a quantifiable financial or non-financial benefit from collaborating?
3. Can the administrative and transaction costs of coordination be measured quantitatively? If so, are they outweighed by the benefits of collaboration?
4. Could the benefit of formal collaboration be obtained to the same degree through informal mechanisms?
5. Are existing third party programs in place which could provide the same or similar coordination benefits while avoiding transaction costs of direct collaboration?

While existing coordination between institutions was viewed as strong, a number of interviewees expressed a desire for strengthened coordination between their offices and local public sector agencies.

Because emergency response is by definition a local-level activity, stakeholders interviewed as part of this process expressed interest in working more closely with City emergency response and climate preparedness departments along. Interviewees suggested that an emergency management function that was integrated across multiple disciplines would allow for more efficient and comprehensive coordination between the higher education sector and local city agencies.

In addition, interviewees stressed their dependence on external systems and the need to coordinate with agencies responsible for management of those systems. At the foremost of this is the Charles River, which could cause significant damage to all three universities if it experienced severe flooding. In this case, a watershed-level approach to planning and coordination could be far more cost-effective than a series of site-specific mitigation measures.

Conversations with utilities and city, state, and federal agencies on these issues are now beginning. More formalized partnerships may be of benefit in expediting the development of collaborations between the higher education and public sectors.

Appendix A - Profiles

This appendix includes profiles of Boston University, Harvard University and the Massachusetts Institute of Technology. Each profile first describes the existing emergency preparedness planning systems and plans that the institution has in place. Next, each profile presents the emergency preparedness activities that are in progress. Finally the profiles conclude with planning considerations and insights shared by emergency preparedness staff from each university.

Boston University



Existing plans

- Emergency Response Plan
- Continuity of Operations Plans
- Emergency Response Planning Management Plan
- Comprehensive Emergency Management Plans

Initiatives underway

- Hazard vulnerability assessments

Existing Emergency Preparedness Systems

Emergency Response Plan

Boston University (BU) has established standard operating procedures for mobilizing resources and communicating with the BU community in the event of a large-scale emergency. The Emergency Response Plan identifies roles and responsibilities of key offices and departments, discusses the three levels/phases of emergency situations as well as evacuation and shelter-in-place procedures when evacuation is not appropriate. The Plan was developed by the Office of Environmental Health and Safety in cooperation with over a dozen departments, colleges, and offices, as well as public safety agencies.

Continuity of Operations Plan (COOP)

BU's university-wide continuity of operations planning program serves to mitigate the impact of disasters on essential functions. Departments are responsible for preparing a COOP under the direction and support of the EHS Office's Emergency Response planning staff. COOPs use an all-hazards approach to ensure that they plan is relevant to man-made, technological, and natural disasters.

Emergency Response Planning Management Plan

In addition to the Emergency Response Plan (see above), BU has a detailed process for managing and improving its ongoing emergency management planning efforts. This program encompasses a range of governance structures designed to prepare for, prevent, respond to, and recover from large-scale emergencies, disasters, or other threats. It also includes a set of policies, procedures, plans, and outreach strategies and a multi-year strategic planning process to continue to refine the University's emergency preparedness and response.

Comprehensive Emergency Management Plans (CEMP)

BU's CEMP covers all buildings but most information on the CEMP is not made public, except for an example CEMP that is specific to the National Emerging Infectious Diseases Laboratory (The NEIDL).

Emergency Preparedness Activities Underway

Hazard vulnerability assessment

BU has an ongoing hazard vulnerability assessment process for periodically examining emergency scenarios for high-risk hazards for which the University does not yet have mitigations in place. The exercises involves bringing in experts to provide an overview of the implications under a given scenario, focusing on impacts at specific locations. For example, an upcoming exercise will consider an earthquake scenario based on the 1755 earthquake¹ and consider the implications at three priority locations on BU's campuses. Emergency management personnel hope to use this process to investigate flooding impacts, integrating new FEMA flood maps as soon as they are available.

BU uses this process to identify areas which need to be strengthened and work toward an enterprise risk management approach. Climate change is not necessarily discussed explicitly except in the context of certain topics such as extreme heat; however, the process is considered to be dealing with the implications of climate change from a natural disaster perspective because it addresses a number of impacts which will be worsened by climate change.

Response to hazards identified

The hazard vulnerability assessment process helps lead to an enterprise risk management approach that assesses the likelihood and potential impact of various events. This information can help inform design and siting of new facilities in capital improvement plans (building an underground data center was mentioned as a hypothetical example), although BU personnel report that few high-cost mitigations have emerged from the University's vulnerability assessments. Most mitigations have involved low cost improvements and activities, such as planning, drills and exercises to train staff, minor facility upgrades, and investment in developing good contractual relationships with vendors to ensure uninterrupted services even during emergency events.

