Construction Credits

Intent
The Green Guide for Health Care (Green Guide) is a voluntary, best practices toolkit that acknowledges current U.S. regulatory standards. However, the Green Guide for Health Care is not a regulatory document.

The Green Guide’s Construction section supports the design and construction phases of health care facilities. Project teams are encouraged to consider complementary credits from the Green Guide’s Operations section during the design process. Credit synergies are designated at the end of the Potential Technologies & Strategies section of each credit. Existing facilities are encouraged to track their ongoing performance using the Operations section and to use the Construction section on future expansion, renovation and new construction projects.

The Green Guide’s organizational framework is summarized as follows:

• The Green Guide’s organizational structure is borrowed by agreement from the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED®) Green Building Rating System. The Green Guide is not a LEED® Rating System nor a product of the U.S. Green Building Council. The LEED structure was adopted because it is a familiar and effective method used by a rapidly growing sector of the building design, construction, operations and maintenance industries.

• The Green Guide addresses the unique structural, usage, and regulatory challenges of health care buildings and emphasizes the environmental and public health considerations that underpin a health care institution’s approach to sustainability in their building portfolio.

• For many credits, the Green Guide directly incorporates the language of a parallel LEED credit, referencing credits in the LEED systems for New Construction, Existing Buildings and Commercial Interiors. In some cases, existing LEED credits have been modified to respond to the unique needs and concerns of health care facilities. In others, new credits have been added beyond those in current LEED products. The Green Guide’s Credit Summary identifies its relationship to LEED® credits.

Organization
The Green Guide Construction section is organized in accordance with LEED for New Construction v2.2 format. Each credit or prerequisite corresponds to a distinct aspect of health care facilities’ design and construction. Within each credit, one or more points define a range of opportunities and strategies to reduce the facility’s ecological footprint. As noted above, teams using the Green Guide as a self-certifying tool should work towards achieving as many of the prerequisites and credits as possible, but the prerequisites are really there to help those teams interested in pursuing eventual LEED certification.

Credit Structure
The Green Guide for Health Care borrows the credit numbering scheme and credit outline structure of the U.S. Green Building Council (USGBC) LEED® family of products, by agreement, with some modifications. Each credit has the following elements:

• Intent – Summarizes the credit goal.

• Health Issues – (new to the Green Guide) Identifies specific health concerns addressed by the credit. Reviewed by Dr. Ted Schettler, M.D., MPH.

• Credit Goals – Itemizes the specific steps to achieve the credit including threshold goals.

• Suggested Documentation – Suggests documentation to monitor and baseline performance and to benchmark achievement of the Credit Goals. The Green Guide is a voluntary self-certifying document,
that does not offer third party certification. Users of the Green Guide are encouraged to establish internal record keeping and tracking systems to support ongoing monitoring and continuous improvement. Note that while the suggested documentation requirements in Green Guide for Health Care: Construction can be completed by the end of construction, some of the strategies in the Operations section require collection of up to a year’s data to determine credit achievement. Furthermore, while these operational data requirements are especially geared for existing facilities, they are also intended to serve as useful references for new construction projects as they establish operations policies and ongoing operational protocols. In addition, the Suggested Documentation will help those teams interested in pursuing eventual LEED certification, as being an approximation what might be documents required by the LEED document.

- **Reference Standards** – Identify the standards and documents that establish the basis of the credit requirements.

- **Potential Technologies & Strategies** – Suggest helpful information to support the credit Intent and Credit Goals. Regional considerations and project specific performance needs, goals and other constraints are important factors to consider. Products and materials referenced in the Potential Technologies & Strategies section do not represent an endorsement but are suggestions for consideration in some applications.

- **Resources** – Cites selected information sources associated with the credit Intent, Credit Goals, and Potential Technologies and Strategies.

**Points & Achievement Levels**
Because the Green Guide is not a third-party certification tool, it does not provide achievement level threshold rankings. The intent of the point system is to mimic the familiar LEED system, while giving the hospital design and construction team a way to baseline and benchmark their achievement and support continuous improvement.
Integrated Design

Required

ID Prerequisite 1

Integrated Design Process

Intent
Establish and implement a multi-stakeholder collaborative goal setting and design process.

Health Issues
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 develop and implement cost-effective green and healthy building strategies. More so than in the commercial sector, conventional health care facility construction, with its myriad technical requirements, is often fragmented. 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.

Credit Goals
Use cross discipline design and decision-making starting in the programming and pre-design phase of the project and continuing throughout construction to optimize achievement of sustainable design objectives. At a minimum, ensure the following process:

• Define an integrated design team, including representation from all end user stakeholders, including (as applicable): owner’s capital budget manager; development staff; physician and nursing teams; administrators; facility managers; support services; housekeeping staff; engineering/maintenance personnel; functional and space programmers; architect; interior designer; landscape architect; lighting consultant; MEP engineer; energy modeler; life cycle cost analyst; construction cost estimator; construction manager or general contractor; sustainability consultant; and, commissioning agent. Individuals may perform more than one role for the team; ie, the architect may also be the space programmer or the administrator may also manage the capital budget.

• Consider community participation as appropriate.

• Designate an on-site party responsible to oversee the project’s environmental and health goals and implement procedures for environmental protection.

• Conduct an initial Integrated Design Charrette with the team to develop the project vision and goals. Document the charrette outcomes, including preparation of the Health Mission Statement (see GGHC ID Prerequisite 2) incorporated in the project’s Design Intent Document and/or Owner’s Program Requirements.

• Develop and implement a regular meeting schedule for the integrated design team to continue refining the project’s sustainable design strategies throughout the design process. Review strategies for synergies between systems and processes, with the goal of linking strategies into a larger design framework.

• Where possible, develop measurable metrics associated with sustainable design goals for the project, using the credits in the Green Guide for Health Care Construction section as a guide, where appropriate.
ID Prerequisite 1 continued

Integrated Design Process

- Identify a minimum of one (1) Innovation credit for the project.

Suggested Documentation

- Register the project with the Green Guide for Health Care (http://www.gghc.org).
- Register or document previous registration with the Hospitals for a Healthy Environment Program (http://www.h2e-online.org)
- Document the meeting minutes of the Integrated Design Charrette and regular meetings of the integrated design team and regular meetings of the integrated design team including a list of attendees representing each owner and professional discipline noted in the Credit Goals. Indicate in the meeting notes which person will be responsible for each professional discipline.
- Update the GGHC credit checklist online (http://www.gghc.org) quarterly, indicating the credits the team intends to pursue (Y), those in question (?), and those that do not apply (N/A).
- At the completion of each phase, revisit and refine the checklist to reflect project development decisions. For credits that are “abandoned” in the process, document the major obstacles that were encountered that prevented the team from realizing the originally identified goals and/or performance targets.
- Compile copies of the Goals Statements, performance checklists, and/or other design tools used in the development of the project’s high performance design components.

Reference Standards

There is no reference standard for this credit.

Potential Technologies & Strategies

- Reinforce corporate/institutional commitments to environmental health and community responsibility.
- Use cross discipline design, decision-making, and charrettes. Use goal-setting workshops and build a team approach to the project.
- Prepare checklists for points and strategies prior to beginning the design process; refer to the checklist at milestones during the design process.
- Engage owner, staff, contractors, user groups and community groups, educating them on the benefits of green design and bringing them into the design process at key points in the decision-making process.
- Participate in peer-to-peer information exchange and problem solving through the Green Guide Forum with other project teams implementing sustainable design, construction and operations.
- Apply performance-based incentives to professional contracts that reward achievement of Integrated Design Goals and Project Vision. Incentives may be based on life cycle cost-based equipment and material selection, levels of achievement in the Green Guide, comparisons to benchmarks of existing facility performance or combinations of these and other benchmarks.
ID Prerequisite 1 continued

Integrated Design Process

• Contractually apportion professional fees to create specific line items for the Integrated Design Charrette and subsequent monitoring and follow-up meetings. Integrated Design may benefit from re-apportioning design fees to provide a higher percentage early in the process leading to stronger integration and streamlining in subsequent design stages.

• Seek foundation support for integrated design initiatives, such as the Kresge Foundation.

Resources


Audio Conference of “Introduction to the Hospital for a Healthy Environment Program and Data Collection, http://www.h2e-online.org

Going Green, A Resource Kit for Pollution Prevention in Health Care, http://www.noharm.org/goingGreen

Hospitals for a Healthy Environment, http://h2e-online.org/about/overview.htm

“Institutionalizing Environmental Programs,” Hospitals for a Healthy Environment. This document includes a description of how to form a multi-disciplinary team, a job description for an environmental manager and a sample health statement. http://www.h2e-online.org/docs/h2esample.eco.goals80206.pdf

GGHC Construction Credit Synergies
• EA Prerequisite 1: Fundamental Commissioning of the Building Energy Systems
• EA Credit 3: Enhanced Commissioning
• EA Credit 5: Measurement & Verification

GGHC Operations Credit Synergies
• IO Prerequisite 1: Integrated Operations & Maintenance Process
• IO Prerequisite 2: Recertification Process
• WC Credit 3: Performance Measurement: Enhanced Metering
• EE Prerequisite 1: Existing Building Commissioning
• EE Credit 5: Performance Measurement
Required ID Prerequisite 2
Health Mission Statement & Program

Intent
Establish human health as a fundamental evaluative criterion for building design, construction, and operational strategies.

Health Issues
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.

Credit Goals

- Incorporate a health mission statement in the project’s design intent document that includes goals to safeguard the health of building occupants, the local community, and the global environment while creating a high performance healing environment for the building’s patients, caregivers, and staff. Include consideration of "triple bottom line" values - economic, environmental, and social.

- Express the facility’s commitment to implement the health mission statement in present and future design, construction and operations in the design intent document.

- Incorporate the health mission statement and program into the other project documents retained by the facility to assure that future alterations, additions, and program changes are consistent with its intent.

Suggested Documentation

- Document the inclusion of a health mission statement and program in the project’s design intent document.

- Develop the design intent document at an Integrated Design Charrette early in the design or goal-setting process.

Reference Standards
There is no reference standard for this credit.
ID Prerequisite 2 continued

Health Mission Statement & Program

Potential Technologies and Strategies

- Where possible, establish quantifiable strategies. Document progress at the conclusion of each project phase and, where applicable, for at least a year post-occupancy.
- Use the design intent document as a basis for design team selection, design criteria, and construction documents.

Resources

Boulder Community Hospital Environmental Stewardship Brochure, http://www.h2e-online.org/docs/boulder.jpg

“Institutionalizing Environmental Programs,” Hospitals for a Healthy Environment. This document includes a description of how to form a multi-disciplinary team, a job description for an environmental manager and a sample health statement, http://www.h2e-online.org/docs/h2esample.eco.goals80206.pdf

St. Mary’s Hospital Environmental Stewardship Brochure, http://www.h2e-online.org/docs/environstewardship51906.pdf

GGHC Construction Credit Synergies
- ID Prerequisite 1: Integrated Design Process

GGHC Operations Credit Synergies
- IO Prerequisite 1: Integrated Operations & Maintenance Process
- IO Prerequisite 2: Recertification Process
Sustainable Sites

Required

SS Prerequisite 1

Construction Activity Pollution Prevention

Intent

Reduce pollution from construction activities by controlling soil erosion, waterway sedimentation and airborne dust generation.

Health Issues

Controlling erosion retains soil resources on site, preventing run-off from entering aquatic bodies with potential for sedimentation and human exposure to waterborne pollutants and toxic chemicals, and dispersion of dust and particulate matter that can exacerbate respiratory illnesses.

Credit Goals

- Create and implement an Erosion and Sedimentation Control (ESC) Plan for all construction activities associated with the project. The ESC Plan shall conform to the erosion and sedimentation requirements of the 2003 EPA Construction General Permit OR local erosion and sedimentation control standards and codes, whichever is more stringent. The Plan shall describe the measures implemented to accomplish the following objectives:
  - Prevent loss of soil during construction by stormwater run-off and/or wind erosion, including protecting topsoil by stockpiling for reuse.
  - Prevent sedimentation of storm sewer or receiving streams.
  - Prevent polluting the air with dust and particulate matter.

The Construction General Permit (CGP) outlines the provisions necessary to comply with Phase I and Phase II of the National Pollutant Discharge Elimination System (NPDES) program. While the CGP only applies to construction sites greater than 1 acre, the requirements are applied to all projects for the purposes of this prerequisite. Information on the EPA CGP is available at: http://cfpub.epa.gov/npdes/stormwater/cgp.cfm.

- Site Utilization
  - Compile a site access plan to minimize site disruption associated with the project's construction phase.
  - Plan temporary construction facilities, designated staging areas, access roads and construction parking within new building and paving footprints to minimize site disturbance.
  - Establish measures to protect priority sensitive areas of the site, including prohibiting staging, stockpiling and soil compaction.
  - Prevent disturbance to natural resources, protected wetlands and endangered species.
  - Handle and store fuels to prevent spills and discharges into waterways.
SS Prerequisite 1 continued
Construction Activity Pollution Prevention

Suggested Documentation

- Prepare an Erosion and Sedimentation Control (ESC) Plan and specifications, by a civil engineer or other responsible party, noting how the project complies with the credit goals and identifying the limits of construction and disturbance and protection measures, including erosion control measures.
- Prepare a Site Access and Utilization Plan in compliance with the Credit Goals.

Reference Standards


Potential Technologies & Strategies

- Adopt an erosion and sedimentation control plan for the project site during construction that employs strategies such as:
  - Temporary and permanent seeding
  - Mulching
  - Earth dikes
  - Silt fencing
  - Sediment traps
  - Sediment basins
- Minimize unnecessary ground disturbance (topsoil stripping) and removal of existing groundcover by protecting existing vegetation, including clusters or groupings of existing trees or shrub masses. Avoid planting isolated plant material.

GGHC Construction Credit Synergies

- SS Credit 2: Development Density & Community Connectivity
- SS Credit 3: Brownfield Redevelopment
- SS Credit 4: Alternative Transportation
- SS Credit 5: Site Development
- SS Credit 6: Stormwater Design
- SS Credit 7: Heat Island Effect

GGHC Operations Credit Synergies

- WE Credit 1: Water Efficient Landscaping
- ES Credit 1: Outdoor Grounds & Building Exterior Management
1 point

SS Credit 1

Site Selection

Intent
Avoid development of inappropriate sites and reduce the environmental impact from the location of a building on a site.

Health Issues
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.

Credit Goals
Do not develop buildings, hardscape, roads or parking areas on portions of sites that meet any one of the following criteria:

• Prime farmland as defined by the United States Department of Agriculture in the United States Code of Federal Regulations, Title 7, Volume 6, Parts 400 to 699, Section 657.5 (citation 7CFR657.5).

• Previously undeveloped land whose elevation is lower than 5 feet above the elevation of the 100-year flood as defined by the Federal Emergency Management Agency (FEMA).

• Land that is specifically identified as habitat for any species on Federal or State threatened or endangered lists.

• Within 100 feet of any wetlands as defined by United States Code of Federal Regulations 40 CFR, Parts 230-233 and Part 22, and isolated wetlands or areas of special concern identified by state or local rule, OR within setback distances from wetlands prescribed in state or local regulations, as defined by local or state rule or law, whichever is more stringent.

• Previously undeveloped land that is within 50 feet of a water body, defined as seas, lakes, rivers, streams, and tributaries which support or could support fish, recreation or industrial use, consistent with the terminology of the Clean Water Act.

• Land which prior to acquisition for the project was public parkland, unless land of equal or greater value as parkland is accepted in trade by the public landowner (Park Authority projects are exempt).

Suggested Documentation
- Obtain verification from the civil engineer that the project site meets the credit goals.

Reference Standards

SS Credit 1 continued

Site Selection


Potential Technologies & Strategies

- During the site selection process, give preference to those sites that do not include sensitive site elements and restricted land types.

- Select a suitable building location and design the building with the minimal footprint to minimize site disruption of those environmentally sensitive areas identified above. Strategies include:
  - Stacking the building program
  - Tuck-under parking
  - Shared facilities with neighboring buildings

GGHC Construction Credit Synergies

- SS Prerequisite 1: Construction Activity Pollution Prevention
- SS Credit 2: Development Density & Community Connectivity
- SS Credit 3: Brownfield Redevelopment
- SS Credit 4: Alternative Transportation
- SS Credit 5: Site Development
- SS Credit 6: Stormwater Design
- SS Credit 7: Heat Island Effect
- SS Credit 8: Light Pollution Reduction
- MR Credit 1: Building Reuse
- EQ Credit 8: Daylight & Views

GGHC Operations Credit Synergies

- TO Credit 1: Alternative Transportation
- EP Credit 1: Food
Intent

Channel development to urban areas with existing infrastructure, protect greenfields and preserve habitat and natural resources. In rural areas, increase development density on existing or previously developed sites rather than undeveloped rural land.

<table>
<thead>
<tr>
<th>Health Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Siting decisions for hospitals and health care facilities reflect regional health care needs. This may lead to a rural site selection to keep pace with shifting population patterns. Adhering to integrated land use and development planning helps to contain sprawl and the associated development patterns that influence it (transportation, air quality, exercise, obesity, blood pressure, etc.) and 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.</td>
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</tbody>
</table>

Credit Goals

OPTION 1 – DEVELOPMENT DENSITY

Construct or renovate building on a previously developed site AND in a community with a minimum density of 60,000 square feet per acre net (Note: density calculation must include the area of the project being built and is based on a typical two-story downtown development).

OR

OPTION 2 – COMMUNITY CONNECTIVITY

Construct or renovate building on a previously developed site AND within ½ mile of a residential zone or neighborhood with an average density of 10 units per acre net AND within ½ mile of at least 10 Basic Services AND with pedestrian access between the building and the services.

Basic Services include, but are not limited to:


Proximity is determined by drawing a 1/2 mile radius around the main building entrance on a site map and counting the services within that radius. (Note: These services may be contained within the medical center. Addressing this issue by master planning for future provision of Basic Services does not meet the credit requirement unless within a five-year projected planned build-out.)

OR

OPTION 3 – EXISTING RURAL SITES

For previously developed rural sites, increase density of the existing site to a minimum development density of 30,000 square feet per acre.
SS Credit 2 continued
Development Density & Community Connectivity

Suggested Documentation

- Prepare a calculation demonstrating that the project has achieved the required development densities. Where applicable, obtain density calculations for the project site and for the surrounding area.
- Prepare an area plan with the project location and appropriate surrounding services highlighted in compliance with credit goals.

Reference Standards
There is no reference standard for this credit.

Potential Technologies & Strategies

- During the site selection process, give preference to urban sites with pedestrian access to a variety of services.
- Increase development density on previously developed sites rather than achieving expansion through acquisition of undeveloped rural land.

Resources


Urban Land Institute, http://www.washington.uli.org, a non-profit organization that promotes the responsible use of land to enhance the environment.

GGHC Construction Credit Synergies
- SS Prerequisite 1: Construction Activity Pollution Prevention
- SS Credit 1: Site Selection
- SS Credit 3: Brownfield Redevelopment
- SS Credit 4: Alternative Transportation
- SS Credit 5: Site Development
- SS Credit 6: Stormwater Design
- SS Credit 7: Heat Island Effect
- MR Prerequisite 1: Storage & Collection of Recyclables
- MR Credit 1: Building Reuse
- MR Credit 2: Construction Waste Management
- MR Credit 3: Sustainably Sourced Materials
- EQ Prerequisite 1: Minimum IAQ Performance
- EQ Credit 2: Natural Ventilation
- EQ Credit 8: Daylight & Views

GGHC Operations Credit Synergies
- TO Credit 1: Alternative Transportation
1 point  

SS Credit 3.1  
Brownfield Redevelopment: Basic Remediation Level

Intent

Rehabilitate damaged sites and buildings where development is complicated by real or perceived environmental contamination, reducing pressure on undeveloped land and protecting the health of the populations occupying a health care facility.

<table>
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<tbody>
<tr>
<td>With appropriate remediation, brownfield redevelopment has the potential to protect public health by safely removing health hazards from communities and restoring degraded land to productive use.</td>
</tr>
</tbody>
</table>

Credit Goals

- Develop on a site or in a building documented as contaminated (by means of an ASTM E1903-97 Phase II Environmental Site Assessment or a local Voluntary Cleanup Program) OR on a site defined as a brownfield by a local, state or federal government agency.

- Effectively remediate site contamination.

Suggested Documentation

- Obtain documentation from a local, state or federal regulator agency confirming that the site and/or building is documented as contaminated or defined as a brownfield by that agency.

- Obtain documentation, including test results, declaring the type of damage that existed on the site and/or building and describing the remediation performed.

- Obtain a copy of state agency clearance certification (or other regulatory authority) allowing for construction of a health care facility on the remediated site.

Reference Standards


Potential Technologies & Strategies

- During the site selection process, give preference to brownfield sites and contaminated buildings. Consider opportunities and risks associated with these sites.

- Coordinate site development plans with remediation activity, as appropriate.

- Identify tax incentives and property cost savings by selecting a brownfield site.

- Develop and implement a site and/or building remediation plan and remediate using strategies such as pump-and-treat, bioreactors, land farming, and in-situ remediation.

- There are many remediation techniques available to developers, depending upon the contaminant(s), the nature of the soil involved, the receptor pathway, and the individuals to be protected. Avoid remediation methods with negative environmental side effects such as incinerating the material or dumping the contaminated material off-site.
SS Credit 3.1 continued

Brownfield Redevelopment: Basic Remediation Level

- Specify and plant species that have a natural capacity to absorb and filter out pollutants.

Resources


GGHC Construction Credit Synergies

- SS Prerequisite 1: Construction Activity Pollution Prevention
- SS Credit 1: Site Selection
- SS Credit 2: Development Density & Community Connectivity
- SS Credit 4: Alternative Transportation
- SS Credit 5: Site Development
- SS Credit 6: Stormwater Design
- MR Credit 1: Building Reuse
- MR Credit 2: Construction Waste Management
- EQ Prerequisite 3: Hazardous Material Removal or Encapsulation
- EQ Credit 5: Chemical & Pollutant Source Control

GGHC Operations Credit Synergies

- IO Prerequisite 2: Integrated Operations & Maintenance Program
- IO Credit 1: Building Operations & Maintenance
- CM Credit 1: Community Contaminant Prevention
- ES Credit 1: Outdoor Grounds & Building Exterior Management
SS Credit 3.2
Brownfield Redevelopment: Residential Remediation Level

Intent
Rehabilitate damaged sites and buildings where development is complicated by real or perceived environmental contamination, reducing pressure on undeveloped land and protecting the health of the populations occupying a health care facility.

Health Issues
Redeveloping brownfields can be an effective strategy to lessen environmental and health risks associated with contaminated sites and restore land to productive use. Stringent remediation is required in brownfield rehabilitation to protect the health and safety of all people residing and working in a health care facility, some of whom are particularly vulnerable to exposure to environmental contaminants.

Existing brownfield regulations are inconsistent and differ in their requirements. Healthcare facilities that locate on brownfield sites can help insure protection of public health through rigorous remediation and consistent compliance with chemical cleanup standards intended to protect vulnerable individuals and populations.

Credit Goals
- Achieve SS Credit 3.1
- Remediate the site to the residential level as defined by the EPA Region 9 Preliminary Remediation Guidelines.

Suggested Documentation
- Obtain documentation, including test results, demonstrating compliance with the EPA Region 9 Preliminary Remediation Guidelines.

Reference Standards
- EPA Sustainable Redevelopment of Brownfields Program, http://www.epa.gov/brownfields

Potential Technologies & Strategies
- See GGHC SS Credit 3.1 Potential Technologies & Strategies and Credit Synergies.

Resources
- See GGHC SS Credit 3.1 Resources section.
SS Credit 3.3

Brownfield Redevelopment: Minimizing Future Hazards

Intent
Rehabilitate damaged sites and buildings where development is complicated by real or perceived environmental contamination, reducing pressure on undeveloped land and protecting the health of the populations occupying a health care facility.

Health Issues
Redeveloping brownfields can be an effective strategy to lessen environmental and health risks associated with contaminated sites and restore land to productive use. Stringent remediation is required in brownfield rehabilitation to protect the health and safety of all people residing and working in a health care facility, some of whom are particularly vulnerable to exposure to environmental contaminants.

Existing brownfield regulations are inconsistent and differ in their requirements. Healthcare facilities that locate on brownfield sites can help insure protection of public health through rigorous remediation and consistent compliance with chemical cleanup standards intended to protect vulnerable individuals and populations.

Note that remediation of a single site may leave adjacent properties with problematic levels of contamination, thus potentially subjecting patients, workers, and the surrounding community to unhealthy levels of exposure.

Credit Goals
Remediation of a single site may leave adjacent properties with problematic levels of contamination, thus potentially subjecting patients or the surrounding community to unhealthful exposure. In addition to the rehabilitation achieved in credits 3.1 and/or 3.2, ensure continued safety of the project site to better provide for the protection of the occupants.

- Achieve SS Credit 3.1 OR SS Credit 3.2

AND

- Verify that the site is more than 2,000 feet from another site classified as a brownfield by a local, state, or federal government agency.

OR

- Establish and implement preventative measures that protect the project site from re-contamination from other proximate sites.

Suggested Documentation
- Obtain verification from the civil engineer or authorized party that the adjacent properties have been surveyed and determined not to be sources of potential hazards.

OR

- Obtain documentation, including test results, demonstrating that the project site is effectively protected from contamination by proximate sites.
SS Credit 3.3 continued
Brownfield Redevelopment: Minimizing Future Hazards

Reference Standards
There is no reference standard for this credit.

Potential Technologies & Strategies
See GGHC SS Credit 3.1 Potential Technologies & Strategies and Credit Synergies.

Resources
See GGHC SS Credit 3.1 Resources section.
SS Credit 4.1
Alternative Transportation: Public Transportation Access

Intent
Reduce pollution and land development impacts from automobile use.

Health Issues
Motor vehicles represent the largest single source of atmospheric pollution including nitrogen oxides (a precursor of smog); benzene (a carcinogen); particulate matter (a trigger of respiratory and cardiovascular illnesses and symptoms); volatile organic compounds (some of which are potentially hazardous and precursors of smog); carbon dioxide (a greenhouse gas); and carbon monoxide (a contributor to heart disease).

Credit Goals

• Locate project within 1/2 mile of an existing, or planned and funded, commuter rail, light rail or subway station.

OR

• Locate project within 1/4 mile of one or more stops for two or more public or campus bus lines usable by building occupants.

Suggested Documentation

☑ Prepare an area drawing or transit map highlighting the building location and the fixed rail stations and bus lines, and indicate the distances between them. Include a scale bar for distance measurement.

Reference Standards

There is no reference standard for this credit.

Potential Technologies & Strategies

• Perform a transportation survey of future building occupants to identify transportation needs.

• Site the building near mass transit, or establish shuttle services to encourage use of mass transit options.

• Provide clear pedestrian access paths between the main building entrance(s) and public transportation stops.

• If public transportation stops are on the project site, provide adequate shelter and proper security measures at the transportation stops to encourage their use.
SS Credit 4.1 continued

Alternative Transportation: Public Transportation Access

GGHC Construction Credit Synergies
- SS Prerequisite 1: Construction Activity Pollution Prevention
- SS Credit 1: Site Selection
- SS Credit 2: Development Density & Community Connectivity
- SS Credit 3: Brownfield Redevelopment
- SS Credit 5: Site Development
- SS Credit 6: Stormwater Design
- SS Credit 7: Heat Island Effect
- SS Credit 8: Light Pollution Reduction
- WE Credit 2: Potable Water Use Reduction
- EA Prerequisite 1: Fundamental Commissioning of the Building Energy Systems
- EA Credit 1: Optimize Energy Performance
- EA Credit 3: Enhanced Commissioning
- EA Credit 5: Measurement & Verification
- MR Credit 1: Building Reuse
- EQ Prerequisite 1: Minimum IAQ Performance

GGHC Operations Credit Synergies
- TO Credit 1: Alternative Transportation
SS Credit 4.2

Alternative Transportation: Bicycle Storage & Changing Rooms

Intent
Reduce pollution and land development impacts from automobile use.

Health Issues
Encouraging bicycling to work contributes to a healthy lifestyle, while offsetting reliance on motorized transport, and the associated chemical and particulate emissions, and land use dedicated for parking and other vehicular infrastructure. According to the World Health Organization, bicycling may be an important contributor to delayed mortality.

Credit Goals

• For institutional buildings, provide secure bicycle racks and/or storage (within 200 yards of a building entrance) for 3% or more of peak building day shift staff, AND, provide shower and changing facilities in the building, or within 200 yards of a building entrance, for 0.5% of peak building day shift staff. (Note: Base calculation on primary day shift FTE hospital staff and on-site outsourced labor, but not visiting clergy or physicians. Staff shower facilities within the building may be incorporated into the calculation.)

OR

• For residential buildings, provide covered storage facilities for securing bicycles for 15% or more of building occupants in lieu of changing/shower facilities.

Suggested Documentation

 Compile site drawings and documents highlighting bicycle storage and changing and shower facilities. Include calculations demonstrating compliance with Credit Goals.

Reference Standards

There is no reference standard for this credit.

Potential Technologies & Strategies

• Design the building with transportation amenities such as bicycle storage and showering/changing facilities. Share shower and changing facilities with Staff Locker facilities.

• Ideal bicycle storage for staff includes enclosed lockers or other secure systems, conveniently located near staff entries.

• Consider the abilities of patients using the specific facility being designed. Some patients treated in medical office buildings, hospitals and other health care facilities may be capable of commuting by bicycle, consistent with an emphasis on preventative medicine.

• Conduct annual reviews of commute modes and preferences and increase bicycle storage capacity as needed to meet potential demand.

• Consider the placement of showers to provide availability for all staff members.
SS Credit 4.2 continued
Alternative Transportation: Bicycle Storage & Changing Rooms

GGHC Construction Credit Synergies
• SS Prerequisite 1: Construction Activity Pollution Prevention
• SS Credit 1: Site Selection
• SS Credit 2: Development Density & Community Connectivity
• SS Credit 3: Brownfield Redevelopment
• SS Credit 5: Site Development
• SS Credit 6: Stormwater Design
• SS Credit 7: Heat Island Effect
• SS Credit 8: Light Pollution Reduction
• WE Credit 2: Potable Water Use Reduction
• EA Prerequisite 1: Fundamental Commissioning of the Building Energy Systems
• EA Credit 1: Optimize Energy Performance
• EA Credit 3: Enhanced Commissioning
• EA Credit 5: Measurement & Verification
• MR Credit 1: Building Reuse
• EQ Prerequisite 1: Minimum IAQ Performance

GGHC Operations Credit Synergies
• TO Credit 1: Alternative Transportation
1 point

SS Credit 4.3

Alternative Transportation: Low-Emitting & Fuel Efficient Vehicles

Intent
Reduce pollution and land development impacts from automobile use.

Health Issues

Health care facilities normally operate fleets of vehicles for the purposes of maintaining and operating their facilities. These vehicles range from ambulances to delivery vans to shuttle buses, which often operate continuously and relatively locally.

Motor vehicles represent the largest single source of atmospheric pollution including nitrogen oxides (a precursor of smog); benzene (a carcinogen); particulate matter (a trigger of respiratory and cardiovascular illnesses and symptoms); volatile organic compounds (some of which are potentially hazardous and precursors of smog; carbon dioxide (a greenhouse gas); and carbon monoxide (a contributor to heart disease). By reducing emissions, alternative fuel fleets contribute to healthier air quality, benefiting the health of the building occupants and the surrounding and global communities.

Credit Goals

OPTION 1

Provide low-emitting and fuel-efficient vehicles for 3% of peak building day-shift FTE (Full-time Equivalent) occupants AND provide preferred parking for these vehicles.

OR

OPTION 2

Provide preferred parking for low-emitting and fuel-efficient vehicles for 5% of the total vehicle parking capacity of the site.

OR

OPTION 3

Install alternative-fuel refueling stations for 3% of the total vehicle parking capacity of the site (liquid or gaseous fueling facilities must be separately ventilated or located outdoors).

Note: The definition of FTE occupants for this credit calculation includes all primary day shift FTE hospital staff and on-site out-sourced labor, but not visiting clergy or physicians.

For the purposes of this credit, low-emitting and fuel-efficient vehicles are defined as vehicles that are either classified as Zero Emission Vehicles (ZEV) by the California Air Resources Board or have achieved a minimum green score of 40 on the American Council for an Energy Efficient Economy (ACEEE) annual vehicle rating guide.

“Preferred parking” refers to the parking spots that are closest to the main entrance of the project (exclusive of spaces designated for handicapped) or parking passes provided at a discounted price.
SS Credit 4.3 continued
Alternative Transportation: Low-Emitting & Fuel Efficient Vehicles

Suggested Documentation

- Prepare calculations indicating that low-emitting and/or fuel efficient vehicles have been provided for 3% of FTE staff AND provide a parking plan highlighting preferred parking.

OR

- Prepare calculations indicating that preferred parking for hybrid, low-emitting, fuel-efficient, and/or alternative fuel vehicles is being provided for at least 5% of the total vehicle parking capacity. Provide site drawings or parking plan highlighting preferred parking for hybrid and/or alternative fuel vehicles.

OR

- Compile site drawings highlighting alternative fuel refueling stations. Provide calculations demonstrating that these facilities accommodate at least 3% of the total vehicle parking capacity. Provide documentation that the alternative fuel refueling stations proposed will serve current available street legal vehicles.

Reference Standards


Potential Technologies & Strategies

- Retain existing preferred handicapped parking areas. Handicapped parking is inclusive of any patient population that is designated by the hospital as weak.

- Alternative fuel vehicle fleets can be used to provide on campus transportation or between campus transportation, transportation to remote parking and staff housing, ambulance and ambulette fleets, and carpool/vanpool programs.

- Low sulfur diesel fuel and biodiesel are becoming available in many markets nationwide, particularly in regions designated as non-attainment areas or where there are high levels of ground level ozone. Low sulfur diesel fuels can be used in all diesel engines without modifications. Biodiesel is usable in most diesel engines as well, although in some older engines may require changing of rubber gaskets and more frequent changing of filters during initial use as it cleans the system.

GGHC Construction Credit Synergies

- SS Prerequisite 1: Construction Activity Pollution Prevention
- SS Credit 1: Site Selection
- SS Credit 2: Development Density & Community Connectivity
- SS Credit 3: Brownfield Redevelopment
- SS Credit 5: Site Development
- SS Credit 6: Stormwater Design
- SS Credit 7: Heat Island Effect
- SS Credit 8: Light Pollution Reduction
SS Credit 4.3 continued
Alternative Transportation: Low-Emitting & Fuel Efficient Vehicles

- WE Credit 2: Potable Water Use Reduction
- EA Prerequisite 1: Fundamental Commissioning of the Building Energy Systems
- EA Credit 1: Optimize Energy Performance
- EA Credit 3: Enhanced Commissioning
- EA Credit 5: Measurement & Verification
- MR Credit 1: Building Reuse
- EQ Prerequisite 1: Minimum IAQ Performance

GGHC Operations Credit Synergies
- TO Credit 1: Alternative Transportation
Intent
Reduce pollution and land development impacts from single occupancy vehicle use.

**Health Issues**
Motor vehicles represent the largest single source of atmospheric pollution including nitrogen oxides (a precursor of smog); benzene (a carcinogen); particulate matter (a trigger of respiratory and cardiovascular illnesses and symptoms); volatile organic compounds (some of which are potentially hazardous and precursors of smog; carbon dioxide (a greenhouse gas); and carbon monoxide (a contributor to heart disease).

Credit Goals

**OPTION 1 – NON-RESIDENTIAL**
- Size parking capacity to meet, but not exceed, minimum local zoning requirements OR health department regulatory authority, whichever is the overriding requirement, AND provide preferred parking for carpools or vanpools for 5% of the total provided parking spaces.

**OR**

**OPTION 2 – NON-RESIDENTIAL**
For projects that provide parking for less than 5% of FTE building occupants:
- Provide preferred parking for carpools or vanpools, marked as such, for 5% of total provided parking spaces.

**OR**

**OPTION 3 – RESIDENTIAL**
Size parking capacity to not exceed minimum local zoning requirements, AND, provide infrastructure and support programs to facilitate shared vehicle usage such as carpool drop-off areas, designated parking for vanpools, or car-share services, ride boards, and shuttle services to mass transit.

**OR**

**OPTION 4 – ALL**
- Provide no new parking

**OR**

**OPTION 5 – EXPANSIONS/RENOVATIONS**
- For renovation projects, provide preferred parking and implement/document programs and policies for carpools and/or vanpools capable of serving 5% of the total building staff and add no parking beyond what is required by the authorities having jurisdiction.

Note: “Preferred parking” refers to the parking spots that are closest to the main entrance of the project (exclusive of spaces designated for handicapped) or parking passes provided at a discounted price.
SS Credit 4.4 continued
Alternative Transportation: Parking Capacity

Suggested Documentation

- Document local zoning or health department requirements, as applicable.
- If providing no new parking, document the existing site plan and project site plan highlighting parking capacity in each and illustrating that no new parking capacity has been added.
- Compile a description, parking plan, and supporting public outreach literature describing carpool and/or vanpool programs in compliance with Credit Goals. Prepare an annual summary on carpool and vanpool usage.
- For renovation projects, prepare a pre-renovation parking plan and a post-renovation parking plan demonstrating that no new parking capacity was added beyond what is required by the authorities having jurisdiction and that preferred parking policies for carpools and/or vanpools capable of serving 5% of the total building staff have been adopted.

Reference Standards

There is no reference standard for this credit.

Potential Technologies & Strategies

- Retain existing preferred handicapped parking areas. Handicapped parking is inclusive of any patient population that is designated by the hospital as weak.
- Minimize parking lot and garage size.
- Share parking facilities with adjacent buildings and implement shared staff carpool and vanpool programs.
- Institute shuttle bus services for staff members who live in the neighborhood, or to link with bus or rail lines.

GGHC Construction Credit Synergies

- SS Prerequisite 1: Construction Activity Pollution Prevention
- SS Credit 1: Site Selection
- SS Credit 2: Development Density & Community Connectivity
- SS Credit 3: Brownfield Redevelopment
- SS Credit 5: Site Development
- SS Credit 6: Stormwater Design
- SS Credit 7: Heat Island Effect
- SS Credit 8: Light Pollution Reduction
- WE Credit 2: Potable Water Use Reduction
- EA Prerequisite 1: Fundamental Commissioning of the Building Energy Systems
- EA Credit 1: Optimize Energy Performance
- EA Credit 3: Enhanced Commissioning
- EA Credit 5: Measurement & Verification
- MR Credit 1: Building Reuse
- EQ Prerequisite 1: Minimum IAQ Performance

GGHC Operations Credit Synergies

TO Credit 1: Alternative Transportation
Intent

Conserve, preserve and enhance existing natural areas and restore damaged areas to provide habitat for native flora and fauna and to promote biodiversity. Reduce the development footprint to reserve site area for future development.

Health Issues

Healthy ecosystems contribute to the health of people in many ways, including the health-promoting qualities of clean air and water systems as well as significant social, psychological and physical benefits derived from physical and visual connections to the natural environment. By minimizing site disruption associated with construction practices, the health of these ecosystems can be protected. Health care facilities should protect and enhance the site’s existing natural areas as a therapeutic resource for patients, staff, and visitors.

Credit Goals

• On both greenfield and previously developed sites, limit all site disturbance including earthwork and clearing of vegetation to 40 feet beyond the building perimeter, 10 feet beyond surface walkways, patios, surface parking and utilities greater than 12 inches in diameter; and, 15 feet beyond primary roadway curbs and main utility branch trenches.

• Implement measures to avoid reducing the permeability of the sub-surface below a future permeable lot (such as pervious paving areas, stormwater detention facilities and playing fields).

AND

• On both greenfield and previously developed sites, protect or restore natural habitat area as follows:

\[
\text{Natural Habitat Area Required} = (\text{Site Area}) \times (0.15 - \text{Site Size Factor}) \div (\text{Floor Space Ratio})
\]

For the above formula:

Floor Space Ratio = the constructed building gross floor building area including all service spaces, excluding parking areas, divided by the site area.

Site Size Factor = \((\sqrt{\text{Site Area}/\text{Site Area}})(10)\)

Notes:

• For the purpose of this credit, all “greenfield” sites are those that were not previously developed or graded and remain in a natural state; remediated “brownfield” sites; and, previously developed sites on which all existing buildings have been or will be demolished. “Previously developed” sites are those that contain existing buildings, roadways, and/or parking lots, or were graded or altered by direct human activities.
Credit 5.1 continued
Site Development: Protect or Restore Open Space or Habitat

- **The Natural Habitat Area formula requires larger areas of habitat for less densely developed sites.**
- **Natural habitat area may include vegetated roof area at any building level and non-native vegetation if required to survive the reduced sunlight if the area’s irrigation system uses a non-potable water source, is high-efficiency, or if no permanent irrigation system is installed.**
- **Native plants are plants indigenous to a locality or cultivars of native plants that are adapted to the local climate and are not considered invasive species or noxious weeds. Projects pursuing GGHC SS Credit 2 and using vegetated roof surfaces may apply the vegetated roof surface to this calculation if the plants meet the definition of native/adapted.**
- **Rows of street trees spaced at or less than 1.0 x mature diameter apart qualify as natural habitat area, equal to mature diameter x length of row.**
- **Sample calculation: For 100,000 gsf site with a 200,000 gsf building; Floor Space Ratio = 2; Site Size Factor is \( \frac{316}{100,000} \times 10 = 0.0316 \). The natural habitat area required by formula is: \( 100,000 \times (0.15 - 0.0316)/2 = 5,920 \) gsf.**

**Suggested Documentation**
- Prepare a Site Protection Plan and specifications, by a civil engineer or responsible party, noting limits of construction, disturbance, protection and enhancement measures.
- Prepare highlighted site drawings with area calculations demonstrating the percentage of the site that has been provided/restored with native vegetation.
- Provide a narrative describing restoration and re-vegetation of degraded habitat areas, including use of native and non-invasive adapted vegetation.

**Reference Standards**
There is no reference standard for this credit.

**Potential Technologies & Strategies**
- Perform a site survey to identify site elements and adopt a master plan for development of the project site.
- Establish clearly marked construction boundaries and provide adequate protection measures to minimize disturbance of existing site and restore previously degraded areas to their natural state.
- Minimize unnecessary ground disturbance (topsoil stripping) and removal of existing groundcover by protecting existing vegetation, including clusters or groupings of existing trees or shrub masses. Avoid planting isolated plant material.
- Coordinate habitat, wetland, and stream preservation programs with erosion control and stormwater management goals, including soil bioengineering technologies.
- Adopt rehabilitation, restoration, and reclamation strategies for the site’s watershed management.
Credit 5.1 continued
Site Development: Protect or Restore Open Space or Habitat

- Restore or provide natural vegetated area with emphasis on native and limited use of adapted vegetation. Ensure that no adapted vegetation is a known invasive species. Native plants are those species that occur naturally in the particular region, state, ecosystem, and habitat without direct or indirect human actions.

- Protect and encourage the development of native vegetation.

- Protect permeable lots on the construction site by building the area up with granular material to distribute the load and then salvaging the material when the staging area is no longer required.

