DEPARTMENT OF PUBLIC HEALTH

DETERMINATION OF NEED GUIDELINES FOR ENVIRONMENTAL AND HUMAN HEALTH IMPACT

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Determination of Need Program
2 Boylston Street
Boston, MA 02116

I. INTRODUCTION

Americans are estimated to spend about 90% of their time indoors. The Department of Public Health recognizes significant changes in building systems, building science, material selection and facility design now make possible the adoption of far more effective public health-protecting, environmentally sound practices in new construction, renovation and operation of health care facilities. These changes are driven by global and regional environmental losses, and by mounting evidence linking healthy and environmentally sound building design, construction, materials and operations to the well-being of building occupants and public health. This interest is consistent with the Department's commitment to insuring best practice in all health care facilities licensed by the Department. The Department therefore is adopting the Leadership in Energy and Environmental Design-Health Care (LEED-HC), Green Guide for Healthcare, (GGHC) or their equivalent, nationally accepted best practice standard as part of the Determination of Need (DoN) review process to ensure that Massachusetts health-related institutions are adopting and using nationally accepted best practices in designing, building, renovating and operating licensed facilities. The Guidelines incorporate by reference the LEED-HC, the Green Guide and any equivalent current nationally accepted best practice standard.

II. BACKGROUND

In recent decades, various non-governmental organizations, in concert with federal and state agencies and healthcare and building industry stakeholders, have developed and implemented national "green building" standards and tools, which are now in use by hundreds of healthcare systems, many federal and state agencies, and the private sector. These include:

- US Green Building Council's ("USGBC") consensus-based Leadership in Energy and Environmental Design – Health Care ("LEED-HC") an energy and environmental rating system for buildings.
- Green Guide for Health Care ("GGHC V2.2") a peer-reviewed health-based, design and operational tool

More locally, as of January, 2007 all construction projects in Boston over 50,000 sq. ft. must comply with the Boston Redevelopment Authority's new Article 80/37, which states, "The Green Guide for Health Care...and LEED-HC are the appropriate standards for hospitals."

Pursuant to these DoN guidelines, applicants shall utilize the Leadership in Energy ~~and~~ Environmental Design-Health Care (LEED-HC), the Construction Section of the Green Guide for Healthcare (GGHC) (See Appendix 1: GGHC V2.2 Construction Section Checklist), or with the approval of the Department, the equivalent current nationally accepted best practice standard in all DoN applications as one of their Factor 8 Environmental Impact requirements. To demonstrate their consideration of and commitment to such standards, applicants shall submit to the Department as part of their DoN application a provisional green and healthy building strategy assessment (as referenced in LEED-HC, GGHC or other Department approved equivalent current nationally accepted best practice standard) based on the most current plans for the project to indicate the likely strategies to be employed to meet the applicable percentage threshold. Applicants will then submit the completed certifiable green and healthy strategy credit point assessment as part of the plan review. DoN application approval will consider but not be contingent upon the information included in the provisional assessment, but plan review approval will be contingent on the final credit assessment meeting the applicable percentage threshold.

All new DoN applications filed on or after January 1, 2009 related to new construction or gut renovation[1] projects in acute care hospitals, chronic disease hospitals, rehabilitation hospitals and ambulatory surgery clinics that exceed

[1] "Gut renovation" is defined as construction within an existing building that requires complete demolition of all non-structural building components. After demolition, only the floor, deck above, outside walls and structural columns would remain.

the DoN capital expenditure minimum, as recalculated annually, shall meet all of the Prerequisites and achieve at least 50% of the possible points for the Construction section of the Leadership in Energy and Environmental Design-Health Care (LEED-HC), GGHC, or with the Department's approval the equivalent current nationally accepted best practice standard. This is the percentage needed to achieve a certifiable "silver level" green building.

All new DoN applications filed on or after July 1, 2009 related to new construction or gut renovation projects in nursing homes that exceed the DoN capital expenditure minimum, as recalculated annually, shall meet all of the Prerequisites, and achieve at least 50% of the possible points for the Leadership in Energy and Environmental Design-Health Care (LEED-HC) GGHC, or with the Department's approval the equivalent current nationally accepted best practice standard. This is the percentage needed to achieve a certifiable "silver level" green building.

Ancillary buildings such as health care facility water treatment plants or other building types seeking DoN approval shall meet all the Prerequisites, and achieve at least 50% of the possible points for Leadership in Energy and Environmental Design-Health Care (LEED-HC) GGHC, or with the Department's approval the equivalent current nationally accepted best practice standard. This is the percentage needed to achieve a certifiable "silver level" green building.

DPH recognizes the 50% reference benchmark is likely soon to be viewed as overly modest, due to rapid advances in environmental public health science, green and healthy building technology, green building standards and competition amongst providers. Therefore, DoN applicants are strongly encouraged to be aggressive in exceeding the above benchmarks.

Furthermore, since using unhealthy materials and practices in the furnishings, equipment, maintenance and operation of a facility can undermine the best efforts of the design and construction phases, applicants are strongly encouraged to implement and continue indefinitely the use of the Operations section of the Green Guide for Healthcare (See Appendix 2: GGHC V2.2 Operations Section Checklist), or LEED-EB (Existing Buildings) or their equivalent, current nationally accepted best practice standard.

III. FACTORS FOR REVIEW under LEED-HC or GGHC

Each Factor consists of standards which represent the broad Guidelines used to evaluate each application. Each standard is supported by Measures which provide the specific criteria used to evaluate compliance with the standard. Based on DPH experience in the Massachusetts climate, five credit areas require special attention and/or documentation. They are:

1. Building material reuse,
2. Outdoor air delivery monitoring,
3. Natural ventilation,
4. Construction practices: site and materials management, and
5. Construction environmental quality management plan during construction.

Details and documentation requirements are provided in Appendix 3.

Factor One: INTEGRATED DESIGN

Standard: GGHC 2.2 Integrated Design Prerequisites 1 and 2, LEED-HC or their equivalents:

Measures: The applicant shall describe the process and/or key rationale used to meet each GGHC, LEED-HC or their equivalents in each measure, highlighting the environmental and/or human health improvements achieved. For any measures that cannot be met, project specific information and an

explanation of the process and criteria used in the decision not to implement the measure must be provided.

Prerequisite Measure 1	GGHC 2.2 Integrated Design Process, LEED-HC or their equivalents.
Prerequisite Measure 2	Health Mission Statement and Program, LEED-HC or their equivalents.

Discussion and Intent: Integrated design leads to understanding the building as a set of interrelated and interdependent systems where a single design decision can trigger multiple systemic improvements. An integrated design process, supported by guiding principles, is instrumental to successfully design, build and operate a healthier, more cost-effective, environmentally more benign facility. An expanded design team – including contractors, facility managers, building operators and employees – involved throughout the process will support cross-discipline decision making relative to issues such as building siting, configuration, envelope and HVAC design and controls. Such teams and processes start in the programming and pre-design phase of the project and continue throughout construction to optimize achievement of sustainable design objectives.

Prevention is a fundamental principle of health care and public health. Too often, design decisions are driven by limited economic analyses, availability of land and other external factors, rather than improving the health and wellbeing of a building's occupants. The health care industry acknowledges that prevention is preferable to treatment of disease after it has occurred. Even in the face of uncertainty, precautionary action is appropriate to prevent harm. This public health approach makes sense both in the clinical setting and in response to environmental and public health hazards. Similarly, a precautionary and preventive approach is an appropriate basis for decisions regarding health care building design and materials choices and activities. Linking a health mission statement and program to the project's design intent document will ensure that a health-based, precautionary approach to decision making is sustained throughout the process.

