Department of Planning & Development
Ports, Customs & Free Zone Corporation
Government of Dubai

تراخيص
Trakhees

دائـرة الـتـخـطـيـط والـتـطـويـر
مؤسسة الموانئ والجمارك والمنطقة الحرة
حـكـومـة دبـي

Green Building Regulations for Dubai World Developments

(For projects Registered with USGBC under LEED Version 2.2)

REGULATION NO.GB-001
1st EDITION January 2008

GREEN BUILDING

ENVIRONMENT, HEALTH & SAFETY DIVISION

Introduction

In line with Dubai Strategic Plan 2015 and recent (October 2007) directive as laid out by His Highness Sheikh Mohammed bin Rashid Al Maktoum, UAE Vice President and Prime Minister and Ruler of Dubai, EHS has drafted comprehensive Green Building Regulations for Dubai World Developments. EHS Regulations are intended to meet or exceed other local, federal and international regulations as stated in our Vision and Mission Statements.

Objectives

Given the fact that the requirements of Dubai and the Middle East Region are unique, the Objective of these Regulations, is to ensure that developers in Dubai World incorporate minimum critical sustainable development requirements (especially in terms of efficient energy and water/waste water management) rather than focus on lesser (cosmetic) aspects of Green Building Certification, which may also be part of the International Green Building Certification Process. These minimum requirements (as need to be certified by independent accredited "Certifying Agencies") have been drawn from the existing (International) LEED (V 2.2) parameters to outline an obligatory requirement from EHS. This Regulation takes into account existing Good Development practices by Dubai World Developers and existing Regulations. This Regulation does not limit any developer from achieving higher /more stringent requirements (e.g. Silver, Gold or Platinum LEED Certification) and such higher initiatives are welcomed and encouraged, but without compromising on the critical/ mandatory EHS requirements.

Scope

The scope of these regulations covers all developments under the jurisdiction of Dubai World. Commercial and residential /mixed use facilities are targeted primarily while for Industrial developments, these regulations will be applied on a case-to-case basis depending on EHS assessment.

Continuous Improvement

As in the case of any Management system or Process, while the Current EHS Regulations incorporate basic requirements for Green Building Certification, all stakeholders have pledged the need for Continuous Improvement and dynamism in the Regulations as the concept and practices mature.

Operational Sustainability

EHS, as a path breaking initiative, also necessitates that annually, all Green Certified Buildings shall need to ensure that their developments/buildings are "operationally sustainable" and meets the objectives for which they were designed/ established. It shall remain the sole responsibility of the client to annually provide full evidence of operational compliance to Green Building Requirements and provide evidence (in the form of 3rd. party Certification from their Certifying bodies) annually in this regard.

Sustainable Development

The concept of sustainable development implies, first, the integration of environmental issues with the imperatives of economic development in order to meet the immediate needs of populations today without undermining the aspirations of future generations.

Sustainable development can only be achieved in a long-term perspective. However, this cannot be done reactively, but rather through applying the principles of proactive and strategic planning and management. It is therefore essential to establish clear principles at all levels of participation and decision-making, together with clear objectives and measures that are part of a long-term approach.

Green Buildings Introduction & Principles

The design, construction, and maintenance of buildings have a tremendous impact on our environment and our natural resources. The challenge will be to build them smart, so they use a minimum of nonrenewable energy, produce a minimum of pollution, and cost a minimum of energy dollars, while increasing the comfort, health, and safety of the people who live and work in them.

Traditional building practices often overlook the interrelationships between a building, its components, its surroundings, and its occupants. "Typical" buildings consume more of our resources than necessary, negatively impact the environment, and generate a large amount of waste. Often, these buildings are costly to operate in terms of energy and water consumption. And they can result in poor indoor air quality, which can lead to health problems.

Green building practices offer an opportunity to create environmentally-sound and resource-efficient buildings by using an integrated approach to design. Green buildings promote resource conservation, including energy efficiency, renewable energy, and water conservation features; consider environmental impacts and waste minimization; create a healthy and comfortable environment; reduce operation and maintenance costs; and address issues such as historical preservation, access to public transportation and other community infrastructure systems. The entire life-cycle of the building and its components is considered, as well as the economic and environmental impact and performance.

More and more designers, builders, and building owners are becoming interested and involved in green building. Worldwide, programs encouraging green building are growing and reporting successes, while hundreds of demonstration projects and private buildings provide tangible examples of what green building can accomplish in terms of comfort, aesthetics, and energy and resource efficiency.

Energy Efficiency and Renewable Energy Resources

Commercially available, cost-effective energy technologies could reduce overall energy consumption and implement strategies such as proper sitting and airtight construction, as well as installing energy-efficient equipment and appliances and renewable energy systems. Such technologies can reduce the amount of energy your building needs to operate and to keep its occupants comfortable.

Environmental Impact

The built environment has had a tremendous impact on the environment. However, your building can interact more positively with the environment if you pay special attention to preserving the site’s integrity and natural characteristics, landscaping appropriately, and selecting materials that have lower embodied energy and those that are produced locally.

Resource Conservation

Conserving resources is a cornerstone of green building techniques. There are many ways to conserve resources during the building process. For example, selecting materials that have at least some recycled content can conserve natural resources and virgin materials. Minimizing construction waste can ease the impact on landfills and resources. Installing water- and energy-efficient products can conserve resources

while reducing operating costs. Choosing a green (plant-covered) roof can reduce energy use, cool urban heat islands, and prevent storm water runoff, as well as contributing to wildlife habitat and air quality.

Indoor Air Quality

Energy-efficient buildings are more airtight and therefore hold greater potential for indoor air quality problems, especially if not properly ventilated. Building products can contribute to poor air quality, but these potential problems can be reduced by selecting materials lower in chemicals and toxins, and installing mechanical ventilation systems to ensure an adequate fresh air supply.

Community Issues

Placing green building projects within easy access of public transportation, medical facilities, shopping areas, and recreational facilities decreases the need for automobiles and encourages bicycling and walking. In addition, successful green buildings blend into the community, preserving natural and historical characteristics, and will utilize existing infrastructure in order to reduce sprawl. Co housing represents one approach to creating a community of green buildings.

What Makes a Building Green?

Summarizing the above criteria, broadly, what is intended is:

- Minimum disturbance to site conditions
- Efficient use of Water and Water Recycling
- Use of Energy Efficient and Eco-Friendly Equipment
- Use of Renewable Energy
- Use of Recycled & Environmental Friendly Building Material
- Use of Non-Toxic and recycled/recyclable Materials
- Indoor Air Quality for Human Safety and Comfort
- Effective Controls and Building Management Systems

What Are the Economic Benefits of Green Buildings?

A green building may cost more up front, but saves through lower operating costs over the life of the building. The green building approach applies a project life cycle cost analysis for determining the appropriate up-front expenditure. This analytical method calculates costs over the useful life of the asset. These and other cost savings can only be fully realized when they are incorporated at the project's conceptual design phase with the assistance of an integrated team of professionals. The integrated systems approach ensures that the building is designed as one system rather than a collection of stand-alone systems. Some benefits, such as improving occupant health, comfort, productivity, reducing pollution and landfill waste are not easily quantified. For this reason, consider setting aside a small portion of the building budget to cover differential costs associated with less tangible green building benefits or to cover the cost of researching and analyzing green building options. Even with a tight budget, many green building measures can be incorporated with minimal or zero increased up-front costs and they can yield enormous savings

Conclusion

We stand at a crossroads. The decisions made by national governments, business leaders and individuals today will determine the extent of global climate change and the capacity of communities and countries to adapt to its impacts.

Decisions related to the future production and use of energy and water will be especially critical given the future needs of the region. The challenge before us is therefore clear—how will we meet resource needs and development aspirations while reducing greenhouse gas emissions and responding to current and future climatic changes? PCFC has taken up the challenge under the directives of His Highness Sheikh Mohammed bin Rashid Al Maktoum, UAE Vice President and Prime Minister and Ruler of Dubai. We hence present to you the following Regulations effective from January, 2008 for implementation for all projects under Dubai World. Also prepared and available, is a guideline document especially for industrial development in Economic Zones World that outlines various facets of Sustainable Development.

EHS Green Building – New Development Regulations

SS Prerequisite 1: Construction Activity Pollution Prevention <EHS MANDATORY> Required

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

Requirements
Create and implement an Erosion and Sedimentation Control (ESC) Plan for all construction activities associated with the project. The ESC Plan shall conform to local erosion and sedimentation control standards and codes. The Plan shall describe the measures implemented to accomplish the following objectives:
- Prevent loss of soil during construction by storm water runoff 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.

