2.0 PROPOSED ACTION & ALTERNATIVES

2.1 INTRODUCTION

The Proposed Action is to partially fund the construction of the National Emerging and Infectious Diseases Laboratories at the BioSquare Research Park in the South End neighborhood of Boston, MA. As required under the NEPA regulations, the following sections describe the reasonable alternatives that were evaluated, alternatives that were eliminated from further consideration and the process used to determine the Proposed Action.

The two reasonable alternatives that are evaluated below include the Proposed Action involving partial funding of the construction of an NBL facility by the National Institutes of Health (NIH) at the BioSquare Research Park in Boston, and the No Action. The No Action Alternative is included in accordance with Council of Environmental Quality (CEQ) regulations (40 Code of Federal Regulations (CFR) 1502.14(d)) and creates a baseline against which to compare other alternatives. Under the No Action Alternative, the Boston-NBL at the BioSquare Research Park would not be built. The No Action Alternative does not serve the purpose and need of the Project.

Other alternatives not considered reasonable include alternative locations outside of Massachusetts or lower density areas outside Boston; alternative locations for the BSL-4 laboratory component and alternative locations at Boston University-owned sites. These alternatives are discussed in Section 2.3 below.

2.2 PROPOSED ACTION

2.2.1 LOCATION

The proposed Boston-NBL facility site is located in the BioSquare Research Park (see "Figure 2-1, Project Area Context"). The facility's location in the BioSquare Research Park, which is adjacent to the Boston University Medical Center (BUMC) campus and within the Greater Boston academic hub, would allow for dynamic collaborations among investigators at multiple research entities such as the Boston University School of Medicine, Harvard Medical School, Massachusetts Institute of Technology, Massachusetts General Hospital, Brigham and Women's Hospital, University of Massachusetts Medical Center, the Massachusetts Biological Laboratories, Tufts University, New England Medical Center, Brandeis University and others.

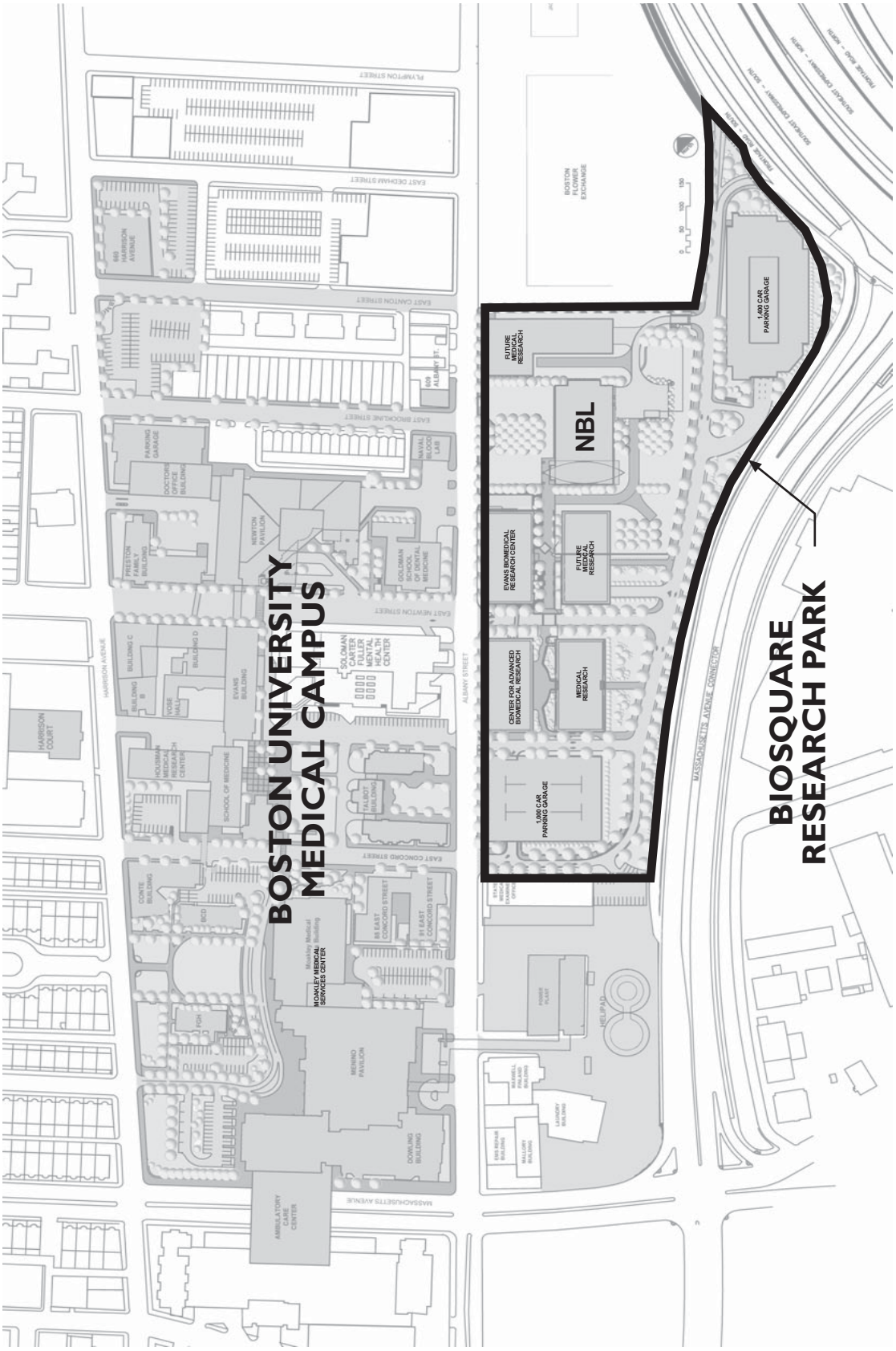

FIGURE 2-1
Project Area Context
source: Stubbins Associates, Fort Point Associates, Inc.

"Figure 2-2, BioSquare Research Park", shows the location of the proposed Boston-NBL facility including the parcel boundary. The proposed facility would be constructed on an approximately 3.4-acre parcel of land.

The building would be situated on the site surrounded by an anti-scale fence that allows for controlled access at staffed checkpoints for both vehicles and pedestrians and to create setbacks of approximately 150 feet from any location that could accommodate unchecked vehicles and 100 feet from areas that could accommodate unscreened pedestrian traffic. Vehicular access would be strictly limited to BUMC vehicles and selected delivery and service vehicles. The service and loading area would be located on the south side of the facility within the secure perimeter. Pedestrian access to the building would be limited to a single entrance and security officers would be assigned to provide protective services at the site twenty four hours a day, monitoring both the building and grounds (see "Figure 2-3, Site Plan Safety Features").

2.2.2 BUILDING PROGRAM

The Boston-NBL facility would contain approximately 194,000 gross square feet (sf) of state-of-the-art BSL-2, BSL-3 and BSL-4 laboratories as well as associated research and administrative support space. The high-level containment labs would be designed and built using the strictest federal standards, incorporating special engineering and design features to prevent microorganisms from being released into the environment (see "Figure 2-4, Conceptual Laboratory Design and Safety Features").

The building would be approximately 126 feet in height with four stories of occupied biomedical research space and three stories of mechanical/building support space. The building program would include high-level containment BSL-4 modules. The BSL-4 modules would support work with live agents for tissue culture, antigen production, and in-vivo studies. The three modules would each include procedure space such as centrifuge and isolation areas; support space such as suit rooms and decontamination showers; and animal holding space. A discussion of the building program follows and is summarized in Table 2-1, Boston-NBL Building Program.

2.2.2.1 LABORATORIES

BSL-4 core laboratory space would incorporate the most technologically advanced scientific equipment for infectious disease research in a high containment environment. The BSL-4 modules would support research on agents with no known prevention or treatment and those found in animals that may cause human infection. All of these agents are found on the Centers for Disease Control and Prevention (CDC) select agent list.

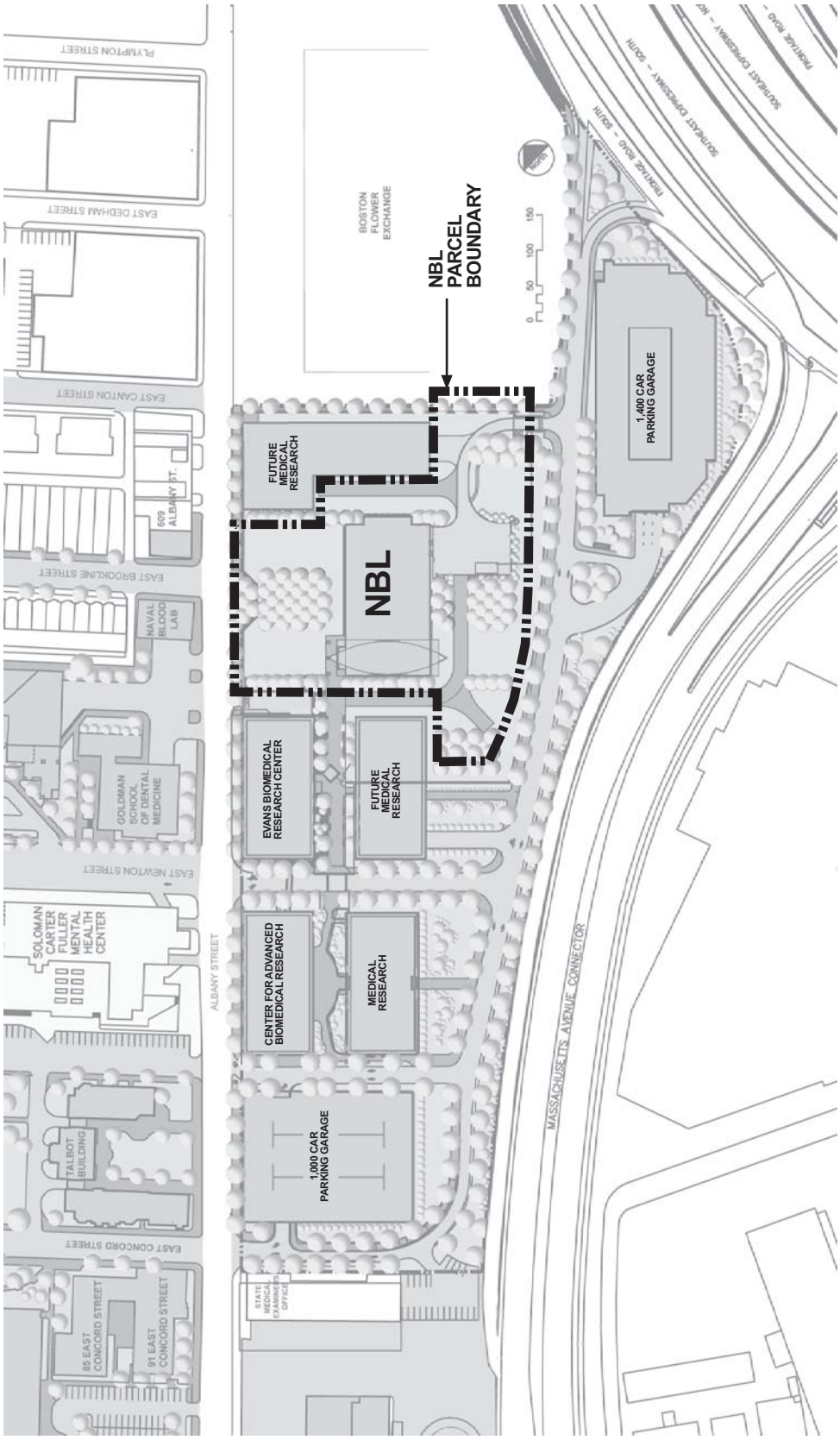

FIGURE 2-2
BioSquare Research Park
source: Stubbins Associates, Fort Point Associates, Inc.