Factor Two: SUSTAINABLE SITES

Standard: GGHC 2.2 Sustainable Sites Prerequisite 1, Credits 1-10.2 LEED-HC or their equivalent:

Measures: The applicant shall describe the process and/or key rationale used to meet each GGHC, LEED-HC or their equivalents in each measure, highlighting the environmental and/or human health improvements achieved. For any measures that cannot be met, project specific information and an explanation of the process and criteria used in the decision not to implement the measure must be provided.

Prerequisite Measure 1	Construction Activity Pollution Prevention
Measure 1	Site Selection
Measure 2	Development Density & Community Connectivity
Measure 3.1-3	Brownfield Redevelopment; Basic Remediation Level; Residential Remediation Level; Minimizing Future Hazards
Measure 4.1-4	Alternative Transportation; Public Transportation Access, Bicycle Storage & Changing Rooms; Low-Emitting & Fuel Efficient Vehicles, Parking Capacity
Measure 5.1-3	Site Development; Protect or Restore Open Space or Habitat; Reduce Development Footprint; Structured Parking
Measure 6.1-2	Stormwater Design; Quantity Control

Measure 7.1-2	Heat Island Effect; Non-Roof; Roof
Measure 8	Light Pollution Reduction
Measure 9.1-2	Connection to the Natural World; Outdoor Places of Respite; Exterior Access for Patients
Measure 10.1-2	Airborne Releases; Leaks & Spills

Discussion and Intent: Sustainable site development channels projects to urban areas with existing infrastructure, protects greenfields and preserves habitat and natural resources. It avoids the use of inappropriate sites, may restore contaminated sites, increases access to the facility while reducing transportation impacts, and reduces the environmental impact from the location of a building on a site.

Sustainable sites adhere to integrated land use and development planning to contain sprawl and the associated development patterns that influence it (transportation, air quality, exercise, obesity, blood pressure, etc.) as well as the resulting unhealthy air quality and sedentary lifestyle indicators associated with auto-dependence and transportation-related air pollution. Several studies show that increased sprawl correlates with obesity and high blood pressure. Sustainable site selection criteria contribute to healthy ecosystems – clean air and clean water – thereby enhancing the public health by protecting wetlands, agricultural lands and open spaces. Biodiversity protects ecosystems, water systems and endangered and threatened species. Sustainable siting decisions for hospitals and health care facilities integrate regional health care needs with the above public health factors.

Factor Three: Water Efficiency

Standard: GGHC 2.2 Water Efficiency Prerequisite 1, Credits 1-2.5 LEED-HC or their equivalents:

Measures: The applicant shall describe the process and/or key rationale used to meet each GGHC, LEED-HC or their equivalents in each measure, highlighting the environmental and/or human health improvements achieved. For any measures that cannot be met, project specific information and an explanation of the process and criteria used in the decision not to implement the measure must be provided.

Prerequisite Measure 1	Potable Water Use for Medical Equipment Cooling Eliminate potable water use for medical equipment cooling.
Measure 1	Water Efficiency -Landscaping: No Potable Water Use or No Irrigation
Measure 2.1-5	Potable Water Use Reduction: Measurement & Verification Domestic Water Process Water & Building System Equipment

Discussion and Intent: The intent of this sustainable strategy is to eliminate potable water use for medical equipment cooling (for once-through cooling for any medical equipment that rejects heat). This credit does not apply to potable water for cooling tower makeup, or for other evaporative cooling systems. As an exception to the above, controlled once-through cooling is allowed where local requirements mandate limiting the discharge temperature of fluids into the drainage system.

Maintaining adequate potable water supplies is a basic necessity for the health of individuals and communities. Only about 1% of the water on Earth is fresh water. Processing potable water is energy intensive and thus contributes to air emissions associated with fossil fuel energy generation (for the treatment, pumping and maintenance of the potable water systems). Only about 20% of current urban water is used for drinking and sanitary purposes, with the other 80% not requiring treatment to potable standards. Using reclaimed water for selected applications can reduce costs and preserve precious potable water supplies. To protect the public health, a dual or dedicated distribution system must be installed to segregate potable and reclaimed water for health, product and process purposes.

Factor Four: Energy and Atmosphere

Standard: GGHC 2.2 Energy and Atmosphere Prerequisites 1-3, Credits 1-7, LEED-HC or their equivalents:
Measures: The applicant shall describe the process and/or key rationale used to meet each GGHC, LEED-HC or their equivalents in each measure, highlighting the environmental and/or human health improvements achieved. For any measures that cannot be met, project specific information and an explanation of the process and criteria used in the decision not to implement the measure must be provided.

Prerequisite Measure 1	Fundamental Commissioning of the Building Energy Systems Required
Prerequisite Measure 2	Minimum Energy Performance Required
Prerequisite Measure 3	Fundamental Refrigerant Management Required
Measure 1	Optimize Energy Performance
Measure 2.1-3	On-Site Renewable Energy: 0.05-0.15 watts of renewable generating capacity per sf of building area
Measure 3	Enhanced Commissioning
Measure 4	Enhanced Refrigerant Management
Measure 5	Measurement & Verification
Measure 6.1-4	Green Power: 20-100%
Measure 7	Equipment Efficiency

Discussion and Intent: Public health institutions have moral, environmental, financial and human health reasons to strive for maximum energy efficiency and the ongoing accountability of building energy consumption over time. Reductions in operational expenses for energy use may allow for future investments in improved facilities or services. Reducing and optimizing energy consumption benefits health and reduces dependence on natural resources, contributing to healthy ecosystems and reducing the particulate, toxic chemical, and greenhouse gas emissions associated with fossil-fuel generated electricity, and energy consumption for heating and cooling, thereby improving air quality, improving public health, and helping curb global warming.

EPA data on health impacts of electricity generation, adjusted for the Commonwealth of MA's electric utility grid fuel mix, indicate that the state's 14,891 acute care beds are responsible for an estimated:

	Annual Quantity	Right to Emit Pollutants[4]	
SO2 (Tons):	707.4	$387,600	per year
NOx (Tons):	156.5	$461,600	per year
CO2 (Tons):	207,512.5	$6,640,400	per year EU valuation[5]
Carbon (Metric Tonnes):	51,342.0	N/A	
Mercury (lbs):	4.9677	$322,900	per Year

	Number of Incidents/Year	Societal Value/EPA[1,7]	Direct Medical & Other Costs[2,8]	
Premature Mortality	2.2	$14,857,465	$658,789	per year
Chronic Bronchitis	1.4	$662,183	$169,419	per year
Hospital + ER Visits	2.0	$26,182	$20,845	per year
Asthma Attacks	45.1	$2,785	$2,658	per year
Respiratory Symptoms	2,153	$78,344	$78,344	per year
Work Loss Days	397	$72,375	$67,292	per year
Mercury Related Health Impact[3]	NA	$695,023	$695,023	per year
Total Value/Cost (in 2008)[6]		$16,394,357	$1,692,370	per year
Value of Unintended Societal & Direct Health Impacts per kWh		$ 0.03336	$ 0.00344	

(Source: Healthcare Clean Energy Exchange, *Energy Impact Calculator*)

If these facilities purchase certified clean energy, all these numbers fall to zero; clearly the best price on conventional "brown" power may not be the best deal for healthcare in the state, especially if the sector looks at full costs, and considers public health issues.

Furthermore, DPH recognizes continuing rapid changes in energy markets, climate change science and energy efficiency mean any current reference document is likely soon to be viewed as overly modest in its Energy and Atmosphere benchmarks. Because of the very significant public health impacts of conventional energy fuel extraction, refining, distribution, production and use, DoN applicants are strongly encouraged to be aggressive in meeting or beating the highest existing standards.

