

# GREEN BUILDING DESIGN AND CONSTRUCTION

WITH ALTERNATIVE COMPLIANCE PATHS FOR  
EUROPE

LEED Reference Guide for Green Building Design and Construction  
For the Design, Construction and Major Renovations of Commercial and  
Institutional Buildings Including Core & Shell and K–12 School Projects  
2009 Edition





# PREFACE FROM USGBC

The built environment has a profound impact on our natural environment, economy, health, and productivity. Breakthroughs in building science, technology, and operations are now available to designers, builders, operators, and owners who want to build green and maximize both economic and environmental performance.

Through the LEED® green building certification program, the U.S. Green Building Council (USGBC) is transforming the built environment. The green building movement offers an unprecedented opportunity to respond to the most important challenges of our time, including global climate change, dependence on non sustainable and expensive sources of energy, and threats to human health. The work of innovative building professionals is a fundamental driving force in the green building moment. Such leadership is a critical component to achieving USGBC's mission of a sustainable built environment for all within a generation.

## USGBC MEMBERSHIP

USGBC's greatest strength is the diversity of our membership. USGBC is a balanced, consensus-based nonprofit with more than 18,000 member companies and organizations representing the entire building industry. Since its inception in 1993, USGBC has played a vital role in providing a leadership forum and a unique, integrating force for the building industry. USGBC's programs have three distinguishing characteristics:

### Committee-based

The heart of this effective coalition is our committee structure, in which volunteer members design strategies that are implemented by staff and expert consultants. Our committees provide a forum for members to resolve differences, build alliances, and forge cooperative solutions for influencing change in all sectors of the building industry.

### Member-driven

Membership is open and balanced and provides a comprehensive platform for carrying out important programs and activities. We target the issues identified by our members as the highest priority. We conduct an annual review of achievements that allows us to set policy, revise strategies, and devise work plans based on members' needs.

### Consensus-focused

We work together to promote green buildings, and in doing so, we help foster greater economic vitality and environmental health at lower costs. We work to bridge ideological gaps between industry segments and develop balanced policies that benefit the entire industry.

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## LEED 2009 FOR NEW CONSTRUCTION, CORE & SHELL, AND SCHOOLS

100 base points; 6 possible innovation in Design and 4 Regional Priority points

Certified	40–49 points
Silver	50–59 points
Gold	60–79 points
Platinum	80 points and above

\*Credit not applicable to all Rating systems, please refer to the credit for more details.

# INTRODUCTION

## I. WHY MAKE YOUR BUILDING GREEN?

See the LEED 2009 Green Building Design and Construction Reference Guide for this section of the Introduction.

## II. LEED® GREEN BUILDING RATING SYSTEM

See the LEED 2009 Green Building Design and Construction Reference Guide for this section of the Introduction.

## III. OVERVIEW AND PROCESS

See the LEED 2009 Green Building Design and Construction Reference Guide for additional guidance related to the Overview and Process section.

### When to Use LEED 2009 Alternative Compliance Paths

Alternative Compliance Paths (ACPs) provide additional options or approaches to LEED credits that address unique project needs and advancements in science and technology. ACPs allow LEED to be more flexible and applicable to a wider range of projects. Global ACPs and Regional ACPs for Europe are integrated into this guidance document. The LEED 2009 Building Design and Construction (BD&C) ACPs for Europe were developed for the new construction and major renovation of commercial and institutional buildings, core and shell developments, and schools specifically for projects in Europe. Global ACPs apply to all projects regardless of location, although some are available only for projects outside the U.S., as indicated in the credit language.

ACPs can be applied at the discretion of the project based on applicability; they are not mandatory for any project.

Projects may choose to use none, some or all of the LEED 2009 Global ACPs or Regional ACPs for Europe and do not need to apply them consistently across credits unless noted in the credit language. Each credit category's Overview section includes a table identifying which credits have either a Global ACP or a Europe ACP.

For specific guidance on which rating system to use see the LEED 2009 Green Building Design and Construction Reference Guide.

## IV. LEED ONLINE DOCUMENTATION REQUIREMENTS

See the LEED 2009 Green Building Design and Construction Reference Guide for this section of the Introduction.

## V. CERTIFICATION APPLICATION

See the LEED 2009 Green Building Design and Construction Reference Guide for this section of the Introduction.

## **VI. CERTIFICATION STRATEGY**

See the LEED 2009 Green Building Design and Construction Reference Guide for this section of the Introduction.

## **VII. EXEMPLARY PERFORMANCE STRATEGIES**

See the LEED 2009 Green Building Design and Construction Reference Guide for this section of the Introduction.

## **VIII. REGIONAL PRIORITY**

See the LEED 2009 Green Building Design and Construction Reference Guide for this section of the Introduction.

## **IX. TOOLS FOR REGISTERED PROJECTS**

See the LEED 2009 Green Building Design and Construction Reference Guide for this section of the Introduction.

## **X. HOW TO USE THIS REFERENCE GUIDE**

See the LEED 2009 Green Building Design and Construction Reference Guide for additional guidance.

The LEED 2009 BD&C Global Alternative Compliance Path Reference Guide Supplement is a supporting document to the LEED Global ACPs and the Euopre ACPs. This guide helps project teams understand the criteria, the reasons behind them, strategies for implementation, and documentation requirements. It includes examples of strategies that can be used in each category and additional resources. It does not provide an exhaustive list of strategies for meeting the criteria or all the information that a project team needs to determine the applicability of a credit to the project.

The LEED 2009 BD&C Alternative Compliance Path for Europe Reference Guide Supplement should be consulted in conjunction with the LEED 2009 Green Building Design and Construction Reference Guide. Information in the reference guide is not repeated in this supplement, which focuses instead on the following:

- Information specific to considerations for projects outside the U.S.
- Information specific to considerations for projects in Europe
- New information for existing credits with new Alternative Compliance Paths

## **XI. CREDIT SUBSTITUTION**

Project teams wishing to use LEED v4 credits in lieu of LEED 2009 credits may now do so. To substitute a LEED v4 credit for a LEED 2009 credit, project teams must consult the list of approved credit substitutions available on USGBC.org and download the LEED v4 sample credit form. Project teams must then complete and upload the sample form into LEED Online within the LEED 2009 credit they are substituting.

Credit substitutions are available for all projects, regardless of location. However, projects outside the U.S. may find credit substitutions particularly helpful for LEED v4 credits that address circumstances for projects outside the U.S.



# SUSTAINABLE SITES

## SS OVERVIEW

### OVERVIEW

See the LEED 2009 Green Building Design and Construction Reference Guide for additional guidance.

Project teams outside the U.S. face many of the same challenges as their American counterparts when determining where to locate a new project. However, American codes and regulations often prove difficult to apply abroad. Projects in Europe frequently comply with local requirements of equivalent scope and technical stringency.

Combined with the Global Alternative Compliance Paths, the Europe Alternative Compliance Paths for Sustainable Sites allow project teams in Europe to select local alternatives to the prescribed U.S. codes and regulations for select credits. In many cases this will lower overall project costs by reducing the required documentation.

### Global ACPs

Local equivalent standards can be used in place of U.S. government regulations for Schools SS Prerequisite 2 (Environmental Site Assessment), SS Credit 1 (Site Selection), and SS Credit 3 (Brownfield Redevelopment). Project teams outside the U.S. can use a local code or regulation if it meets the intent of the prerequisite or credit.








A new option for SS Credit 4.1 (Alternative Transportation—Public Transportation Access) allows project teams to include additional vehicle types when calculating alternative transportation use for building occupants. The new option for SS Credit 6.1 (Stormwater Design—Quantity Control) allows project teams to calculate stormwater runoff reduction using a method that may be more appropriate in areas where it is difficult to calculate the 1- and 2-year 24-hour design storm.

### Europe ACPs

The guidance for SS Credit 1 (Site Selection) has been expanded to provide European equivalents to the sensitive habitat definitions listed in the credit. This includes use of Directive 2007/60/EC for flood hazard areas, Natura 2000 for species and wetlands, and the European Red List for species.












Projects may use the Euro 6 standard to identify eligible vehicles for preferred parking in SS Credit 4.3 (Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles). This standard is mandatory for new vehicles in the European Union as of September 2015.

 **Table 1.** SS Credits with Alternative Compliance Paths

Credit	Title	NC	Schools	CS
<b>SS Prerequisite 1</b>	Construction Activity Pollution Prevention	 	 	 
<b>SS Prerequisite 2</b>	Environmental Site Assessment			
<b>SS Credit 1</b>	Site Selection			
<b>SS Credit 2</b>	Development Density and Community Connectivity			

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

## SS OVERVIEW

Credit	Title	NC	Schools	CS
<b>SS Credit 3</b>	Brownfield Redevelopment			
<b>SS Credit 4.1</b>	Alternative Transportation—Public Transportation Access			
<b>SS Credit 4.2</b>	Alternative Transportation—Bicycle Storage and Changing Rooms			
<b>SS Credit 4.3</b>	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles			
<b>SS Credit 4.4</b>	Alternative Transportation—Parking Capacity			
<b>SS Credit 5.1</b>	Site Development—Protect or Restore Habitat			
<b>SS Credit 5.2</b>	Site Development—Maximize Open Space			
<b>SS Credit 6.1</b>	Stormwater Design—Quantity Control			
<b>SS Credit 6.2</b>	Stormwater Design—Quality Control			
<b>SS Credit 7.1</b>	Heat Island Effect—Nonroof			
<b>SS Credit 7.2</b>	Heat Island Effect—Roof			
<b>SS Credit 8</b>	Light Pollution Reduction			
<b>SS Credit 9</b>	Tenant Design and Construction Guidelines			
<b>SS Credit 9</b>	Site Master Plan			
<b>SS Credit 10</b>	Joint Use of facilities			

## ENVIRONMENTAL SITE ASSESSMENT

	NC	SCHOOLS	CS
Prerequisite	SS Prerequisite 2	SS Prerequisite 2	SS Prerequisite 2
Points	NA	Required	NA

### Intent

To ensure that the site is assessed for environmental contamination and if contaminated, that the environmental contamination has been remediated to protect children's health.

### Requirements

#### SCHOOLS

Conduct a Phase I Environmental Site Assessment (as described in ASTM E1527-05) to determine whether environmental contamination exists at the site. If contamination is suspected conduct a Phase II Environmental Site Assessment (as described in ASTM E1903-97, 2002). Projects outside the U.S. may use a local equivalent to ASTM E1527-05 Phase I Environmental Site Assessment and ASTM E 1903-97 Phase II Environmental Site Assessment.

Schools sites that are contaminated by past use as a landfill are ineligible for LEED certification. If a site is otherwise contaminated, it must be remediated to meet local, state, or federal EPA region residential (unrestricted) standards, whichever is most stringent. Documentation from the authority (such as EPA's "Ready for Reuse" document) must be provided to prove that safe levels of contamination have been achieved. Because the remediation process leads to significant environmental benefit, 1 point in SS Credit 3: Brownfield Redevelopment can be achieved for successful documented remediation of the site.