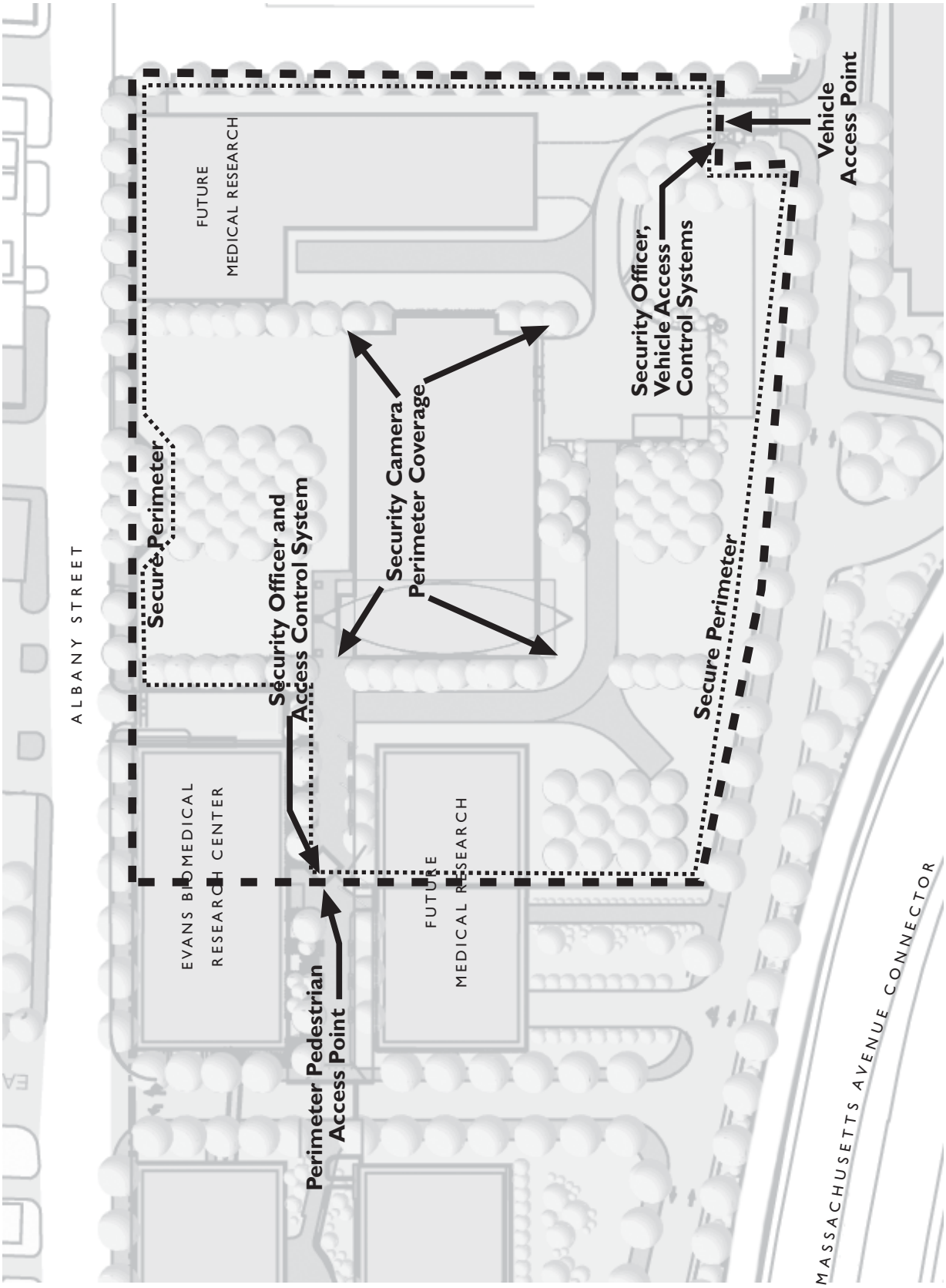

FIGURE 2-3
Site Plan Safety Features
source: BUMC Operations and Public Safety

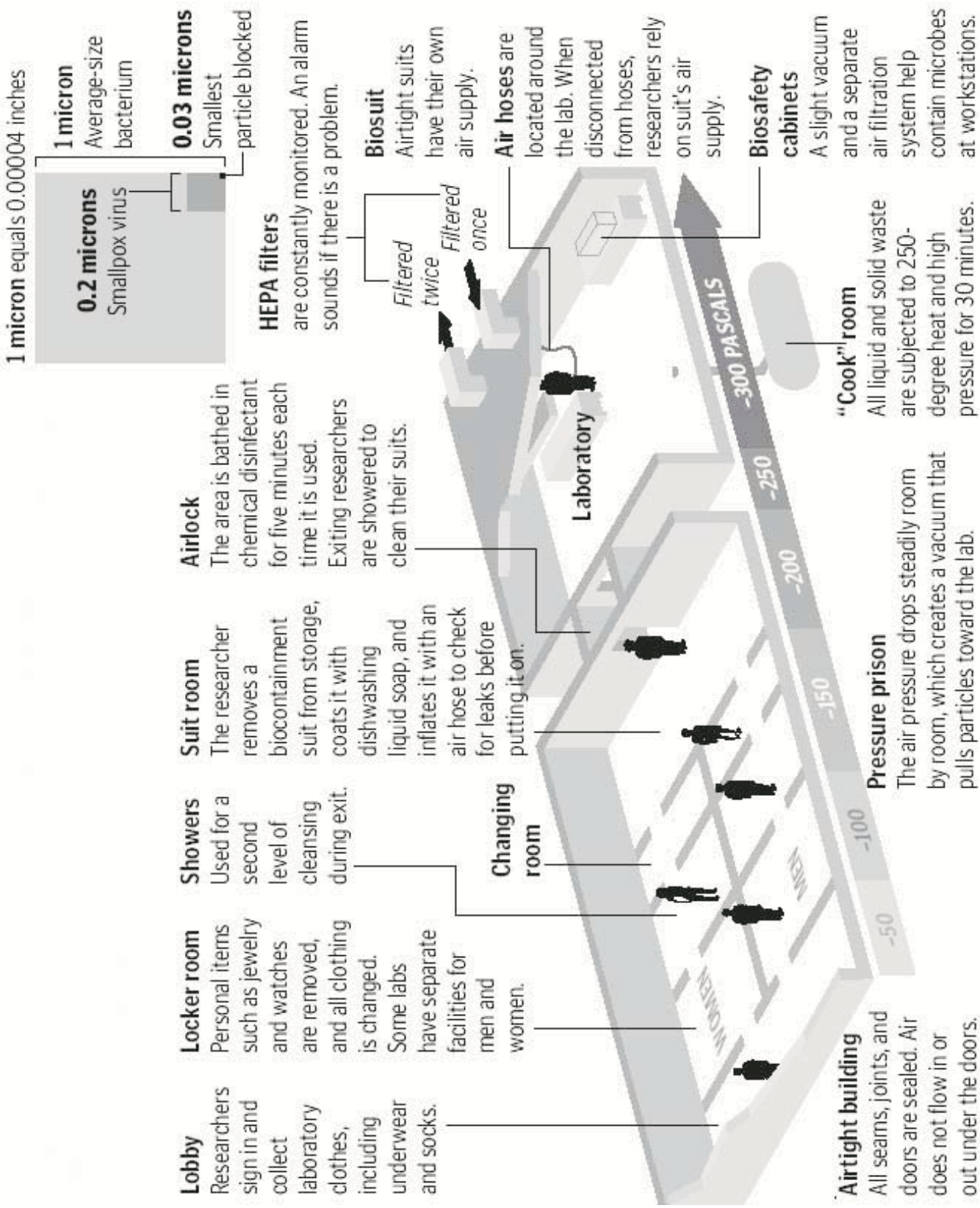

FIGURE 2-4
Conceptual Laboratory Design and Safety Features
source: Boston Globe,September 30, 2003

Appendix 2 describes the characteristic of agents currently studied at BUMC and which may be studied at BUMC and the Boston-NBL.

Table 2-1: Boston-NBL Building Program

Use	Program SF
BSL-4 Laboratories	13,100
BSL-3 Laboratories	10,900
BSL-2 Laboratories	17,700
Clinical Research	3,500
Laboratory Support	15,400
Offices and Support	15,400
Building Support	8,100
Subtotal Assignable Space	84,100
Circulation, Mechanical, Elevators, Restrooms and other support space	109,900
Total	194,000

BSL-3 laboratories would be provided to accommodate research work on many of the NIH and Centers for Disease Control and Prevention (CDC) "A" and "B" list agents, which can be safely handled for routine use in a BSL-3 environment.

Basic biochemistry and molecular biology laboratories at BSL-2 would be provided to support the non-hazardous aspects of the work on BSL-3 and BSL-4 infectious disease agents. The adjacency of the BSL-2 and BSL-3 laboratories at the Boston-NBL facility with similar, nearby BioSquare Research Park facilities would increase productivity for researchers and lab workers. Animal holding rooms and their associated support space would also be provided in connection with the BSL-3 and BSL-4 laboratories. All research protocols involving animals would be reviewed and approved by the Institutional Animal Care and Use Committee, in accordance with the Public Health Service Policy on Humane Care and Use of Laboratory Animals (U.S. DHHS 2002e).

2.2.2.2 CLINICAL RESEARCH

Clinical research space would be provided to support clinical research protocols. The clinical research facility would include reception, nursing, administration, and exam rooms. The facility would accommodate approximately 3,000 ambulatory visits of healthy, normal volunteers per year with no overnight stays. Boston Medical Center has a number of protocols designed to address concerns surrounding patient confidentiality, patients with infectious conditions and patients who require isolated areas for both clinical and non-clinical reasons. These protocols are in place and would be utilized in the event that laboratory workers, or others, were exposed to infectious diseases and were determined to be in need of secure clinical facilities for

treatment. Specific protocols are being developed to address the transport of infected individuals from the Boston-NBL facility to the existing isolation facilities at Boston Medical Center, should that be necessary. In accordance with current practices, the BUMC Institutional Review Board, which is comprised of members of the academic community overseen by the BUMC Provost, would approve all human investigation studies to be undertaken at the Boston-NBL. All research undertaken at the Boston-NBL will comply with local, state and federal regulations.

There is a detailed mechanism for the recruitment of subjects, both normal volunteers and individuals with particular conditions, that complies with regulations of the Human Investigation Review Committee. This institutional committee functions under the authority of the Office of Human Protections at the DHHS. All protocols which involve human subjects are reviewed prior to approval. Part of the materials that are reviewed include how subjects would be recruited. All flyers and advertisements would be approved by the Institutional Review Board before posting. In virtually all cases adult individuals are required to give informed consent prior to enrollment in an approved study. The risks and benefits of all protocols are thoroughly explained to each potential participant prior to their informed consent. BUMC does not intend to solicit any individuals who are unable to provide informed consent.

2.2.2.3 OFFICE AND SUPPORT SPACE

Offices and support space would be provided to house administrative staff, safety staff, resident principal investigators (PI), visiting PIs, and facility support staff employed to operate the facility. Building support spaces would include spaces for glassware cleaning, materials handling, waste handling, security, radiation safety and housekeeping.

2.2.3 GENERAL BUILDING DESIGN COMPONENTS

The building would be designed with redundant critical mechanical and electrical systems to ensure that the facility can operate at all times. The utility infrastructure for the facility is designed for multiple redundancies. The electrical service would be what is known as a network service where the utility provides three separate incoming feeds installed in such a way that any one of the feeds may be de-energized without interrupting facility service. As a back up to the electrical utility, the facility would be equipped with on-site diesel generation of sufficient power to operate the facility in the event of a utility failure with two days worth of on-site fuel storage. The facility would be designed to have two heating mediums; the first being a connection to the district steam service, and the second a natural gas-fired heating plant. The water service would have two independent utility connections.

The building infrastructure has been designed with redundant systems where critical building systems are designed to operate at full capacity with the loss of any single component. For example, the building cooling plant would be equipped with three refrigeration machines, however; only two are needed for full operation of the facility.

During the design process all possible failure modes of mechanical systems and design components for the building were identified in a procedure similar to a fault-tree analysis, a graphical technique that provides a systematic description of the combinations of possible occurrences in a system. As a result, the health and safety protection elements of the laboratory design have built-in redundancies to ensure essentially zero risk of failure for safety features.

2.2.3.1 WATER SYSTEM

An existing Boston Water and Sewer Commission (BWSC) water main located in Albany Street would provide water service to the Boston-NBL facility. The Project would require extending the looped water services through the site and creating new connections to the service water mains in Albany Street. The building water services would incorporate reduced pressure assembly backflow preventors on the connections to the municipal water supply as required by the Massachusetts State Plumbing Code and NIH Design Policy and Guidelines (U.S. DHHS 2003b). The backflow preventors would be inspected annually to ensure proper operation. In addition to these devices, the facility would incorporate several further levels of protection by segregating all non-potable systems connections including HVAC make up water and laboratory water services. An added layer of protection would be incorporated as water services enter the BSL-4 envelope.

2.2.3.2 SANITARY SEWER

An existing BWSC sanitary sewer line in Albany Street would provide sanitary sewer service to the Boston-NBL facility. All liquid waste from all laboratories would be monitored and receive additional treatment prior to discharge to the sanitary system (see Waste Decontamination below).

2.2.3.3 STORMWATER

Stormwater runoff from the site would discharge into the existing BWSC system entering the Roxbury Canal Conduit, which runs through the site and flows easterly toward an outfall in the Fort Point Channel, a coastal water body located approximately 0.9 miles from the Project site.

2.2.3.4 AIR TREATMENT

Air supplied to the Boston-NBL would be filtered upon entering the facility at levels increasing from 65% efficiency at the core office and BSL-2 to High Efficiency

Particulate Air (HEPA) filters for the BSL-4 facilities. Air exhausted from biological safety cabinets (a piece of laboratory containment equipment in which infectious materials must be manipulated at BSL-3 and above) is passed through a HEPA filter prior to recirculation to a laboratory room or discharge through the building exhaust system. HEPA filters acceptable for biological safety installations routinely give collection efficiencies greater than 99.99% when tested with 0.3 μm diameter particles (Edwards 2002). This is the most difficult particle size to capture, aerodynamically. The filters are even more efficient above and below this size range for a variety of technical reasons related to interception of the particle, the effect of inertial forces and capture by diffusion. Therefore they capture a full size range of organisms, from very tiny viruses to much larger bacteria (approximately 20 nm – 200 μm).