The building commissioning process begins early during the design process, and then has additional activities after systems performance verification is completed. Commissioning verifies the efficient and effective operations of a building's mechanical and electrical system, the health organization has gotten what it paid for, and that facility managers and staff can work in support of reliable, cost-effective HVAC, plumbing and electrical systems. It ensures compliance with energy performance goals and indoor air quality and thermal comfort design criteria. The benefits of commissioning lessen dependence on natural resources, resulting in improved outdoor air quality and reduced greenhouse gas emissions.

Stratospheric ozone layer depletion leads to increased exposure to ultraviolet radiation, increasing risk factors for skin cancer and immune system depression. The United States is one of the world's largest emitters of ozone depleting substances. As part of the US commitment to implementing the Montreal Protocol, the EPA has implemented regulations relative to the responsible management of chlorofluorocarbons ("CFCs"), including programs to end the production of ozone depleting substances.

HVAC refrigerant emissions of halogenated hydrocarbons such as CFCs deplete the stratospheric ozone layer, which shields life on Earth from harmful levels of ultraviolet radiation. Higher levels of exposure can lead to increases in the incidence of skin cancers and eye cataracts. In addition, CFCs are thousands of

times more powerful than carbon dioxide in trapping heat and therefore significantly contribute to the greenhouse warming effect.

Provision of increasing levels of on-site renewable energy can increase system reliability, can increase passive survivability during natural or other disasters, and reduces the health, environmental and economic impacts associated with fossil fuel energy use, as shown above. The use of grid-source, renewable energy technologies on a net zero pollution basis to fulfill a portion of a building's energy needs offsets the greenhouse gas and particulate emissions associated with fossil-fuel electrical generation and helps develop public demand for and finance the development of new clean energy generation.

Factor Five: Materials and Resources

Standard: GGHC 2.2 Materials and Resources Prerequisites 1-2, Credits 1-7.2, LEED-HC or their equivalents:

Measures: The applicant shall describe the process and/or key rationale used to meet each GGHC, LEED-HC or their equivalents in each measure, highlighting the environmental and/or human health improvements achieved. For any measures that cannot be met, project specific information and an explanation of the process and criteria used in the decision not to implement the measure must be provided.

Prerequisite Measure 1	Storage & Collection of Recyclables
Prerequisite Measure 2	Mercury Elimination
Measure 1	Materials & Resources Building Reuse
Measure 2.1- 4	Construction Waste Management: Divert from Disposal
	Construction Practices: Site & Materials Management
	Construction Practices: Utility & Emissions Control
Measure 3	Sustainably Sourced Materials
Measure 4.1-3	PBT Elimination :
	Dioxin
	Mercury
	Lead &
	Cadmium
Measure 5.1-3	Furniture & Medical Furnishings: Resource Reuse
	Materials
	Manufacturing, Transportation & Recycling
Measure 6	Copper Reduction
Measure 7.1-2	Resource Use: Design for Flexibility & Durability

Discussion and Intent: The intent of this sustainable strategy is to extend the life cycle of existing building stock, conserve resources, retain cultural resources, reduce waste and reduce environmental impacts of new buildings as they relate to materials manufacturing and transport.

Current health care facility construction in the U.S. represents more than 100 million square feet annually, valued at approximately $17 billion in the U.S. of completed construction, with renovations and expansions representing a significant percentage. The extraction of raw materials used in the construction of new buildings represents significant natural resource extraction with the potential for ecological disruption, while fossil fuel and chemical emissions associated with materials' processing and product manufacturing and transportation can result in exposures harmful to human health. In addition, building reuse reduces the amount of solid waste leaving the project site. Construction and demolition debris accounts for more than 30% of municipal solid waste.

A second intent of this strategy is to eliminate mercury-containing building products and reduce mercury discharge through product substitution and capture. In 1998, a Memorandum of Understanding between the American Hospital Association and the US EPA set new goals for hospital pollution prevention. One of the top priorities was the virtual elimination of mercury and mercury-containing devices from the hospital waste stream by the year 2005. Mercury is a potent neurotoxin. Significant amounts of mercury released into the environment are transformed into methylmercury, which bioconcentrates in the food chain. Prenatal exposure to methylmercury can result in deficits in language, memory and attention. The most sensitive health effect of mercury is an adverse impact on the neurological development of fetuses, infants and children. Low level prenatal exposure can result in language, memory and attention deficits in children who were exposed in-utero. Hospitals have substantially reduced the purchase of mercury containing chemicals and medical devices and found substitutes for many pharmaceuticals. To achieve virtual elimination of mercury from the waste stream, however, requires the phasing out and recycling of mercury containing building products, such as thermostats, switches, batteries, and lamps, for mercury recovery.

Factor Six: Environmental Quality (EQ)

Standard: GGHC 2.2 Environmental Quality Prerequisites 1-3, Credits 1-9.2, LEED-HC or their equivalents:

Measures: The applicant shall describe the process and/or key rationale used to meet each GGHC, LEED-HC or their equivalents in each measure, highlighting the environmental and/or human health improvements achieved. For any measures that cannot be met, project specific information and an explanation of the process and criteria used in the decision not to implement the measure must be provided.

Prerequisite Measure 1	Minimum IAQ Performance
Prerequisite Measure 2	Environmental Tobacco Smoke (ETS) Control
Prerequisite Measure 3	Hazardous Material Removal or Encapsulation
Measure 1	Environmental Quality- Outdoor Air Delivery Monitoring
Measure 2	Natural Ventilation
Measure 3.1-2	Construction EQ Management Plan: During Construction & Before Occupancy
Measure 4.1-6	Low-Emitting Materials: Interior Adhesives & Sealants Wall & Ceiling Finishes Flooring Systems Composite Wood & Insulation

	Furniture & Medical Furnishings Exterior Applied Products
Measure 5.1-2	Chemical & Pollutant Source Control: Outdoor Indoor
Measure 6.1-2	Controllability of Systems: Lighting Thermal & Ventilation
Measure 7	Thermal Comfort
Measure 8.1-3	Daylight & Views: Daylight for Occupied Spaces Connection to the Natural World: Indoor Places of Respite Lighting and Circadian Rhythm
Measure 9.1-2	Acoustic Environment: Exterior Noise, Acoustical Finishes, & Room Noise Levels Sound Isolation, Paging & Call Systems, & Building Vibration

Discussion and Intent: The first environmental quality ("EQ") prerequisite is to establish minimum indoor air quality ("IAQ") performance to enhance indoor air quality in buildings, thus contributing to the comfort and wellbeing of the occupants. Establishing strategies for good indoor air quality at the outset of project development is more effective and achievable than addressing air quality as an issue during construction or building operation.

The EPA estimates that indoor air pollution is one of the top five environmental risks to public health. Indoor air can be as much as 10 times more polluted than outside air and contain many unique contaminants. Indoor air pollutants can cause problems ranging from immediate acute effects such as eye, nose, and throat irritation; sinusitis, asthma attacks, headaches; loss of coordination; and nausea; to long range chronic damage to the lungs, liver, kidney, and central nervous system and cancer. Building materials and the products used to install, clean and maintain them can be significant sources of a wide range of VOCs (spell out) and other indoor air pollutants. Coupling properly designed, operated and maintained mechanical equipment with low-emitting materials can ensure healthy indoor air.

The second EQ prerequisite is to prevent exposure of building occupants, indoor surfaces, and ventilation air distribution systems to Environmental Tobacco Smoke ("ETS").

The third EQ prerequisite relates to existing buildings, but is instructive to renovations and to new construction that attaches to, and therefore modifies, existing buildings. The intent is to reduce or eliminate the building occupant's potential exposure to asbestos, mercury, lead, and mold and the associated harmful effects through hazardous material removal or encapsulation. (New construction projects are exempt from compliance with this Prerequisite, except as stated above.)