Future Areas of Focus

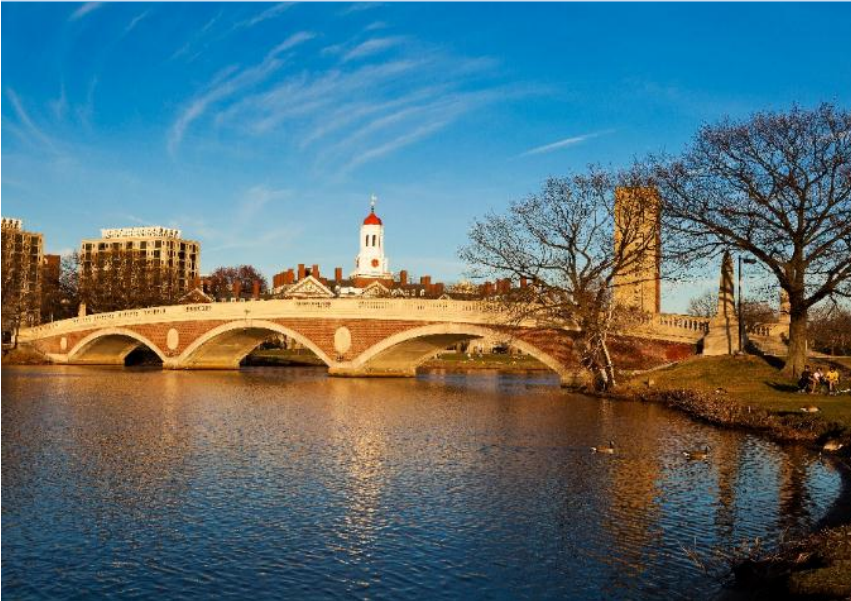
A number of climate-related impacts were mentioned as priority areas for future emergency preparedness efforts. Among these, water-related impacts (including run-off, coastal flooding, and wind-driven rain) are considered a high priority. BU staff also mentioned emerging infectious diseases, extreme heat, and the secondary enterprise disruption impacts that can arise from emergency situations.

Planning Considerations

- **Disaster risk mitigations need not be capital-intensive.** BU personnel emphasized the value of low-cost mitigations in improving resilience to major disruptions. While infrastructure is needed in some cases, the most critical mitigation is ensuring staff know who to call to get things fixed, and providing adequate training and practical experience in dealing with disasters.
- **Vendor relationships are critical.** Building strong relationships with vendors is a critical strategy for making sure that the providing products or services to the university is a priority for contractors during extreme events with wide geographical impacts.

¹ The largest earthquake in Massachusetts' history, registering between 6.0 and 6.3 on the Richter scale.

Harvard University



Existing systems

- Severe Weather Action Plan
- All Hazards Plan
- Emergency Shelter Management Plan

Initiatives underway

- Climate Preparedness Working Group
- Climate Preparedness Summit
- Expanding co-generation facilities
- Business continuity planning

Existing Emergency Preparedness Systems

Energy management

Operations and maintenance across the Harvard University system is somewhat decentralized, with the notable exception of energy management. Harvard manages a network of internal mini-grids, purchasing power in bulk at various interconnection points with the NStar grid. Power is supplemented in winter by a dual-fuel 5 megawatt cogeneration facility located on the Cambridge campus. The ability to island this plant from the surrounding grid, combined with a high degree of control over where power is allocated within the Harvard mini-grids, makes Harvard’s energy system more resilient to external failures.

Severe Weather Action Plan (SWAP)

Each school within the Harvard system has an emergency management team with one designated point person who is responsible for administering the campus-wide Severe Weather Action Plan (SWAP). This plan specifies the activities required of each relevant department each day 5 days prior to—and directly following—a severe weather event.

Emergency Shelter Management Plan

Harvard has a detailed 144-page emergency shelter management plan that guides the planning and operation of temporary shelters during and following major disasters. The plan identifies locations for different types of shelters, clear roles and responsibilities, checklists for equipment and supplies, forms, checklists, and other resources for managing shelters, and protocols for communication and coordination between departments.

Emergency Preparedness Activities Underway

Climate preparedness summit

Harvard held a summit on September 19th, 2013 focused on climate change impacts in the region and invited representatives from emergency management teams at other area universities to attend. The event was designed as an educational tool to increase awareness of climate impacts and to jointly identify vulnerabilities, and generate additional buy-in for near-term action. The summit consisted of a series of presentations and panel discussion with experts in the fields of climatology, environmental planning, sustainability, and emergency management, as well as an emergency tabletop exercise focusing on a severe weather event similar to Hurricane Sandy impacting Harvard and its surrounding areas.