These mechanisms have been fully described for HEPA filters by the International Atomic Energy Agency. In a BSL-4 laboratory, two HEPA filters are used in series to assure the exhaust air is sufficiently treated before discharge to the outdoors. In effect, all discharge air is filtered at least twice, and in many cases three times, prior to discharge, making the risk to the public from any infectious exhaust essentially zero. HEPA filter installations, whether in containment equipment such as biological safety cabinets or in building mechanical systems, are tested in place at least once per year using National Sanitation Foundation (NSF) Standard 49 procedures that provide quantitative assurance that the installations do not contain defects that reduce microbiological safety. HEPA filters are known to have long functional lives; however, age can play a factor in decreasing tensile strength of the filter media. For this reason, the Boston-NBL would use a conservative service life of five years for HEPA filters in biological safety cabinets and other ventilation system applications. HEPA filters are decontaminated in place prior to removal from equipment and ventilation system housings and therefore pose no risk to the public from subsequent handling and/or disposal. Perhaps the best and most practical proof that HEPA filters are effective is that they are used in respirators worn by researchers working with high concentrations of infectious organisms (bacteria and viruses). These HEPA filtered respirators are uniformly protective in the laboratory and in field applications.

In the Boston-NBL facility, exhaust from the BSL-4 suite area, decontamination shower, and decontamination airlocks would pass through a series of two HEPA filters rated for microbial aerosols before discharge to the outside.

Laboratory biological safety cabinets (including air filters) would be certified annually to ensure proper function. Safety cabinets would be re-certified when moved or re-located to other locations. The re-certification process would include testing of the HEPA filters, gaskets and other air-handling systems in the cabinet. HEPA filters would be decontaminated prior to disposal (see below).

The Boston-NBL facility will be designed with a redundant mechanical ventilation and High Efficiency Particulate Air (HEPA) filtration system for treating air prior to its release outside of the laboratory. NIH design guidelines (U.S. DHHS 2003b) require that HEPA filters be configured in the ventilation system so that they can be isolated for individual unit testing or decontamination. When a HEPA filter needs to be serviced, a redundant HEPA filter is put into service or the zone being serviced is isolated ensuring all exhaust air is properly filtered. The ventilation design for the facility includes fail-safe controls so that no contaminated air can bypass both HEPA filters.

The HEPA filters are designed to be resistant to moisture and the low level of solvents present in laboratory exhaust. In compliance with CDC requirements and National Sanitation Foundation (NSF) Standard 49 procedures, all HEPA filters would be tested and certified at least once per year, and if any degradation of the filter is found it will be replaced. CDC requires that the HEPA filter design allow for *in situ* decontamination of the filter prior to removal or removal in a sealed container for transport and disposal off-site. HEPA filters used at NEIDL will be decontaminated in place following a strict decontamination protocol. Depending on the exposure history of the unit, decontamination will utilize either vaporized hydrogen peroxide or formaldehyde gas.

The in situ decontamination process is carried out in the HEPA filter housing an air tight assembly so that the sterilizing gas does not escape to the environment before it is neutralized. Hydrogen peroxide vapor decontamination of HEPA filters is a relatively quick technique that can be used for BSL-4 laboratory filters. It decomposes to oxygen and water vapor and leaves no residues in the filter. The other decontamination method utilizes formaldehyde gas to sterilize the filter element, followed by neutralization with ammonia vapors. The neutralization process leaves a harmless solid residue of hexamine on the filter, and purging of the decontamination space after neutralization may release small amounts of hexamine into the air. Hexamine is used as an antiseptic and antibacterial agent and is harmless at the low concentrations that might occur in ventilation air for a short period of time. The selection of the decontamination approach would depend on the microbiological agents that were filtered out by the HEPA filter. No toxic releases will be made to the outside environment from the decontamination process.

2.2.3.5 HVAC

The Boston-NBL is incorporating a redundant design approach to the installation of the HVAC system. Each air handling system and corresponding exhaust system would incorporate multiple air handlers and exhaust fans. Each system would be sized to operate at full capacity with any individual unit out of service. This concept

would be carried into all HVAC support systems including refrigeration machines, boilers and steam service as well as heat exchangers for terminal reheat. These redundant systems would be operated in parallel under an integrated automatic control system. This integrated system arrangement would allow active control and compensation throughout the system. A system that experiences a failure under operating conditions would compensate by increasing the loads served by the remaining systems while isolating the failed unit from the system.

All laboratory ventilation systems would be single pass or 100% outdoor air units, with no air being re-circulated through the laboratory facilities. Under this design tempered "fresh" outdoor air is distributed throughout the building and the facility is constantly being supplied and simultaneously being exhausted at a predetermined rate. This air exchange rate, measured in air changes per hour (usually between 8 and 12 air changes per hour) provides a level of protection to the researchers by reducing the ability of laboratory agents or chemicals to build up concentration in the laboratory environment.

The integrated HVAC system provides a controlled indoor environment. The system allows the ability to adjust temperature and humidity (within selected laboratories) to parameters required by individual research requirements.

2.2.3.6 SYSTEMS MONITORING

The Boston–NBL is being designed with a fully integrated Building Automation System (BAS). All building HVAC systems would be controlled and monitored through this system. The BAS is a fully integrated computer control system. The system architecture consisting of a dedicated "head end" server, user workstations, and field panels would operate on a dedicated local area network. The building automation system would have the ability to operate in both automatic and manual modes through user interaction. The ability to control system operations would be limited to select individuals with security clearances.

All HVAC systems throughout the facility would be operated on the BAS, from the refrigeration plant down to the individual laboratory temperature controls. All systems would be controlled within the facility as well as outside of the building in the existing dedicated BUMC Control Center. All points on the system would be viewed and adjusted remotely by the dedicated BUMC Control Center Staff. The Control Center, a manned twenty four hours a day, seven days a week operation, would be responsible for monitoring building systems and coordinating maintenance response to abnormal operating conditions throughout the system.

2.2.3.7 FIRE PROTECTION

Fire protection systems in the Boston-NBL would be designed to meet existing code requirements for both the State of Massachusetts and the City of Boston. The fire suppression system for the facility is being designed to incorporate both traditional sprinklers and a water misting system for within the BSL-4 laboratory. The system would be designed to incorporate zones so that repairs and modifications may be made with minimal impact to the systems operation and coverage.

2.2.3.8 EMERGENCY ELECTRICAL POWER SYSTEM

Two 1,750 kilowatt (KW) emergency generators with emergency / standby switchboard are needed to support the standby requirements of the facility. Sufficient fuel storage would be available on site to run the emergency generators for 48 hours.

2.2.3.9 SEISMIC REQUIREMENTS

The Boston-NBL facility would be designed to the seismic performance requirements of the Massachusetts State Building Code, Sixth Edition. The code assigns Seismic Hazard Exposure Groups and Seismic Performance Categories to buildings depending on the nature of their occupancy.

The proposed facility would be classified as Seismic Hazard Exposure Group II, which includes buildings having substantial hazards due to occupancy and use. The Seismic Hazard Exposure Group II classification assigns Seismic Performance Category C to this facility.

Seismic forces, as provided in the code, are based on a predicted "Design Earthquake". The provision of Seismic Performance Category C assures that the building structure stays functional after an event.

2.2.3.10 DECONTAMINATION FACILITIES

Considering the variable and possibly unknown nature of agents to be used in containment facilities, decontamination of facilities, equipment, and personal protection equipment is as important as the research being performed within the facility. Within BSL-4 laboratories, researchers would be protected from accidental laboratory exposures by a positive pressure suit. The suits would be decontaminated prior to researchers exiting the containment laboratory. The researcher's primary exit mode would be via a decontamination shower, a contained shower unit isolated between the containment laboratory and change room by sequenced air pressure resistant isolation doors (or submarine doors). The shower, utilizing a liquid disinfectant that has been selected for its efficacy against the agents being used within the laboratory, uses a pre-validated shower and rinse cycle to disinfect the positive pressure suit as well as the chemical shower itself prior to the room being opened and being exposed to the non-contained environment.

As described above for the chemical shower, all access paths to the BSL-4 laboratories would follow a strict protocol of disinfection prior to access to the uncontained environment. In following the sequence from first opening a clean, previously disinfected passage, the outer access would be opened, the material placed in the pass, and the outer access sealed. The inner door can then be opened and the material accessed from within the containment. The inner door would then be resealed and the passage decontaminated. The disinfection method is dependent on the passage. The chemical shower or sterilizer would be put through a cycle prior to outer non-containment door being opened. A fumigation room would be utilized to transfer large equipment and would be decontaminated by either gaseous or aerosolized disinfectant.

The laboratory would be designed with multiple decontamination zones. These independent zones would allow the laboratory to be decontaminated in smaller sections, taking only the facilities that need to be decontaminated out of service and leaving the remaining ones in operation. The BSL-4 laboratory would be decontaminated by introducing gaseous or aerosolized disinfectant into the laboratory for a predetermined time period. After the facility has been decontaminated, previously inserted biological indicators would verify decontamination prior to allowing unprotected personnel access to the decontaminated facility.

WASTE DECONTAMINATION

No waste materials would be removed from the BSL-4 laboratory unless those materials are first autoclaved or decontaminated by a method approved and managed by the Boston University's Office of Environmental Health and Safety (OEHS). There are several materials that require special decontamination methods in order to assure safe removal from the BSL-3 and BSL-4 laboratories. These materials are biological samples needing further analysis, laboratory equipment, and laboratory clothing.

Biological materials that would be removed from the BSL-4 laboratories would undergo a decontamination process that would be validated using biological indicators. Once validated, electronic monitoring and charting of the processes would verify the decontamination cycle. These materials would be packaged in sealed containers that would circulate through a disinfectant dunk tank, fumigation chamber or an airlock in order to decontaminate the container. This material would then be irradiated using a gamma cell machine used to render various BSL-3 and BSL-4 organisms non-viable and, therefore, appropriate for research in BSL-2 laboratories.

Liquid wastes from BSL-4 laboratories have a special method to ensure two layers of decontamination. All liquid waste from the BSL-4 laboratories would first be decontaminated with a chemical disinfectant. This sterilized liquid would then be piped to a biowaste cooker and heated under pressure until the temperature reaches

121° C for at least 60 minutes. Decontamination would be verified via biological indicators and electronic monitoring and charting of the process. Once cooled to acceptable levels, the waste, with an estimated peak discharge of 4,800 gallons produced over an 8-hour operational period, would be discharged to the BWSC sanitary sewer system. Ventilation from plumbing systems would pass through a microbial filter prior to discharge to the atmosphere. The filters would be decontaminated and disposed of as appropriate.

Laboratory equipment or material that could be damaged by the high temperatures or steam of an autoclave may be decontaminated using gaseous or vapor methods in an airlock or chamber. Laboratory clothing would be removed by laboratory staff in an inner change room and then autoclaved before being removed from the laboratory for safe laundering services.

BUMC operates in accordance with all plumbing codes and MWRA regulations requiring that sinks in laboratories drain to a pH adjustment system, where pH, flow monitoring and water sampling take place. The Boston-NBL would have a plumbing system, which would carry laboratory waste water from every non-BSL-4 area to mixing tanks in the basement where pH adjustment and compliance sampling would occur.

2.2.3.11 ENERGY CONSUMPTION

NATURAL GAS

The Project would purchase natural gas from KeySpan Energy. The facility is designed to use either district steam or natural gas as the primary heating medium. There is currently a 30″ intermediate pressure main which runs the full length of the site in Albany Street. The anticipated gas requirement for the Boston-NBL is approximately 1,650 cubic feet per hour (cfh) when self-generating steam. Gas service would be provided by a natural gas service connection from Albany Street.

STEAM

The Project is capable of utilizing district steam as its heating medium. There is currently an existing 12″ steam line located beneath Albany Street south of East Newton Street. This service line was extended into the BioSquare Research Park development. The existing service would be extended to the Project site. Anticipated steam demand from the Project is approximately 19,300 pounds per hour.

ELECTRICAL

NStar Electric would provide electric service for the Project. An existing 13.8 kilovolt (KV) distribution system in Albany Street would be extended into the Project site. The building would be provided with secondary service at 480/277 volts from a secondary

spot network located within the building. Each spot network would include multiple transformers, each fed from a different 13.8 KV circuit to provide redundancy in the event of a primary feeder or transformer failure. Anticipated electric demand from the Project is approximately 8,900 Kva.

2.2.3.12 NOISE

An analysis of the Project's noise impact conducted for the 2003 BioSquare Phase II Draft Project Impact Report/Environmental Impact Report (Fort Point Associates, Inc., 2003) indicated that the Project would be in compliance with City of Boston and the Commonwealth of Massachusetts Department of Environmental Protection (DEP) noise regulations. During the final design of the Project, appropriate low noise equipment and noise control measures would be selected, as necessary, to ensure compliance with the City of Boston and the state DEP noise regulations at all nearby sensitive locations.

Design elements to reduce noise include:

- Selecting fans for exhaust and air handling units that can work adequately at their lowest possible speed to reduce fan noise;
- Installing a silencer or bank of silencers in the air-handling unit, in the exhaust ductwork or stacks, and in the emergency generator;
- Smooth transitions and elbows to limit turbulent airflow;
- Selecting quiet equipment;
- Conducting tests of the emergency generator during normal weekday working hours and not during quiet periods;
- Installing a muffler as part of the generator exhaust system;
- Provide sound attenuating generator enclosures; and
- Limiting the discharge air opening for the emergency generator to as small as feasible.

Existing sound levels at the closest sensitive locations in the Project area during the quietest period of the day (late night/early morning) were measured to range from 54 to 57 decibels. Future sound levels, with the Project and the described measures to reduce noise impacts, were predicted to be the same as the existing noise levels.