## SS PREREQUISITE 2

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

SS	
NC	NA
SCHOOLS	Prerequisite 2
CS	NA

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this prerequisite.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this prerequisite.

## 3. Summary of Referenced Standards

No new standards are referenced; see the LEED 2009 Green Building Design and Construction Reference Guide for summaries of the ASTM E1527-05, Phase I Environmental Site Assessment, and ASTM E1903-97, Phase II Environmental Site Assessment. If a local equivalent to the ASTM Phase I or Phase II site assessment has been selected, substitute that standard for the listed standards.

## 4. Implementation

If a local equivalent to the ASTM Phase I or Phase II Environmental Site Assessment has been selected, ensure that it is the most widely used and accepted by remediation experts in the project country. It should, at a minimum, test for the presence of any hazardous substances on the property, as indicated through present release, past release, or threat of release into the ground, ground water, surface water, or any structures on the property. If the local equivalent assessment determines that critical levels of contaminants are present at the project site, the site must be remediated to unrestricted use standards. Equivalency means meeting the criteria of the ASTM Phase I or Phase II Environmental Site Assessment listed in the Implementation section of the LEED 2009 Green Building Design and Construction Reference Guide.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this prerequisite.

## 6. Calculations

There are no calculations associated with this prerequisite.

## 7. Documentation Guidance

As a first step in preparing to complete the LEED Online documentation requirements, work through the following measures. Refer to LEED Online for the complete descriptions of all required documentation.

- Retain copies of the executive summaries from all local equivalent environmental site assessments performed.
- If remediation efforts were necessary, prepare a description of the efforts.
- Acquire documentation from the local governing authority showing that remediation to unrestricted use standards has been completed. The remediation efforts undertaken must at least match the stringency of the U.S. Environmental Protection Agency (EPA) requirements for residential (unrestricted) use. Residential land use is considered the most restrictive land use by EPA; it assumes that no contaminants are left on site to which children could be exposed.
- Provide documentation from the remediation expert or local authority stating that there are no contaminants remaining at the project site.

## 8. Examples

There are no examples for this prerequisite.

## 9. Exemplary Performance

This prerequisite is not eligible for exemplary performance under the Innovation in Design section of the LEED 2009 rating system.

## 10. Regional Variations

Preliminary screening levels and remediation criteria may differ by region or country. Please ensure that local equivalents to ASTM assessments meet the intent of the prerequisite and ensure that local or regional criteria at least match the stringency of the EPA and ASTM requirements.

## 11. Operations and Maintenance Considerations

For project sites that use a local equivalent in place of an ASTM Phase I and Phase II assessment process and require ongoing remediation, the project team and owner should keep careful records of remediation activities and develop a plan for ongoing compliance with local regulators' monitoring and reporting requirements.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

See the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this prerequisite.

## 13. Definitions

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms used in this prerequisite.

SS	
NC	NA
SCHOOLS	Prerequisite 2
CS	NA

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.



## SITE SELECTION

## SS CREDIT 1

	NC	SCHOOLS	CS
Credit	SS Credit 1	SS Credit 1	SS Credit 1
Points	1 point	1 point	1 point

### Intent

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

### Requirements

#### NC, SCHOOLS & CS

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

- Prime farmland as defined by the U.S. Department of Agriculture in the United States Code of Federal Regulations, Title 7, Volume 6, Parts 400 to 699, Section 657.5 (citation 7CFR657.5). Projects outside the U.S. may use a local equivalent.
- Previously undeveloped land whose elevation is lower than 5 feet (1.5 meters) above the elevation of the 100-year flood as defined by the Federal Emergency Management Agency (FEMA), an equivalent local regulatory agency, or a professional hydrologist. Projects in Europe may use the Directive 2007/60/EC definition of floods with a medium probability (likely return period  $\geq 100$  years).
- Land specifically identified as habitat for any species on federal or state threatened or endangered lists. Projects outside the U.S. may use a local equivalent. Projects in Europe may use Natura 2000 network of protected areas and the European Red List.
- Land within 100 feet (30 meters) of any wetlands as defined by the U.S. Code of Federal Regulations 40 CFR, Parts 230-233 and Part 22, or a local equivalent definition outside the U.S., and isolated wetlands or areas of special concern identified by state or local rule, OR within setback distances from wetlands prescribed in state or local regulations, as defined by local or state rule or law, whichever is more stringent.
- Previously undeveloped land that is within 50 feet (15 meters) of a water body, defined as seas, lakes, rivers, streams and tributaries that support or could support aquatic life, recreation or industrial use, consistent with the terminology of the Clean Water Act.
- Land that prior to acquisition for the project was public parkland, unless land of equal or greater value as parkland is accepted in trade by the public landowner (park authority projects and projects which are operated by and support the function of the park are exempt).

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SS	
NC	Credit 1
SCHOOLS	Credit 1
CS	Credit 1

## 1. Benefits and Issues to Consider

Several existing EU directives contain similar definitions for federal flood plains, habitat and wetlands listed in the credit and may be used by European project teams. EU Directive 2000/60/EC requires member states to assess, delineate and manage flood risks for all water courses and coast lines, and requires the preparation of flood hazard maps according to three different probability scenarios. Natura 2000 was established as a network of nature protection areas designated by EU member states and serves as a way for project teams to identify sensitive habitat, including habitat for threatened and endangered species, as well as wetlands. The European Red List identifies threatened and endangered species at the European level according to IUCN guidelines.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

### Directive 2000/60/EC establishing a framework for the community action in the field of water policy (The Water Framework Directive)

[http://ec.europa.eu/environment/water/water-framework/index\\_en.html](http://ec.europa.eu/environment/water/water-framework/index_en.html)

The Water Framework Directive has a number of objectives, such as preventing and reducing pollution, promoting sustainable water usage, environmental protection, improving aquatic ecosystems and mitigating the effects of floods and droughts. Its ultimate objective is to achieve “good ecological and chemical status” for all Community waters by 2015. Among the elements of this directive is to require EU member states to assess, delineate and manage flood risks for all water courses and coast lines.

### European Red List

<http://ec.europa.eu/environment/nature/conservation/species/redlist/>

The European Red List enumerates the conservation status of over 6000 European animal and vascular plant species according to IUCN regional Red Listing guidelines. It identifies species that are threatened with extinction at the European level as identified through status assessments and compiled in IUCN Red List Reports by type of species.

### Natura 2000

<http://ec.europa.eu/environment/nature/natura2000/>

Natura 2000 is the centerpiece of EU nature & biodiversity policy. It is an EU-wide network of nature protection areas established under the 1992 Habitats Directive. The aim of the network is to assure the long-term survival of Europe’s most valuable and threatened species and habitats. It is comprised of Special Areas of Conservation designated by EU member countries under the Habitats Directive, and also incorporates Special Protection Areas which they designate under the Birds Directive. The establishment of this network of protected areas also fulfills a Community obligation under the UN Convention on Biological Diversity.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional referenced standards related to this credit.

## 4. Implementation

Avoid the sensitive land areas described in the credit requirements when selecting a site. Project



teams in Europe may use the following local equivalents for credit requirements:

- The EU Directive 2007/60/EC definition of floods with a medium probability (likely return period  $\geq 100$  years) may be used by projects in Europe as an alternative to the 100-year floodplain as defined by the Federal Emergency Management Agency (FEMA).
- Natura 2000 and the European Red List may be used by projects in Europe to identify threatened and endangered species habitat.
- Natura 2000 may be used by projects in Europe to identify wetlands as an alternative to the definition in the U.S. Code of Federal Regulations 40 CFR, Parts 230-233 and Part 22.

To identify flood-prone areas within a site, project teams should consult the relevant local agency or agencies responsible for flood management to access a flood hazard map for the project location. A directory of country-specific flood map information can be found at [http://ec.europa.eu/environment/water/flood\\_risk/flood\\_atlas/](http://ec.europa.eu/environment/water/flood_risk/flood_atlas/). Scenario (b), floods with medium probability (likely return period  $\geq 100$  years) is considered an acceptable alternative to credit requirements.

Project teams in Europe should also refer to the local administrative body for Natura 2000 sites when evaluating the location for threatened and endangered species habitat and for wetlands. A full listing of national agencies can be found through the European Commission's website: [http://ec.europa.eu/environment/nature/natura2000/db\\_gis/index\\_en.htm#sites](http://ec.europa.eu/environment/nature/natura2000/db_gis/index_en.htm#sites).

If the level of the 100-year flood is not defined in the project region or country, engage a professional hydrologist to determine the flood risk of the project site. The professional hydrologist should use the U.S. Federal Emergency Management Agency (FEMA) definition of the 100-year flood (the flood elevation that has a 1% chance of being reached or exceeded each year) to determine flood risk. If the professional hydrologist determines that the project site is less than 5 feet above the level of the 100-year flood, the project is not eligible to earn this credit.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional implementation guidance.

## 5. Timeline and Team

If the level of the 100-year flood is not defined in the project region or country, use a professional hydrologist to determine the flood risk of the project site. See the LEED 2009 Green Building Design and Construction Reference Guide for additional guidance on the timeline and team.

## 6. Calculations

There are no calculations associated with this credit.

## 7. Documentation Guidance

As a first step in preparing to complete the LEED Online documentation requirements, work through the following measures. Refer to LEED Online for the complete descriptions of all required documentation.

- Record any special circumstances regarding compliance with the site selection criteria.
- If the level of level of the 100-year flood is defined by a local equivalent to FEMA, include the definition used and the name of the local authority.
- Projects in Europe with access to local flood hazard maps pursuant to Directive 2007/60/EC should list "Directive 2007/60/EC definition of floods with a medium probability" in the local equivalent field.

SS	
NC	Credit 1
SCHOOLS	Credit 1
CS	Credit 1

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

SS	
NC	Credit 1
SCHOOLS	Credit 1
CS	Credit 1

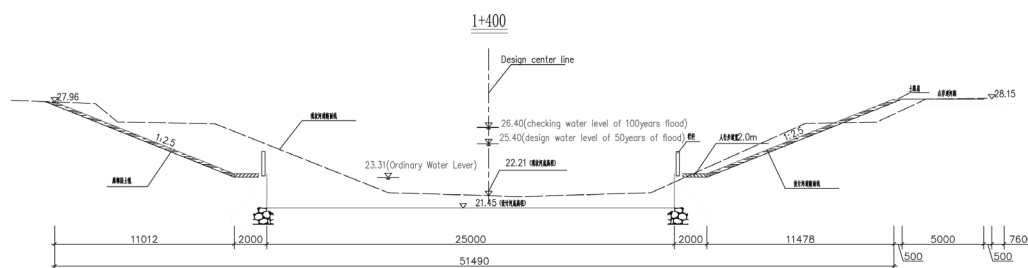
- If the level of the 100-year flood is not defined in the project region or country, engage a professional hydrologist to determine the flood risk of the project site. The professional hydrologist should produce a report or an executive summary of findings and supporting documentation, such as site elevations and/or topographic maps and sections identifying the flood risk of the project site.