**GGHC Construction Credit Synergies**
- SS Prerequisite 1: Construction Activity Pollution Prevention
- SS Credit 1: Site Selection
- SS Credit 2: Development Density & Community Connectivity
- SS Credit 3: Brownfield Redevelopment
- SS Credit 4: Alternative Transportation
- SS Credit 6: Stormwater Design
- SS Credit 7: Heat Island Effect
- WE Credit 1: Water Efficient Landscaping
- WE Credit 2: Potable Water Use Reduction
- MR Credit 2: Construction Waste Management
- EQ Credit 8: Daylight & Views

**GGHC Operations Credit Synergies**
- ES Credit 1: Outdoor Grounds & Building Exterior Management
SS Credit 5.2
Site Development: Reduce Development Footprint

Intent
Reduce the development footprint to reduce site disturbance and to reserve site area for future development.

Health Issues
Healthy ecosystems promote healthy people by maintaining balance in air and water systems, and by minimizing construction site disruption. Health care facilities can protect and enhance the site’s existing natural areas as a therapeutic resource. Research shows that physical and visual connections to the natural environment provide social, psychological and physical benefits for patients, staff and visitors.

Credit Goals
• Achieve GGHC SS Credit 5.1

AND

• On both greenfield and previously developed sites, limit the building footprint as follows:

<table>
<thead>
<tr>
<th>Gross Building Area</th>
<th>Maximum Building Footprint (MBF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 62,500 SF</td>
<td>MBF = 1.0 x Gross Floor Area</td>
</tr>
<tr>
<td>62,501 – 999,999 SF</td>
<td>MBF = square root of Gross Floor Area x 250</td>
</tr>
<tr>
<td>≥1,000,000SF</td>
<td>MBF = 0.25 x Gross Floor Area</td>
</tr>
</tbody>
</table>

For the above formulae:
Building Footprint = ground floor area, including area over basements and area under fixed canopies and overhanging floors, but excluding area over below-grade parking extending beyond building footprint.
The footprint of parking structures count as parking area, not as building footprint. Below or above building parking area counts neither as parking area nor building footprint.

The Maximum Building Footprint formula allows larger footprints relative to Gross Floor Area for smaller buildings. For less densely developed sites, the minimum habitat area from GGHC SS Credit 5.1, plus the maximum building footprint plus the maximum area of on-grade parking and access road may be less than the area of the site, generating a reserve area that may not be used for surface parking. Conversely more densely developed sites may not be large enough to accommodate the minimum habitat area plus the maximum building footprint plus the maximum area of on-grade parking and access road area, requiring some combination of a smaller footprint, vegetated roof area as habitat area or a higher percentage of structured parking.

Plan-enclosed courtyards are not considered as building footprint if they are on ground or at ground level above below grade parking. Courtyards on sloping sites are considered at ground level if there is a patient, staff or service entrance from grade at the level of the courtyard.
Credit 5.2 continued

Site Development: Reduce Development Footprint

Suggested Documentation

- Prepare highlighted site drawings with area calculations demonstrating area of the maximum building footprint demonstrating compliance with credit goals.

Reference Standards

There is no reference standard for this credit.

Potential Technologies & Strategies

- Perform a site survey to identify site elements and adopt a master plan for development of the project site.

- Select a suitable building location and design the building with the minimal footprint to minimize site disruption. Strategies include:
  - Stacking the building program
  - Tuck-under parking
  - Sharing facilities with neighbors
  - Locating the loading dock underneath the building
  - Locating helipads on top of the building or as a component of other paved surface areas, such as a section of the parking lot. Coordinate placement of helipads with GGHC EQ c5.1: Chemical and Pollutant Source Control: Outdoor.

- See GGHC SS c5.1 Credit Synergies.
1 point

SS Credit 5.3
Site Development: Structured Parking

Intent
Reduce the development footprint to reduce site disturbance and to reserve site area for future development.

Health Issues
Healthy ecosystems promote healthy people by maintaining balance in air and water systems, and by minimizing construction site disruption. Health care facilities can protect and enhance the site’s existing natural areas as a therapeutic resource. Research shows that physical and visual connections to the natural environment provide social, psychological and physical benefits for patients, staff and visitors.

Credit Goals
• Achieve GGHC SS Credit 5.1

AND

• Provide structured parking for 50% or more of total parking spaces. A minimum of 100 spaces must be provided in structured parking to achieve this credit.

Suggested Documentation
☐ Prepare highlighted site drawings with parking calculations demonstrating compliance with credit goals.

Reference Standards
There is no reference standard for this credit.

Potential Technologies & Strategies
See GGHC SS Credit 5.1 and 5.2 Potential Technologies & Strategies and Credit Synergies.
Stormwater Design: Quantity Control

Intent

Limit disruption of natural water hydrology by reducing impervious cover, increasing on-site infiltration, reducing or eliminating pollution from stormwater runoff, and eliminating contaminants.

Health Issues

Controlling stormwater run-off lessens contamination of receiving waters thereby safeguarding people and wildlife from exposure to waterborne pollutants, including bacteria, toxic chemicals, and lawn care nutrients that degrade water quality and increase risks of cancer, birth defects, and nervous system disorders.

Credit Goals

OPTION 1 – EXISTING IMPERVIOUSNESS IS LESS THAN OR EQUAL TO 50%

- Implement a stormwater management plan that prevents the post-development peak discharge rate and quantity from exceeding the pre-development peak discharge rate and quantity for the one- (1) and two- (2) year 24-hour design storms.

OR

- Implement a stormwater management plan that protects receiving stream channels from excessive erosion by implementing a stream channel protection strategy and quantity control strategies.

OR

OPTION 2 – EXISTING IMPERVIOUSNESS IS GREATER THAN 50%

- Implement a stormwater management plan that results in a 25% decrease in the volume of stormwater run-off from the two- (2) year, 24-hour design storm.

Suggested Documentation

- Prepare calculations demonstrating that: (1) existing site imperviousness is less than or equal to 50%; and, (2) a stormwater management plan that complies with the credit goals has been implemented. Identify the recognizing authority.

- Prepare calculations demonstrating that (1) existing site imperviousness is greater than 50%; and, (2) the stormwater management plan complies with the credit goals. Identify the recognizing authority.

Reference Standards

Credit 6.1 continued

Stormwater Design: Quantity Control

Potential Technologies & Strategies

- Design the project to maintain natural stormwater flows by promoting infiltration.
- Specify vegetated roofs, pervious paving, and other measures to minimize impervious surfaces.
- Reuse stormwater volumes generated for non-potable uses such as landscape irrigation, toilet and urinal flushing and custodial uses.

GGHC Construction Credit Synergies
- SS Prerequisite 1: Construction Activity Pollution Prevention
- SS Credit 1: Site Selection
- SS Credit 2: Development Density & Community Connectivity
- SS Credit 3: Brownfield Redevelopment
- SS Credit 4: Alternative Transportation
- SS Credit 5: Site Development
- SS Credit 7: Heat Island Effect
- WE Credit 1: Water Efficient Landscaping
- WE Credit 2: Potable Water Use Reduction
- MR Credit 1: Building Reuse

GGHC Operations Credit Synergies
- WC Credit 1: Water Efficient Landscaping
- CM Credit 1: Community Contaminant Prevention
- ES Credit 1: Outdoor Grounds & Building Exterior Management
1 point

SS Credit 6.2

Stormwater Design: Quality Control

Intent

Limit disruption and pollution of natural water flows by managing stormwater run-off.

<table>
<thead>
<tr>
<th>Health Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controlling stormwater run-off lessens contamination of receiving waters thereby safeguarding people and wildlife from exposure to waterborne pollutants, including bacteria, toxic chemicals, and lawn care nutrients that degrade water quality and increase risks of cancer, birth defects, and nervous system disorders.</td>
</tr>
</tbody>
</table>

Credit Goals

• Implement a stormwater management plan that reduces impervious cover, promotes infiltration, and captures and treats the stormwater runoff from 90% of the average rainfall\(^1\) using acceptable best management practices (BMPs).

• BMPs used to treat runoff must be capable of removing 80% of the average annual post development total suspended solids (TSS) load based on existing monitoring reports. BMPs are considered to meet these criteria if: (1) they are designed in accordance with standards and specifications from a state or local program that has adopted these performance standards., or (2) there exists in-field performance monitoring data demonstrating compliance with the criteria. Data must conform to an accepted protocol (e.g., Technology Acceptance Reciprocity Partnership [TARP], Washington State Department of Ecology) for BMP monitoring.

Suggested Documentation

[ ] Compile plans, drawings, and calculations demonstrating that the stormwater management plan complies with the credit goals.

Reference Standard


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\(^1\) In the United States, there are three distinct climates that influence the nature and amount of rainfall occurring on an annual basis. Humid watersheds are defined as those that receive at least 40 inches of rainfall each year, Semi-arid watersheds receive between 20 and 40 inches of rainfall per year, and Arid watersheds receive less than 20 inches of rainfall per year. For this credit, 90% of the average annual rainfall is equivalent to treating the runoff from:

(a) Humid Watersheds – 1 inch of rainfall;
(b) Semi-arid Watersheds – 0.75 inches of rainfall; and
(c) Arid Watersheds – 0.5 inches of rainfall
Credit 6.2 continued

Stormwater Design: Quality Control

Potential Technologies & Strategies

- Use alternative surfaces (e.g., vegetated roofs, pervious pavement or grid pavers) and nonstructural techniques (e.g., rain gardens, vegetated swales, disconnection of imperviousness, rainwater recycling) to reduce imperviousness and promote infiltration.

- Use environmentally sensitive design strategies (e.g., Low Impact Development, Maryland Stormwater Design Manual) to design mechanical or natural treatment systems to treat the site’s stormwater.

- Utilize biologically-based and innovative stormwater management features to reduce and treat pollutant loads such as constructed wetlands, filters and open channels.

- Coordinate habitat, wetland, and stream preservation programs with erosion control and stormwater management goals, including soil bioengineering technologies.

- Adopt rehabilitation, restoration, and reclamation strategies for the site’s watershed management.

GGHC Construction Credit Synergies

- SS Prerequisite 1: Construction Activity Pollution Prevention
- SS Credit 1: Site Selection
- SS Credit 2: Development Density & Community Connectivity
- SS Credit 3: Brownfield Redevelopment
- SS Credit 4: Alternative Transportation
- SS Credit 5: Site Development
- SS Credit 7: Heat Island Effect
- WE Credit 1: Water Efficient Landscaping
- WE Credit 2: Potable Water Use Reduction
- MR Credit 1: Building Reuse

GGHC Operations Credit Synergies

- WC Credit 1: Water Efficient Landscaping
- CM Credit 1: Community Contaminant Prevention
- ES Credit 1: Outdoor Grounds & Building Exterior Management
Intent

Reduce heat islands (thermal gradient differences between developed and undeveloped areas) to minimize impact on microclimates and human and wildlife habitat.

**Health Issues**

Mitigating the heat island effect results in lowering ground level temperatures near buildings thereby reducing conditions favorable for ground-level ozone (smog) formation that can lead to respiratory symptoms and illness. In addition, a cooler microclimate reduces a building’s cooling load, thereby reducing energy costs, curbing reliance on fossil-fuel generated electricity, and reducing associated particulate and greenhouse gas emissions.

Credit Goals

**OPTION 1**

- Provide any combination of the following strategies for 50% of the site hardscape (including roads, sidewalks, courtyards, and parking lots):
  - Shade (within 5 years of occupancy)
  - Paving materials with a Solar Reflectance Index (SRI) of at least 29
  - Open grid pavement system

OR

**OPTION 2**

- Place a minimum of 50% of parking spaces under cover (defined as underground, under deck, under roof, or under a building). Any roof used to shade or cover parking must have an SRI of at least 29.

**Suggested Documentation**

- Compile a site plan and develop calculations demonstrating areas of hardscape (including paving, walking areas, plazas, fire lanes, etc.), landscaping (list species) and building footprint, and demonstrating compliance with the credit goals.

---

2 The Solar Reflectance Index (SRI) is a measure of the constructed surface’s ability to reflect solar heat, as shown by a small temperature rise. It is defined so that a standard black (reflectance 0.05, emittance 0.90) is 0 and a standard white (reflectance 0.80, emittance 0.90) is 100. To calculate the SRI for a given material, obtain the reflectance value and emittance value for the material. SRI is calculated according to ASTM E 1980-01. Reflectance is measured according to ASTM E 903, ASTM E 1918, or ASTM C 1549. Emittance is measured according to ASTM E 408 or ASTM C 1371.
Credit 7.1 continued

Heat Island Effect: **Non-Roof**

Table 1

<table>
<thead>
<tr>
<th>Material</th>
<th>Emissivity</th>
<th>Reflectance</th>
<th>SRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical New Gray Concrete</td>
<td>0.9</td>
<td>0.35</td>
<td>35</td>
</tr>
<tr>
<td>Typical Weathered* Gray Concrete</td>
<td>0.9</td>
<td>0.2</td>
<td>19</td>
</tr>
<tr>
<td>Typical New White Concrete</td>
<td>0.9</td>
<td>0.7</td>
<td>86</td>
</tr>
<tr>
<td>Typical Weathered* White Concrete</td>
<td>0.9</td>
<td>0.4</td>
<td>45</td>
</tr>
<tr>
<td>New Asphalt</td>
<td>0.9</td>
<td>0.05</td>
<td>0</td>
</tr>
<tr>
<td>Weathered* Asphalt</td>
<td>0.9</td>
<td>0.10</td>
<td>6</td>
</tr>
</tbody>
</table>

*Reflectance of surfaces can be maintained with cleaning. Typical pressure washing of cementitious materials can restore reflectance close to original value. Weathered values are based on no cleaning.

Reference Standards

There is no reference standard for this credit.

Potential Technologies & Strategies

- Employ strategies, materials and landscaping techniques to reduce heat absorption of exterior materials.
- Shade constructed surfaces on the site with landscape features and utilize high-reflectance materials for hardscape.
- Consider replacing constructed surfaces (e.g., roof, roads, sidewalks, etc.) with vegetated surfaces such as vegetated roofs and open grid paving or specify high-albedo materials to reduce the heat absorption.

Resources


GGHC Construction Credit Synergies
- SS Prerequisite 1: Construction Activity Pollution Prevention
- SS Credit 1: Site Selection
- SS Credit 2: Development Density & Community Connectivity
- SS Credit 4: Alternative Transportation
- SS Credit 5: Site Development
- SS Credit 6: Stormwater Design
- WE Credit 1: Water Efficient Landscaping
- EA Credit 1: Optimize Energy Performance
- MR Credit 1: Building Reuse
- EQ Credit 7: Thermal Comfort

GGHC Operations Credit Synergies
- WC Credit 1: Water Efficient Landscaping
Heat Island Effect: Roof

Intent
Reduce heat islands (thermal gradient differences between developed and undeveloped areas) to minimize impact on microclimate and human and wildlife habitat.

Health Issues
Mitigating the heat island effect results in lowering ground level temperatures near buildings thereby reducing conditions favorable for ground-level ozone (smog) formation that can lead to respiratory symptoms and illness. In addition, a cooler microclimate reduces a building’s cooling load, thereby reducing energy costs, curbing reliance on fossil-fuel generated electricity, and reducing associated particulate and greenhouse gas emissions.

Credit Goals

OPTION 1
- Use roofing materials having a Solar Reflectance Index (SRI)\(^3\) equal to or greater than the values in the table below for a minimum of 75% of the roof surface.

Note: Reflectance values used to calculate SRI are based on values from product ratings from the Cool Roof Rating Council’s (CRRC) Directory of Rated Products or the U.S. EPA Energy Star Program’s Rated Products list or Independent Laboratory testing in accordance with ASTM E903-96 for homogeneous, non-patterned materials having both specular and diffused optical properties OR ASTM E1084 for inhomogeneous, patterned, or corrugated materials OR field measurements using ASTM E1918-97 procedure.

Note: Emissivity values used to calculate SRI are based upon product ratings from the CRRC’s Directory of Rated Products OR field measurements using ASTM E 408-71 procedure.

OR

OPTION 2
- Install a vegetated roof for at least 50% of the roof area.

OR

OPTION 3
- Install high albedo and vegetated roof surfaces that, in combination, meet the following criteria:

\[
\text{Total Roof Area} = \frac{\text{Area of SRI Roof}}{0.75} + \frac{\text{Area of vegetated roof}}{0.5}
\]

\(^3\) The Solar Reflectance Index (SRI) is a measure of the constructed surface’s ability to reflect solar heat, as shown by a small temperature rise. It is defined so that a standard black (reflectance 0.05, emittance 0.90) is 0 and a standard white (reflectance 0.80, emittance 0.90) is 100. To calculate the SRI for a given material, obtain the reflectance value and emittance value for the material. SRI is calculated according to ASTM E 1980. Reflectance is measured according to ASTM E 903, ASTM E 1918, or ASTM C 1549. Emittance is measured according to ASTM E 408 or ASTM C 1371.
SS Credit 7.2 continued

Heat Island Effect: **Roof**

<table>
<thead>
<tr>
<th>Roof Type</th>
<th>Slope</th>
<th>SRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-Sloped Roof</td>
<td>≤ 2:12</td>
<td>78</td>
</tr>
<tr>
<td>Steep-Sloped Roof</td>
<td>&gt; 2:12</td>
<td>29</td>
</tr>
</tbody>
</table>

**Suggested Documentation**

- Document that the roofing materials have a Solar Reflectance Index (SRI) in compliance with the credit goals.
  
  OR

- Prepare photographs and calculations demonstrating that vegetated roof areas constitute at least 50% of the total roof area, and prepare a maintenance plan for the vegetated roof system.

- Provide documentation of the vegetated roof’s irrigation system: no potable water, high-efficiency irrigation, or no permanently installed irrigation system.

  OR

- Prepare a calculation indicating that the Total Roof Area complies with the credit goals using combined approaches.

**Reference Standards**


Potential Technologies & Strategies

- Consider installing high-albedo and vegetated roofs to reduce heat absorption. Solar Reflectance Index (SRI) is calculated according to ASTM E 1980. Reflectance is measured according to ASTM E 903, ASTM E 1918, or ASTM C 1549. Emittance is measured according to ASTM E 408 or STM C 1371. The following table of typical SRI values for common roofing materials taken from the Lawrence Berkeley National Laboratory Cool Roofing Materials Database are for reference only.

<table>
<thead>
<tr>
<th>Example SRI Values for Generic Roofing Materials</th>
<th>Solar Reflectance</th>
<th>Infrared Emittance</th>
<th>Temperature Rise</th>
<th>Solar Reflectance Index (SRI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gray EPDM</td>
<td>0.23</td>
<td>0.87</td>
<td>68F</td>
<td>21</td>
</tr>
<tr>
<td>Gray Asphalt Shingle</td>
<td>0.22</td>
<td>0.91</td>
<td>67F</td>
<td>22</td>
</tr>
<tr>
<td>Unpainted Cement Tile</td>
<td>0.25</td>
<td>0.9</td>
<td>65F</td>
<td>25</td>
</tr>
<tr>
<td>White Granular Surface Bitumen</td>
<td>0.26</td>
<td>0.92</td>
<td>63F</td>
<td>28</td>
</tr>
<tr>
<td>Red Clay Tile</td>
<td>0.33</td>
<td>0.9</td>
<td>58F</td>
<td>36</td>
</tr>
<tr>
<td>Light Gravel on Built-Up Roof</td>
<td>0.34</td>
<td>0.9</td>
<td>57F</td>
<td>37</td>
</tr>
<tr>
<td>Aluminum</td>
<td>0.61</td>
<td>0.25</td>
<td>48F</td>
<td>56</td>
</tr>
<tr>
<td>White-Coated Gravel on Built-Up</td>
<td>0.65</td>
<td>0.9</td>
<td>28F</td>
<td>79</td>
</tr>
<tr>
<td>White Coating on Metal Roof</td>
<td>0.67</td>
<td>0.85</td>
<td>28F</td>
<td>82</td>
</tr>
<tr>
<td>White EPDM</td>
<td>0.69</td>
<td>0.87</td>
<td>25F</td>
<td>84</td>
</tr>
<tr>
<td>White Cement Tile</td>
<td>0.73</td>
<td>0.9</td>
<td>21F</td>
<td>90</td>
</tr>
<tr>
<td>White Coating – 1 Coat, 8 mils</td>
<td>0.8</td>
<td>0.91</td>
<td>14F</td>
<td>100</td>
</tr>
<tr>
<td>PVC White</td>
<td>0.83</td>
<td>0.92</td>
<td>11F</td>
<td>104</td>
</tr>
<tr>
<td>White Coating – 2 Coats, 20 mils</td>
<td>0.85</td>
<td>0.91</td>
<td>9F</td>
<td>107</td>
</tr>
</tbody>
</table>

- Employ strategies, materials and landscaping techniques that reduce heat absorption of exterior materials.
- Consider new coatings, roof materials and colorants to achieve reflectance and emissivity values.
- Install photovoltaic cells to shade roof areas.
SS Credit 7.2 continued

Heat Island Effect: Roof

Resources


GGHC Construction Credit Synergies
- SS Prerequisite 1: Construction Activity Pollution Prevention
- SS Credit 1: Site Selection
- SS Credit 2: Development Density & Community Connectivity
- SS Credit 4: Alternative Transportation
- SS Credit 5: Site Development
- SS Credit 6: Stormwater Design
- WE Credit 1: Water Efficient Landscaping
- EA Credit 1: Optimize Energy Performance
- MR Credit 1: Building Reuse
- EQ Credit 7: Thermal Comfort

GGHC Operations Credit Synergies
- WC Credit 1: Water Efficient Landscaping
Intent

Minimize light trespass from the building and site, reduce sky-glow to increase night sky access, improve nighttime visibility through glare reduction, and reduce development impact on nocturnal environments.

Health Issues

Studies have found a potential link between light pollution and hormone production, specifically related to melatonin and estrogen levels in women. Light at night reduces melatonin levels, which can be causally related to elevated estrogen levels in women and increased responsiveness of estrogen-dependent tissues to cellular proliferation. Collectively, these changes are linked to increased breast cancer risk. Light-related decreases in melatonin may also increase the risk of other kinds of cancer.

Credit Goals

FOR INTERIOR LIGHTING

• The angle of maximum candela from each interior luminaire as located in the building should be designed to intersect opaque building interior surfaces and not exit out through the windows.

    OR

• All non-emergency interior lighting should be automatically controlled to turn off during non-business hours. Provide manual override capability for after hours use.

    Note: Interior lighting requirements only apply to spaces that do not function 24/7.

AND

FOR EXTERIOR LIGHTING

• Zone and control lights to allow for limiting night-time lighting to the Emergency Department, a small employee parking area, a small visitor parking area, pedestrian walkways, and circulation routes.

• Only light areas as required for safety and comfort. Do not exceed 80% of the lighting power densities for exterior areas and 50% for building facades and landscape features as defined in ASHRAE/IESNA Standard 90.1-2004, Exterior Lighting Section, without amendments.

• All projects shall be classified under one of the following zones, as defined in IESNA RP-33, and shall follow all of the requirements for that specific zone:

    LZ1 — Dark (Park and Rural Settings)

    Design exterior lighting so that all site and building mounted luminaires produce a maximum initial illuminance value no greater than 0.01 horizontal and vertical footcandles at the site boundary and beyond. Document that 0% of the total initial designed fixture lumens are emitted at an angle of 90 degrees or higher from nadir (straight down).
Light Pollution Reduction

LZ2 — Low (Residential areas)
Design exterior lighting so that all site and building mounted luminaires produce a maximum initial illuminance value no greater than 0.10 horizontal and vertical footcandles at the site boundary and no greater than 0.01 horizontal footcandles 10 feet beyond the site boundary. Document that no more than 2% of the total initial designed fixture lumens are emitted at an angle of 90 degrees or higher from nadir (straight down). For site boundaries that abut public rights-of-way, light trespass requirements may be met relative to the curb line instead of the site boundary.

LZ3 — Medium (Commercial/Industrial, High-Density Residential)
Design exterior lighting so that all site and building mounted luminaires produce a maximum initial illuminance value no greater than 0.20 horizontal and vertical footcandles at the site boundary and no greater than 0.01 horizontal footcandles 15 feet beyond the site. Document that no more than 5% of the total initial designed fixture lumens are emitted at an angle of 90 degrees or higher from nadir (straight down). For site boundaries that abut public rights-of-way, light trespass requirements may be met relative to the curb line instead of the site boundary.

LZ4 — High (Major City Centers, Entertainment Districts)
Design exterior lighting so that all site and building mounted luminaires produce a maximum initial illuminance value no greater than 0.60 horizontal and vertical footcandles at the site boundary and no greater than 0.01 horizontal footcandles 15 feet beyond the site. Document that no more than 10% of the total initial designed site lumens are emitted at an angle of 90 degrees or higher from nadir (straight down). For site boundaries that abut public rights-of-way, light trespass requirements may be met relative to the curb line instead of the site boundary.

Suggested Documentation

- Compile a brief exterior lighting system narrative describing the lighting objectives and the measures taken to meet the ambient light and direct beam illumination requirements.
- Compile an electrical site plan showing the zoning of the light fixtures and the control system for the fixtures.

Reference Standards


Potential Technologies & Strategies

- Adopt site lighting criteria to maintain safe light levels while avoiding off-site lighting and night sky pollution.
- Minimize site lighting where possible and model the site lighting using a computer model.
- Technologies to reduce light pollution include:
  - Full cutoff luminaries
  - Low-reflectance surfaces
  - Low-angle spotlights
SS Credit 8 continued

Light Pollution Reduction

GGHC Construction Credit Synergies
- SS Credit 1: Site Selection
- SS Credit 4: Alternative Transportation
- SS Credit 5: Site Development
- SS Credit 7: Heat Island Effect
- EA Prerequisite 1: Fundamental Commissioning of the Building Energy Systems
- EA Credit 1: Optimize Energy Performance
- EA Credit 3: Enhanced Commissioning
- EA Credit 5: Measurement & Verification
- MR Prerequisite 1: Storage & Collection of Recyclables
- MR Prerequisite 2: Mercury Elimination
- MR Credit 4: PBT Elimination

GGHC Operations Credit Synergies
- EE Prerequisite 2: Minimum Energy Performance
- EE Credit 1: Optimize Energy Performance
- EE Credit 3: Energy Efficient Equipment
- WM Prerequisite 1: Waste Stream Audit
- WM Credit 2: Regulated Medical Waste Reduction
- EP Credit 4: Toxic Reduction
SS Credit 9.1
Connection to the Natural World: Outdoor Places of Respite

Intent
Provide outdoor places of respite on the health care campus to connect health care patients, staff, and visitors to the health benefits of the natural environment.

Health Issues
Health care facility design should address the physical, emotional, and spiritual needs of the patients and/or residents, staff, family members, and visitors that inhabit these buildings. Privacy, confidentiality, security, dignity, comfort, orientation, and connection to nature are key elements and issues that need to be addressed in the design of supportive environments.

Places of respite connected to the natural environment are key elements in defining a supportive, high performance, healing environment with proven effects on patient, staff, and visitor well-being and improved clinical outcomes. A growing body of research indicates that patients and medical staff experience positive health benefits from access to daylight and landscape views. Providing a variety of spaces for patients, families, and caregivers to pause and experience their natural surroundings is an important programming and design objective.

Credit Goals

- Provide patient, staff, and visitor accessible outdoor places of respite at 5% of the net usable program area. Qualifying spaces should be universally accessible and provide a variety of seating areas for both ambulatory and wheelchair users.

AND

- Provide additional dedicated outdoor place(s) of respite for staff at 2% of the net usable program area.

Design exterior places of respite located within 200 feet of a building entrance or access point, and where no medical intervention or direct medical care is delivered. Design areas to be open to fresh air, the sky and the natural elements, including seasonal weather. In addition, design qualifying areas to reflect the following considerations:

- Provide shade or indirect sun options for seating areas including, but not limited to, shade structures, a trellis or tree-shaded wheelchair accessible seating areas at a minimum of 1 space/ 200 sf of garden area with 1 wheelchair space per 5 seating spaces.

- Horticultural therapy or other specific clinical special use gardens (e.g., Cancer Healing Garden), unavailable to all building occupants may be used to meet up to 50% of the credit goal.

- Consider universal access natural trails with places to pause, available to staff and/or patients. (Nature trails may comprise up to 30% of the required area, provided trail access is available within 200 feet of a building entrance.)

- Existing exterior places of respite on the hospital campus may be used to comply with this credit, provided that the location of the existing spaces meets the credit goals.
SS Credit 9.1 continued
Connection to the Natural World: Outdoor Places of Respite

Suggested Documentation

- Provide net program summary.
- Compile site plans highlighting public outdoor places of respite equal to 5% of project net program area.
- Compile floor plans and site plans highlighting outdoor places of respite dedicated for staff use equal to an additional 2% of project net program area.

Reference Standards

There is no reference standard for this credit.

Potential Technologies & Strategies

- Select appropriate locations for places of respite, taking into account:
  - Environmental factors (e.g., winds, orientation, views)
  - Programs of care (e.g., Horticultural Therapy)
  - Needs of specific patient populations (e.g., immune suppression, sunlight sensitivity)
  - Realistic maintenance requirements
- Consider issues of wayfinding and orientation, accessibility, strength and stamina, activity and interest, privacy and security, independence.
- Provide choice and variety in the design of spaces (for example, spaces that engage all the senses but also areas with limited sensory stimulation). Consider a variety of smaller spaces conveniently located throughout the facility rather than one large space. Also consider integrating these exterior spaces with interior public spaces to enhance the connection to nature throughout the facility.
- Design considerations should include freedom from distractions, such as noise from mechanical systems, facility administrative activities and medical treatments.
- Direct connection to the natural environment includes views of distant and nearby nature (such as inaccessible rooftop spaces with “green” (vegetated) roofs and mature street trees). Positive views and vistas should be considered and visual barriers into patient rooms, treatment rooms and mechanical systems should be implemented.
- Coordinate the integration of gardens and nature for exterior environments with the facility’s Infectious Disease Control Specialist. This includes addressing concerns of chemical sensitivities and allergens with certain high-pollen plant materials.
- Specify and install plant materials that are natural, appropriate to sun/shade requirements and hardiness zone, and able to display seasonal habitat and change.
- Qualifying areas should not be used for regularly scheduled physical rehabilitation.
- Consider the development of on-grade gardens and green spaces that will also help integrate the facility into the surrounding community.
SS Credit 9.1 continued
Connection to the Natural World: Outdoor Places of Respite

- For building atria and greenhouses, see GGHC EQ Credit 8.2.
- For dedicated protected/preserved natural site area, see GGHC SS Credit 5.1.

GGHC Construction Credit Synergies
- SS Credit 5: Site Development
- WE Credit 1: Water Efficient Landscaping
- EQ Credit 8.2: Daylight & Views: Indoor Places of Respite

GGHC Operations Credit Synergies
- WC Credit 1: Water Efficient Landscaping
Connection to the Natural World: Exterior Access for Patients

Intent
Provide inpatients and outpatients with a greater than 4-hour length of stay (LOS) with direct access from their unit/department to secure, supervised, and sun-oriented outdoor space.

Health Issues
Health care facility design should address the physical, emotional, and spiritual needs of the patients and/or residents, staff, family members, and visitors that inhabit these buildings. Privacy, confidentiality, security, dignity, comfort, orientation, and connection to nature are key elements and issues that need to be addressed in the design of supportive environments.

Places of respite connected to the natural environment are key elements in defining a supportive, high performance healing environment with proven effects on patient, staff, and visitor well-being and improved clinical outcomes. A growing body of research indicates that patients and medical staff experience positive benefits from direct access to nature. Providing direct access to exterior spaces for patients, families, and caregivers is an important programming and design objective in all health care construction and renovation.

Credit Goals
- Provide direct access to an exterior courtyard, terrace or balcony with a minimum area of 5 square feet/patient served for 75% of all inpatients and 75% of qualifying outpatients with clinical length of stay (LOS) greater than 4 hours.
- Design balcony edges to ensure patient safety.
- Include exterior areas in the credit calculation only if their vegetated areas (including planters) use a non-potable water irrigation system, a high-efficiency irrigation system, or no permanent irrigation system.
- Patients with LOS > 4hrs whose treatment restricts their ability to move, such as patients in Emergency, Stage 1 surgical recovery, and critical care, may be excluded.
- Qualifying outpatients may include Outpatient Renal Dialysis, Chemotherapy, Ambulatory Surgery Intake, and Stage 2 Recovery.
- Direct access to outdoor places of respite, as defined by GGHC SS Credit 9.1, may be used to meet this goal.

Suggested Documentation
- Compile diagrams describing and demonstrating that 75% of all inpatients and 75% of qualifying outpatients with >4 hour LOS have access to secure and supervised outdoor space in compliance with the credit goals.
Connection to the Natural World: Exterior Access for Patients

Reference Standards
There is no reference standard for this credit.

Potential Technologies & Strategies
- Locate patient accessible outdoor spaces in direct line of sight from the most continuously occupied staff workstation.
- Provide appropriate safety barriers to secure upper level patient accessible outdoor spaces.
- Locate patient accessible outdoor spaces facing south, east or west in priority order, ideally within or with views over exterior places of respite and other natural site amenities.
- Provide planting where possible.
- Provide the majority of seating and wheelchair space in filtered sunlight. Provide additional full sunlit areas where possible.
- Provide medical services support, such as oxygen outlets, to allow extended use.

Resources

GGHC Construction Credit Synergies
- ID Prerequisite 1: Integrated Design Process
- ID Prerequisite 2: Health Mission Statement & Program
- SS Credit 1: Site Selection
- SS Credit 2: Development Density & Community Connectivity
- SS Credit 5: Site Development
- SS Credit 9: Connection to the Natural World
- WE Credit 1: Water Efficient Landscaping

GGHC Operations Credit Synergies
- WC Credit 1: Water Efficient Landscaping
- ES Credit 1: Outdoor Grounds & Building Exterior Management
Intent
Prevent contaminant releases to air, land and water.

Health Issues
Health care facilities include laboratories, pharmacies, and diagnostic services, and often are designed with back-up emergency generators. These activities generate substances toxic to patients, physicians, staff, visitors, and the neighboring communities. Human health effects associated with exposure to airborne toxicants, particulates, gases, and bioaerosols may include respiratory diseases (e.g., asthma, hypersensitivity pneumonitis, bronchitis); cardiovascular events (e.g., sudden death associated with particulate air pollution), among others, depending on exposure levels.

Credit Goals
- Meet California South Coast Air Quality Management District standards for all products of combustion.

Suggested Documentation
- Obtain documentation from the mechanical engineer of record verifying that California South Coast Air Quality Management District standards for products of combustion have been met.

Reference Standards
California South Coast Air Quality Management District, http://www.aqmd.gov. See especially, Rules 1110 Emissions from stationary internal combustion engines; 1111 NOx from natural gas forced, fan-type furnaces; 1146.1 and 1146.2 Emissions of NOx from industrial institutional and commercial boilers, steam generators, and process heaters.

Potential Technologies & Strategies
- Provide scrubbers and filters for boilers and diesel generators.
- Test and certify all filters as installed prior to occupancy and placard them for at least annual recertification.
- Burn diesel fuels low in sulfur content.
- Provide air quality abatement equipment for equipment that burns fossil fuels.
- Burn bio-diesel fuels in lieu of fossil fuels.
- Substitute a ground-cooled heat exchanger for the cooling tower to eliminate biohazard from cooling water.
SS Credit 10.1 continued

Community Contaminant Prevention: Airborne Releases

GGHC Construction Credit Synergies
- SS Prerequisite 1: Construction Activity Pollution Prevention
- SS Credit 4: Alternative Transportation
- SS Credit 6: Stormwater Design
- SS Credit 7: Heat Island Effect

GGHC Operations Credit Synergies
- IO Prerequisite 4: Outside Air Introduction & Exhaust Systems
- TO Credit 1: Alternative Transportation
- CM Credit 1: Community Contaminant Prevention
- CM Credit 3: Chemical Discharge
SS Credit 10.2
Community Contaminant Prevention: Leaks & Spills

Intent
Prevent contaminant releases to air, land and water.

Health Issues
Health care facilities store and manage chemicals in both underground tanks and other outdoor facilities. Along with run-off from parking areas, these are significant potential sources of surface and groundwater contamination. By minimizing potential exposure, health care facilities can contribute to protecting the health of the surrounding community. The reference standards cited below are more stringent than many local and state regulatory thresholds and are designed to ensure that contamination risks associated with chemical storage are reduced.

Credit Goals

- Establish oil interceptors at all drains from parking areas and central plant areas as described in the Potential Technologies and Strategies section of this credit or as described in local regulations, whichever is more stringent.

- For underground fuel-oil storage tanks, comply with U.S. EPA Title 40, Code of Federal Regulations, Part 112, or local regulations, whichever is more stringent. Where local regulations do not require double-containment and monitoring of such tanks, provide them, as described in the Potential Technologies and Strategies section of this credit.

Suggested Documentation

- Compile design documentation of on-site fuel oil storage system(s) verifying compliance with the credit goals.

- Compile a plan indicating the location of all storage facilities, and a narrative describing secondary containment provisions verifying compliance with the credit goals.

Reference Standards


Potential Technologies & Strategies

- Ensure that storage facilities include secondary containment provisions to prevent unintentional spills and leakage from contaminating aquifers and site stormwater.
SS Credit 10.2 continued
Community Contaminant Prevention: Leaks & Spills

- Provide oil interceptors at all drains from parking areas and from central plant areas in accordance with the following performance standards, as a minimum:
  1. Vent each interceptor to the outer air with a minimum 2” vent.
  2. Provide each interceptor with a readily accessible gastight cleanout cover.
  3. Provide either a waste line not less than 6 inches in diameter with a full-sized cleanout to grade, or a two-inch pump-out connection at grade.

- Ensure that storage facilities include secondary containment provisions in accordance with the following performance standards:
  1. Secondary containment must be constructed, operated, and maintained product tight. The secondary containment must also be constructed, operated, and maintained in a manner that prevents structural weakening as a result of contact with any hazardous substances released from the primary containment, and be capable of storing the hazardous substances for the maximum anticipated period of time necessary for the recovery of any released hazardous substance.
  2. Secondary containment must be constructed, operated, and maintained to prevent any water intrusion into the system by precipitation, infiltration, or surface runoff.
  3. In the case of an installation with multiple primary tanks, provide the secondary containment sized to hold 150 percent of the volume of the largest primary tank placed in it, or 10 percent of the aggregate internal volume of all primary tanks, whichever is greater.

- Provide a continuous monitoring system for the tank system. The monitoring system must be capable of detecting both the entry of the liquid- or vapor-phase of the fuel oil and water into the secondary containment.

- The interstitial space of the underground storage tank must be maintained under constant vacuum or pressure such that a breach in the primary or secondary containment is detected before the liquid or vapor phase of the fuel oil is released into the environment.

- Provide equipment in the underground storage tank to prevent spills and overfills from the primary tank.

- Equip underground pressurized piping that conveys the fuel with an automatic line leak detector.

- Before covering or placing the underground storage tank in use, test it using the standard installation testing requirements for underground storage systems specified in Section 2.4 of the Flammable and Combustible Liquids Code, adopted by the National Fire Protection Association (NFPA 30).

GGHC Construction Credit Synergies
- SS Prerequisite 1: Construction Activity Pollution Prevention
- SS Credit 4: Alternative Transportation
- SS Credit 6: Stormwater Design
- SS Credit 7: Heat Island Effect

GGHC Operations Credit Synergies
- IO Prerequisite 4: Outside Air Introduction & Exhaust Systems
- TO Credit 1: Alternative Transportation
- CM Credit 1: Community Contaminant Prevention
- CM Credit 3: Chemical Discharge
Water Efficiency

Required  

WE Prerequisite 1

Potable Water Use for Medical Equipment Cooling

Intent
Eliminate potable water use for medical equipment cooling.

Health Issues
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.

Credit Goals

• Do not use potable water for once-through cooling for any medical equipment that rejects heat. *(Note: This credit does not apply to potable water for cooling tower makeup, or for other evaporative cooling systems; refer to GGHC WE Credit 2.3 & 2.4 for process water use reduction.)*

• 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.

Suggested Documentation

Compile documentation of technologies employed to eliminate once-through use of potable water for all medical equipment cooling purposes.

Reference Standards
There is no reference standard for this credit.

Potential Technologies & Strategies

• Use closed-loop cooling water for medical equipment cooling instead of open-loop (once-through). Often, cooling of equipment is considered a critical application, where redundancy is desired to significantly reduce or eliminate the possibility of a loss of cooling. When using closed-loop cooling systems for critical applications (i.e. where failure of equipment due to loss of cooling would result in danger to patients or medical personnel, damage to equipment, loss of medical information, or other significant adverse impacts), owners should utilize multiple pieces of cooling equipment (n+1 redundancy). Where this is not possible, an owner may elect to use potable water in an open-loop (once-through) configuration as the emergency back-up cooling system only. Design such emergency back-up
WE Prerequisite 1 continued

Potable Water Use for Medical Equipment Cooling

systems to switch on only in the event that the primary closed-loop cooling equipment has failed, and such a failure is visually and audibly indicated at the point of use and alarmed at a continuously monitored location.

• Use non-potable water sources for once-through cooling applications.

GGHC Construction Credit Synergy
• WE Credit 2: Potable Water Use Reduction

GGHC Operations Credit Synergy
• WC Credit 2: Building Water Use Reduction
• WC Credit 3: Performance Measurement: Enhanced Metering
WE Credit 1

Water Efficient Landscaping: No Potable Water Use or No Irrigation

Intent
Eliminate the use of potable water, or other natural surface or subsurface water resources available on or near the project site, for landscape irrigation.

Health Issues
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.

Native landscapes can dramatically lower irrigation requirements, with little if any supplemental irrigation required after plant establishment, and attract native wildlife, birds, and insects, creating a building site integrated with its natural surroundings.

Credit Goals

• Use only captured rainwater, recycled wastewater, recycled greywater, or water treated and conveyed by a public agency specifically for non-potable uses for irrigation.

OR

• Install landscaping that does not require permanent irrigation systems. Temporary irrigation systems used for plant establishment are allowed only if removed within one year of installation.

Note: Vegetated areas in compliance with GGHC SS Credit 5.1: Reduced Site Disturbance: Protect or Restore Open Space or Habitat; GGHC SS Credit 7.2: Heat Island Effect: Roof; GGHC SS Credit 9.1: Connection to the Natural World: Outdoor Places of Respite; or GGHC SS Credit 9.2: Connection to the Natural World: Exterior Access for Patients are exempted from this credit if they use a high-efficiency irrigation system.

Note: Native plants are plants indigenous to a locality or cultivars of native plants that are adapted to the local climate and are not considered invasive species or noxious weeds.

Suggested Documentation

- Prepare documentation substantiating that potable water consumption for irrigation has been eliminated.
- Include a brief narrative of the use of native plants or non-invasive drought-tolerant plants.
- If vegetated areas comply with GGHC SS Credit 5.1, GGHC SS Credit 7.2, GGHC SS Credit 9.1, and/or GGHC SS Credit 9.2, prepare documentation (plans, cut sheets, etc.) of the high-efficiency irrigation system(s) used in those areas.
WE Credit 1 continued

Water Efficient Landscaping: No Potable Water Use or No Irrigation

Reference Standards
There is no reference standard for this credit.

Potential Technologies & Strategies

- Perform a soil and climate analysis to determine appropriate landscape types and design the landscape with indigenous plants to reduce or eliminate irrigation requirements.