2.2.4 OPERATIONS

The Boston-NBL facility is designed with high level security as described in the Building Safety and Security paragraphs below. Seven security layers would extend from the first layer at the site's perimeter fence to the seventh layer of select agent storage areas within the building (select agents are any biological agent or toxin listed

in 42 CFR Part 73 and all select agents, researchers working with select agents and the BUMC will be registered with the CDC prior to possessing, transferring, or using a select agent). The security layers would be operationally assured using security officers, biometric and card access devices, closed circuit television cameras, automatic door locking systems and access alarms assigned or installed at each layer's barrier.

2.2.4.1 COMMISSIONING

Prior to occupation, the Boston-NBL facility would be commissioned in accordance with the NIH Commissioning Guidelines (U.S. DHHS 2005) and the Massachusetts State Building Code to ensure that all systems are operating according to design and required program. All mechanical systems and equipment would be tested to ensure proper operation as described in the System Testing paragraphs below.

Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and operational needs. The commissioning process would encompass and coordinate the traditionally separate functions of system documentation, equipment start-up, control system calibration, testing and balancing, performance testing, and training.

Commissioning during the construction phase is designed to achieve the following:

- Verify applicable equipment and systems are installed according to the manufacturer's recommendations and industry standards, and they receive adequate operational checkout;
- Verify and document proper performance as well as failure modes of critical equipment and systems;
- Verify that operation and maintenance documentation is complete; and
- Verify that operating personnel are adequately trained.

SYSTEM TESTING

The facility would undergo an extensive commissioning process. The objective of commissioning is to provide documented confirmation that a facility fulfills the functional and performance requirements of the building owner, occupants and operators. To obtain this goal, it is necessary for the commissioning process to establish and document the owner's criteria for system function, performance, and maintainability as well as to verify and document compliance with these criteria throughout design, construction, start-up and the initial period of operation.

During design, a tailored commissioning plan would be developed for an integrated system testing protocol. During the construction process, the commissioning agent

would witness and verify installation of equipment and witness factory startups. Upon substantial completion of the facility, each system would be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load and redundant, fail safe) where there is a specified system response. The operational sequences would be verified and tailored where applicable to produce the best system responses.

The following is a representation of building components and systems within the building's commissioning plan that would require development of custom testing protocols.

HVAC SYSTEMS

- Chillers
- Cooling Towers
- Heat Exchangers
- Boilers & Associated Equipment
- All Pumps
- Air Handling Units
- Laboratory Exhaust Fan Systems
- Humidifiers
- Space Heating Equipment
- Ventilation Fans
- Variable Frequency Drives
- Air Terminal Units
- Laboratory Air Valves
- Ductwork
- HEPA Filter Systems
- Piping
- Grills, Registers & Diffusers

LABORATORY SPECIALTY SYSTEMS

- Biowaste Decontamination System
- Breathing Air System
- Chemical Showers
- Tissue Digester System
- Pressure Testing Laboratory Suites
- Pneumatic Air Pressure Resistant Doors
- Air Pressure Resistant (APR) Windows

- APR Frames & Glazing
- Camera Bubbles
- Laboratory Equipment
- Environmental Rooms (Cold Rooms & Freezers)
- Specialty Gas Systems
- Animal Watering Systems

BUILDING AUTOMATION SYSTEM (BAS)

- Operator Work Station
- BAS Network
- Control Panels (Including System Controlled)
- Field Sensors & Devices
- Room Space Pressure Sensors
- Air Compressor

PLUMBING SYSTEM

- Plumbing Equipment
- Reverse Osmosis Water Systems
- Plumbing Fixtures & Trim
- Plumbing Piping
- Fire Pump

ELECTRICAL SYSTEMS

- Normal Power Systems
- Emergency Power Systems
- Grounding Systems
- Lightning Protection
- Un-Interruptible Power Supply
- Generators
- Automatic Transfer Switches
- Security
- Telecommunications

INTEGRATED SYSTEM TESTS

- Room / Laboratory Module Test
- Biowaste Decontamination System
- Fire / Life Safety System

- Normal Power Failure Test

2.2.5 BUILDING SAFETY AND SECURITY

BUMC security staff would provide building security. Security staff assigned to the Boston-NBL would undergo training with respect to the nature of the research, the risk associated with the building's unique emergency response protocols, and enhanced police academy training in addition to the significant ongoing training program currently in place. See Appendix 5 for the Boston-NBL Security Program and Emergency Response.

Within the facility, a combination of security systems and staffing would reinforce the access layers. The anticipated personnel required to staff the facility is approximately 660 workers, including research, security, safety, maintenance staff, and support personnel. Access to the BSL-3 and BSL-4 labs would be restricted to workers who have received appropriate immunization, if an immunization is available, and security clearances for the agents in use at the labs. Access to different areas or layers may require positive identification and signing in with a security officer, utilizing access control systems such as biometrics or proximity card technologies, requesting access with an authorized colleague, or a combination of these approaches. Work being performed within high level containment areas will be monitored by systems to ensure that there are two authorized persons in each area to minimize risk.

Other safety design features that would be incorporated into the building include:

- Locating the high containment laboratories outside of the general facility circulation;
- Positioning the high containment laboratories as a "box-in-a-box" where both gas-tight (pressure decay tested) physical and pressure differential barriers would separate high hazard areas from the outside;
- Isolating infectious biological agents within containment laboratories equipped with biological safety cabinets (the initial means of containment developed for working safely with infectious microorganisms, designed to provide personnel, environmental and product protection);
- Isolation workrooms, directional air flow and air pressure resistant doors; and
- Providing decontamination facilities including chemical showers, autoclaves, fumigation rooms, HEPA filters, and biowaste cookers to ensure that all personnel's garments, laboratory materials, exhaust air, and liquid effluent are decontaminated before leaving the BSL-4 high containment area.

2.2.5.1 LABORATORY SAFETY

The BUMC OEHS oversees a laboratory safety program that emphasizes prevention of illness and injury, promotion of safe work practices, and protection of the environment related to work with chemical and biological agents. Through this program, safety staff provides risk assessment, consultation and support to workers, supervisors, and management. Laboratory safety services include specialized safety training in chemical and biological safety, annual laboratory inspections, new laboratory setups as well as laboratory decommissioning services in collaboration with BUMC's Facilities Department. BUMC currently has policies and procedures in place to monitor and prevent worker exposure. These include a detailed medical surveillance training program, serum banking, and other procedures effective at prevention and monitoring of worker exposures. The Boston-NBL would have a comprehensive medical surveillance program which would be integrated into the current medical monitoring system. Compliance with local, state and federal regulations and the promotion of safe work practices for researchers and support staff is achieved through these services.

The laboratory safety program requires all personnel who work with chemical or biological hazardous materials to be aware of the hazards that are present, use appropriate personal protective equipment, and be trained in emergency response procedures. The OEHS Chemical Hygiene Plan includes procedures for laboratory use of chemically hazardous materials and the Integrated Contingency Plan includes protocols to be followed in the event of hazardous materials spills.

BUMC will comply with all federal, state and local regulations regarding rDNA use. Any research involving rDNA must be registered with the Institutional Biosafety Committee (IBC), and monitored by the OEHS Biosafety Officer. The Boston Public Health Commission has regulations governing the use of rDNA molecules by institutions in the City of Boston. The regulations require strict conformity with the National Institutes of Health Guidelines for Research involving recombinant DNA molecules as published in the Federal Register of May 7, 1986 and any amendments, revisions or substitutions that are made subsequently.

OEHS currently manages the Select Agent Program for BUMC. Under the Select Agent rule at 42 CFR Part 73, the DHHS regulates the possession of biologicals (bacteria, viruses, and toxins) that have the potential to pose a severe threat to public health and safety (U.S. DHHS, 2002c). BUMC requires all principal investigators proposing work with any select agents be registered through the CDC or USDA.

Standard measures would be in place for personnel protection. All laboratory personnel would be trained in safety measures including potential hazards associated with the work. If an agent-specific immunization is available, laboratory personnel

would receive immunizations for agents handled or potentially present in the laboratory. Laboratory equipment would be surface-decontaminated on a daily basis, including following lab procedures, and prior to the performance of any maintenance or repairs. A surveillance system would be installed to monitor areas where critical substances are collected and/or stored.

BUMC provides annual laboratory training as a minimum standard and increases training frequencies depending upon the type of work being done in each specific laboratory. BUMC would determine the levels of training necessary to ensure that all employees are compliant with and fully knowledgeable of all regulations. Regulatory authorities would ask for training rosters and levels of competency and would interview employees to determine if training, education and knowledge are appropriate.

All persons who would work in the BSL-3 and BSL-4 laboratories would be required to undergo additional specialized training. Individuals requiring the use of radioactive materials in their research would receive prior authorization from the BUMC's Radioisotope Committee.

A training area would be provided to support training programs for laboratory practices and safety protocols in high containment laboratories. The block would include a seminar room, a mock BSL-4 laboratory, and viewing windows into the operating high containment suite. Once trained in lab procedures and wearing a positive pressure suit, laboratory workers would enter the main BSL-4 laboratory in order to shadow trained staff until they demonstrate proficiency in entering, exiting, and working in the facility. Locker rooms and showers would be provided for all BSL-3 and BSL-4 laboratories. In the BSL-4 laboratory, workers would be required to remove all personal clothing and wear only approved laboratory clothing and positive pressure suits. Prior to exiting the BSL-4 laboratory, workers would be required to take a chemical shower to decontaminate the positive pressure suits. Following the chemical shower, workers would remove their positive pressure suit and all laboratory clothing and take a personal shower. No suits or laboratory clothing would be removed from the facility without going through proper decontamination.

Access to the BSL-4 laboratory would be restricted to people whose presence is required and authorized. Strict operational protocols would be imposed on laboratory personnel including specific training and background checks prior to working in the facility. Positive pressure, lockable doors would be monitored and controlled by the security system. A log of persons entering and exiting the laboratory with name, time, date, and reason for entering the lab would be maintained, and the log would be frequently audited by BUMC's OEHS professionals, as well as Security Officers assigned to the lab.

2.2.5.2 BUILDING SECURITY

Furthermore, access to the Boston-NBL would be strictly controlled by the following measures:

- Background and security checks on all employees prior to being assigned to a laboratory area;
- Security Officers on duty 24 hours per day;
- Multiple security layers including perimeter fencing around site and controlled access;
- Photo identification badges;
- Security cameras;
- Biometric systems; and
- Screened and secure deliveries.

As mentioned, the building has been designed to incorporate significant security systems as well as redundant utility systems. Continuing systems maintenance procedures would be instituted to insure a high level of reliability of the safety infrastructure.

2.2.6 TRANSPORT OF SELECT AGENTS

Infectious substances have specific shipping and transport requirements regulated by several federal agencies. The definition of an infectious substance is a viable microorganism or toxin that causes or may cause disease in human beings or animals. These substances include Select Agents listed under the DHHS Select Agent rule (U.S. DHHS 2002c) and any other agent that causes or may cause some disabling or fatal disease.

The Boston-NBL facility would include work on a variety of infectious agents at BSL-2, BSL-3 and BSL-4 laboratories. The agents to be used in these laboratories would be transported according to the strictest federal regulations for identification of materials, packaging, labeling, documentation, personnel training, transport and final receipt of materials. Several federal and other government agencies including the U.S. Department of Transportation (DOT), International Civil Aviation Organization (ICAO) (an organization promoting cooperation in the development of uniform standards and practices for civil aviation), DHHS, USDA and the U.S. Postal Service (USPS) strictly regulate the shipping and transport of infectious substances. Transportation of materials to and from the Boston-NBL would follow all regulations for shipping packages.

The packaging, labeling, and transport of etiologic agents are regulated by 42 CFR 72 (Interstate Shipment of Etiologic Agents); 49 CFR 172 and 173 (U.S. Dept. of Transportation regulations concerning shipment of hazardous materials); 9 CFR 122 (U.S. Dept. of Agriculture [USDA]-Restricted Animal Pathogens), and International Air Transport Association (IATA) rules. In addition, special rules apply for the transport of materials regulated by the U.S. Food and Drug Administration (21 CFR 312.120, Drugs for Investigational Use in Laboratory Research Animals or in Vitro Tests). Recent legislation – the USA PATRIOT Act, and the Public Health Preparedness and Bioterrorism Response Act of 2001 – have further strengthened the regulations controlling transport of certain etiologic agents, referred to as Select Agents, to include controls over possession and use. Boston-NBL will be registered with the Centers for Disease Control and Prevention and the USDA for possession, use, and transport of these agents. A Responsible Official will be designated at Boston-NBL and approved by the regulating agencies to oversee the shipping, receipt, and usage. These individuals are subject to security risk assessments performed by the Federal Bureau of Investigation. Packaging requirements are strictly implemented in accordance with IATA regulations.

There have been no cases of illness attributable to the release of infectious materials during transport, worldwide, although incidents of damage to outer packaging of properly packaged materials have been reported (World Health Organization 2002; U.S. DOT 2001).

The risk to the community surrounding the Boston University and specifically the Boston-NBL from transport of infectious agents or other biologically-derived material is negligible.

The BUMC OEHS recently updated its High Hazard Material Management (HHMM) Policy governing shipping of materials determined to be high-risk (see Appendix 7 - High Hazard Material Management (HHMM) Policy). This policy applies to all select agents. OEHS would be responsible for the management of hazardous materials shipping, receiving and transportation in accordance with federal guidelines. OEHS and the BUMC Office of General Services (OGS), through its Security Investigations Unit, would determine the appropriate locations for the receipt, storage and shipping of packages determined to be potentially high risk. This location would have a specially trained OEHS staff member assigned to receive and ship OEHS-authorized materials, and the location would be routinely audited by the BUMC Security Manager and the OEHS Biosafety Manager. OEHS would train appropriate Boston-NBL personnel in the laws, regulations, polices, and requirements involved in the shipping and receiving of materials determined to be high risk and the approved procedures for packaging of materials, the contracted services to be used, and the

penalties of failing to follow all aspects of this policy. OEHS would manage the tightly controlled, pre-approved scheduling of shipment and delivery times.