## 8. Examples

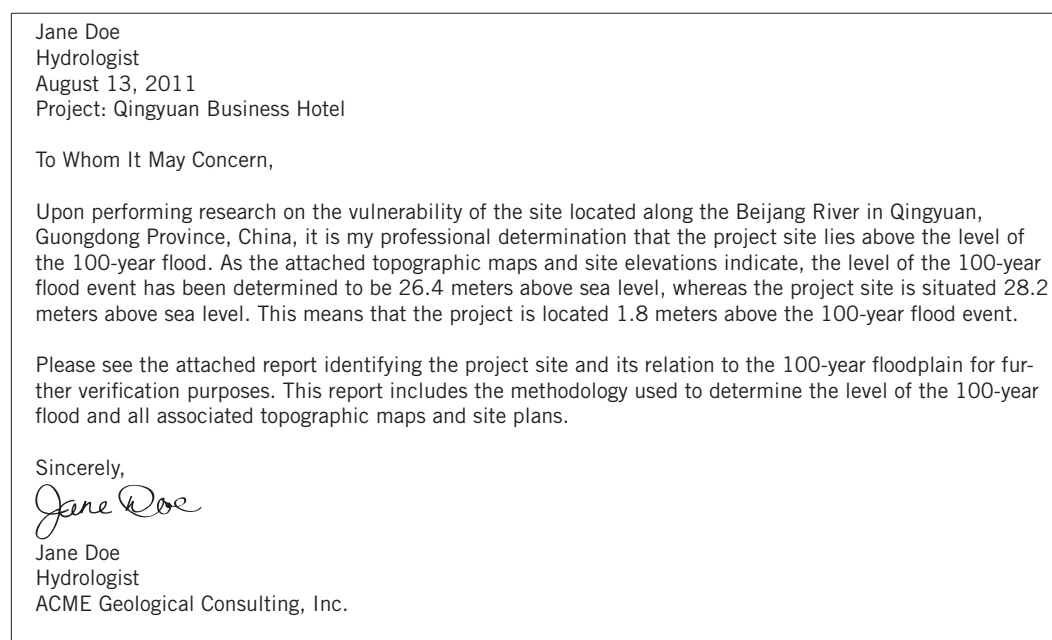
### Professional Hydrologist

A project outside the U.S. is located in an area where no definition of the 100-year flood exists. The project team has hired a professional hydrologist to identify the flood risk of the project site and produce topographical maps and sections for the area surrounding the project site. The resulting site elevation map identifies the elevation of the project in meters above sea level. A topographic section identifies the water surface height of a nearby river during normal levels and during a 100-year storm event in relation to the elevation of the project site. This documentation is accompanied by a separate report from the professional hydrologist.

**Figure 1.** Topographic map identifying level of 100-year flood event and project site.



**Figure 2.** Letter from professional hydrologist explaining topographic map and level of 100-year flood.



SS	
NC	Credit 1
SCHOOLS	Credit 1
CS	Credit 1

## Europe Example

A project team in the Netherlands is considering the acquisition and redevelopment of one of two project sites. Neither sites is currently owned or managed a public entity as park land. The project team conducts a simple visual survey to determine that there are no apparent water bodies or wetlands on either site, and consults a flood hazard map for the area to determine that both sites fall within an area for floods with a low probability, or extreme event scenarios.

The project team proceeds by consulting the local administrative body for Natura 2000 and determines that one of the candidate sites includes a Special Area of Conservation (SAC) for a threatened animal species. The project team thereby excludes this site.

As part of a planned ecological survey following site ownership, the project team confirms that the selected site includes no wetlands and no additional species present on the European Red List.

## 9. Exemplary Performance

This credit is not eligible for exemplary performance under the Innovation in Design section of the LEED 2009 rating system.

## 10. Regional Variations

There are no regional variations associated with this credit.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this credit.

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SS	
NC	Credit 1
SCHOOLS	Credit 1
CS	Credit 1

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

### Websites

#### **Directive 2009/147/EC on the conservation of wild birds (The Birds Directive)**

[http://ec.europa.eu/environment/nature/legislation/birdsdirective/index\\_en.htm](http://ec.europa.eu/environment/nature/legislation/birdsdirective/index_en.htm)

The Birds Directive works in tandem with the Habitat Directive to form the cornerstone of Europe's nature conservation policy. It establishes a system of protection for wild bird species and focuses on the protection of habitat for endangered and migratory species. The Birds Directive also establishes Special Protection Areas (SPAs) that are incorporated in the Natura 2000 network.

#### **Directive 2000/60/EC establishing a framework for the community action in the field of water policy (The Water Framework Directive)**

[http://ec.europa.eu/environment/water/water-framework/index\\_en.html](http://ec.europa.eu/environment/water/water-framework/index_en.html)

The Water Framework Directive has a number of objectives, such as preventing and reducing pollution, promoting sustainable water usage, environmental protection, improving aquatic ecosystems and mitigating the effects of floods and droughts. Its ultimate objective is to achieve "good ecological and chemical status" for all Community waters by 2015. Among the elements of this directive is to require EU member states to assess, delineate and manage flood risks for all water courses and coast lines.

#### **Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (The Habitat Directive)**

[http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index\\_en.htm](http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm)

The Habitat Directive is considered the cornerstone of Europe's nature conservation policy along with the Birds Directive. It includes language that "Member States shall take the requisite measures to establish a system of strict protection for the animal species listed in Annex IV", with Annex IV listing animal and plant species of community interest in need of strict protection. The Habitat Directive establishes the Natura 2000 network.

### **European Red List**

<http://ec.europa.eu/environment/nature/conservation/species/redlist/>

The European Red List enumerates the conservation status of over 6000 European animal and vascular plant species according to IUCN regional Red Listing guidelines. It identifies species that are threatened with extinction at the European level as identified through status assessments and compiled in IUCN Red List Reports by type of species.

### **EXCIMAP Handbook of good practices in flood mapping**

[http://ec.europa.eu/environment/water/flood\\_risk/flood\\_atlas/](http://ec.europa.eu/environment/water/flood_risk/flood_atlas/)

The European Exchange Circle on Flood Mapping (EXCIMAP) was established through a mandate by the Water Directors to review flood mapping practices in Europe and to facilitate exchanges between European experts. The handbook produced by EXCIMAP includes an Atlas of Flood Maps, with examples from 19 European countries as well as the U.S. and Japan.

### **Guidance Document No. 12: Common Implementation Strategy for the Water Framework Directive (2000/60/EC)**

<http://www.apambiente.pt/dqa/assets/guidance-12---the-role-of-wetlands-in-the-water-framework-directive.pdf>

This document provides non-legally binding, practical guidance for stakeholders implementing the Water Framework Directive (2000/60/EC). Protected areas addressed by the Water Framework Directive, such as wetlands, are identified through the Natura 2000 network per this Guidance Document.

#### **Natura 2000**

<http://ec.europa.eu/environment/nature/natura2000/>

Natura 2000 is the centerpiece of EU nature & biodiversity policy. It is an EU-wide network of nature protection areas established under the 1992 Habitats Directive. The aim of the network is to assure the long-term survival of Europe's most valuable and threatened species and habitats. It is comprised of Special Areas of Conservation designated by EU member countries under the Habitats Directive, and also incorporates Special Protection Areas (SPAs) which they designate under the Birds Directive. The establishment of this network of protected areas also fulfills a Community obligation under the UN Convention on Biological Diversity.

### **13. Definitions**

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms used in this credit.

SS	
NC	Credit 1
SCHOOLS	Credit 1
CS	Credit 1

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.



## BROWNFIELD REDEVELOPMENT

## SS CREDIT 3

	NC	SCHOOLS	CS
Credit	SS Credit 3	SS Credit 3	SS Credit 3
Points	1 point	1 point	1 point

### Intent

To rehabilitate damaged sites where development is complicated by environmental contamination to reduce pressure on undeveloped land.

### Requirements

#### NC, SCHOOLS & CS

Projects can achieve this point only via SS Prerequisite 2: Environmental Site Assessment and remediating site contamination.

For projects where asbestos is found and remediated also earn this credit. Testing should be done in accordance with EPA Reg 40CFR part 763, when applicable.

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SS	
NC	Credit 3
SCHOOLS	Credit 3
CS	Credit 3

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

No new standards are referenced; see the LEED 2009 Green Building Design and Construction Reference Guide for summaries of the U.S. EPA definition of brownfields; ASTM E1527-05, Phase I Environmental Site Assessment; and ASTM E1903-97, Phase II Environmental Site Assessment. If a local equivalent to the ASTM Phase II site assessment has been selected, substitute that standard for the listed standard.

## 4. Implementation

If a local equivalent to the ASTM Phase II Environmental Site Assessment has been selected, ensure that it is the most widely used and accepted by remediation experts in the project country. It should, at a minimum, require that an environmental professional test the soil, air, and water of the project site to identify what kinds of contaminants exist and at what levels. If contaminants are found on site, follow the Implementation guidance in the LEED 2009 Green Building Design and Construction Reference Guide.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## 6. Calculations

There are no calculations associated with this credit.

## 7. Documentation Guidance

As a first step in preparing to complete the LEED Online documentation requirements, work through the following measures. Refer to LEED Online for the complete descriptions of all required documentation.

- For projects using Option 1, prepare descriptions of site contamination and remediation efforts undertaken by the project and show how those efforts are equivalent to an ASTM Phase II Environmental Site Assessment.
- For projects using Option 2, identify the local, state, tribal, or national government agency that defines the site as a brownfield and provide documentation of the remediation efforts that were undertaken.

## 8. Examples

There are no examples for this credit.

## 9. Exemplary Performance

This credit is not eligible for exemplary performance under the Innovation in Design section of the LEED 2009 rating system.



## 10. Regional Variations

Preliminary screening levels or remediation criteria may differ by region or country. Please ensure that local equivalents to ASTM meet the intent of the credit and ensure that local or regional criteria at least match the stringency of the EPA and ASTM requirements.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this credit.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

See the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this credit.

## 13. Definitions

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms used in this credit.

SS	
NC	Credit 3
SCHOOLS	Credit 3
CS	Credit 3

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## ALTERNATIVE TRANSPORTATION—PUBLIC TRANSPORTATION ACCESS

## SS CREDIT 4.1

	NC	SCHOOLS	CS
Credit	SS Credit 4.1	SS Credit 4.1	SS Credit 4.1
Points	4 points	4 points	4 points

### Intent

To reduce pollution and land development impacts from automobile use.

### Requirements

#### NC, SCHOOLS & CS

##### OPTION 1. Rail Station, Bus Rapid Transit Station & Ferry Terminal Proximity

Locate the project within 1/2-mile (800-meter) walking distance (measured from a main building entrance) of an existing or planned and funded commuter rail, light rail, subway station, bus rapid transit<sup>1</sup> station or commuter ferry terminal.