Harvard University Climate Preparedness Working Group

Harvard's internal Climate Preparedness Working Group (similarly named but separate from the GRC Climate Preparedness Working Group) includes members from multiple departments spanning infrastructure and project planning to sustainability and EHS. The working group is in the process of preparing a report identifying climate change considerations which should be integrated into the process of development of a new three to five year strategic plan. This is one of a number of interconnected initiatives related to resilience planning which Harvard hopes to unite into a more integrated planning process.

Expanding on-campus cogeneration facilities

Harvard is considering adding a 7 megawatt dual fuel electric generator to its existing Blackstone cogeneration facility (see description under "Energy Management" above). In addition to providing cheaper baseload power year-round, this would increase Harvard's resilience to power disruptions, allowing greater on-campus power generation in the event of a community-wide or system-wide utility outage. This will also provide an opportunity to integrate flood resilience measures, such as having redundant interconnection points with the campus mini-grids.

Evacuation planning

Planning for campus-wide evacuation has not been designated a near-term priority given the low likelihood it would be required. The emergency shelter management plan designates both short-term and long-term emergency shelter locations, as well as evacuation centers, but Harvard intends to develop more comprehensive evacuation planning in the future.

Residence hall backup power

Harvard recently completed a comprehensive cost-benefit analysis of various options for backup power at residence halls. The financial cost and environmental impacts associated with two primary models were evaluated by outside consultants: building-specific backup generators in all dorms or larger, more centralized systems. An executive task force selected a hybrid option that combines these approaches by installing larger systems that would fully power select dorms where students would be consolidated in a "shelter in place" event. This initiative is now moving to the implementation phase.

Business continuity planning

Harvard's business continuity planning efforts focus on ensuring Harvard's critical functions are maintained during and following disruptive incidents. Prior to 2012, business continuity planning efforts

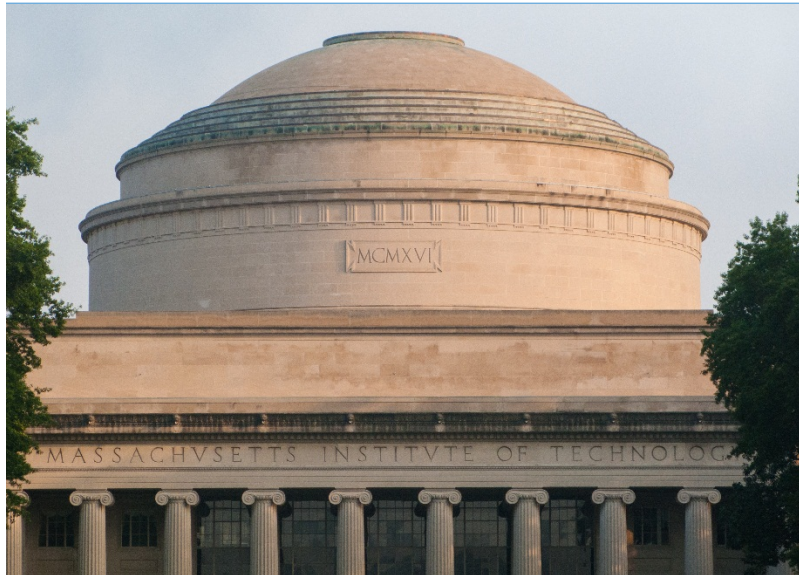
were conducted inconsistently at the school and department level with limited cross-departmental collaboration. The new program provides schools and departments with online resources and technical assistance for developing customized business continuity plan.

This two-year, cross-departmental initiative uses the Kualu Foundation's *KualiReady* software to systematically examine systems that affect business continuity. This includes evaluating vulnerabilities associated with water and energy disruptions and strategies for building in redundancy. It also covers soft infrastructure systems like payroll and benefits.

Planning Considerations

- **Strategic use of downtime.** Harvard staff mentioned that it is important for emergency preparedness personnel and the university community to recognize that sometimes the goal in disaster preparedness and response is not to “keep everything on.” Deliberately shutting equipment down for a period of time can often minimize damage and help speed recovery.
- **Understanding the vulnerability to staff capacity disruptions.** For example, it is important to recognize the critical role that personnel play in disaster recovery and the potential impacts of transportation disruptions on the university's capacity to operate. Sometimes staff capacity constraints pose a greater risk to recovery than infrastructure damage and it is important to put in place systems that recognize potential for disruptions to the university's human capital.
- **Diversity of power sources.** Power supply disruptions can be one of the most common and damaging weather-related disruptions. Diversification of power sources is a key strategy in reducing this vulnerability and Harvard is working to diversify its electricity supply, such as through co-generation facilities and building-specific backup systems.