Potential Technologies & Strategies
Create an Erosion and Sedimentation Control Plan during the design phase of the project. Consider employing strategies such as temporary and permanent seeding, mulching, earth dikes, silt fencing, sediment traps and sediment basins.

SS Credit 1: Site Selection <EHS MANDATORY>
1 Point

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

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

a) Prime farmland as identified by Dubai Municipality.
b) Previously undeveloped land whose elevation is lower than 5 feet above the elevation of the 100-year flood
c) Land that is specifically identified as habitat for any species of threatened or endangered lists
d) Within 100 feet of any wetlands 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
e) 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.
f) Land which prior to acquisition for the project was public parkland, unless land of equal or greater value as parkland is accepted in trade.

Potential Technologies & Strategies
During the site selection process, give preference to those sites that do not include sensitive site elements and restrictive 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.

SS Credit 2: Development Density & Community Connectivity
1 Point

Intent
Channel development to urban areas with existing infrastructure, protect greenfields and preserve habitat and natural resources.

Requirements
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 1/2 mile of a residential zone or neighborhood with an average density of 10 units per acre net AND within 1/2 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:
1) Bank; 2) Place of Worship; 3) Convenience Grocery; 4) Day Care; 5) Cleaners; 6) Fire Station; 7) Beauty; 8) Hardware; 9) Laundry; 10) Library; 11) Medical/Dental; 12) Senior Care Facility; 13) Park; 14) Pharmacy; 15) Post Office; 16) Restaurant; 17) School; 18) Supermarket; 19) Theater; 20) Community Center; 21) Fitness Center; 22) Museum.
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.

Potential Technologies & Strategies
During the site selection process, give preference to urban sites with pedestrian access to a variety of services.

SS Credit 3: Brownfield Redevelopment
1 Point

Intent
Rehabilitate damaged sites where development is complicated by environmental contamination, reducing pressure on undeveloped land.

Requirements
Develop on a site 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.

Potential Technologies & Strategies
During the site selection process, give preference to Brownfield sites. Identify tax incentives and property cost savings. Coordinate site development plans with remediation activity, as appropriate.

SS Credit 4.1: Alternative Transportation: Public Transportation Access
1 Point

Intent
Reduce pollution and land development impacts from automobile use.

Requirements
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.

Potential Technologies & Strategies
Perform a transportation survey of future building occupants to identify transportation needs. Site the building near mass transit.

SS Credit 4.2: Alternative Transportation: Bicycle Storage & Changing Rooms 1 Point

Intent
Reduce pollution and land development impacts from automobile use.

Requirements
For commercial or institutional buildings, provide secure bicycle racks and/or storage (within 200 yards of a building entrance) for 5% or more of all building users (measured at peak periods), AND, provide shower and changing facilities in the building, or within 200 yards of a building entrance, for 0.5% of Full-Time Equivalent (FTE) occupants.
OR
For residential buildings, provide covered storage facilities for securing bicycles for 15% or more of building occupants in lieu of changing/shower facilities.

Potential Technologies & Strategies
Design the building with transportation amenities such as bicycle racks and showering/changing facilities.

SS Credit 4.3: Alternative Transportation: Low Emitting & Fuel Efficient Vehicles - 1 Point

Intent
Reduce pollution and land development impacts from automobile use.

Requirements
OPTION 1
Provide low-emitting and fuel-efficient vehicles for 3% of Full-Time Equivalent (FTE) 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).
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.

Potential Technologies & Strategies
Provide transportation amenities such as alternative fuel refueling stations. Consider sharing the costs and benefits of refueling stations with neighbors.

SS Credit 4.4: Alternative Transportation: Parking Capacity <EHS MANDATORY>
1 Point

Intent
Reduce pollution and land development impacts from single occupancy vehicle use.

Requirements
OPTION 1 — NON-RESIDENTIAL
- Size parking capacity to meet, but not exceed, minimum local zoning requirements, 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.
"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.

Potential Technologies & Strategies
Minimize parking lot/garage size. Consider sharing parking facilities with adjacent buildings. Consider alternatives that will limit the use of single occupancy vehicles.

SS Credit 5.1: Site Development: Protect or Restore Habitat <EHS MANDATORY>
1 Point

Intent
Conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity.

Requirements
OPTION 1
On Greenfield sites, limit all site disturbance to 40 feet beyond the building perimeter; 10 feet beyond surface walkways, patios, surface parking and utilities less than 12 inches in diameter; 15 feet beyond primary roadway curbs and main utility branch trenches; and 25 feet beyond constructed areas with permeable surfaces (such as pervious paving areas, storm water detention facilities and playing fields) that require additional staging areas in order to limit compaction in the constructed area.
OR

OPTION 2
On previously developed or graded sites restore or protect a minimum of 50% of the site area (excluding the building footprint) with native or adapted vegetation. Native/adapted 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 earning 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.
Greenfield sites are those that are not previously developed or graded and remain in a natural state. Previously developed sites are those that previously contained buildings, roadways, parking lots, or were graded or altered by direct human activities.

Potential Technologies & Strategies
On Greenfield sites, perform a site survey to identify site elements and adopt a master plan for development of the project site. Carefully site the building to minimize disruption to existing ecosystems and design the building to minimize its footprint. Strategies include stacking the building program, tuck-under parking and sharing facilities with neighbors. Establish clearly marked construction boundaries to minimize disturbance of the existing site and restore previously degraded areas to their natural state. For previously developed sites, utilize local and regional governmental agencies, consultants, educational facilities, and native plant societies as resources for the selection of appropriate native or adapted plant materials. Prohibit plant materials listed as invasive or noxious weed species. Native/adapted plants require minimal or no irrigation following establishment, do not require active maintenance such as mowing or chemical inputs such as fertilizers, pesticides or herbicides, and provide habitat value and promote biodiversity through avoidance of monoculture plantings.

SS Credit 5.2: Site Development: Maximize Open Space <EHS MANDATORY> 1 Point

Intent
Provide a high ratio of open space to development footprint to promote biodiversity.

Requirements
OPTION 1
Reduce the development footprint (defined as the total area of the building footprint, hardscape, access roads and parking) and/or provide vegetated open space within the project boundary to exceed the local zoning's open space requirement for the site by 25%.
OR
OPTION 2
For areas with no local zoning requirements (e.g., some university campuses, military bases), provide vegetated open space area adjacent to the building that is equal to the building footprint.
OR
OPTION 3
Where a zoning ordinance exists, but there is no requirement for open space (zero), provide vegetated open space equal to 20% of the project's site area.
ALL OPTIONS:

- For projects located in urban areas that earn SS Credit 2, vegetated roof areas can contribute to credit compliance.
- For projects located in urban areas that earn SS Credit 2, pedestrian oriented hardscape areas can contribute to credit compliance. For such projects, a minimum of 25% of the open space counted must be vegetated.
- Wetlands or naturally designed ponds may count as open space if the side slope gradients average 1:4 (vertical: horizontal) or less and are vegetated.

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 a minimal footprint to minimize site

disruption. Strategies include stacking the building program, tuck-under parking and sharing facilities with neighbors to maximize open space on the site.

SS Credit 6.1: Storm water Design: Quantity Control <EHS MANDATORY> 1 Point

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

Requirements
CASE 1 — EXISTING IMPERVIOUSNESS IS LESS THAN OR EQUAL TO 50%
Implement a storm water 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- and two-year 24-hour design storms.
OR
Implement a storm water management plan that protects receiving stream channels from excessive erosion by implementing a stream channel protection strategy and quantity control strategies.
OR
CASE 2 — EXISTING IMPERVIOUSNESS IS GREATER THAN 50%
Implement a storm water management plan that results in a 25% decrease in the volume of storm water runoff from the two-year 24-hour design storm.
Potential Technologies & Strategies
Design the project site to maintain natural storm water flows by promoting infiltration. Specify vegetated roofs, pervious paving, and other measures to minimize impervious surfaces. Reuse storm water volumes generated for non-potable uses such as landscape irrigation, toilet and urinal flushing and custodial uses.

SS Credit 6.2: Storm water Design: Quality Control <EHS MANDATORY> 1 Point

Intent
Limit disruption and pollution of natural water flows by managing storm water runoff.

