Department of Biomedical Engineering
Emergency Operations Plan

1.0 Mission

1.1 The Department of Biomedical Engineering provides a full range of technical and engineering services to MGH. In addition to repairing, maintaining, and inspecting equipment, the department evaluates and installs new medical technologies, supports medical/IT systems, investigates devices failures, collaborates in recall activities, and manages regulatory requirements.

1.2 The major responsibility of Biomedical Engineering personnel during a Disaster is to continue to provide technical support for patient care equipment, such as: physiological monitoring systems, defibrillators, infusion pumps, external pacemakers, etc. In addition, the department can assist in redistributing monitoring equipment to meet emergent needs.

1.3 It is imperative that throughout a Disaster situation routine activities be maintained to the greatest extent possible in order to ensure that the needs and safety of the existing patients, visitors, and staff are fulfilled.

1.4 The Director of Biomedical Engineering will ensure that this plan and department call lists are updated as necessary, but at least annually.

2.0 Department Leadership Positions, Hospital Incident Command System (HICS) Functional Responsibilities and Reporting Relationship(s)

2.1 Positions

2.1.1 **Biomedical Engineering Unit Leader:** the Director of Biomedical Engineering will be the Unit Leader. If s/he is unavailable, the role of Unit Leader will be assumed by one of the following individuals, in this order: (1) the Assistant Director of Biomedical Engineering, (2) the OR/Anesthesia Clinical Engineering Manager, or (3) the Clinical Engineer (CE) On Call.

2.1.2 **One-Call Operator:** helps to contact members of the department to indicate Disaster status and to track the status/availability of staff throughout the event.

2.1.3 **Team Leaders:** responsible for assessing the status/availability of Biomedical Engineering Technicians, assigning tasks to the technicians depending on hospital needs, and tracking technician time associated with the Disaster.

2.1.4 The Biomedical Engineering Unit Leader will designate individuals to fill these roles as needed in the event the primary person is unavailable.

2.2 Reporting Relationships

Biomedical Engineering is under the Logistics Section of the MGH Hospital Incident Command System (HICS) and reports to the Logistics Section Chief.

3.0 Department Notification

3.1 HICS staff are typically notified of the "Code Disaster" status via the HICS Emergency Notification System (ENS).

3.2 In the event of a sudden major disaster requiring immediate notification to all staff, "Code Disaster" might be overhead paged.

3.3 The Telecommunications Department will activate the HICS ENS when asked to do so by an authorized person.

3.4 The Director of Biomedical Engineering, Assistant Director, and OR/Anesthesia CE Manager are all included on the HICS ENS and will collectively ensure 24x7x365 coverage and response to the ENS.

3.5 When notified via the HICS ENS, the Director, Assistant Director, OR/Anesthesia CE Manager, or CE On Call will assume the role of Biomedical Engineering Unit Leader per Section 2.1. (In the case of the CE On Call, s/he will be notified by one of the other three individuals.)

3.6 The Biomedical Engineering Unit Leader will then be responsible for activating the Emergency Operations Plan (i.e. this plan) for the department.

3.7 The Biomedical Engineering Unit Leader will notify other necessary members of the department through call trees.

4.0 Department Plan Activation

4.1 Biomedical Engineering Unit Leader

The Director, if available, will assume the role of Biomedical Engineering Unit Leader. If the Director is unavailable, then the Assistant Director, OR/Anesthesia CE Manager, or CE On Call will assume the role of Biomedical Engineering Unit Leader per Section 2.1.

4.2 Staff Notification

4.2.1 **Regular business hours (8am – 4pm weekdays):** The Biomedical Engineering Unit Leader (typically the Director), after notification of the Disaster, will notify the One-Call Operator, who will in turn notify the Assistant Director, OR/Anesthesia CE Manager, Team Leaders, CEs, and other managers. Each of these people will report

back to the One-Call Operator and give their status. The Team Leaders and other managers, in turn, will notify their team members, assess their status, and report back to the One-Call Operator. The One-Call Operator will track staff status throughout the Disaster via the Staff Status Log, located at L:\DBEMAIN\Emergency Preparedness\HICS forms.xls and the Biomedical Engineering website (http://biomed.partners.org).

4.2.2 **Off hours (4pm – 8am weekdays, all day weekends/holidays):** Notification of staff will be initiated by the Biomedical Engineering Unit Leader after s/he has been notified and has assessed the level of Biomedical Engineering assistance required for the Disaster. S/he may pass this task onto someone else in order to handle other issues. If more staff is needed during off hours, Biomedical Engineering personnel will be contacted at home and asked to report to the hospital.