BUMC requires adherence to a stringent protocol for the transfer of biological agents, and no agents may be transported without significant advance notification. The BUMC OEHS, along with the Institutional Biosafety Committee, must first authorize approval for the use of the agent. If an agent is approved for use, the investigator may submit for the transfer of the agent to OEHS. Both the personnel and the facility are then reviewed by OEHS and the sending institution, and submitted to the appropriate federal authority (CDC or USDA) for review. Upon subsequent approval by the federal authority, the transfer process can be initiated. The OEHS HHMM Policy defines the roles and responsibilities for each office in the shipping process. The HHMM Policy requires federal background checks for all transporters, as well as OEHS personnel handling the receipt of these packages. OEHS and OGS would ensure that all staff involved in the high-risk materials shipping and receiving areas would undergo a background clearance check, as appropriate, consistent with the Select Agent law requirements prior to being approved to work in these locations.

Transportation of infectious agents occurs by air, sea, or land depending on where the agent is located and method of transport available. All personnel throughout the process of transport, from shipper, transporter, to receiver, would be thoroughly trained in the process. Such training teaches employees how to recognize improperly packaged or labeled boxes and how to respond to emergency situations.

The receiving and shipping location(s) for select agents would have a designated route to and from BUMC utilizing the local and interstate highway system and would avoid residential streets. These routes would be mandated at all times when materials determined to be high risk are en route to or from BUMC.

2.2.6.1 DOCUMENTATION

Prior to shipment of any infectious agent, shippers would be required to coordinate with the OEHS regarding all appropriate shipping documentation. Shippers would complete a Shippers Declaration Form and submit three original copies to the transporter for review. Original documentation of every shipment would be kept by the shipper, transporter, and receiver at each facility for every infectious substance package shipped or received by a facility.

2.2.6.2 TRANSFER OF BIOLOGICAL AGENTS

Any agent listed and defined under the select agent rule in 42 CFR 73 must be formally processed for facility transfer, using a form called an EA-101. This form is completed and sent to the transferring institution, which then sends the paperwork to the CDC or USDA for verification. In order to be in full compliance with the select

agent rule, no facility may transfer or accept agents without prior approval of the CDC, and if approved, agent transfer is limited to organizations that are formally registered with the CDC. Facilities that have animal or plant pathogens must contact the USDA for all facility transfer approvals. Once the CDC or USDA approves the transfer, the material is shipped to the requester in accordance with the strict shipping requirements described in this section.

All packages determined to be high risk in accordance with BUMC policy would be managed at a special shipping station. Once packages are received, OEHS would inspect, verify, document and transport the high hazard materials to the appropriate location within the Boston-NBL. Transport from the receiving location into the Boston-NBL would be completed using a secure BUMC vehicle and would include OEHS or BUMC security personnel. Supplies and materials for the BSL-3 and BSL-4 laboratories would then be transported through a double-door autoclave, fumigation chamber, or airlock, which would be decontaminated after each use. Biosafety cabinets would be used for the inspection of packages and locked refrigerators or freezers would be used to secure those packages once in containment.

All bacteriological, virological, and toxic laboratory materials would be packaged and labeled in accordance with all applicable federal, state and local regulations when shipped.

2.2.6.3 TRAINING

Under the requirements of DOT, all shippers, transporters, and receivers of infectious substances must receive training every three years. Under the International Civil Aviation Organization (ICAO) regulations however, such training is required every two years.

Boston-NBL employees that ship or receive infectious substances would be required to undergo training every two years to ensure compliance with the transportation guidelines and regulations. Such training is currently offered at BUMC to meet the requirements of both DOT and ICAO and includes information on facility policies and procedures, the proper packaging, labeling, and documentation of materials to be mailed, and other information on safety procedures and notification systems to confirm package receipt.

2.2.6.4 PACKAGING

All materials would be packaged according to DOT regulations, including the basic requirement for triple packaging of each substance. The outer package would comply with particular tests for leakage, durability and safety, including a drop test of 1.2 meters, pressure test of 14 pounds per square inch (95 kPa), and temperature tolerance range of 40° Fahrenheit (F) to 131°F (4.4° Celsius (C) to 55°C).

2.2.6.5 LABELING AND MARKING

Also in accordance with DOT regulations, each transport box must clearly indicate the material being shipped and whether it affects humans or animals. For example, a box containing a sample of rabies virus would be labeled "Infectious substance affecting humans (rabies)." Required markings include a diamond shaped biohazard symbol, containing the words "infectious substance", and if shipping on dry ice, a diamond-shaped symbol with seven black stripes indicating presence of dry ice as a refrigerant for the infectious material.

2.2.6.6 NOTICE OF DELIVERY

For infectious agents under the select agent rule, received packages have a very specific notification scheme. The recipient must confirm receipt by telephone to the shipper, and then complete the required information in the EA-101 form. This form must be sent to the CDC within 24 hours of package receipt and should also be sent to the shipper. If the material is not a select agent, then the shipper is notified of receipt.

2.2.7 EMERGENCY RESPONSE

BUMC already has a very sophisticated emergency response plan which incorporates an Incident Command System (ICS). The program-planning group works closely with local response agencies including the Local Emergency Planning Committee, which is chaired by the Boston Fire Department, and whose membership includes public and private representation from utility providers, healthcare, emergency response and a variety of municipal agencies. BUMC is currently one of two hospitals represented on the Executive Board of the Metropolitan Medical Response System (MMRS), chaired by the Chief of Boston Emergency Medical Services (EMS).

In addition to participating in these committees, BMC has the largest Level I Emergency Department (ED) Trauma center in New England. The ED, which is located two blocks from the proposed Boston-NBL facility, sees over 117,500 patients annually and includes a dedicated isolation/decontamination facility for patients with biological, chemical or radiological contamination. The facility is equipped to decontaminate victims of a hazardous materials incident providing Level B and Level C protection for its hazardous materials decontamination team. Level B protection includes supplied air respiratory protection with protective suits including Tyvex, Barricade, and Sarinex brand suits. The facility is staffed by trained ED personnel and monitored by a Disaster Coordinator and the OEHS. The staff is trained under the Occupational Safety and Health Administration's (OSHA) Hazardous Waste Operations and Emergency Response (29 CFR 1910.12) standard. The decontamination room contains supplied air for up to 12 staff (eight outside connections and four inside connections), dedicated exhaust, a heated water supply

system and wastewater rinse and collection. Level B and Level C personal protective equipment is on-site should the incident warrant that level of protection. The Level C protective equipment includes various types of chemical resistant suits and power air purifying respirators. A minimum of four trained BUMC ED staff are on duty at all times. Disaster drills have been conducted as recently as May 2004, in conjunction with the local emergency response agencies.

BUMC also has a detailed Disaster Plan, which includes specific plans for eleven different hazards, including biological emergencies. The Biological Emergency Plan contains a biological event-reporting algorithm as well as fact sheets on five specific select agents, namely: anthrax, plague, Ebola virus, smallpox, and Botulinum toxin. BUMC has recently amended a higher-level disaster plan called the Phase D Disaster Plan in light of the September 11 events, to deal with large-scale off-campus mass casualty events. BMC's dedicated Disaster Coordinator is responsible for coordination of disaster drills, hospital staff training, and disaster management in the event of an emergency. The Coordinator, through BUMC's ICS, is the liaison to local emergency response agencies including the Boston Public Health Commission (BPHC) during disaster events. The Coordinator chairs a Disaster Committee, which provides a forum for discussion and evaluation of plans and response effectiveness. Following every disaster drill, a formal critique process is held to determine if improvements to the system can be made.

2.2.7.1 EMERGENCY RESPONSE PLAN

An Emergency Response Plan for the Boston-NBL facility would be developed in conjunction with the disaster coordinator, facility administrators, investigators, laboratory and OEHS, BUMC staff and the NIH safety and security personnel to address the specifics of the Boston-NBL facility. Local police, fire and other emergency responders would be informed of the types of biological material used in the laboratory and consulted in the preparation of an Emergency Response Plan to address the following:

- Evacuation
- Room clear
- Shelter in place
- Lockdown
- Dangerous person on site
- Suicide threat or attempt
- Death, serious injuries or medical condition on site
- Fire or explosion
- Hazardous materials spill

- Bomb or suspicious device
- Bomb threat
- Earthquake
- Civil disturbance
- Severe weather conditions
- Utility Failures / electrical outage
- Blood borne pathogen exposure
- Medical assessment procedure
- Emergency communication for use in extreme emergencies
- Radiation spill on body
- Chemical spill on body
- Biological spill
- Suspicious packages or mail
- Elevator failure

At the local level the Boston-NBL would directly link to the BPHC by having the Communicable Diseases Section of the BPHC participate on the Boston-NBL's External Advisory Board. The BPHC is currently developing the Boston Emergency Preparedness Training Institute to provide free, competency-based training to key public health professionals, infectious disease specialists, emergency department staff, EMS providers, and public safety professionals from the eastern region of the Commonwealth of Massachusetts on bioterrorism, disaster, and large-scale emergency response.

The laboratory staff of the Boston-NBL would be cross-trained to rapidly assess the identity of environmental samples as well as how to report these results directly to public health officials through the development of a secure, web-based laboratory reporting system. The Boston-NBL would partner with local, state and federal public safety and emergency management agencies to increase reporting efficiency and develop a more uniform context for action relating to emergency response triage, public health decision-making and external communications.

2.2.7.2 INCIDENT REPORTING AND PROTOCOLS

BUMC already has several incident reporting and protocol systems in place. Policies and procedures have been developed by BUMC for reporting incidents involving hazardous materials in accordance with local, state, and federal laws and standards. The Integrated Contingency Plan (ICP) would be updated prior to occupancy of the Boston-NBL and is reviewed and updated any time that a change in protocol, personnel or equipment is needed. These changes typically occur annually. The

updated plan would provide specific information on how hazardous materials incidents specific to this building would be handled. It would also outline the reporting protocol to local, state, and federal agencies. These reports would be communicated to appropriate regulatory authorities, including the U.S. Environmental Protection Agency, the Massachusetts Department of Public Health (DPH), the Massachusetts Department of Environmental Protection and the Boston Fire Department, and reviewed and disseminated to the public as necessary. This system would work similar to the existing communication plan executed during citywide emergency events. The Incident Command System (ICS) would be activated for all BUMC events to effectively communicate to internal response personnel, staff, and local emergency responders. The ICS is reviewed and updated on an ongoing basis due to the need for continuous testing of emergency response systems and protocols in a 24 hour a day, 7 days a week urban academic medical center environment.

2.2.8 POLLUTION PREVENTION

2.2.8.1 SPILL PREVENTION

An ICP has been prepared by BUMC pursuant to the Environmental Protection Agency's (EPA's) Oil Pollution Prevention Regulations (40 CFR 112), EPA's Hazardous Waste Regulations (40 CFR 260-265), and the state DEP's Hazardous Waste Regulations (310 Code of Massachusetts Regulations (CMR) 30.000). The ICP is updated regularly and the Boston-NBL would be incorporated into the plan.

The purpose of the ICP is to establish preparedness, prevention, planning, spill response, and spill notification procedures as set forth in the applicable state and federal regulations related to hazardous waste and oil management. It identifies the procedures and equipment implemented and maintained by BUMC to prevent and to minimize hazards to public health, safety, or welfare of the environment from fires, explosions, or any other unplanned sudden or non-sudden release of hazardous waste, hazardous waste constituents, or oil to air, soil, surface water or groundwater, and activities and guidelines to be implemented to mitigate these situations should they occur. The Plan also details the procedures implemented to prevent spills/releases of oil or hazardous waste that violate applicable water quality standards.

As required by 40 CFR 112, 40 CFR 265.55 and 310 CMR 30.521, BUMC has appointed Primary and Alternate Emergency/Spill Prevention Controls and Countermeasures (SPCC) Coordinators for the facility. The Primary Emergency/SPCC Coordinator is directly responsible for the implementation of this Plan and all policies and procedures described in the Plan. The Emergency/SPCC Coordinator and Alternate Emergency/SPCC Coordinators have been authorized by BUMC to implement the Plan and utilize any resources described within the Plan to minimize

the hazards to human health or the environment from a fire, explosion, or spill/release of oil or hazardous waste. The Alternate Emergency/SPCC Coordinators assume the responsibilities of the Primary Emergency/SPCC Coordinator in his/her absence. The Primary and Alternate Emergency/SPCC Coordinators for the facility, and their respective phone numbers and addresses, are identified on the Emergency Contact List of the Plan. Specific responsibilities of the Primary and Alternate Emergency/SPCC Coordinators include:

- coordinating the amendment and distribution of the Plan;
- conducting the ICP training program;
- directing response efforts;
- assess human health and environmental hazards and impacts;
- assess spill/release to determine if external reporting is required and/or if spill contractor is needed;
- initiating/coordinating incident response and communicating required follow-up actions;
- conducting follow-up notifications with outside agencies;
- initiate/coordinate sustained actions;
- initiate/coordinate termination and follow-up actions;
- implementing identified corrective actions; and
- ensuring the allocation of necessary resources (e.g., manpower and equipment) to address site-specific ICP implementation issues.