Requirements
Implement a storm water management plan that reduces impervious cover, promotes infiltration, and captures and treats the storm water runoff from 90% of the average annual 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.
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 thereby reducing pollutant loadings. Use sustainable design strategies (e.g., Low Impact Development, Environmentally Sensitive Design) to design integrated natural and mechanical treatment systems such as constructed wetlands, vegetated filters, and open channels to treat storm water runoff.

SS Credit 7.1: Heat Island Effect: Non-Roof <EHS MANDATORY>
1 Point

Intent

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

Requirements

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)[2] of at least 29
- Open grid pavement system

OR

OPTION 2

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

Potential Technologies & Strategies

Shade constructed surfaces on the site with landscape features and utilize high-reflectance materials for hardscape. Consider replacing constructed surfaces (i.e. 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.

[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. Default values for some materials will be available in the LEED for New Construction v2.2 Reference Guide.

SS Credit 7.2: Heat Island Effect: Roof <EHS MANDATORY>
1 Point

Intent

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

Requirements

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.

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:

(Area of SRI Roof / 0.75) + (Area of vegetated roof / 0.5) >= Total Roof Area

Roof Type	Slope	SRI
Low-Sloped Roof	**≤ 2:12**	**78**
Steep-Sloped Roof	**> 2:12**	**29**

[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 8: Light Pollution Reduction <EHS MANDATORY>
1 Point

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.

Requirements

FOR INTERIOR LIGHTING

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

OR

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

AND

FOR EXTERIOR LIGHTING

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, 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 foot-candles 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).

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 foot-candles at the site boundary and no greater than 0.01 horizontal foot-candles 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 foot-candles at the site boundary and no greater than 0.01 horizontal foot-candles 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 foot-candles at the site boundary and no greater than 0.01 horizontal foot-candles 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.

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 luminaires, low-reflectance surfaces and low-angle spotlights.

Water Efficiency

WE Credit 1.1: Water Efficient Landscaping: Reduce by 50% <EHS MANDATORY>

1 Point

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

Requirements
Reduce potable water consumption for irrigation by 50% from a calculated baseline case. Reductions shall be attributed to any combination of the following items:

- Plant species factor
- Irrigation efficiency
- Use of captured rainwater
- Use of recycled wastewater
- Use of water treated and conveyed by a public agency specifically for non-potable uses

Potential Technologies & Strategies
Perform a soil/climate analysis to determine appropriate plant material and design the landscape with native or adapted plants to reduce or eliminate irrigation requirements. Where irrigation is required, use high-efficiency equipment and/or climate-based controllers.

WE Credit 1.2: Water Efficient Landscaping: No Potable Water Use or No Irrigation - 1 Point in addition to WE Credit 1.1

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.

Requirements
Achieve WE Credit 1.1.and:
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.
Potential Technologies & Strategies
Perform a soil/climate analysis to determine appropriate landscape types and design the landscape with indigenous plants to reduce or eliminate irrigation requirements. Consider using storm water, greywater, and/or condensate water for irrigation.

WE Credit 2: Innovative Wastewater Technologies <EHS MANDATORY>
1 Point

Intent
Reduce generation of wastewater and potable water demand, while increasing the local aquifer recharge.

Requirements
OPTION 1
Reduce potable water use for building sewage conveyance by 50% through the use of water-conserving fixtures (water closets, urinals) or non-potable water (captured rainwater, recycled greywater, and on-site or municipally treated wastewater).
OR
OPTION 2
Treat 50% of wastewater on-site to tertiary standards. Treated water must be infiltrated or used on-site.
Potential Technologies & Strategies
Specify high-efficiency fixtures and dry fixtures such as composting toilet systems and non-water using urinals to reduce wastewater volumes. Consider reusing storm water or greywater for sewage conveyance or on-site wastewater treatment systems (mechanical and/or natural). Options for on-site wastewater treatment include packaged biological nutrient removal systems, constructed wetlands, and high-efficiency filtration systems.

WE Credit 3.1: Water Use Reduction: 20% Reduction <EHS MANDATORY>
1 Point

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

Requirements
Employ strategies that in aggregate use 20% less water than the water use baseline calculated for the building (not including irrigation). Calculations are based on estimated occupant usage and shall include only the following fixtures (as applicable to the building): water closets, urinals, lavatory faucets, showers and kitchen sinks.
Potential Technologies & Strategies
Use high-efficiency fixtures, dry fixtures such as composting toilet systems and non-water using urinals, and occupant sensors to reduce the potable water demand. Consider reuse of storm water and greywater for non-potable applications such as toilet and urinal flushing and custodial uses.

WE Credit 3.2: Water Use Reduction: 30% Reduction <EHS MANDATORY>
1 Point in addition to WE Credit 3.1

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

Requirements
Employ strategies that in aggregate use 30% less water than the water use baseline calculated for the building (not including irrigation) after meeting the Energy Policy Act of 1992 fixture performance requirements. Calculations are based on estimated occupant usage and shall include only the following fixtures (as applicable to the building): water closets, urinals, lavatory faucets, showers and kitchen sinks.
Potential Technologies & Strategies

Use high-efficiency fixtures, dry fixtures such as composting toilets and waterless urinals, and occupant sensors to reduce the potable water demand. Consider reuse of storm water and greywater for non-potable applications such as toilet and urinal flushing, mechanical systems and custodial uses.

EA Prerequisite 1: Fundamental Commissioning of the Building Energy Systems Required <EHS MANDATORY>

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.

Benefits of Commissioning

Benefits of commissioning include reduced energy use, lower operating costs, reduced contractor callbacks, better building documentation, improved occupant productivity, and verification that the systems perform in accordance with the owner's project requirements.

Requirements

The following commissioning process activities shall be completed by the commissioning team, in accordance with the LEED for New Construction 2.2 Reference Guide.

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.
6) Complete a summary commissioning report

Commissioned 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.)

Potential Technologies & Strategies

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, building envelope systems, and other systems in the scope of the commissioning plan as appropriate. The building envelope is an important

component of a facility which impacts energy consumption, occupant comfort and indoor air quality. While it is not required to be commissioned by LEED, an owner can receive significant financial savings and reduced risk of poor indoor air quality by including building envelope commissioning.
The LEED for New Construction 2.2 Reference Guide provides guidance on the rigor expected for this prerequisite for the following:

- Owner's project requirements
- Basis of design
- Commissioning plan
- Commissioning specification
- Performance verification documentation
- Commissioning report

EA Prerequisite 2: Minimum Energy Performance <EHS MANDATORY> Required

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

Requirements
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).
- NOTE: LEED for New Construction projects registered after June 26, 2007 must exceed the minimum energy performance requirements of ASHRAE/IESNA Standard 90.1-2004. See EAc1 for the new requirements.

Potential Technologies & Strategies
Design the building envelope, HVAC, lighting, and other systems to maximize energy performance. The ASHRAE 90.1-2004 User's Manual contains worksheets that can be used to document compliance with this prerequisite. For projects pursuing points under EA Credit 1, the computer simulation model may be used to confirm satisfaction of this prerequisite.

If a local code has demonstrated quantitative and textual equivalence following, at a minimum, the U.S. Department of Energy standard process for commercial energy code determination, then it may be used to satisfy this prerequisite in lieu of ASHRAE 90.1-2004. Details on the DOE process for commercial energy code determination can be found at www.energycodes.gov/implement/determinations_com.stm.

EA Prerequisite 3: Fundamental Refrigerant Management <EHS MANDATORY> Required

Intent
Reduce ozone depletion.

Requirements
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. Phase-out plans extending beyond the project completion date will be considered on their merits.

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.

EA Credit 1: Optimize Energy Performance <EHS MANDATORY> 1–10 Points

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.

Requirements
Select one of the three compliance path options described below. Project teams documenting achievement using any of the three options are assumed to be in compliance with EA Prerequisite 2.
WHOLE BUILDING ENERGY SIMULATION (1–10 Points) – 4 points EHS Mandatory.
Demonstrate a percentage improvement in the proposed building performance rating compared to the baseline building performance rating per ASHRAE/IESNA Standard 90.1-2004 (without amendments) by a whole building project simulation using the Building Performance Rating Method in Appendix G of the Standard. The minimum energy cost savings percentage for each point threshold is as follows:

New Buildings	Existing Building Renovations	Points
10.5%*	3.5%	1
14%	7%	2
17.5%	10.5%	3
21%	**14%**	**4**
24.5%	17.5%	5
28%	21%	6
31.5%	24.5%	7
35%	28%	8
38.5%	31.5%	9
42%	35%	10

* Note: Only projects registered prior to June 26, 2007 may pursue 1 point under EAc1.
Appendix G of Standard 90.1-2004 requires that the energy analysis done for the Building Performance Rating Method include ALL of the energy costs within and associated with the building project. To achieve points using this credit, the proposed design—

- must comply with the mandatory provisions (Sections 5.4, 6.4, 7.4, 8.4, 9.4 and 10.4) in Standard 90.1-2004 (without amendments);
- must include all the energy costs within and associated with the building project; and
- Must be compared against a baseline building that complies with Appendix G to Standard 90.1-2004 (without amendments). The default process energy cost is 25% of the total energy cost for the baseline building. For buildings where the process energy cost is less than 25% of the baseline building energy cost, the LEED submittal must include supporting documentation substantiating that process energy inputs are appropriate.