Asbestos exposure is linked to documented health impacts, most notably mesothelioma (a specific kind of cancer of the lung, chest and/or abdominal lining) and asbestosis, a chronic form of lung disease. To minimize exposure of building occupants, regulatory authorities require remediation of asbestos containing building materials, either through a process of encapsulation or removal. Asbestos abatement undertaken during renovation while building is partially occupied should take especial precautions to

ensure 100% containment of asbestos fibers.

Persistent bio-accumulative toxics ("PBTs") are toxic chemicals of particular health concern because they do not break down quickly in the environment, they become widely distributed geographically and they biomagnify or concentrate in the tissue of living organisms as they move up the food chain. Because of their toxicity, persistence, and bioaccumulative characteristics, even very small, difficult to detect releases can lead to harmful exposures. This has led to an emphasis on strategies that eliminate the production and use of PBT substances, or those that are known to lead to their formation, rather than attempts to control emissions.

Lead is a potent neurotoxin, particularly in the developing brain of fetuses and children, and can also cause kidney and reproductive system damage. Mercury is a potent neurotoxin. Significant amounts of mercury released into the environment are transformed into methylmercury, which bioconcentrates in the foodchain. Prenatal exposure to methylmercury can result in deficits in language, memory and attention.

Exposure to molds can cause symptoms such as nasal stuffiness, eye irritation, wheezing, skin irritation, fever and shortness of breath. Conditions not generally associated with an allergic response—including nervous-system effects, suppression of the immune response, hemorrhage in the intestinal and respiratory tracts, rheumatoid disease, and loss of appetite—have also been reported in people who work or live in buildings exhibiting toxic microbial growth. Appropriate design of envelope waterproofing and breathable interior finishes has been found to greatly reduce the risk of mold growth in wall spaces.

GGHC V 2.2 EQ credits 1-9.2 address a wide range of issues related to patient and staff wellbeing and healing. These are summarized below.

Ventilation system monitoring helps sustain occupant comfort and wellbeing. Elevated CO2 levels can indicate diminished indoor air quality due to inadequate amounts of outdoor air being introduced into the building. By maintaining low CO2 levels, building occupants are likely to experience improved indoor air quality to the extent that outdoor ambient air quality is good, resulting in improved health and productivity. This is particularly important in hospitals, where inadequate dilution of re-circulated air with outdoor air can result in exposure of patients to higher levels of indoor generated pollutants. Children, pregnant women, the elderly, and those with allergies, asthma or chemical sensitivities are especially at risk of suffering adverse health effects from compromised indoor air quality.

Natural ventilation can improve occupant comfort, well-being, and productivity. Improved ventilation can be linked to enhanced worker productivity, comfort and reduced absenteeism. Children, pregnant women, the elderly, and those with allergies, asthma or chemical sensitivities are especially at risk of suffering adverse health effects from compromised indoor environmental quality. Research shows that natural ventilation can improve patient outcomes by providing control over thermal comfort and ventilation. In addition, natural ventilation can reduce energy consumption, thereby lowering chemical and particulate emissions resulting from fossil fuel extraction, processing and combustion that contribute to smog and global warming.

Enhanced indoor air quality is an imperative for health care facilities. Air that is free from harmful levels of contaminants aids patients with a variety of underlying chronic diseases or conditions and the capacity of staff to make critical decisions and perform critical tasks. IAQ complaints commonly include headaches, eye irritation, sinus congestion, cough, and wheeze. Health impacts associated with construction practices in health care settings are regulated through Infection Control Risk Assessment (ICRA) policies and procedures in the *AIA Guidelines for Construction of Health Care Facilities*, adopted by many U.S. states, including MA. The Infection Control Risk Assessment and AIA *Guidelines*

themselves, mandate construction procedures and practices to minimize health impacts on building occupants in adjacent occupied areas. This credit includes sustainable construction practices that reinforce and exceed the current ICRA and AIA *Guideline* provisions.

The indoor air quality impacts of recently installed construction materials are well documented. Many wet applied products, such as paints, adhesives, varnishes, and sealants, and some dry interior finish materials such as carpets, flooring and wall coverings, off-gas considerable levels of volatile organic compounds ("VOCs") for months after application, but particularly in the 7 – 14 day period following their initial installation. These may result in a variety of health effects in patients and health care workers, including headaches and respiratory symptoms. Many of the products of particular concern are finish materials, which are applied or installed on the site late in the construction process, shortly before intended occupancy dates, which potential exposures need to be eliminated or reduced.

VOCs from building materials compromise air quality and negatively affect human health. VOCs and other carcinogens and reproductive toxicants that can be emitted by building materials can represent a serious health risk to both the installers and the building occupants. Children, pregnant women, the elderly, and those with allergies, asthma or chemical sensitivities are especially at risk of suffering adverse health effects from indoor pollutants.

Several persistent bioaccumulative toxicants ("PBTs") used in building products are being found at levels of concern in blood samples in the general population, raising serious health concerns. Animal studies indicate growing evidence that many of the halogenated flame retardants ("HFRs") used to counteract the high flammability of plastics have toxic properties akin to those of chlorinated PBTs, such as dioxin and PCBs. These effects include immune system suppression, endocrine disruption, nervous system disorders, and cancer. Of particular concern are the widely used polybrominated diphenyl ethers ("PBDEs").

DEHP and several other phthalates have received attention in the medical community because of their potential to disrupt normal reproductive tract development in male fetuses, infants, and children. DEHP is used as a plasticizer in many PVC medical products. Other phthalates of concern are also used in some building materials. Phthalates in flexible PVC building materials have also been linked to bronchial irritation and asthma in building occupants.

Formaldehyde ("HCHO") is listed by the U.S. EPA as a probable human carcinogen and by the National Institute for Occupational Safety as a workplace carcinogen. Formaldehyde exposure can increase the risk of a range of health effects in installers and building occupants. These effects include: irritation of mucous membranes, including the eyes and respiratory tract; sensitization resulting in asthma symptoms (e.g., wheezing and chest congestion) and skin reactions; and cancer.

It is beneficial to minimize the use of furniture including medical furnishings that may release indoor air contaminants that are odorous or potentially irritating and may be deleterious to installer and occupant health, comfort and wellbeing. The perfluorochemicals ("PFCs") used directly in the manufacture of many stain protection and non stick treatments, most notably perfluorooctanoic acid ("PFOA"), or resulting as a breakdown product, are showing up in human blood samples in increasing frequency and are demonstrating a similar broad range of toxicological effects in animal studies.

Health care construction rarely occurs on undeveloped sites remote from ongoing existing operations. In most instances, construction operations are proximate to existing operational health care facilities, where construction practices have health impacts on adjacent building occupants and building system performance. It is beneficial to eliminate and/or control fumes from application of hot applied materials,

such as coal tar, asphalt and bitumens, particularly for roofing, pavement sealing and waterproofing increase risks of cancer and respiratory disease.

Building systems, equipment and processes should prevent the entry of contaminants into buildings from the exterior, including ensuring adequate supply of air that meets the National Ambient Air Quality Standard to the building at all times. Indoor air pollution often begins with unintended outdoor pollutants penetrating the building envelope. Health care buildings are highly trafficked, with large numbers of staff and visitors entering the building. Vehicular traffic patterns often include idling vehicles near major entryways, and emissions sources (vehicles, helicopters, emergency generators, etc.) can generate various pollutants that can be harmful or offensive to hospital staff and patients.

The Joint Commission on the Accreditation of Health Care Organizations ("JCAHO") has expressed increasing concern over growing respiratory issues among health care workers. JCAHO has identified indoor chemical pollutants as a contributing factor to indoor air quality issues, including photocopiers, glutaraldehyde and ethylene oxide sterilants, xylene, aerosolized medication distribution systems, anesthetic gases, chemotherapeutic agents, latex, cleaners and floor finishes.