OR

##### OPTION 2. Bus Stop Proximity

Locate project within 1/4-mile (400-meter) walking distance (measured from a main building entrance), of 1 or more stops for 2 or more public, campus, or private bus lines usable by building occupants. A school bus system may count as 1 of these lines.

#### SCHOOLS

##### OPTION 3. Pedestrian Access

Show that the school has an attendance boundary such that at least 80% of students live within no more than 3/4-mile (1,200-meter) walking distance for grades 8 and below, and 1 1/2-mile (2,400-meter) walking distance for grades 9 and above. In addition, locate the project on a site that allows pedestrian access to the site from all residential neighborhoods that house the planned student population.

#### NC, SCHOOLS & CS

##### OPTION 3. Rideshare Proximity (OPTION 4 SCHOOLS)

Projects outside the U.S. may locate the project within 1/4-mile (400-meter) walking distance (measured from a main building entrance) of 1 or more stops for 2 or more existing rideshare options<sup>2</sup> that meet the definition of public transportation<sup>3</sup> and are authorized by the local transit authority if one exists.

#### ALL OPTIONS

For all options, provide dedicated walking or biking lanes to the transit lines that extend from the school building at least to the end of the school property in 2 or more

- 1 Bus rapid transit is an enhanced bus system that operates on exclusive bus lanes or other transit rights-of-way; it is designed to combine the flexibility of buses with the efficiency of rail.
- 2 Rideshare is a transit service that involves sharing a single vehicle with multiple people, excluding large-scale vehicles such as buses and trains. The rideshare transit facility must include a signed stop and a clearly defined waiting area. Additionally, the rideshare must include an enclosed passenger seating area, fixed route service, fixed fare structure, continuous daily operation, and the ability to pick up and drop off multiple riders. Rideshare options must hold 4 or more passengers, except for human-powered conveyances which must hold 2 or more passengers.
- 3 Public transportation consists of bus, rail, or other transit services for the general public that operate on a regular, continual basis.

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SS	
NC	Credit 4.1
SCHOOLS	Credit 4.1
CS	Credit 4.1

directions without any barriers (e.g., fences) on school property.

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

There are no standards referenced for this credit.

## 4. Implementation

If Option 1, Rail Station, Bus Rapid Transit Station & Ferry Terminal Proximity, is selected, see the LEED 2009 Green Building Design and Construction Reference Guide for implementation guidance.

If Option 3, Rideshare Proximity (Option 4 in Schools), is selected, ensure that the vehicles that serve the project site meet the definition of rideshare provided in the Definitions section. See the LEED 2009 Green Building Design and Construction Reference Guide for additional implementation guidance.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## 6. Calculations

If Option 3, Rideshare Proximity (Option 4 in Schools), is selected, please follow the calculations instructions for Options 1 and 2 in the LEED 2009 Green Building Design and Construction Reference Guide.

## 7. Documentation Guidance

As a first step in preparing to complete the LEED Online documentation requirements, work through the following measures. Refer to LEED Online for the complete descriptions of all required documentation.

- Identify local rail stations, bus rapid transit stations, commuter ferry terminals, and bus or rideshare routes serving the project building.
- Develop a site vicinity plan, to scale, and label walking paths between the project building's main entrance and rail stations, bus rapid transit stations, commuter ferry terminals, and bus or rideshare stops.
- If the team anticipates rail service, obtain verification of funding for the rail project.
- For schools projects pursuing the pedestrian access credit, create an attendance boundary map showing a 3/4-mile (1,200-meter) radius for grades K-8 and a 1 1/2-mile (2,200-meter) radius for grades 9 and above.
- Schools projects pursuing this credit must also delineate the dedicated bicycle and walking paths leading from the school building to the property line in 2 or more directions.

## 8. Examples

An office building in Manila is within walking distance of multiple public rideshare lines. Figure 1 shows all rideshare routes within a 1/4-mile (400-meter) walking distance from the building's main entrance. Rideshare stop locations are clearly identified on the vicinity map. The rideshare routes also connect to additional public transportation lines that traverse the city.

**Figure 1.** Sample area drawing: Vicinity map identifying rideshare stop locations and route destination information



- Project Location
- 1/4 Mile (400 Meters)
- Waterfront Route  
4.7 mi - about 13 mins
- Padre Faura & A. Mabini  
Serves the East West Route and the Waterfront Route
- Padre Faura & M.H. del Pilar
- East West Route  
3.1 mi - about 15 mins
- FX Stop - Roxas



Additionally, the project team has identified the type of vehicle, rideshare stop location, and route information for each route identified in a separate table, as shown in Figure 2

SS	
NC	Credit 4.1
SCHOOLS	Credit 4.1
CS	Credit 4.1

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SS	
NC	Credit 4.1
SCHOOLS	Credit 4.1
CS	Credit 4.1

**Figure 2.** Rideshare transportation table

TRANSPORTATION TABULATION			
	SERVICE IDENTIFICATION (CORRESPONDS TO THE UPDATED VICINITY MAP)	LOCATION	ROUTE
1		Padre Faura corner M.H. del Pilar	Sta. Cruz - Baclaran
2		Padre Faura corner A. Mabini	Divisoria - F.B. Harrison
3	FX ROUTE	Roxas Boulevard	Lawton - Baclaran/Sucat

## 9. Exemplary Performance

Project teams may earn an Innovation in Design credit for exemplary performance by complying with the requirements of 1 of the 2 options described in the Exemplary Performance section of the LEED 2009 Green Building Design and Construction Reference Guide.

Projects located within 1/2 mile (800 meters) of bus rapid transit or commuter ferries are eligible for exemplary performance through Option 2, Double Transit Ridership.

Project teams that select Option 3, Rideshare Proximity, are not eligible for exemplary performance under the Innovation in Design section.

## 10. Regional Variations

There are no regional variations associated with this credit.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this credit.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

See the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this credit.

## 13. Definitions

**Bus rapid transit** is an enhanced bus system that operates on exclusive bus lanes or other transit rights-of-way; it is designed to combine the flexibility of buses with the efficiency of rail.

**Rideshare** is a transit service that involves sharing a single vehicle with multiple people, excluding large-scale vehicles such as buses and trains. The rideshare transit facility must include a signed stop and a clearly defined waiting area. Additionally, the rideshare must include an enclosed passenger seating area, fixed route service, fixed fare structure, continuous daily operation, and the ability to pick up and drop off multiple riders. Rideshare vehicles must hold 4 or more passengers, except for human-powered conveyances, which must hold 2 or more passengers.

**Public transportation** consists of bus, rail, or other transit services for the general public that operate on a regular, continual basis.

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## ALTERNATIVE TRANSPORTATION—LOW-EMITTING AND FUEL-EFFICIENT VEHICLES

## SS CREDIT 4.3

	NC	SCHOOLS	CS
Credit	SS Credit 4.3	SS Credit 4.3	SS Credit 4.3
Points	3 points	2 points	3 points

### Intent

To reduce pollution and land development impacts from automobile use.

### Requirements

#### OPTION 1

##### NC & CS

Provide preferred parking<sup>1</sup> for low-emitting and fuel-efficient vehicles<sup>2</sup> for 5% of the total vehicle parking capacity of the site. Providing a discounted parking rate is an acceptable substitute for preferred parking for low-emitting/fuel-efficient vehicles. To establish a meaningful incentive in all potential markets, the parking rate must be discounted at least 20%. The discounted rate must be available to all customers (i.e., not limited to the number of customers equal to 5% of the vehicle parking capacity), publicly posted at the entrance of the parking area and available for a minimum of 2 years.

##### CS Additional Requirement

For project types that demonstrate market barriers to the definition of preferred parking closest to the main entrance, alternatives may be considered on a case-by-case basis.

##### SCHOOLS

Provide preferred parking<sup>1</sup> for low-emitting and fuel-efficient vehicles<sup>2</sup> for 5% of the total vehicle parking capacity of the site and at least 1 designated carpool drop-off area for low-emitting and fuel-efficient vehicles.

OR

#### OPTION 2

##### NC & CS

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

- <sup>1</sup> For the purposes of this credit “preferred parking” refers to the parking spots that are closest to the main entrance of the project (exclusive of spaces designated for handicapped persons) or parking passes provided at a discounted price.
- <sup>2</sup> 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. Projects in Europe may use vehicles meeting the Euro 6 limit values of Regulation (EC) No. 715/2007.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

SS	
NC	Credit 4.3
SCHOOLS	Credit 4.3
CS	Credit 4.3

## SCHOOLS

Develop and implement a plan for the buses and maintenance vehicles serving the school to use 20% (by vehicles, fuel or both) natural gas, propane or biodiesel or to be low-emitting and fuel-efficient vehicles<sup>2</sup>.

OR

### OPTION 3

#### NC

Provide low-emitting and fuel-efficient vehicles<sup>1</sup> for 3% of full-time equivalent (FTE) occupants.

Provide preferred parking<sup>2</sup> for these vehicles.

OR

### OPTION 4

#### NC

Provide building occupants access to a low-emitting or fuel-efficient vehicle-sharing program. The following requirements must be met:

- One low-emitting or fuel-efficient vehicle must be provided per 3% of FTE occupants, assuming that 1 shared vehicle can carry 8 persons (i.e., 1 vehicle per 267 FTE occupants). For buildings with fewer than 267 FTE occupants, at least 1 low emitting or fuel-efficient vehicle must be provided.
- A vehicle-sharing contract must be provided that has an agreement of at least 2 years.
- The estimated number of customers served per vehicle must be supported by documentation.
- A narrative explaining the vehicle-sharing program and its administration must be submitted.
- Parking for low-emitting and fuel-efficient vehicles must be located in the nearest available spaces in the nearest available parking area. Provide a site plan or area map clearly highlighting the walking path from the parking area to the project site and noting the distance.

## 1. Benefits and Issues to Consider

The ACEEE Green Book and CARB Zero Emissions Vehicle classifications include only vehicles sold within the US. While several low-emitting and fuel-efficient vehicle models are sold in both the U.S. and the EU, and are thus eligible for preferred parking, most project teams will find this definition does not by itself provide adequate vehicle options for European consumers.

Various EU directives and their amending acts have vehicle standards for emissions and fuel economy for both diesel and petrol vehicles. These standards have come into force in stages, beginning with Euro 1 and most recently with Euro 6. The Euro 6 standard is now mandatory for all new vehicles sold in the EU and requires vehicle manufacturers to meet advanced tailpipe emissions and fuel economy targets. These targets exceed U.S. regulations and are considered equivalent to the average low-emitting and fuel-efficient vehicle in the U.S.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

**Regulation (EC) No. 715/2007 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information**

<http://eur-lex.europa.eu/>

Regulation (EC) No 715/2007 is an amendment to Directive 70/220/EEC that establishes the Euro 5 and Euro 6 limit values for vehicles sold in the EU. Compliance with the Euro 6 emissions standards is determined by a standardized test cycle measuring emissions of nitrogen oxides (NO<sub>x</sub>), total hydrocarbon (THC), non-methane hydrocarbons (NMHC), carbon monoxide (CO), particulate matter (PM) and hydrocarbons and nitrogen oxides (HC+N, for diesel vehicles only).