For the purpose of this analysis, process energy is considered to include, but is not limited to, office and general miscellaneous equipment, computers, elevators and escalators, kitchen cooking and refrigeration, laundry washing and drying, lighting exempt from the lighting power allowance (e.g. lighting integral to medical equipment) and other (e.g. waterfall pumps). Regulated (non-process) energy includes lighting (such as for the interior, parking garage, surface parking, façade, or building grounds, except as noted above), HVAC (such as for space heating, space cooling, fans, pumps, toilet exhaust, parking garage ventilation, kitchen hood exhaust, etc.), and service water heating for domestic or space heating purposes.
For EA Credit 1, process loads shall be identical for both the baseline building performance rating and for the proposed building performance rating. However, project teams may follow the Exceptional Calculation

Method (ASHRAE 90.1-2004 G2.5) to document measures that reduce process loads. Documentation of process load energy savings shall include a list of the assumptions made for both the base and proposed design, and theoretical or empirical information supporting these assumptions.

Potential Technologies & Strategies
Design the building envelope and systems to maximize energy performance. Use a computer simulation model to assess the energy performance and identify the most cost-effective energy efficiency measures. Quantify energy performance as compared to a baseline building.
If a local code has demonstrated quantitative and textual equivalence following, at a minimum, the U.S. Department of Energy standard process for commercial energy code determination, then the results of that analysis may be used to correlate local code performance with ASHRAE 90.1-2004. Details on the DOE process for commercial energy code determination can be found at www.energycodes.gov/implement/determinations_com.stm.

EA Credit 2: On-Site Renewable Energy <EHS MANDATORY>
1–3 Points

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.

Requirements
Use on-site renewable energy systems to offset building energy cost. Calculate project performance by expressing the energy produced by the renewable systems as a percentage of the building annual energy cost and using the table below to determine the number of points achieved. (2.5% is mandatory by EHS)
Use the building annual energy cost calculated in EA Credit to determine the estimated electricity use. (Table of use for different building types is provided in the LEED Reference Guide.)

%	Renewable Energy Points
2.5%	**1**
7.5%	2
12.5%	3

Potential Technologies & Strategies
Assess the project for non-polluting and renewable energy potential including solar, wind, geothermal, low-impact hydro, biomass and bio-gas strategies. When applying these strategies, take advantage of net metering with the local utility.

EA Credit 3: Enhanced Commissioning <EHS MANDATORY>
1 Point

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

Requirements
Implement, or have a contract in place to implement, the following additional commissioning process activities in addition to the requirements of EA Prerequisite 1 and in accordance with the LEED for New Construction 2.2 Reference Guide:

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.
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.

Potential Technologies & Strategies

Although it is preferable that the CxA be contracted by the Owner, 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 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 4: Enhanced Refrigerant Management <EHS MANDATORY>
1 Point

Intent

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

Requirements

OPTION 1

Do not use refrigerants.

OR

OPTION 2

Select refrigerants and HVAC&R 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:

$$LCGWP + LCODP \times 10^5 \leq 100$$

Where:
$LCODP = [ODP_r \times (Lr \times Life + Mr) \times Rc]/Life$
$LCGWP = [GWPr \times (Lr \times Life + Mr) \times Rc]/Life$
LCODP: Lifecycle Ozone Depletion Potential (lbCFC11/Ton-Year)
LCGWP: Lifecycle Direct Global Warming Potential ($lbCO_2$/Ton-Year)
GWPr: Global Warming Potential of Refrigerant (0 to 12,000 $lbCO_2$/lbr)
ODPr: Ozone Depletion Potential of Refrigerant (0 to 0.2 lbCFC11/lbr)
Lr: Refrigerant Leakage Rate (0.5% to 2.0%; default of 2% unless otherwise demonstrated)
Mr: End-of-life Refrigerant Loss (2% to 10%; default of 10% unless otherwise demonstrated)
Rc: Refrigerant Charge (0.5 to 5.0 lbs of refrigerant per ton of cooling capacity)
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:

$$[\ \Sigma\ (LCGWP + LCODP \times 10^5) \times Qunit\ ]\ /\ Qtotal \leq 100$$

Where:
Qunit = Cooling capacity of an individual HVAC or refrigeration unit (Tons)
Qtotal = 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).

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 minimizes 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 5: Measurement & Verification <EHS MANDATORY>
1 Point

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

- Develop and implement a Measurement & Verification (M&V) Plan consistent with Option D: Calibrated Simulation (Savings Estimation Method 2), or Option B: Energy Conservation Measure Isolation, as specified in the *International Performance Measurement & Verification Protocol (IPMVP) Volume III: Concepts and Options for Determining Energy Savings in New Construction, April, 2003.*
- The M&V period shall cover the life span of the building.

Potential Technologies & Strategies
Develop an M&V Plan to evaluate 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.
While the IPMVP describes specific actions for verifying savings associated with energy conservation measures (ECMs) and strategies, this LEED credit expands upon typical IPMVP M&V objectives. M&V activities should not necessarily be confined to energy systems where ECMs or energy conservation strategies

have been implemented. 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.

It shall be noted that this point pertains mainly to "Operational Sustainability" and shall need to be ensured by the End-User during the operations as stated in the EHS Approval Procedure.

EA Credit 6: Green Power
1 Point

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

Requirements
Provide at least 35% of the building's electricity from renewable sources by engaging in at least a two-year renewable energy contract. Renewable sources are as defined by the Center for Resource Solutions (CRS) Green-e products certification requirements.
DETERMINE THE BASELINE ELECTRICITY USE
Use the annual electricity consumption from the results of EA Credit 1.
OR
Use the Department of Energy (DOE) Commercial Buildings Energy Consumption Survey (CBECS) database to determine the estimated electricity use.

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 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 EA Credit 6 requirements.

Materials & Resources

MR Prerequisite 1: Storage & Collection of Recyclables <EHS MANDATORY>
Required

Intent
Facilitate the reduction of waste generated by building occupants that is hauled to and disposed of in landfills.

Requirements
Provide an easily accessible area that serves the entire building and is dedicated to the collection and storage of non-hazardous materials for recycling, including (at a minimum) paper, corrugated cardboard, glass, plastics and metals.

Potential Technologies & Strategies
Coordinate the size and functionality of the recycling areas with the anticipated collection services for glass, plastic, office paper, newspaper, cardboard and organic wastes to maximize the effectiveness of the dedicated areas. Consider employing cardboard balers, aluminum can crushers, recycling chutes and collection bins at individual workstations to further enhance the recycling program.

MR Credit 1.1: Building Reuse: Maintain 75% of Existing Walls, Floors & Roof
1 Point

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.

Requirements

Maintain at least 75% (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. If the project includes an addition to an existing building, this credit is not applicable if the square footage of the addition is more than 2 times the square footage of the existing building.

Potential Technologies & Strategies

Consider reuse of existing, previously occupied buildings, including structure, envelope and 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.

MR Credit 1.2: Building Reuse - Maintain 95% of Existing Walls, Floors & Roof
1 Point in addition to MR Credit 1.1

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.

Requirements

Maintain an additional 20% (95% 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 re-mediated as a part of the project scope shall be excluded from the calculation of the percentage maintained. If the project includes an addition to an existing building, this credit is not applicable if the square footage of the addition is more than 2 times the square footage of the existing building.

Potential Technologies & Strategies

Consider reuse of existing buildings, including structure, envelope and 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.

MR Credit 1.3: Building Reuse: Maintain 50% of Interior Non-Structural Elements
1 Point

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.

Requirements

Use existing interior non-structural elements (interior walls, doors, floor coverings and ceiling systems) in at least 50% (by area) of the completed building (including additions). If the project includes an addition to an

existing building, this credit is not applicable if the square footage of the addition is more than 2 times the square footage of the existing building.