Building occupants' health is directly impacted by the degree of control that individuals can exercise over their immediate environment. Given the wide range and variety of individuals receiving care, patient or resident control cannot be extended to all elements of the physical environment. Because the sense of loss of control can be disturbing and stressful to patients or residents and their family members, every effort should be made to allow individual control over as many elements of the environment as possible and reasonable, including but not limited to temperature, lighting, and privacy. Control over lighting, window treatments, and temperature directly impacts the quality of the experience of the interior environment.

Studies have shown that occupant control over the immediate thermal environment positively impacts patient and staff satisfaction, while decreasing overall energy consumption. Occupant comfort is an essential component of healthy and productive indoor environments. By optimizing thermal control, including humidity control, there are documented improvements in occupant health, including improved respiratory function, and reduced mold and mildew growth. This is particularly important in hospitals, where patients are likely to have suppressed immune systems or other illnesses that make them more vulnerable to poor indoor environmental conditions.

Occupant control of ventilation or airflow may conflict with regulatory requirements for ventilation rates and pressurization in health care environments, but to the extent feasible, the intent of this credit is to provide a high level of lighting and thermal comfort systems control by individual occupants, or by specific groups in multi-occupant spaces (i.e., holding and recovery areas, treatment spaces, patient rooms), to promote the productivity, comfort, wellbeing, and satisfaction of building occupants. Systems also need to provide for the assessment of building thermal comfort over time.

This credit seeks to provide building occupants with a connection between indoor spaces and the outdoors by introducing daylight and views into the building's regularly occupied areas. Americans are estimated to spend about 90% of their time indoors. Increasingly, studies are identifying links between a range of health issues and exposure to lightness and darkness during the daily 24-hour cycle. The distinction between daylit and electrically lit spaces is significant: daylight intensity levels are in the range of 10,000 to 40,000 lux, while a brightly lit interior averages between 300 and 500 lux. Daylight changes and modulates not only in intensity but also in spectrum and creates cues for the passage of time with continuously changing shadow patterns.

Benefits of natural light in hospitals and health care facilities include improved physiological and psychological states for both patients and staff. Studies show that daylighting can reduce the stress experienced by caregivers, patients and families. Studies also indicate that daylight can reduce a patient's post surgical recovery time. Moreover, in certain illnesses, the human biological clock or the circadian system plays an important role in maintaining the well-being of the individual by alleviating depression, improving night sleep quality, alertness and performance quality. In Alzheimer's patients, for example, exposure to bright lights during the day consolidates nighttime sleep, which in turn reduces the stress on caregivers. Studies show that "ICU psychosis", a state of delirium experienced in critical care environments, is dramatically reduced when spaces are daylit.

Daylighting in long term care facilities is beneficial in maintaining calcium levels, sleep patterns among elderly, and higher ambient lighting levels required for the aging eye (glare should be prevented). Recent studies have linked the quality of light to the quality of life for frail elderly.

Research shows that physical and visual connections to the natural environment (access to outdoor space, views of nature, natural daylighting) provide social, psychological, and physical benefits. Such connections also assist in patient recovery and healing, reduce stress, and improve the overall health care environment. Similar benefits accrue to the staff, thus leading to improved delivery of services to the patients they serve.

Lighting, both natural and electric, has an effect on the system regulating human circadian rhythm. Light received at the retina suppresses the amount of melatonin released into the blood stream from the pineal gland. Melatonin regulates the sleep-wake cycle, and long-term imbalanced melatonin levels have been linked to effects on the immune system and risk of cancer and Alzheimer's Disease, among others. The use of natural and electric light in the healthcare environment should support circadian rhythms to the extent possible. However, the timing of an individual's circadian functions will typically vary dependent upon their population group (i.e. the young, the aged, those undergoing chemotherapy, day-shift versus evening- or night-shift staff.) Therefore, any lighting system that helps to support a healthy circadian rhythm must be capable of being tuned to the individual patient or to the staff. Care must be taken to educate the staff on the use of such a system because when the lighting works against the establishment of a healthy circadian rhythm, adverse impacts may occur. Even over the short term, low alertness, deteriorated work performance, sleep disturbance, carbohydrate craving, confusion, or loss of coordination may ensue.

This credit seeks to provide building occupants with a healing environment free of disruptive levels of sound. Noise is a well-documented source of stress in health care settings. Noise from personnel, equipment, and visitors impacts patient privacy and sleep patterns. In turn, noise increases stress levels for patients and caregivers. Research finds that in hospitals that reduced noise levels, the patients' satisfaction with care giving increased, their sleep improved, and their blood pressure lowered; similarly, staff in low-noise environments were more positive about their jobs and indicated improved sleep. The World Health Organization recommends that continuous background noise in hospital rooms should not exceed 35 decibels (dB), and nighttime peaks in patient care areas should not exceed 40 dB. Studies have found that background noise levels typically are in the range of 45 to 68 dB and many peaks commonly exceed 90 dB. As hospitals operate continuously, the noise from heliports, generators, outdoor mechanical equipment, and service vehicles impacts the local community as well as the building occupants.

Factor Seven: Innovation and Design Process

Standard: GGHC 2.2 Innovation and Design Process, Credits 1-3, LEED-HC or their equivalents:

Measures: The applicant shall describe the process and/or key rationale used to meet each GGHC, LEED-HC or their equivalents in each measure, highlighting the environmental and/or human health improvements achieved. For any measures that cannot be met, project specific information and an explanation of the process and criteria used in the decision not to implement the measure must be provided.

Measure 1.1-3	Innovation in Design: Identify the intent of the proposed innovation credit, the proposed credit goals, proposed documentation to demonstrate the achievement, and the design approach used to meet the goals. Credit 1.2 (1 point) Same as Credit 1.1. Credit 1.3 (1 point) Same as Credit 1.1.
Measure 2	Documenting Health, Quality of Care & Productivity Performance Impacts: Research Initiatives

Discussion and Intent: The relationship between buildings and health is continuously evolving. The health care industry is uniquely positioned to evolve ever more powerful and innovative strategies to enhance building performance, and thereby community, staff and patient health. These credits are intended to reward exemplary performance of existing credits and encourage implementation of innovative design elements.

By documenting absenteeism, health care cost, employee retention, productivity gains and other health, quality of care, and similar measures of enhanced building performance, MA-based facilities help augment the currently limited data available that tracks how sustainable building and operational strategies influence and protect public health. It helps build the financial case for sound public health policy related to building construction and operations.

Studies focused on commercial office buildings conclude that building occupants supplied with high quality indoor air and given control of ventilation and lighting, and access to nature have reduced illness/absenteeism and increased productivity.

Appendix 1, 2, 3 attached

Appendix 1: GGHC V2.2 Construction Section Checklists

Project architects, project managers and/or hospital facilities staff have ready access to the GGHC, the USGBC LEED-HC, and similar documents. In many cases a green team or individual routinely use these documents for investigating options and tracking progress in addressing green and healthy project goals. Pursuant to the DoN guidelines for environmental and human health impact, an applicant shall utilize Leadership in Energy and Environmental Design-Health Care (LEED-HC), the Construction section of the Green Guide for Healthcare listed below (or with the approval of the Department the equivalent current nationally accepted best practice standard) in all DoN applications as one of their Factor 8 Environmental Impact requirements.

Applicants shall submit to the Department as part of their DoN application a provisional green and healthy building strategy assessment (as referenced in LEED-HC, GGHC or other Department approved equivalent current nationally accepted best practice standard) based on the most current plans for the project to indicate the likely strategies to be employed to meet the applicable percentage threshold. Applicants will then submit a completed certifiable green and healthy strategy credit point assessment as part of the plan review. DoN application approval will consider but not be contingent upon the information included in the provisional assessment, and plan review approval will be contingent on the final credit assessment meeting the applicable percentage threshold.