- Specify and install a roof-water or groundwater collection system. Use metal, clay, or concrete based roofing materials and take advantage of gravity water flows whenever possible. Roofing materials made of asphalt or with lead-containing materials contaminate collected rainwater and render it unsuitable. Check with local regulatory authorities regarding the collection of rainwater as there may be local regulations governing rainwater collection and reuse.

- Utilize stormwater, greywater, and/or condensate water for irrigation.

GGHC Construction Credit Synergies

- SS Prerequisite 1: Construction Activity Pollution Prevention
- SS Credit 1: Site Selection
- SS Credit 5: Site Development
- SS Credit 6: Stormwater Design
- SS Credit 7: Heat Island Effect
- SS Credit 9: Connection to the Natural World
- WE Credit 2: Potable Water Use Reduction
- EA Prerequisite 1: Fundamental Commissioning of the Building Energy Systems
- EA Prerequisite 2: Minimum Energy Performance
- EA Credit 1: Optimize Energy Performance
- EA Credit 3: Enhanced Commissioning
- EA Credit 5: Measurement & Verification
- EQ Credit 7: Thermal Comfort
- EQ Credit 8: Daylight & Views

GGHC Operations Credit Synergies

- WC Credit 1: Water Efficient Landscaping
- ES Credit 1: Outdoor Grounds & Building Exterior Management
WE Credit 2.1
Potable Water Use Reduction: Measurement & Verification

Intent
Provide for the ongoing accountability and optimization of building water consumption performance over time.

Health Issues
Approximately 70% of the potable water consumption in health care facilities is attributable to process water uses, compared to less than 30% consumed for “domestic” use. 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).

Credit Goals

- Meter the following water uses (as applicable to the project):
  - Water use in laboratory
  - Water use in dietary department
  - Water use in central sterile and processing department
  - Water use in laundry
  - Water use in radiology and imaging department
  - Water use in surgical suite
  - Purified water system (reverse osmosis and/or de-ionized) and filter backwash water
  - Outdoor irrigation systems
  - Cooling tower make-up and filter backwash water
  - Steam boiler system make-up water
  - Closed loop hydronic system make-up water
  - Cold-water make up for hot water system

- The M&V Plan shall cover a period of no less than one year of post-construction occupancy.

Suggested Documentation
- Compile a Measurement & Verification Plan with summary schedule of the instrumentation and controls for the required monitoring categories, highlighting the I/O data points to be collected.
- Document the monitoring system, including cut sheets of sensors and the data collection system.
WE Credit 2.1 continued

Potable Water Use Reduction: Measurement & Verification

Reference Standards


Potential Technologies & Strategies

- Design the building with equipment to measure water performance. Sub-meter potable water systems.
- Use measured system data to identify opportunities for reduced use of potable water.

**GGHC Construction Credit Synergies**

- SS Credit 1: Site Selection
- SS Credit 5: Site Development
- SS Credit 6: Stormwater Design
- WE Credit 1: Water Efficient Landscaping
- WE Credit 2: Potable Water Use Reduction
- EA Prerequisite 1: Fundamental Commissioning of the Building Energy Systems
- EA Prerequisite 2: Minimum Energy Performance
- EA Credit 1: Optimize Energy Performance
- EA Credit 3: Enhanced Commissioning
- EA Credit 5: Measurement & Verification

**GGHC Operations Credit Synergies**

- WC Prerequisite 1: Minimum Water Efficiency
- WC Credit 1: Water Efficient Landscaping
- WC Credit 2: Building Water Use Reduction
- WC Credit 3: Performance Measurement: Enhanced Metering
Potable Water Use Reduction: Domestic Water

**Intent**
Maximize potable water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems.

*Note: These credits refer to domestic potable water use. For reduction of potable water use in cooling and process applications, refer to GGHC WE Credits 2.4 and 2.5, Potable Water Use Reduction: Process Water & Building System Equipment. For reduction of potable water use in irrigation, refer to GGHC WE Credit 1, Water Efficient Landscaping.*

**Health Issues**
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. 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.

**Credit Goals**
- **Credit 2.2 (1 point)** Equip all urinals (but not toilets or bed pan washers) with sensor operators. Equip all handwash sinks (but not compounding sinks, housekeeping sinks, or sinks in toilet rooms for inpatient bed rooms) with sensor operators.

- **Credit 2.3 (1 point)** Use low-flow fixtures or control fixture flows to achieve the following maximum water flows: lavatories - 1.5 gpm; showers - 1.8 gpm; urinals - 1 gallon/flush; and use 1.6 gpm/1.1 gpm flushometers for all toilets.

**Suggested Documentation**
- Compile cut sheets for all sensor-operated controls. Compile schedule sheets and plans indicating the use of such operators.
- Compile cut sheets for all water consuming fixtures necessary for the occupancy use for the building with water flow measures highlighted.

**Reference Standards**
There is no reference standard for this credit.

**Potential Technologies & Strategies**
- Provide a separate glass-fill device in patient room sinks located to prevent activation of the handwash sensor.
**WE Credit 2.2, 2.3 continued**

**Potable Water Use Reduction: Domestic Water**

- Use high-efficiency fixtures, dry fixtures such as composting toilets and waterless urinals, and occupant sensor controls to reduce potable water demand. Reuse stormwater or graywater for non-potable applications such as toilet and urinal flushing, mechanical systems (see GGHC WE Credit 2.4 & 2.5) and custodial uses.

- Water-efficient shower heads are available that require less than 2.5 gallons per minute.

- Lavatory faucets are typically used only for wetting purposes and can be effective with as little as 1.0 gallon per minute.

- Specify self-closing, slow-closing or electronic sensor faucets, particularly in high-use public areas where it is likely that faucets may be carelessly left running.

- Water closets are a significant user of potable water. A number of toilets are available that use considerably less than 1.6 GPF, including pressure-assisted toilets and dual flush toilets that have an option of 0.8 GPF or 1.0 GPF.

**Resources**

**GGHC Construction Credit Synergies**
- SS Credit 1: Site Selection
- SS Credit 5: Site Development
- SS Credit 6: Stormwater Design
- WE Credit 1: Water Efficient Landscaping
- EA Prerequisite 1: Fundamental Commissioning of the Building Energy Systems
- EA Prerequisite 2: Minimum Energy Performance
- EA Credit 1: Optimize Energy Performance
- EA Credit 3: Enhanced Commissioning
- EA Credit 5: Measurement & Verification

**GGHC Operations Credit Synergies**
- WC Prerequisite 1: Minimum Water Efficiency
- WC Credit 1: Water Efficient Landscaping
- WC Credit 2: Building Water Use Reduction
- WC Credit 3: Performance Measurement: Enhanced Metering
Potable Water Use Reduction: **Process Water & Building System Equipment**

**Intent**
Reduce or eliminate the use of potable water for non-potable process use in building system equipment.

**Health Issues**
Approximately 70% of the potable water consumption in health care facilities is attributable to process water uses, compared to less than 30% consumed for “domestic” use. 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).

**Credit Goals**

**Credit 2.4 (1 point)**
- Reduce cooling tower blowdown rate (in GPM) by at least 20%. Calculate baseline blowdown rates using the following formula:

\[
\frac{(\text{Evaporation rate in GPM} + \text{Carryover in GPM})}{(\text{Cycles of Concentration} - 1)}
\]

Base cycles of concentration on a maximum allowable chloride concentration of 400 PPM and a maximum allowable silica concentration of 150 PPM.
- Use no potable water for vacuum pumps, air compressors, or mechanical seals on pumps.
- Eliminate the discharge of potable water to drain for equipment cooling using methods such as closed loop cooling condensate discharge for sterilizers.

**Credit 2.5 (1 point)**
- Provide a system to capture air handling system condensate for use in non-potable applications such as cooling tower makeup or irrigation. Reuse cooling tower and boiler blowdown water for other suitable purposes based on chemical properties of the blowdown water (generally make-up or irrigation).

OR
- Use municipality-provided non-potable water for all non-potable process water applications.
WE Credit 2.4, 2.5 continued

Potable Water Use Reduction: **Process Water & Building System Equipment**

**Suggested Documentation**

WE Credit 2.4

- Compile construction drawings showing use of building equipment in compliance with the credit goals.

WE Credit 2.5

- Compile construction drawings showing water reuse systems or municipally-provided non-potable water use in compliance with credit goals.

**Reference Standards**

There is no reference standard for this credit.

**GGHC Construction Credit Synergies**

- SS Credit 1: Site Selection
- SS Credit 5: Site Development
- SS Credit 6: Stormwater Design
- WE Credit 1: Water Efficient Landscaping
- WE Credit 2: Potable Water Use Reduction
- EA Prerequisite 1: Fundamental Commissioning of the Building Energy Systems
- EA Prerequisite 2: Minimum Energy Performance
- EA Credit 1: Optimize Energy Performance
- EA Credit 3: Enhanced Commissioning
- EA Credit 5: Measurement & Verification

**GGHC Operations Credit Synergies**

- WC Prerequisite 1: Minimum Water Efficiency
- WC Credit 1: Water Efficient Landscaping
- WC Credit 2: Building Water Use Reduction
- WC Credit 3: Performance Measurement: Enhanced Metering
Energy & Atmosphere

Required

EA Prerequisite 1

Fundamental Commissioning of the Building Energy Systems

Intent
Verify that the building’s energy related systems are installed, calibrated, and perform according to the owner’s project requirements, basis of design, and construction documents.

Health Issues
Commissioning verifies the efficient and effective operations of a building’s mechanical 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.

Credit Goals

- The following commissioning process activities shall be completed by the commissioning team:

  1. Designate an individual as the Commissioning Authority (CxA) to lead, review and oversee the completion of the commissioning process activities.
     
     a. The CxA shall have documented commissioning authority experience in at least two building projects.
     
     b. The individual serving as the CxA shall be independent of the project’s design and construction management, though they may be employees of the firms providing those services. The CxA may be a qualified employee or consultant of the Owner.
     
     c. The CxA shall report results, findings and recommendations directly to the Owner.
     
     d. For projects smaller than 50,000 gross square feet, the CxA may include qualified persons on the design or construction teams who have the required experience.

  2. The Owner shall document the Owner’s Project Requirements (OPR). The design team shall develop the Basis of Design (BOD). The CxA shall review these documents for clarity and completeness. The Owner and design team shall be responsible for updates to their respective documents.

  3. Develop and incorporate commissioning requirements into the construction documents.

  4. Develop and implement a commissioning plan.

  5. Verify the installation and performance of the systems to be commissioned. Verify that training and operation and maintenance documentation have been provided to the owner’s operations staff.

  6. Complete a commissioning report.
**EA Prerequisite 1 continued**

**Fundamental Commissioning of the Building Energy Systems**

- Commissioning process activities shall be completed for the following energy-related systems, at a minimum:
  - Heating, ventilating, air conditioning, and refrigeration (HVAC&R) systems (mechanical and passive) and associated controls.
  - Lighting and daylighting controls
  - Domestic hot water systems
  - Renewable energy systems (wind, solar etc.)
  - Building envelope systems

- For renovations and additions, all energy-related systems that meet the following criteria shall be commissioned or recommissioned. All other systems in the facility are exempt from this Prerequisite.
  1. All existing energy-related systems located within the boundaries of the project that serve the addition or alteration.
  2. Existing energy-related equipment or systems that do not have sufficient capacity to serve the addition or alteration and are supplemented to provide the required capacity.
  3. Energy-related equipment that is replaced or relocated.
  4. New energy-related equipment serving the addition or alteration.
  5. Existing energy-related systems where the project uses more than 25% of the capacity of such systems.
  6. Any modified portions of the existing envelope, or the entire envelope where more than 50% of the existing building is renovated.

**Suggested Documentation**

- Document that the commissioning requirements outlined in the credit goals have been successfully executed or will be provided under existing contract(s).

**Reference Standard**

EA Prerequisite 1 continued

Fundamental Commissioning of the Building Energy Systems

Potential Technologies and Strategies

- Engage a commissioning authority and adopt a commissioning plan.
- Include commissioning requirements in bid documents and task the commissioning authority to produce a commissioning report once commissioning activities are completed. Hospitals and healthcare systems with in-house expertise in design and commissioning may perform this work. However, this is extremely specialized expertise and the Owner may benefit from engaging a credentialed Commissioning Authority.
- Owners are encouraged to seek out qualified individuals to lead the commissioning process. Qualified individuals are identified as those who possess a high level of experience in the following areas:
  - Energy systems design, installation and operation
  - Commissioning planning and process management
  - Hands-on field experience with energy systems performance, interaction, start-up, balancing, testing, troubleshooting, operation, and maintenance procedures
  - Energy systems automation control knowledge
- Owners are encouraged to consider including water-using systems and other similar systems in the scope of the commissioning plan as appropriate.
- The LEED for New Construction Version 2.2 Reference Guide provides guidance on the rigor expected for this prerequisite for the following:
  1. Owner's Project Requirements
  2. Basis of Design
  3. Commissioning plan
  4. Commissioning specification
  5. Performance verification documentation
  6. Commissioning report

Resources


“Retro-Commissioning & Commissioning Building Envelope Systems to Reduce Health Risks & Improve IAQ: What we have Learned to Date,” William Turner, Steven Caulfield, et. al., Turner Building Science, LLC, 2005.
EA Prerequisite 1 continued

Fundamental Commissioning of the Building Energy Systems

**GGHC Construction Credit Synergies**
- SS Credit 4: Alternative Transportation
- SS Credit 8: Light Pollution Reduction
- WE Credit 1: Water Efficient Landscaping
- WE Credit 2: Potable Water Use Reduction
- EA Prerequisite 2: Minimum Energy Performance
- EA Credit 1: Optimize Energy Performance
- EA Credit 2: On-Site Renewable Energy
- EA Credit 3: Enhanced Commissioning
- EA Credit 5: Measurement & Verification
- EQ Prerequisite 1: Minimum IAQ Performance
- EQ Prerequisite 3: Hazardous Material Removal or Encapsulation
- EQ Credit 1: Outdoor Air Delivery Monitoring
- EQ Credit 5: Chemical & Pollutant Source Control
- EQ Credit 6: Controllability of Systems
- EQ Credit 7: Thermal Comfort
- EQ Credit 8: Daylight & Views

**GGHC Operations Credit Synergies**
- IO Prerequisite 1: Integrated Operations & Maintenance Process
- IO Prerequisite 4: Outside Air Introduction & Exhaust Systems
- IO Credit 1: Building Operations & Maintenance
- IO Credit 2: IAQ Management
- WC Credit 1: Water Efficient Landscaping
- WC Credit 2: Building Water Use Reduction
- WC Credit 3: Performance Measurement: Enhanced Metering
- EE Prerequisite 1: Existing Building Commissioning
- EE Credit 1: Optimize Energy Performance
- EE Credit 2: On-Site & Off-Site Renewable Energy
- EE Credit 5: Performance Measurement
Required

EA Prerequisite 2

Minimum Energy Performance

Intent
Establish the minimum level of energy efficiency for the proposed building and systems.

Health Issues
Lower building energy use results in reduced combustion of fossil fuels for source energy generation. Energy efficiency benefits health by reducing emissions from the products of combustion, including fewer particulates and pollutants, which in turn help to improve outdoor air quality. Greenhouse gas emissions, which contribute to global climate change, are also reduced.

Credit Goals

- Many codes applicable to health care facilities have requirements that preclude the building from meeting ASHRAE 90.1-2004 requirements. This section has been designed to allow a building baseline computation that recognizes regulatory context. This prerequisite distinguishes between (a) buildings regulated by health code requirements, which exempt them from all or portions of local energy code requirements, and (b) buildings that are required to meet local energy codes.

- For acute care hospitals, long term care facilities or freestanding surgery centers with regulatory requirements that exempt the facility from all or portions of the local energy code, design to meet or exceed the energy requirements as defined below under Documentation.

- For buildings not exempted from any portion of the local energy codes, design to meet building energy efficiency requirements of the local energy code or ASHRAE/IESNA 90.1-2004, whichever is more stringent.

- Establish an ENERGY STAR® Rating goal of 75 or higher for the facility design using U.S. EPA’s Target Finder rating tool.

Suggested Documentation

- For acute care hospitals, long term care facilities or freestanding surgery centers with regulatory requirements that exempt the facility from all or portions of the local energy code, select one of the two compliance paths described below:

  OPTION 1:
  - Model anticipated building energy performance in accordance with ASHRAE 90.1-2004 Appendix G as modified by the Design Assumptions in GGHC Appendix 1, using DOE2.1E or Energy Plus.
  - Demonstrate that the proposed building performance meets the ASHRAE 90.1-2004 Energy Cost Budget.
  - Obtain an EPA energy performance rating of 75 or higher for estimated energy use of the design project from Target Finder. Print the Statement of Energy Design Intent generated from Target Finder. Apply for the “Designed to Earn the ENERGY STAR” graphic from EPA. Place the graphic in the title block on drawings and on the cover of project Contract Documents.
Minimum Energy Performance

OR

OPTION 2:

- Design the building project to comply with both—
  - The mandatory provisions (Sections 5.4, 6.4, 7.4, 8.4, 9.4 and 10.4) of ASHRAE/IESNA Standard 90.1-2004 (without amendments); and
  - The prescriptive requirements (Sections 5.5, 6.5, 7.5 and 9.5) or performance requirements (Section 11) of ASHRAE/IESNA Standard 90.1-2004 (without amendments).

☐ For acute care hospitals, long term care facilities or freestanding surgery centers, medical office buildings, clinics or health care buildings not exempted from any portion of the local energy codes:

  OPTION 1

  - Prepare calculations verifying that the building complies with ASHRAE/IESNA 90.1-2004 using the Energy Cost Budget Method or local energy codes. If local energy codes were applied, demonstrate that the local code is equivalent to, or more stringent than, ASHRAE/IESNA 90.1-2004.

  OR

  OPTION 2

  - Design the building project to comply with both—
    - The mandatory provisions (Sections 5.4, 6.4, 7.4, 8.4, 9.4 and 10.4) of ASHRAE/IESNA Standard 90.1-2004 (without amendments); AND
    - The prescriptive requirements (Sections 5.5, 6.5, 7.5 and 9.5) or performance requirements (Section 11) of ASHRAE/IESNA Standard 90.1-2004 (without amendments).

☐ For all buildings where the energy cost budget has been calculated, estimate anticipated whole building energy performance using DOE2.1E or Energy Plus modeling results. Use the Process Loads Procedures and Assumptions listed in GGHCC Appendix 1 to create a whole building energy consumption estimate from the results of the modeling. Incorporate energy efficiency measures into the design energy model to ensure a minimum energy performance rating of 75 or higher using EPA’s Target Finder rating tool. The GGHCC is exploring new methods and tools for increasing energy performance in the design stage. We strongly request that projects submit the Statement of Energy Design Intent generated by Target Finder and a detailed description of the proposed building to:

  GGHCC Research Project; Center for Maximum Potential Building Systems; 8604 FM 969, Austin, TX 78724.

  (Note: while the GGHCC process, including this prerequisite, is both voluntary and self-certifying, your submission of this data will greatly inform the process of improving future versions of this document.)
EA Prerequisite 2 continued

Minimum Energy Performance

Reference Standards

Potential Technologies & Strategies

- Design building systems to maximize energy performance while maintaining or improving health and safety requirements. Consider the following strategies as regionally appropriate:
  - Use energy (latent and sensible) recovery.
  - Ground source heat pumps.
  - Use evaporative cooling when ambient conditions allow.
  - Reduce outside airflow during unoccupied periods.
  - Expand unoccupied temperature dead band by automatically resetting zone temperature set points based on occupancy.
  - Separate HVAC zones with constant airflow, temperature and humidity control requirements from those with single or double shift occupancy that would allow reductions in air changes or setbacks in temperature and humidity.
  - Provide a cooling system with at least two cooling loops operated at different temperatures. This can be accomplished with separate chillers (or direct tower cooling).
  - Design for high part-load heating and cooling efficiency.

- Daylighting decreases energy costs for buildings by providing natural solar lighting. A well-designed daylighted building is estimated to reduce lighting energy use by 50 to 80% and reduce the associated HVAC energy used to remove the heat of electric lighting from 10 to 20%. Overall power density can be reduced as much as 30%, resulting in lower capital costs for power and HVAC systems. Daylighting should be implemented in health care facilities with the special needs of the building occupants in mind (See GGHC EQ Credit 8: Daylight & Views).

- Design high efficiency chiller plants that use various technologies and strategies to reduce overall plant energy consumption at full and part loads (such as chillers with variable speed drives on the compressors, primary-only variable flow pumping, series-counterflow chiller arrangements, etc.).
**EA Prerequisite 2 continued**

**Minimum Energy Performance**

- Use low leakage air handling units to reduce overall fan horsepower while ensuring that air is properly filtered.

- Use a computer simulation model to assess the energy performance and identify the most cost effective energy efficiency measures. Quantify whole building energy performance as compared to a baseline building and to an annual energy performance target, if available.

- Obtain local, state, and federal incentives to help fund energy conservation measures.

- Use heat recovery from laundry and kitchen operations.

- Use a heat recovery loop on steam condensate for pre-heating water.

- Connect to a combined heat and power (cogeneration) plant.

- Provide occupancy sensors to control all lighting in administration areas, equipment rooms, storage rooms, med prep rooms, offices, lounges, break rooms, public toilets, and other similar spaces.

- Provide dimming or other multi-level switching capable of reasonably uniform illuminance reduction for conference rooms, dining areas, lounges, and all other spaces larger than 100 square feet in which the connected lighting load exceeds 0.8 watts per square foot.

- For daylit areas that are deeper than 15 feet from the source of natural illumination and do not require controls for patient treatment, provide separate controls for lighting fixtures located within 15 feet of the source of daylight.

- Specify and install fluorescent lamps rated for high efficiency and long life to reduce energy use. See GGHC MR Prerequisite 2: Mercury Elimination and GGHC MR Credit 4.2: PBT Elimination: Mercury.

**GGHC Construction Credit Synergies**

- ID Prerequisite 1: Integrated Design Process
- SS Credit 8: Light Pollution Reduction
- EA Prerequisite 1: Fundamental Commissioning of the Building Energy Systems
- EA Prerequisite 3: Fundamental Refrigerant Management
- EA Credit 1: Optimize Energy Performance
- EA Credit 2: On-Site Renewable Energy
- EA Credit 3: Enhanced Commissioning
- EA Credit 5: Measurement & Verification
- EA Credit 7: Equipment Efficiency
- EQ Prerequisite 1: Minimum IAQ Performance
- EQ Credit 1: Outdoor Air Delivery Monitoring
- EQ Credit 2: Natural Ventilation
- EQ Credit 6: Controllability of Systems
- EQ Credit 7: Thermal Comfort
- EQ Credit 8: Daylight & Views
EA Prerequisite 2 continued

Minimum Energy Performance

GGHC Operations Credit Synergies

- IO Prerequisite 1: Integrated Operations & Maintenance Process
- IO Prerequisite 4: Outside Air Introduction & Exhaust Systems
- IO Credit 1: Building Operations & Maintenance
- EE Prerequisite 1: Existing Building Commissioning
- EE Prerequisite 2: Minimum Energy Performance
- EE Prerequisite 3: Ozone Protection
- EE Credit 1: Optimize Energy Performance
- EE Credit 2: On-Site & Off-Site Renewable Energy
- EE Credit 3: Energy Efficient Equipment
- EE Credit 4: Refrigerant Selection
- EE Credit 5: Performance Measurement
Required

EA Prerequisite 3

Fundamental Refrigerant Management

Intent
Reduce ozone depletion.

Health Issues
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 CFCs, including programs to end the production of ozone depleting substances.

Credit Goals

- Zero use of CFC-based refrigerants in new base building HVAC&R systems. When reusing existing base building HVAC equipment, complete a comprehensive CFC phase-out conversion prior to project completion. Small HVAC units (defined as containing less than 0.5 lbs of refrigerant), and other equipment such as standard refrigerators, small water coolers, and any other cooling equipment that contains less than 0.5 lbs of refrigerant, are not considered part of the “base building” system and are not subject to the requirements of this prerequisite.

Suggested Documentation

- Document that the building’s HVAC&R systems do not use CFC based refrigerants.
- For existing buildings, compile a listing of all existing HVAC&R components and state whether each component uses CFCs. For those components that use CFCs, prepare a phase out plan describing how these components will be converted or removed and replaced with CFC-free components before construction is complete.

Reference Standards
There is no reference standard for this credit.

Potential Technologies & Strategies

- When reusing existing HVAC systems, conduct an inventory to identify equipment that uses CFC refrigerants and provide a replacement schedule for these refrigerants. For new buildings, specify new HVAC equipment in the base building that uses no CFC refrigerants.

Resources
EA Prerequisite 3 continued

Fundamental Refrigerant Management

**GGHC Construction Credit Synergies**
- SS Credit 1: Site Selection
- EA Prerequisite 2: Minimum Energy Performance
- EA Credit 1: Optimize Energy Performance
- EA Credit 4: Enhanced Refrigerant Management
- MR Credit 1: Building Reuse

**GGHC Operations Credit Synergies**
- EE Prerequisite 2: Minimum Energy Performance
- EE Prerequisite 3: Ozone Protection
- EE Credit 4: Refrigerant Selection
- WM Credit 2: Regulated Medical Waste Reduction
- CM Credit 1: Community Contaminant Prevention
10 points

EA Credit 1

Optimize Energy Performance

Intent
Achieve increasing levels of energy performance above the baseline in the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use.

Health Issues
Lower building energy use results in reduced combustion of fossil fuels for energy generation. Energy efficiency benefits health by reducing emissions from the products of combustion, including less particulates and pollutants, which in turn help to improve outdoor air quality. Greenhouse gas emissions, which contribute to global climate change, are also reduced. Reductions in operational expenses for energy use may allow for future investments in improved facilities or services.

Credit Goals

- Model anticipated building energy performance using DOE2.1E or Energy Plus in accordance with the instructions provided in Prerequisite 2.

- For buildings that are not exempt from local energy codes, compare performance of the proposed building systems with the baseline systems in accordance with ASHRAE 90.1-2004 Appendix G.

- For buildings that are exempt from all or portions of the local energy code, compare performance of the proposed building systems with the baseline building systems as described in Prerequisite 2.

(Note: An alternate prescriptive pathway for achievement of a portion of the total available points will be added to this credit in 2007 via an administrative update.)

<table>
<thead>
<tr>
<th>Point total</th>
<th>Exempt Health Care Buildings and All Building Renovations</th>
<th>All Other Buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit 1.1  (1 point)</td>
<td>Reduce design energy consumption by 3.5%</td>
<td>Reduce design energy cost by 10.5%</td>
</tr>
<tr>
<td>Credit 1.2  (2 points)</td>
<td>Reduce design energy consumption by 7%</td>
<td>Reduce design energy cost by 14%</td>
</tr>
<tr>
<td>Credit 1.3  (3 points)</td>
<td>Reduce design energy consumption by 10.5%</td>
<td>Reduce design energy cost by 17.5%</td>
</tr>
<tr>
<td>Credit 1.4  (4 points)</td>
<td>Reduce design energy consumption by 14%</td>
<td>Reduce design energy cost by 21%</td>
</tr>
<tr>
<td>Credit 1.5  (5 points)</td>
<td>Reduce design energy consumption by 17.5%</td>
<td>Reduce design energy cost by 24.5%</td>
</tr>
</tbody>
</table>
**EA Credit 1 continued**

**Optimize Energy Performance**

<table>
<thead>
<tr>
<th>Point total (cont.)</th>
<th>Exempt Health Care Buildings and All Building Renovations Compared with baseline described in GGHC EA Prerequisite 2</th>
<th>All Other Buildings Compared to ASHRAE 90.1-2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit 1.6 (6 points)</td>
<td>Reduce design energy consumption by 21%</td>
<td>Reduce design energy cost by 28%</td>
</tr>
<tr>
<td>Credit 1.7 (7 points)</td>
<td>Reduce design energy consumption by 24.5%</td>
<td>Reduce design energy cost by 31.5%</td>
</tr>
<tr>
<td>Credit 1.8 (8 points)</td>
<td>Reduce design energy consumption by 28%</td>
<td>Reduce design energy cost by 35%</td>
</tr>
<tr>
<td>Credit 1.9 (9 points)</td>
<td>Reduce design energy consumption by 31.5%</td>
<td>Reduce design energy cost by 38.5%</td>
</tr>
<tr>
<td>Credit 1.10 (10 points)</td>
<td>Reduce design energy consumption by 35%</td>
<td>Reduce design energy cost by 42%</td>
</tr>
</tbody>
</table>

**Suggested Documentation**

- Prepare a narrative documenting energy saving measures incorporated in the building design, including a table listing baseline and proposed comparisons of all model variables that are different.
- Prepare calculations verifying the building energy consumption performance achieved by the proposed energy conservation measures.
- Document anticipated whole building energy performance using the EPA’s Target Finder design tool as described in GGHC EA Prerequisite 2.

**Reference Standards**

- U.S. EPA Target Finder new design rating tool, [http://www.energystar.gov/newbuildingdesign](http://www.energystar.gov/newbuildingdesign)

**Potential Technologies & Strategies**

See GGHC EA Prerequisite 2 Potential Technologies & Strategies and Credit Synergies.
3 points  EA Credit 2

On-Site Renewable Energy

Intent
Encourage and recognize increasing levels of on-site renewable energy self-supply in order to reduce environmental and economic impacts associated with fossil fuel energy use.

<table>
<thead>
<tr>
<th>Health Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Providing renewably-based on-site electricity to fulfill a portion of a building’s energy needs offsets the greenhouse gas, toxic chemical, and particulate emissions associated with fossil-fuel electrical generation.</td>
</tr>
</tbody>
</table>

Credit Goals
Supply a net fraction of the building’s total energy use (as expressed as a fraction of watts per square foot) with on-site renewable energy systems.

<table>
<thead>
<tr>
<th>Point total</th>
<th>Renewable energy provided as fraction of annual energy use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit 2.1 (1 point)</td>
<td>0.05 watts of renewable generating capacity / sf of building area</td>
</tr>
<tr>
<td>Credit 2.2 (2 points)</td>
<td>0.10 watts of renewable generating capacity / sf of building area</td>
</tr>
<tr>
<td>Credit 2.3 (3 points)</td>
<td>0.15 watts of renewable generating capacity / sf of building area</td>
</tr>
</tbody>
</table>

Notes: The renewable energy fraction in the above table is based on the following calculation:

\[(21.5 \text{ kWh/sf}) \times (0.25\%) \times (1,000 \text{ Wh/1 kW}) = 53.75 \text{ Wh/sf}\]

This calculation makes two assumptions:
- A typical hospital uses 21.5 kWh/sf of electricity per year.
- A typical PV array operates 1,000 hours per year.


Note: Natural gas and oil consumption are not addressed in this credit.

Suggested Documentation
- Obtain calculations demonstrating that the required generating capacity is supplied by renewable energy system(s) in accordance with the credit goals.

Reference Standards
EA Credit 2 continued

On-Site Renewable Energy

Potential Technologies & Strategies

- Assess the project for non-polluting and renewable energy potential including:
  - Solar: Photovoltaic and active thermal systems
  - Wind
  - Bio-fuel- and biogas- based electrical systems (including biodiesel)
  - Geothermal heating systems
  - Geothermal electric systems
  - Low-impact hydro electric power systems
  - Wave and tidal power systems
    - When applying these strategies, take advantage of "net metering" with the local utility if possible.
- Ineligible On-Site Renewable Energy Systems:
  - Architectural features
  - Passive solar strategies (included under EA Credit 1 calculation)
  - Daylighting strategies
  - Geo-exchange systems (ground source heat pumps)
  - Renewable or Green-power from off-site sources

GGHC Construction Credit Synergies

- ID Prerequisite 1: Integrated Design Process
- SS Credit 1: Site Selection
- SS Credit 5: Site Development
- EA Prerequisite 1: Fundamental Commissioning of the Building Energy Systems
- EA Prerequisite 2: Minimum Energy Performance
- EA Credit 1: Optimize Energy Performance
- EA Credit 3: Enhanced Commissioning
- EA Credit 5: Measurement & Verification
- EQ Credit 8: Daylight & Views

GGHC Operations Credit Synergies

- IO Prerequisite 1: Integrated Operations & Maintenance Process
- IO Prerequisite 4: Outside Air Introduction & Exhaust Systems
- IO Credit 1: Building Operations & Maintenance
- EE Prerequisite 1: Existing Building Commissioning
- EE Credit 1: Optimize Energy Performance
- EE Credit 2: On-Site & Off-Site Renewable Energy
1 point

## EA Credit 3

Enhanced Commissioning

### Intent

Begin the commissioning process early during the design process and execute additional activities after systems performance verification is completed.

#### Health Issues

Commissioning verifies the efficient and effective operations of a building’s mechanical 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.

### Credit Goals

In addition to the Fundamental Commissioning of the Building Energy Systems prerequisite (GGHC EA Prerequisite 1), implement or have a contract in place to implement, the following additional commissioning process activities:

1. Prior to the start of the construction documents phase, designate an independent Commissioning Authority (CxA) to lead, review, and oversee the completion of all commissioning process activities. The CxA shall, at a minimum, perform Tasks 2, 3 and 6. Other team members may perform Tasks 4 and 5.
   a. The CxA shall have documented commissioning authority experience in at least two building projects.
   b. The individual serving as the CxA shall be—
      i. independent of the work of design and construction;
      ii. not an employee of the design firm, though they may be contracted through them;
      iii. not an employee of, or contracted through, a contractor or construction manager holding construction contracts; and,
      iv. (can be) a qualified employee or consultant of the Owner.
   c. The CxA shall report results, findings and recommendations directly to the Owner.
   d. This requirement has no deviation for project size.

2. The CxA shall conduct, at a minimum, one commissioning design review of the Owner’s Project Requirements (OPR), Basis of Design (BOD), and design documents prior to mid-construction documents phase and back-check the review comments in the subsequent design submission.

3. The CxA shall review contractor submittals applicable to systems being commissioned for compliance with the OPR and BOD. This review shall be concurrent with A/E reviews and submitted to the design team and the Owner.

4. Develop a systems manual that provides future operating staff the information needed to understand and optimally operate the commissioned systems.
EA Credit 3 continued

Enhanced Commissioning

5. Verify that the requirements for training operating personnel and building occupants are completed.

6. Assure the involvement by the CxA in reviewing building operation within 10 months after substantial completion with O&M staff and occupants. Include a plan for resolution of outstanding commissioning-related issues.

Suggested Documentation

☐ Document that the required additional commissioning tasks have been successfully executed or will be provided under existing contracts.

Reference Standards

  Potential Technologies & Strategies

• GGHC EA Prerequisite 1 establishes the framework of an effective commissioning program. The Enhanced Commissioning credit ensures peer review through independent, third party verification.

• Engage the commissioning authority early in the design phase.

• It is recommended that the same independent Commissioning Authority deliver the two re-commissioning tasks, although it is not required. Hospitals and health care systems with in-house expertise in design and commissioning may perform this work. However, this is extremely specialized expertise and the owner may benefit from engaging a credentialed Commissioning Authority.

• Although it is preferable that the Owner directly contract the CxA, for the enhanced commissioning credit the CxA may also be contracted through the design firms or construction management firms not holding construction contracts.

• The LEED for New Construction Version 2.2 Reference Guide provides detailed guidance on the rigor expected for following process activities:
  • Commissioning design review
  • Commissioning submittal review
  • Systems manual
EA Credit 3 continued

Enhanced Commissioning

GGHC Construction Credit Synergies
• SS Credit 4: Alternative Transportation
• SS Credit 8: Light Pollution Reduction
• WE Credit 1: Water Efficient Landscaping
• WE Credit 2: Potable Water Use Reduction
• EA Prerequisite 1: Fundamental Commissioning of the Building Energy Systems
• EA Prerequisite 2: Minimum Energy Performance
• EA Credit 1: Optimize Energy Performance
• EA Credit 2: On-Site Renewable Energy
• EA Credit 3: Enhanced Commissioning
• EA Credit 5: Measurement & Verification
• EQ Prerequisite 1: Minimum IAQ Performance
• EQ Prerequisite 3: Hazardous Material Removal or Encapsulation
• EQ Credit 1: Outdoor Air Delivery Monitoring
• EQ Credit 5: Chemical & Pollutant Source Control
• EQ Credit 6: Controllability of Systems
• EQ Credit 7: Thermal Comfort
• EQ Credit 8: Daylight & Views

GGHC Operations Credit Synergies
• IO Prerequisite 1: Integrated Operations & Maintenance Process
• IO Prerequisite 4: Outside Air Introduction & Exhaust Systems
• IO Credit 1: Building Operations & Maintenance
• IO Credit 2: IAQ Management
• WC Credit 1: Water Efficient Landscaping
• WC Credit 2: Building Water Use Reduction
• WC Credit 3: Performance Measurement: Enhanced Metering
• EE Prerequisite 1: Existing Building Commissioning
• EE Credit 1: Optimize Energy Performance
• EE Credit 2: On-Site & Off-Site Renewable Energy
• EE Credit 5: Performance Measurement
Enhanced Refrigerant Management

Intent
Reduce ozone depletion and support early compliance with the Montreal Protocol while minimizing direct contributions to global warming.

Health Issues
HVAC refrigerant emissions of halogenated hydrocarbons such as chlorofluorocarbons (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.

Credit Goals

OPTION 1
• Do not use refrigerants.

OR

OPTION 2
• Select refrigerants and HVAC&R equipment that minimize or eliminate the emission of compounds that contribute to ozone depletion and global warming. The base building HVAC&R equipment shall comply with the following formula, which sets a maximum threshold for the combined contributions to ozone depletion and global warming potential:

\[
\text{LCGWP} + \text{LCODP} \times 10^5 \leq 100
\]

Where:
- \( \text{LCODP} \) = \( \text{ODPr} \times (\text{Lr} \times \text{Life} + \text{Mr}) \times \text{Rc}/\text{Life} \)
- \( \text{LCGWP} \) = \( \text{GWPr} \times (\text{Lr} \times \text{Life} + \text{Mr}) \times \text{Rc}/\text{Life} \)
- \( \text{LCODP} \): Lifecycle Ozone Depletion Potential (lbCFC11/Ton-Year)
- \( \text{LCGWP} \): Lifecycle Direct Global Warming Potential (lbCO2/Ton-Year)
- \( \text{GWPr} \): Global Warming Potential of Refrigerant (0 to 12,000 lbCO2/lbr)
- \( \text{ODPr} \): Ozone Depletion Potential of Refrigerant (0 to 0.2 lbCFC11/lbr)
- \( \text{Lr} \): Refrigerant Leakage Rate (0.5% to 2.0%; default of 2% unless otherwise demonstrated)
- \( \text{Mr} \): End-of-life Refrigerant Loss (2% to 10%; default of 10% unless otherwise demonstrated)
- \( \text{Rc} \): Refrigerant Charge (0.5 to 5.0 lbs of refrigerant per ton of cooling capacity)
- \( \text{Life} \): Equipment Life (10 years; default based on equipment type, unless otherwise demonstrated)

• For multiple types of equipment, a weighted average of all base building level HVAC&R equipment shall be applied using the following formula:

\[
\left[ \Sigma (\text{LCGWP} + \text{LCODP} \times 10^5) \times \text{Qunit} \right] / \text{Qtotal} \leq 100
\]
EA Credit 4 continued

Enhanced Refrigerant Management

Where:

\[ Q_{\text{unit}} = \text{Cooling capacity of an individual HVAC or refrigeration unit (Tons)} \]
\[ Q_{\text{total}} = \text{Total cooling capacity of all HVAC or refrigeration} \]

- Small HVAC units (defined as containing less than 0.5 lbs of refrigerant), and other equipment such as standard refrigerators, small water coolers, and any other cooling equipment that contains less than 0.5 lbs of refrigerant, are not considered part of the “base building” system and are not subject to the requirements of this credit.

AND

- Do not install fire suppression systems that contain ozone-depleting substances (CFCs, HCFCs or Halons).

Suggested Documentation

- Document that HVAC&R systems either do not use refrigerants or use refrigerants that meet the credit goals for leakage, ozone depletion and global warming potential as described in this credit.
- Document that fire suppression systems do not contain ozone-depleting substances in accordance with credit goals.

Reference Standards

There is no reference standard for this credit.

Potential Technologies & Strategies

- Design and operate the facility without mechanical cooling and refrigeration equipment.
- Where mechanical cooling is used, utilize base building HVAC and refrigeration systems for the refrigeration cycle that minimize direct impact on ozone depletion and global warming.
- Select HVAC&R equipment with reduced refrigerant charge and increased equipment life.
- Maintain equipment to prevent leakage of refrigerant to the atmosphere.
- Utilize fire suppression systems that do not contain HCFCs or Halons.
EA Credit 4 continued

Enhanced Refrigerant Management

<table>
<thead>
<tr>
<th>Refrigerant</th>
<th>ODP</th>
<th>GWP</th>
<th>Common Building Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chlorofluorocarbons</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CFC-11</td>
<td>1.0</td>
<td>4,680</td>
<td>Centrifugal chillers</td>
</tr>
<tr>
<td>CFC-12</td>
<td>1.0</td>
<td>10,720</td>
<td>Refrigerators, chillers</td>
</tr>
<tr>
<td>CFC-114</td>
<td>0.94</td>
<td>9,800</td>
<td>Centrifugal chillers</td>
</tr>
<tr>
<td>CFC-500</td>
<td>0.605</td>
<td>7,900</td>
<td>Centrifugal chillers, humidifiers</td>
</tr>
<tr>
<td>CFC-502</td>
<td>0.221</td>
<td>4,600</td>
<td>Low-temperature refrigeration</td>
</tr>
<tr>
<td><strong>Hydrochlorofluorocarbons</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCFC-22</td>
<td>0.04</td>
<td>1,780</td>
<td>Air-conditioning, chillers</td>
</tr>
<tr>
<td>HCFC-123</td>
<td>0.02</td>
<td>76</td>
<td>CFC-11 replacement</td>
</tr>
<tr>
<td><strong>Hydrofluorocarbons</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HFC-23</td>
<td>0</td>
<td>12,240</td>
<td>Ultra-low-temperature refrigeration</td>
</tr>
<tr>
<td>HFC-134a</td>
<td>0</td>
<td>1,320</td>
<td>CFC-12 or HCFC-22 replacement</td>
</tr>
<tr>
<td>HFC-245fa</td>
<td>0</td>
<td>1,020</td>
<td>Insulation agent, centrifugal chillers</td>
</tr>
<tr>
<td>HFC-404A</td>
<td>0</td>
<td>3,900</td>
<td>Low-temperature refrigeration</td>
</tr>
<tr>
<td>HFC-407C</td>
<td>0</td>
<td>1,700</td>
<td>HCFC-22 replacement</td>
</tr>
<tr>
<td>HFC-410A</td>
<td>0</td>
<td>1,890</td>
<td>Air conditioning</td>
</tr>
<tr>
<td>HFC-507A</td>
<td>0</td>
<td>3,900</td>
<td>Low-temperature refrigeration</td>
</tr>
<tr>
<td><strong>Natural Refrigerants</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon Dioxide (CO2)</td>
<td>0</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Ammonia</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Propane</td>
<td>0</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Resources


Environmental Protection Agency, Global Programs Division, Washington, DC 2003, “Data maintained in the tracking system for compliance with the Montreal Protocol.”