## 4. Implementation

Projects in Europe may use the Euro 6 limit values listed in Regulation (EC) No. 715/2007 to meet the definition of low-emitting and fuel-efficient vehicles in this credit. Only vehicles classified as M1 category (vehicles with at least four wheels designed and constructed for the carriage of passengers and comprising no more than eight seats in addition to the driver's seat) are eligible.

When providing resources to building users regarding designated preferred parking, project teams should note that all new vehicles first registered in Europe after September 1, 2015 will be required to comply with the Euro 6 vehicle standard. Several manufacturers have voluntarily incorporated Euro 6 limit values prior to this date, however enforcement of Euro 6 vehicle standard will not retroactively apply to vehicles on the road but sold prior to this date. Manufacturer websites may include information on compliant vehicles prior to enforcement.

See the LEED 2009 Green Building Design and Construction Reference Guide for implementation guidance related to this credit.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

SS	
NC	Credit 4.3
SCHOOLS	Credit 4.3
CS	Credit 4.3

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

SS	
NC	Credit 4.3
SCHOOLS	Credit 4.3
CS	Credit 4.3

## 6. Calculations

There are no additional calculations associated with this credit. See LEED 2009 Green Building Design and Construction Reference Guide for calculations associated with this credit.

## 7. Documentation Guidance

See the LEED 2009 Green Building Design and Construction Reference Guide for documentation guidance related to this credit.

## 8. Examples

A project team in France is contacted by a building user requesting further information on the preferred parking spaces for low-emitting and fuel-efficient vehicles provided by the project as part of Option 1. The user indicates that she is purchasing a Citroen C4 Cactus (MY 2014) which has voluntarily met the Euro 6 standard in advance of the enforcement date. The parking attendant confirms with the user that she may use the preferred parking space with this vehicle.

See the LEED 2009 Green Building Design and Construction Reference Guide for an example detailing a plan for preferred parking spaces.

## 9. Exemplary Performance

See the LEED 2009 Green Building Design and Construction Reference Guide for information about Exemplary Performance related to this credit.

## 10. Regional Variations

See the LEED 2009 Green Building Design and Construction Reference Guide for regional variations associated with this credit.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this credit.

## 12. Resources

See the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this credit.

### Websites

#### **Directive 2001/116/EC on the approximation of the laws of the Member States relating to the type-approval of motor vehicles and their trailers**

<http://eur-lex.europa.eu/>

Directive 2001/116/EC establishes the vehicle category classes (M, N, O and G) which are used to classify emissions limits in many European vehicle regulations. It adapts EU Directive 70/156/EEC on the approximation of the laws of the Member States relating to the type-approval of motor vehicles and their trailers.

#### **Directive 70/220/EEC on measures to be taken against air pollution by emissions from motor vehicles**

<http://eur-lex.europa.eu/>

Directive 70/220/EEC established mandatory technical standards for vehicle emissions and serves as the basis for subsequent amendments and directives regarding vehicle emissions and the Euro vehicle standards.

## European Union Directives and Regulations for Motor Vehicles

[http://ec.europa.eu/enterprise/sectors/automotive/documents/directives/motor-vehicles/index\\_en.htm](http://ec.europa.eu/enterprise/sectors/automotive/documents/directives/motor-vehicles/index_en.htm)

A directory of EU vehicle directives and regulations for motor vehicles, trailers, systems and components, organized by year. This directory includes several amending acts to EU Framework Directive 2007/46/EC related to the Euro 6 standard.

## European Vehicle Market Statistics Pocketbook

<http://eupocketbook.theicct.org/>

The European Vehicle Market Statistics Pocketbook offers a statistical portrait of passenger car and light commercial vehicles in the EU, including vehicle sales, fuel consumption and CO<sub>2</sub> emissions by brand and model. The pocketbook dates back to 2001 and is updated annually. Statistics are drawn from data maintained by the International Council on Clean Transportation.

**Regulation (EC) No 715/2007 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information**

<http://eur-lex.europa.eu/>

Regulation (EC) No 715/2007 is an amendment to Directive 70/220/EEC that establishes the Euro 5 and Euro 6 limit values for vehicles sold in the EU. Compliance with the Euro 6 emissions standards is determined by a standardized test cycle measuring emissions of nitrogen oxides (NO<sub>x</sub>), total hydrocarbon (THC), non-methane hydrocarbons (NMHC), carbon monoxide (CO), particulate matter (PM) and hydrocarbons and nitrogen oxides (HC+N, for diesel vehicles only).

**Regulation (EC) No. 443/2009 setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO<sub>2</sub> emissions from light-duty vehicles**

<http://eur-lex.europa.eu/>

Regulation 443/2009/EC requires mandatory reductions of CO<sub>2</sub> emissions for new passenger vehicles in order to reach an objective of 130 g CO<sub>2</sub>/km for the average new car fleet.

**Regulation (EC) No. 692/2008 implementing and amending Regulation (EC) No 715/2007 of the European Parliament and of the Council on type-approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information**

<http://eur-lex.europa.eu/>

Regulation 692/2008/EC describes the procedures for implementation and manufacturer obligations. It also explains member state non-compliance penalties and guidance on financial incentives.

## 13. Definitions

See LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms identified in this credit.

## SS

NC	Credit 4.3
SCHOOLS	Credit 4.3
CS	Credit 4.3

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.



## STORMWATER DESIGN—QUANTITY CONTROL

## SS CREDIT 6.1

	NC	SCHOOLS	CS
Credit	SS Credit 6.1	SS Credit 6.1	SS Credit 6.1
Points	1 point	1 point	1 point

### Intent

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

### Requirements

#### NC, SCHOOLS & CS

#### OPTION 1. Design Storms

##### CASE 1. Sites with Existing Imperviousness 50% or Less

##### PATH 1

Implement a stormwater management plan that prevents the postdevelopment peak discharge rate and quantity from exceeding the predevelopment peak discharge rate and quantity for the 1- and 2-year 24-hour design storms.

OR

##### PATH 2

Implement a stormwater management plan that protects receiving stream channels from excessive erosion. The stormwater management plan must include a stream channel protection strategy and quantity control strategies.

##### CASE 2. Sites with Existing Imperviousness Greater Than 50%

Implement a stormwater management plan that results in a 25% decrease in the volume of stormwater runoff from the 2-year 24-hour design storm.

OR

#### OPTION 2. Percentile Rainfall Events

##### CASE 1. Non-Zero Lot Line Projects

In a manner best replicating natural site hydrology<sup>1</sup> processes, manage onsite<sup>2</sup> the runoff from the developed site for the 95th percentile of regional or local rainfall events using Low Impact Development (LID)<sup>3</sup> and green infrastructure<sup>4</sup>.

<sup>1</sup> Natural Site Hydrology is defined as the natural land cover function of water occurrence, distribution, movement, and balance.

<sup>2</sup> Manage Onsite refers to capturing and retaining the specified volume of rainfall to mimic natural hydrologic function. This includes, but is not limited to, strategies that manage volume through evapotranspiration, infiltration, or capture and reuse.

<sup>3</sup> Low Impact Development (LID) is defined as an approach to managing stormwater runoff that emphasizes on-site natural features to protect water quality by replicating the natural land cover hydrologic regime of watersheds and addressing runoff close to its source. Examples include better site design principles such as minimizing land disturbance, preserving vegetation, minimizing impervious cover, and design practices like rain gardens, vegetated swales and buffers, permeable pavement, rainwater harvesting, and soil amendments. These are engineered practices that may require specialized design assistance.

<sup>4</sup> Green Infrastructure is a soil and vegetation-based approach to wet weather management that is cost-effective, sustainable, and environmentally friendly. Green infrastructure management approaches and

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## SS CREDIT 6.1

Use daily rainfall data and the methodology in the United States Environmental Protection Agency's Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act to determine the 95th percentile amount.

OR

### CASE 2. Zero Lot Line Projects

For zero lot line projects located in urban areas with a minimum density of 1.5 FAR (13,800 square meters per hectare net), in a manner best replicating natural site hydrology processes, manage onsite the runoff from the developed site for the 85th percentile of regional or local rainfall events using LID and green infrastructure.

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technologies infiltrate, evapotranspire, capture and reuse stormwater to maintain or restore natural hydrologies (US EPA).



## 1. Benefits and Issues to Consider

Projects outside the U.S. often use different size design storms than those identified in Option 1 of this credit. This doubles the effort required for project teams to demonstrate compliance, as they need to recalculate design storms based on the parameters outlined in the requirements. This can add time and cost, while not achieving the actual intent of the credit to limit disruption of natural hydrology cycles through stormwater best management practices. However, projects using infiltration strategies to mitigate stormwater runoff may not need to recalculate design storms to demonstrate compliance with this credit.

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

### Stormwater Management for Federal Facilities under Section 438 of the Energy Independence and Security Act (USA)

<http://www.epa.gov/owow/NPS/lid/section438/>

Stormwater runoff in urban areas is one of the leading sources of water pollution. Section 438 of the U.S. Energy Independence and Security Act sets guidelines for restoring project sites to their predevelopment hydrology. U.S. EPA's technical guidance for Section 438 provides background information, definitions, and case studies. See the website for additional information and resources.

## 4. Implementation

### Option 1. Design Storms

LEED Interpretations #5214 and #2615 rule that projects using onsite infiltration practices to mitigate 100% of stormwater runoff meet the requirements of both this credit and SS6.2: Stormwater Management – Quality Control. Therefore, projects can achieve this credit when using and documenting alternative storm events (i.e. 5-and-10 year storm events) through infiltrating 100% of stormwater onsite.

### Option 2. Percentile Rainfall Events

Projects that fall under Case 1, Non-Zero Lot Line Projects, should obtain local rainfall data for at least the past 5 years, if available. This information may be obtained from various sources:

- Aquastat
- the local governing authority
- local airports
- universities
- water treatment plants
- other facilities whose monitoring stations record time and total precipitation depth during each time interval

With the rainfall data, calculate the 95th percentile of regional or local storm events using the methodology in Section E of the Technical Guidance on Implementing Stormwater Runoff Requirements from the referenced standard. Determine the volume of rainwater runoff for

SS	
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CS	Credit 6.1

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CS	Credit 6.1

the project site. Based on the developed project site conditions, identify areas with potential to produce runoff (areas where rainwater will not infiltrate completely into the ground). For these developed site conditions, manage the runoff by using Low-Impact Development (LID) strategies and green infrastructure on site.

If rainfall data are not available for the project's region, natural land cover maps may be used. Determine the natural land cover conditions of the project site and use these conditions to assign runoff curve numbers. Calculate the volume of rainfall using the method described in the LEED 2009 Green Building Design and Construction Reference Guide.