A copy of the Table of Contents for the ICP is provided in Appendix 8 as a reference to the scope of the plan.

2.2.8.2 WASTE MANAGEMENT PRACTICES

Current waste management practices at BUMC are laboratory-specific and dependent on the waste streams generated by individual BSL-1, BSL-2 and BSL-3 laboratory activities. In general, disposal of waste is particular to the organisms or standard operating procedure of the research group, but in general the following principles apply:

- Cardboard boxes lined with red biohazard bags are provided in every clinical and research lab at BUMC for all biohazard waste; and
- Sharp containers are also provided specifically for needles, syringes, and scalpel blade disposal.

There would be approximately 28,750 pounds of solid waste volume generated monthly for the Boston-NBL. Solid waste would include all non-hazardous waste

generated from offices and maintenance areas, including recyclable materials. In addition to normal solid waste, the Boston-NBL would generate three types of special waste: biological waste, radioactive waste and hazardous chemical waste. The use, storage and disposal of all solid and special waste would be performed in accordance with state and local regulations. All contaminated solid wastes would be treated prior to disposal including all wastes from the BSL-4 laboratory. Pre-disposal treatment would include alkaline hydrolysis. The waste disposal program is further described on pages 2-31 through 2-33 below.

SPECIAL WASTES

In addition to normal solid waste, the Boston-NBL would generate three types of special waste: biological, radioactive and hazardous chemicals. The use, storage and disposal of all special waste would be performed in accordance with state and local regulations. All contaminated solid wastes would be treated prior to disposal including all wastes from the BSL-4 laboratories.

BIOLOGICAL WASTE

The proposed Boston-NBL would have a separate waste management system, which would only be integrated with the current BUMC system in the final steps of the process. The proposed system would include a multi-sterilization system for BSL-3 and BSL-4 facilities, tissue digesters for animal waste, and a dedicated liquid effluent decontamination system.

The range of monthly biological waste volumes for the Boston-NBL is estimated to be 7,500 to 9,500 pounds. Biological waste would be disposed of in strict compliance with the DPH State Sanitary Code Title VIII (105 CMR 480.00), the Massachusetts Solid Waste regulations (310 CMR 19.000) and Section 2.01 of the BPHC Regulation titled "Waste Container Lot, Junk Yard, and Recycling Facilities." These regulations require written manifests.

The multi-sterilization system for the BSL-3 and BSL-4 laboratories would include five large autoclaves and 11 medium autoclaves. Animal carcass materials would be placed on rack sterilizers for easy entry/exit of large materials while smaller autoclave models would be used for general laboratory waste. Once waste material has been autoclaved in biodegradable bags and removed from the BSL-3 and BSL-4 contained space, all animal carcass waste would be placed in the tissue digestion system and undergo alkaline hydrolysis for final processing. This process uses heated caustic solutions to completely digest and disinfect biological matter that might be infectious.

A dedicated liquid effluent decontamination system would treat all liquid wastewater from the BSL-4 facilities, including both autoclave drains and chemical disinfectant wash waste. The liquid waste would be plumbed through a dedicated drainage

system directly into the cook tanks for processing prior to discharge to the municipal sanitary system.

The BSL-2 laboratories would use the current system of bagging biohazardous waste and shipping the material off-site for incineration, using a licensed third-party contractor. In all cases, BSL-3 research waste would be autoclaved onsite prior to shipping for off-site incineration. Laboratories would be responsible for autoclaving the waste material prior to shipment. Following completion of laboratory work in the BSL-3 facilities, workspace areas would be disinfected using a newly prepared 1:10 bleach solution or other OEHS-approved disinfectant.

RADIOACTIVE WASTE

Radioactive waste generated at the Boston-NBL would consist primarily of solid waste such as paper, plastic and glass contaminated with trace amounts of radioactive isotopes (radioisotopes). It is expected that the facility would generate about 10 to 15 pounds of radioactive waste each month, which is typical of such research facilities.

Radioactive waste is strictly regulated by the Massachusetts DPH, Radiation Control Program. On March 21, 1997 the state of Massachusetts became an Agreement State with the Nuclear Regulatory Commission (NRC) and was granted regulatory authority over the use and disposal over byproduct radioactive materials. The NRC issues facility-based radioactive material licenses for the management of radioactive waste and the facilities are inspected on an annual basis.

BUMC's Radioisotope Committee oversees the disposal and management of radioactive waste. Any waste containing biological agents would be deactivated biologically (as described in the previous section) prior to treatment as radioactive waste. Researchers typically place radioactive waste in labeled, special containers at the point of generation, and contact the BUMC's Radiation Protection Office (RPO) when the special container is filled. An RPO representative then removes the waste, obtains a list of materials placed in the container, and manifests and transports the container to a licensed radioactive waste storage facility for storage and handling. All records associated with radioactive waste, beginning from waste collection to final disposition, are maintained by the RPO.

The radioisotopes include both long-lived and short-lived radioisotopes. Long-lived radioisotopes require disposal off-site, such as at the Duratek site in Barnwell, South Carolina. Waste contaminated with short-lived radioisotopes would be held on-site in BUMC's decay-in-storage facility for periods ranging anywhere from one week to not more than 2¾ years, depending on the radioisotope's half-life, to wait for complete decay and subsequently disposed as non-radioactive sanitary waste.

HAZARDOUS WASTE

The generation of hazardous chemical waste at the entire Boston-NBL facility has been estimated based upon biological laboratories in comparable sized facilities at BUMC. Approximately 10-15 containers would be generated per month including the following typical waste streams with estimated monthly volumes generated:

Flammable Liquids:	400-600 lbs.
Flammable, Toxic Liquids:	300-400 lbs.
Corrosive Liquids:	50-100 lbs.
Oxidizing Liquids:	20-40 lbs.
Ethidium Bromide Solids:	100-150 lbs.

The Boston-NBL would obtain a U.S. EPA identification for hazardous waste generation and would be subject to all the federal and state "cradle-to-grave" regulations for container management, shipping and disposal. The existing BUMC campus-wide ICP, Waste Minimization Plan and Recycling Program would be modified to incorporate the Boston-NBL facility. The BUMC OEHS would manage all regulatory documentation including shipping manifests.

2.2.9 TRANSPORTATION DEMAND MANAGEMENT

Transportation Solutions for Commuters (TranSComm) is the Transportation Management Association (TMA) for the Boston University Medical Center and BioSquare. The TMA, established in 1993 in association with BioSquare Phase I implementation, is one of the oldest and most effective TMAs in the Boston area. Over the years, the continuing efforts of TranSComm, with the support of University Associates and BUMC administration, have yielded a reduction in Single Occupant Vehicle use from 70 percent in July 1993 to 48 percent in 2003, as measured by employer surveys. This is a significant reduction of 31 percent over about 10 years. Over the same time period, transit use increased from 17 percent of mode share up to 40 percent. Walking increased from 3 to 4 percent, and ridesharing dropped from 11 percent to 8 percent. Over the years, TranSComm has been active in helping its members implement a variety of Transportation Demand Management (TDM) measures. These programs, which are described in more detail in the following paragraphs, include parking management and pricing, transit pass subsidies, shuttle bus service to Massachusetts Bay Transportation Authority (MBTA) stations and other destinations, car pooling, van pooling, bicycling, car sharing, flex time, telecommuting and guaranteed ride home. Membership in TransComm would be part of the TDM implementation plan for the NBL.

TransComm is the Transportation Management Association (TMA) for the BUMC and BioSquare Research Park. The Project would participate in TransComm's TMA measures including:

- Reduce off-street parking and charge reasonable fees.
- Participate in MBTA transit pass subsidies for employees.
- Participate in MBTA transit pass subsidies for students.
- Continue evening shuttle bus service to the MBTA's Orange and Red line stations.
- Participate in additional free shuttle services described in Chapter 3.
- Continue working with State Ridesharing Agency to provide carpooling and vanpooling.
- Provide bicycle spaces at nearby sites.
- Provide Zipcar opportunities for car sharing.
- Encourage flex time and telecommuting.
- Provide Guaranteed Ride Home for carpool and vanpool commuters in case of an emergency.
- Continue to participate in Transportation Demand Management (TDM) programs to reduce single occupant vehicle use.

Furthermore, the Project would work with the Boston Transportation Department (BTD) to finalize a package of transportation improvements to be implemented as part of the traffic mitigation for the overall buildout of the BioSquare Research Park including the following:

- Right-turn-in, right-turn-out site driveway at Southbound Frontage Road;
- Modification of the East Newton Street/Albany Street intersection as a four-way intersection, including associated traffic signal upgrades;
- Improvements at East Concord Street/Albany Street, including any required traffic signal upgrades;
- A traffic and parking management plan for Albany Street between East Newton Street and Union Park Street. Subject to BTD approval, the plan would convert Albany Street to a 3-lane cross-section that typically consists of a single travel lane in each direction and a center left-turn lane. No widening of the street is proposed. The plan would also include recommendations for changes to the existing on-street parking regulations.
- Installation of fiber optic communications cable and conduit within the Albany Street sidewalks that are scheduled to be rebuilt as part of the BioSquare Project;
- Directional signage for employees, hospital patients, and visitors on and near the campus;
- The provision of up to 2 variable message boards in the area to provide opportunities for real-time traffic information.

2.2.10 CONSTRUCTION MANAGEMENT PLAN

The Project would work with the BTD to develop a Construction Management Plan (CMP) to minimize such impacts. The Plan would detail measures to ensure the maintenance of existing levels of service on adjacent roadways during the construction of a project and to minimize disruption in the area. The CMP will be submitted to BTD for approval as text with an accompanying plan prior to obtaining a building permit from the City of Boston Inspectional Services Department. The CMP will address work phasing with specific provisions for activities such as site preparation and deliveries. A separate CMP will be devised for each phase if such phases are determined to be substantially different in terms of site set-up and/or operations. The CMP will specifically address coordination issues between the BioSquare Phase I Building D, which is currently under construction, the proposed roadways and the proposed parking garage. The plans will include provision of jersey barriers, fencing, pedestrian walkways, pavement marking and on-street parking, to ensure safe and efficient movement through the work area. All existing traffic control devices affected by the work will be noted. In addition to access, storage, and queuing, the CMP will also show truck-maneuvering paths to and within the site. The location of any incidental equipment, such as cranes or concrete pumps, will also be shown on the plans. Potential off-site areas and locations adjacent to the site for truck staging will be investigated and identified if required by the City.

The Project would also comply with the City of Boston and the state DEP's air and construction noise regulations and DEP's Diesel Retrofit Program for Construction Vehicles. The DEP Diesel Retrofit Program for Construction Vehicles includes the use of retrofitted equipment and/or cleaner diesel fuel. Electric welders would be used and no diesel powered generators would be used unless for emergency reasons. The exhaust system of all heavy equipment including excavators and cranes would be modified with scrubbers if they were to remain on site for more than two months. All diesel equipment would utilize low sulfur fuel. All diesel equipment would be equipped with a mufflers and sound shrouds / shields.

2.3 PROJECT ALTERNATIVES

Alternatives to the Proposed Action are limited to No Action and actions that were considered but eliminated from further consideration. These alternatives are discussed below.

2.3.1 NO ACTION

Under the No Action Alternative, the Boston-NBL would not be built.

2.3.2 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

This section discusses three alternatives to the Proposed Action that were identified during the public scoping process, considered and subsequently eliminated from further review. These alternatives provide no environmental advantage over the Proposed Action or No Action, do not meet the purpose and need of the Project, or are not suitable given the programmatic and siting criteria stated below. These alternatives include:

1. Locations outside Massachusetts or lower density areas outside of Boston
2. Alternative location for the BSL-4 facilities

BACKGROUND

BUMC undertook a comprehensive analysis of potential site alternatives prior to submitting a proposal to NIH in response to the Broad Agency Announcement (BAA) issued on October 15, 2002 (U.S. DHHS, 2002b). This section reviews the programmatic and siting criteria used by BUMC to select the preferred site and provides further information regarding the above alternatives.

PROGRAMMATIC CRITERIA

Criteria that were used by BUMC to determine appropriate sites included:

- Meeting NIAID's national research goals,
- Incorporation of existing BUMC institutional programs and objectives,
- Use of existing medical research facilities,
- Support for the research of other institutions in the greater Boston area, and
- Partnership with the Harvard University Medical School's NIAID-sponsored Regional Center of Excellence (RCE).

SITING CRITERIA

Sites for the proposed NBL were evaluated if there was a reasonable expectation that a facility could be constructed with the available funding, in a reasonable time, and while meeting federal safety criteria. To meet these constraints, two minimum siting criteria were established:

1. The site must be controlled (owned or currently leased) by Boston University (to remain within funding and timing constraints); and
2. The lot size must be sufficient to accommodate a minimum building size of 190,000 sf and at the same time meet federal security setback requirements (to meet federal safety criteria).

The lot size criterion was established around the proposed program for the facility, which requires a building of approximately 190,000 sf including research laboratories, support space and mechanical space. This building form could be a mid-rise vertical structure or a low rise horizontal structure, depending on soil conditions, land values, availability of nearby employee parking and public transit and local zoning constraints. For urban sites, it was assumed that a 7 story, 26,500 sf footprint building with off site parking and nearby public transit would require a lot size of at least 60,000 sf. The actual lot size required could be substantially larger due to the required setbacks of approximately 150 feet from adjacent vehicular ways and, if applicable, 100 feet from pedestrian areas.