To avoid the common failings of a "checklist" approach to design and DoN guidelines, and to achieve optimum public health and environmental benefits from these strategy assessments, the Department recommends the use of American National Standards Institute, ANSI/MTS (2007) 1.0 *Whole Systems Integrated Process Guide (WSIP)-2007 for Sustainable Buildings & Communities* or other Department approved, equivalent current nationally accepted best practice standard.

The purpose of the form below is to better enable the healthcare institution to protect the public health in the design, development, construction and operation of its facilities, and to provide a nationally accepted methodology as a framework for interactions between applicants and the Department.

Construction

Achievable	Percent Likely or Unknown*	Not Achievable	Not Applicable		
					For provisional strategy assessment in DoN applications, applicants are encouraged to estimate the percent likelihood of adoption on credits for which there is significant uncertainty. Such provisional estimates will be used strictly as indicators of intent and/or areas requiring additional design work. If such an estimate is not practical, insert "U" for "Unknown" in the second column. For certifiable plan review approval, the "Percent Likely or Unknown" column cannot be used.
Integrated Design					
Y				Prereq 1	Integrated Design Process
Y				Prereq 2	Health Mission Statement & Program
Sustainable Sites					
Y				Prereq 1	Construction Activity Pollution Prevention
Y	?	N	NA	Credit 1	Site Selection
Y	?	N	NA	Credit 2	Development Density & Community Connectivity
Y	?	N	NA	Credit 3.1	Brownfield Redevelopment: Basic Remediation Level
Y	?	N	NA	Credit 3.2	Brownfield Redevelopment: Residential Remediation Level

Y	?	N	NA	Credit 3.3	Brownfield Redevelopment: Minimizing Future Hazards
Y	?	N	NA	Credit 4.1	Alternative Transportation: Public Transportation Access
Y	?	N	NA	Credit 4.2	Alternative Transportation: Bicycle Storage & Changing Rooms
Y	?	N	NA	Credit 4.3	Alternative Transportation: Low-Emitting & Fuel Efficient Vehicles
Y	?	N	NA	Credit 4.4	Alternative Transportation: Parking Capacity
Y	?	N	NA	Credit 5.1	Site Development: Protect or Restore Open Space or Habitat
Y	?	N	NA	Credit 5.2	Site Development: Reduce Development Footprint
Y	?	N	NA	Credit 5.3	Site Development: Structured Parking
Y	?	N	NA	Credit 6.1	Stormwater Design: Quantity Control
Y	?	N	NA	Credit 6.2	Stormwater Design: Quality Control
Y	?	N	NA	Credit 7.1	Heat Island Effect: Non-Roof
Y	?	N	NA	Credit 7.2	Heat Island Effect: Roof
Y	?	N	NA	Credit 8	Light Pollution Reduction
Y	?	N	NA	Credit 9.1	Connection to the Natural World: Outdoor Places of Respite
Y	?	N	NA	Credit 9.2	Connection to the Natural World: Exterior Access for Patients
Y	?	N	NA	Credit 10.1	Community Contaminant Prevention: Airborne Releases
Y	?	N	NA	Credit 10.2	Community Contaminant Prevention: Leaks & Spills

Water Efficiency

Y				Prereq 1	Potable Water Use for Medical Equipment Cooling
Y	?	N	NA	Credit 1	Water Efficient Landscaping: No Potable Water Use or No Irrigation
Y	?	N	NA	Credit 2.1	Potable Water Use Reduction: Measurement & Verification
Y	?	N	NA	Credit 2.2	Potable Water Use Reduction: Domestic Water
Y	?	N	NA	Credit 2.3	Potable Water Use Reduction: Domestic Water
Y	?	N	NA	Credit 2.4	Potable Water Use Reduction: Process Water & Building System Equipment
Y	?	N	NA	Credit 2.5	Potable Water Use Reduction: Process Water & Building System Equipment

Energy & Atmosphere

Y				Prereq 1	Fundamental Commissioning of the Building Energy Systems
Y				Prereq 2	Minimum Energy Performance
Y				Prereq 3	Fundamental Refrigerant Management
Y	?	N	NA	Credit 1.1	Optimize Energy Performance: 3.5%/10.5%
Y	?	N	NA	Credit 1.2	Optimize Energy Performance: 7%/14%
Y	?	N	NA	Credit 1.3	Optimize Energy Performance: 10.5%/17.5%
Y	?	N	NA	Credit 1.4	Optimize Energy Performance: 14%/21%
Y	?	N	NA	Credit 1.5	Optimize Energy Performance: 17.5%/24.5%
Y	?	N	NA	Credit 1.6	Optimize Energy Performance: 21%/28%
Y	?	N	NA	Credit 1.7	Optimize Energy Performance: 24.5%/31.5%
Y	?	N	NA	Credit 1.8	Optimize Energy Performance: 28%/35%
Y	?	N	NA	Credit 1.9	Optimize Energy Performance: 31.5%/50.5%
Y	?	N	NA	Credit 1.10	Optimize Energy Performance: 35%/42%
Y	?	N	NA	Credit 2.1	
Y	?	N	NA	Credit 2.2	

Y	?	N	NA	Credit 2.3	
Y	?	N	NA	Credit 3	Enhanced Commissioning
Y	?	N	NA	Credit 4	Enhanced Refrigerant Management
Y	?	N	NA	Credit 5	Measurement & Verification
Y	?	N	NA	Credit 6.1	Green Power: 20%
Y	?	N	NA	Credit 6.2	Green Power: 50%
Y	?	N	NA	Credit 6.3	Green Power: 80%
Y	?	N	NA	Credit 6.4	Green Power: 100%
.Y	?	N	NA	Credit 7	Equipment Efficiency

Materials & Resources

Y	Prereq 1	Storage & Collection of Recyclables
Y	Prereq 2	Mercury Elimination

Y	?	N	NA	Credit 1.1	Building Reuse: Maintain 40% of Existing Walls, Floors & Roof
Y	?	N	NA	Credit 1.2	Building Reuse: Maintain 80% of Existing Walls, Floors & Roof
Y	?	N	NA	Credit 1.3	Building Reuse: Maintain 50% of Interior Non-Structural Elements
Y	?	N	NA	Credit 2.1	Construction Waste Management: Divert 50% from Disposal
Y	?	N	NA	Credit 2.2	Construction Waste Management: Divert 75% from Disposal
Y	?	N	NA	Credit 2.3	Construction Practices: Site & Materials Management
Y	?	N	NA	Credit 2.4	Construction Practices: Utility & Emissions Control
Y	?	N	NA	Credit 3.1	Sustainably Sourced Materials: 10%
Y	?	N	NA	Credit 3.2	Sustainably Sourced Materials: 20%
Y	?	N	NA	Credit 3.3	Sustainably Sourced Materials: 30%
Y	?	N	NA	Credit 3.4	Sustainably Sourced Materials: 40%
Y	?	N	NA	Credit 3.5	Sustainably Sourced Materials: 50%
Y	?	N	NA	Credit 4.1	PBT Elimination: Dioxins
Y	?	N	NA	Credit 4.2	PBT Elimination: Mercury
Y	?	N	NA	Credit 4.3	PBT Elimination: Lead & Cadmium
Y	?	N	NA	Credit 5.1	Furniture & Medical Furnishings: Resource Reuse
Y	?	N	NA	Credit 5.2	Furniture & Medical Furnishings: Materials
Y	?	N	NA	Credit 5.3	Furniture & Medical Furnishings: Manufacturing, Transportation & Recycling
Y	?	N	NA	Credit 6	Copper Reduction
Y	?	N	NA	Credit 7.1	Resource Use: Design for Flexibility
Y	?	N	NA	Credit 7.2	Resource Use: Design for Durability