4.3 Call List

4.3.1 Biomedical Engineering staff will be called in the following order in the event of a Disaster when personnel are not on site:

- Clinical Engineer On Call (pager 35699, cell 617-697-7525)
- Biomedical Engineering Technician On Call (24814, 617-678-5991)
- OR/Anesthesia BMET On Call (24811, 617-643-9577)
- Dialysis BMET On Call (20839, 617-968-6753)
- Team Leaders
  - Biomedical Engineering Technicians
- Clinical Engineers
- Other managers
  - Other staff
- PBME Medical Director

The Disaster Call List, with contact numbers, is kept on file with the department and with Emergency Preparedness personnel at the hospital.

4.3.2 During off hours Biomedical Engineering will also contact the Department of Respiratory Therapy to retrieve the Biomedical Engineering pager (24800) that is carried by Respiratory Therapy during off hours.

4.4 Job Action Sheets

The Biomedical Engineering Unit Leader Job Action Sheet is located (1) in the HICS folder in Ruth Sleeper Hall 120, (2) at L:\DBEMAIN\Emergency Preparedness\MGH Biomedical Engineering Job Action Sheet.doc., and (3) on the Biomedical Engineering website.

5.0 Reporting Location(s)

5.1 The Biomedical Engineering Unit Leader will report to the Logistics Command Center located in the Buildings and Grounds Conference Room, Gray Sub-Basement, Room 0011.

5.2 Biomedical Engineering headquarters will be in Ruth Sleeper Hall 120. All Biomedical Engineering personnel who are on duty, or who are off duty but are called in, will report to this location. Videoconferencing to establish communications with BWH Biomedical Engineering will occur in Ruth Sleeper Hall 020C as needed.

6.0 Response Actions

6.1 General

6.1.1 Any time a Code Disaster is declared the Unit Leader will activate the department's Emergency Operations Plan (this plan) and will initiate the call tree to mobilize staff as needed.

6.1.2 The department will continue to support operations to the extent possible, and will begin to identify equipment for possible re-deployment.

6.1.3 **Short-term Events**

Short-term events are defined as events that last for 24 hours or less and have a predictable end time. These events will be handled by Biomedical Engineering using current staffing levels with minor increases in the length of shifts if the event occurs during normal business hours. If the event occurs during off hours, staff may be requested to report to the hospital as needed. Normal operations will be maintained for as long as possible depending on the nature of the Disaster. Department staff will be made available to support other areas as requested.

6.1.4 **Long-term Events**

Long-term events can continue over multiple days and whenever possible staff will be deployed on a 12-hour shift rotation. Biomedical Engineering may postpone any scheduled routine tasks as requested by the Incident Commander, and will begin to limit the use of consumable resources while continuing to provide a safe environment for patients.

6.2 External Events

6.2.1 **Influx of Patients**

6.2.1.1 **Assessment:** One of the department's primary roles during a Disaster will be to locate available equipment and deploy it to areas in need. To determine the exact need of medical equipment, the Biomedical Engineering Unit Leader will report to the Logistics Section Chief to

understand the extent of the Disaster. Factors that will be considered include:

- number of patients expected
- type of patients expected and the extent of their injuries
- current bed capacity
- location(s) the patients are expected to be placed.

6.2.1.2 **Surveying Available Equipment:** Team leaders will send out technicians to survey areas for available equipment using the Equipment Availability Log. Potential areas to survey include:

- Equipment Services
- Biomedical Engineering loaner equipment pool
- Operating Rooms/Induction Rooms
- unoccupied beds in care units
- PACU
- Endoscopy
- Imaging
- Cath Lab
- outpatient practices

6.2.1.3 **Equipment In-Service/Training:** The department will, to the extent possible, provide clinical training on medical equipment for clinicians unfamiliar with equipment deployed to their area during a Disaster.

6.2.2 **Threats to the Facility**

Biomedical Engineering will continue to support operations to the extent possible, and re-deploy equipment as needed to respond to the event.

6.2.3 **Interruption of Supply Chain**

Biomedical Engineering will continue to support operations to the extent possible, and re-deploy equipment as needed to respond to the event.

6.2.4 **Difficulty Accessing the Hospital**

Biomedical Engineering will continue to support operations to the extent possible, and re-deploy equipment as needed to respond to the event.