Potential Technologies & Strategies
Consider reuse of existing buildings, including structure, envelope and interior non-structural elements. Remove elements that pose contamination risk to building occupants and upgrade components that would improve energy and water efficiency, such as mechanical systems and plumbing fixtures. Quantify the extent of building reuse.

MR Credit 2.1: Construction Waste Management: Divert 50% From Disposal
1 Point <EHS MANDATORY>

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.

Requirements
Recycle and/or salvage at least 50% of non-hazardous construction and demolition debris. Develop and implement a construction waste management plan that, at a minimum, identifies the materials to be diverted from disposal and whether the materials will be sorted on-site or co-mingled. Excavated soil and land-clearing debris do not contribute to this credit. Calculations can be done by weight or volume, but must be consistent throughout.

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 tile, concrete, plastic, clean wood, glass, gypsum wallboard, carpet and insulation. Designate a specific area(s) on the construction site for segregated or comingled collection of recyclable materials, and track recycling efforts throughout the construction process. Identify construction haulers and recyclers to handle the designated materials. Note that diversion may include donation of materials to charitable organizations and salvage of materials on-site.

MR Credit 2.2: Construction Waste Management: Divert 75% From Disposal
1 Point in addition to MR Credit 2.1

Intent
Divert construction and demolition debris from disposal in landfills and incinerators. Redirect recyclable recovered resources back to the manufacturing process. Redirect reusable materials to appropriate sites.

Requirements
Recycle and/or salvage an additional 25% beyond MR Credit 2.1 (75% total) of non-hazardous construction and demolition debris. Excavated soil and land-clearing debris do not contribute to this credit. Calculations can be done by weight or volume, but must be consistent throughout.

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 tile, concrete, plastic, clean wood, glass, gypsum wallboard, carpet and insulation. Designate a specific area(s) on the construction site for segregated or commingled collection of recyclable materials, and track recycling efforts throughout the construction process. Identify construction haulers and recyclers to handle the designated

materials. Note that diversion may include donation of materials to charitable organizations and salvage of materials on-site.

MR Credit 3.1: Materials Reuse: 5%
1 Point

Intent
Reuse building materials and products in order to reduce demand for virgin materials and to reduce waste, thereby reducing impacts associated with the extraction and processing of virgin resources.

Requirements
Use salvaged, refurbished or reused materials such that the sum of these materials constitutes at least 5%, based on cost, of the total value of materials on the project.
Mechanical, electrical and plumbing components and specialty items such as elevators and equipment shall not be included in this calculation. Only include materials permanently installed in the project. Furniture may be included, providing it is included consistently in MR Credits 3–7.

Potential Technologies & Strategies
Identify opportunities to incorporate salvaged materials into building design and research potential material suppliers. Consider salvaged materials such as beams and posts, flooring, paneling, doors and frames, cabinetry and furniture, brick and decorative items.

MR Credit 3.2: Materials Reuse: 10%
1 Point in addition to MR Credit 3.1

Intent
Reuse building materials and products in order to reduce demand for virgin materials and to reduce waste, thereby reducing impacts associated with the extraction and processing of virgin resources.

Requirements
Use salvaged, refurbished or reused materials for an additional 5% beyond MR Credit 3.1 (10% total, based on cost).
Mechanical, electrical and plumbing components and specialty items such as elevators and equipment shall not be included in this calculation. Only include materials permanently installed in the project. Furniture may be included, providing it is included consistently in MR Credits 3–7.

Potential Technologies & Strategies
Identify opportunities to incorporate salvaged materials into building design and research potential material suppliers. Consider salvaged materials such as beams and posts, flooring, paneling, doors and frames, cabinetry and furniture, brick and decorative items.

MR Credit 4.1: Recycled Content: 10% (post-consumer + 1/2 pre-consumer)
1 Point <EHS MANDATORY>

Intent
Increase demand for building products that incorporate recycled content materials, thereby reducing impacts resulting from extraction and processing of virgin materials.

Requirements
Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 10% (based on cost) of the total value of the materials in 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. Mechanical, electrical and plumbing components and specialty items such as elevators shall not be included in this calculation. Only include materials permanently installed in the project. Furniture may be included, providing it is included consistently in MR Credits 3–7. Recycled content shall be defined in accordance with the International Organization of Standards document, *ISO 14021—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.

Potential Technologies & Strategies

Establish a project goal for recycled content materials and identify material suppliers that can achieve this goal. During construction, ensure that the specified recycled content materials are installed. Consider a range of environmental, economic and performance attributes when selecting products and materials.

MR Credit 4.2: Recycled Content: 20% (post-consumer + 1/2 pre-consumer) 1 Point in addition to MR Credit 4.1

Intent

Increase demand for building products that incorporate recycled content materials, thereby reducing the impacts resulting from extraction and processing of virgin materials.

Requirements

Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes an additional 10% beyond MR Credit 4.1 (total of 20%, based on cost) of the total value of the materials in 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.

Mechanical, electrical and plumbing components and specialty items such as elevators shall not be included in this calculation. Only include materials permanently installed in the project. Furniture may be included, providing it is included consistently in MR Credits 3–7.

Recycled content shall be defined in accordance with the International Organization of Standards document, *ISO 14021—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.

Potential Technologies & Strategies

Establish a project goal for recycled content materials and identify material suppliers that can achieve this goal. During construction, ensure that the specified recycled content materials are installed. Consider a range of environmental, economic and performance attributes when selecting products and materials.

MR Credit 5.1: Regional Materials: 10% Extracted, Processed & Manufactured Regionally - 1 Point

Intent
Increase demand for building materials and products that are extracted and manufactured within the region, thereby supporting the use of indigenous resources and reducing the environmental impacts resulting from transportation.

Requirements
Use building materials or products that have been extracted, harvested or recovered, as well as manufactured, within 500 miles of the project site for a minimum of 10% (based on cost) of the total materials value. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
Mechanical, electrical and plumbing components and specialty items such as elevators and equipment shall not be included in this calculation. Only include materials permanently installed in the project. Furniture may be included, providing it is included consistently in MR Credits 3–7.

Potential Technologies & Strategies
Establish a project goal for locally sourced materials, and identify materials and material suppliers that can achieve this goal. During construction, ensure that the specified local materials are installed and quantify the total percentage of local materials installed. Consider a range of environmental, economic and performance attributes when selecting products and materials

MR Credit 5.2: Regional Materials: 20% Extracted, Processed & Manufactured Regionally : 1 Point in addition to MR Credit 5.1

Intent
Increase demand for building materials and products that are extracted and manufactured within the region, thereby supporting the use of indigenous resources and reducing the environmental impacts resulting from transportation.

Requirements
Use building materials or products that have been extracted, harvested or recovered, as well as manufactured, within 500 miles of the project site for an additional 10% beyond MR Credit 5.1 (total of 20%, based on cost) of the total materials value. If only a fraction of the material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.

Potential Technologies & Strategies
Establish a project goal for locally sourced materials and identify materials and material suppliers that can achieve this goal. During construction, ensure that the specified local materials are installed. Consider a range of environmental, economic and performance attributes when selecting products and materials.

MR Credit 6: Rapidly Renewable Materials
1 Point

Intent
Reduce the use and depletion of finite raw materials and long-cycle renewable materials by replacing them with rapidly renewable materials.

Requirements
Use rapidly renewable building materials and products (made from plants that are typically harvested within a ten-year cycle or shorter) for 2.5% of the total value of all building materials and products used in the project, based on cost.

Potential Technologies & Strategies
Establish a project goal for rapidly renewable materials and identify products and suppliers that can support achievement of this goal. Consider materials such as bamboo, wool, cotton insulation, agrifiber, linoleum, wheat board, strawboard and cork. During construction, ensure that the specified renewable materials are installed.

MR Credit 7: Certified Wood
1 Point

Intent
Encourage environmentally responsible forest management.

Requirements
Use a minimum of 50% of wood-based materials and products, which are certified in accordance with the **Forest Stewardship Council's (FSC) Principles and Criteria**, for wood building components. These components include, but are not limited to, structural framing and general dimensional framing, flooring, sub-flooring, wood doors and finishes.
Only include materials permanently installed in the project. Furniture may be included, providing it is included consistently in MR Credits 3–7.

Potential Technologies & Strategies
Establish a project goal for FSC-certified wood products and identify suppliers that can achieve this goal. During construction, ensure that the FSC-certified wood products are installed and quantify the total percentage of FSC-certified wood products installed.