EA Credit 4 continued

Enhanced Refrigerant Management


GGHC Construction Credit Synergies

• EA Prerequisite 2: Minimum Energy Performance
• EA Prerequisite 3: Fundamental Refrigerant Management
• EA Credit 1: Optimize Energy Performance
• MR Credit 1: Building Reuse

GGHC Operations Credit Synergies

• EE Prerequisite 3: Ozone Protection
• EE Credit 3: Energy Efficient Equipment
• EE Credit 4: Refrigerant Selection
1 point

EA Credit 5

Measurement & Verification

Intent
Provide for the ongoing accountability of building energy consumption over time.

Health Issues
Optimizing energy consumption 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.

Credit Goals


- Provide for long-term (minimum 3 years) continuous measurement of substantive energy uses within the facility (i.e. electrical loads greater than 100 KVA).

- At a minimum, provide metering for the following electrical and mechanical systems (as applicable to the scope of the project):
  - Lighting system power and controls
  - Motor loads (including air compressors, vacuum pumps and boiler systems)
  - Chillers
  - Data Centers
  - Critical Equipment Electrical Distribution Systems
  - Air distribution systems

Suggested Documentation

- Prepare a Measurement & Verification Plan.
- Include a summary schedule of the instrumentation and controls for the required monitoring categories, highlighting the I/O data points to be collected.
- Document the monitoring system, including cut sheets of sensors and the data collection system.

Reference Standards

EA Credit 5 continued

Measurement & Verification

Potential Technologies & Strategies

• Model the energy systems to predict savings.

• Develop and implement a Measurement and Verification Plan evaluating building and/or energy system performance. Characterize the building and/or energy systems through energy simulation or engineering analysis. Install the necessary metering equipment to measure energy use. Track performance by comparing predicted performance to actual performance, broken down by component or system as appropriate. Evaluate energy efficiency by comparing actual performance to baseline performance.

• Sub-meter electric systems.

• Use measured system data to analyze the performance of electrically driven equipment and systems (such as chiller performance at part loads, and operational profiles of variable flow fan and pump systems).

• While the IPMVP describes specific actions for verifying savings associated with energy conservation measures (ECMs) and strategies, this credit expands upon typical IPMVP M&V objectives. The IPMVP provides guidance on M&V strategies and their appropriate applications for various situations. These strategies should be used in conjunction with monitoring and trend logging of significant energy systems to provide for the ongoing accountability of building energy performance.

• Research possible peak load reduction incentive programs offered by some states or utility providers.

GGHC Construction Credit Synergies

• SS Credit 4: Alternative Transportation
• SS Credit 8: Light Pollution Reduction
• WE Credit 1: Water Efficient Landscaping
• WE Credit 2: Potable Water Use Reduction
• EA Prerequisite 1: Fundamental Commissioning of the Building Energy Systems
• EA Prerequisite 2: Minimum Energy Performance
• EA Credit 1: Optimize Energy Performance
• EA Credit 2: On-Site Renewable Energy
• EA Credit 3: Enhanced Commissioning
• EQ Prerequisite 1: Minimum IAQ Performance
• EQ Prerequisite 3: Hazardous Material Removal or Encapsulation
• EQ Credit 1: Outdoor Air Delivery Monitoring
• EQ Credit 2: Natural Ventilation
• EQ Credit 5: Chemical & Pollutant Source Control
• EQ Credit 6: Controllability of Systems
• EQ Credit 7: Thermal Comfort
• EQ Credit 8: Daylight & Views
EA Credit 5 continued

Measurement & Verification

GGHC Operations Credit Synergies
- IO Prerequisite 1: Integrated Operations & Maintenance Process
- IO Credit 1: Building Operations & Maintenance
- IO Credit 2: IAQ Management
- TO Credit 1: Alternative Transportation
- WC Credit 1: Water Efficient Landscaping
- WC Credit 2: Building Water Use Reduction
- WC Credit 3: Performance Measurement: Enhanced Metering
- EE Prerequisite 1: Existing Building Commissioning
- EE Prerequisite 2: Minimum Energy Performance
- EE Credit 1: Optimize Energy Performance
- EE Credit 2: On-Site & Off-Site Renewable Energy
- EE Credit 3: Energy Efficient Equipment
- EE Credit 5: Performance Measurement
4 points

EA Credit 6

Green Power

Intent
Encourage the development and use of grid-source, renewable energy technologies on a net zero pollution basis.

<table>
<thead>
<tr>
<th>Health Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchasing renewably-based electricity to fulfill a portion of a building’s energy needs offsets the greenhouse gas and particulate emissions associated with fossil-fuel electrical generation.</td>
</tr>
</tbody>
</table>

Credit Goals

- Provide a portion of the building’s electricity from renewable sources by engaging in at least a two-year renewable energy contract. The annual electricity usage of the facility should be modeled to determine the expected energy demand. Renewable sources are defined by the Center for Resource Solutions (CRS) Green-e products certification requirements.

<table>
<thead>
<tr>
<th>Point total</th>
<th>Green power provided as fraction of total annual electrical energy use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit 6.1 (1 point)</td>
<td>20%</td>
</tr>
<tr>
<td>Credit 6.2 (2 points)</td>
<td>50%</td>
</tr>
<tr>
<td>Credit 6.3 (3 points)</td>
<td>80%</td>
</tr>
<tr>
<td>Credit 6.4 (4 points)</td>
<td>100%</td>
</tr>
</tbody>
</table>

To determine baseline electricity use:

- Use the annual electricity consumption from the results of GGHC EA Credit 1 calculations.

OR

- Use the Department of Energy (DOE) Commercial Buildings Energy Consumption Survey (CBECS) database to determine the estimated electricity use.

Suggested Documentation

☐ Compile calculations of the building’s baseline energy use and contracts that demonstrate the percentage of annual energy use in accordance with the credit goals.

Reference Standards
EA Credit 6 continued

Green Power

Potential Technologies & Strategies

- Determine the energy needs of the building and investigate opportunities to engage in a green power contract. Green power is derived from solar, wind, geothermal, biomass or low-impact hydro sources. Visit [http://www.green-e.org](http://www.green-e.org) for details about the Green-e program. The power product purchased to comply with credit requirements need not be Green-e certified. Other sources of green power are eligible if they satisfy the Green-e program's technical requirements. Renewable energy certificates (RECs), tradable renewable certificates (TRCs), green tags and other forms of green power that comply with Green-e’s technical requirements can be used to document compliance with GGHC EA Credit 6 credit goals.

**GGHC Construction Credit Synergies**

- ID Prerequisite 1: Integrated Design Process
- SS Credit 1: Site Selection
- SS Credit 5: Site Development
- EA Prerequisite 1: Fundamental Commissioning of the Building Energy Systems
- EA Prerequisite 2: Minimum Energy Performance
- EA Credit 1: Optimize Energy Performance
- EA Credit 3: Enhanced Commissioning
- EA Credit 5: Measurement & Verification
- EQ Credit 8: Daylight & Views

**GGHC Operations Credit Synergies**

- IO Prerequisite 1: Integrated Operations & Maintenance Process
- IO Prerequisite 4: Outside Air Introduction & Exhaust Systems
- IO Credit 1: Building Operations & Maintenance
- EE Prerequisite 1: Existing Building Commissioning
- EE Credit 1: Optimize Energy Performance
- EE Credit 2: On-Site & Off-Site Renewable Energy
1 point

EA Credit 7

Equipment Efficiency

Intent
Reduce energy consumption by using efficient medical and other equipment.

<table>
<thead>
<tr>
<th>Health Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy efficiency benefits health by reducing particulate, toxic chemical, and greenhouse gas emissions associated with fossil-fuel based electrical generation, thereby improving outdoor air quality and curbing global climate change potential.</td>
</tr>
</tbody>
</table>

Credit Goals

- Calculate 75% of the equipment purchased for the project (based on number of units, not cost) according to one of the following criteria:
  - Where Energy Star® rating is available for a class of equipment, use only Energy Star qualified equipment.
  - OR
  - Where Energy Star rating is not available for a class of equipment, use models that are among the 25th percentile of lowest energy consumers for that class of equipment. Equipment shall be compared based on their continuous (or “standby”) mode electrical energy consumption.

Suggested Documentation

- Where Energy Star rating is available for a class of equipment, compile a listing of all medical and non-medical equipment purchased and demonstrate that Energy Star-qualified products have been purchased.
- Where Energy Star-qualified equipment is not yet available for an application, evaluate multiple pieces of equipment in accordance with credit goals.

Reference Standards


Potential Technologies & Strategies

- Purchase computers, related electronics, and office equipment that carry the Energy Star® label. Examples of these include:
  - Computers, Monitors Printers & Scanners
  - Copiers
  - DVD Products
  - Exit Signs
  - Refrigerators and Freezers
  - TVs & VCRs
  - Water Coolers
**EA Credit 7 continued**

### Equipment Efficiency

This is just a sampling of a steadily increasing list. Refer to EPA’s Energy Star® Program for an up to date list of product categories and models (http://www.energystar.gov).

- Investigate the availability of Energy Star® qualified products for medical equipment purchases, particularly those items that are purchased or leased in quantity or represent particularly high electric consumption. Compile a market survey for classes of equipment where Energy Star® labeling is not yet available, identifying the top 25th percentile of lowest energy consumers. Examples of the most important high load medical equipment to focus upon include:
  - Diagnostic imaging equipment (x-rays, MRIs, etc)
  - Sterilization
  - Physiological monitoring
  - Laundry
  - Dietary

- Example calculation:
  - A facility is trying to decide whether purchasing the following equipment package for the new addition will win them this credit:
    - 20 computers (Energy Star rated)
    - 10 printers (Energy Star)
    - 2 copiers (not Energy Star)
    - 5 refrigerators (2 Energy Star, 3 not)
    - 1 MRI (Siemens’ best, has higher heat rejection than the Philips, but lower than the GE)
    - 2 Cath lab set-ups (Siemens again, but this time, lower heat rejection than both the Philips and the GE). The set-up from Acme Cath Labs has higher heat rejection, but it isn’t really the equivalent to the Siemens, Philips and GE set-ups. Acme does real-time 3-D imaging while the other three don’t.
    - 4 scope washers (much worse heat rejection than any of the competitors)
    - 2 commercial hot food holding cabinets (not Energy Star rated)
    - 2 commercial steam cookers (Energy Star rated)

- EVALUATION:
  - 48 pieces of equipment total.
  - To achieve the 75% threshold, 36 pieces of equipment must meet the credit goals.
  - 34 are Energy Star.
  - The two Cath Lab set-ups are the best in the industry, but there are only two other equivalent competitors, so they only represent the top 33rd percentile (not top 25th).
  - As originally scoped, the project misses the credit by two pieces of equipment. In order to receive the credit, the facility will need to switch two additional refrigerators to an Energy Star qualified model or two additional commercial hot food holding cabinets to an Energy Star qualified model, or one from each to an Energy Star qualified model or purchase medical equipment that is in the top 25%.

---

**GGHC Operations Credit Synergies**

- EE Prerequisite 1: Existing Building Commissioning
- EE Prerequisite 2: Minimum Energy Performance
- EE Credit 1: Optimize Energy Performance
- EE Credit 2: On-Site & Off-Site Renewable Energy
- EE Credit 3: Energy Efficient Equipment
GGHC Appendix 1

Design Assumptions & Procedures for Modeling for the GGHC Energy Credits

The following design assumptions that differ from the requirements of ASHRAE 90.1-2004 Appendix G shall be used:

- Lighting levels – area category lighting power density values shall be as described in Table L-1 below. Use area categories from Table L-1 in combination with any valid area category from ASHRAE-90.1.

- Indoor Design Conditions: in accordance with 1999 ASHRAE Handbook, HVAC Applications, Chapter 7 Health Care Facilities, Specific Design Criteria, or the requirements of the local jurisdiction, whichever is more stringent.

- Ventilation, air changes and air pressure relationships: Use specific ventilation rates, air changes, and pressure relationships, as required by authorities having jurisdiction. If the authorities having jurisdiction have no specific requirements, use the requirements from 2006 AIA Guidelines for Design and Construction of Hospital and Health Care Facilities, or most recent version.

- Baseline Building HVAC Systems: The requirements of ASHRAE 90.1-2004, Appendix G, Section G4.2 shall be modified as follows: If the proposed building systems are Constant Air Volume or Variable Air Volume with devices to maintain pressure relationships at all times, the HVAC systems in the baseline building design shall be Constant Volume Systems with hot water (not electric) reheat. If the proposed building systems are Variable Air Volume without pressure tracking devices, then the HVAC systems in the baseline building design shall be Variable Air Volume with hot water (not electric) reheat.

- Plug Loads: See Occupancy Assumptions below.

- Process Ventilation loads: Special ventilation requirements in a health care facility are not unusual. While Table OCC-1 quantifies the typical ventilation in a health care facility, some spaces may require higher ventilation rates. The higher ventilation rates shall be simulated in both the Baseline and Proposed building simulation runs, making this an energy neutral feature.

- Process Fan Loads: Any energy consumed by fans that are solely related to process uses (such as EtO exhaust and kitchen hood exhaust), where the fan does not run 24 hours per day, may be excluded from the analysis.

- Occupancy Assumptions: Table OCC-1 lists the default values that shall be used in both the Baseline and Proposed building simulations. Should the user choose to use a different value for any of these assumptions (except for the lighting baseline), based upon professional judgment, the same value will be used in both the Baseline and Proposed building simulations.

- Lighting Controls and Daylighting: Table D-1 below shows factors that may be used to reduce lighting power densities calculated by the area category method to account for the various lighting control strategies listed. Factors shall be used to reduce the calculated LPD by multiplying the LPD for the area affected by the relevant strategy by the sum of 1 minus the factor listed. This corrected area LPD can then be used in the area/category calculations.

- Occupancy Schedules: In accordance with ASHRAE 90.1-2004 guidelines.
Table D-1 Lighting Power Savings Adjustment

<table>
<thead>
<tr>
<th>TYPE OF CONTROL</th>
<th>TYPE OF SPACE</th>
<th>FACTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupant sensor With separate sensor for each space</td>
<td>Any space &lt;250 square feet enclosed by opaque floor-to-ceiling partitions; any size classroom, corridor, conference or waiting room; Rooms of any size that are used exclusively for storage; Greater than &lt;250 square feet</td>
<td>0.20</td>
</tr>
<tr>
<td>Dimming system Manual</td>
<td>Hotels/motels, restaurants, auditoriums, theaters</td>
<td>0.10</td>
</tr>
<tr>
<td>Multiscene programmable</td>
<td>Hotels/motels, restaurants, auditoriums, theaters</td>
<td>0.20</td>
</tr>
<tr>
<td>Tuning</td>
<td>Any space</td>
<td>0.10</td>
</tr>
<tr>
<td>Automatic time switch control device</td>
<td>&lt;250 square feet and with a timed manual override at each switch location required by §131 (a), and controlling only the lights in the area enclosed by ceiling-height partitions</td>
<td>0.05</td>
</tr>
<tr>
<td>Combined controls Occupant sensor with programmable multiscene dimming system</td>
<td>Hotels/motels, restaurants, auditoriums, theaters</td>
<td>0.35</td>
</tr>
<tr>
<td>Occupant sensor with a separate sensor for each space used in conjunction with daylighting controls and separate sensor for each space</td>
<td>Any space &lt;250 square feet within a daylight area and enclosed by opaque floor-to-ceiling partitions</td>
<td>0.10 (may be added to daylighting control credit)</td>
</tr>
</tbody>
</table>

Automatic Daylighting Controls (Steeper/Dimming)

<table>
<thead>
<tr>
<th>Glazing Type</th>
<th>WINDOWS Window Wall Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLT&gt; 60%</td>
<td>20%</td>
</tr>
<tr>
<td>VLT&gt; 35% and &lt; 60%</td>
<td>0.20 / 0.30</td>
</tr>
<tr>
<td>VLT&lt; 35%</td>
<td>0/0</td>
</tr>
</tbody>
</table>

SKYLIGHTS Percentage of Gross Exterior Roof Area

<table>
<thead>
<tr>
<th>Glazing Type</th>
<th>&lt; 1%</th>
<th>1% to 3%</th>
<th>&gt;3%</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLT&gt; 60%</td>
<td>0/0.30</td>
<td>0.15/0.40</td>
<td>0.30/0.40</td>
</tr>
<tr>
<td>VLT&gt; 35% and &lt; 60%</td>
<td>0/0.20</td>
<td>0/0.30</td>
<td>0.15/0.40</td>
</tr>
<tr>
<td>VLT&lt; 35%</td>
<td>0/0.10</td>
<td>0/0.20</td>
<td>0/0.30</td>
</tr>
</tbody>
</table>

Notes for Table D-1:
<table>
<thead>
<tr>
<th>Space Function</th>
<th>Occ. Densit (^{(1)}) (peopl)</th>
<th>Sensible Heating (^{(1)}) (Btu/h / person)</th>
<th>Latent Heating (^{(1)}) (Btu/h / person)</th>
<th>Receptacle Power (^{(2)}) (W/ft(^2))</th>
<th>Service Water Heating (^{(3)}) (Btu/h / person)</th>
<th>Lighting Power Density (^{(4)}) (W/ft(^2))</th>
<th>Minimum O.A. (^{(5)}) (CFM/ft(^2))</th>
<th>Operating Schedule (^{(1)}) (Table 7.1.C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anesthesia Storage</td>
<td>5</td>
<td>250</td>
<td>213</td>
<td>1.00</td>
<td>0</td>
<td>3.0</td>
<td>1.20</td>
<td>H</td>
</tr>
<tr>
<td>Angiographic-All Other Types</td>
<td>5</td>
<td>250</td>
<td>213</td>
<td>1.00</td>
<td>600</td>
<td>3.0</td>
<td>0.30</td>
<td>H</td>
</tr>
<tr>
<td>Angiographic-Heart Only</td>
<td>5</td>
<td>250</td>
<td>213</td>
<td>1.00</td>
<td>600</td>
<td>3.0</td>
<td>0.75</td>
<td>H</td>
</tr>
<tr>
<td>Autopsy</td>
<td>5</td>
<td>250</td>
<td>213</td>
<td>1.00</td>
<td>600</td>
<td>1.2</td>
<td>0.30</td>
<td>H</td>
</tr>
<tr>
<td>Bathroom/ Public</td>
<td>3.3</td>
<td>250</td>
<td>250</td>
<td>0.10</td>
<td>0</td>
<td>0.6</td>
<td>0.15</td>
<td>H</td>
</tr>
<tr>
<td>Bedpan Room</td>
<td>5</td>
<td>250</td>
<td>213</td>
<td>0.10</td>
<td>600</td>
<td>0.5</td>
<td>0.15</td>
<td>H</td>
</tr>
<tr>
<td>Cast Room</td>
<td>5</td>
<td>250</td>
<td>213</td>
<td>1.00</td>
<td>600</td>
<td>3.0</td>
<td>0.30</td>
<td>H</td>
</tr>
<tr>
<td>Clean Linen Storage</td>
<td>1</td>
<td>250</td>
<td>250</td>
<td>0.10</td>
<td>0</td>
<td>0.5</td>
<td>0.30</td>
<td>H</td>
</tr>
<tr>
<td>Clean Utility / Workroom</td>
<td>5</td>
<td>250</td>
<td>213</td>
<td>2.00</td>
<td>215</td>
<td>1.2</td>
<td>0.30</td>
<td>H</td>
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<tr>
<td>Conference Rooms</td>
<td>20</td>
<td>245</td>
<td>155</td>
<td>0.10</td>
<td>150</td>
<td>1.2</td>
<td>0.50</td>
<td>H</td>
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<tr>
<td>Corridors</td>
<td>10</td>
<td>250</td>
<td>250</td>
<td>0.10</td>
<td>0</td>
<td>0.6</td>
<td>0.30</td>
<td>H</td>
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<tr>
<td>Cystoscopy</td>
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<td>250</td>
<td>213</td>
<td>1.00</td>
<td>600</td>
<td>3.0</td>
<td>0.75</td>
<td>H</td>
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<tr>
<td>Darkroom</td>
<td>5</td>
<td>250</td>
<td>213</td>
<td>1.00</td>
<td>600</td>
<td>0.3</td>
<td>0.30</td>
<td>H</td>
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<tr>
<td>Decontamination</td>
<td>5</td>
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<td>213</td>
<td>1.00</td>
<td>600</td>
<td>1.2</td>
<td>0.30</td>
<td>H</td>
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<tr>
<td>Delivery Room</td>
<td>5</td>
<td>250</td>
<td>213</td>
<td>1.00</td>
<td>1000</td>
<td>4.5</td>
<td>0.75</td>
<td>H</td>
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<tr>
<td>Dietary Day Storage</td>
<td>2</td>
<td>250</td>
<td>250</td>
<td>0.10</td>
<td>0</td>
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<td>275</td>
<td>275</td>
<td>0.10</td>
<td>300</td>
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<td>1.50</td>
<td>B</td>
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<td>Dishwashing</td>
<td>5</td>
<td>275</td>
<td>475</td>
<td>1.00</td>
<td>215</td>
<td>1.7</td>
<td>0.30</td>
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<tr>
<td>Endoscopy</td>
<td>5</td>
<td>250</td>
<td>213</td>
<td>1.00</td>
<td>600</td>
<td>3.0</td>
<td>0.30</td>
<td>H</td>
</tr>
<tr>
<td>Histology</td>
<td>5</td>
<td>150</td>
<td>213</td>
<td>1.00</td>
<td>600</td>
<td>4.5</td>
<td>0.30</td>
<td>H</td>
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<tr>
<td>Isolation</td>
<td>5</td>
<td>250</td>
<td>213</td>
<td>1.00</td>
<td>300</td>
<td>0.5</td>
<td>0.30</td>
<td>H</td>
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<td>1</td>
<td>250</td>
<td>250</td>
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<td>0.5</td>
<td>1.50</td>
<td>H</td>
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<tr>
<td>Kitchen, Food Preparation</td>
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<td>275</td>
<td>475</td>
<td>1.00</td>
<td>400</td>
<td>1.7</td>
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<td>B</td>
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<tr>
<td>Labor/ Delivery/Recovery</td>
<td>5</td>
<td>250</td>
<td>213</td>
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<td>L / D / R / Post Partum</td>
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<td>3.0</td>
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<td>0.30</td>
<td>H</td>
</tr>
<tr>
<td>Pharmacy / Medicine Room</td>
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<td>213</td>
<td>1.00</td>
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<td>3.0</td>
<td>0.30</td>
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<tr>
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<td>213</td>
<td>1.00</td>
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<td>1.2</td>
<td>0.30</td>
<td>C</td>
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<td>213</td>
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<td>300</td>
<td>3.0</td>
<td>0.30</td>
<td>H</td>
</tr>
<tr>
<td>Scrub Up Area, Surgical Corridor</td>
<td>5</td>
<td>250</td>
<td>213</td>
<td>1.00</td>
<td>1000</td>
<td>4.5</td>
<td>0.30</td>
<td>H</td>
</tr>
<tr>
<td>Soiled Linen, Sorting</td>
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<td>250</td>
<td>213</td>
<td>1.00</td>
<td>600</td>
<td>1.2</td>
<td>1.50</td>
<td>H</td>
</tr>
<tr>
<td>Special Procedure Room, Diagnostic</td>
<td>5</td>
<td>250</td>
<td>213</td>
<td>1.00</td>
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<td>3.0</td>
<td>0.30</td>
<td>H</td>
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### Space Function

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<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
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</tr>
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<td>Special Procedure Room, Invasive</td>
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<td>600</td>
<td>3.0</td>
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<td>0.10</td>
<td>0</td>
<td>0.6</td>
<td>0.15</td>
<td>H</td>
</tr>
<tr>
<td>Sterilizer Room</td>
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<td>250 213</td>
<td>1.00</td>
<td>600</td>
<td>1.2</td>
<td>1.50</td>
<td>H</td>
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<tr>
<td>Sub-Sterile</td>
<td>5</td>
<td>250 213</td>
<td>1.00</td>
<td>600</td>
<td>0.7</td>
<td>0.30</td>
<td>H</td>
</tr>
<tr>
<td>Surgical Supply</td>
<td>5</td>
<td>250 213</td>
<td>1.00</td>
<td>0</td>
<td>1.2</td>
<td>0.30</td>
<td>H</td>
</tr>
<tr>
<td>Trash Chute Room</td>
<td>0.5</td>
<td>250 250</td>
<td>0.10</td>
<td>0</td>
<td>0.5</td>
<td>1.50</td>
<td>H</td>
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<tr>
<td>Trauma</td>
<td>5</td>
<td>250 213</td>
<td>1.00</td>
<td>600</td>
<td>3.0</td>
<td>0.75</td>
<td>H</td>
</tr>
<tr>
<td>Treatment / Examination</td>
<td>5</td>
<td>250 213</td>
<td>1.00</td>
<td>300</td>
<td>1.2</td>
<td>0.30</td>
<td>C</td>
</tr>
<tr>
<td>Unsterile Supply</td>
<td>2</td>
<td>250 250</td>
<td>1.00</td>
<td>0</td>
<td>0.5</td>
<td>0.30</td>
<td>H</td>
</tr>
<tr>
<td>Waiting Areas/Lounges</td>
<td>10</td>
<td>250 250</td>
<td>0.10</td>
<td>0</td>
<td>1.1</td>
<td>0.15</td>
<td>H</td>
</tr>
<tr>
<td>X-ray, Diagnostic and Treatment</td>
<td>5</td>
<td>250 213</td>
<td>1.00</td>
<td>600</td>
<td>3.0</td>
<td>0.30</td>
<td>H</td>
</tr>
</tbody>
</table>

Notes for Table OCC-1
(1) From ASHRAE/IESNA 90.1-2001 ECB Supplement Tables 7.1A & 7.1B
(2) See Table L-1
From 1998 California Mechanical Code when listed, otherwise from California ACM Manual Table 2-2.
Table L-1 Area Category Method

<table>
<thead>
<tr>
<th>Baseline Lighting Power Density Values (watts/sf) by Primary Function</th>
<th>For Hospital / Healthcare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anesthesia Storage</td>
<td>3.0</td>
</tr>
<tr>
<td>Angiographic-All Other Types</td>
<td>3.0</td>
</tr>
<tr>
<td>Angiographic-Heart Only</td>
<td>3.0</td>
</tr>
<tr>
<td>Autopsy</td>
<td>1.2</td>
</tr>
<tr>
<td>Bathroom</td>
<td>0.6</td>
</tr>
<tr>
<td>Bedpan Room</td>
<td>0.5</td>
</tr>
<tr>
<td>Cast Room</td>
<td>3.0</td>
</tr>
<tr>
<td>Clean Linen Storage</td>
<td>0.5</td>
</tr>
<tr>
<td>Clean Utility / Workroom</td>
<td>1.2</td>
</tr>
<tr>
<td>Conference Rooms</td>
<td>1.2</td>
</tr>
<tr>
<td>Corridors</td>
<td>0.6</td>
</tr>
<tr>
<td>Cystoscopy</td>
<td>3.0</td>
</tr>
<tr>
<td>Darkroom</td>
<td>0.3</td>
</tr>
<tr>
<td>Decontamination</td>
<td>1.2</td>
</tr>
<tr>
<td>Delivery Room</td>
<td>4.5</td>
</tr>
<tr>
<td>Dietary Day Storage</td>
<td>0.5</td>
</tr>
<tr>
<td>Dining Room</td>
<td>1.1</td>
</tr>
<tr>
<td>Dishwashing</td>
<td>1.7</td>
</tr>
<tr>
<td>Endoscopy</td>
<td>3.0</td>
</tr>
<tr>
<td>Histology</td>
<td>4.5</td>
</tr>
<tr>
<td>Isolation</td>
<td>0.5</td>
</tr>
<tr>
<td>Janitors Closet / Utility</td>
<td>0.5</td>
</tr>
<tr>
<td>Kitchen, Food Preparation</td>
<td>1.7</td>
</tr>
<tr>
<td>Labor/Delivery/Recovery</td>
<td>4.5</td>
</tr>
<tr>
<td>L / D / R / Post Partum</td>
<td>0.7</td>
</tr>
<tr>
<td>Laboratory</td>
<td>3.0</td>
</tr>
<tr>
<td>Linen Storage, Clean</td>
<td>0.5</td>
</tr>
<tr>
<td>Lobby</td>
<td>1.1</td>
</tr>
</tbody>
</table>

From Pacific Gas & Electric’s 2003 Savings By Design Healthcare Modeling Procedures

Process Loads Procedures:

- Remove the process load energy consumption calculated in the model used to demonstrate that the proposed building performance meets the ASHRAE 90.1-2004 Energy Cost Budget.

- Add in the process loads. Create an estimate of whole building process load usage or use the area category method, selecting load densities from Table P-1 below. Multiply the load density for an area by the operating hours per year for that area, and sum up all the areas to obtain the annual process energy consumption to be added to the modeling results for the HVAC, lighting, and service water heating energy consumption.

Table P-1 Process Load Densities

<table>
<thead>
<tr>
<th>Space Function</th>
<th>Process Equipment Average Watts/sf</th>
<th>Process Steam Average W/sf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imaging Department or area</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Emergency Department</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Full-Service Kitchen</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Surgical Suite</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Radiation Therapy (linear accelerator and simulator room)</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>ICU/CCU</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Nursing Units</td>
<td>½</td>
<td>0</td>
</tr>
<tr>
<td>Central Sterile</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Cath Labs</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Laundry</td>
<td>½</td>
<td>10</td>
</tr>
<tr>
<td>Labs</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>
Materials & Resources

Required

MR Prerequisite 1

Storage & Collection of Recyclables

Intent
Facilitate the reduction of waste generated by building occupants that is hauled to and disposed of in landfills and incinerators through reduction, reuse, recycling and composting.

Health Issues
A 1998 Memorandum of Understanding between the U.S. EPA and the American Hospital Association targeted a 33% reduction in solid waste to landfill or incineration by 2005; 50% by 2010. As hospitals develop environmentally preferable purchasing standards and implement recycling programs to achieve this goal, the spatial and programming implications associated with these goals must be considered. More than 50% of a hospital’s waste stream is composed of the materials addressed in this credit. Diverting a building’s operational waste stream constituents from landfilling and incineration reduces the need to extract virgin natural resources, saves energy, reduces emissions associated with new production and transportation, and reduces potential groundwater contamination from landfills and toxic air emissions from incineration.

Credit Goals
• Provide an easily accessible area that serves the entire building and is dedicated to the collection and storage of materials for recycling in accordance with Section 6.5.3.1 (and Appendix) of the 2006 AIA Guidelines for Design and Construction of Health Care Facilities. Establish a collection system and controlled areas serving the portion of the building affected by the project dedicated to the separation, storage, and collection of materials for recycling including (at a minimum) paper, corrugated cardboard, glass, plastics, metals, fluorescent lamps (tube, compact fluorescent and HID) and batteries.

Suggested Documentation
❑ Confirm that recycling collection areas have been provided in accordance with Section 6.5.3.1 (and Appendix) of the 2006 AIA Guidelines for Design and Construction of Health Care Facilities, to meet the needs of the project.
❑ Confirm the types of materials that are being collected for recycling.
❑ Provide an optional narrative describing any special circumstances or considerations regarding the project’s prerequisite approach.

Reference Standards
MR Prerequisite 1 continued

Storage & Collection of Recyclables

Potential Technologies & Strategies

- To facilitate space planning, develop a Waste Management Plan projecting the categories and volumes of waste for recycling.
  - The functional program should include the space requirements associated with the waste management plan, and include centralized recycling collection and storage spaces.
  - Determine size of spaces based upon volume of projected waste and length of anticipated storage. At loading docks or other waste removal areas, include space for compactors and balers for recycling cardboard waste.
  - Staging areas for sharps containers and recycling containers must be included to facilitate efficient operation of the recycling program.
  - Secure storage should be provided for fluorescent lamps and batteries to minimize risk of mercury contamination.
  - Coordinate on-site processing and haul-away arrangements for collected recyclables with storage space and methods of containment to preserve neighborhood health and safety.

Resources

The American Hospital Association (AHA) and the United States Environmental Protection Agency (EPA) signed a Memorandum of Understanding (MOU) identifying goals to reduce the impact of health care facilities on the environment. A primary goal is the reduction of the health care solid waste stream. http://www.h2e-online.org/about/mou.htm. Other credits relevant to the AHA/EPA MOU include GGHC MR Prerequisite 2 (Mercury Elimination), GGHC MR Credits 2.1 & 2.2 (Construction Waste Management) and GGHC MR Credit 8.2 PBT Elimination: Mercury).

Basel Action Network (BAN) - http://www.ban.org/. Learn about an organization working towards controlling the flow of toxic materials (electronics and e-waste) to other countries, where safety protocols are not in place. Do you know where your computers are going? You can order their video “Exporting Harm.”


Hospitals for a Healthy Environment – Current List of Partner Facilities at http://h2e-online.org/partners/all.cfm

Hospitals for a Healthy Environment – Guidance on recycling various materials, including HIPAA compliant office paper recycling, http://h2e-online.org/wastereduction/overview.html


Massachusetts Department of Environment, Helpful Table to convert various recycling streams into pounds, http://www.mass.gov/dep/recycle/approvals/dsconv.pdf
MR Prerequisite 1 continued

Storage & Collection of Recyclables


Tellus Institute, Boston, MA under US EPA Cooperative Agreement X 821580-01-0, 2000, Healthy Hospitals: Environmental Improvements through Environmental Accounting.


For space programming data, see the following resources:


GGHC Construction Credit Synergies
- SS Credit 2: Development Density
- SS Credit 5: Reduced Site Disturbance
- MR Credit 1: Building Reuse
- EQ Prerequisite 1: Minimum IAQ Performance
- EQ Credit 5: Chemical & Pollutant Source Control

GGHC Operations Credit Synergies
- CM Credit 2: Indoor Pollutant Source Control
- CM Credit 3: Chemical Discharge
- EP Credit 2: Janitorial Paper & Other Disposable Products
- WM Prerequisite 1: Waste Stream Audit
- WM Credit 1: Total Waste Reduction
- WM Credit 2: Regulated Medical Waste Reduction
- WM Credit 3: Food Waste Reduction
Required

MR Prerequisite 2

Mercury Elimination

Intent
Eliminate mercury-containing building products and reduce mercury discharge through product substitution and capture.

Health Issues

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.

Credit Goals

- Highlight in the project’s Waste Management Plan (see GGHC MR Prerequisite 1) the types of mercury containing devices that are handled by the recycling program and disposal methods for captured mercury. Include dental wastes, such as scrap amalgam, chair side traps, and separator wastes.

- In facilities delivering dental care, install amalgam separation devices that meet or exceed the standard ISO-11143.

- Comply with the 2006 AIA Guidelines for Design and Construction of Hospital and Health Care Facilities requirement regarding mercury elimination (Section 1.3, 4.2 Mercury Elimination):
  - 4.2.1.1 New construction. In new construction, health care facilities shall not use mercury-containing equipment, including thermostats, switching devices, and other building system sources.
  - 4.2.1.2 Renovation. For renovation, health care facilities shall develop a plan to phase out mercury-containing sources and upgrade current mercury-containing lamps to low or no mercury lamp technology.

- Do not specify or install mercury vapor High Intensity Discharge (HID) lamps in the project.

- Specify and install all illuminated exit signs to meet the following criteria: LED lamps, Energy Star qualified and UL certified.
MR Prerequisite 2 continued

Mercury Elimination

- Specify and install low mercury fluorescent lamps according to the following specifications:

<table>
<thead>
<tr>
<th>Fluorescent Lamp</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eight-foot T-8 (Standard and High Output)</td>
<td>Maximum 10 mg mercury</td>
</tr>
<tr>
<td>Four-foot T-8 (Standard and High Output)</td>
<td>Maximum 3.5 mg mercury</td>
</tr>
<tr>
<td>Three-foot T-8</td>
<td>Maximum 6 mg mercury</td>
</tr>
<tr>
<td>Two-foot T-8</td>
<td>Maximum 6 mg mercury</td>
</tr>
<tr>
<td>U-Bent T-8</td>
<td>Maximum 8 mg mercury</td>
</tr>
<tr>
<td>28-watt T-5</td>
<td>Maximum 2.5 mg mercury</td>
</tr>
<tr>
<td>24-watt T5HO (High Output)</td>
<td>Maximum 2.5 mg mercury</td>
</tr>
<tr>
<td>54-watt T5HO (High Output)</td>
<td>Maximum 2.5 mg mercury</td>
</tr>
<tr>
<td>22-watt Circular T-5</td>
<td>Maximum 9 mg mercury</td>
</tr>
<tr>
<td>Compact fluorescent lamps</td>
<td>Maximum 5 mg mercury</td>
</tr>
<tr>
<td></td>
<td>Energy Star® qualified, (excluding pin base lamps)</td>
</tr>
</tbody>
</table>

Suggested Documentation

- Compile a copy of the Waste Management Plan in accordance with the Credit Goals.
- Document that the facility is free of or phasing out mercury containing devices (excluding lamps and any devices mandated by Federal law), and that any dental facilities have installed amalgam separators that meet or exceed the standard ISO-11143.
- Compile documentation including mechanical schedules noting the mercury-free specifications.
- Document that mercury vapor High Intensity Discharge (HID) lamps were not specified or installed for the project.
- Compile documentation verifying compliance with the prerequisite credit goal criteria for mercury content in fluorescent lamps and illuminated exit signs.
- Provide specification language that identifies the mercury reduction goal in equipment and fluorescent lighting in accordance with the prerequisite credit goals, and request that all submittals for products covered by this prerequisite disclose the maximum mercury content in milligrams.
MR Prerequisite 2 continued

Mercury Elimination

Reference Standards


Potential Technologies & Strategies

- Establish a project goal for mercury-free materials and identify materials and suppliers to fulfill this goal. Consider digital measurement devices and controls.

- PBT elimination is reflected in policies established by a broad range of local, state, federal and international governmental bodies as well as major health care systems and organizations. Refer to the listing in GGHC MR Credit 4.1.

- Consider long life, low mercury lamps to reduce costs associated with relamping, recycling and purchase.

- Very low mercury induction lamps, with instant on–off control, offer reduced energy usage and long life.

- Verify that high-intensity discharge lamps are purchased with the lowest mercury content available, providing that all other performance specifications are met. Low mercury, high intensity discharge lamps such as ceramic metal halides and low mercury high-pressure sodium lamps are increasingly available.

- Avoid eight-foot T-8 lamps and U-bent lamps when possible due to concerns that breakages during installation can expose staff to mercury contamination.

- Mercury ballast lamps contain more mercury than electronic ballast lamps. Specify and install only electronic ballasts on the project.

- Reduce mercury in the facility by specifying LED lamps instead of low wattage fluorescent lamps.

- Require disclosure of lead content in lamp glass and solder. Specify that lamps contain 100% lead-free solder. Avoid use of “lead free” products as defined by the U.S. EPA Safe Drinking Water Act (SDWA) (http://www.epa.gov/safewater/sdwa/index.html), because these products may contain lead. The SDWA defines “lead free” as:
  - Solders and flux containing 0.2% lead or less.
  - Pipes, pipe fittings, and well pumps containing 8% lead or less.

- Mercury Elimination Plan

- Successful implementation of the Green Guide mercury elimination prerequisite and credit requires an understanding of potential sources of mercury within the building. Developing a spreadsheet of potential sources and an action plan for their removal are the first steps in mercury elimination. The following plan paraphrases the Health Care Without Harm “Mercury Alternatives” website, http://www.noharm.org/mercury/alternatives.
  1. Identify mercury-containing items using resources from organizations such as Health Care Without Harm, National Institutes of Health, U.S. EPA, and Hospitals for a Healthy Environment.
Mercury Elimination

2. Implement a mercury-free purchasing policy that targets construction materials, equipment, and medical supplies. Most purchasing policies phase in substitutions as equipment ages rather than rushing premature equipment replacement. The policy must also develop a plan for proper disposal or recycling of mercury-containing materials as they are replaced.

3. Set mercury reduction goals for mercury-containing devices in use at the facility. Policies that phase in substitutions in conjunction with a facility-wide education campaign will raise the level of awareness among the staff regarding the importance of eliminating mercury use.

4. Measure success through a program such as the Hospitals for a Healthy Environment “Making Medicine Mercury Free” award.

- Specify HVAC systems, control systems, and other large electrical product and/or systems that are free of mercury switches (tilt, float, pressure and temperature) and mercury relays. Categories of equipment screened should include, but not be limited to:
  - HVAC systems
  - Control systems
  - Boiler systems
  - Pump and other fluid control systems

Resources

The American Hospital Association (AHA) and the United States Environmental Protection Agency (EPA) signed a Memorandum of Understanding identifying goals to reduce the impact of health care facilities on the environment. A primary goal included the virtual elimination of mercury waste from the health care waste stream. Other credits relevant to the AHA/EPA MOU include GGHC MR Prerequisite 1 (Storage and Collection of Recyclables), GGHC MR Credits 2.1 & 2.2 (Construction Waste Management) and GGHC MR Credit 8.2 (PBT Elimination: Mercury). http://www.h2e-online.org/about/mou.htm

A variety of state laws prohibiting some or all uses of mercury-containing building products have been enacted. These include but are not limited to:

- California State law (SB 633) restricts the use and distribution of mercury fever thermometers and other uses.
- California Health and Safety code (Rule 25214) prohibits the sale of mercury-added thermostats, switches, and relays. It also prohibits the sale of refurbished mercury-added barometers, esophageal dilators, bougie tubes, gastrointestinal tubes, flow meters, hydrometers, psychometers, manometers, pyrometers, sphygmomanometers, and thermometers.
- Connecticut State law (House Bill 5539) bans the sale and distribution of mercury fever thermometers and places restrictions on the sale of other mercury-containing equipment.
- Maine State law (LD 1159) prohibits the sale of mercury in switches, measuring devices (including sphygmomanometers), instruments and thermostats.
- Oregon State law (HB 3007) phases out mercury thermostats and prohibits the sale of fever thermometers and other uses.
- Washington State law (House Bill 1002) requires the labeling of fluorescent lamps that contain mercury and prohibits the sale of mercury-containing items in products such as thermometers and thermostats.

MR Prerequisite 2 continued

Mercury Elimination


Hospital for a Healthy Environment’s Mercury Page — Includes background info, educational info, alternatives and state locator page. http://h2e-online.org/hazmat/mercury.html


Sustainable Hospitals — Alternatives to mercury-containing equipment, http://www.sustainablehospitals.org


GGHC Construction Credit Synergies

• SS Credit 8: Light Pollution Reduction
• EA Prerequisite 2: Minimum Energy Performance
• EA Credit 1: Optimize Energy Performance
• EA Credit 7: Medical Equipment Efficiency
• MR Credit 8: PBT Elimination

GGHC Operations Credit Synergies

• EE Credit 1: Optimize Energy Performance
• EE Credit 3: Energy Efficient Equipment
• WM Prerequisite 1: Waste Stream Audit
• WM Credit 2: Regulated Medical Waste Reduction
• CM Prerequisite 1: Polychlorinated Biphenyl (PCB) Removal
• CM Credit 2: Indoor Pollutant Source Control
• CM Credit 3: Chemical Discharge
• EP Credit 4: Toxic Reduction
MR Credit 1.1

Building Reuse: Maintain 40% of Existing Walls, Floors & Roof

Intent

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.

Health Issues

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.

Credit Goals

• Maintain at least 40% (based on surface area) of existing building structure (including structural floor and roof decking) and envelope (exterior skin and framing, excluding window assemblies and non-structural roofing material). Hazardous materials that are remediated as a part of the project scope shall be excluded from the calculation of the percentage maintained.