6.3 Internal Events

6.3.1 **Facility or Physical Plant Failure**

In the event of a facility or physical plant failure, such as a fire or collapse of an area, Biomedical Engineering will assess the situation in terms of medical equipment needs and respond as appropriate. For example, in the event of a fire where medical

equipment is either damaged or wet, Biomedical Engineering will remove the equipment, locate replacements if available, assess damage to the equipment, and repair it as necessary.

6.3.2 Major Equipment Failure

6.3.2.1 Patient Monitoring System

6.3.2.1.1 **General Response:** In the event of a major malfunction or failure in a physiological monitoring network, Biomedical Engineering will assess the nature of the event and develop appropriate steps to mitigate it, which could include isolating specific care units from the rest of the monitoring network, isolating bedside monitors from central monitors, and directing clinical staff to suspend use of wireless monitors until the system has been restored.

6.3.2.1.2 **Contingency Plans:** Biomedical Engineering has developed contingency plans for clinicians to follow in the immediate moments of a monitoring system failure. These plans are available on the Biomedical Engineering clinical website (http://biomed.partners.org/clinical) and in Appendices 12.3 through 12.6.

6.3.3 Loss of Utilities

6.3.3.1 **Electrical Power:** Most essential medical equipment is plugged into Emergency Power. When switching between Normal and Emergency Power, a “brownout” may result, causing equipment failures (such as power supply or microchip failures) that would need to be repaired and/or reset. Biomedical Engineering will respond to these problems as reported and deal with them appropriately. In the event of a failure of the Emergency Power System, Biomedical Engineering will assist in finding alternative means of ensuring equipment operation, such as running systems on battery and working with Buildings and Grounds to find alternate electrical power sources.

6.3.3.2 **Water:** The loss of water will have particular impact on dialysis patients. The main dialysis system will not be able to operate without a water supply. In the short term, the Hemodialysis Unit will be able to finish treatments in the unit using the remaining water supply in the main storage tank, or by treating patients using continuous veno-venous hemofiltration (CVVH) under the direction of the Medical Director of the Hemodialysis Unit.

6.3.3.2.1 **Water Emergency:** In the event where the water supply is in tact but has been compromised (e.g. a “boil water” order has been issued by the city), Biomedical Engineering and the Hemodialysis Unit will follow the MGH Dialysis Water Emergency Action Plan (see Appendix 12.2).

6.3.3.3 **Steam:** The loss of steam will impact the steam sterilizers used in the Operating Rooms. As appropriate, Biomedical Engineering will work with Buildings and Grounds to ensure that the sterilization of equipment can still be performed.

6.3.3.4 **Gases:** The loss of gas systems will have particular impact on the Operating Rooms. Depending on the gas(es) affected, Biomedical Engineering can assist Buildings and Grounds to mitigate the impact:

- Nitrogen: Biomedical Engineering has a supply of portable H cylinders normally used for power tools that can be re-deployed for clinical use.
- Oxygen: Anesthesia machines are equipped with tanks in the event of a failure of the oxygen system.

6.3.4 Communications Disaster

6.3.4.1 In the event of a communications system failure all Biomedical Engineering personnel will report back to Biomedical Engineering headquarters.

6.3.4.2 Staff will be assigned to manually deliver messages and obtain information and resources until communication systems are restored. Telecommunications will distribute backup communications equipment if available.

6.3.4.3 On-call personnel are equipped with both pagers and cell phones to guard against a failure in either of those systems.

6.3.5 Loss of Information Systems

Several medical-IT systems managed by Biomedical Engineering interface with hospital information systems, and could be impacted by the loss of an information system(s). If a medical-IT system is affected in this way, the department will activate the Disaster Response plan for that system.

6.3.6 Incident Within a Department Location

6.3.6.1 Staff will follow the appropriate departmental Fire Plan to the designated location where roll call will be conducted. If any staff members are unaccounted for, Police & Security will be notified immediately.

6.3.6.2 If the incident has occurred in one of Biomedical Engineering's ancillary locations (i.e. not headquarters), staff will go to headquarters once roll call is complete.

6.3.6.3 A re-entry/support plan will be developed, and the department will identify essential resources and equipment needed for operations. The Facility Unit Leader will assist Biomedical Engineering in relocating.

6.3.7 **Employee Injury at the Disaster Site**
The Biomedical Engineering Unit Leader will ensure that Police & Security is notified to help arrange for medical assistance, and that Occupational Health Services is notified and appropriate personal injury reports are completed.