Indoor Environmental Quality

EQ Prerequisite 1: Minimum IAQ Performance : Required <EHS MANDATORY>

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

Requirements
Meet the minimum requirements of Sections 4 through 7 of ASHRAE 62.1-2004, Ventilation for Acceptable Indoor Air Quality. 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.

Potential Technologies & Strategies
Design ventilation systems to meet or exceed the minimum outdoor air ventilation rates as described in the ASHRAE standard. Balance the impacts of ventilation rates on energy use and indoor air quality to optimize for energy efficiency and occupant health. Use the ASHRAE 62 Users Manual for detailed guidance on meeting the referenced requirements.

EQ Prerequisite 2: Environmental Tobacco Smoke (ETS) Control <EHS MANDATORY>
Required

Intent
Minimize exposure of building occupants, indoor surfaces, and ventilation air distribution systems to Environmental Tobacco Smoke (ETS).
Requirements
OPTION 1

- Prohibit smoking in the building.
- Locate any exterior designated smoking areas at least 25 feet away from entries, outdoor air intakes and operable windows.

OR
OPTION 2

- Prohibit smoking in the building except in designated smoking areas.
- Locate any exterior designated smoking areas at least 25 feet away from entries, outdoor air intakes and operable windows.
- Locate designated smoking rooms 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 gauge).
- Performance of the smoking room differential air pressures shall be verified 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. The testing will be conducted 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.

OR
OPTION 3 (For residential buildings only)

- Prohibit smoking in all common areas of the building.
- Locate any exterior designated smoking areas at least 25 feet away from entries, outdoor air intakes and operable windows opening to common areas.
- Minimize uncontrolled pathways for ETS transfer between individual residential units by sealing penetrations in walls, ceilings and floors in the residential units, and by sealing vertical chases adjacent to the units.
- All doors in the residential units leading to common hallways shall be weather-stripped to minimize air leakage into the hallway.
- If the common hallways are pressurized with respect to the residential units then doors in the residential units leading to the common hallways need not be weather-stripped provided that the positive differential pressure is demonstrated as in Option 2 above, considering the residential unit as the smoking room. Acceptable sealing of residential units shall be demonstrated by a blower door test conducted in accordance with ANSI/ASTM-E779-03, Standard Test Method for Determining Air Leakage Rate By Fan Pressurization, AND use the progressive sampling methodology defined in Chapter 4 (Compliance Through Quality Construction) of the Residential Manual for Compliance with California's 2001 Energy Efficiency Standards (www.energy.ca.gov/title24/residential_manual). Residential units must demonstrate less than 1.25 square inches leakage area per 100 square feet of enclosure area (i.e. sum of all wall, ceiling and floor areas).

Potential Technologies & Strategies
Prohibit smoking in commercial buildings or effectively control the ventilation air in smoking rooms. For residential buildings, prohibit smoking in common areas, design building envelope and systems to minimize ETS transfer among dwelling units

EQ Credit 1: Outdoor Air Delivery Monitoring <EHS MANDATORY>
1 Point

Intent
Provide capacity for ventilation system monitoring to help sustain occupant comfort and well-being.

Requirements
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 set point, 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 1000 sq.ft.). CO_2 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 15% of the design minimum outdoor air rate, as defined by ASHRAE 62.1-2004.

FOR NATURALLY VENTILATED SPACES
Monitor CO_2 concentrations within all naturally ventilated spaces. CO_2 monitoring shall be located within the room between 3 feet and 6 feet above the floor. One CO_2 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.
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.

EQ Credit 2: Increased Ventilation
1 Point

Intent
Provide additional outdoor air ventilation to improve indoor air quality for improved occupant comfort, well-being and productivity.

Requirements
FOR MECHANICALLY VENTILATED SPACES

- Increase breathing zone outdoor air ventilation rates to all occupied spaces by at least 30% above the minimum rates required by ASHRAE Standard 62.1-2004 as determined by EQ Prerequisite 1.

FOR NATURALLY VENTILATED SPACES
Design natural ventilation systems for occupied spaces 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, for at least 90% of occupied spaces.

Potential Technologies & Strategies
For Mechanically ventilated Spaces: Use heat recovery, where appropriate, to minimize the additional energy consumption associated with higher ventilation rates.
For Naturally ventilated Spaces: 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.

EQ Credit 3.1: Construction IAQ Management Plan: During Construction <EHS MANDATORY>

1 Point

Intent
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.

Requirements
Develop and implement an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building as follows:

- During construction meet or exceed the recommended Control Measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 1995, Chapter 3.
- Protect stored on-site or installed absorptive materials from moisture damage.
- If permanently installed air handlers are used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 shall be used at each return air grille, as determined by ASHRAE 52.2-1999. Replace all filtration media immediately prior to occupancy.

Potential Technologies & Strategies
Adopt an IAQ management plan 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 Indoor Environmental Quality 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 v2.2 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.

EQ Credit 3.2: Construction IAQ Management Plan: Before Occupancy
1 Point <EHS MANDATORY>

Intent
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.

Requirements
Develop and implement an Indoor Air Quality (IAQ) Management Plan for the pre-occupancy phase 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 F and 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 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 IAQ 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 additionally detailed in the Reference Guide.
- Demonstrate that the contaminant maximum concentrations listed below are not exceeded.

CONTAMINANT	MAXIMUM CONCENTRATION
Formaldehyde	50 parts per billion
Particulates (PM10)	50 micrograms per cubic meter
Total Volatile Organic Compounds (TVOC)	500 micrograms per cubic meter
* 4-Phenylcyclohexene (4-PCH)	6.5 micrograms per cubic meter
Carbon Monoxide (CO)	9 part per million and no greater than 2 parts per million above outdoor levels

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.

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.

Potential Technologies & Strategies

Prior to occupancy, perform a building flush-out or test the air contaminant levels in the building. The flush-out is often used where occupancy is not required immediately upon substantial completion of construction. IAQ testing can minimize schedule impacts but may be more costly. Coordinate with Indoor Environmental Quality Credits 3.1 and 5 to determine the appropriate specifications and schedules for filtration media.

EQ Credit 4.1: Low-Emitting Materials: Adhesives & Sealants <EHS MANDATORY>

1 Point

Intent

Reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants.

Requirements

All adhesives and sealants used on the interior of the building (defined as inside of the weatherproofing system and applied on-site) shall comply with the requirements of the following reference standards:

- Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management District (SCAQMD) Rule #1168. VOC limits are listed in the table below and correspond to an effective date of July 1, 2005 and rule amendment date of January 7, 2005.

Architectural Applications	**VOC Limit [g/L less water]**	**Specialty Applications**	**VOC Limit [g/L less water]**
Indoor Carpet Adhesives	50	PVC Welding	510
Carpet Pad Adhesives	50	CPVC Welding	490
Wood Flooring Adhesives	100	ABS Welding	325
Rubber Floor Adhesives	60	Plastic Cement Welding	250
Subfloor Adhesives	50	Adhesive Primer for Plastic	550
Ceramic Tile Adhesives	65	Contact Adhesive	80
VCT & Asphalt Adhesives	50	Special Purpose Contact Adhesive	250
Drywall & Panel Adhesives	50	Structural Wood Member Adhesive	140
Cove Base Adhesives	50	Sheet Applied Rubber Lining Operations	850
Multipurpose Construction Adhesives	70	Top & Trim Adhesive	250
Structural Glazing Adhesives		100	
Substrate Specific Applications	**VOC Limit [g/L less water]**	**Sealants**	**VOC Limit [g/L less water]**
Metal to Metal	30	Architectural	250
Plastic Foams	50	Nonmembrane Roof	300
Porous Material (except wood)	50	Roadway	250
Wood	30	Single-Ply Roof Membrane	450
Fiberglass	80	Other	420
Sealant Primers	**VOC Limit [g/L less water]**		
Architectural Non Porous	250		
Architectural Porous	775		
Other	750		

Aerosol Adhesives: Green Seal Standard for Commercial Adhesives GS-36 requirements in effect on October 19, 2000.

Aerosol Adhesives:VOC weight [g/L minus water]General purpose mist spray65% VOCs by weight General purpose web spray55% VOCs by weight Special purpose aerosol adhesives (all types) 70% VOCs by weight

Potential Technologies & Strategies

Specify low-VOC materials in construction documents. Ensure that VOC limits are clearly stated in each section of the specifications where adhesives and sealants are addressed. Common products to evaluate include: general construction adhesives, flooring adhesives, fire-stopping sealants, caulking, duct sealants, plumbing adhesives, and cove base adhesives.