Design the site to manage the volume of runoff for the 95th percentile of regional or local events. There may be multiple low-impact development or green infrastructure rainwater management facilities on the site. Consult U.S. EPA for a list of potential LIDs. Consider the following:

- A project site can utilize one or multiple facilities
- Locate facilities strategically to best mimic natural site hydrology (direction of flow, etc)
- Facilities may have different infiltration rates and storage capacity.
- The contaminant removal potential of the facilities

Projects that fall under Case 2, Zero Lot Line Projects, should confirm the zero lot line designation. This means that the building limits align with the site limits and the LEED project boundary. Calculate the density of the area surrounding the project. If the density is 1.5 FAR or greater, the project is eligible to use this case.

Follow the steps in Option 2, Case 1, above but calculate the 85th percentile rather than the 95th percentile.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## 6. Calculations

### Option 1. Design Storms

There are no additional calculations associated with this option. See the LEED 2009 Green Building Design and Construction Reference Guide for calculations associated with this credit.

### Option 2. Percentile Rainfall Events

Instructions for calculating percentile storm events can be found in Section E of the Technical Guidance on Implementing Stormwater Runoff Requirements from the referenced standard. of the referenced standard.

Calculate the runoff volume based on the project's developed conditions; refer to the LEED 2009 Green Building Design and Construction Reference Guide. Size the LID facility based on the projected volume of runoff water for the percentile storm event. All calculated runoff from the percentile storm events must be managed.

Alternatively, if using natural land cover condition maps, refer to the LEED 2009 Green Building Design and Construction Reference Guide and manage the runoff for the developed site conditions.

## 7. Documentation Guidance

### Option 1. Design Storms

When documenting alternative storm events, identify the project's predevelopment and postdevelopment discharge rates in the standard section of the LEED Online form. Be sure to indicate that an alternative storm event (other than the standard 1-and-2 year storm event) was used for this calculation in the "Special Circumstances" section. Also indicate that 100% of stormwater is infiltrated onsite.

### Option 2. Percentile Rainfall Events

As a first step in preparing to complete the LEED Online documentation requirements, work through the following measures. Refer to LEED Online for the complete descriptions of all required documentation.

- Gather rainfall event data over at least 5 years and document the source of that information.
- Show the calculations for the 85th or 95th percentile and for volume of runoff based on the developed site area.
- Describe the proposed stormwater management practices used on site, explain what qualifies them as LID or green infrastructure, and show how the design replicates natural site hydrology.

## 8. Examples

### Option 1. Design Storms

A project in Temuco, Chile is attempting to achieve this credit using a 5 year design storm rather than the 1-and 2-year design storm. The project is situated in an area with a requirement to mitigate 100% of stormwater on-site through infiltration.

First, the project team documented the predevelopment conditions of the building site.

Figure 1. Example documentation identifying predevelopment site conditions.



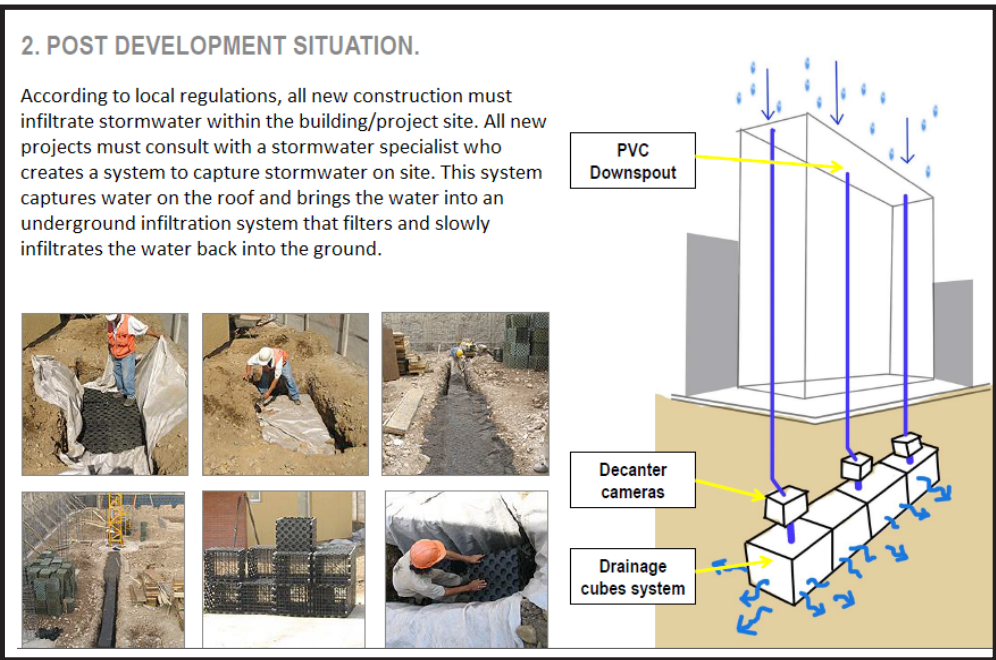
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Then, the project team demonstrated how stormwater is mitigated at the project site.

Figure 2. Example documentation identifying stormwater management strategies.



Because 100% of stormwater is collected onsite and infiltrated into the ground, the project qualifies for both this credit and SSc6.2: Stormwater Design – Quality Control.

## Option 2. Percentile Rainfall Events

See the Technical Guidance on Implementing Stormwater Runoff Requirements from the referenced standard for examples of how to implement LID and green infrastructure practices to manage runoff for the percentile storm event.

## 9. Exemplary Performance

### Option 1. Design Storms

LEED Interpretation #10108 identifies exemplary performance strategies available for this credit.

To demonstrate a comprehensive approach and performance above and beyond the credit requirements, the stormwater management strategies must:

1. Address runoff from the entire development footprint of the site using Low Impact Development (LID) practices.
2. Achieve the following stormwater quantity performance:
  - a. Option 1, Case 1, Path 1: Achieve a post-development peak discharge rate and quantity that is equivalent to those calculated for the pre-development site conditions.
  - b. Option 1, Case 1, Path 2: No Exemplary Performance is available for his compliance path.
  - c. Option 1, Case 2: Achieve a 50% reduction in the volume of runoff during the 2-year 24-hour design storm.

Projects may achieve exemplary performance in this credit by infiltrating 100% of stormwater onsite.

## Option 2. Percentile Rainfall Events

Projects using this option are not eligible for exemplary performance under the Innovation in Design section of the LEED 2009 rating system.

SS	
NC	Credit 6.1
SCHOOLS	Credit 6.1
CS	Credit 6.1

## 10. Regional Variations

There are no regional variations associated with Option 2, Percentile Rainfall Events.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this credit.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

### Websites

#### Aquastat

<http://www.fao.org/nr/water/aquastat/main/index.stm>

This international resource for precipitation data is maintained by the Food and Agriculture Organization of the United Nations.

#### U.S. EPA, Low-Impact Development, Stormwater Management, Section 438

<http://www.epa.gov/owow/NPS/lid/section438/>

This website provides valuable information, including technical guidance and fact sheets, on low-impact development strategies that can be used to mitigate stormwater runoff.

#### USGBC LEED Interpretations Database

<http://www.usgbc.org/node/1731618?view=interpretations>

Several LEED Interpretations have been issued clarifying how projects using infiltration practices can approach this credit and establishing exemplary performance strategies.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional resources related to this credit.

## 13. Definitions

**Natural site hydrology** is the natural land cover function of water occurrence, distribution, movement, and balance.

**Manage onsite** refers to capturing and retaining the specified volume of rainfall to mimic natural hydrologic function. Strategies may include evapotranspiration, infiltration, and capture and reuse.

**Low-Impact Development (LID)** is an approach to managing stormwater runoff that emphasizes onsite natural features to protect water quality by replicating the natural land cover hydrologic regime of watersheds and addressing runoff close to its source. Examples include better site design principles, such as minimizing land disturbance, preserving vegetation, and minimizing impervious cover, and design practices like rain gardens, vegetated swales and buffers, permeable pavement, rainwater harvesting, and soil amendments. These engineered practices may require specialized design assistance.

**Green infrastructure** is a soil- and vegetation-based approach to wet weather management that is cost-effective, sustainable, and environmentally friendly. Green infrastructure management approaches and technologies infiltrate, evapotranspire, capture and reuse stormwater to maintain or restore natural hydrologies (U.S. EPA).

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## HEAT ISLAND EFFECT—NONROOF

## SS CREDIT 7.1

EB: O&M	
Credit	SS Credit 7.1
Points	1 point

### Intent

To reduce heat islands<sup>1</sup> to minimize impacts on microclimates and human and wildlife habitats.

### Requirements

#### NC, SCHOOLS & CS

#### OPTION 1

Use any combination of the following strategies for 50% of the site hardscape (including roads, sidewalks, courtyards and parking lots):

- Provide shade from the existing tree canopy or within 5 years of landscape installation. Landscaping (trees) must be in place at the time of occupancy.
- Provide shade from structures covered by solar panels that produce energy used to offset some nonrenewable resource use.
- Provide shade from architectural devices or structures that have a solar reflectance index<sup>2</sup> (SRI) of at least 29.
- Use hardscape materials with an SRI of at least 29.
- Use an open-grid pavement system (at least 50% pervious).

OR

#### OPTION 2

Place a minimum of 50% of parking spaces under cover<sup>3</sup>. Any roof used to shade or cover parking must have an SRI of at least 29, be a vegetated green roof or be covered by solar panels that produce energy used to offset some nonrenewable resource use. 1 Heat islands are defined as thermal gradient differences between developed and underdeveloped areas.

<sup>1</sup> Heat islands are defined as thermal gradient differences between developed and undeveloped areas.

<sup>2</sup> 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 surface (reflectance 0.05, emittance 0.90) is 0 and a standard white surface (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.

<sup>3</sup> For the purposes of this credit, under cover parking is defined as parking underground, under deck, under roof, or under a building.

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CS	Credit 7.1

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

**ASTM C1549-02, -04 and -09**

### **Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer**

[www.astm.org](http://www.astm.org)

This test method covers a technique for determining the solar reflectance of flat opaque materials in a laboratory or in the field using a commercial portable solar reflectometer. The purpose of the test method is to provide solar reflectance data required to evaluate temperatures and heat flows across surfaces exposed to solar radiation.

**ASTM E1175 – 87(1996), (2003) and (2009)**

### **Standard Test Method for Determining Solar or Photopic Reflectance, Transmittance, and Absorptance of Materials Using a Large Diameter Integrating Sphere**

[www.astm.org](http://www.astm.org)

This test method covers the measurement of the absolute total solar or photopic reflectance, transmittance, or absorptance of materials and surfaces. Although there are several applicable test methods employed for determining the optical properties of materials, they are generally useful only for flat, homogeneous, isotropic specimens. Materials that are patterned, textured, corrugated, or are of unusual size cannot be measured accurately using conventional spectrophotometric techniques, or require numerous measurements to obtain a relevant optical value. The purpose of this test method is to provide a means for making accurate optical property measurements of spatially non-uniform materials.

See LEED Interpretation 10092 for a description of superseded and withdrawn ASTM standards related to Heat Island Reduction.