7.0 Evacuation

7.1 Notification

Biomedical Engineering will receive notification from Incident Command or the Boston Fire Department when an evacuation has been ordered for any of the department locations. The Incident Commander will relay the overall scope of the evacuation, which could range from only isolated non-clinical locations, to horizontal evacuation of specific clinical units, to an evacuation of the entire hospital, The department will follow hospital evacuation procedures and then await further instructions from Incident Command, while continuing to support operations to the extent possible.

7.2 Response

7.2.1 The Biomedical Engineering Unit Leader, upon being notified of the evacuation, will instruct staff at every affected department location(s) to activate their respective Fire Plans.

7.2.2 Because Biomedical Engineering's headquarters is located in Ruth Sleeper Hall, away from the inpatient towers but the department also has multiple ancillary locations within the inpatient towers, many possible evacuation scenarios could require evacuating some or all of the ancillary locations but not headquarters. Therefore, when notifying staff at the ancillary locations, the Unit Leader will also instruct them where to re-group – at headquarters or the department's assembly point, depending on whether headquarters is included in the evacuation order.

7.3 Roles and Responsibilities When Evacuating the Department

7.3.1 The Biomedical Engineering Unit Leader at the time of the evacuation will be responsible for ensuring that staff are evacuated from the affected department location(s).

7.3.2 Staff will be required to arrive at headquarters or at the department assembly point (see Section 7.2.2) in front of the Holiday Inn (5 Blossom St.) to be counted by the Biomedical Engineering Unit Leader.

7.3.3 Staff that normally work in the affected department location(s) but are elsewhere on site when the evacuation is ordered will either evacuate with the unit they are on if that unit is evacuating, or shelter in place until it is safe to leave and meet at headquarters or the department assembly point.

7.3.4 Staff will be accounted for during the evacuation and again once they reach headquarters or the department assembly point.

7.4 Roles and Responsibilities at the Hospital Assembly Point

7.4.1 Biomedical Engineering will continue to perform its emergency functions to the extent possible at the Hospital Assembly Point.

7.4.2 Biomedical Engineering will assist with medical equipment needs of patient care units that are evacuating.

7.4.3 Biomedical Engineering staff will help support a safe environment for patients until transfer to another facility or discharge home was possible.

7.4.4 All normal activities that would be completed via computer will be written and tracked on paper.

8.0 Training and Education

8.1 New Employees

New employees attend one and a half days of orientation that includes a module on Emergency Preparedness for the hospital. This is supplemented at a later date through detailed training of the Biomedical Engineering Emergency Operations Plan and specific training of an employee's role during various types of disasters and emergencies.

8.2 Refresher Training

Biomedical Engineering staff will review Emergency Preparedness procedures on an annual basis as part of yearly education. Staff members also gain first-hand knowledge and experience through drills conducted throughout the year.

9.0 Reports/Recordkeeping

9.1 Tracking Activities and Time

9.1.1 All managers and supervisors will track personnel used during the Disaster and the hours spent on disaster activities using the Section Personnel Time Sheet.

9.1.2 Actions taken by individuals will be documented using the Activity Log.

9.2 Logs

Electronic copies of the logs are located at L:\DBEMAIN\Emergency Preparedness\HICS forms.xls and on the Biomedical Engineering website, and can be printed out as needed.

9.2.1 **Activity Log:** Used to document incident activities and actions taken.

9.2.2 **Section Personnel Time Sheet:** Used to track personnel involved in the Disaster and the number of hours worked.

9.2.3 **Equipment Availability Log:** Used to survey available equipment that could be relocated during the Disaster.

9.2.4 **Equipment Movement Log:** Used to document equipment that is relocated in the hospital during the Disaster.

9.2.5 **Staff Status Log:** Used to track the availability of staff throughout the Disaster.

10.0 Termination of Event/Recovery

10.1 Gathering Documentation for Submission to Incident Commander

10.1.1 Biomedical Engineering staff will submit all log forms completed during the Disaster to the One-Call Operator for collation.

10.1.2 The One-Call Operator will make copies of the forms for Biomedical Engineering's records and will give copies of the Equipment Movement Logs to the Team Leaders.

10.1.3 Collated documents will be given to the Biomedical Engineering Unit Leader for submission to the Incident Commander.

10.2 Conducting Physical Assessments of Department Locations

10.2.1 Team Leaders will assess any physical damage in their areas and report back to the Biomedical Engineering Unit Leader.

10.2.2 Team Leaders will review the Equipment Movement Logs and parse out the work to team members to retrieve the redeployed devices, carry out performance verification tests, and return them to their original owners.