Environmental Quality

Y	Prereq 1	Minimum IAQ Performance
Y	Prereq 2	Environmental Tobacco Smoke Control (ETS)
Y	Prereq 3	Hazardous Material Removal or Encapsulation

Y	?	N	NA	Credit 1	Outdoor Air Delivery Monitoring
Y	?	N	NA	Credit 2	Natural Ventilation
Y	?	N	NA	Credit 3.1	Construction EQ Management Plan: During Construction
Y	?	N	NA	Credit 3.2	Construction EQ Management Plan: Before Occupancy
Y	?	N	NA	Credit 4.1	Low-Emitting Materials: Interior Adhesives & Sealants
Y	?	N	NA	Credit 4.2	Low-Emitting Materials: Wall & Ceiling Finishes
Y	?	N	NA	Credit 4.3	Low-Emitting Materials: Flooring Systems

Y	?	N	NA	Credit 4.4	Low-Emitting Materials: Composite Wood & Insulation
Y	?	N	NA	Credit 4.5	Low-Emitting Materials: Furniture & Medical Furnishings
Y	?	N	NA	Credit 4.6	Low-Emitting Materials: Exterior Applied Products
Y	?	N	NA	Credit 5.1	Chemical & Pollutant Source Control: Outdoor
Y	?	N	NA	Credit 5.2	Chemical & Pollutant Source Control: Indoor
Y	?	N	NA	Credit 6.1	Controllability of Systems: Lighting
Y	?	N	NA	Credit 6.2	Controllability of Systems: Thermal Comfort
Y	?	N	NA	Credit 7	Thermal Comfort
Y	?	N	NA	Credit 8.1a	Daylight & Views: Daylight for Occupied Spaces: 6% above 'square-root base' daylit area
Y	?	N	NA	Credit 8.1b	Daylight & Views: Daylight for Occupied Spaces: 12% above 'square-root base' daylit area
Y	?	N	NA	Credit 8.1c	Daylight & Views: Daylight for Occupied Spaces: 18% above 'square-root base' daylit area
Y	?	N	NA	Credit 8.1d	Daylight & Views: Daylight for Occupied Spaces: 75% of regularly occupied spaces
Y	?	N	NA	Credit 8.1e	Daylight & Views: Daylight for Occupied Spaces: 90% of regularly occupied spaces
Y	?	N	NA	Credit 8.2	Daylight & Views: Connection to the Natural World: Indoor Places of Respite
Y	?	N	NA	Credit 8.3	Daylight & Views: Lighting & Circadian Rhythm
Y	?	N	NA	Credit 9.1	Acoustic Environment: Exterior Noise, Acoustical Finishes, & Room Noise Levels
Y	?	N	NA	Credit 9.2	Acoustic Environment: Sound Isolation, Paging & Call System, & Building Vibration

Innovation & Design Process

Y	?	N	Credit 1.1	Innovation in Design:
Y	?	N	Credit 1.2	Innovation in Design
Y	?	N	Credit 1.3	Innovation in Design
Y	?	N	Credit 2	Documenting Health, Quality of Care & Productivity Performance Impacts: Research Initiatives

Operations

Integrated Operations

Y				Prereq 1	Ongoing Self-Certification
Y				Prereq 2	Integrated Operations & Maintenance Process
Y				Prereq 3	Environmental Tobacco Smoke Control
Y				Prereq 4	Outside Air Introduction & Exhaust Systems
Y	?	N	NA	Credit 1.1	Building Operations & Maintenance: Staff Education
Y	?	N	NA	Credit 1.2	Building Operations & Maintenance: Building Systems Maintenance
Y	?	N	NA	Credit 1.3	Building Operations & Maintenance: Building Systems Monitoring
Y	?	N	NA	Credit 2.1	IAQ Management: Maintaining Indoor Air Quality
Y	?	N	NA	Credit 2.2	IAQ Management: Reduce Particulates in Air Distribution

Transportation Operations

Y	?	N	NA	Credit 1.1	Alternative Transportation: Public Transportation Access
Y	?	N	NA	Credit 1.2	Alternative Transportation: Low Emitting & Fuel Efficient Vehicles
Y	?	N	NA	Credit 1.3	Alternative Transportation: Carpool Programs

Energy Efficiency

Y				Prereq 1	Existing Building Commissioning
Y				Prereq 2	Minimum Building Energy Performance
Y				Prereq 3	Ozone Protection
Y	?	N	NA	Credit 1.1	Optimize Energy Performance: Energy Star score of 63
Y	?	N	NA	Credit 1.2	Optimize Energy Performance: Energy Star score of 67
Y	?	N	NA	Credit 1.3	Optimize Energy Performance: Energy Star score of 71
Y	?	N	NA	Credit 1.4	Optimize Energy Performance: Energy Star score of 75
Y	?	N	NA	Credit 1.5	Optimize Energy Performance: Energy Star score of 79
Y	?	N	NA	Credit 1.6	Optimize Energy Performance: Energy Star score of 83
Y	?	N	NA	Credit 1.7	Optimize Energy Performance: Energy Star score of 87
Y	?	N	NA	Credit 1.8	Optimize Energy Performance: Energy Star score of 91
Y	?	N	NA	Credit 1.9	Optimize Energy Performance: Energy Star score of 95
Y	?	N	NA	Credit 1.10	Optimize Energy Performance: Energy Star score of 99
Y	?	N	NA	Credit 2.1	On-Site & Off-Site Renewable Energy: 1% on or 5% off
Y	?	N	NA	Credit 2.2	On-Site & Off-Site Renewable Energy: 2% on or 10% off
Y	?	N	NA	Credit 2.3	On-Site & Off-Site Renewable Energy: 5% on or 25% off
Y	?	N	NA	Credit 2.4	On-Site & Off-Site Renewable Energy: 10% on or 50% off
Y	?	N	NA	Credit 3	Energy Efficient Equipment
Y	?	N	NA	Credit 4	Refrigerant Selection
Y	?	N	NA	Credit 5.1	Performance Measurement: Enhanced Metering
Y	?	N	NA	Credit 5.2	Performance Measurement: Emission Reduction Reporting

Water Conservation

Y				Prereq 1	Minimum Water Efficiency
Y	?	N	NA	Credit 1.1	Water Efficient Landscaping: Reduce potable water use by 50%
Y	?	N	NA	Credit 1.2	Water Efficient Landscaping: Eliminate potable water use
Y	?	N	NA	Credit 2.1	Building Water Use Reduction: Reduce 10%
Y	?	N	NA	Credit 2.2	Building Water Use Reduction: Reduce 20%
Y	?	N	NA	Credit 2.3	Building Water Use Reduction: Reduce 30%
Y	?	N	NA	Credit 2.4	Building Water Use Reduction: Reduce 40%
Y	?	N	NA	Credit 2.5	Building Water Use Reduction: Reduce 50%
Y	?	N	NA	Credit 3	Performance Measurement: Enhanced Metering

Chemical Management

Y				Prereq 1	Polychlorinated Biphenyl (PCB) Removal
Y	?	N	NA	Credit 1.1	Community Contaminant Prevention: Airborne Releases
Y	?	N	NA	Credit 1.2	Community Contaminant Prevention: Leaks & Spills
Y	?	N	NA	Credit 2.1	Indoor Pollutant Source Control & Other Occupational Exposures: Chemical Management & Minimization
Y	?	N	NA	Credit 2.2	Indoor Pollutant Source Control & Other Occupational Exposures: High Hazard Chemicals
Y	?	N	NA	Credit 3	Chemical Discharge: Pharmaceutical Management & Disposal