A second tier of site evaluation was developed for those sites that met the two minimum siting criteria listed above. The second tier criteria addressed other BUMC locational and programmatic objectives deemed necessary to make the proposal nationally competitive and institutionally feasible from a medical, research, and teaching perspective. These objectives included the following:

- Proximity to the proposed Harvard University Medical School's NIAID-Sponsored Regional Center of Excellence
- Ease of access to and use of existing medical research institutions/research facilities, opportunities for efficient medical research collaboration and ability to function as a training center (see "Figure 2-5. Location of Nearby Research Facilities").
- Proximity to a trained workforce
- Proximity to state of the art emergency response programs and facilities including police, fire, public health and medical trauma
- Proximity to interstate highway systems and a regional airport
- Presence of adequate public infrastructure including water and sewer
- Facility use and building dimensions allowed under local zoning
- Siting achieves Smart Growth objectives (locating new development near existing transit and utility infrastructure and redeveloping brownfield sites).

2.3.2.1 ALTERNATIVE LOCATIONS OUTSIDE MASSACHUSETTS OR LOWER DENSITY AREAS OUTSIDE OF BOSTON

Some commentors suggested that the Boston-NBL facility be located outside of Massachusetts or in a lower density area outside of the City of Boston.

Boston University has several landholdings in Massachusetts and New Hampshire, as shown on "Figure 2-6, Boston University Controlled Properties". These sites include: the BUMC campus and the BioSquare Research Park located in Boston's South End, the main campus of Boston University at the Charles River campus, the Corporate Education Center in Tyngsborough, MA, and the Sargent Center for Outdoor

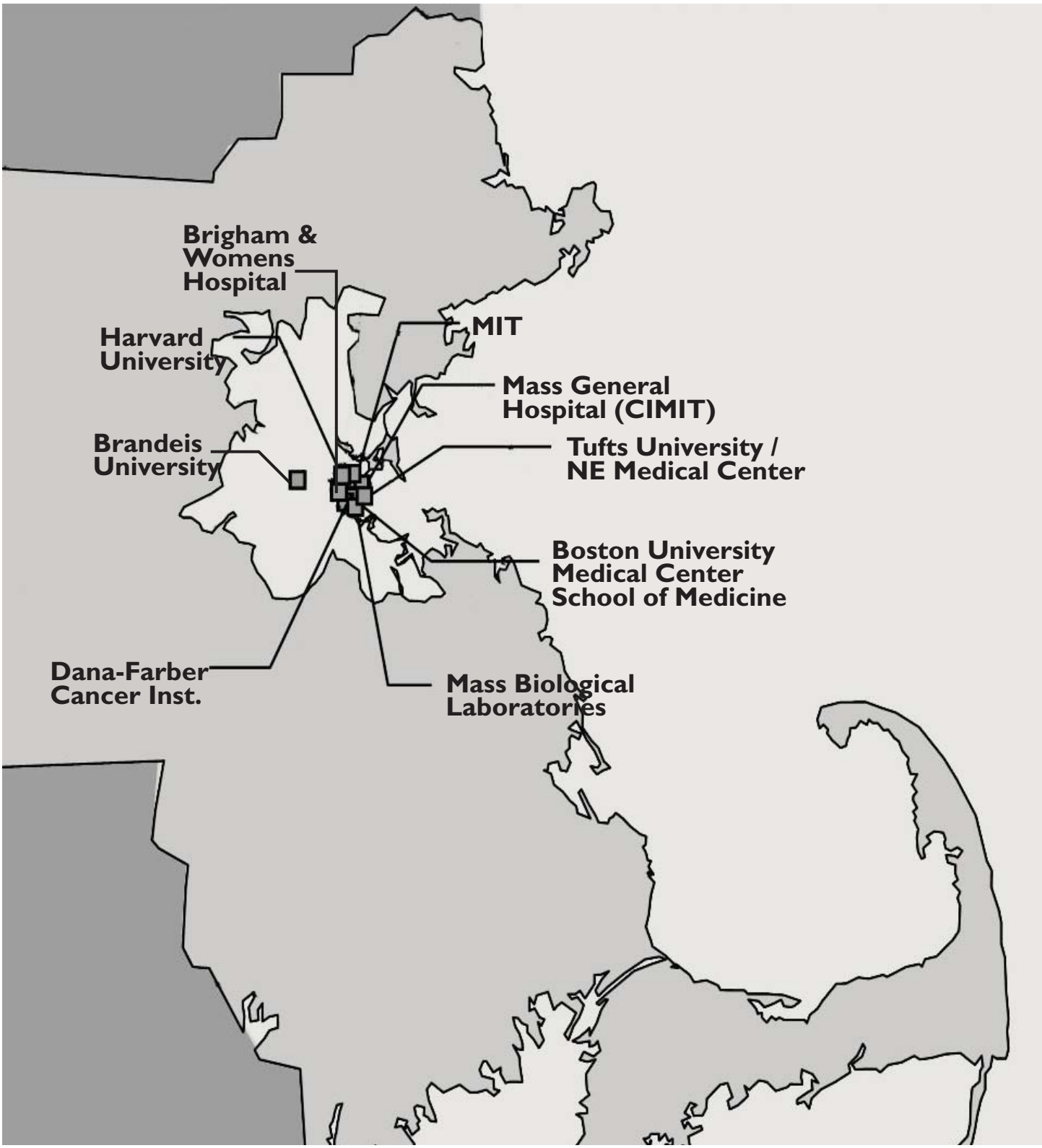

FIGURE 2-5
Location of Nearby Research Facilities
source: NIH Office of Extramural Research

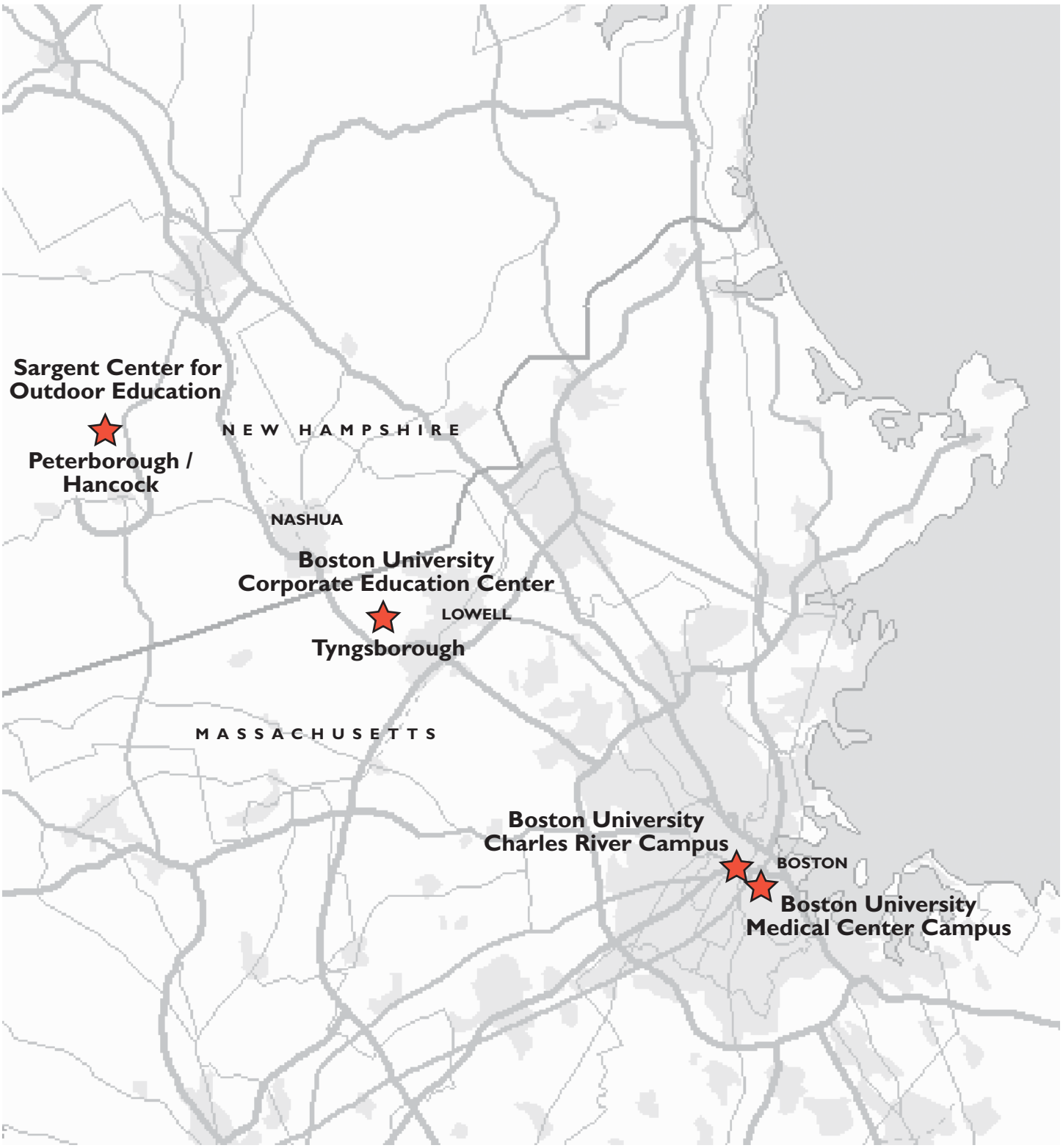

FIGURE 2-6
Boston University Controlled Properties
source: Fort Point Associates, Inc.

Education in Peterborough, New Hampshire. Brief descriptions of these landholdings and potential development sites are provided below.

BOSTON UNIVERSITY CORPORATE EDUCATION CENTER TYNGSBOROUGH, MA

The Boston University Corporate Education Center is located on the site of the former Wang Institute for Graduate Studies on Tyng Road in Tyngsborough, MA, approximately 30 miles from downtown Boston.

The site consists of 210 acres, the majority of which are located in the Town of Tyngsborough with 6.6 acres located in Chelmsford and 22 acres located in Westford. The site includes the historic Tyng mansion which houses a high-tech training facility providing over 20,000 square feet of conference space including a 280-seat auditorium and seven conference rooms, a caretaker's residence and a Quonset hut. The conference center complex is located along the northern portion of the site off of Tyng Street. The balance of the property contains heavily wooded areas, wetlands, several open fields and the remnants of a rock quarry operation. See "Figure 2-7, Boston University Corporate Education Center".

BOSTON UNIVERSITY SARGENT CENTER FOR OUTDOOR EDUCATION, PETERBOROUGH, NH

The Boston University Sargent Center for Outdoor Education is located along Sargent Camp Road in Hancock and Peterborough, New Hampshire, approximately 70 miles from downtown Boston. The facility has operated since 1912 as a training facility, summer youth camp, and year round outdoor education and conference center. The entire site, which is located in the northwest portion of the community, consists of 850 acres with 505 acres in Hancock and 345 acres in Peterborough. Of the 850 acres, approximately 166 acres are non developable with an estimated 24 acres of protected wetlands, 82 acres of protected watershed and a 60 acre pond, Half Moon Pond. Of the 684 remaining acres, the main campus of Sargent Camp, located in the southern portion of the site, occupies a 16-acre parcel.

This parcel is improved with a number of buildings including staff and guest housing as well as support lodges and offices containing approximately 59,000 sf. See "Figure 2-8, Boston University Sargent Center for Outdoor Education".