## 4. Implementation

### OPTIONS 1 and 2

#### High Reflectance Materials

Projects outside the U.S. may meet the material solar reflectance index (SRI) testing requirements by consulting the Cool Roof Rating Council's (CRRC) Rated Products Directory at <http://coolroofs.org/products/results> and ANSI/CRRC Standard 1, for a list of materials and associated SRI values. If the project's specific material is listed, provide the SRI rating from this website as documentation in the credit form to fulfill the testing requirements.

Color values do not have direct correlation to emissivity and solar reflectance values which are the basis for the SRI calculation. The project can meet the testing requirement in one of three ways: by conducting in-place testing, finding a local lab for sample testing, or by using previous project data to determine the SRI.



## In Place Testing

Non roof elements may be tested using ASTM E1918-06 (Solar Reflectance) and ASTM E408-71 (Thermal Emittance) and then the SRI may be calculated using ASTM E1980. Measure solar reflectance with a pyranometer and thermal emittance with a solar reflectometer and use the CRRRC calculator to determine the SRI. Local universities or research institutions can be a good source to locate these instruments. Reference the resources section for options to purchase these instruments.

Teams can also reference LEED Interpretations 10113 and 10110 for more information regarding in place testing.

## Lab Testing

If teams do not wish to pursue in place testing, project teams can send a coupon of the non roof elements to a lab for testing. Testing labs can be found using the ASTM lab directory at [www.astm.org](http://www.astm.org) or from Intertek's lab directory at <http://www.intertek.com/contact/>. Contact individual country or regional labs to locate a facility that does SRI testing.

## Using Data from a Previous Project

It is acceptable to use the previous test data as documentation of the materials reflectivity or albedo assuming the material is identical and the test data was done in accordance with ASTM E 903, ASTM E 1918, or ASTM C 1549. This reflectivity value can then be used in conjunction with the material's emissivity value to determine the material's SRI. To document the reflectivity value, the project team should provide the test data along with documentation demonstrating that the materials used in both cases are identical. It should also be noted that when a range of values is provided the more conservative number should be used, not the average. See LEED interpretations 1717 and 5243 for more information.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## 6. Calculations

See the LEED 2009 Green Building Design and Construction Reference Guide for calculations associated with this credit.

## 7. Documentation Guidance

- If the project uses an SRI calculator, the project team should upload the calculator along with any applicable manufacturing information into the special circumstances box.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional documentation guidance related to this credit.

## 8. Examples

A Project in Germany wishes to document the reflectivity of poured concrete by using project data from a LEED v2.2 Building Design and Construction project. The project first ensures that the concrete is comparable to the concrete used in the v2.2 project and that the initial testing of the concrete was done in accordance with acceptable referenced standards.

Next the team measures emissivity according to ASTM E408-71(2008) and downloads the

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CS	Credit 7.1

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SCHOOLS	Credit 7.1
CS	Credit 7.1

Lawrence Berkeley National Laboratory CRRC Calculator to determine the SRI. The team submits uploaded test results from the previous project, the test results for emissivity, and a PDF of the SRI calculator results to the credit's form. The team also includes manufacturer data on the materials used towards credit compliance.

## 9. Exemplary Performance

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to Exemplary Performance.

## 10. Regional Variations

See the LEED 2009 Green Building Design and Construction Reference Guide for regional variations associated with this credit.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this credit.

## 12. Resources

### ASTM

[www.astm.org](http://www.astm.org)

ASTM is a globally recognized leader in the development and delivery of international voluntary consensus standards.

### Global Cool Cities Alliance

<http://www.globalcoolcities.org/>

The Global Cool Cities Alliance accelerates a world-wide transition to highly reflective, cooler, healthier cities. Its mission is to advance policies and programs that increase the solar reflectance of buildings and pavements to promote cool buildings, cool cities, and, most importantly, to mitigate the effects of climate change through global cooling.

### Cool Roof Rating Council

<http://coolroofs.org/>

This nonprofit organization is dedicated to implementing and communicating fair, accurate, and credible radiative energy performance rating systems for roof surfaces; supporting research into energy related radiative properties of roofing surfaces, including durability; and providing education and objective support to parties interested in understanding and comparing roofing options.

### European Cool Roofs Council

<http://coolroofcouncil.eu/>

The European Cool Roofs Council (ECRC) is a non-profit European association whose initiatives are driven and paid for by its members. It is a voluntary organization that brings value by promoting the benefits of cool roofing products to regulators, policy makers, consumers and other stakeholders. The ECRC also intends to enable cool roof products to be identified through the creation of an accreditation scheme.

### **Intertek**

<http://www.intertek.com>

Intertek is an industry leader with over 1,000 locations in over 100 countries. Tests products to meet quality, health, environmental, safety, and social accountability standards for virtually any market around the world.

### **Kipp and Zonen**

<http://www.kippzonen.com/>

Worldwide company that provides high quality solutions for the measurement of both natural and simulated solar radiation, ultraviolet to the infrared, for both photovoltaic and thermal solar energy systems.

### **The Lawrence Berkeley National Laboratory CRRC Calculator**

<http://coolcolors.lbl.gov/assets/docs/SRI%20Calculator/SRI-calc10.xls>

An industry-consensus tool to calculate SRI.

### **World Meteorological Organization**

[http://www.wmo.int/pages/index\\_en.html](http://www.wmo.int/pages/index_en.html)

The World Meteorological Organization (WMO) is a specialized agency of the United Nations. The WMO provides a framework international cooperation around meteorology and hydrology.

## **13. Definitions**

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms used in this credit.

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## HEAT ISLAND EFFECT—ROOF

EB: O&M	
Credit	SS Credit 7.2
Points	1 point

**Intent**

To reduce heat islands<sup>1</sup> to minimize impacts on microclimates and human and wildlife habitats.

**Requirements****NC, SCHOOLS & CS****OPTION 1**

Use roofing materials with a solar reflectance index (SRI)<sup>2</sup> equal to or greater than the values in the table below for a minimum of 75% of the roof surface.

Roofing materials having a lower SRI value than those listed below may be used if the weighted rooftop SRI average meets the following:

$$\frac{\text{Area Roof Meeting Minimum SRI}}{\text{Total Roof Area}} \times \frac{\text{SRI of Installed Roof}}{\text{Required SRI}} \geq 75\%$$

Alternatively, the following equation may be used to calculate compliance:

$$\frac{\left[ \frac{\text{Area of Roof A} \times \frac{\text{SRI of Roof A}}{\text{Required SRI}} \right] + \left[ \frac{\text{Area of Roof B} \times \frac{\text{SRI of Roof B}}{\text{Required SRI}} \right] + \dots}{0.75} \geq \text{Total Roof Area}$$

Roof Type	Slope	SRI
Low-sloped roof	≤ 2:12 (15%)	78
Steep-sloped roof	> 2:12 (15%)	29

Implement a maintenance program that ensures all SRI surfaces are cleaned at least every 2 years to maintain good reflectance.

OR

**OPTION 2**

Install and maintain a vegetated roof that covers at least 50% of the roof area.

OR

**OPTION 3**

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

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SS CREDIT 7.2

Area Roof Meeting Minimum SRI

0.75

+

Area of Vegetated Roof

0.5

≥

Total Roof Area

Alternatively, a weighted approach may be used to calculate compliance for multiple materials:

[

Area of Roof A

×

SRI of Roof A

Required SRI

]

+

[

Area of Roof B

×

SRI of Roof B

Required SRI

]

Area of Vegetated Roof

0.5

≥

Total Roof Area

Roof Type	Slope	SRI
Low-sloped roof	≤ 2:12 (15%)	78
Steep-sloped roof	> 2:12 (15%)	29

1 Heat islands are defined as thermal gradient differences between developed and underdeveloped areas.

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 surface (reflectance 0.05, emittance 0.90) is 0 and a standard white surface (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 E408 or ASTM C 1371.

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LEED REFERENCE GUIDE FOR BUILDING DESIGN & CONSTRUCTION

2009 EDITION

2009 ALTERNATIVE COMPLIANCE PATHS FOR EUROPE

2009 EDITION

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

### ANSI/CRRRC Standard 1.

[http://coolroofs.org/documents/CRRRC-1-2012\\_Standard.pdf](http://coolroofs.org/documents/CRRRC-1-2012_Standard.pdf)

This standard covers specimen preparation and test methods for determining the initial and aged Radiative Properties of Roofing Products.

### ASTM C1371-98, -04, -04a and -04a (2010) e1

#### Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers

[www.astm.org](http://www.astm.org)

This test method covers a technique for determination of the emittance of typical materials using a portable differential thermopile emissometer.

### ASTM C1549-02, -04 and -09

#### Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer

[www.astm.org](http://www.astm.org)

This test method covers a technique for determining the solar reflectance of flat opaque materials in a laboratory or in the field using a commercial portable solar reflectometer. The purpose of the test method is to provide solar reflectance data required to evaluate temperatures and heat flows across surfaces exposed to solar radiation.

### ASTM E408-71(1996), (2002), (2008), and (2013)

#### Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques

[www.astm.org](http://www.astm.org)

These test methods cover determination of the total normal emittance of surfaces by means of portable, inspection-meter instruments.

### ASTM E903-96, -12

#### Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres

[www.astm.org](http://www.astm.org)

This test method covers the measurement of spectral absorptance, reflectance, and transmittance of materials using spectrophotometers equipped with integrating spheres.

### ASTM E1175 – 87(1996), (2003) and (2009)

#### Standard Test Method for Determining Solar or Photopic Reflectance, Transmittance, and Absorptance of Materials Using a Large Diameter Integrating Sphere

[www.astm.org](http://www.astm.org)

This test method covers the measurement of the absolute total solar or photopic reflectance,

SS	
NC	Credit 7.2
SCHOOLS	Credit 7.2
CS	Credit 7.2

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SS	
NC	Credit 7.2
SCHOOLS	Credit 7.2
CS	Credit 7.2

transmittance, or absorptance of materials and surfaces. Although there are several applicable test methods employed for determining the optical properties of materials, they are generally useful only for flat, homogeneous, isotropic specimens. Materials that are patterned, textured, corrugated, or are of unusual size cannot be measured accurately using conventional spectrophotometric techniques, or require numerous measurements to obtain a relevant optical value. The purpose of this test method is to provide a means for making accurate optical property measurements of spatially non-uniform materials.

#### **ASTM E1918-97 and -06**

#### **Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field**

[www.astm.org](http://www.astm.org)

This test method covers the measurement of solar reflectance of various horizontal and low-sloped surfaces and materials in the field, using a pyranometer. The test method is intended for use when the sun angle to the normal from a surface is less than 45°.

#### **ASTM E1980-98, -01, and -11**

#### **Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces**

[www.astm.org](http://www.astm.org)

This practice covers the calculation of the Solar Reflectance Index (SRI) of horizontal and low-sloped opaque surfaces at standard conditions. The method is intended to calculate SRI for surfaces with emissivity greater than 0.1.