Suggested Documentation

☐ Calculate the total area of existing exterior envelope (not including windows) and existing building structure to ensure that the credit goals have been met.

Reference Standards

There is no reference standard for this credit.

Potential Technologies & Strategies

• Consider reuse of existing, previously occupied buildings, including structure and envelope elements. Remove elements that pose contamination risk to building occupants and upgrade components that would improve energy and water efficiency such as windows, mechanical systems and plumbing fixtures. Quantify the extent of building reuse.

• Use only areas (sq. ft.) to calculate the quantity of preserved materials. The area to be used in the denominator is the sum of all (1) floor and roof area, including the ground floor to account for slabs-on-grade and footings, and (2) the exterior wall area, excluding window assemblies. The area to be used in the numerator is the sum of reused floor, roof, and wall area, excluding window assemblies.
MR Credit 1.1 continued

Building Reuse: Maintain 40% of Existing Walls, Floors & Roof

GGHC Construction Credit Synergies
- SS Credit 4: Alternative Transportation
- SS Credit 5: Site Development
- SS Credit 6: Stormwater Design
- SS Credit 7: Heat Island Effect
- SS Credit 8: Light Pollution Reduction
- WE Credit 1: Water Efficient Landscaping
- WE Credit 2: Potable Water Use Reduction
- EA Prerequisite 2: Minimum Energy Performance
- EA Prerequisite 3: Fundamental Refrigerant Management
- EA Credit 1: Optimize Energy Performance
- EA Credit 4: Enhanced Refrigerant Management
- MR Prerequisite 1: Storage & Collection of Recyclables
- MR Credit 2: Construction Waste Management
- EQ Credit 5: Chemical & Pollutant Source Control
- EQ Credit 6: Controllability of Systems
- EQ Credit 8: Daylight & Views

GGHC Operations Credit Synergies
- TO Credit 1: Alternative Transportation
- WC Credit 1: Water Efficient Landscaping
- WC Credit 2: Building Water Use Reduction
- WC Credit 3: Performance Measurement: Enhanced Metering
- EE Prerequisite 3: Ozone Protection
- EE Credit 1: Optimize Energy Performance
- EE Credit 4: Refrigerant Selection
- WM Prerequisite 1: Waste Stream Audit
- WM Credit 1: Total Waste Reduction
- WM Credit 2: Regulated Medical Waste Reduction
1 point in addition to MR 1.1

MR Credit 1.2

Building Reuse: Maintain 80% of Existing Walls, Floors & Roof

Intent
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.

<table>
<thead>
<tr>
<th>Health Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

Credit Goals

- Maintain an additional 40% (80% total, based on surface area) of existing building structure (including structural floor and roof decking) and envelope (exterior skin and framing, excluding window assemblies and non-structural roofing material). Hazardous materials that are remediated as a part of the project scope shall be excluded from the calculation of the percentage maintained.

Suggested Documentation

- Calculate the total area of envelope skin (not including windows) and existing building structure to ensure that the credit goals have been met.
- Use only areas (sq. ft.) to calculate the quantity of preserved materials. The area to be used in the denominator is the sum of all (1) floor and roof area, including the ground floor to account for slabs-on-grade and footings, and (2) the exterior wall area, excluding window assemblies. The area to be used in the numerator is the sum of reused floor, roof, and wall area, excluding window assemblies.

Reference Standards
There is no reference standard for this credit.

Potential Technologies & Strategies
See GGHC MR Credit 1.1 Potential Technologies & Strategies and Credit Synergies.
1 point  MR Credit 1.3

Building Reuse: Maintain 50% of Interior Non-Structural Elements

Intent
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.

Health Issues
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.

Construction and demolition debris accounts for more than 30% of municipal solid waste, whereas building reuse reduces the amount of solid waste leaving the project site. In addition, renovations and upgrades to existing buildings may reduce overall disruption to patients, such as demolition noise and dust, as well as take advantage of environmental quality improvements demonstrated by older hospital buildings, such as a higher percentage of daylit space.

Credit Goals
• Use existing non-shell elements (interior walls, doors, floor coverings, and ceiling systems) in at least 50% (by area) of the renovated area.
• Remove and properly dispose of abandoned wiring.

Suggested Documentation
☑ Calculate the total and reused areas (sq. ft.) of each non-structural interior element in compliance with the credit goals.

Reference Standards
There is no reference standard for this credit.

Potential Technologies & Strategies
• Reuse existing buildings, including structure, shell and non-shell elements whenever possible. Remove elements that pose contamination risk to building occupants, and upgrade inefficient components such as windows, mechanical systems and plumbing fixtures.
• Recycle abandoned wiring during demolition. Copper wiring, in particular, is a valuable recycling commodity.
• See GGHC MR Credit 1.1 Potential Technologies & Strategies and Credit Synergies.
2 points

MR Credit 2.1 & 2.2

Construction Waste Management: Divert from Disposal

Intent
Divert construction, demolition and land-clearing debris from disposal in landfills and incinerators. Redirect recyclable recovered resources back to the manufacturing process. Redirect reusable materials to appropriate sites. Redirect hazardous waste in compliance with federal and state regulations.

Health Issues
The US EPA estimates that more than 30% of municipal solid waste is generated by construction and demolition activities. Typical construction projects generate approximately 2.2 pounds of waste per square foot, which equates to over 110 thousand tons of construction waste annually based on current rates of over 100 million square feet of annual average health care construction. A 1998 study by the New York State Department of Health found that women living near solid waste landfills have a four-fold increased chance of bladder cancer or leukemia, based on data from 38 landfills, while a 1989 study by the U.S. EPA found elevated cancers of the bladder, lung, stomach and rectum in counties with the highest concentration of waste sites. Municipal solid waste incinerators emit hydrocarbons, heavy metals, dioxins and furans, acid gases, sulfur dioxide, nitrogen oxides and particulates, exposure to each of which pose risks to human health. Diversion of construction and demolition (C&D) debris through salvaging and recycling extends the life of existing landfills and reduces demand for virgin resources thereby curbing unhealthful air and water emissions resulting from manufacturing with virgin feedstocks and from landfill and incineration operations.

Credit Goals

- Develop and implement a construction waste management plan that, at a minimum, identifies the materials to be diverted from disposal in landfill or incineration. Identify whether the materials will be sorted on-site or co-mingled.
- Calculations can be done by weight or volume, but must be consistent throughout.
- Excavated soil and land-clearing debris do not contribute to the credit calculation.
- Comply with all applicable state and federal regulations for hazardous waste disposal. Hazardous waste does not contribute to the credit calculation.
- Credit 2.1 (1 credit) Recycle and/or salvage at least 50% of non-hazardous construction and demolition debris.
- Credit 2.2 (1 credit) Recycle and/or salvage an additional 25% (75% total) of non-hazardous construction and demolition debris.

Suggested Documentation
- Compile a Waste Management Plan tabulating the total waste materials, quantities diverted from landfill and incineration and the means by which diverted. Compare this to calculations of total C&D waste generated by the project.
- Record disposal methods for all hazardous construction and demolition debris in accordance with the credit goals.
MR Credit 2.1 & 2.2 continued

Construction Waste Management: Divert from Disposal

Reference Standards
U.S. Clean Air Act (CAA); 42 USC s/s 7401 et seq. (1970).
U.S. Code of Federal Regulations (CFR)
U.S. Toxic Substances Control Act (TSCA); 15 USC s/s 2601 et seq. (1976); www.eh.doe.gov/oepa/laws/tsca.html

Potential Technologies & Strategies
- Establish goals for diversion from disposal in landfills and incinerators and adopt a construction waste management plan to achieve these goals.
- Consider recycling:
  - Cardboard
  - Metal
  - Brick
  - Acoustical board and tile
  - Concrete
  - Plastic
  - Clean wood
  - Glass
  - Gypsum wallboard
  - Carpet
  - Insulation
- Designate a specific area on the construction site appropriate for either on-site or off-site sorting of materials.
- Record efforts throughout the construction process.
- Identify construction haulers and recyclers to handle the designated materials.
- Reuse unpainted gypsum board waste as a soil amendment if appropriate to project soil conditions.
- Note that salvage may include donation of materials to charitable organizations such as Habitat for Humanity.
MR Credit 2.1 & 2.2 continued

Construction Waste Management: Divert from Disposal

- Pay particular attention to lead in C&D debris, often used as components of Radiation Protection Systems. Separate sheet lead radiation protection, lead lined gypsum board products, and lead-lined doors and frames for reuse, salvage or reprocessing. Salvage all lead-lined glazing products for reuse or reprocessing.

Resources


Building Materials Reuse Association - scroll down for link to their directory which lists organizations/companies around the country that can assist with salvage and deconstruction on old hospitals (and other buildings) being taken down or remodeled. http://www.ubma.org/


Institution Recycling Network document “Recycling Construction and Demolition Wastes – A Guide for Architects and Contractors.” The site also includes sample specifications for Construction and Demolition Recycling. These specifications can be included in Requests for Proposals and contract language to assure that recycling will be part of the project. They allow the specification writer to identify what materials are to be recycled, and include planning, reporting, and recordkeeping requirements. The site also shares case studies demonstrating the cost effectiveness. http://www.wastemiser.com/resources.html

King County – Sample specification as well as other useful data, http://www.metrokc.gov/dnrp/swd/construction-recycling/documents.asp


StopWaste.org - StopWaste.Org is the Alameda County, CA Waste Management Authority and the Alameda County Source Reduction and Recycling Board operating as one public agency. http://www.stopwaste.org/home/index.asp?page=292
MR Credit 2.1 & 2.2 continued

Construction Waste Management: **Divert from Disposal**


**GGHC Construction Credit Synergies**

- SS Credit 2: Development Density & Community Connectivity
- SS Credit 3: Brownfield Redevelopment
- MR Credit 1: Building Reuse
- EQ Credit 3: Construction EQ Management Plan
MR Credit 2.3

Construction Practices: Site & Materials Management

Intent
Implement site and materials management practices during construction to minimize adverse impacts.

Health Issues
Health care construction rarely occurs on undeveloped sites remote from ongoing existing operations. In many instances, construction operations are proximate to existing operational health care facilities, where construction practices may affect the health of adjacent building occupants and building system performance. Careful attention to minimize construction-related adverse health and environmental impacts enhances high performance building objectives.

Credit Goals
• Develop and implement a Construction Practices Environmental Management System (EMS) for the construction and pre-occupancy phases of the building. The below listed “best practices” are strategies the contractor could employ as part of the EMS depending on the size, scope and circumstances of the project. Achieve five of the following six goals:
  • Goal 1: Temporary Facilities:
    • Utilize salvaged or refurbished materials for construction of temporary facilities, excluding reuse of CCA-pressure treated lumber or lumber with lead paint. Note that while most production of CCA (copper chromium arsenate) pressure treated wood was phased out in the US after Dec. 31, 2003, except for specialty markets such as highways and marine applications, there are no restrictions on continued sale or use of stockpiled or recycled CCA products after this date.
    • Make all temporary heated or air-conditioned facilities weathertight.
  • Goal 2: Delivery, Storage and Handling:
    • Coordinate delivery with scheduled installation date to minimize packaging, handling and storage time at site.
    • Implement best practices for proper disposal of waste materials (e.g., concrete truck wash out, tool cleaning, painter clean-up, waste oils from pipe cutting) to prevent discharges into sanitary and stormwater facilities.
  • Goal 3: Construction Site Housekeeping and Particulates Control. Establish a contractor’s policy and document implementation of the following:
    • Control particulate discharge resulting from demolition, cutting, grinding and sandblasting operations.
    • Use water sprinkling to control dust generation.
  • Goal 4: Moisture Control
    • Develop a moisture control plan to address measures that will maintain dry conditions to protect installed work from damage due to spills, line breaks, severe weather and other causes within areas under construction.
    • Address removal and disposal of water damaged materials.
MR Credit 2.3 continued

Construction Practices: Site & Materials Management

- Implement spill control measures to clean-up spills before they spread to other parts of the work.
- Goal 5: Environmental Manager: Designate an on-site party responsible for overseeing the environmental goals for the project and implementing procedures for environmental protection.
- Goal 6: Environmental Training Program: Provide environmental training for construction workers on site. Include as a minimum:
  - Overview of environmental issues related to the building industry.
  - Overview of environmental issues related to the health care industry and this project.
  - Review site specific procedures and management plans, including GGHC SS Prerequisite 1; GGHC MR Credits 2.1, 2.2, 2.3; and, GGHC EQ Credits 3.1, 3.2, and 4.6.

Suggested Documentation

- Document that a Construction Practices Environmental Management System (EMS) was implemented for the project. Include evidence of compliance with the plan during the construction period.

Reference Standards


Potential Technologies & Strategies

Demands are increasing from both private and public owners that contractors provide high-performance, environmentally friendly construction. An Environmental Management System (EMS) serves as a management tool to continually improve operations that impact the environment including regulatory compliance. It identifies goals and enlists the entire workforce in a coordinated effort to achieve them. A well-implemented plan reaps both short-term and long-term benefits and soon pays for itself by:

- Helping a company meet its environmental obligations and avoiding fines for noncompliance.
- Saving costs through process improvements: reducing material inputs, waste disposal costs, reporting costs, and risk of liability.
- Maintaining a company's competitiveness in its markets, and helping to solicit new business from owners specifying high performance, green construction.
- Retaining valuable employees by improving employee morale.
- Boosting public image and relations with regulatory agencies.
- Bringing public recognition by the federal government and some states. An EMS is one of the main criteria for participation in U.S. EPA's National Performance Track Program.
MR Credit 2.3 continued

Construction Practices: Site & Materials Management

Resources

Environmental Management Systems Guidelines, New South Wales Construction Policy Steering Committee, November 1998. This initiative is aimed at providing a systematic approach to the management of the environmental impacts of the construction industry within the context of the principles of Ecologically Sustainable Development.


GGHC Construction Credit Synergies
- SS Credit 2: Development Density & Community Connectivity
- SS Credit 3: Brownfield Redevelopment
- MR Credit 1: Building Reuse
- EQ Credit 3: Construction EQ Management Plan
Construction Practices: Utility & Emissions Control

**Intent**
Minimize air and noise pollution from fossil fueled vehicle and construction equipment during the construction process. Implement conservation and efficiency practices for temporary utilities.

**Health Issues**
Health care construction rarely occurs on undeveloped sites remote from ongoing existing operations. In many instances, construction operations are proximate to operational health care facilities, where construction practices may affect the health of adjacent building occupants and building system performance. Emissions and particulate air pollution associated with operating construction-related vehicles and equipment adversely impacts air quality in and around adjacent buildings. Construction vehicles and equipment may operate outside routine traffic areas in locations near outdoor air intakes and operable windows. Noise from construction equipment, even within daytime working hours, can be particularly disruptive to therapeutic recovery and healing processes. Currently, the only diesel fuel regulated by the U.S. EPA is intended for use in highway engines. Specifically, diesel fuel sold for use in most non-road applications such as construction equipment has sulfur on the order of 3,300 parts per million (ppm). In comparison, current standards for fuel used in highway diesel engines limit sulfur concentrations to a maximum of 500 ppm, and the new 2007 rule will drop the cap even lower to 15 ppm in 2006. Higher sulfur content of diesel fuel directly correlates to higher health risks associated with fuel combustion.

**Credit Goals**
- Develop and implement a plan to reduce utility, vehicle and other emissions during the construction phase. Achieve nine of the fourteen goals listed below including at least one goal from each of the following three categories.
  - Category 1: Temporary Utilities: Efficiencies and Conservation
    - Temporary lighting & power: Use energy efficient fluorescent, LED, HID, and other efficient lighting and controls in lieu of incandescent lighting. Control light pollution.
    - Temporary water: Meter water usage. Use hoses with trigger nozzles. Control runoff, preventing pollutants from entering the storm sewer system; prevent ponding and creation of mosquito habitat.
    - Temporary heating & cooling: Use high efficiency equipment. Use Energy Star® rated equipment when available to meet performance requirements. Maintain enclosure integrity to reduce heat gain/loss.
  - Category 2: Engine use: Efficiencies and Conservation
    - Use low-emitting, fuel-efficient vehicles for on-road construction vehicles to provide 50% of the project’s vehicular transportation needs (as measured by total mileage logged). Low-emitting and fuel-efficient vehicles are defined as follows: vehicles classified as Zero Emission Vehicles (ZEV) by the California Air Resources Board; hybrid vehicles; vehicles fueled by biodiesel, compressed natural gas, or liquid propane.
MR Credit 2.4 continued

Construction Practices: Utility & Emissions Control

• Implement a plan to minimize vehicle and equipment engine idling when machines are not moving or working.
• Use electric powered cranes, compressors and other equipment as appropriate in lieu of combustion engine powered equipment.
• Demonstrate efforts to establish carpooling or an alternative transportation program for full time on-site construction personnel.
• Reduce air emissions from construction equipment and other non-road diesel engines by utilizing low-sulfur diesel fuel or biodiesel, or converting to natural gas powered engines.

Category 3: Noise and Vibration

• Reduce noise emissions from construction equipment and other non-road engines, by specifying low noise emission design or the lowest decibel level available that meets performance requirements. Where available, use equipment that meets the allowable sound power levels listed below or equipment in compliance with the European Union’s Blue Angel Criteria for Low-noise Construction Machinery RAL-UZ 53.
• Perform a noise and vibration assessment in conjunction with the Owner and other affected stakeholders to establish acceptable limits, durations and schedules for operations that generate noise and/or vibration.
• Assess available construction technology and choose low-impact tools, equipment and processes where feasible. Employ abatement measures where low-impact solutions are impractical.
• Monitor noise and vibration in Owner-designated critical areas and modify process, schedule or duration to achieve resolution of disruptive conditions.
• Set up portable barriers and enclosures to contain noise emissions from static equipment such as generators and concrete pumps.
• Retrofit heavy equipment with cabs and insulation to reduce noise exposure to equipment operators.
Table: Allowable Sound Power Levels

Part 1 – Mainly Earth-moving Machinery

<table>
<thead>
<tr>
<th>Type of Construction Machinery</th>
<th>Operating Conditions</th>
<th>Usable Power</th>
<th>Permissible Sound Power Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All</td>
<td>P &lt; 87hp</td>
<td>P &gt; 87hp</td>
</tr>
<tr>
<td>Chain driven machinery except excavators</td>
<td></td>
<td>99dBA</td>
<td>101dBA</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>P &lt; 87hp</td>
<td>P &lt; 108hp</td>
</tr>
<tr>
<td>Mobile cranes and all rubber tired: loaders, graders, dump trucks, etc</td>
<td></td>
<td>97dBA</td>
<td>99dBA</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>P &gt; 108hp</td>
<td>101dBA</td>
</tr>
<tr>
<td>Vibratory compactors</td>
<td></td>
<td>P &lt; 31hp</td>
<td>P &lt; 60hp</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>97dBA</td>
<td>99dBA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P &gt; 60hp</td>
<td>101dBA</td>
</tr>
<tr>
<td>Excavators</td>
<td></td>
<td>P &lt; 20hp</td>
<td>P &lt; 38hp</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>91dBA</td>
<td>94dBA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P &lt; 72hp</td>
<td>97dBA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P &lt; 108hp</td>
<td>99dBA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P &gt; 108hp</td>
<td>101dBA</td>
</tr>
</tbody>
</table>

“P” – represents the usable (taxable) machine power operating at the highest possible speed.
### MR Credit 2.4 continued

**Construction Practices: Utility & Emissions Control**

**Part 2 – Other Construction Machinery**

<table>
<thead>
<tr>
<th>Type of Construction Machinery</th>
<th>Operating Conditions</th>
<th>Permissible Sound Power Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine Compressors</td>
<td>Q &lt; 177cfm</td>
<td>88dBA</td>
</tr>
<tr>
<td></td>
<td>177cfm &lt; Q &lt; 350cfm</td>
<td>89 dBA</td>
</tr>
<tr>
<td></td>
<td>350cfm &lt; Q &lt; 1050cfm</td>
<td>91 dBA</td>
</tr>
<tr>
<td></td>
<td>Q &gt; 1050cfm</td>
<td>93 dBA</td>
</tr>
<tr>
<td>Engine Generators</td>
<td>All</td>
<td>91 dBA</td>
</tr>
<tr>
<td>Welding Generators</td>
<td>All</td>
<td>91dBA</td>
</tr>
<tr>
<td>Road Finishing Machines</td>
<td>&lt; 300ton/hr</td>
<td>90dBA*/100dBA+</td>
</tr>
<tr>
<td></td>
<td>&gt; 300ton/hr</td>
<td>94dBA*/104dBA+</td>
</tr>
<tr>
<td>Mobile Concrete Mixers</td>
<td>&lt; 10cu. Yd</td>
<td>98dBA+</td>
</tr>
<tr>
<td></td>
<td>&gt; 10cu. Yd</td>
<td>100dBA+</td>
</tr>
</tbody>
</table>

**Type of Construction Machinery (continued)**

<table>
<thead>
<tr>
<th>Type of Construction Machinery (continued)</th>
<th>Operating Conditions (continued)</th>
<th>Permissible Sound Power Level Lw dBA (continued)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revolving Tower Crane – lifting gear</td>
<td>&lt; 20hp</td>
<td>86dBA</td>
</tr>
<tr>
<td></td>
<td>20hp &lt; P &lt; 40hp</td>
<td>88dBA</td>
</tr>
<tr>
<td></td>
<td>&gt; 40hp</td>
<td>90dBA</td>
</tr>
<tr>
<td>Revolving Tower Crane – engine power</td>
<td>All</td>
<td>91dBA</td>
</tr>
<tr>
<td>Revolving Tower Crane - combined</td>
<td>All</td>
<td>91dBA</td>
</tr>
<tr>
<td>Concrete Pumps</td>
<td>&lt; 67hp</td>
<td>99dBA</td>
</tr>
<tr>
<td></td>
<td>&gt; 67hp</td>
<td>101dBA</td>
</tr>
</tbody>
</table>

*Nominal power with heat activated
+Operation of all components simultaneously at 50% capacity and no material

**Suggested Documentation**

- Document the utility and emissions control plan and implementation.
- Photograph temporary lighting sources and controls.
- Photograph water conservation measures and control of runoff and ponding.
MR Credit 2.4 continued

Construction Practices: Utility & Emissions Control

- Document cranes and compressor equipment types for the construction period.
- Document the site carpooling program components, with annual summaries, indicating that the carpooling program has been developed and implemented throughout the entire construction period.
- Document proof of ownership of, or 2 year lease agreement for, alternative fuel vehicles and calculations indicating that alternative fuel vehicles comprise 50% of contractor operated vehicle fleet, in terms of miles driven per year. Document fleet total annual mileage as well as total annual mileage driven by alternative fuel fleet vehicles.
- Document the noise and vibration control plan, measurements and abatement efforts.

Reference Standards

Potential Technologies & Strategies
- Use alternative fueled on-road construction vehicles, low-sulfur diesel fuel or biodiesel, electric powered cranes, compressors and other equipment and develop carpooling or alternative transportation programs.

Resources
Noise Pollution Clearinghouse, www.nonoise.org

GGHC Construction Credit Synergies
- SS Credit 2: Development Density & Community Connectivity
- SS Credit 3: Brownfield Redevelopment
- MR Credit 1: Building Reuse
- EQ Credit 3: Construction EQ Management Plan
Intent
Reduce the environmental impacts of the materials acquired for use in the construction of buildings and in the upgrading of building services.

Health Issues
Resource reuse and recycling eliminates primary extraction of virgin resources and manufacturing, thus preventing associated ecosystem disruption, energy expenditure and toxic emissions, while diverting materials from disposal.

Recycled content materials have the potential to conserve non-renewable resources, lower embodied energy, reduce ecological disruption and air, land and water emissions associated with extracting, transporting, and processing raw materials and manufacturing, and lower global warming potential.

The use of regional building materials may avoid local and remote human health impacts that result from transportation activities and the resulting pollution associated with delivery of materials and products to the project site.

Rapidly renewable materials can generally yield more material from less acreage, with lower irrigation and pesticide requirements, and avoid significant biodiversity loss if they are grown at appropriate scale with sustainable agricultural or forestry practices that prevent pollution of water and land resources and help to maintain healthy ecosystems.

Human and environmental health is inextricably linked with forest health. Sustainable forestry protects water quality by reducing water and soil runoff and pesticide and herbicide use. Specifying and procuring certified sustainably harvested wood increases acreage using sustainable management practices. These practices also protect aquatic life, including threatened and endangered species, and maintain viable diverse plant life increasing air filtration and carbon dioxide sequestration. The balancing of carbon dioxide mitigates global climate change, and thereby reduces the spread and redistribution of disease that can be a consequence of climate change.

Sustainable sourcing of materials should not be done at the expense of indoor air quality so requires screening for emissions.

Credit Goals
• One point (up to a maximum of five) will be awarded for each 10% of the total value of all building materials used in the project (on a dollar basis) that achieve at least one of the following sustainability criteria:
  • Contains at least 70% salvaged material.
  • Contains at least 50% rapidly renewable materials. Materials or products may receive double credit toward the total percentage if they contain at least 50% rapidly renewable materials that meet at least one of the following criteria:
    • Certified USDA organic, California Certified Organic Farmers, Oregon Tilth, Pennsylvania Certified Organic; or,
Sustainably Sourced Materials

- Grown using environmentally sustainable agriculture harvest methods that have been certified under a program that meets the criteria of ISEAL Alliance full membership (e.g. IFOAM organically grown materials).
- Contains 100% wood certified in accordance with the Forest Stewardship Council’s (FSC) Principles and Criteria.
- Contains at least 50% materials harvested and processed or extracted and processed within 500 miles of the project.
- Contains recycled content. Materials with recycled content can be credited toward the sustainably sourced total at the sum of post-consumer recycled content plus one-half of the pre-consumer content. The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
- Do not include mechanical, electrical and plumbing components and specialty items in this credit calculation. Only include materials permanently installed in the project. Furniture is not included (see GGHC MR Credit 5.1-5.3).
- Due to the critical nature of indoor air emissions to health care, materials must meet any relevant credit goals of GGHC EQ Credit 4 to attain further points under this credit. (For example, a carpet claiming credit for recycled content under this credit must also meet the requirement for low emitting flooring of GGHC EQ Credit 4.3.)
- Define recycled content in accordance with the International Organization of Standards document, ISO 14021-1999 — Environmental labels and declarations—Self-declared environmental claims (Type II environmental labeling).
  - Post-consumer material is defined as waste material generated by households or by commercial, industrial and institutional facilities in their role as end-users of the product, which can no longer be used for its intended purpose.
  - Pre-consumer material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it.
- Acceptable recycled-content cements used as substitutes for Portland cement include:
  - Fly ash generated as a coal combustion by-product only with documentation that the coal plant was not co-fired with hazardous waste, medical waste, or tire-derived fuel.
  - Ground granulated blast furnace slag as a by-product of pig iron production only with documentation that the plant was not co-fired with hazardous waste, medical waste, or tire-derived fuel.
  - Rice husk ash.
  - Fly ash generated from municipal solid waste incinerators is not an acceptable recycled-content material under this credit.

Note: In calculating the percentage of purchases for the project conforming to the credit goals, each material or product can only receive credit against a single requirement (i.e., a product that contains both 10% post-consumer recycled content and is harvested within 500 miles of the project counts only once in this calculation).
Sustainably Sourced Materials

Suggested Documentation

- For calculating the total value of all materials for this calculation, projects may choose to use a default value of 35% of total project cost instead of adding up the actual entire materials cost. Alternatively, projects can tally the actual materials cost in Divisions 2-10. If this calculation yields a smaller number than the default, achieving the desired percentage thresholds for GGHC MR c3 will be easier. (NOTE: The 35% default value is lower than the LEED for New Construction 45% default value recognizing the higher FF&E percentage in health care vs. commercial office buildings.)

- Provide documentation of all covered materials purchases that meet one or more of the specified sustainability criteria and the cost of these purchases for the project. The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.

- Provide a calculation of the fraction of covered materials purchased that meet one or more of the specified sustainability criteria (on a cost basis).

Reference Standards


ISEAL Member certifying organizations, http://www.isealalliance.org/membership

Potential Technologies & Strategies

- Identify opportunities to incorporate salvaged materials into the building design and research potential material suppliers.

- Consider salvaged materials such as:
  - Beams and posts
  - Flooring
  - Paneling
  - Doors and frames
  - Metal casework
  - Brick
  - Decorative items
MR Credit 3 continued
Sustainably Sourced Materials

- During construction, ensure that the specified recycled content materials are procured and installed. Quantify the total percentage of recycled content materials installed. Third party certification can be useful to assure validity of recycling claims. While mechanical and electrical components are not included in this calculation, specification of products with recycled content is encouraged where available for electrical equipment, such as light fixture housings, electrical raceways and mechanical products such as air ducts, diffusers and return grilles.

- Seek to incorporate products into the building design that not only have recycled content but are also recyclable, reusable or compostable at the end of their useful life in the building.

- Consider rapidly renewable materials such as:
  - Bamboo flooring
  - Wool carpet
  - Straw and wheat board
  - Sunflower seed board
  - Cotton batt insulation
  - Linoleum flooring
  - Cork flooring
  - Poplar OSB
  - Plastics produced from bio-based materials

- For rapidly renewable materials, seek materials from producers using low impact sustainable agricultural practices to avoid eutrophication, soil depletion, and use of toxic chemicals.

- Seek FSC-certified wood for non-rented temporary construction applications such as bracing, concrete formwork and pedestrian barriers. See GGHC MR Credit 2.4 for additional information.

GGHC Construction Credit Synergies
- SS Credit 1: Site Selection
- SS Credit 2: Development Density & Community Connectivity
- SS Credit 3: Brownfield Redevelopment
- EA Credit 7: Equipment Efficiency
- MR Credit 1: Building Reuse
- EQ Credit 4: Low-Emitting Materials

GGHC Operations Credit Synergies
- EE Credit 3: Energy Efficient Equipment
- WM Credit 3: Food Waste Reduction
- EP Credit 1: Food
- EP Credit 2: Janitorial Paper & Other Disposable Products
- EP Credit 3: Electronics Purchasing & Take Back
- EP Credit 5: Furniture & Medical Furnishings
1 point

**MR Credit 4.1**

**PBT Elimination: Dioxins**

**Intent**
Reduce the release of persistent bioaccumulative toxic chemicals (PBTs) associated with the life cycle of building materials.

**Health Issues**

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 bio-magnify or concentrate in the tissue of living organisms as they move up the food chain. These toxic chemicals cause a range of adverse wildlife and human health effects, including cancer, and developmental impacts in the nervous, reproductive, and immune systems. Immature, developing organisms are often the most sensitive to exposures to PBTs.

Dioxin is an extremely potent carcinogen and reproductive/developmental toxicant, with adverse impacts at extremely low levels of exposure.

The plastics that contain chlorine, such as PVC and cement from kilns fired with hazardous waste, are targeted by this credit because direct dioxin generation is associated with their manufacture as well as with many forms of disposal and accidental combustion of chlorine-containing materials in building fires or landfills. In addition, PVC feedstock production also creates several other target PBTs including PCBs (polychlorinated biphenyls), HCB (hexachlorobenzene), HCBD (hexachlorobutadiene) and octachloro-styrene (OCS).

**Credit Goals**

- Accomplish a minimum of three of the following five strategies:
  - Specify no use of cement from kilns fired with hazardous waste.
  - Specify no use of materials containing virgin or recycled chlorinated compounds in exterior and structural components (roof membranes, window and door frames, siding or other exterior finishes and geomembranes).
  - Specify no use of materials containing virgin or recycled chlorinated compounds in interior finishes (Flooring (minimum of 50% of total floor area), base, ceiling tiles, wall coverings, and window treatments). Due to the critical nature of indoor air emissions to healthcare, all interior materials must meet any applicable credit goals of GGHC EQ 4 to attain points under this credit.
  - Specify no use of materials containing virgin or recycled chlorinated compounds in piping, conduit and electrical boxes.
  - Specify no use of materials containing virgin or recycled chlorinated compounds in electrical cable and wire jacketing.

- Chlorinated compounds covered in this credit include:
  - Chlorinated polyethylene (CPE)
  - Chlorinated polyvinyl chloride (CPVC)
  - Chlorosulfonated polyethylene (CSPE)
  - Polychloroprene (CR or chloroprene rubber, also brand name Neoprene)
  - Polyvinyl chloride (PVC)
MR Credit 4.1 continued
PBT Elimination: Dioxins

- Exception can be made for minor parts, such as tracks, gaskets, and other seals, as long as a chlorinated compound is not one of the primary materials of the product.

Suggested Documentation

- Compile documentation verifying compliance with the credit goals.
- Provide specification language identifying the dioxin reduction goal to the contractor and indicating that review of material content will be a criterion in all substitution reviews.

Reference Standards

The American Hospital Association (AHA) and the United States Environmental Protection Agency (U.S. EPA) signed a Memorandum of Understanding (MOU) identifying goals to reduce the impact of health care facilities on the environment. One goal of the MOU is to minimize the production of PBT pollutants. http://www.h2e-online.org/about/mou.htm.

PBT elimination is reflected in policies established by a broad range of local, state, federal and international governmental bodies as well as major health care systems and organizations:


The Canada – U.S. International Joint Commission (IJC) study of PBTs in the Great Lakes led to a “Canada -- United States Strategy for the Virtual Elimination of Persistent Toxic Substances in the Great Lakes” signed in April of 1997 by both countries. The Strategy targets dioxins and furans, PCBs, HCB, HCBD, cadmium, lead and mercury, among other toxic substances, for elimination. http://www.epa.gov/gltnpo/p2/bns.html.

The U.S. Environmental Protection Agency (U.S. EPA), in response to the Stockholm Convention, UNEP and IJC, has established a list of target PBTs including dioxins, PCBs, HCB, OCS, lead, and mercury. US EPA Strategy for Priority Persistent, Bioaccumulative and Toxic (PBT) Pollutants, http://www.epa.gov/oppintr/pbt/pbtstrat.htm.


Washington State’s Department of Ecology has established a list of 22 PBTs including dioxins, HCB, HCBD, cadmium, lead, and mercury that the Department has targeted to be virtually eliminated from Washington sources. Washington State PBT Strategy, http://www.ecy.wa.gov/programs/eap/pbt/pbtfaq.html.

The cities of Seattle and San Francisco have both established plans to reduce PBT releases, including eliminating the use of PVC building materials. City of Seattle PBT Reduction Strategy, http://www.cityofseattle.net/environment/Documents/PBTSstrategy3-07-03.pdf.
MR Credit 4.1 continued

PBT Elimination: Dioxins

A wide range of health care related organizations have passed resolutions directly encouraging action by member organizations to reduce dioxin releases or to reduce or eliminate the use of PVC due to its association with PBTs, including the American Public Health Association, American Nurses Association, California Medical Association, Chicago Medical Society and the Maine Hospital Association. Several major health care systems, including Kaiser Permanente and Catholic Healthcare West are acting to reduce their use of PVC and other PBT related materials from health care products and building materials. American Public Health Association resolution, “Prevention of Dioxin Generation from PVC Plastic Use by Health Care Facilities,” http://www.apha.org/legislative/policy/policysearch/index.cfm?fuseaction=view&id=125.

Health Care Without Harm listing of resolutions on PVC, http://www.noharm.org/pvcDehp/reducingPVC.

Potential Technologies & Strategies

- Establish a project goal for materials that meet the dioxin reduction emission goals and identify materials and suppliers to fulfill this goal.

- The following list indicates where the specified chlorinated compounds are primarily used in building materials:
  - Chlorinated polyethylene (CPE) – geomembranes, wire and cable jacketing
  - Chlorinated polyvinyl chloride (CPVC) - water pipes
  - Chlorosulfonated polyethylene (CSPE) – roof membranes, electrical connectors and sheet membrane for pond liners
  - Neoprene - weather stripping, expansion joint filler, water seals, and other gaskets and adhesives
  - Polyvinyl chloride (PVC) – pipes and conduit, waterproofing, siding, roof membranes, door and window frames, resilient flooring, carpet backing, wall covering, signage, window treatments, furniture, wire and cable sheathing
  - While exception can be made for minor parts, specifiers are encouraged to seek EPDM and silicone or other non-chlorinated alternative seals and other minor parts where possible.

- Consider materials that are not manufactured with chlorine or other halogens. Options include (but are not limited to) TPO, EPDM, and FPO for roof membranes; natural linoleum, rubber, or alternate polymers for flooring and surfacing; natural fibers, polyethylene, polyester and paint for wall covering; polyethylene for wiring; wood, fiberglass, HDPE, and aluminum with thermal breaks for windows; and, copper, cast iron, steel, concrete, clay, polypropylene and HDPE for piping.

- Substitutions consistent with this credit are also encouraged in furniture and wiring. In wiring substitution, also avoid other halogenated compounds (compounds containing chlorine, bromine or fluorine), most notably the fluoropolymers that have similar health concerns.
MR Credit 4.1 continued

PBT Elimination: Dioxins

Resources
Dioxin formation and waste combustion continues to be studied by the U.S. EPA and others. For reference, please consult http://www.h2e-online.org/ for recent U.S. EPA findings on the subject.


GGHC Construction Credit Synergies
- SS Credit 8: Light Pollution Reduction
- EA Prerequisite 2: Minimum Energy Performance
- EA Credit 1: Optimize Energy Performance
- EA Credit 7: Equipment Efficiency
- MR Prerequisite 2: Mercury Elimination

GGHC Operations Credit Synergies
- EE Credit 1: Optimize Energy Performance
- EE Credit 3: Energy Efficient Equipment
- WM Prerequisite 1: Waste Stream Audit
- WM Credit 2: Regulated Medical Waste Reduction
- CM Prerequisite 1: Polychlorinated Biphenyl (PCB) Removal
- CM Credit 2: Indoor Pollutant Source Control
- CM Credit 3: Chemical Discharge
- EP Credit 4: Toxic Reduction
MR Credit 4.2
PBT Elimination: Mercury

Intent
Reduce the release of persistent bioaccumulative and toxic chemicals (PBTs) associated with the life cycle of building materials.

Health Issues
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 bio-magnify or concentrate in the tissue of living organisms as they move up the food chain. With a few exceptions, the major source of human exposures to PBTs in the general population occurs from the consumption of contaminated food in the ordinary diet. These toxic chemicals cause a range of adverse wildlife and human health effects, including cancer, and developmental impacts in the nervous, reproductive, and immune systems. Immature, developing organisms are often the most sensitive to exposures to PBTs.
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 targeting elimination of the production and use of PBT substances, or those that are known to lead to their formation, rather than attempts to control emissions.
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. Mercury is one of at least six PBTs commonly addressed in PBT elimination policies that have direct links with building materials. Others include cadmium, lead, dioxins (including furans and dioxin like compounds), PCBs (polychlorinated biphenyls) and PBDEs (polybrominated diphenyl ethers). These PBTs are used in the manufacture of building materials or unavoidably produced and released into the environment during one or more stages of the material’s life cycle. These credits are aimed at eliminating building materials typically used in construction that either contain one or more PBTs or are associated with PBT releases at one or more stages of their life cycle. PBT elimination is reflected in policies established by a broad range of local, state, federal and international governmental bodies as well as major health care systems and organizations as reflected in the Resources section in GGHC MR Credit 4.1.

Credit Goals
• In addition to the Credit Goals outlined in GGHC MR Prerequisite 2: Mercury Elimination, specify and install low mercury fluorescent lamps according to the following criteria:

<table>
<thead>
<tr>
<th>Fluorescent Lamp</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eight-foot T-8 (both Standard and High Output)</td>
<td>18,000 rated hours on instant start ballasts OR 24,000 rated hours on program start ballasts</td>
</tr>
<tr>
<td>Four-foot T-8 (both Standard and High Output)</td>
<td>18,000 rated hours on instant start ballasts OR 24,000 rated hours on program start ballasts</td>
</tr>
<tr>
<td>Three-foot T-8</td>
<td>18,000 rated hours on instant start ballasts OR 24,000 rated hours on program start ballasts</td>
</tr>
<tr>
<td>Two-foot T-8</td>
<td>18,000 rated hours on instant start ballasts OR 24,000 rated hours on program start ballasts</td>
</tr>
</tbody>
</table>
MR Credit 4.2 continued

PBT Elimination: Mercury

<table>
<thead>
<tr>
<th>Fluorescent Lamp (continued)</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>U-Bent T-8</td>
<td>18,000 rated hours on instant start ballasts OR 24,000 rated hours on program start ballasts</td>
</tr>
<tr>
<td>28-watt T-5</td>
<td>20,000 rated hours on program start ballasts</td>
</tr>
<tr>
<td>24-watt T5HO (High Output)</td>
<td>20,000 rated hours on program start ballasts</td>
</tr>
<tr>
<td>54-watt T5HO (High Output)</td>
<td>25,000 rated hours on program start ballasts</td>
</tr>
<tr>
<td>Compact fluorescent lamps</td>
<td>Minimum 10,000 rated hours</td>
</tr>
</tbody>
</table>

*Note: Longer lamp life contributes to lower mercury use by reducing the frequency of lamp replacement.*

- Do not specify or install circular fluorescent lamps on the project.
- Do not specify or install standard (e.g. non-pulse start) metal halide lamps on the project.

**Suggested Documentation**
- Compile documentation verifying compliance with the credit goal criteria for mercury content in fluorescent lamps.
- Document that circular fluorescent lamps were not specified or installed for the project.
- Document that standard metal halide High Intensity Discharge (HID) lamps were not specified or installed for the project.

**Reference Standards**
There is no reference standard for this credit.

**Potential Technologies & Strategies**
See GGHC MR Prerequisite 2 for Potential Technologies & Strategies and Credit Synergies.

**Resources**
See GGHC MR Prerequisite 2 for Resources.
PBT Elimination: Lead & Cadmium

Intent
Reduce the release of persistent bioaccumulative toxic chemicals (PBTs) associated with the life cycle of building materials.

Health Issues
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 bio-magnify or concentrate in the tissue of living organisms as they move up the food chain. With a few exceptions, the major source of human exposures to PBTs in the general population occurs from the consumption of contaminated food in the ordinary diet. These toxic chemicals cause a range of adverse wildlife and human health effects, including cancer, and developmental impacts in the nervous, reproductive, and immune systems. Immature, developing organisms are the most sensitive to exposures to PBTs.

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 targeting elimination of 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. Cadmium is a carcinogen and causes kidney, lung, intestinal, and placental damage.

Lead and cadmium are two of at least five PBTs commonly addressed in PBT elimination policies that have direct links with building materials. Others include cadmium, lead, dioxins (including furans and dioxin like compounds), PCBs (polychlorinated biphenyls) and PBDEs (polybrominated diphenyl ethers). These PBTs are used in the manufacture of building materials or unavoidably produced and released into the environment during one or more stages of the material’s life cycle. These credits are aimed at eliminating building materials typically used in construction that either contain one or more PBTs or are associated with PBT releases at one or more stages of their life cycle.

Credit Goals

• Specify substitutes for materials manufactured with lead and cadmium, when cost effective alternatives that meet or exceed performance standards are available, as follows:

  • Specify use of 100% lead-free solder and roofing. Lead is typically found in roofing products in terne, copper roofing, and roof flashing.

  • Specify use of 100% lead-free insulated jacketing of electrical wire and cable that meets or exceeds performance requirements.