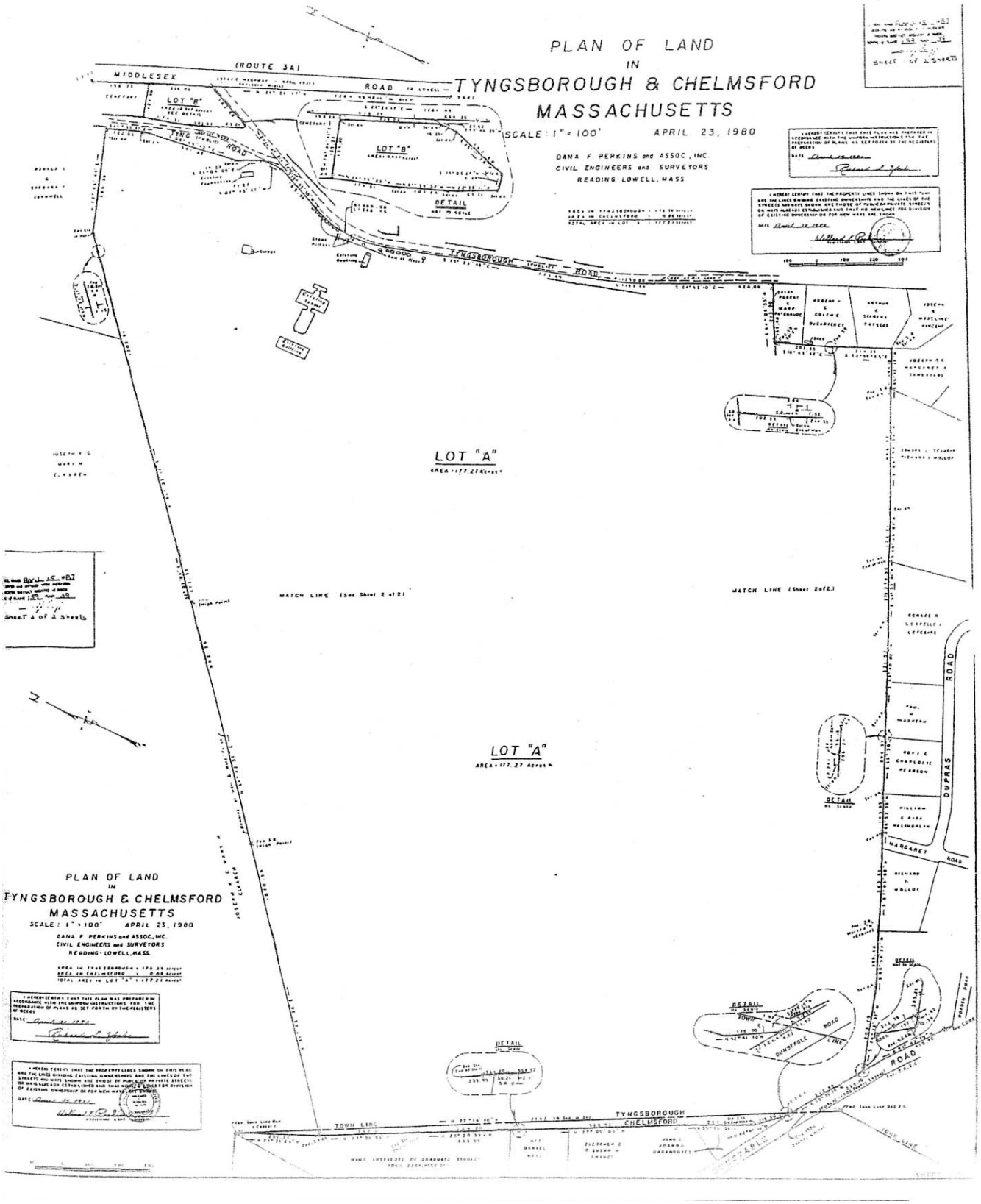

FIGURE 2-7
Boston University Corporate Education Center (Tyngsborough, MA)
source: Boston University

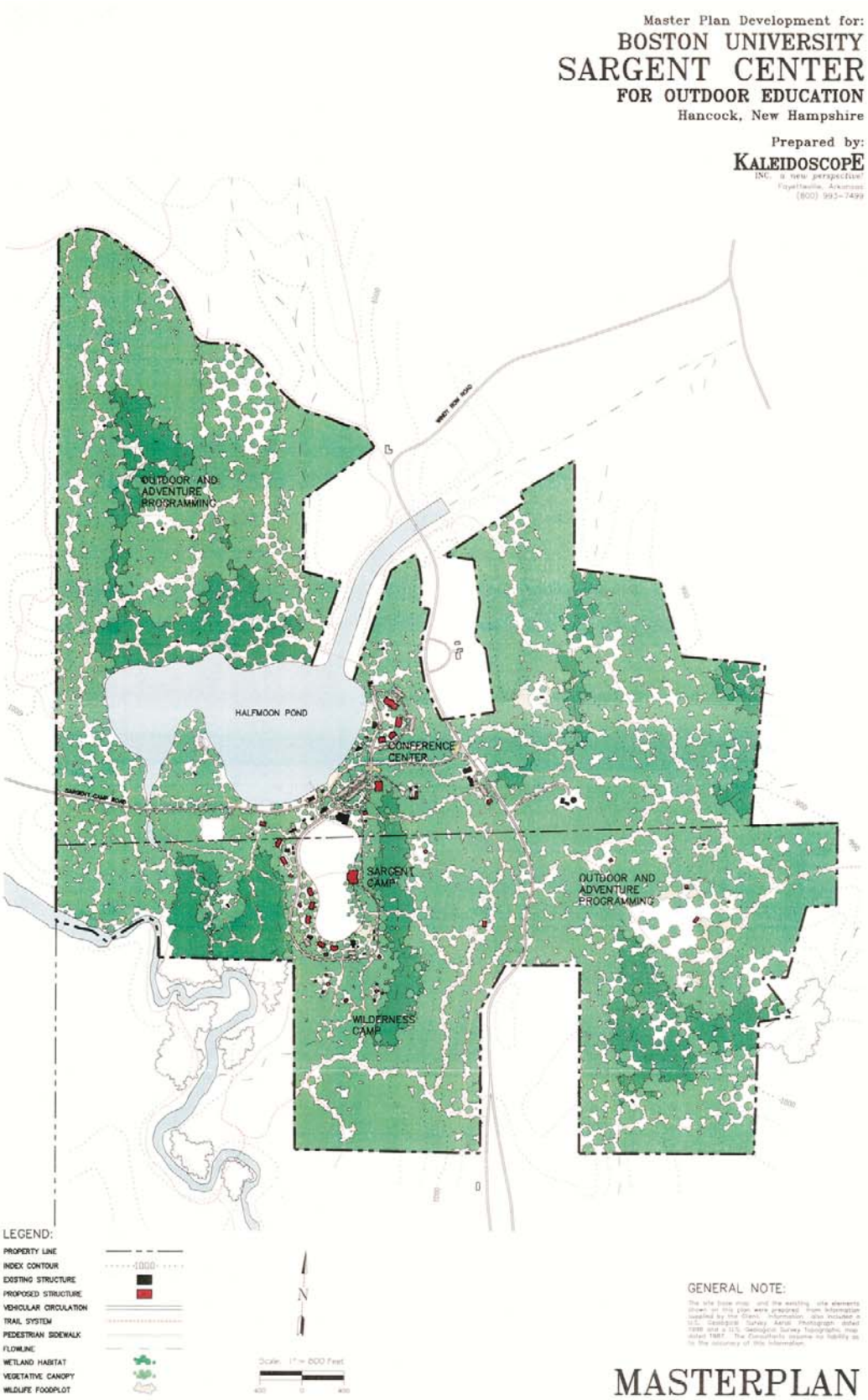

FIGURE 2-8
Boston University Sargent Center for Outdoor Education
source: Comprehensive Master Plan Development, October 2001

RATIONALE FOR DISMISSING

In February of 2003, the National Institute of Allergy and Infectious Diseases (NIAID) received competitive proposals to construct NBLs in response to the BAA. As stated in the BAA, the overall objective of NIAID's NBL construction program is "to provide funding to design, construct, renovate (if needed) and commission and install and certify fixed equipment into comprehensive, state-of-the-art BSL-4 biocontainment laboratories and the necessary associated BSL-3 labs, BSL-2 labs, animal facilities, clinical facilities and research support space." The BAA further stated that NBLs would serve as a national resource and must support the research of Regional Centers of Excellence (RCE). Among numerous sites submitted nationwide, NIAID selected the BUMC in Boston, Massachusetts as one location to construct an NBL. The selection was based on multiple factors including a review of environmental issues, but focused primarily on the scientific and technical merit of the application as assessed by peer review and on BUMC's ability to contribute to the overall NIAID biodefense research agenda (U.S. DHHS, 2003).

The extensive research expertise on infectious diseases found within BUMC and within the surrounding institutions participating in the RCE is not available elsewhere in the country and is one of the prime reasons for the choice of the proposed Boston-NBL facility location.

Furthermore, one of the program requirements of the BAA was that the Applicant must be "associated with or have planned linkages to one or more institutions or consortia that are applying for NIAID Regional Centers of Excellence (RCE), Biodefense and Emerging Infectious Diseases research grant awards" (U.S. DHHS 2002b). RCE's are consortiums of universities and complementary research institutions serving a specific geographical region which will build and maintain a strong scientific infrastructure supporting multifaceted research and development activities that promote scientific discovery and translational research capacity required to create the next generation of therapeutics, vaccines, and diagnostics for the NIAID Category A-C agents. BUMC has established a formal association with the Region 1 RCE located at Harvard Medical School in Boston, MA. Like other national research-intensive enterprises, the Boston-NBL would become a hub of research training for these future RCE investigators. Within the Boston-NBL, there would be principal investigators, staff, trainees, and a large number of support personnel. There would also be principal investigators and their research teams from the RCEs as well as from other NIAID supported programs whose research projects would mature to require access to BSL-4 high containment facilities.

Placement of the lab outside Massachusetts or outside the City of Boston in a lower density area would run counter to the goals of the NIH program and lessen the value

of the above-described physical and intellectual capital present at the BioSquare Research Park. Alternatives located in lower density areas also would not alter, reduce or mitigate the environmental impacts of the preferred alternative because as demonstrated by the "worst case" analysis included in Chapter 4, locating the facility in a lower density area would not in any way reduce the risk to the public.

Locations outside Massachusetts or outside the City of Boston in a lower density area are not feasible alternatives as they do not meet several of programmatic or second-tier siting criteria listed above, specifically:

- Incorporate existing BUMC institutional programs and objectives,
- Support the research of other institutions in the greater Boston area, and
- Be considered in proximity to the proposed Harvard University Medical School's NAIAD-Sponsored Regional Center of Excellence.

Locations in a lower density area outside of Boston are not feasible alternatives as they do not meet the purpose and need for the Project, nor do they meet several of the second-tier siting criteria listed above. Areas of lower density outside of Boston would not have the:

- Proximity to trained workforce,
- Proximity to interstate highway systems and a regional airport, or
- Presence of adequate public infrastructure including water and sewer.

2.3.2.2 ALTERNATIVE LOCATION FOR THE BSL-4 FACILITIES

Some commentors suggested that the BSL-4 laboratories should be separated from the Boston-NBL facility and located in a less densely populated area. This alternative is similar to the above alternative and would also result in great inefficiencies in terms of capital expenditures and labor.

RATIONALE FOR DISMISSING

The NIAID BAA for the NBL construction described above requires the NBL facilities to include BSL-3, BSL-4 and other facilities in one location. For this reason and the reasons described in the paragraphs below, the proposed location represents the most efficient use of resources and capital facilities and the alternative location for a BSL-4 laboratory does not meet the program criteria.

A key component of the research proposed at the Boston-NBL relies on the integration of existing BioSquare Research Park and BUMC scientists with those who would work in the new facility. Locating the BSL-4 laboratory at a separate location would eliminate the connected research on projects that use the existing and proposed BSL-2 and BSL-3 facilities, resulting in inefficient and impractical research efforts. This

alternative fails to meet the NIAID's purposes "to provide…state-of-the-art BSL-4 biocontainment laboratories and the necessary associated BSL-3 labs, BSL-2 labs, animal facilities, clinical facilities and research support space" that would serve as a national resource and support the research of RCEs. In preparing the funding proposal for the Boston-NBL facility, BUMC surveyed the RCE scientific objectives and developed a program to accommodate the unique needs of the RCEs at a national biocontainment laboratory.

Separating the BSL-4 laboratories from the BSL-2 and BSL-3 laboratories would also result in great inefficiencies of capital expenditures and labor. The integration of the existing BUMC safety and security programs into the Boston-NBL facility would not occur and researchers at the proposed Boston-NBL facility and existing researchers at the BUMC and BioSquare Research Park would not benefit from the adjacency of the BSL-4 laboratory. For the above reasons, this alternative is not a feasible alternative and would not achieve the stated purpose and need for the Project.

2.3.3 AGENCY'S PREFERRED ALTERNATIVE

The Proposed Action is the agency's preferred alternative. While the Proposed Action results in mitigated impacts that would not occur with the No Action, the Proposed Action fulfills the purpose and need of the NIH biodefense research.

The proposed site for the Boston-NBL provides a unique setting where established teams of researchers already work side-by-side on medical research. The Boston-NBL facility would be constructed within the 14 acre, 2.2 million square foot BioSquare Research Park, which is the City of Boston's only research park devoted exclusively to the life sciences sector. The site is immediately adjacent to the BUMC and its extensive medical, clinical and research facilities as well as several other medical research facilities in the City of Boston and neighboring Cambridge. The site also has excellent highway access and sufficient utility infrastructure to support the Boston-NBL Project without any adverse impacts.

An important advantage of the proposed location is the ability to integrate with these extensive research facilities and BUMC research employees, which would not need duplication within the Boston-NBL building. In addition, investigators at BUMC, whose research programs would be part of the facility, currently occupy 27,000 square feet of new BSL-2 and BSL-3 laboratory space in the existing BioSquare biomedical research buildings. This adjacency would create enormous added value since these laboratory facilities would not need to be duplicated in the Boston-NBL facility. Furthermore, the proposed location would allow dynamic collaborations between investigators at multiple research entities such as the Boston University School of Medicine, Harvard Medical School which is a NIAID designated RCE, Massachusetts Institute of Technology, Massachusetts General Hospital, Brigham and

Women's Hospital, The Center for Blood Research, University of Massachusetts Medical Center, The Massachusetts Biological Laboratories and Brandeis University .

Locating the Boston-NBL in the BioSquare Research Park in the City of Boston takes advantage of the extensive biomedical and biotechnology research portfolio of this area. Because of its large concentration of research-intensive biomedical institutions, Boston is ranked #1 among recipients of the NIH research grant funds of all cities in the United States. The proposed Boston-NBL would be located in proximity to proposed Project Principal Investigators and is conveniently accessible to all the Principal Investigators of the other New England RCEs. The Principal Investigators of the research projects to be undertaken at Boston-NBL are located at these institutions. Because the Boston–NBL would be located in proximity to the conventional laboratories of these investigators (which includes 11,000 sf of conventional laboratory space for New England RCE projects alone) the Boston-NBL would not need to duplicate all of the BSL-2 and infrastructure space that is so critical to the research mission.

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