EQ Credit 4.2: Low-Emitting Materials: Paints & Coatings
1 Point

Intent

Reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants.

Requirements

Paints and coatings used on the interior of the building (defined as inside of the weatherproofing system and applied on-site) shall comply with the following criteria:

- Architectural paints, coatings and primers applied to interior walls and ceilings: Do not exceed the VOC content limits established in Green Seal Standard GS-11, Paints, First Edition, May 20, 1993.
  - o Flats: 50 g/L
  - o Non-Flats: 150 g/L
- Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates: Do not exceed the VOC content limit of 250 g/L established in Green Seal Standard GC-03, Anti-Corrosive Paints, Second Edition, January 7, 1997.
- Clear wood finishes, floor coatings, stains, and shellacs applied to interior elements: Do not exceed the VOC content limits established in South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1, 2004.
  - o Clear wood finishes: varnish 350 g/L; lacquer 550 g/L
  - o Floor coatings: 100 g/L
  - o Sealers: waterproofing sealers 250 g/L; sanding sealers 275 g/L; all other sealers 200 g/L
  - o Shellacs: Clear 730 g/L; pigmented 550 g/L
  - o Stains: 250 g/L

Potential Technologies & Strategies

Specify low-VOC paints and coatings in construction documents. Ensure that VOC limits are clearly stated in each section of the specifications where paints and coatings are addressed. Track the VOC content of all interior paints and coatings during construction.

EQ Credit 4.3: Low-Emitting Materials: Carpet Systems
1 Point

Intent

Reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants.

Requirements

All carpet installed in the building interior shall meet the testing and product requirements of the Carpet and Rug Institute's Green Label Plus program.

All carpet cushion installed in the building interior shall meet the requirements of the Carpet and Rug Institute Green Label program.

All carpet adhesive shall meet the requirements of EQ Credit 4.1: VOC limit of 50 g/L.

Potential Technologies & Strategies
Clearly specify requirements for product testing and/or certification in the construction documents. Select products that are either certified under the Green Label Plus program or for which testing has been done by qualified independent laboratories in accordance with the appropriate requirements.
The Green Label Plus program for carpets and its associated VOC emission criteria in micrograms per square meter per hour, along with information on testing method and sample collection developed by the Carpet & Rug Institute (CRI) in coordination with California's Sustainable Building Task Force and the California Department of Health Services (DHS), are described in Section 9, Acceptable Emissions Testing for Carpet, DHS Standard Practice CA/DHS/EHLB/R-174, dated 07/15/04. This document is available at: www.dhs.ca.gov/ps/deodc/ehlb/iaq/VOCS/Section01350_7_15_2004_FINAL_PLUS_ADDENDUM-2004-01.pdf. (also published as Section 01350 Section 9 [dated 2004] by the Collaborative for High Performance Schools [www.chps.net]).

EQ Credit 4.4: Low-Emitting Materials: Composite Wood & Agrifiber Products 1 Point

Intent
Reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants.

Requirements
Composite wood and agrifiber products used on the interior of the building (defined as inside of the weatherproofing system) shall contain no added urea-formaldehyde resins. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins.
Composite wood and agrifiber products are defined as: particleboard, medium density fiberboard (MDF), plywood, wheat board, strawboard, panel substrates and door cores. Materials considered fit-out, furniture, and equipment (FF&E) are not considered base building elements and are not included.

Potential Technologies & Strategies
Specify wood and agrifiber products that contain no added urea-formaldehyde resins. Specify laminating adhesives for field and shop applied assemblies that contain no added urea-formaldehyde resins.

EQ Credit 5: Indoor Chemical & Pollutant Source Control <EHS MANDATORY> 1 Point

Intent
Minimize exposure of building occupants to potentially hazardous particulates and chemical pollutants.

Requirements
Design to minimize and control pollutant entry into buildings and later cross-contamination of regularly occupied areas:

- 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.
- Where hazardous gases or chemicals may be present or used (including garages, 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 0.50 cfm/sq.ft., 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 doors to the rooms are closed.

- In mechanically ventilated buildings, provide regularly occupied areas of the building with air filtration media prior to occupancy that provides 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.

Potential Technologies & Strategies
Design facility cleaning and maintenance areas with isolated exhaust systems for contaminants. Maintain physical isolation from the rest of the regularly occupied areas of the building. Install permanent architectural entryway systems such as grills or grates to prevent occupant-borne contaminants from entering the building. Install high-level filtration systems in air handling units processing both return air and outside supply air. Ensure that air handling units can accommodate required filter sizes and pressure drops.

EQ Credit 6.1: Controllability of Systems: Lighting <EHS MANDATORY>
1 Point

Intent
Provide a high level of lighting system control by individual occupants or by specific groups in multi-occupant spaces (i.e. classrooms or conference areas) to promote the productivity, comfort and well-being of building occupants.

Requirements
Provide individual lighting controls for 90% (minimum) of the building occupants to enable adjustments to suit individual task needs and preferences.
AND
Provide lighting system controllability for all shared multi-occupant spaces to enable lighting adjustment that meets group needs and preferences.

Potential Technologies & Strategies
Design the building with occupant controls for lighting. 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 6.2: Controllability of Systems: Thermal Comfort
1 Point

Intent
Provide a high level of thermal comfort system control by individual occupants or by specific groups in multi-occupant spaces (i.e. classrooms or conference areas) to promote the productivity, comfort and well-being of building occupants.

Requirements
Provide individual comfort controls for 50% (minimum) of the building occupants to enable adjustments to suit individual task needs and preferences. Operable windows can be used in lieu of comfort controls for occupants of 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.

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.

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. Control strategies can be developed to expand on the comfort criteria 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).

EQ Credit 7.1: Thermal Comfort: Design <EHS MANDATORY>
1 Point

Intent
Provide a comfortable thermal environment that supports the productivity and well-being of building occupants.

Requirements
Design HVAC systems and the building envelope to meet the requirements of ASHRAE Standard 55-2004, Thermal Comfort Conditions for Human Occupancy. Demonstrate design compliance in accordance with the Section 6.1.1 Documentation.

Potential Technologies & Strategies
Establish comfort criteria per ASHRAE Standard 55-2004 that support the desired quality and occupant satisfaction with building performance. Design building envelope and systems with the capability to deliver performance to the comfort criteria under expected environmental and use conditions. Evaluate air temperature, radiant temperature, air speed, and relative humidity in an integrated fashion and coordinate these criteria with EQ Prerequisite 1, EQ Credit 1, and EQ Credit 2.

EQ Credit 7.2: Thermal Comfort: Verification <EHS MANDATORY>
1 Point

Intent
Provide for the assessment of building thermal comfort over time.

Requirements
Agree to implement a thermal comfort survey of building occupants 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 occupants 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.

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 8.1: Daylight & Views: Daylight 75% of Spaces
1 Point

Intent
Provide for the building occupants a connection between indoor spaces and the outdoors through the introduction of daylight and views into the regularly occupied areas of the building.

Requirements
OPTION 1 — CALCULATION
Achieve a minimum glazing factor of 2% in a minimum of 75% of all regularly occupied areas.
OR
OPTION 2 — SIMULATION
Demonstrate, through computer simulation, that a minimum daylight illumination level of 25 foot-candles has been achieved in a minimum of 75% of all regularly occupied areas. Modeling must demonstrate 25 horizontal foot-candles under clear sky conditions, at noon, on the equinox, at 30 inches above the floor.
OR
OPTION 3 — MEASUREMENT
Demonstrate, through records of indoor light measurements, that a minimum daylight illumination level of 25 foot-candles has been achieved in at least 75% of all regularly occupied areas. Measurements must be taken on a 10-foot grid for all occupied spaces and must be recorded on building floor plans.
In all cases, only the square footage associated with the portions of rooms or spaces meeting the minimum illumination requirements can be applied towards the 75% of total area calculation required to qualify for this credit.

In all cases, provide daylight redirection and/or glare control devices to avoid high-contrast situations that could impede visual tasks. Exceptions for areas where tasks would be hindered by the use of daylight will be considered on their merits.

Potential Technologies & Strategies
Design the building to maximize interior daylighting. Strategies to consider include building orientation, shallow floor plates, increased building perimeter, exterior and interior permanent shading devices, high performance glazing and automatic photocell-based controls. Predict daylight factors via manual calculations or model daylighting strategies with a physical or computer model to assess foot-candle levels and daylight factors achieved.