  • Specify no use of interior or exterior paints containing cadmium or lead. Green Seal certified or recommended paints meeting Green Seal criteria exclude metals including cadmium, lead, mercury, antimony, and hexavalent chromium.

• For renovation projects, ensure the removal and appropriate disposal of disconnected wires with lead stabilizers

  Note: Avoid use of “lead free” products as defined by the U.S. EPA Safe Drinking Water Act (SDWA) (http://www.epa.gov/safewater/sdwa/index.html), because these products may contain lead.

  The SDWA defines “lead free” as:

  • Solders and flux containing 0.2% lead or less.
MR Credit 4.3 continued

PBT Elimination: Lead & Cadmium

- Pipes, pipe fittings, and well pumps containing 8% lead or less.
  To comply with the intent of this credit, specify only “100% lead free” products.

Suggested Documentation

- Prepare roofing, electrical wiring and painting schedules noting the 100% lead- and cadmium-free specifications.
- Prepare specification language identifying the lead- and cadmium-free goal to the contractor for the aforementioned material categories and indicating that review of material content will be a criterion in all substitution reviews.

Reference Standards

Green Seal, http://www.greenseal.org

PBT elimination is reflected in policies established by a broad range of local, state, federal and international governmental bodies as well as major health care systems and organizations. Refer to the listing in GGHC MR Credit 4.1.

Potential Technologies & Strategies

- Establish a project goal for lead- and cadmium-free products and identify products and suppliers to fulfill this goal. Consider products such as silver and other lead-free solder, solderless copper connectors and polyethylene piping, aluminum flashing and Green Seal compliant paints. Note that it is understood that there may be a small allowable use of cadmium in equipment beyond the knowledge and access of the designer, such as relay contacts.
- Consider lead-free alternatives for radiation shielding materials.
- Note that some PVC products contain lead or cadmium as stabilizers. For example, lead remains the primary stabilizer in PVC insulation for electrical wire and cable, and cadmium and lead are both still found in PVC resilient flooring products. While not all PVC products contain lead or cadmium, specifying PVC-free products as per GGHC MR Credit 4.1 (Dioxin) will help ensure greater elimination of potential lead and cadmium sources.

Resources

MR Credit 4.3 continued

PBT Elimination: **Lead & Cadmium**

**GGHC Construction Credit Synergies**
- SS Credit 8: Light Pollution Reduction
- EA Prerequisite 2: Minimum Energy Performance
- EA Credit 1: Optimize Energy Performance
- EA Credit 7: Equipment Efficiency
- MR Prerequisite 2: Mercury Elimination

**GGHC Operations Credit Synergies**
- EE Credit 1: Optimize Energy Performance
- EE Credit 3: Energy Efficient Equipment
- WM Prerequisite 1: Waste Stream Audit
- WM Credit 2: Regulated Medical Waste Reduction
- CM Prerequisite 1: Polychlorinated Biphenyl (PCB) Removal
- CM Credit 2: Indoor Pollutant Source Control
- CM Credit 3: Chemical Discharge
- EP Credit 4: Toxic Reduction
MR Credit 5.1
Furniture & Medical Furnishings: Resource Reuse

Intent
Reduce the environmental impacts from the manufacture, use and disposal of furniture and medical furnishings products.

Health Issues
Resource reuse eliminates primary extraction of virgin resources, transportation and manufacturing, thus preventing associated ecosystem disruption, energy expenditure and toxic emissions, while diverting materials from disposal.

Credit Goals
• Specify salvaged, refurbished, or used furniture and medical furnishings for a minimum 20% of the total furniture and medical furnishings budget.

  Note: Hospital beds are excluded from this credit as they are customarily reused in hospitals.

Suggested Documentation
☐ Compile a list of furniture and medical furnishings, with the salvaged or reused components identified and indicate their replacement value to determine that the credit goals have been met for the requisite amount of furniture.

Potential Technologies & Strategies
• Identify opportunities to salvage and reuse furniture from existing inventory and research potential used furniture suppliers.
• Salvage and reuse systems furniture and furnishings such as:
  • Case pieces
  • Seating
  • Filing systems
  • Medical furnishings such as exam tables, stools, carts, etc.
• Furniture dealers are sources for reused furniture and furniture recycling programs at the local and regional levels. This helps save energy and other resources by reducing reshipping impacts and creation of new product using virgin material.

GGHC Construction Credit Synergies
• MR Credit 1: Building Reuse
• MR Credit 3: Sustainably Sourced Materials
• EQ Credit 4: Low-Emitting Materials

GGHC Operations Credit Synergies
• EP Credit 5: Furniture & Medical Furnishings
Health Issues

The environmental and health issues surrounding materials used in the manufacture of furniture products parallel those outlined for building products in the Material and Resource credits. Significant health impacts are associated with the use of Persistent, Bioaccumulative and Toxic Chemicals (PBTs), chrome plated finishes, and wood harvesting for furniture products manufacture.

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 bio-magnify or concentrate in the tissue of living organisms as they move up the food chain. With a few exceptions, the major source of human exposures to PBTs in the general population occurs from the consumption of contaminated food in the ordinary diet. These toxic chemicals cause a range of adverse wildlife and human health effects, including cancer, and developmental impacts in the nervous, reproductive, and immune systems. Immature, developing organisms are often the most sensitive to exposures to PBTs. 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 targeting elimination of the production and use of PBT substances, or those that are known to lead to their formation, rather than attempts to control emissions.

Hexavalent chromium is another particularly toxic chemical used in furniture for chrome plating. It poses a wide range of health impacts ranging from respiratory tract damage to cancer, particularly for workers and for residents surrounding manufacturing sites.

The furniture industry is a major market for wood products. Human and environmental health is inextricably linked with forest health. Sustainable forestry protects water quality by reducing water and soil runoff and pesticide and herbicide use. Specifying and procuring certified sustainably harvested wood increases acreage using sustainable management practices. These practices also protect aquatic life, including threatened and endangered species, and maintain viable diverse plant life increasing air filtration and carbon dioxide sequestration. The balancing of carbon dioxide mitigates global climate change, and thereby reduces the potential disease spread predicted to be a consequence of global warming induced climate change.

Credit Goals

- Specify 40% of furniture and medical furnishings by cost that complies with a minimum of two (2) of the following three (3) goals:
  - No PBTs in material manufacture - Mercury, Cadmium, Lead or chlorinated compounds (including PVC) in furniture components, textiles, finishes or dyes (per GGHC MR Credit 4). Exception can be made for minor parts, as long as a chlorinated compound is not one of the primary materials of the product.
  - Comply with the European Union RoHS (Restriction of the Use of Certain Hazardous Substances) Directive regarding hexavalent chrome for plated finishes.
  - All wood components from FSC Certified Wood (per GGHC MR Credit 3).
**MR Credit 5.2** continued

**Furniture & Medical Furnishings: Materials**

**Reference Standard**

**Suggested Documentation**
- Prepare a matrix indicating the three goals and a listing of furniture, indicating that the requisite amount of furniture complies with a minimum of two out of the three listed goals.
- For each material or product used to meet the Certified Wood goal, document the vendor or manufacturer’s Forest Stewardship Council chain-of-custody certificate number.

**Potential Technologies & Strategies**
- Heavy metals, such as lead, cadmium, and mercury, can be found in PVC products, fabric dyes and leather tanning. Some manufacturers in the textile industry have eliminated heavy metals from the dyes used in upholstery, backing or barrier cloths, panel fabrics and window textiles. In addition, alternatives exist for PVC-free edging material, furniture connection pieces and panel base covers.
- Specify furniture from manufacturers that offer FSC-certified wood products, with an emphasis on regionally supplied products that can contribute to achieving this goal.

**GGHC Construction Credit Synergies**
- MR Credit 1: Building Reuse
- MR Credit 3: Sustainably Sourced Materials
- EQ Credit 4: Low-Emitting Materials

**GGHC Operations Credit Synergies**
- EP Credit 5: Furniture & Medical Furnishings
**MR Credit 5.3**

**Furniture & Medical Furnishings: Manufacturing, Transportation & Recycling**

**Intent**
Reduce the environmental impacts from the manufacture, use and disposal of furniture and medical furnishings products.

**Health Issues**
The use of regional assembly practices reduces transportation activities and the resulting pollution associated with delivery of furniture products to the project site. Reducing or eliminating packaging, and/or ensuring that the packaging is recyclable or compostable, results in a lessened reliance on disposal. Similarly, the end of life recycling of furniture products reduces solid waste volumes by diverting materials from disposal and reduces the need for continued extraction and raw manufacturing. In both cases, unhealthy air, water, and land pollution associated with landfill and incineration can be reduced.

**Credit Goals**
- Specify 40% of furniture and medical furnishings based on cost that complies with a minimum of two (2) of the following goals:
  - Locally and/or regionally sourced – Furniture and medical furnishings that have been extracted, harvested or recovered, as well as manufactured, within 500 miles of the project site.
  - Transported with a minimum of packaging - Reduce, reuse, recycle, compost or minimize packaging for shipping, and packaging that is “taken back” by manufacturer for reuse (such as blanket wrapping).
  - Has “end of life” destination – is designed for disassembly, recyclability, biodegradability, or is part of a “take back” program. Furniture that can be disassembled or recycled at end of life, either locally or by the manufacturer through a “take back” program, qualifies.

**Suggested Documentation**
- Prepare a matrix indicating the three goals and a listing of furniture and medical furnishings and their associated costs, indicating that the requisite amount of furniture complies with a minimum of two out of the three listed goals.

**Potential Technologies & Strategies**
- Specify furniture products that are assembled within 500 miles of the project site to reduce environmental impacts from transportation and support the regional economy.
- Packaging:
  - Minimize packaging and reuse or return packaging to the sender for recycling.
  - Encourage manufacturers to use cardboard with recycled content.
  - Soy inks should be substituted for inks made with heavy metals.
  - Encourage shippers to blanket wrap bulky items, such as chairs, if going directly to the end user. Blankets and pallets are reusable.
MR Credit 5.3 continued

Furniture & Medical Furnishings: Manufacturing, Transportation & Recycling

- A growing number of furniture items are available that can be disassembled to allow for almost 100% recycling done locally and/or by sending back to the manufacturer. A number of manufacturers also have programs to extend product life for reuse by re-manufacturing and recycling programs in furniture systems (see GGHC MR Credit 5.1).

GGHC Construction Credit Synergies
- MR Credit 1: Building Reuse
- MR Credit 3: Sustainably Sourced Materials
- EQ Credit 4: Low-Emitting Materials

GGHC Operations Credit Synergies
- EP Credit 5: Furniture & Medical Furnishings
Intent
Prevent copper-contaminated stormwater run-off from entering aquatic systems.

Health Issues
Copper is toxic to aquatic species and acutely toxic to plankton and thus can impair the vitality of aquatic ecosystems. Copper enters aquatic systems through direct and indirect sources. In a study of the South San Francisco Bay, 23% of copper was from wastewater treatment plants (the rest was from stormwater sources) and 60 percent of that was estimated to derive from copper pipe corrosion.

Credit Goals
- Eliminate the use of copper metal roofing, copper granule-containing asphalt shingles, copper gutters, and copper cladding.

AND
- If using copper pipe requiring the use of solder and flux during installation, specify all solder joints to be compliant with ASTM B828. Specify and use ASTM B813 flux to reduce copper pipe corrosion.

Suggested Documentation
☑ Document that the roofing and plumbing schedules and specifications for the project comply with the credit goals.

Reference Standards


Potential Technologies & Strategies
- Establish a project goal to eliminate use of exterior copper building products at the project’s inception, particularly if the run-off from the building site flows into a sensitive aquatic zone.
- Identify alternative material options.
- Reduce copper pipe corrosion through the use of less corrosive fluxes, identified as ASTM B813, offered by most flux manufacturers and by specifying that all solder joints comply with ASTM B828.
- Using a solderless copper pipe system, such as ProPress, eliminates the need for solder and flux and thereby the source of significant copper corrosion.
- Alternative pipe materials such as cross-linked polyethylene and cast iron, depending on application, should also be considered as substitutes for copper piping.
MR Credit 6 continued

Copper Reduction

**GGHC Construction Credit Synergies**
- ID Prerequisite 1: Integrated Design Process
- ID Prerequisite 2: Health Mission Statement & Program
- SS Prerequisite 1: Construction Activity Pollution Prevention
- SS Credit 6: Stormwater Design
- SS Credit 7: Heat Island Effect

**GGHC Operations Credit Synergies**
- CM Credit 1: Community Contaminant Prevention
- CM Credit 3: Chemical Discharge
- ES Credit 1: Outdoor Grounds & Building Exterior Management

**Resources**
MR Credit 7.1

Resource Use: Design for Flexibility

Intent
Conserve resources associated with the construction and management of buildings by designing for durability, flexibility and ease of future adaptation, and maximizing life of constituent components and assemblies.

Health Issues
Health care facilities undergo substantial renovation and remodeling to accommodate changing technologies and regulatory requirements, thereby generating significant quantities of construction-related wastes, and subjecting building occupants to noise, dust, and other health impacting disruptions associated with construction. By designing durable, flexible, adaptive, generic spaces, buildings can better respond to changes imposed by new equipment and infrastructure requirements with minimum waste and maintain a healthier environment during renovations.

Credit Goals
• Increase building flexibility and ease of adaptive reuse over the life of the structure by employing three (3) or more of the following design and/or space planning strategies:
  • Use of interstitial space serving for a minimum 20% of project diagnostic & treatment or other clinical floor area (calculation based on DGSF). Provide ‘zonal service distribution systems’ for electrical, information technology (IT), communication, medical gases, and sprinklers in all clinical spaces. (Inpatient units are excluded from this calculation.)
  • Provide programmed ‘soft space’ (such as administration/storage) equal to a minimum of 5% of total clinical space. Locate ‘soft space’ adjacent to clinical departments that anticipate growth. Determine strategy for future accommodation of displaced ‘soft space’ (calculation based on project DGSF).
  • Construct ‘soft space’ with movable or demountable partition systems, or use movable or demountable walls for a minimum of 20% of interior partitions (calculation based on LF of partition); inpatient units may be excluded from this calculation.
  • Locate ‘shelled space’ equal to a minimum of 5% of total project departmental clinical space, where it can be occupied without displacing occupied space (calculation based on project DGSF).
  • Identify horizontal expansion capacity equal to a minimum of 30% of diagnostic and treatment or other clinical space accessible without demolition of occupied space (other than at the connection point of future expansion). Reconfiguration of additional existing occupied space that has been constructed with movable partition systems is permitted. (Calculation based on project DGSF-Inpatient units are excluded).
  • Design for future vertical expansion on a minimum of 75% of roof, ensuring minimal disruption to existing operations and service systems.
  • Designate location(s) for future above-grade parking structure(s) equal to 50% of existing on-grade parking capacity, with direct access to the main hospital lobby/ circulation/ vertical transportation pathways.
  • Design on a modular planning grid based upon material size modules to reduce waste and increase flexibility. Use movable/modular casework for a minimum of 50% of casework and custom millwork. (Calculation is based upon the combined value of the two elements, as determined by the Cost Estimator or Constructor.).
MR Credit 7.1 continued

Resource Use: Design for Flexibility

Suggested Documentation
- Compile evidence of strategies employed to improve ease of adaptive reuse of the structure in future expansion, renovations, including floor plans, building sections, or modular technology technical data.

Reference Standards
There is no reference standard for this credit.

Potential Technologies & Strategies
Flexible, adaptable and generic spaces increase building longevity. Strategies for achieving this include:

- Right size the space program, insuring that space assignments are optimized through considering multiple uses for individual spaces, alternative officing (whereby unassigned, flexible workstations are shared by multiple users), and universal sizing (standardized room or workstation sizing).

- Dimensional planning to recognize standard material sizes – wherever possible, design rooms using 2-foot incremental dimensions. An 8’ x 11’-6” room creates less waste than a 7’-6” x 11’-4” dimension.

- On large-scale projects, use repetitive elements throughout the design. Redundant dimensions facilitates cutting in large batches in a single location, which in turn facilitates recycling and efficient disposal of cutoffs.

- Plan for future adaptability, including ample floor-to-floor heights, raised floor distribution systems or interstitial space to allow for ease of future modifications, implementation of undifferentiated “technology floors” to accommodate surgical, cardiology and radiological procedures in equally sized and adaptable planning modules.

- Locating shell or ‘soft space’ adjacent to major clinical areas (such as radiology, surgery, etc) allows for ease of expansion rather than early obsolescence. Determine which programs are likely to require such expansion and locate shell or soft space to permit this needed expansion without major disruption or reconfiguration of existing, operational space.

- Consider components that can be removed and reused in future reconfigurations or may be salvaged for future renovations.

- Plan corridor systems and exit stairways to support future building additions such that demolition of occupied space will not be required. This will cause less disruption during future construction as well as reduce waste from demolition.

- Adopt acuity adaptable and universal patient room concepts to both enhance patient care quality and reduce the probability of need for future change.

- Consider ease of installation and deconstruction, including modular, demountable building systems that can be relocated, reused, or salvaged in the future. Detailing for easy disassembly by using screws and bolts in place of nails and adhesives will reduce future renovation costs.

- Employ design strategies to reduce the use of materials, such as exposed ceilings, concrete floors, and exposed structural framework.
MR Credit 7.1 continued

Resource Use: Design for Flexibility

Resources


GGHC Construction Credit Synergies

- ID Prerequisite 1: Integrated Design Process
- MR Credit 1: Building Reuse
- MR Credit 2: Construction Waste Management
- MR Credit 3: Sustainably Sourced Materials
- MR Credit 5: Furniture & Medical Furnishings
- EQ Credit 4: Low-Emitting Materials
- EQ Credit 8: Daylight & Views
- EQ Credit 9: Acoustic Environment

GGHC Operations Credit Synergies

- EP Credit 2: Janitorial Paper & Other Disposable Products
1 point

**MR Credit 7.2**

**Resource Use:** Design for Durability

**Intent**

Conserve resources associated with the construction and management of buildings by designing for durability, flexibility and ease of future adaptation, and maximizing life of constituent components and assemblies.

**Health Issues**

Health care facilities undergo substantial renovation and remodeling to accommodate changing technologies and regulatory requirements, thereby generating significant quantities of construction-related wastes, and subjecting building occupants to noise, dust, and other health impacting disruptions associated with construction. By designing durable, flexible, adaptive, generic spaces, buildings can better respond to changes imposed by new equipment and infrastructure requirements with minimum waste and maintaining a healthier environment during renovations.

**Credit Goals**

- Design and construct to achieve the minimum “design service life” of the building or renovation in accordance with the following table (based upon Table 2 in CSA S478-95 (R2001):

<table>
<thead>
<tr>
<th>Category</th>
<th>Design Service Life</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary</td>
<td>Less than 10 years</td>
<td>Tenant Occupancies&lt;br&gt;Portable Buildings&lt;br&gt;‘Soft space” Fitouts&lt;br&gt;Open Building: Tertiary Systems</td>
</tr>
<tr>
<td>Medium Life</td>
<td>20 – 49 years</td>
<td>Long Term Tenant Occupancies&lt;br&gt;Medical Office Buildings&lt;br&gt;Long Term Care Facilities&lt;br&gt;Laboratory Core &amp; Shell&lt;br&gt;Most Parking Structures&lt;br&gt;Open Building Secondary Systems</td>
</tr>
<tr>
<td>Long Life</td>
<td>50-99 years</td>
<td>Acute Care Medical Buildings Core &amp; Shell&lt;br&gt;Open Building Primary Systems&lt;br&gt;Parking Structures as components of above</td>
</tr>
<tr>
<td>Permanent Buildings</td>
<td>Minimum 100 years</td>
<td>Historic Structures&lt;br&gt;Monumental Buildings</td>
</tr>
</tbody>
</table>

AND

- For Long Life and Medium Life New Construction, develop and implement a Building Durability Plan for the major building components for the construction and pre-occupancy phases of the building as follows (all Tables cited are from the CSA S478 reference standard):
  - Design and construct the building to ensure that the predicted service life of major building structural and shell components exceeds the design service life.
MR Credit 7.2 continued

Resource Use: Design for Durability

a. Where component and assembly design service lives are shorter than the design service life of the building, design and construct those components and assemblies so that they can be readily replaced. For components and assemblies whose Categories of Failure are 6, 7 or 8 in Table 3, use a design service life equal to the design service life of the building.

b. For components and assemblies whose Categories of Failure are 4 or 5 in Table 3, use a design service life equal to at least half of the design service life of the building.

c. Document the elements of quality assurance activities to be carried out to ensure the predicted service life is achieved, in the format contained in Table 1, Quality Assurance and the Building Process, of CSA S478.

d. Develop and document the quality management program for the project that ensures the quality assurance activities are carried out, in accordance with the elements identified in Clause 5.3, Elements of Quality Management.

- For Renovations, the current condition of the building should be assessed for its ability to provide acceptable performance for the uses for which the renovation will be designed. Such assessment must include structure; codes and regulations; serviceability; mechanical and electrical systems, and identification of needed repairs. Ensure that the intended service life of the renovated area is matched by the service life of the existing building, in accordance with the table above and the reference standard.

Reference Standard


Suggested Documentation

- Prepare a narrative indicating that construction systems or strategies comply with the credit goals. Design Life and Maintenance documents can be found in the Reference Standard, Appendix A. The narrative should reflect the understanding between the design team and owner regarding objectives and expectations.

Potential Technologies & Strategies

- Requirements for durability are expressed in terms of the design service life of the structure. The design service life of the building provides one basis for the design service life of the building components. Articulating expectation about design service life allows project teams to make important decisions regarding construction methods, system choices, and flexibility measures.

- Often, health care buildings include individual components of differing design service life. Design teams are encouraged to explore “open building” technologies and methodologies to match building and system components to design service life. In “open building design”, primary systems are designed with maximum flexibility and durability (core and shell, in most instances), with secondary and tertiary systems constructed for specific design service life well within the expected design service life of primary systems.
MR Credit 7.2 continued
Resource Use: Design for Durability

- Permanent components of the building (foundations, main structural members) are expected to perform for the entire life of the structure. Partition systems should be designed to last only as long as the interior installation is expected to remain useful. Exterior cladding systems should be selected to respond to the design service life of the structure – a cladding system with a service life of 20 years may require extensive maintenance if used on a building with a design service life of 50 years or more.

- Consider the local site parameters when selecting materials and construction systems. Local environmental conditions may impose particular parameters on material and component maintenance and damage.

- Where possible with temporary buildings, design for disassembly and deconstruction. Identify building components that may be salvaged for reuse, recycled, or adapted.

Resources


Construction Credit Synergies

- ID Prerequisite 1: Integrated Design Process
- MR Credit 1: Building Reuse
- MR Credit 2: Construction Waste Management
- MR Credit 3: Sustainably Sourced Materials
- MR Credit 5: Furniture & Medical Furnishings
- EQ Credit 4: Low-Emitting Materials
- EQ Credit 8: Daylight & Views
- EQ Credit 9: Acoustic Environment

Operations Credit Synergies

- EP Credit 2: Janitorial Paper & Other Disposable Products
Environmental Quality

Required EQ Prerequisite 1

Minimum IAQ Performance

Intent
Establish minimum indoor air quality (IAQ) performance to enhance indoor air quality in buildings, thus contributing to the comfort and wellbeing of the occupants.

Health Issues
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 and other indoor air pollutants. Coupling properly designed, operated and maintained mechanical equipment with low-emitting materials can ensure healthy indoor air.

Credit Goals
• Meet the minimum requirements of the relevant local licensing requirement for ventilation or Section 4 through 7 of voluntary consensus standard ASHRAE 62-2004, Ventilation for Acceptable Indoor Air Quality, whichever is more stringent. Mechanical ventilation systems shall be designed using the Ventilation Rate Procedure or the applicable local code, whichever is more stringent.
• Naturally ventilated buildings shall comply with ASHRAE 62.1-2004, paragraph 5.1 or the relevant local licensing requirement, whichever is more stringent.

Suggested Documentation
☐ Prepare calculations demonstrating that the project is fully compliant with relevant local licensing requirements or ASHRAE 62-2004 and describing the procedure employed in the IAQ analysis (Ventilation Rate Procedure).

Reference Standards

Potential Technologies & Strategies
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. These strategies can be categorized by type and prioritized as follows:
• Ventilation (refer to GGHC EQ Credit 2). Develop ventilation strategies that support operable windows, where appropriate. Design for mechanical ventilation air change rates required by health code standards, zoning areas where contaminants are generated.
Minimum IAQ Performance

- **Construction Methods** (refer to GGHC EQ Credit 3). Control indoor air quality during construction and mitigate impacts on occupied building air quality. Flush newly constructed or renovated buildings with 100% outside air prior to occupancy.

- **Building Materials** (refer to GGHC EQ Credits 4 & 8). Many materials and products used in the building emit volatile organic compounds (VOCs), including formaldehyde. Examples of possible sources of indoor air pollution include adhesives, paints, carpeting, upholstery, manufactured wood products and other components of furniture, including medical furniture & equipment.

- **Chemical & Pollutant Source Control** (refer to GGHC EQ Credit 5 and Operations). Sources can include outdoor pollutants, indoor chemical use (including glutaraldehyde and other sterilizing agents and methylene chloride, used in adhesive removers, paint stripper, and aerosol spray paints), cleaning products, fragrances and pest control activities.

- **Building Maintenance and Operation** (refer to GGHC EQ Credit 5 and GGHC Operations section).

- **Control Systems** (refer to GGHC EQ Credits 6 & 7). Install sensors for relative humidity, temperature, and carbon dioxide. Consider occupant control systems to improve individual comfort.

**Resources**


**GGHC Construction Credit Synergies**

- SS Credit 1: Site Selection
- SS Credit 2: Development Density & Community Connectivity
- SS Credit 4: Alternative Transportation
- WE Credit 1: Water Efficient Landscaping
- EA Prerequisite 1: Fundamental Building Systems Commissioning
- EA Prerequisite 2: Minimum Energy Performance
- EA Credit 1: Optimize Energy Performance
- EA Credit 3: Enhanced Commissioning
- EA Credit 5: Measurement & Verification
- MR Prerequisite 1: Storage & Collection of Recyclables
- MR Credit 1: Building Reuse
- EQ Prerequisite 2: Hazardous Material Removal or Encapsulation
- EQ Credit 1: Outdoor Air Delivery Monitoring
- EQ Credit 2: Natural Ventilation
- EQ Credit 3: Construction EQ Management Plan
- EQ Credit 4: Low-Emitting Materials
EQ Prerequisite 1 continued

Minimum IAQ Performance

- EQ Credit 5: Chemical & Pollutant Source Control
- EQ Credit 7: Thermal Comfort

GGHC Operations Credit Synergies

- IO Prerequisite 4: Outside Air Introduction & Exhaust Systems
- IO Credit 2: IAQ Management
- IO Prerequisite 3: Environmental Tobacco Smoke Control
- IO Prerequisite 4: Outside Air Introduction & Exhaust Systems
- IO Credit 1: Building Operations & Maintenance
- IO Credit 2: IAQ Management
- EE Prerequisite 1: Existing Building Commissioning
- EE Prerequisite 2: Minimum Energy Performance
- CM Prerequisite 1: Polychlorinated Biphenyl (PCB) Removal
- CM Credit 1: Community Contaminant Prevention
- CM Credit 2: Indoor Pollutant Source Control
- CM Credit 3: Chemical Discharge
- ES Credit 2: Indoor Integrated Pest Management
- ES Credit 4: Sustainable Cleaning Products & Materials
- ES Credit 5: Environmentally Preferable Janitorial Equipment
- EP Credit 6: IAQ Compliant Products
Environmental Tobacco Smoke (ETS) Control

**Intent**
Prevent exposure of building occupants, indoor surfaces, and ventilation air distribution systems to Environmental Tobacco Smoke (ETS).

**Health Issues**
There are well-known health risks associated with Environmental Tobacco Smoke (or “secondhand smoke”). A 1993 report published by the United States EPA, *Respiratory Health Effects of Passive Smoking: Lung Cancer and Other Disorders*, concluded that secondhand smoke causes lung cancer in adult nonsmokers and impairs the respiratory health of children, corroborating earlier studies undertaken by the National Academy of Sciences and the U.S. Surgeon General. The EPA report classified secondhand smoke as a Group A carcinogen, indicating sufficient evidence of the substance causing cancer in humans. Only 15 other substances including asbestos, benzene and radon are included in the U.S. EPA’s list of known carcinogens.

**Credit Goals**
- Prohibit smoking in the building (except as noted below).
- Locate any exterior designated smoking areas at least 50 feet (15.24 meters) away from entries, operable windows, air intakes, bus stops, disabled parking, and other locations where occupants could inadvertently come in contact with ETS when occupying, entering or leaving the building.
- Only for residential facilities where the functional program requires accommodation for smokers may there be an exception to establish negative pressure smoking rooms:
  - Provide one or more designated smoking rooms designed to effectively contain, capture and remove ETS from the building. At a minimum, the smoking room must be directly exhausted to the outdoors with no re-circulation of ETS-containing air to the non-smoking area of the building, and enclosed with impermeable deck-to-deck partitions. With the doors to the smoking room closed, operate exhaust sufficient to create a negative pressure with respect to the adjacent spaces of at least an average of 5 Pa (0.02 inches of water gauge) and with a minimum of 1 Pa (0.004 inches of water) when the door(s) to the smoking room are closed.
  - Verify performance of the smoking room differential air pressures by conducting 15 minutes of measurement, with a minimum of one measurement every 10 seconds, of the differential pressure in the smoking room with respect to each adjacent area and in each adjacent vertical chase with the doors to the smoking room closed. Conduct the testing with each space configured for worst case conditions of transport of air from the smoking rooms to adjacent spaces with the smoking rooms’ doors closed to the adjacent spaces.

**Suggested Documentation**
- Establish and maintain a no-smoking policy on the property.
- Provide a site map showing exterior designated smoking areas in compliance with the Credit Goals.
EQ Prerequisite 2 continued

Environmental Tobacco Smoke (ETS) Control

- Residential facilities that accommodate smoking:
  - Prepare a copy of the building site plan indicating designated smoking areas and their distances from entries, operable windows, air intakes, and other locations where occupants could inadvertently come in contact with ETS.
  - Compile documentation demonstrating that designated smoking rooms comply with Credit Goals.

Reference Standards
There is no reference standard for this credit.

Potential Technologies & Strategies

- Prohibit smoking in the building and other locations where occupants could inadvertently come in contact with ETS.
- Take into account prevailing winds and micro-climate effects in siting exterior smoking areas.

Resources

Construction Credit Synergies

- EA Prerequisite 1: Fundamental Building Systems Commissioning
- EA Prerequisite 2: Minimum Energy Performance
- EA Credit 1: Optimize Energy Performance
- EA Credit 3: Enhanced Commissioning
- EA Credit 5: Measurement & Verification
- EQ Prerequisite 1: Minimum IAQ Performance
- EQ Credit 2: Natural Ventilation
- EQ Credit 5: Chemical & Pollutant Source Control
- EQ Credit 6: Controllability of Systems

Operations Credit Synergies

- IO Credit 2: IAQ Management
- EE Prerequisite 1: Existing Building Commissioning
- EE Prerequisite 2: Minimum Energy Performance
- EE Credit 1: Optimize Energy Performance
- EE Credit 3: Energy Efficient Equipment
- EE Credit 5: Performance Measurement
- CM Credit 1: Community Contaminant Prevention
- ES Credit 1: Outdoor Grounds & Building Exterior Management
Required

EQ Prerequisite 3
Hazardous Material Removal or Encapsulation

Intent
Reduce the building occupant’s potential exposure to asbestos, mercury, lead, and mold; and, prevent associated harmful effects of these hazardous materials in existing buildings. (New construction projects are exempt from compliance with this Prerequisite.)

Health Issues
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.

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 bio-magnify or concentrate in the tissue of living organisms as they move up the food chain. With a few exceptions, the major source of human exposures to PBTs occurs from the consumption of contaminated food in the ordinary diet. PBTs cause a range of adverse wildlife and human health effects, including cancer, and developmental impacts in the nervous, reproductive, and immune systems. Immature, developing organisms are the most sensitive to exposures to PBTs.

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.

Credit Goals
- Establish a program for the discovery, testing and mitigation of asbestos, mercury, lead and mold.
- Identify applicable regulatory requirements.
- Obtain survey records that identify known contamination in the building and on the site. Survey locations where hazardous materials may be present in previously uninvestigated areas of the building and site.
EQ Prerequisite 3 continued

Hazardous Material Removal or Encapsulation

- Include a plan for capture of historical mercury sources during demolition, including but not limited to piping infrastructure. Designate collected mercury devices for recycling that precludes overseas donation/disposal.
- Remove and properly dispose of disconnected wiring that contains lead stabilizers.
- Provide contract requirements for reporting and investigating suspect mold encountered in demolition. Remediate contaminated surfaces: remove and dispose of contaminated materials in accord with recognized procedures that protect workers, building occupants and the public.

Suggested Documentation

- Obtain a letter from the facility manager, an accredited HAZMAT (Hazardous Materials) program manager or inspector stating that hazardous materials are not present in the building, on the building exterior or on the site.

OR

- Describe the current HAZMAT management program that identifies the applicable local, state, and federal regulatory requirements and explains how the program is addressing HAZMAT remaining in the building on an ongoing basis.
- Review the previously completed HAZMAT abatement work and incorporate this data in a comprehensive HAZMAT survey for the building and the site that describes: (1) where asbestos, lead, mercury, and mold has been removed; (2) where these materials remain; and, (3) how the remaining contamination is being addressed.
- Update the HAZMAT survey for the building and the site with current information by: (1) sampling additional likely locations in the building and on the site for HAZMAT; and, (2) testing samples to confirm if HAZMAT is present.
- If the survey identifies any previously unknown contamination, describe how the HAZMAT management program is addressing all remaining asbestos, lead, mercury, and mold remaining in the building.
- Obtain a letter from the licensed abatement contractor stating that all materials within the affected demolition or renovation areas have been removed or encapsulated.

Reference Standards


U.S. Code of Federal Regulations (CFR)

EQ Prerequisite 3 continued

Hazardous Material Removal or Encapsulation

U.S. EPA


U.S. Toxic Substances Control Act (TSCA); 15 USC s/s 2601 et seq. (1976), http://www.eh.doe.gov/oepa/laws/tsca.html

Potential Technologies & Strategies

- Engage an environmental testing agency and licensed abatement professional to audit building systems and materials and determine protocols and procedures to encapsulate or remove materials as appropriate.

- Mercury Elimination Plan

  - Successful implementation of the Green Guide mercury elimination credits requires an understanding of potential sources of mercury within the building. Developing a spreadsheet of potential sources and an action plan for their removal are the first steps in mercury elimination. The following plan paraphrases the Health Care Without Harm “Mercury Alternatives” website, http://www.noharm.org/mercury/alternatives.

    1. Identify mercury-containing items using resources from organizations such as Health Care Without Harm, National Institutes of Health, U.S. EPA, and Hospitals for a Healthy Environment.

    2. Implement a mercury-free purchasing policy that targets construction materials, equipment, and medical supplies. Most purchasing policies phase in substitutions as equipment ages rather than rushing premature equipment replacement. The policy must also develop a plan for proper disposal or recycling of mercury-containing materials as they are replaced.

    3. Set mercury reduction goals for mercury-containing devices in use at the facility. Policies that phase in substitutions in conjunction with a facility-wide education campaign will raise the level of awareness among the staff regarding the importance of eliminating mercury use.

    4. Measure success through a program such as the Hospitals for a Healthy Environment “Making Medicine Mercury Free” award.

- Define a process for surveying and assessing hazardous materials in the existing building, including mold, mercury, lead and asbestos. Mercury is a material that may require special remediation attention in the renovation or demolition of an existing health care facility as significant quantities of mercury can accumulate in places such as traps, light fixtures and ceiling and inter-floor spaces from medical equipment breakage over the years, providing an unanticipated significant hazard to construction and demolition crews.
**EQ Prerequisite 3 continued**

**Hazardous Material Removal or Encapsulation**

- Lead Radiation Protection construction components. Pay particular attention to lead in C&D debris, often used as components of Radiation Protection Systems. Separate sheet lead radiation protection and lead lined gypsum board products, lead-lined doors and frames for reuse, salvage or reprocessing. Salvage for reuse or reprocessing all lead-lined glazing products.

**Resources**

American Hospital Association (AHA) and the United States Environmental Protection Agency (U.S. EPA) signed a Memorandum of Understanding identifying goals to reduce the impact of health care facilities on the environment. A primary goal included the virtual elimination of mercury waste from the health care waste stream. [http://www.h2e-online.org/about/mou.htm](http://www.h2e-online.org/about/mou.htm).


**GGHC Construction Credit Synergies**

- ID Prerequisite 2: Health Mission Statement & Program
- SS Credit 1: Site Selection
- SS Credit 3: Brownfield Redevelopment
- EA Prerequisite 1: Fundamental Building Systems Commissioning
- MR Credit 1: Building Reuse
- EQ Prerequisite 1: Minimum IAQ Performance
- EQ Credit 1: Outdoor Air Delivery Monitoring
- EQ Credit 2: Natural Ventilation
- EQ Credit 3: Construction EQ Management Plan
- EQ Credit 4: Low-Emitting Materials

**GGHC Operations Credit Synergies**

- IO Credit 2: IAQ Management
- EE Prerequisite 1: Existing Building Commissioning
- CM Credit 1: Community Contaminant Prevention
- CM Credit 2: Indoor Pollutant Source Control
1 point

**EQ Credit 1**

**Outdoor Air Delivery Monitoring**

**Intent**
Provide capacity for ventilation system monitoring to help sustain occupant comfort and wellbeing.

**Health Issues**
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 recirculated 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.

**Credit Goals**

- Install permanent monitoring systems that provide feedback on ventilation system performance to ensure that ventilation systems maintain design minimum ventilation requirements. Configure all monitoring equipment to generate an alarm when the conditions vary by 10% or more from setpoint, via either a building automation system alarm to the building operator or via a visual or audible alert to the building occupants.

**FOR MECHANICALLY VENTILATED SPACES**

- Monitor carbon dioxide concentrations within all densely occupied spaces (those with a design occupant density greater than or equal to 25 people per 1,000 sq. ft.). CO2 monitoring locations shall be between 3 feet and 6 feet above the floor.
- For each mechanical ventilation system serving non-densely occupied spaces, provide a direct outdoor airflow measurement device capable of measuring the minimum outdoor airflow rate with an accuracy of plus or minus 5% of the design minimum outdoor air rate.

**FOR NATURALLY VENTILATED SPACES**

- Monitor CO2 concentrations within all naturally ventilated interior spaces. CO2 monitoring shall be located within the room between 3 feet and 6 feet above the floor. One CO2 sensor may be used to represent multiple spaces if the natural ventilation design uses passive stack(s) or other means to induce airflow through those spaces equally and simultaneously without intervention by building occupants.

**Suggested Documentation**

- Confirm the type of ventilation system and installed controls.
- Compile a narrative summary describing the project’s ventilation design and CO2 monitoring system. Include specific information regarding location and quantity of installed monitors, operational parameters and set points.
EQ Credit 1 continued

Outdoor Air Delivery Monitoring

- Compile copies of the applicable project drawings to document the location and type of installed sensors. Drawings should also show natural ventilation components (operable windows, air intakes, etc.) as applicable.

Reference Standards
There is no reference standard for this credit.

Potential Technologies & Strategies
- Install carbon dioxide and airflow measurement equipment and feed the information to the HVAC system and/or Building Automation System (BAS) to trigger corrective action, if applicable. If such automatic controls are not feasible with the building systems, use the measurement equipment to trigger alarms that inform building operators or occupants of a possible deficiency in outdoor air delivery.

GGHC Construction Credit Synergies
- ID Prerequisite 1: Integrated Design Process
- EA Prerequisite 1: Fundamental Building Systems Commissioning
- EA Prerequisite 2: Minimum Energy Performance
- EA Credit 1: Optimize Energy Performance
- EA Credit 3: Enhanced Commissioning
- EA Credit 5: Measurement & Verification
- MR Credit 1: Building Reuse
- EQ Prerequisite 1: Minimum IAQ Performance
- EQ Credit 2: Natural Ventilation
- EQ Credit 5: Chemical & Pollutant Source Control
- EQ Credit 6: Controllability of Systems
- EQ Credit 7: Thermal Comfort

GGHC Operations Credit Synergies
- IO Prerequisite 4: Outside Air Introduction & Exhaust Systems
- IO Credit 2: IAQ Management
- EE Prerequisite 1: Existing Building Commissioning
- EE Prerequisite 2: Minimum Energy Performance
- EE Credit 1: Optimize Energy Performance
- EE Credit 3: Energy Efficient Equipment
- EE Credit 5: Performance Measurement
- CM Credit 1: Community Contaminant Prevention
- CM Credit 2: Indoor Pollutant Source Control
- CM Credit 3: Chemical Discharge
Intent
Provide natural ventilation for improved occupant comfort, well-being, and productivity.

Health Issues
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.

Credit Goals
• Design natural ventilation systems for occupied spaces in the building where allowed by relevant building code requirements AND where air distribution design is not mandated and/or restricted by process requirements (such as operating rooms, negative pressure isolation rooms, burn rooms, and certain other critical care rooms) to meet the recommendations set forth in the Carbon Trust “Good Practice Guide 237” [1998]. Determine that natural ventilation is an effective strategy for the project by following the flow diagram process shown in Figure 1.18 of the Chartered Institution of Building Services Engineers (CIBSE) Applications Manual 10:2005, Natural Ventilation in Non-Domestic Buildings.

AND

• Use diagrams and calculations to show that the design of the natural ventilation systems meets the recommendations set forth in the CIBSE Applications Manual 10:2005, Natural Ventilation in Non-Domestic Buildings.

OR

• Use a macroscopic, multi-zone, analytic model to predict that room-by-room airflows will effectively naturally ventilate, defined as providing the minimum ventilation rates required by ASHRAE 62.1-2004 Chapter 6 or relevant building code requirements, for at least 90% of applicable occupied spaces.

Suggested Documentation
☐ Use diagrams and calculations to show that the design of the natural ventilation systems meets the recommendations set forth in the CIBSE Applications Manual 10: 2005, Natural Ventilation in Non-Domestic Buildings.

OR
Use a macroscopic, multi-zone, analytic model that predicts that room-by-room outdoor airflow rates meets credit goals for at least 90% of applicable occupied spaces.

Reference Standards

Potential Technologies & Strategies
• Test the air change effectiveness of the building after construction.
• Follow the eight design steps described in the Carbon Trust Good Practice Guide 237
  1. Develop design requirements.
  2. Plan airflow paths.
  3. Identify building uses and features that might require special attention.
  4. Determine ventilation requirements.
  5. Estimate external driving pressures.
  6. Select types of ventilation devices.
  7. Size ventilation devices.
  8. Analyze the design. Use public domain software such as NIST’s CONTAM, Multizone Modeling Software, along with LoopDA, Natural Ventilation Sizing Tool, to analytically predict room-by-room airflows.