11.0 Evaluation of Response

11.1 Conducting Evaluation/Critique of Department Response

11.1.1 A meeting of those staff members involved in the Disaster will occur no later than three days after the termination of the event to debrief the event.

11.1.2 Notes will be gathered on what went well and what could be improved.

11.1.3 Appropriate changes to the Emergency Operations Plan and related policies will be made in accordance with lessons learned.

11.2 Submit Department Evaluation to Incident Commander

Notes will be submitted to the Incident Commander by the Biomedical Engineering Unit Leader.

12.0 Appendices

12.1 Job Action Sheet: Biomedical Engineering Unit Leader

12.2 MGH Dialysis Water Emergency Action Plan (L:\DBEMAIN\Resource Book\MGH\MGH Dialysis\Plans and Procedures\Dialysis Water Emergency Action Plan May 2010.doc)

12.3 GE Monitoring System Multi-bed Failure Clinical Contingency Plan (http://biomed.partners.org/clinical > Monitors > Contingency Plans > GE Multi-bed Failure)

12.4 GE Medical Telemetry System Failure Clinical Contingency Plan (http://biomed.partners.org/clinical > Monitors > Contingency Plans > GE Telemetry Failure)

12.5 Welch Allyn Monitoring System Multi-bed Failure Clinical Contingency Plan (http://biomed.partners.org/clinical > Monitors > Contingency Plans > Welch Allyn Multi-bed Failure)

12.6 Welch Allyn Telemetry System Failure Clinical Contingency Plan (http://biomed.partners.org/clinical > Monitors > Contingency Plans > Welch Allyn Telemetry Failure)

Effective: 07/03
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Mass General Hospital
Job Action Sheet

LOGISTICS SECTION
Biomedical Engineering Unit Leader
Revised: 12/2011

BIOMEDICAL ENGINEERING UNIT LEADER

Positioned Assigned To: _____

You Report To: _____(Logistics Section Chief)

Logistics Response Center: _____ Telephone: _____

Mission: Maintain medical equipment in operable condition and assist in rearranging the distribution of medical equipment to meet emergent needs.

Immediate

____ Receive appointment from Logistics Section Chief.
____ Read this entire Job Action Sheet.
____ Put on position identification vest.
____ Obtain briefing from Logistics Section Chief.
____ Establish communications with Situation-Status Unit Leader and Emergency Treatment Area Supervisor to get an assessment of equipment needs related to clinical area activities.
____ Establish Biomedical Engineering Department Headquarters.
____ Establish communications with Biomedical Engineering staff.
____ Survey Biomedical Engineering staff availability.
____ Call in Biomedical Engineering staff as appropriate.
____ Survey equipment availability (see below for potential areas) and complete Equipment Availability Log.
____ Notify BWH Biomedical Engineering (617-732-8889), to alert them to the disaster status in the event that extra assistance is required.
____ If necessary, establish videoconferencing communication with sister institution to facilitate quick communication.

Intermediate

____ Maintain medical equipment in operable condition.
____ If necessary, gather available medical equipment to prepare for redeployment.
____ Help distribute or redistribute medical equipment to meet emergent needs; document in the Equipment Movement Log.

____ Deploy technical staff to support clinicians in the use of the medical equipment such as setting up the equipment, ensuring that appropriate cables and accessories are available, and training in general operation if required.

____ If phones become overloaded, deploy a technician to the Emergency Department, or any other area where assistance is required, to help as necessary and report back any developing requirements for medical equipment.

____ If necessary, arrange to borrow equipment from other institutions and manufacturers.

____ If necessary, arrange to rent medical equipment.

____ Continually brief the Logistics Section Chief with updates.

____ Stay in contact with Situation-Status Leader and Emergency Treatment Areas Supervisor to obtain updates.

____ Make arrangements with Nutritional Supply Unit Leader for nourishment if needed.

____ Make arrangements with Environmental Services if accommodations /mattresses will be required for overnight stays.

Extended

____ Observe all staff, volunteers and patients for signs of stress and inappropriate behavior. Report concerns to Staff Support Unit Leader. Provide for staff rest periods and relief.

____ Other concerns:

_____
_____
_____
_____
_____

Areas to potentially survey for available medical equipment:

- Equipment Services
- Biomedical Engineering loaner equipment pool
- Operating Rooms/Induction Rooms
- unoccupied beds in care units
- PACU
- Endoscopy
- Imaging
- Cath Lab
- outpatient practices