Waste Management

Y				Prereq 1	Waste Stream Audit
Y	?	N	NA	Credit 1.1	Total Waste Reduction: 15%
Y	?	N	NA	Credit 1.2	Total Waste Reduction: 25%
Y	?	N	NA	Credit 1.3	Total Waste Reduction: 35%
Y	?	N	NA	Credit 2.1	Regulated Medical Waste Reduction: <10%
Y	?	N	NA	Credit 2.2	Regulated Medical Waste Reduction: Minimize incineration
Y	?	N	NA	Credit 3	Food Waste Reduction

Environmental Services

Y	?	N	NA	Credit 1.1	Outdoor Grounds & Building Exterior Management : Implement 4 strategies
Y	?	N	NA	Credit 1.2	Outdoor Grounds & Building Exterior Management : Implement 8 strategies
Y	?	N	NA	Credit 2	Indoor Integrated Pest Management
Y	?	N	NA	Credit 3	Environmentally Preferable Cleaning Policy
Y	?	N	NA	Credit 4.1	Sustainable Cleaning Products & Materials: 30% of annual purchases
Y	?	N	NA	Credit 4.2	Sustainable Cleaning Products & Materials: 60% of annual purchases
Y	?	N	NA	Credit 4.3	Sustainable Cleaning Products & Materials: 90% of annual purchases
Y	?	N	NA	Credit 5	Environmentally Preferable Janitorial Equipment

Environmentally Preferable Purchasing

Y	?	N	NA	Credit 1.1	Food: Organic or Sustainable
Y	?	N	NA	Credit 1.2	Food: Antibiotics
Y	?	N	NA	Credit 1.3	Food: Local Production / Food Security
Y	?	N	NA	Credit 2	Janitorial Paper & Other Disposable Products
Y	?	N	NA	Credit 3	Electronics Purchasing & End of Life Management
Y	?	N	NA	Credit 4.1	Toxic Reduction: Mercury
Y	?	N	NA	Credit 4.2	Toxic Reduction: DEHP
Y	?	N	NA	Credit 4.3	Toxic Reduction: Natural Rubber Latex
Y	?	N	NA	Credit 5	Furniture & Medical Furnishings
Y	?	N	NA	Credit 6.1	IAQ Compliant Products: 45% of annual purchases
Y	?	N	NA	Credit 6.2	IAQ Compliant Products: 90% of annual purchases

Innovation in Operation

Y	?	N	Credit 1.1	Innovation in Operations
Y	?	N	Credit 1.2	Innovation in Operations
Y	?	N	Credit 1.3	Innovation in Operations
Y	?	N	Credit 1.4	Innovation in Operations
Y	?	N	Credit 2	Documenting Sustainable Operations: Business Case Impacts
Y	?	N	Credit 3.1	Documenting Productivity Impacts: Absenteeism & Health Care Cost Impacts
Y	?	N	Credit 3.2	Documenting Productivity Impacts: Research Initiatives

Appendix 3: Detailed Requirements for Massachusetts

Based on DPH experience in MA climate, five credit areas require special attention and/or documentation. They are:

1. Building material reuse,
2. Outdoor air delivery monitoring,
3. Natural ventilation,
4. Construction practices: site and materials management, and
5. Construction environmental quality management plan during construction.

Details and documentation are provided below.

Materials and Resources: Credit 1.1 or its equivalent
Building reuse: Maintaining 40% of existing walls, floors and roof

In order to qualify for a credit under this section, the applicant must provide documentation that the materials proposed for reuse are, have been and will be free of water damage and mold growth. This documentation shall include a description of the condition of materials to be reused, with supporting documents and/or photographs.

MR Credit 1.2 or its equivalent
Building reuse: Maintaining in 80% of existing walls, floors

In order to qualify for a credit under this section, the applicant must provide documentation that the materials proposed for reuse are, have been and will be free of water damage and mold growth. This documentation shall include a description of the condition of materials to be reused, with supporting documents and/or photographs.

MR Credit 1.3 or its equivalent
Building reuse: Maintaining 50% of interior non-structural elements

In order to qualify for a credit under this section, the applicant must provide documentation that the materials proposed for reuse are, have been and will be free of water damage and mold growth. This documentation shall include a description of the condition of materials to be reused, with supporting documents and/or photographs.

EQ Credit 1 or its equivalent
Outdoor air delivery monitoring

In order to qualify for a credit under this section, the applicant must provide documentation of the purpose and principle elements of the air delivery monitoring system, as well as an operations and maintenance plan for this system, especially if carbon dioxide detectors are being installed in patient rooms. The applicant must also describe how thermal comfort can be maintained as required by any applicable regulation.

EQ Credit 2 or its equivalent
Natural ventilation

In order to qualify for a credit under this section, the applicant must provide documentation of the means and methods used to control humidity resulting from temperature extremes which can lead to mold on building materials. Such documentation shall include a description of the heating, ventilating and air conditioning (HVAC) system and methods used to insulate and prevent moisture accumulation in building materials if windows are open during hot, humid weather.

MR Credit 2.3 or its equivalent
Construction practices: site and materials management

In order to qualify for a credit under this section, the applicant must provide documentation of how materials will be protected from water damage.

EQ Credit 3.1 or its equivalent
Construction EQ management plan: during construction

In order to qualify for a credit under this section, the applicant must provide documentation on methods related to the protection of building occupants who may be at risk of exposure to pollutants generated during the renovation process.

Documentation of containment plans which addresses the following issues:

- administrative management methods to prevent exposure to pollutants generated during construction/renovation;
- physical isolation of occupied areas from construction/renovation areas;
- the use of air pressurization/depressurization techniques to direct pollutants away from building occupants;
- operation of the existing ventilation systems during the renovation; and
- control/reduction of pollutants in occupied areas.

Guidance concerning these topics can be found in the Massachusetts Department of Public Health, Bureau of Environmental Health, Indoor Air Quality Program's guidelines "Methods Used to Reduce/Prevent Exposure to Construction/Renovation Generated Pollutants in Occupied Buildings, November 2006".

Attachment 1

Addition to the DoN Application under the Factor 8 – Environmental Impact Section:

The Department of Public Health further recognizes the importance of improving environmental quality and the health of the citizens of the commonwealth by linking environmentally sound building design, construction, materials and operations in new construction, renovation and operation of health care facilities. The Department is adopting the Leadership in Energy and Environmental Design-Health Care (LEED-HC), the Green Guide for Health Care ("GGHC"), or with the approval of the Department an equivalent current nationally accepted best practice standard, for all DoN applications for such projects that exceed the capital expenditure thresholds. The Guidelines incorporate by reference the LEED-HC, the Green Guide and any equivalent current nationally accepted best practice standard.

Pursuant to these DoN guidelines, applicants shall utilize the Leadership in Energy and Environmental Design-Health Care (LEED-HC), the Construction Section of the Green Guide for Healthcare (See Appendix 1: GGHC V2.2 Construction Section Checklist), or with the approval of the Department the equivalent current nationally accepted best practice standard in all DoN applications. To demonstrate their consideration of and commitment to such standards, applicants shall submit to the Department as part of their DoN application a provisional green and healthy building strategy assessment (as referenced in LEED-HC, GGHC V2.2 or other Department approved equivalent current nationally accepted best practice standard) based on the most current plans for the project to indicate the likely strategies to be employed to meet the applicable percentage threshold. Applicants will then submit a completed certifiable green and healthy strategy credit point assessment as part of the plan review. Final approval of the strategy assessment cannot be given by DoN as part of the application review process, since elements of the building may change as part of an active and vigorous plan review process. Thus, application approval will consider but not be contingent upon the information included in the provisional assessment. Plan review approval, however, will be contingent on the final credit assessment meeting the applicable percentage threshold.