Massachusetts Institute of Technology



Existing systems

- Decentralized emergency management
- Emergency Preparedness Coordinator
- After Action Reviews

Initiatives underway

- All-hazards plan
- Building preparedness
- Emergency support for leased buildings

Existing Emergency Preparedness Systems

Decentralized emergency management led by the security and emergency management office

The Massachusetts Institute of Technology (MIT) has many schools and buildings across multiple campuses and manages its emergency preparedness in a decentralized manner with the Security and Emergency Management Office (SEMO) as the responsible coordinator. SEMO coordinates resources and technologies across all campuses and buildings during emergency situations. In particular, SEMO relies on the Environmental Health and Safety (EHS) Office and its Safety Program for support with implementing procedures, developing emergency preparedness plans and working with MIT's departments, labs and centers on safety issues.

Emergency preparedness coordinator

Each academic, administrative, and research unit has at least one designated Emergency Preparedness Coordinator (EPC) who is responsible for emergency education and prevention awareness; communicating with MIT's emergency and security staff; and developing and implementing an emergency plan that is specific to their respective department. Drawing from a template provided by EHS, EPCs assist in the development and implementation of an Emergency Preparedness Plan for each department. The Emergency Preparedness Plan identifies essential and emergency personnel (i.e. the EPCs) and provides contact information, roles and responsibilities, communication and alarm procedures, possible fire hazards and ignition sources, and evacuation and sheltering processes.

After Action Reviews

After Action Reviews identify successes, failures and areas for improvement in emergency response following a major emergency and represent a key component of MIT's emergency preparedness and response system. These reviews are conducted within 30 days of an emergency situation and include the entire emergency operations team, regardless of their involvement. Additionally, MIT regularly runs trainings and conducts walk-throughs to ensure that the appropriate protocols and processes are in place for a range of emergency and climate-related events.

Emergency Preparedness Activities Underway

All-hazards Plan

Emergency planning staff are currently reviewing existing emergency management plans and the administration has set a goal of developing an All-hazards Plan. This plan would more fully integrate climate-related emergencies into planning and would likely address topics such as flooding, storms, seismic events, terrorism, and internet failure, among others.

Building preparedness for MIT-owned buildings

MIT has increasingly begun to recognize the importance of building management in climate preparedness and in evaluating the designs of future construction projects. In the meantime, MIT is reviewing the option of moving transformers and critical equipment above flood levels when undertaking major building renovations, and is testing the feasibility of using permeable surfaces near flood prone areas. Additionally, MIT is considering whether to retain an on-call contractor to ensure continuous operations for some MIT-owned buildings, such as by bringing back-up generators when needed.

Emergency support for buildings leased by MIT

MIT's investment buildings are leased to commercial tenants and managed by a third-party property manager. Building tenants are responsible for developing emergency management and business continuity plans for extreme events, including natural disasters, as part of their lease obligation. MIT's emergency staff is available to help review the plans, if needed. The MIT Real Estate team is also available to support tenants with response and recovery after events.

Planning Considerations

- **Value of trade organizations.** MIT emphasized how their membership with several organizations, including ULI, BOMA, NAIOP, IAEM, and ASIS, help MIT be aware of emerging safety and emergency management concepts. Participation in such networks also helps MIT benchmark where it stands relative to other institutions and businesses of comparable size.
- **Building portfolios.** The buildings owned by MIT are a mixture of an owner-occupied academic portfolio and a commercially-leased investment portfolio. MIT's Department of Facilities manages the academic portfolio, the MIT Investment Management Company manages the investment portfolio, and the two groups share information as needed. However, they have different emergency preparedness, management, and operational procedures a result of the different needs of academic and commercial users.
- **Value of collaboration with state and local regulators.** In particular, MIT emphasized the benefits of frequent communications and coordination with state and local regulators so that procedures work effectively during emergency situations. Information sharing is an important management element which is why MIT recently obtained WebEOC, a web-based crisis management software. A product also used by public officials to monitor activities, this will strengthen collaboration through information sharing and by enabling remote operations of MIT's emergency center.

About MCG

Meister Consultants Group, Inc. (MCG) is an international consulting firm specializing in climate and disaster resilience, renewable energy, international dialogue, and corporate sustainability. Our services include strategy and policy development, market analysis, research program planning and management, as well as new governance tools such as stakeholder and citizen participation, dialogue and mediation, multi-sectoral cooperation and the development and management of various multi-stakeholder initiatives.

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