GGHC Construction Credit Synergies
• ID Prerequisite 2: Health Mission Statement & Program
• SS Credit 1: Site Selection
• EA Prerequisite 2: Minimum Energy Performance
• EA Credit 1: Optimize Energy Performance
• EA Credit 3: Enhanced Commissioning
• EA Credit 5: Measurement & Verification
• MR Credit 1: Building Reuse
• EQ Prerequisite 1: Minimum IAQ Performance
• EQ Credit 1: Outdoor Air Delivery Monitoring
• EQ Credit 5: Chemical & Pollutant Source Control
• EQ Credit 7: Thermal Comfort
EQ Credit 2 continued

Natural Ventilation

**GGHC Operations Credit Synergies**

- IO Prerequisite 4: Outside Air Introduction & Exhaust Systems
- IO Credit 2: IAQ Management
- EE Prerequisite 2: Minimum Energy Performance
- EE Credit 1: Optimize Energy Performance
- EE Credit 3: Energy Efficient Equipment
- EE Credit 5: Performance Measurement
- CM Credit 1: Community Contaminant Prevention
- CM Credit 2: Indoor Pollutant Source Control
- CM Credit 3: Chemical Discharge
- ES Credit 2: Indoor Integrated Pest Management
- ES Credit 4: Sustainable Cleaning Products & Materials
- ES Credit 5: Environmentally Preferable Janitorial Equipment
- EP Credit 6: IAQ Compliant Products
EQ Credit 3.1

Construction EQ Management Plan: During Construction

Intent
Reduce indoor air quality problems resulting from the construction/renovation process in order to help sustain the comfort and wellbeing of construction workers and building occupants.

Health Issues
Enhanced indoor air quality is an imperative for healthcare 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. 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.

Credit Goals
Develop and implement an Environmental Quality (EQ) Management Plan for the construction and pre-occupancy phases of the building as follows:

- Establish an integrated Infection Control Team comprised of the Owner, Designer, and Contractor to evaluate infection control risk and document the required precautions in a project-specific plan. Utilize the Infection Control Risk Assessment (ICRA) standard as defined by the Joint Commission on Accreditation of Health Care Organizations (JCAHO) Environment of Care Standard (EC.3.2.1) as a guideline for construction activities.

- Mold & mildew: Prepare a written program to guide actions to prevent mold and mildew growth. Protect stored on-site or installed absorptive materials from moisture damage. Immediately remove from site and properly dispose of any materials with stains, mold, mildew or other evidence of water damage and replace with new, undamaged materials.

- If permanently installed air handlers are used during construction, install filtration media with a Minimum Efficiency Reporting Value (MERV) of 8, as determined by ASHRAE 52.2-1999, at each return air grill. Protect outdoor air intakes with filtration media. Replace all filtration media immediately prior to occupancy.

- VOC Absorption – Schedule construction procedures to minimize exposure of absorbent materials to VOC emissions. Complete “wet” construction procedures such as painting and sealing before storing or installing “dry” absorbent materials such as carpet or ceiling tiles. These materials accumulate pollutants and release them over time. Store fuels, solvents and other sources of VOCs separately from absorbent materials.
**EQ Credit 3.1 continued**

**Construction EQ Management Plan: During Construction**

**Suggested Documentation**

- Compile, implement and maintain a written Construction EQ Management Plan highlighting the ICRA requirements.

- Compile, implement and maintain a written mold and mildew growth prevention program in accordance with credit goals.

- Document the use of air filtration media during construction. Photograph representative applications of filter media on return air grilles during construction when required by the Construction EQ Management Plan. Document the installation of temporary filter media in permanent air-handling units operated during construction and the installation of new filter media in those units immediately prior to occupancy. Include the MERV value, manufacturer name and model number of filter media used in the project.

- Prepare and document the implementation of specifications requiring proper sequencing of construction procedures materials storage to minimize exposure of absorbent materials to VOC emissions.

**Reference Standards**


**Potential Technologies & Strategies**

- Adopt an EQ Management Plan utilizing an Infection Control Risk Assessment (ICRA) standard to protect the HVAC system during construction, control pollutant sources and interrupt contamination pathways. Sequence the installation of materials to avoid contamination of absorptive materials such as insulation, carpeting, ceiling tile and gypsum wallboard. Coordinate with GGHQ EQ Credits 3.2 and 5 to determine the appropriate specifications and schedules for filtration media.

- If possible, avoid using permanently installed air handlers for temporary heating/cooling during construction. Consult the LEED for New Construction Version 2.2 Reference Guide for more detailed information on how to ensure the well-being of construction workers and building occupants if permanently installed air handlers must be used during construction.

- Utilize negative air machines vented to the outside atmosphere to extract floating dust or particulate matter even if negative air is not required. This reduces the amount of exposure to the construction crews by constantly “vacuuming” or cleaning the air, which will effectively purge the air of materials that have adverse health impacts. Maintain indoor air quality meeting the National Institute for Occupational Safety and Health (NIOSH) standards for worker exposures.
Construction EQ Management Plan: During Construction

- Prepare temporary ventilation and exhaust systems to maintain a negative pressure relationship in the construction area relative to the adjacent space. Maintain containment areas (negative air pressure) with the use of negative air machines ducted to outside of the building that is under construction. Use air pressure monitors (e.g. magnahelic gages) connected to an audible or visual alarm that notifies the construction area when negative pressure as relates to the protection areas has not been maintained. Reduce the amount of supply air to the construction area (if construction is adjacent to an occupied area or building) to help facilitate this negative pressure area. Seal off windows and building envelope locations separating patients adjacent to the construction area that may be susceptible to the suction created by negative air machines in the construction zone to prevent possible particulate exposure.

- Provide effective dust control. When existing ventilation systems serving occupied areas are to be modified, the designer should evaluate the changes and provide guidance to the contractor to avoid disturbing pressure relationships in the occupied areas of the building during the modifications. Survey existing ventilation systems to determine the extent of dust accumulation and include requirements for proper duct cleaning when the survey indicates need.

- Consider outdoor vectors that increase infection risk and degrade ambient air quality and implement effective mitigation measures.

- Install full height (floor to deck) partitions to contain dust, fumes and odors generated during construction (e.g. demolition, cutting/sawing, grinding, painting, epoxy flooring, adhesive and coating applications) and an Ante Room for secondary air containment and a wipe down and changing area if recommended by the ICRA process.

- Wear “booties” within the construction area if access is through an occupied building and utilize floor “tacky” mats just outside construction areas to trap particles from shoes after booty removal and wheeled items like covered and taped debris carts leaving the construction zone.

- Frequently wet mop floors outside of construction area that are being used for access to the construction area to prevent particle disturbance.

- Vacuum and disinfect the bottom metal stud tracks with Biocide (or similar) prior to second-side drywall installation to remove construction dust and debris.

- When construction requires working above existing ceilings in occupied areas or corridors, confirm that a ceiling access permit has been issued if required by the facility. The facility may require the installation of a pre-fabricated plastic partition, “zip wall” or similar for this work taking place outside the construction area.
**EQ Credit 3.1 continued**

Construction EQ Management Plan: **During Construction**

**Resources**

**GGHC Construction Credit Synergies**
- MR Credit 2: Construction Waste Management
- EQ Prerequisite 1: Minimum IAQ Performance
- EQ Credit 4: Low-Emitting Materials

**GGHC Operations Credit Synergies**
- IO Credit 2: IAQ Management
- EP Credit 6: IAQ Compliant Products
Intensity
Reduce indoor air quality problems resulting from the construction/renovation process in order to help sustain the comfort and well-being of construction workers and building occupants.

<table>
<thead>
<tr>
<th>Health Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

Credit Goals
Develop and implement an Indoor Air Quality (IAQ) Management Plan for the pre-occupancy phase of the building as follows:

OPTION 1: Flush Out
- After construction ends, prior to occupancy, and with all interior finishes installed, perform a building flush-out by supplying a total air volume of 14,000 cu.ft. of outdoor air per sq.ft. of floor area while maintaining an internal temperature of at least 60 degrees Fahrenheit and, where mechanical cooling is available, relative humidity no higher than 60%.
  OR
- If occupancy is desired prior to completion of the flush out, the space may be occupied following delivery of a minimum of 3,500 cu.ft. of outdoor air per sq.ft. of floor area to the space. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm/sq.ft. of outside air or the design minimum outside air rate determined in GGHC EQ Prerequisite 1, whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of 14,000 cu.ft./sq.ft. of outside air has been delivered to the space.

OR

OPTION 2: Air Testing
- Conduct baseline indoor air quality testing, after construction ends and prior to occupancy, using testing protocols consistent with the United States Environmental Protection Agency Compendium of Methods for the Determination of Air Pollutants in Indoor Air and as detailed below.
**EQ Credit 3.2 continued**

Construction EQ Management Plan: **Before Occupancy**

*Note: Additional contaminant maximum concentrations limitations are listed below beyond those required in U.S. EPA and LEED for New Construction guidelines. Demonstrate that the contaminant maximum concentrations listed below are not exceeded.*

- Demonstrate that the contaminant maximum concentrations listed below are not exceeded.

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Maximum Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formaldehyde</td>
<td>33 micrograms per cubic meter (27 ppb)</td>
</tr>
<tr>
<td>Particulates (PM10)</td>
<td>50 micrograms per cubic meter</td>
</tr>
<tr>
<td>Total Volatile Organic Compounds (TVOC)</td>
<td>500 micrograms per cubic meter</td>
</tr>
<tr>
<td>Individual Organic Compounds</td>
<td>Chronic Reference Exposure Levels (CREL) established by California Office of Environmental Health Hazard Assessment (OEHHA) plus additional compounds, supplemented by CA DHS Standard Practice For the Testing of Volatile Organic Emissions of July 15, 2004</td>
</tr>
<tr>
<td>* 4-Phenylcyclohexene (4-PCH)</td>
<td>2.5 micrograms per cubic meter</td>
</tr>
<tr>
<td>Carbon Monoxide (CO)</td>
<td>9 parts per million and no greater than 2 parts per million above outdoor levels</td>
</tr>
</tbody>
</table>

*Source: PM10, TVOC and CO levels are the same as LEED for New Construction Version 2.2. All other levels are based upon the CA DHS Standard Practice For the Testing of Volatile Organic Emissions of July 15, 2004.*

*This test is only required if carpets and fabrics with styrene butadiene rubber (SBR) latex backing material are installed as part of the base building systems.*

- For each sampling point where the maximum concentration limits are exceeded, conduct additional flush-out with outside air and retest the specific parameter(s) exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting non-complying building areas, take samples from the same locations as in the first test.

- The air sample testing shall be conducted as follows:
  1. All measurements shall be conducted prior to occupancy, but during normal occupied hours, and with the building ventilation system starting at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the duration of the air testing.
  2. The building shall have all interior finishes installed, including but not limited to millwork, doors, paint, carpet and acoustic tiles. Non-fixed furnishings such as workstations and partitions are encouraged, but not required, to be in place for the testing.
Construction EQ Management Plan: Before Occupancy

3. The number of sampling locations will vary depending upon the size of the building and number of ventilation systems. For each portion of the building served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 sq.ft., or for each contiguous floor area, whichever is larger, and include areas with the least ventilation and greatest presumed source strength.

4. Air samples shall be collected between 3 feet and 6 feet from the floor to represent the breathing zone of occupants, and over a minimum 4-hour period.

Suggested Documentation

- Document the building flush-out procedures in accordance with credit goals, including actual dates for building flush out.
- OR
- Document that the referenced standard's IAQ testing protocol has been followed. Include a copy of the testing results.

Reference Standards


Chronic Reference Exposure Levels (CREL), California Office of Environmental Health Hazard Assessment (OEHHA), http://www.oehha.ca.gov/air/chronic_rels/AllChrels.html


Potential Technologies & Strategies

- Specification of low-emitting materials as per GGHC EQ Credit 4 will improve potential for early passage of baseline testing. Coordinate with GGHC EQ Credits 3.1 and 5.1 and replace the filtration media if it is not dirty.

- For IAQ testing use a recognized measurement protocol such as the U.S. EPA "Compendium of Methods for the Determination of Air Pollutants in Indoor Air."

- Copies of the IAQ testing results should describe:
  - The contaminant sampling and analytical methods
  - The locations and duration of contaminant samples
  - The field sampling log sheets and laboratory analytical data
**EQ Credit 3.2 continued**

Construction EQ Management Plan: **Before Occupancy**

- The methods and results utilized to determine that the ventilation system was started at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode through the duration of the air testing.

**GGHC Construction Credit Synergies**
- MR Credit 2: Construction Waste Management
- EQ Prerequisite 1: Minimum IAQ Performance
- EQ Credit 4: Low-Emitting Materials

**GGHC Operations Credit Synergies**
- IO Credit 2: IAQ Management
- EP Credit 6: IAQ Compliant Products
Low-Emitting Materials: Interior Adhesives & Sealants

**Intent**
Minimize indoor air contaminants that are odorous, potentially irritating and/or harmful to the comfort and wellbeing of installers and occupants.

**Health Issues**
Volatile organic compound emissions (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.

**Credit Goals**
- Use only adhesives and sealants with volatile organic compound (VOC) content that does not exceed the VOC content limits of South Coast Air Quality Management District (SCAQMD) Rule #1168 limits scheduled for 2007 as indicated in the table below. Aerosol adhesives not covered by Rule 1168 must meet Green Seal Standard GS-36 requirements.

<table>
<thead>
<tr>
<th>Adhesives (SCAQMD 1168)</th>
<th>VOC limit</th>
<th>Adhesives (SCAQMD 1168)</th>
<th>VOC limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceramic tile</td>
<td>65</td>
<td>Welding: ABS (avoid)</td>
<td>325</td>
</tr>
<tr>
<td>Contact</td>
<td>80</td>
<td>Welding: CPVC (avoid)</td>
<td>490</td>
</tr>
<tr>
<td>Fiberglass</td>
<td>80</td>
<td>Welding: plastic cement</td>
<td>250</td>
</tr>
<tr>
<td>Metal to metal</td>
<td>30</td>
<td>Welding: PVC (avoid)</td>
<td>510</td>
</tr>
<tr>
<td>Multipurpose construction</td>
<td>70</td>
<td>Plastic primer (avoid)</td>
<td>650</td>
</tr>
<tr>
<td>Rubber floor</td>
<td>60</td>
<td>Special Purpose Contact</td>
<td>250</td>
</tr>
<tr>
<td>Wood: Structural member</td>
<td>140</td>
<td>Sealants (SCAQMD 1168)</td>
<td></td>
</tr>
<tr>
<td>Wood: flooring</td>
<td>100</td>
<td>Architectural Porous Primers (avoid)</td>
<td>775</td>
</tr>
<tr>
<td>Wood: all other</td>
<td>30</td>
<td>Sealants &amp; Non Porous Primers</td>
<td>250</td>
</tr>
<tr>
<td>All other adhesives</td>
<td>50</td>
<td>Other Primers (avoid)</td>
<td>750</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Aerosol Adhesives (GS-36)</th>
<th>VOC limit</th>
<th>Aerosol Adhesives (GS-36)</th>
<th>VOC limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>General purpose mist spray</td>
<td>65%</td>
<td>Special purpose aerosol adhesives</td>
<td>70%</td>
</tr>
<tr>
<td>General purpose web spray</td>
<td>55%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**VOC weight limit based on grams/liter of VOC minus water. Percentage is by total weight**

- Use only adhesives and sealants with no carcinogen or reproductive toxicant components present at more than 1% of total mass of the product as defined in the following lists:
  - California Air Resources Board (ARB), list of Toxic Air Contaminants (California Air Toxics).
EQ Credit 4.1 continued

Low-Emitting Materials: Interior Adhesives & Sealants

Suggested Documentation

- Compile a list of adhesives and sealants used in the building and manufacturer verification documenting compliance with the applicable standards.

Reference Standards

California Air Resources Board (ARB), list of Toxic Air Contaminants (California Air Toxics), http://www.arb.ca.gov/toxics/summary/summary.htm.


Potential Technologies & Strategies

- Specify low-VOC and non-carcinogenic, non toxic materials in construction documents, including furniture and equipment specifications.

- Ensure that VOC and carcinogen/toxicant component limits are clearly stated in each section where adhesives and sealants are addressed.

- Avoid use of all products with VOC content of ≥300 g/l or greater.

- VOC content has serious limitations as a predictor of emissions. Emissions testing protocols are beginning to evolve to evaluate building materials and products. Ask distributors for products with actual emission testing from protocols such as CA 01350 or GREENGUARD. This Green Guide credit will evolve in that direction as more tested products enter the marketplace.

GGHC Construction Credit Synergies

- ID Prerequisite 1: Integrated Design Process
- ID Prerequisite 2: Health Mission Statement & Program
- MR Credit 1: Building Reuse
- MR Credit 3: Sustainably Sourced Materials
- MR Credit 4: PBT Elimination
- MR Credit 5: Furniture & Medical Furnishings
- EQ Prerequisite 1: Minimum IAQ Performance
- EQ Prerequisite 3: Hazardous Material Removal or Encapsulation
- EQ Credit 3: Construction EQ Management Plan
EQ Credit 4.1 continued

Low-Emitting Materials: **Interior Adhesives & Sealants**

**GGHC Operations Credit Synergies**

- IO Credit 1: Building Operations & Maintenance
- IO Credit 2: IAQ Management
- CM Prerequisite 1: Polychlorinated Biphenyl (PCB) Removal
- EP Credit 4: Toxic Reduction
- EP Credit 5: Furniture & Medical Furnishings
- EP Credit 6: IAQ Compliant Products
1 point

EQ Credit 4.2

Low-Emitting Materials: Wall & Ceiling Finishes

**Intent**

Minimize indoor air contaminants that are odorous, potentially irritating and/or harmful to the comfort and wellbeing of installers and occupants.

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**Health Issues**

Volatile organic compound emissions (VOCs) from building materials compromise air quality and negatively affect human health. VOCs and other carcinogens and reproductive toxicants emitted by building materials can represent a serious health risk to both 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.

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**Credit Goals**

- Use only paints and coatings on the interior of the building that do not exceed the VOC limits of South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect for 7/1/2008, as indicated below.

<table>
<thead>
<tr>
<th>Coating (SCAQMD 1113)</th>
<th>Limit (g/l)</th>
<th>Coating (SCAQMD 1113)</th>
<th>Limit (g/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paints (flat and non flat, except anti rust)</td>
<td>50</td>
<td>Rust preventative paints &amp; coatings</td>
<td>100</td>
</tr>
<tr>
<td>Clear wood finishes: (varnish, lacquer or sanding sealers)</td>
<td>275</td>
<td>Sealers: Waterproofing &amp; all other</td>
<td>100</td>
</tr>
<tr>
<td>Shellacs: Clear (avoid)</td>
<td></td>
<td></td>
<td>730</td>
</tr>
<tr>
<td>Primers and undercoaters</td>
<td>100</td>
<td>Shellacs: Pigmented (avoid)</td>
<td>550</td>
</tr>
<tr>
<td>Swimming pool coatings (avoid)</td>
<td>340</td>
<td>Stains</td>
<td>100</td>
</tr>
</tbody>
</table>
EQ Credit 4.2 continued

Low-Emitting Materials: Wall & Ceiling Finishes

- Specify ceiling tiles (including suspended acoustical tiles) and wall coverings that meet or exceed the indoor air quality requirements of California’s Special Environmental Requirements, Specifications Section 01350, as specified in California Department of Health Services Standard Practice CA/DHS/EHLB/R-174. Testing should be conducted by an independent laboratory, and modeling should use the standard office building protocol parameters. The following programs currently utilize 01350 requirements for compliance:
  - Certification by Scientific Certification Systems (SCS) under their Indoor Advantage Gold Environmental Certification Program.
  - Certification by GREENGUARD under their Product Emission Standard For Children & Schools.

AND

- Do not contain either of the following ingredients:
  - Polybrominated diphenyl ethers (PBDE)
  - Phthalates

Suggested Documentation

☐ Compile a list of paints and coatings used in the building with manufacturers’ documentation declaring that they comply with the current VOC and chemical component limits of the credit goals. Compile documentation indicating that wall covering and ceiling tile products have been tested for compliance with the VOC credit goals and do not contain any of the restricted ingredients. Listing in the CHPS Low-Emitting Materials Compliant Materials Table will suffice for documentation of the VOC goal. Ingredient goals, however, are not covered by this listing.

Reference Standards


EQ Credit 4.2 continued
Low-Emitting Materials: Wall & Ceiling Finishes

Potential Technologies & Strategies

- Specify low- and no-VOC paints, coatings, and interior finishes in construction documents, including furniture and equipment specifications. Ensure that the relevant chemical limits are clearly stated in each section where these finishes are addressed.

- Green Seal Class A paints are both lowest in toxic content and do not contain VOCs. Use Class A paints wherever possible.

- Avoid use of all products with VOC content of 300 g/l or greater.

- VOC content has serious limitations as a predictor of emissions. Emissions testing protocols are beginning to evolve to evaluate building materials and products. Ask distributors for products with actual emission testing from protocols such as CHPS/CA01350 or GREENGUARD. This standard will evolve in that direction as more tested products enter the marketplace. Note also that no current emission standard addresses the release of SVOCs (semi-volatile organic compounds) such as phthalates and materials such as heavy metal stabilizers and halogenated flame retardants.

- Avoid paints with added antimicrobials.

- Avoid field-applied painting entirely by using pre-finished metals.

- Avoid all halogenated organic flame retardants (HFRs), including not only PBDEs (polybrominated diphenyl ether) but also Tetrabromobisphenol-A (TBBPA), Hexabromocyclododecane (HBCD), Deca-BDE (Decabromodiphenyl ether), Tris(2-chloroisopropyl) phosphate (TCP), Tris(2-chloroethyl) phosphate (TCEP), and Dechlorane Plus.

- Several new chemicals of concern, listed below, are emerging that should be avoided where possible. While substitutes are not yet widely available to support a credit, substitution is encouraged where suitable alternatives exist for products containing the following:
  - Polycarbonate: The bisphenol-A (BPA) used in its production is a suspected endocrine disruptor.
  - Teflon, Stainmaster and Zonyl: The PFOA (Perfluorooctanoic acid or C8) used in its production persists in the environment and is found on a widespread basis in human blood samples. Studies have linked PFOA to cancer, birth defects and other serious health problems in animals. Because of concerns regarding the health impact of PFOA Scotchguard and some other stain resistant treatments are now made from a different perfluoroochemical, PFBS (perfluorobutane sulfonate, or C4). All perfluorochemical related products should be avoided when possible.

GGHC Construction Credit Synergies

- ID Prerequisite 1: Integrated Design Process
- ID Prerequisite 2: Health Mission Statement & Program
- MR Credit 1: Building Reuse
- MR Credit 3: Sustainably Sourced Materials
- MR Credit 4: PBT Elimination
- MR Credit 5: Furniture & Medical Furnishings
- EQ Prerequisite 1: Minimum IAQ Performance
- EQ Prerequisite 3: Hazardous Material Removal or Encapsulation
- EQ Credit 3: Construction EQ Management Plan
EQ Credit 4.2 continued

Low-Emitting Materials: Wall & Ceiling Finishes

GGHC Operations Credit Synergies

- IO Credit 1: Building Operations & Maintenance
- IO Credit 2: IAQ Management
- CM Prerequisite 1: Polychlorinated Biphenyl (PCB) Removal
- EP Credit 4: Toxic Reduction
- EP Credit 5: Furniture & Medical Furnishings
- EP Credit 6: IAQ Compliant Products
EQ Credit 4.3
Low-Emitting Materials: Flooring Systems

Intent
Minimize indoor air contaminants that are odorous, potentially irritating and/or harmful to the comfort and wellbeing of installers and occupants.

Health Issues
Volatile organic compound emissions (VOCs) from building materials contribute to lower air quality and negatively affect human health. VOCs and other contaminants emitted by building materials can include carcinogens, reproductive toxicants, and respiratory irritants and 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 other phthalates have received most attention in the medical community for their potential developmental toxicity for young children. Phthalates have also been linked to bronchial irritation and asthma associated with their use in flexible PVC building materials.

Credit Goals
• Specify carpet and resilient flooring systems that meet or exceed:
  • The indoor air quality requirements of California’s Special Environmental Requirements, Specifications Section 01350, as specified in California Department of Health Services (DHS) Standard Practice CA/DHS/EHLB/R-174. Testing should be conducted by an independent laboratory, and modeling should use the standard office building protocol parameters. The following programs currently utilize 01350 requirements for compliance:
    • Certification by the Carpet and Rug Institute (CRI) under their Green Label Plus program,
    • Certification by GREENGUARD under their Product Emission Standard For Children & Schools,
    • Certification by the Resilient Floor Covering Institute under their Floor Score program.
    • Listing on the Collaborative for High Performance Schools Low-Emitting Materials Table

AND
• Specify carpet and resilient flooring systems that do not contain any of the following ingredients:
  • Polybrominated diphenyl ethers (PBDE)
  • Phthalates
  • Natural rubber latex
EQ Credit 4.3 continued
Low-Emitting Materials: Flooring Systems

- Testing should be done on whole assemblies of flooring with the adhesive, if any, which will be utilized in the installation.
- Use only adhesives and sealants with no carcinogen or reproductive toxicant components present at more than 1% of total mass of the product as defined in the following lists:
  - California Office of Environmental Health Hazard Assessment (OEHHA), Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).
  - California Air Resources Board (ARB), list of Toxic Air Contaminants (California Air Toxics).
- For wood, concrete or any other floors requiring coatings, sealants or other finishes, use only products meeting the VOC requirements of GGHC EQ Credit 4.2.

Suggested Documentation

- Obtain documentation that all the carpet and resilient flooring systems have been tested by an independent indoor air quality testing laboratory and modeled to comply with the credit criteria. Confirm that tests have been performed within the last twelve months. Listing on the CHPS Low-Emitting Materials Table or the Carpet and Rug Institute (CRI) “Green Label Plus” listing may be accepted in replacement for actual test data.
- Obtain documentation that all adhesives and sealants do not exceed the content limits for carcinogenic or reproductive toxicant substances.
- Obtain documentation that all carpets do not include natural rubber latex in the backing.

Reference Standards

California Air Resources Board (ARB), list of Toxic Air Contaminants (California Air Toxics), http://www.arb.ca.gov/toxics/id/taclist.htm


Potential Technologies & Strategies

- Specify low-VOC carpet and resilient flooring products and systems in Construction Documents. Ensure that all carcinogenic or reproductive toxicant and other VOC limits are clearly stated where carpet and resilient flooring systems are addressed.
EQ Credit 4.3 continued

Low-Emitting Materials: Flooring Systems

- Give preference to materials tested by an independent lab in accordance with “Green Label Plus” or using California DHS Standard Practice CA/DHS/EHLB/R-174 for office buildings. The Carpet and Rug Institute (CRI) “Green Label Plus” program uses most aspects of the DHS protocol, with the exception of the stipulation to report out actual chemical concentrations - it is purely a pass-fail based upon a standard office building specification. If using the “Green Label Plus” certified materials, consider requiring submission of the actual test data from the manufacturer to inform material comparisons.

- Avoid use of all products with VOC content of 300 g/l or greater.

- Avoid all halogenated organic flame retardants (HFRs), including not only PBDEs (polybrominated diphenyl ether) but also Tetrabromobisphenol-A (TBBPA), Hexabromocyclododecane (HBCD), Deca-BDE (Decabromodiphenyl ether), Tris(2-chloroisopropyl) phosphate (TCPP), Tris(2-chloroethyl) phosphate (TCEP), and Dechlorane Plus.

- Several new chemicals of concern, listed below, are emerging that should be avoided where possible. While substitutes are not yet widely available to support a credit, substitution is encouraged where suitable alternatives exist for products containing the following:
  - Polycarbonate: The bisphenol-A (BPA) used in its production is a suspected endocrine disruptor
  - Teflon, Stainmaster and Zonyl: The PFOA (Perfluorooctanoic acid or C8) used in its production persists in the environment and is found on a widespread basis in human blood samples. Studies have linked PFOA to cancer, birth defects and other serious health problems in animals. Because of concerns regarding the health impact of PFOA Scotchguard and some other stain resistant treatments are now made from a different perfluorochemical, PFBS (perfluorobutane sulfonate, or C4). All perfluorochemical related products should be avoided when possible.

**GGHC Construction Credit Synergies**

- ID Prerequisite 1: Integrated Design Process
- ID Prerequisite 2: Health Mission Statement & Program
- MR Credit 1: Building Reuse
- MR Credit 3: Sustainably Sourced Materials
- MR Credit 4: PBT Elimination
- MR Credit 5: Furniture & Medical Furnishings
- EQ Prerequisite 1: Minimum IAQ Performance
- EQ Prerequisite 3: Hazardous Material Removal or Encapsulation
- EQ Credit 3: Construction EQ Management Plan

**GGHC Operations Credit Synergies**

- IO Credit 1: Building Operations & Maintenance
- IO Credit 2: IAQ Management
- CM Prerequisite 1: Polychlorinated Biphenyl (PCB) Removal
- EP Credit 4: Toxic Reduction
- EP Credit 5: Furniture & Medical Furnishings
- EP Credit 6: IAQ Compliant Products
EQ Credit 4.4
Low-Emitting Materials: Composite Wood & Insulation

Intent
Minimize indoor air contaminants that are odorous, potentially irritating and/or harmful to the comfort and wellbeing of installers and occupants.

Health Issues
Volatile organic compound emissions (VOCs) from building materials compromise air quality and negatively affect human health. VOCs and other carcinogens and reproductive toxicants emitted by building materials represent a serious health risk to both installers and 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.

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.

Credit Goals
• Specify composite wood and agrifiber products and fiberglass materials (including acoustical and other suspended ceiling tiles) used on the interior of the building (defined as inside of the weatherproofing system) with no added urea-formaldehyde resins.
• Specify laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies that contain no added urea-formaldehyde resins. Composite wood and agrifiber products are defined as: particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates and door cores.

Suggested Documentation
❑ Obtain documentation, confirming that all the casework, fiberglass insulation (both acoustic and thermal), furniture and other agrifiber or composite wood products used in the building contain no added urea-formaldehyde resins.

Reference Standards
There is no reference standard for this credit.

Potential Technologies & Strategies
• Review the MSDS and other printed literature accompanying building materials and products, especially for composite wood products, casework, fiberglass products, insulation (both acoustic and thermal) agriboard products, and furniture finishes to ensure that no added urea-formaldehyde was used in the products’ manufacture.
EQ Credit 4.4 continued

Low-Emitting Materials: Composite Wood & Insulation

- Specify and use urea-formaldehyde-free substitutes that achieve equal or superior performance.

GGHC Construction Credit Synergies

- ID Prerequisite 1: Integrated Design Process
- ID Prerequisite 2: Health Mission Statement & Program
- MR Credit 1: Building Reuse
- MR Credit 3: Sustainably Sourced Materials
- MR Credit 4: PBT Elimination
- MR Credit 5: Furniture & Medical Furnishings
- EQ Prerequisite 1: Minimum IAQ Performance
- EQ Prerequisite 3: Hazardous Material Removal or Encapsulation
- EQ Credit 3: Construction EQ Management Plan

GGHC Operations Credit Synergies

- IO Credit 1: Building Operations & Maintenance
- IO Credit 2: IAQ Management
- CM Prerequisite 1: Polychlorinated Biphenyl (PCB) Removal
- EP Credit 4: Toxic Reduction
- EP Credit 5: Furniture & Medical Furnishings
- EP Credit 6: IAQ Compliant Products
EQ Credit 4.5
Low-Emitting Materials: Furniture & Medical Furnishings

Intent
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.

Health Issues
Volatile organic compounds (VOCs) from building materials compromise air quality and negatively affect human health. VOCs and other carcinogens and reproductive toxicants emitted by building materials represent a serious health risk to both installers and 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 polybrominated diphenyl ethers (PBDEs) widely used in plastic foam and other parts of furnishings.

Likewise 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.

DEHP and other phthalates have received most attention in the medical community for their potential developmental toxicity for young children. Phthalates have also been linked to bronchial irritation and asthma associated with their use in flexible PVC building materials.

Credit Goals
• Select a minimum of 40% (by cost) of all furniture and medical furnishings (including mattresses, foams, panel fabrics and other textiles) that contain no more than one of the four listed materials:
  • Polybrominated diphenyl ethers (PBDE, a flame retardant)
  • Teflon®, Stainmaster® or other stain protection treatment that utilizes perfluorooctanoic acid (PFOA or C8) in its production
  • Urea formaldehyde
  • Phthalate plasticizers

OR
• That contain no more than two of the four above-listed materials AND meet or exceed the indoor air quality requirements of California’s Special Environmental Requirements, Specifications Section 01350, updated with California DHS Standard Practice CA/DHS/EHLB/R-174 as determined by independent laboratory testing and using the standard office building protocol parameters. The following programs currently utilize 01350 requirements for compliance:
EQ Credit 4.5 continued

Low-Emitting Materials: **Furniture & Medical Furnishings**

- Certification by Scientific Certification Systems (SCS) under their Indoor Advantage Gold Environmental Certification Program
- Certification by GREENGUARD under their Product Emission Standard For Children & Schools

**Suggested Documentation**
- Obtain documentation listing each product description (all components) and complete matrix indicating the number of criteria met for each furnishing group.
- If applicable, obtain test results of the furniture assemblies that have been tested in accordance with the noted VOC protocol indicating compliance with the emissions limits. Test results must be current within twelve (12) months of the project specification, and must be dated and signed by an officer of the independent laboratory where the testing was conducted.

**Reference Standards**
California Department of Health Services Standard Practice CA/DHS/EHLB/R-174, [www.dhs.ca.gov/ps/deodc/ehlb/iaq/VOCS/Practice.htm](http://www.dhs.ca.gov/ps/deodc/ehlb/iaq/VOCS/Practice.htm).

California Office of Environmental Health Hazard Assessment (OEHHA) Chronic Reference Exposure Limits (REL), [http://www.oehha.ca.gov/air/chronic_rels/AllChrels.html](http://www.oehha.ca.gov/air/chronic_rels/AllChrels.html).


**Potential Technologies & Strategies**
- Prepare specification language identifying the VOC and chemicals of concern goals for the aforementioned material categories and indicating that review of material content will be a criterion in all substitution reviews.
- Avoid all halogenated organic flame retardants (HFRs), including not only PBDEs (polybrominated diphenyl ether) but also Tetrabromobisphenol-A (TBBPA), Hexabromocyclododecane (HBCD), DecabDE (Decabromodiphenyl ether), Tris(2-chloroisopropyl) phosphate (TCPP), Tris(2-chloroethyl) phosphate (TCEP), and Dechlorane Plus.
- One strategy to meet the PBDE-free goal is to specify seating with mesh and no foam.
- HFRs are rarely listed on product data sheets; PFCs are most commonly used as a process chemical or a break down product, so they show up as a contaminant rather than a final ingredient. Determining association of these chemicals with furniture may require direct discussion with manufacturers. PFCs are used most commonly in such stain and non-stick treatments as Scotchguard®, Teflon®, Stainmaster®, Scotchban®, and Zonyl®.
EQ Credit 4.5 continued

Low-Emitting Materials: **Furniture & Medical Furnishings**

**GGHC Construction Credit Synergies**
- ID Prerequisite 1: Integrated Design Process
- ID Prerequisite 2: Health Mission Statement & Program
- MR Credit 1: Building Reuse
- MR Credit 3: Sustainably Sourced Materials
- MR Credit 4: PBT Elimination
- MR Credit 5: Furniture & Medical Furnishings
- EQ Prerequisite 1: Minimum IAQ Performance
- EQ Prerequisite 3: Hazardous Material Removal or Encapsulation
- EQ Credit 3: Construction EQ Management Plan

**GGHC Operations Credit Synergies**
- IO Credit 1: Building Operations & Maintenance
- IO Credit 2: IAQ Management
- CM Prerequisite 1: Polychlorinated Biphenyl (PCB) Removal
- EP Credit 4: Toxic Reduction
- EP Credit 5: Furniture & Medical Furnishings
- EP Credit 6: IAQ Compliant Products
EQ Credit 4.6
Low Emitting Materials: Exterior Applied Products

**Intent**
Protect installers and building occupants and safeguard air quality resulting from exposure to hazardous and/or odorous substances used during construction.

**Health Issues**
Volatile organic compound emissions (VOCs) from building materials compromise air quality and negatively affect human health. VOCs and other carcinogens and reproductive toxicants emitted by building materials represent a serious health risk to both installers and 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.

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.

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.

**Credit Goals**
- Specify coatings, roofing and waterproofing materials with volatile organic content (VOC) content limits of South Coast Air Quality Management District (SCAQMD) Rules 1113 and 1168 scheduled for 2007 as indicated in the table below and in the table in GGHC EQ Credit 4.2.
- Specify no roofing installations using hot asphalt.
- Specify no use of coal tar sealants for parking lots and other paved surfaces.
- For any waterproofing, asphalt roofing needing repair, parking lot sealing or other high VOC emissions outdoor construction process, create a plan to manage fumes and avoid infiltration to occupied spaces. Comply with procedures established by NIOSH Publication No. 2003-112: Asphalt Fume Exposures During the Application of Hot Asphalt to Roofs.
EQ Credit 4.6 continued

Low-Emitting Materials: Exterior Applied Products

<table>
<thead>
<tr>
<th>Adhesives (SCAQMD 1113)</th>
<th>limit (g/l)</th>
<th>Sealants &amp; Sealant Primers (SCAQMD 1168)</th>
<th>limit (g/l)</th>
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<tr>
<td>Outdoor carpet</td>
<td>150</td>
<td>Architectural</td>
<td>250</td>
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<tr>
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<td>100</td>
<td>Architectural Porous</td>
<td>775</td>
</tr>
<tr>
<td>Single ply roof membrane</td>
<td>250</td>
<td>Marine Deck</td>
<td>760</td>
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<tr>
<td><strong>Coatings (SCAQMD 1113) limit (g/l)</strong></td>
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<td><strong>Modified bitumen (Avoid)</strong></td>
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<tr>
<td>Fire proofing exterior coatings</td>
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<td>Non membrane roof</td>
<td>300</td>
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<tr>
<td>Roof coatings – aluminum</td>
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<td>Roadway</td>
<td>250</td>
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<tr>
<td>Roof coatings – all other</td>
<td>50</td>
<td>Single ply roof membrane</td>
<td>450</td>
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<tr>
<td>Roof primers, bituminous</td>
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<tr>
<td>Swimming pool coatings</td>
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<tr>
<td>Traffic coatings</td>
<td>150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wood preservatives</td>
<td>350</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Suggested Documentation

- Prepare a written containment plan for isolating potentially hazardous or odorous substances occurring during construction to insure that they do not migrate into occupied areas. Provide verification of implementation.
- Obtain a cut sheet or Material Safety Data Sheet (MSDS) for each material used on the building highlighting VOC limits.

Reference Standards


Potential Technologies & Strategies

- During active outdoor construction periods, establish a schedule for regular monitoring of outdoor air quality at intakes to insure that outdoor air contaminants are not entering the building systems.
- Avoid use of all products with VOC content greater than 300 g/l.
EQ Credit 4.6 continued
Low-Emitting Materials: **Exterior Applied Products**

- Avoid use of pavement sealer entirely if possible in favor of unsealed concrete, pavers or concrete topper on asphalt. If sealing is required, use asphalt instead of coal tar due to its lower PAH content.
- Establish containment barriers to isolate the work area from occupied areas. Use pressurization as needed to protect occupied areas.
- Seal all openings between occupied areas and adjacent construction areas, including but not limited to:
  - Windows
  - Doorways
  - Elevator openings
  - Drains
  - Grates and skylights
  - with exceptions of the means of entry and exit.

**Resources**
City of Austin Ordinance 200051117-070 Relating to Coal Tar Pavement Products,
http://www.ci.austin.tx.us/watershed/coaltar_main.htm

**GGHC Construction Credit Synergies**
- ID Prerequisite 1: Integrated Design Process
- ID Prerequisite 2: Health Mission Statement & Program
- MR Credit 1: Building Reuse
- MR Credit 3: Sustainably Sourced Materials
- MR Credit 4: PBT Elimination
- MR Credit 5: Furniture & Medical Furnishings
- EQ Prerequisite 1: Minimum IAQ Performance
- EQ Prerequisite 3: Hazardous Materials Removal or Encapsulation
- EQ Credit 3: Construction EQ Management Plan

**GGHC Operations Credit Synergies**
- IO Credit 1: Building Operations & Maintenance
- IO Credit 2: IAQ Management
- CM Prerequisite 1: Polychlorinated Biphenyl (PCB) Removal
- EP Credit 4: Toxic Reduction
- EP Credit 5: Furniture & Medical Furnishings
- EP Credit 6: IAQ Compliant Products
Chemical & Pollutant Source Control: Outdoor

**Intent**
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.

**Health Issues**
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.

**Credit Goals**
Design to minimize pollutant contamination of regularly occupied areas due to exterior factors.

- Employ permanent entryway systems at least six feet long in the primary direction of travel to capture dirt and particulates from entering the building at all entryways that are directly connected to the outdoors. Acceptable entryway systems include permanently installed grates, grilles, or slotted systems that allow for cleaning underneath. Roll-out mats are only acceptable when maintained on a weekly basis by a contracted service organization. Qualifying entryways are those that serve as regular entry points for building users.

- Minimize the entry of contaminants into the building from vehicles, pesticides, herbicides, helipads, diesel generators, designated smoking areas, sources of exhaust air, and other sources of potential contaminants. Achieve this by:
  - Providing pressurized entryway vestibules at building entrances; and,
  - Designing facilities to maximize the availability of air meeting the National Ambient Air Quality Standard at the outdoor air intakes.

- Ensure, through the results of mathematical (e.g. CFD) and/or physical (e.g. wind tunnel) modeling that outdoor air intakes will capture less pollutant concentrations than the thresholds established for the project. These thresholds can be achieved through a combination of (1) selecting outdoor air intake locations, (2) moving emissions/pollutant sources, and (3) cleaning emissions at the source. Consideration should be given to emissions from vehicles idling at loading docks and entry points. Policies prohibiting or limiting these sources of pollutants may be included in the design strategy to comply with this credit goal.

- The primary “emissions of concern” shall be CO, Nox, Sox, and particulate matter. Other pollutants specific to the conditions of the project shall be included in the “emissions of concern” (and considering such sources as helicopters, fume hoods, EtO sterilizer exhausts, loading docks, garage exhausts, smoking areas, etc.).
EQ Credit 5.1 continued
Chemical & Pollutant Source Control: Outdoor

- Air intake concentrations shall be no higher than 20% of the acceptable indoor concentrations, and 1% of the Threshold Limit Value (TLV). Acceptable indoor concentrations shall be based on the Short Term Exposure Limits (STEL) from the 2006 Guide to Occupational Exposure Values published by the American Conference of Governmental Industrial Hygienists (ACGIH). TLV values shall be taken from the 2006 Threshold Limit Values for Chemical Substances and Physical Agents, published by the ACGIH.

- In mechanically ventilated buildings, provide regularly occupied areas of the building with new air filtration media prior to occupancy that provide a Minimum Efficiency Reporting Value (MERV) of 13 or better. Filtration should be applied to process both return and outside air that is to be delivered as supply air.

Suggested Documentation

- Compile a building plan showing all entryways that are directly connected to the outdoors and all permanently installed entryway systems (grilles, grates, etc). Show acceptable entryway systems.

- Provide the results of mathematical (e.g. CFD) and/or physical (e.g. wind tunnel) modeling to show that outdoor air intakes will capture less than the desired thresholds of pollutants as outlined in the credit goals.

- Document replacement of air filtration media prior to occupancy that provide a Minimum Efficiency Reporting Value of 13 or better.

Reference Standards


Potential Technologies & Strategies

- Minimize introduction of dirt with appropriately sized, recessed metal grating or similar entryway system within vestibules.