EQ Credit 8.2: Daylight & Views: Views for 90% of Spaces
1 Point

Intent
Provide for the building occupants a connection between indoor spaces and the outdoors through the introduction of daylight and views into the regularly occupied areas of the building.

Requirements
Achieve direct line of sight to the outdoor environment via vision glazing between 2'6" and 7'6" above finish floor for building occupants in 90% of all regularly occupied areas. Determine the area with direct line of sight by totaling the regularly occupied square footage that meets the following criteria:

- In plan view, the area is within sight lines drawn from perimeter vision glazing.
- In section view, a direct sight line can be drawn from the area to perimeter vision glazing.

Line of sight may be drawn through interior glazing. For private offices, the entire square footage of the office can be counted if 75% or more of the area has direct line of sight to perimeter vision glazing. For multi-occupant spaces, the actual square footage with direct line of sight to perimeter vision glazing is counted.

Potential Technologies & Strategies
Design the space to maximize daylighting and view opportunities. Strategies to consider include lower partition heights, interior shading devices, interior glazing, and automatic photocell-based controls.

Innovation & Design Process

ID Credit 1–1.4: Innovation in Design
1–4 Points

Intent
To provide design teams and projects the opportunity to be awarded points for exceptional performance above the requirements set by the LEED for New Construction Green Building Rating System and/or innovative performance in Green Building categories not specifically addressed by the LEED for New Construction Green Building Rating System.

Requirements
Credit 1.1 (1 point) In writing, identify the intent of the proposed innovation credit, the proposed requirement for compliance, the proposed submittals to demonstrate compliance, and the design approach (strategies) that might be used to meet the requirements.
Credit 1.2 (1 point) Same as Credit 1.1
Credit 1.3 (1 point) Same as Credit 1.1
Credit 1.4 (1 point) Same as Credit 1.1
Potential Technologies & Strategies
Substantially exceed a LEED for New Construction performance credit such as energy performance or water efficiency. Apply strategies or measures that demonstrate a comprehensive approach and quantifiable environment and/or health benefits.

ID Credit 2: LEED Accredited Professional <EHS MANDATORY>
1 Point

Intent
To support and encourage the design integration required by a LEED for New Construction green building project and to streamline the application and certification process.

Requirements
At least one principal participant of the project team shall be a LEED Accredited Professional (AP).
Potential Technologies & Strategies
Educate the project team members about green building design & construction and application of the LEED Rating System early in the life of the project. Consider assigning the LEED AP as a facilitator of an integrated design & construction process.

EHS Pre-requisites and Mandatory Requirements:

EHS REGULATIONS FOR GREEN BUILDING DESIGN IN DUBAI WORLD AREAS			EHS-Regulations
Sustainable Sites 14 Possible Points			
Prereq 1	Construction Activity Pollution Prevention	Required	EHS-MANDATORY
Credit 1	Site Selection (Subject to EHS Approval)	1	EHS-MANDATORY
Credit 2	Development Density & Community Connectivity	1	
Credit 3	Brownfield Redevelopment	1	
Credit 4.1	Alternative Transportation, Public Transportation Access	1	
Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms	1	
Credit 4.3	Alternative Transportation, Low Emitting & Fuel Efficient Vehicles	1	
Credit 4.4	Alternative Transportation, Parking Capacity	1	EHS-MANDATORY
Credit 5.1	Site Development, Protect or Restore Habitat	1	EHS-MANDATORY
Credit 5.2	Site Development, Maximize Open Space	1	EHS-MANDATORY
Credit 6.1	Stormwater Design, Quantity Control	1	EHS-MANDATORY
Credit 6.2	Stormwater Design, Quality Control	1	EHS-MANDATORY
Credit 7.1	Heat Island Effect, Non-Roof	1	EHS-MANDATORY
Credit 7.2	Heat Island Effect, Roof	1	EHS-MANDATORY
Credit 8	Light Pollution Reduction	1	EHS-MANDATORY
Water Efficiency 5 Possible Points			
Credit 1.1	Water Efficient Landscaping, Reduce by 50%	1	EHS-MANDATORY
Credit 1.2	Water Efficient Landscaping, No Potable Use or No Irrigation	1	
Credit 2	Innovative Wastewater Technologies	1	EHS-MANDATORY
Credit 3.1	Water Use Reduction, 20% Reduction	1	EHS-MANDATORY
Credit 3.2	Water Use Reduction, 30% Reduction	1	EHS-MANDATORY
Energy & Atmosphere 17 Possible Points			
Prereq 1	Fundamental Commissioning of the Building Energy Systems	Required	EHS-MANDATORY
Prereq 2	Minimum Energy Performance	Required	EHS-MANDATORY
Prereq 3	Fundamental Refrigerant Management	Required	EHS-MANDATORY
Credit 1	Optimize Energy Performance (21% FOR New Developments)	4	EHS-MANDATORY
Credit 2	On-Site Renewable Energy (2.5%)	1	EHS-MANDATORY
Credit 3	Enhanced Commissioning	1	EHS-MANDATORY
Credit 4	Enhanced Refrigerant Management	1	EHS-MANDATORY
Credit 5	Measurement & Verification	1	EHS-MANDATORY
Credit 6	Green Power	1	
Materials & Resources 13 Possible Points			
Prereq 1	Storage & Collection of Recyclables	Required	EHS-MANDATORY
Credit 1.1	Building Reuse, Maintain 75% of Existing Walls, Floors & Roof	1	
Credit 1.2	Building Reuse, Maintain 95% of Existing Walls, Floors & Roof	1	
Credit 1.3	Building Reuse, Maintain 50% of Interior Non-Structural Elements	1	
Credit 2.1	Construction Waste Management, Divert 50% from Disposal	1	EHS-MANDATORY
Credit 2.2	Construction Waste Management, Divert 75% from Disposal	1	
Credit 3.1	Materials Reuse, 5%	1	
Credit 3.2	Materials Reuse, 10%	1	
Credit 4.1	Recycled Content, 10% (post-consumer + 1/2 pre-consumer)	1	EHS-MANDATORY
Credit 4.2	Recycled Content, 20% (post-consumer + 1/2 pre-consumer)	1	
Credit 5.1	Regional Materials, 10% Extracted, Processed & Manufactured Regionally	1	
Credit 5.2	Regional Materials, 20% Extracted, Processed & Manufactured Regionally	1	
Credit 6	Rapidly Renewable Materials	1	
Credit 7	Certified Wood	1	
Indoor Environmental Quality 15 Possible Points			
Prereq 1	Minimum IAQ Performance	Required	EHS-MANDATORY
Prereq 2	Environmental Tobacco Smoke (ETS) Control	Required	EHS-MANDATORY
Credit 1	Outdoor Air Delivery Monitoring	1	EHS-MANDATORY
Credit 2	Increased Ventilation	1	
Credit 3.1	Construction IAQ Management Plan, During Construction	1	EHS-MANDATORY
Credit 3.2	Construction IAQ Management Plan, Before Occupancy	1	EHS-MANDATORY
Credit 4.1	Low-Emitting Materials, Adhesives & Sealants	1	EHS-MANDATORY
Credit 4.2	Low-Emitting Materials, Paints & Coatings	1	
Credit 4.3	Low-Emitting Materials, Carpet Systems	1	
Credit 4.4	Low-Emitting Materials, Composite Wood & Agrifiber Products	1	
Credit 5	Indoor Chemical & Pollutant Source Control	1	EHS-MANDATORY
Credit 6.1	Controllability of Systems, Lighting	1	EHS-MANDATORY
Credit 6.2	Controllability of Systems, Thermal Comfort	1	
Credit 7.1	Thermal Comfort, Design	1	EHS-MANDATORY
Credit 7.2	Thermal Comfort, Verification	1	EHS-MANDATORY
Credit 8.1	Daylight & Views, Daylight 75% of Spaces	1	
Credit 8.2	Daylight & Views, Views for 90% of Spaces	1	
Innovation & Design Process 5 Possible Points			
Credit 1.1	Innovation in Design	1	
Credit 1.2	Innovation in Design	1	
Credit 1.3	Innovation in Design	1	
Credit 1.4	Innovation in Design	1	
Credit 2	LEED Accredited Professional	1	EHS-MANDATORY
LEED Note (V.2.2) - Project Totals 69 Possible Points (as per LEED); Certified 26–32 points Silver 33–38 points Gold 39–51 points Platinum 52–69 points (			
Total Mandatory EHS Points = 32			