- Install additional “walk-off mats” in entryways to prevent dirt from entering the building.
EQ Credit 5.1 continued

Chemical & Pollutant Source Control: Outdoor

GGHC Construction Credit Synergies

- ID Prerequisite 2: Health Mission Statement & Program
- EA Prerequisite 1: Fundamental Building Systems Commissioning
- EA Prerequisite 2: Minimum Energy Performance
- EA Credit 1: Optimize Energy Performance
- EA Credit 3: Enhanced Commissioning
- EA Credit 5: Measurement & Verification
- MR Prerequisite 1: Storage & Collection of Recyclables
- MR Credit 1: Building Reuse
- EQ Prerequisite 1: Minimum IAQ Performance
- EQ Prerequisite 3: Hazardous Material Removal or Encapsulation
- EQ Credit 1: Outdoor Air Delivery Monitoring
- EQ Credit 2: Natural Ventilation

GGHC Operations Credit Synergies

- IO Prerequisite 3: Environmental Tobacco Smoke Control
- IO Credit 2: IAQ Management
- CM Credit 2: Indoor Pollutant Source Control
- ES Credit 2: Indoor Integrated Pest Management
- ES Credit 3: Environmentally Preferable Cleaning Policy
- ES Credit 4: Sustainable Cleaning Products & Materials
- ES Credit 5: Environmentally Preferable Janitorial Equipment
- EP Credit 4: Toxic Reduction, EP Credit 6: IAQ Compliant Products
1 point

EQ Credit 5.2
Chemical & Pollutant Source Control: Indoor

Intent
Minimize exposure of building occupants to potentially hazardous indoor pollutants and chemicals that adversely impact air quality and human health.

Health Issues
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.

Credit Goals
Design to minimize cross-contamination of regularly occupied spaces:

- Where hazardous gases or chemicals may be present or used (including garages, soiled utility areas, sterilization and disinfection areas, housekeeping/laundry areas and copying/printing rooms), exhaust each space sufficiently to create negative pressure with respect to adjacent spaces with the doors to the room closed. For each of these spaces, provide self-closing doors and deck-to-deck partitions or a hard lid ceiling. The exhaust rate shall be at least 6 air changes/hour (for rooms containing disinfectant and sterilant applications, provide minimum 12 air changes/hour), with no air re-circulation. The pressure differential with the surrounding spaces shall be at least 5 Pa (0.02 inches of water gauge) on average and 1 Pa (0.004 inches of water) at a minimum when the door(s) to the room(s) are closed.

- Develop an action plan to eliminate, minimize, substitute, recycle, and dispose of harmful chemicals safely. The plan should improve distribution, and limit quantities, storage and waste.

Suggested Documentation
- Compile a building plan showing all rooms where chemical mixing, sterilization or high level disinfection of instruments occurs, and demonstrating that all chemical use areas and copy rooms have been designed to comply with the credit goals.
- Include review of equipment locations as part of the initial building commissioning plan.
- Compile an action plan for proper handling and disposal of harmful chemicals, in compliance with credit goals.

Reference Standards
There is no reference standard for this credit.

Potential Technologies & Strategies
- Isolate potential pollution sources through separate zoning of areas where contaminants are generated.
EQ Credit 5.2 continued

Chemical & Pollutant Source Control: Indoor

- Consider centralized high-level disinfection and/or sterilization practices to reduce the number of satellite locations, increase quality control and best management practices.
- Consider automatic washers and less toxic methods of sterilization and high-level disinfection of instruments. (See Resources section for guidance documents.) Create a committee to standardize best management practices for high-level disinfection to increase safety and reduce worker exposure.
- Locate copiers, fax machines and other office equipment in spaces with direct exhaust ventilation.
- Include infection control and environmental services in material selection to address cleaning protocol and to reduce toxicity of cleaning agents, including waxes and strippers, required to clean and disinfect interior finishes, furniture, and furnishings.
- In diagnostic and treatment areas, include utility rooms with negative pressure and direct exhaust to accommodate sterilization systems and other medical equipment that require chemical use.
- Develop material handling and processing guidelines as a part of initial building design, and monitor implementation of guidelines as a part of final building commissioning. Guidelines should reduce consumption of hazardous materials, and to prevent potential contamination of the surrounding environment.
- Provide dedicated centralized areas for receiving of, return of, or safe disposal of, hazardous materials. Also consider providing dedicated space in each lab for receiving of, return of, or safe disposal of hazardous materials. Include an area for reporting of all hazardous material “transactions” to a central inventory system.
- Develop decanting procedures that eliminate waste or allow for recycling of waste streams. Minimize proliferation of hazardous materials in laboratories by developing a “just in time” inventory system.
- Provide a coordinated materials transport strategy that allows efficient “just in time” delivery of hazardous materials.
- Use alternative equipment or laboratory methods designed to reduce consumption of hazardous materials.
- Minimize use of hazardous materials in relationship to testing/experimental volume.
- Use automated laboratory equipment that maximizes sample throughput while minimizing sample size, reagent quantity, and waste streams.
- Work with EH&S (Environmental, Health, and Safety) personnel and local code officials in developing an action plan.

Resources


Center for Disease Control and Prevention – Guideline for Handwashing and Hospital Environmental Control, 1985 (Includes guidance on cleaning, disinfecting and sterilizing equipment), http://wonder.cdc.gov/wonder/prevguid/p0000412/p0000412.asp


EQ Credit 5.2 continued
Chemical & Pollutant Source Control: Indoor

Health Facilities Management Article – August 2004 “Instituting a Green Floor Care Program”, http://h2e-online.org/docs/hfm80104.pdf
Hospital for a Healthy Environment’s Ten Step Guide to Implementing a Green Cleaning Program, http://www.h2e-online.org
Overview of Proper use of Cidex OPA for High Level Disinfection of Reusable Medical Equipment, http://h2e-online.org/docs/h2e10stepcidexopa.pdf

GGHC Construction Credit Synergies
- ID Prerequisite 2: Health Mission Statement & Program
- EA Prerequisite 1: Fundamental Building Systems Commissioning
- EA Prerequisite 2: Minimum Energy Performance
- EA Credit 1: Optimize Energy Performance
- EA Credit 3: Enhanced Commissioning
- EA Credit 5: Measurement & Verification
- MR Prerequisite 1: Storage & Collection of Recyclables
- MR Credit 1: Building Reuse
- EQ Prerequisite 1: Minimum IAQ Performance
- EQ Prerequisite 3: Hazardous Material Removal or Encapsulation
- EQ Credit 1: Outdoor Air Delivery Monitoring
- EQ Credit 2: Natural Ventilation

GGHC Operations Credit Synergies
- IO Prerequisite 3: Environmental Tobacco Smoke Control
- IO Credit 2: IAQ Management
- CM Credit 2: Indoor Pollutant Source Control
- ES Credit 2: Indoor Integrated Pest Management
- ES Credit 3: Environmentally Preferable Cleaning Policy
- ES Credit 4: Sustainable Cleaning Products & Materials
- ES Credit 5: Environmentally Preferable Janitorial Equipment
- EP Credit 4: Toxic Reduction, EP Credit 6: IAQ Compliant Products
Controllability of Systems: Lighting

**Intent**
Provide a high level of lighting system 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.

**Health Issues**
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. Occupant control of ventilation or airflow may conflict with regulatory requirements for ventilation rates and pressurization in health care environments.

**Credit Goals**
- Provide individual lighting controls for a minimum of 90% of the building occupants, including staff, to enable adjustments to suit individual needs and preferences.
- Install lighting controls in patient rooms that are readily accessible from the patient bed.
- Provide individual lighting controls for each bed in multi-occupant spaces, such as recovery rooms, emergency departments, infusion areas, and similar open areas.
- Provide occupant controls over window shades, blinds, and/or curtains that are readily accessible from the patient bed.

**Suggested Documentation**
- Provide lighting control plans indicating compliance with the goals of this credit.

**Reference Standards**
There is no reference standard for this credit.

**Potential Technologies & Strategies**
- Design the building with occupant controls for lighting and window treatments. Strategies to consider include lighting controls and task lighting. Integrate lighting systems’ controllability into the overall lighting design, providing ambient and task lighting while managing the overall energy use of the building.
EQ Credit 6.1 continued

Controllability of Systems: Lighting

- Provide dimming or other multi-level switching capable of reasonably uniform illuminance reduction for conference rooms, dining areas, lounges, and all other spaces larger than 100 square feet in which the connected lighting load exceeds 0.8 watts per square foot.
- Provide occupant controls for shading devices in staff and multi-occupant spaces.
- Provide photocell daylighting controls for daylit spaces, including corridors.

GGHC Construction Credit Synergies

- SS Credit 9: Connection to the Natural World
- EA Prerequisite 1: Fundamental Building Systems Commissioning
- EA Prerequisite 2: Minimum Energy Performance
- EA Credit 1: Optimize Energy Performance
- EA Credit 3: Enhanced Commissioning
- EA Credit 5: Measurement & Verification
- MR Credit 1: Building Reuse
- EQ Prerequisite 3: Hazardous Material Removal or Encapsulation
- EQ Credit 1: Outdoor Air Delivery Monitoring
- EQ Credit 2: Natural Ventilation
- EQ Credit 7: Thermal Comfort
- EQ Credit 8: Daylight & Views

GGHC Operations Credit Synergies

- EE Prerequisite 1: Existing Building Commissioning
- EE Prerequisite 2: Minimum Energy Performance
- EE Credit 1: Optimize Energy Performance
- EE Credit 3: Energy Efficient Equipment
- EE Credit 5: Performance Measurement
1 point in addition to EQ Credit 6.1

**EQ Credit 6.2**

Controllability of Systems: **Thermal Comfort**

**Intent**
Provide a high level of thermal comfort system 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, and wellbeing of building occupants.

**Health Issues**
The health of building occupants is directly impacted by the degree of control that individuals can exercise over their immediate environment. Control over 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 control of ventilation or airflow may conflict with regulatory requirements for ventilation rates and pressurization in health care facilities.

**Credit Goals**

- Provide individual thermal comfort controls for 50% (minimum) of the building occupants, exempting patient rooms, to enable adjustments to suit individual task needs and preferences.
- Provide individual thermal comfort controls that are readily accessible from the patient bed in all patient rooms.
- Operable windows can be used in lieu of individual controls for areas that are 20 feet inside of and 10 feet to either side of the operable part of the window. The areas of operable window must meet the requirements of ASHRAE 62.1-2004, paragraph 5.1, Natural Ventilation.

AND

- Provide comfort system controls for all shared multi-occupant spaces to enable adjustments to suit group needs and preferences.

*Note: Conditions for thermal comfort are described in ASHRAE Standard 55-2004 to include the primary factors of air temperature, radiant temperature, air speed and humidity. Comfort system control for the purposes of this credit is defined as the provision of control over at least one of these primary factors in the occupant’s local environment.*

**Suggested Documentation**
- Compile schematic drawings demonstrating the required individual thermal comfort controls are provided.

**Reference Standards**
ASHRAE Standard 55-2004, Thermal Environmental Conditions for Human Occupancy
ASHRAE Standard 62.1-2004, Natural Ventilation, Paragraph 5.1
EQ Credit 6.2 continued

Controllability of Systems: Thermal Comfort

Potential Technologies & Strategies

• Design the building and systems with comfort controls to allow adjustments to suit individual needs or those of groups in shared spaces. ASHRAE Standard 55-2004 identifies the factors of thermal comfort and a process for developing comfort criteria for building spaces that suit the needs of the occupants involved in their daily activities.

• Develop control strategies that expand on the comfort criteria outlined in the Credit Goals to allow adjustments to suit individual needs and preferences. These may involve system designs incorporating operable windows, hybrid systems integrating operable windows and mechanical systems, or mechanical systems alone.

• Individual adjustments may involve individual thermostat controls, local diffusers at floor, desk or overhead levels, or control of individual radiant panels, or other means integrated into the overall building, thermal comfort systems, and energy systems design.

• In addition, designers should evaluate the closely tied interactions between thermal comfort (as required by ASHRAE Standard 55-2004) and acceptable indoor air quality (as required by ASHRAE Standard 62.1-2004, whether natural or mechanical ventilation).

• Additional strategies to consider include:
  • Underfloor HVAC systems with individual diffusers
  • Displacement ventilation systems
  • Operable windows

• See GGHC EQ Credit 6.1 for Credit Synergies.
Intent
Provide for the assessment of building thermal comfort over time.

**Health Issues**
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.

**Credit Goals**
- Agree to implement a thermal comfort survey of building occupants (patients and staff) within a period of six to 18 months after occupancy. This survey should collect anonymous responses about thermal comfort in the building including an assessment of overall satisfaction with thermal performance and identification of thermal comfort-related problems. Agree to develop a plan for corrective action if the survey results indicate that more than 20% of the respondents in each group are dissatisfied with thermal comfort in the building. This plan should include measurement of relevant environmental variables in problem areas in accordance with ASHRAE Standard 55-2004.

**Suggested Documentation**
- Develop a thermal comfort survey and a plan for corrective action in compliance with the credit goals.
- Document the facility’s commitment to implement the thermal comfort survey within six to 18 months after occupancy and to respond to its results in a timely manner.

**Reference Standards**
ASHRAE Standard 55-2004, Thermal Environmental Conditions for Human Occupancy

**Potential Technologies & Strategies**
- ASHRAE Standard 55-2004 provides guidance for establishing thermal comfort criteria and the documentation and validation of building performance to the criteria. While the standard is not intended for purposes of continuous monitoring and maintenance of the thermal environment, the principles expressed in the standard provide a basis for design of monitoring and corrective action systems.
EQ Credit 7 continued

Thermal Comfort

GGHC Construction Credit Synergies

- SS Credit 7: Heat Island Effect
- WE Credit 1: Water Efficient Landscaping
- EA Prerequisite 1: Fundamental Building Systems Commissioning
- EA Prerequisite 2: Minimum Energy Performance
- EA Credit 1: Optimize Energy Performance
- EA Credit 3: Enhanced Commissioning
- EA Credit 5: Measurement & Verification
- MR Credit 1: Building Reuse
- EQ Prerequisite 1: Minimum IAQ Performance
- EQ Credit 1: Outdoor Air Delivery Monitoring
- EQ Credit 2: Natural Ventilation
- EQ Credit 6: Controllability of Systems

GGHC Operations Credit Synergies

- IO Prerequisite 1: Integrated Operations & Maintenance Process
- IO Credit 2: IAQ Management, WC Credit 4: Enhanced Metering
- EE Prerequisite 1: Existing Building Commissioning
- EE Prerequisite 2: Minimum Energy Performance
- EE Credit 1: Optimize Energy Performance
- EE Credit 3: Energy Efficient Equipment
- EE Credit 5: Performance Measurement
5 points

**EQ Credit 8.1**

Daylight & Views: **Daylight for Occupied Spaces**

**Intent**
Provide building occupants with a connection between indoor spaces and the outdoors by introducing daylight and views into the building’s regularly occupied areas.

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**Health Issues**

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.

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**Credit Goals**

*Note: a project may earn either one or both sets of daylighting credits, which calculate daylight for Diagnostic and Treatment area separately from Inpatient areas.*

- **Diagnostic and Treatment (D&T) Areas: (8.1a, 8.1b, and 8.1c: 1 to 3 points)**

  Provide access to daylight in D&T areas as follows:

  1. Determine the gross floor area of the D&T portion of the building floorplate.
  2. Calculate the percentage of area within 15 feet of the perimeter of a hypothetical square floorplate of equal area to the building floorplate to determine the ‘square-root base’ daylit area.
3. Configure the building floorplate to provide an increased percentage of daylit area above the ‘square-root base’ percentage daylit area to achieve 1, 2 or 3 credits using the following table:

<table>
<thead>
<tr>
<th>Criteria percent of total floor area within 15’ of perimeter window by building floorplate area</th>
<th>Point Total</th>
<th>Daylit floor area required</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.1a - 1 point total</td>
<td>6% above ‘square-root base’ daylit area</td>
<td></td>
</tr>
<tr>
<td>8.1b - 2 points total</td>
<td>12% above ‘square-root base’ daylit area</td>
<td></td>
</tr>
<tr>
<td>8.1c - 3 points total</td>
<td>18% above ‘square-root base’ daylit area</td>
<td></td>
</tr>
</tbody>
</table>

Sample calculation of ‘square-root base’ daylit area for 30,000 SF building floorplate:

\[
\sqrt{30,000 \text{ square feet}} = 173.2 \text{ feet}
\]

173.2 feet – 30 feet = 143.2 feet

143.2 feet x 143.2 = 20,507.7 square feet (non-daylit area)

30,000 square feet – 20,507.7 square feet = 9,492.3 square feet (daylit area)

9,492.3 square feet / 30,000 square feet = 31.6% (percent daylit area)

- Floorplates < 14,000 SF are to achieve daylighting percentages equal to those required for a floorplate of 14,000 SF.
- Floorplates > 50,000 SF are to achieve daylighting percentages equal to those required for a floorplate of 50,000 SF.

Note:

- Courtyards with a minimum nominal width the lesser of 15’ per floor or 60’ total qualify as perimeter.
- Atria with one glazed end with a minimum nominal width the lesser of 10’ per storey or 40’ total also qualify as perimeter.
- Floor areas directly under skylights equal to the horizontally projected area of the skylight glazing qualify as daylit floor area.
- This calculation is based upon a percentage of total floor area (building GSF), and is independent of function, layout, or the final distribution of glazing. All floor area within 15’ of an outside facing, qualifying courtyard or atria facing perimeter wall where it would be possible to provide fenestration qualifies.

- Where D&T floors vary in area or perimeter, use the average floor area to determine the percentage of daylit floor area required and use the total area of all floors and the total area within 15’ of the perimeter to determine the percentage of daylit floor area provided.
EQ Credit 8.1 continued

Daylight & Views: Daylight for Occupied Spaces

- Use only the D&T area of floors with both D&T and IPUs to determine daylit floor area.
- Areas or rooms on floors below grade with a normal use occupancy level lower than 1 per 1,000 square feet may be excluded in calculations for this credit.
- For building additions, subtract all daylit area within the existing building that loses daylight (length of windowed wall blocked-in x 15 feet) from the daylit area within the addition.

- Inpatient Units (8.1d, 8.1e: 1-2 points):
  - Provide access to daylight on inpatient units as follows:
    - **8.1d – (1 point):** In multi-bed inpatient rooms, provide a window configuration to ensure that both patients have visual connection to the outdoors, even when cubicle curtains are closed, AND provide a window direct to the outdoors from 75% of regularly occupied staff work spaces and non-inpatient-room spaces.
    - **8.1e – (1 point):** Achieve 8.1d AND provide a window direct to the outdoors from 90% of regularly occupied staff work spaces and non-inpatient-room spaces.
  - Inpatient unit spaces with a direct view of courtyards or atria that meet the requirements of credits 8.1a-c qualify as daylit for credits 8.1d and 8.1e.

Suggested Documentation

- Compile area calculations that define the percentage of daylit gross floor area achieved for the Diagnostic & Treatment area credits.
- Develop Inpatient Unit plans confirming that all patient bed locations have direct access to daylight in multi-bed rooms when curtains are drawn.
- Identify all regularly occupied staff spaces on Inpatient Units, indicating the percentage that have direct access to a window.

Reference Standards

There is no reference standard for this credit.

Potential Technologies & Strategies

- Design the building to maximize interior daylighting. Insure compliance with the goal early in the design process, acknowledging site constraints at the programming stage, when block planning is tested and initial design parameters are established.
- Strategies to consider include:
  - Building orientation
  - Shallow floor plates
  - Increased building perimeter
  - Courtyards
EQ Credit 8.1 continued

Daylight & Views: **Daylight for Occupied Spaces**

- Atria
- Exterior and interior permanent direct daylight shading and diffusion devices
- High performance glazing
- High performance window treatments
- Photo-integrated light sensors

**Resources**


**GGHC Construction Credit Synergies**

- ID Prerequisite 1: Integrated Design Process
- ID Prerequisite 2: Health Mission Statement & Program
- SS Credit 1: Site Selection
- SS Credit 2: Development Density & Community Connectivity
- SS Credit 5: Site Development
- SS Credit 9: Connection to the Natural World
- WE Credit 1: Water Efficient Landscaping
- EA Prerequisite 1: Fundamental Building Systems Commissioning
- EA Prerequisite 2: Minimum Energy Performance
- EA Credit 1: Optimize Energy Performance
- EA Credit 2: On-Site Renewable Energy
- EA Credit 3: Enhanced Commissioning
- EA Credit 5: Measurement & Verification
- MR Credit 1: Building Reuse
- EQ Credit 6: Controllability of Systems

**GGHC Operations Credit Synergies**

- WC Credit 1: Water Efficient Landscaping
- EE Prerequisite 1: Existing Building Commissioning
- EE Prerequisite 2: Minimum Energy Performance
- EE Credit 1: Optimize Energy Performance
- EE Credit 2: On-Site & Off-Site Renewable Energy
- EE Credit 3: Energy Efficient Equipment
- ES Credit 1: Outdoor Grounds & Building Exterior Management
EQ Credit 8.2
Daylight & Views:
Connection to the Natural World: Indoor Places of Respite

Intent
Connect patients, visitors, and staff to the natural environment through views of nature from indoor places of respite.

Health Issues
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.

Credit Goals
• Provide patient, visitor, and staff accessible indoor places of respite with 90% of the aggregate net program area of those spaces having direct views of nature. To qualify, these spaces must have direct connection to the natural environment and must be spaces where no medical intervention or direct medical care is delivered and where no facility administration or maintenance is being conducted.
  • Exterior views of nature or outdoor places of respite (as defined in GGHC SS Credit 9) may be used to meet this credit requirement.
  • Audio-visual technology that simulates nature may be used to fulfill up to 20% of the credit goal in spaces that are not accessible to nature,
• Indoor Places of Respite may include, but are not limited to:
  • Family consultation or gathering spaces
  • Lounges without negative distractions, such as televisions
  • Café or cafeteria seating areas
  • Grieving rooms
  • Meditation spaces or chapels
  • Resource areas and libraries
  • Designated staff break areas with positive sensory distractions
  • Spa or exercise spaces for staff and/or visitors
  • Seating areas within Atrium spaces that are sky lit and have live plant material

Suggested Documentation
☐ Compile floor plans highlighting places of respite with views of nature.
☐ Compile a building program and calculation showing that 90% of these spaces meet the credit goal of having direct views or connection to nature.
EQ Credit 8.2 continued

Daylight & Views:
Connection to the Natural World: Indoor Places of Respite

Compile annotated and descriptive plans graphically demonstrating site planning principles to maximize the experience of significant natural features for therapeutic value.

Compile a list of all places of respite in the building program. Identify their intended activities and areas, with calculations showing that 90% of the aggregate area of those spaces meets the credit goal of having direct views or connection to nature.

Compile floor plans highlighting all places of respite, indicating those with views of nature.

Reference Standards
There is no reference standard for this credit.

Potential Technologies & Strategies

- Direct connection to the natural environment from indoor places of respite includes views of distant and nearby nature (such as inaccessible rooftop spaces with “green” (vegetated) roofs and mature street trees), including, but not limited to:
  - Views of outdoor places of respite as defined in GGHC SS Credit 9.
  - Close views of trees or a vine covered wall
  - Views of a natural rock face or ledge
  - Framed views of a distant landmark
  - Views of a pedestrian activity in an outdoor setting, such as an urban street view with street trees

- Provide sitting areas or vestibules within widened corridors that offer views of nature and places to pause.

- For spaces like cafeterias deeper than 15’ from the perimeter wall with the natural view, only the area of the space within a distance from the perimeter wall less than or equal to 1.5 x the length of the perimeter wall qualifies as an indoor place of respite.

- Provide choice and variety in the design of spaces (for example, spaces that engage all the senses but also areas with limited sensory stimulation). Consider a variety of smaller spaces conveniently located throughout the facility rather than one large space.

- In development of room data sheets or project space programs, include criteria for orientation relative to major exterior views and other natural features (daylight, seasonal variations, sound of water).
EQ Credit 8.2 continued

Daylight & Views:
Connection to the Natural World: Indoor Places of Respite

GGHC Construction Credit Synergies

- ID Prerequisite 1: Integrated Design Process
- ID Prerequisite 2: Health Mission Statement & Program
- SS Credit 1: Site Selection
- SS Credit 2: Development Density & Community Connectivity
- SS Credit 5: Site Development
- SS Credit 9: Connection to the Natural World
- WE Credit 1: Water Efficient Landscaping
- EA Prerequisite 1: Fundamental Building Systems Commissioning
- EA Prerequisite 2: Minimum Energy Performance
- EA Credit 1: Optimize Energy Performance
- EA Credit 2: On-Site Renewable Energy
- EA Credit 3: Enhanced Commissioning
- EA Credit 5: Measurement & Verification
- MR Credit 1: Building Reuse
- EQ Credit 6: Controllability of Systems

GGHC Operations Credit Synergies

- WC Credit 1: Water Efficient Landscaping
- EE Prerequisite 1: Existing Building Commissioning
- EE Prerequisite 2: Minimum Energy Performance
- EE Credit 1: Optimize Energy Performance
- EE Credit 2: On-Site & Off-Site Renewable Energy
- EE Credit 3: Energy Efficient Equipment
- ES Credit 1: Outdoor Grounds & Building Exterior Management
Intent
Reinforce natural circadian rhythms (sleep/wake patterns) in patients and daytime staff, and promote alertness in both day-shift and night-shift staff.

Health Issues
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.

Credit Goals
Establish electric lighting and daylighting systems and controls for patient areas and staff work areas based upon principles of circadian rhythm (a self-sustained biological rhythm that in an organism's natural environment normally has the period of approximately 24 hours). See GGHC EQ Credit 6.1: Controllability of Systems: Lighting for possible Credit Synergies.

PATIENT AREAS
In patient sleeping areas, establish lighting and lighting control design solutions that allow for variation in day and night lighting characteristics.

- Provide a separately controlled nighttime navigational lighting system in the amber to red area of the color spectrum.
- Shield patient rooms from the bright light of work areas and circulation spaces.
- Shield staff self-luminous monitors and chart lighting located within patient rooms from patient bed view.
- Provide night-time shielding of patient rooms from exterior light sources.

STAFF AREAS
In staff areas, establish lighting to support work performance and alertness through both daytime and nighttime lighting cycles. Insure that the area has multiple levels of lighting available.
EQ Credit 8.3 continued

Daylight & Views: Lighting & Circadian Rhythm

• Provide sleeping areas for staff and residents capable of near complete darkness. If more than one person uses the sleeping room, provide a night-time-navigational lighting system in the amber to red area of the color spectrum.

• Provide at least one location for night shift staff that provides a separately controlled vertical lighting element of 4000K or greater color temperature with a target vertical illuminance level of 250 footcandles when measured two (2) feet away at eye height. Provide a control that turns the lighting element off when the space is unoccupied. Provide space for stretching and/or mild physical activity to support alertness. Ensure that staff are not required to walk through this area in order to access the sleeping area.

• Provide access to daylight for all staff on their regularly traversed workpath without the need to enter a patient room or other private space.

Suggested Documentation

☐ Compile drawings and specification information in compliance with credit goals.

Reference Standards

There is no reference standard for this credit.

Potential Technologies & Strategies

• Research shows that light toward the blue portion of the color spectrum is more effective in stimulating a “daytime” response while light in the amber to red portion of the color spectrum has little impact. Carefully use blue or blue-white sources in areas and at times where alertness is desired and avoid in areas and at times when encouraging sleep. Keep in mind that high-quality white light, containing adequate portions of the blue, yellow and red portions of the spectrum, is necessary for proper patient diagnosis.

• Brightness on vertical surfaces is a critical lighting design element. Supplement indirect ceiling lighting with light on the walls.

• Provide automatic multi-level or dimming lighting controls with manual override in patient and common areas to support the change of lighting conditions throughout the day. Connect the lighting controls to a time-of-day controller. Insure that all lighting in staff areas is automatically controlled with temporary overrides available to the staff.

• Provide blackout shades on windows in sleeping areas with occupant controls that are readily accessible from the patient bed. See GGHC Environmental Quality Credit 6.1: Controllability of Systems: Lighting for more information.

• Staff access to natural light should be achieved without going into private spaces. Staff should not have to enter a patient/resident room to have access to natural light. Examples include windows at the ends of corridors, skylights into deep areas of the building in highly trafficked areas, transoms, and door sidelights. Provide solar day rooms or common areas for staff.

• Provide automatic control of electric light variation that can be individually set for each patient, dependent upon his/her situation. Provide a default setting that reinforces the typical daytime cycle (e.g., a time-of-day controller). Provide an educational manual for the hospital staff that describes
how the control system works and how it can be reset per individual. For example, cancer patients undergoing chemotherapy may benefit from a circadian cycle that is shifted from typical daytime cycles. The manual should also cover other aspects of contribution to the circadian cycle such as the effects of daylight and yellow goggles/daylight filters, the effects of nightlights, etc.

- Design for circadian rhythm is particularly important in nurseries and NICUs because research has shown that newborns are sensitive to variations in lighting.

**Resources**


**GGHC Construction Credit Synergies**

- ID Prerequisite 1: Integrated Design Process
- ID Prerequisite 2: Health Mission Statement & Program
- SS Credit 1: Site Selection
- SS Credit 2: Development Density & Community Connectivity
- SS Credit 5: Reduced Site Disturbance
- SS Credit 9: Connection to the Natural World: Outdoor Places of Respite
- WE Credit 1: Water Efficient Landscaping
- EA Prerequisite 1: Fundamental Building Systems Commissioning
- EA Prerequisite 2: Minimum Energy Performance
- EA Credit 1: Optimize Energy Performance
- EA Credit 2: On-Site Renewable Energy
- EA Credit 3: Enhanced Commissioning
- EA Credit 5: Measurement & Verification
- MR Credit 1: Building Reuse
- EQ Credit 6: Controllability of Systems
EQ Credit 8.3 continued

Daylight & Views: **Lighting & Circadian Rhythm**

**GGHC Operations Credit Synergies**

- WC Credit 1: Water Efficient Landscaping
- EE Prerequisite 1: Existing Building Commissioning
- EE Prerequisite 2: Minimum Energy Performance
- EE Credit 1: Optimize Energy Performance
- EE Credit 2: On-Site & Off-Site Renewable Energy
- EE Credit 3: Energy Efficient Equipment
- ES Credit 1: Outdoor Grounds & Building Exterior Management
1 point

**EQ Credit 9.1**

Acoustic Environment: **Exterior Noise, Acoustical Finishes, & Room Noise Levels**

**Intent**

Provide building occupants with a healing environment free of disruptive levels of sound.

---

**Health Issues**

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.

**Credit Goals**

Design the facility’s acoustic environment in accordance with the following three sections of the 2006 AIA/AHA Draft Interim Sound and Vibration Design Guidelines for Hospital and Healthcare Facilities:

- **Minimize the Impact of Site Exterior Noise on the Building Occupants and on the Surrounding Community**: For all categories of exterior noise exposure, taking into account the effect of site heliports, emergency power generators, outdoor mechanical equipment, and building services, comply with Section 1.4 Classification of Facility Produced Noise Exposure.
  
  Measure and collect data to determine the Exterior Site Noise Exposure Category (A, B, C, or D).
  
  - Design the building envelope composite STC rating to meet the design goals in Table 1.4-1 for the Exterior Site Exposure Category that applies.
  
  - Alternatively, test and measure the exterior building envelope sound isolation performance using methods generally conforming to the current edition of ASTM E966 Standard Guide for Field Measurements of Airborne Sound Insulation of Building Façades and Façade Elements. If the NIC rating is no more than 5 dB less than the required composite STC rating, then that section of the building façade meets the criteria for this point. Test no less than 5% of each façade type and condition (i.e. 5% of occupied rooms on exterior walls of each type).

- **Acoustical Finishes and Detail**: Design the facility by selecting and specifying materials, products, mechanical systems and design features to attenuate sound and vibration, and to meet or exceed room average sound absorption coefficients shown in Table 2.3-1.
  
  - In the design process, select room finishes using room sound absorption coefficients as listed in Table 2-1 and Table 2-2 (or other similar laboratory data for the materials considered) as guidance towards meeting the requirements of Table 2.3-1.
EQ Credit 9.1 continued

Acoustic Environment:

**Exterior Noise, Acoustical Finishes, & Room Noise Levels**

- Alternatively, test and measure the average sound absorption coefficient through the measurement of the reverberation time ($T_R$) generally in accordance with the current edition of ASTM C423 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method. Test 5% of occupied rooms of each type (see Table 2.3-1) in the building.

- **Room Noise Levels:** Consider background sound levels generated by building mechanical systems and other hospital noise sources (MRI, elevators, etc.)
  - Design the facility to meet the requirements of Table 3.3-1, Recommended Criteria for Noise in Interior Spaces.
  - Alternatively, test sound level in 25% of rooms of each type using a sound level meter outfitted with a windscreen. Instrumentation must conform to ANSI S1.4 for type 1 precision sound measurement instrumentation.

**Reference Standard**


**Suggested Documentation**

- Compile documentation demonstrating that the acoustic design complies with Credit Goals.
- OR
- Compile test and measurement data demonstrating that the acoustic design complies with Credit Goals.

**Potential Technologies & Strategies**

- In inpatient floor planning, avoid locating patient rooms adjacent to elevators, stairwells, and visitor/public spaces.

- Acoustically isolate patient rooms from each other. Where increased sound isolation between the patient rooms and corridors does not interfere with clinical operation, install gasketed doors. Glass doors and/or vision panels provide both visual supervision and sound isolation.

- Locate televisions in public and staff areas only where there is adequate space for patients and staff to be out of hearing range if they so choose. Provide headsets and/or pillow speakers for televisions and radios located in semi-private rooms or other locations where sound can carry to other patients.

- Specify and install ceiling tiles with Ceiling Attenuation Class (CAC) ratings of 35 or greater for spaces with noisy plenum equipment or walls that stop short of the deck.

- Specify and install sound-absorptive wall treatment with an NRC of 0.7 or higher.
EQ Credit 9.1 continued

Acoustic Environment:

Exterior Noise, Acoustical Finishes, & Room Noise Levels

- Specify and install flooring products to reduce footfall and cart rolling noise.
- Use sound absorbing finish materials in waiting areas and other public spaces.
- Elevate the level of continuous background sound where applicable to achieve a greater perceived level of quiet.
- In open bay treatment areas, such as Emergency Departments or Recovery rooms, select ceiling products for high sound absorption.
- At nurse stations and open staff areas, carefully integrate sound absorbing elements (ceilings, furniture systems, etc.) to reduce noise.
- Enclose nursing and chart stations in IPU areas.
- Isolate vibration-generating equipment from the building structure in accordance with the Sound and Vibration Chapter of the current ASHRAE Applications Handbook.
- Locate noise generating mechanical and electrical equipment away from patient and staff areas, and from neighboring residential communities.
- Implement noise control protocols. This is particularly important in Neonatal Intensive Care Units. Install noise level sensor systems, which provide visual feedback when acoustic thresholds are exceeded.

Resources


GGHC Construction Credit Synergies

- ID Prerequisite 1: Integrated Design Process
- ID Prerequisite 2: Health Mission Statement & Program
- SS Credit 1: Site Selection
- SS Credit 2: Development Density & Community Connectivity
- EA Prerequisite 1: Fundamental Building Systems Commissioning
- EA Credit 3: Enhanced Commissioning
- EA Credit 5: Measurement & Verification
- MR Credit 1: Building Reuse
- MR Credit 3: Sustainably Sourced Materials
- EQ Credit 3: Construction EQ Management Plan

GGHC Operations Credit Synergies

- IO Credit 1: Building Operations & Maintenance
- EE Prerequisite 1: Existing Building Commissioning
- EE Credit 5: Performance Measurement
- EP Credit 6: IAQ Compliant Products
EQ Credit 9.2

Acoustic Environment: Sound Isolation, Paging & Call Systems, & Building Vibration

Intent
Provide building occupants with a healing environment free of disruptive levels of sound.

Health Issues
Noise is a well-documented source of stress in healthcare 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.

Credit Goals


AND

- Design the facility’s acoustic environment in accordance with two out of the three following sections of the 2006 AIA/AHA Draft Interim Sound and Vibration Design Guidelines for Hospital and Healthcare Facilities:

  - **Sound Isolation Performance of Construction – Speech Privacy Goal**: Adequate sound isolation will result in speech privacy, acoustic comfort, and a reduction in noise-produced annoyance. Sound isolation between hospital occupants and noise sources is the sound level difference between source and receiver spaces, and adjusted for the background sound at the receiver’s location.
    
    - Design the facility to meet the criteria of Table 4-3 Speech Privacy goals for Enclosed Rooms and Table 4-4 Speech Privacy Goals for Open Plan Spaces. Design sound isolation between spaces in accordance with Table 4.3-1, Recommended Sound Isolation Performance Between Enclosed Rooms
    
    - Alternatively, Test 5% of the privacy adjacencies in a building.

  - **Paging & Call Systems, Clinical Alarms, Masking Systems & Sound Reinforcement**
    a. **Paging and Call Systems**
    
    - Voice paging and call systems shall be designed to achieve a minimum speech transmission index (STI) of 0.50 or a common intelligibility scale (CIS) rating of 0.70 at representative points within the area of coverage to provide acceptable intelligibility from
Acoustic Environment:

**Sound Isolation, Paging & Call Systems, & Building Vibration**

the system. The conversion between CIS and other scales of intelligibility is available from Annexes A and B of IEC 60489-Sound Systems for Emergency Purposes (NFPA 72-2002).

- Performance of the system shall be designed to achieve:
  1. 70 dBA minimum sound level; or
  2. 10 dBA above background noise levels (whichever is higher); and,
  3. Coverage within +/- 4 dB at the 2000 Hz octave band throughout corridors, open treatment areas and public spaces.

- Alternatively, test and measure performance in 5% of building spaces.

**b. Clinical alarms**

- Clinical alarms shall be designed to be audible according to ISO 7731 “Danger signals for work places – Auditory danger signals”

- Alternatively, test and measure performance in 25% of building spaces.

**c. Audibility of tonal alarms**

- Design the facility according to the 2002 edition of NFPA 72, the National Fire Alarm Code, which provides a method for measuring the audibility of narrow band tonal alarms using the techniques in ISO 7731. These techniques use the favorable audibility of tonal sounds versus broadband sounds in the midst of competing noise, based on staff training.

- Test and measure performance in 50% of building spaces.

**d. Masking Systems:** Sound masking systems are useful tools for reducing patient distractions and enhancing speech privacy in all types of medical facilities.

- Systems shall be designed for levels that do not exceed 48 dBA. Loudspeaker coverage shall provide for uniformity of +/- 2 dBA

- Alternatively, test and measure performance in 100% of building spaces where masking sound has been installed.

**e. Sound Reinforcement:** All large conference rooms and auditoria seating more than 25 persons shall consider sound reinforcement and AV playback capabilities.

- Sound reinforcement system shall be designed to achieve a minimum Speech Transmission Index (STI) of 0.60 or a Common Intelligibility Scale (CIS) rating of 0.77 at representative points within the area of coverage to provide acceptable intelligibility from the system.
EQ Credit 9.2 continued

Acoustic Environment:
Sound Isolation, Paging & Call Systems, & Building Vibration

- Performance of the system shall be designed to achieve:
  i. 70 dBA minimum sound level; or
  ii. 10 dBA above background noise levels (whichever is higher); and
  iii. Coverage within +/- 3 dB at the 2000 Hz octave band throughout the space.
- Alternatively, test in a 100% of spaces where sound systems have been installed.

- **Building Vibration**: Building vibration produced by building mechanical equipment, footfall, road and rail traffic, and medical equipment shall be considered in the design of a hospital building. Seismic restraint shall be compatible with vibration isolation methods covered in this section.
  - Design the building to meet the requirements of Table 6.3.2-1 Recommended Limits on Footfall Vibration in Hospitals. In addition, meet any more restrictive vibration criteria that may be required by manufacturers of medical and laboratory equipment.
  - Alternatively, test floor vibration velocities for a period of 5 minutes at not less than 5% of rooms of each type. Test vibration level as per manufacturers’ requirements in all spaces having equipment having specific ambient vibration limits.

Reference Standard

Suggested Documentation
- Compile documentation demonstrating that the acoustic design complies with Credit Goals.
  - OR
- Compile test and measurement data demonstrating that the acoustic design complies with Credit Goals.

Potential Technologies & Strategies
See GGHC EQ Credit 9.1 for Potential Technologies & Strategies and Credit Synergies.

Resources
See GGHC EQ Credit 9.1 for Resources.
Innovation & Design Process

3 points IN Credit 1 Innovation in Design

Intent
To provide design teams and projects the opportunity to achieve points for exceptional performance above credit goals set by the Green Guide for Health Care and/or innovation for green building goals and strategies not specifically addressed by the Green Guide for Health Care.

<table>
<thead>
<tr>
<th>Health Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>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. These credits are intended to reward exemplary performance of existing credits and encourage implementation of innovative design elements.</td>
</tr>
</tbody>
</table>

Credit Goals

<table>
<thead>
<tr>
<th>Credit 1.1 (1 point)</th>
<th>Identify the intent of the proposed innovation credit, the proposed credit goals, proposed documentation to demonstrate achievement, and the design approach used to meet the goals.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit 1.2 (1 point)</td>
<td>Same as Credit 1.1.</td>
</tr>
<tr>
<td>Credit 1.3 (1 point)</td>
<td>Same as Credit 1.1.</td>
</tr>
</tbody>
</table>

Suggested Documentation

- Prepare the proposal(s) (including intent, credit goal, submittals and design approach) and relevant evidence of performance achieved.
- Share innovations with the Green Guide for Health Care.

Reference Standards
There is no reference standard for this credit.

Potential Technologies & Strategies

- Substantially exceed a Green Guide credit threshold such as for energy performance or water efficiency.
- Apply strategies or measures that are not covered by the Green Guide including, but not limited to:
  - Patient, visitor, and staff education
  - Community development
IN Credit 1 continued

Innovation in Design

- Exceed the credit goal criteria for chemicals of concern (GGHC MR Credits 3, 4 & 5 and GGHC EQ Credit 4) in the Green Guide for Health Care.
- Implement innovative parking schemes, such as sharing off-site structured parking with nearby buildings.
- Integrate the health care campus within the surrounding community’s existing infrastructure, such as incorporating a therapeutic nature walk into a public park.
1 point

IN Credit 2
Documenting Health, Quality of Care & Productivity Performance Impacts:
Research Initiatives

Intent
Document absenteeism, health care cost, employee retention and other health, quality of care and productivity measures of enhanced building performance.

<table>
<thead>
<tr>
<th>Health Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited data are available tracking specific health, quality of care and productivity effects resulting from sustainable building strategies in the health care sector. 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.</td>
</tr>
</tbody>
</table>

Credit Goals

• Engage in peer-reviewed research initiatives that track the relationship between sustainable building performance improvements and building occupant health, quality of care, productivity, and/or resource conservation.

• Identify measures that improve health, quality of care and/or efficiencies within specific processes.

Suggested Documentation

- Initiate a research project in accordance with the Credit Goals.
- Share performance data and research results with the Green Guide for Health Care.

Reference Standards
There is no reference standard for this credit.

Potential Technologies & Strategies

• Parameters for research may include: staff recruitment/retention, patient satisfaction or clinical performance measures (i.e., medical errors, patient throughput, or cure times).