See LEED Interpretation 10092 for a description of superseded and withdrawn ASTM standards related to Heat Island Reduction.

## **4. Implementation**

OPTIONS 1 and 3

### **High Reflectance Materials**

Projects outside the U.S. may meet the material solar reflectance index (SRI) testing requirements by consulting the Cool Roof Rating Council's (CRRRC) Rated Products Directory at <http://coolroofs.org/products/results> and ANSI/CRRRC Standard 1, for a list of materials and associated SRI values. If the project's specific material is listed, provide the SRI rating from this website as documentation in the credit form to fulfill the testing requirements.

Note that aggregate roofs need only be tested for the solar reflectance (SR) of the material, not the SRI.

Color values do not have direct correlation to emissivity and solar reflectance values which are the basis for the SRI calculation. If the material is not listed on the CRRRC website, the project can meet the testing requirement in one of three ways: by conducting in-place testing, finding a local lab for sample testing, or by using previous project data to determine the SRI.

### **In Place Testing**

Aggregate may be tested using ASTM E1918-06 (Solar Reflectance) and ASTM E408-71 (Thermal Emittance) and then the SRI may be calculated using ASTM E1980. Measure solar reflectance with a pyranometer and thermal emittance with a solar reflectometer and use the CRRRC calculator to



determine the SRI. Local universities or research institutions can be a good source to locate these instruments. Reference the resources section for options to purchase these instruments.

For a roof with a veil design, or similar non-homogenous materials, the project should perform a SRI test to ASTM E1175 – 87, using a large diameter integrating sphere. Local universities or research institutions can be a good source to locate this instrument. Reference the resources section for options to purchase this instrument. Include summary of testing results that document the SRI rating for the installed veil surface when submitting documentation. See LEED interpretation 10110 for more information.

Teams can also reference LEED Interpretations 10113 and 10110 for more information regarding in place testing.

### Lab Testing

If teams do not wish to pursue in place testing, project teams can send a coupon of the roofing material to a lab for testing. Testing labs can be found using the ASTM lab directory at [www.astm.org](http://www.astm.org) or from Intertek’s lab directory at <http://www.intertek.com/contact/>. Contact individual country or regional labs to locate a facility that does SRI testing.

### Using Data from a Previous Project

It is acceptable to use the previous test data as documentation of the materials reflectivity or albedo assuming the material is identical and the test data was done in accordance with ASTM E 903, ASTM E 1918, or ASTM C 1549. This reflectivity value can then be used in conjunction with the material’s emissivity value to determine the material’s SRI. To document the reflectivity value, the project team should provide the test data along with documentation demonstrating that the materials used in both cases are identical. It should also be noted that when a range of values is provided the more conservative number should be used, not the average. See LEED interpretations 1717 and 5243 for more information.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## 6. Calculations

See the LEED 2009 Green Building Design and Construction Reference Guide for calculations associated with this credit.

## 7. Documentation Guidance

- If the project uses an SRI calculator, the project team should upload the calculator along with any applicable manufacturing information into the special circumstances box.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional documentation guidance related to this credit.

## 8. Examples

A Project in Germany wishes to document the reflectivity of asphalt shingles by using project data from a LEED v2.2 Building Design and Construction project. The project first ensures that the shingles are comparable to the shingles used in the v2.2 project and that the initial testing of the asphalt shingles was done in accordance with acceptable referenced standards.

SS	
NC	Credit 7.2
SCHOOLS	Credit 7.2
CS	Credit 7.2

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

SS	
NC	Credit 7.2
SCHOOLS	Credit 7.2
CS	Credit 7.2

Next the team measures emissivity according to ASTM E408-71 (2008) and downloads the Lawrence Berkeley National Laboratory CRRC Calculator to determine the SRI. The team submits uploaded test results from the previous project, the test results for emissivity, and a PDF of the SRI calculator results to the credit's form. The team also includes manufacturer data on the materials used towards credit compliance.

## 9. Exemplary Performance

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to Exemplary Performance.

## 10. Regional Variations

See the LEED 2009 Green Building Design and Construction Reference Guide for regional variations associated with this credit.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this credit.

## 12. Resources

### ASTM

[www.astm.org](http://www.astm.org)

ASTM is a globally recognized leader in the development and delivery of international voluntary consensus standards.

### Global Cool Cities Alliance

<http://www.globalcoolcities.org/>

The Global Cool Cities Alliance accelerates a world-wide transition to highly reflective, cooler, healthier cities. Its mission is to advance policies and programs that increase the solar reflectance of buildings and pavements to promote cool buildings, cool cities, and most importantly, to mitigate the effects of climate change through global cooling.

### Cool Roof Rating Council

<http://coolroofs.org/>

This nonprofit organization is dedicated to implementing and communicating fair, accurate, and credible radiative energy performance rating systems for roof surfaces; supporting research into energy related radiative properties of roofing surfaces, including durability; and providing education and objective support to parties interested in understanding and comparing roofing options.

### European Cool Roofs Council

<http://coolroofcouncil.eu/>

The European Cool Roofs Council (ECRC) is a non-profit European association whose initiatives are driven and paid for by its members. It is a voluntary organization that brings value by promoting the benefits of cool roofing products to regulators, policy makers, consumers and other stakeholders. The ECRC also intends to enable cool roof products to be identified through the creation of an accreditation scheme.

**Intertek**

<http://www.intertek.com>

Intertek is an industry leader with over 1,000 locations in over 100 countries. Tests products to meet quality, health, environmental, safety, and social accountability standards for virtually any market around the world.

SS	
NC	Credit 7.2
SCHOOLS	Credit 7.2
CS	Credit 7.2

**Kipp and Zonen**

<http://www.kippzonen.com/>

Worldwide company that provides high quality solutions for the measurement of both natural and simulated solar radiation, ultraviolet to the infrared, for both photovoltaic and thermal solar energy systems.

**The Lawrence Berkeley National Laboratory CRRC Calculator**

<http://coolcolors.lbl.gov/assets/docs/SRI%20Calculator/SRI-calc10.xls>

An industry-consensus tool to calculate SRI.

**Roof Tile Association of Australia (RTAA)**

<http://www.rtaa.com.au/>

The Roof Tile Association of Australia was founded by the faculty of Engineering and the Built Environment at the University of Newcastle. The program is charged with researching the thermal performance of tile and corrugated steel roofing products.

**World Meteorological Organization**

[http://www.wmo.int/pages/index\\_en.html](http://www.wmo.int/pages/index_en.html)

The World Meteorological Organization (WMO) is a specialized agency of the United Nations. The WMO provides a framework international cooperation around meteorology and hydrology.

**13. Definitions**

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms used in this credit.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.



# WATER EFFICIENCY

## WE OVERVIEW

### OVERVIEW

See the LEED 2009 Green Building Design and Construction Reference Guide for additional guidance.

Clean water is a precious resource that is in constant demand. As human development spreads and the world's population continues to increase, it is imperative that water resources be preserved. The ACPs in the Water Efficiency credit category address technological and seasonal differences from a global perspective and consider regional specificities, including pressure differences, for projects in Europe.

### Global ACPs










The language in WE Credit 1 (Water-Efficient Landscaping) has been revised to accommodate projects in locations where the month with the highest irrigation demand may not be in summer. Project teams can now more accurately determine a baseline for irrigation water usage.

### Europe ACPs

WE Prerequisite 1 (Water Use Reduction) has been modified to align flow and flush rates, as well as pressure differences, to European standard values derived from European Union Policy.

WE Credit 3 (Water Use Reduction) has been updated to reflect European standard values in WE Prerequisite 1 (Water Use Reduction).

 **Table 1.** WE Credits with Alternative Compliance Paths

Credit	Title	NC	Schools	CS
<b>WE Prerequisite 1</b>	Water Use Reduction			
<b>WE Credit 1</b>	Water Efficient Landscaping			
<b>WE Credit 2</b>	Innovative Wastewater Technologies			
<b>WE Credit 3</b>	Water Use Reduction			
<b>WE Credit 4</b>	Process Water Use Reduction			

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## WATER USE REDUCTION

## WE PREREQUISITE 1

	NC	SCHOOLS	CS
Prerequisite	WE Prerequisite 1	WE Prerequisite 1	WE Prerequisite 1
Points	Required	Required	Required

### Intent

To increase water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems.

### Requirements

#### NC, SCHOOLS & CS

Employ strategies that in aggregate use 20% less water than the water use baseline calculated for the building (not including irrigation).

Calculate the baseline according to the commercial and/or residential baselines outlined below.<sup>1</sup> Calculations are based on estimated occupant usage and must include only the following fixtures and fixture fittings (as applicable to the project scope): water closets, urinals, lavatory faucets, showers, kitchen sink faucets and pre-rinse spray valves. Projects in Europe may use the values defined by European standards.

Commercial Fixtures, Fittings, and Appliances	Current Baseline (IP)	Current Baseline (SI)
Commercial toilets	1.6 gallons per flush (gpf)* Except blow-out fixtures: 3.5 (gpf)	6 liters per flush (lpf)* Except blow-out fixtures: 13 lpf
Commercial urinals	1.0 (gpf)	4 lpf
Commercial lavatory (restroom) faucets	2.2 gallons per minute (gpm) at 60 pounds per square inch (psi), private applications only (hotel or motel guest rooms, hospital patient rooms) 0.5 (gpm) at 60 (psi)** all others except private applications 0.25 gallons per cycle for metering faucets	8.5 liters per minute (lpm) at 4 bar (58 psi), private applications only (hotel or motel guest rooms, hospital patient rooms) 2.0 lpm at 4 bar (58 psi), all others except private applications 1 liter per cycle for metering faucets
Showerheads	2.5 (gpm) at 80 (psi) per shower stall****	9/5 lpm at 5 bar (58 psi)
For projects with commercial pre-rinse spray valves, the flow rate must comply with the asME a112.18.1 standard of 1.6 gpm or less.		

<sup>1</sup> Tables adapted from information developed and summarized by the U.S. Environmental Protection Agency (EPA) Office of Water based on requirements of the Energy Policy Act (EPAct) of 1992 and subsequent rulings by the Department of Energy, requirements of the EPAct of 2005, and the plumbing code requirements as stated in the 2006 editions of the Uniform Plumbing Code or International Plumbing Code pertaining to fixture performance.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

## WE PREREQUISITE 1

### NC, SCHOOLS & CS (continued)

Residential Fixtures, Fittings, and Appliances	Current Baseline (IP)	Current Baseline (SI)
Residential toilets	1.6 (gpf)***	6 liters per flush (lpf)* Except blow-out fixtures: 13 lpf
Residential lavatory (bathroom) faucets	2.2 (gpm) at 60 psi	4 lpm 8.5 lpm at 4 bar (58 psi), private applications only (hotel or motel guest rooms, hospital patient rooms)
Residential kitchen faucet		2.0 lpm at 4 bar (58 psi), all others except private applications 1 liter per cycle for metering faucets
Residential showerheads	2.5 (gpm) at 80 (psi) per shower stall****	flow rate ≤ 6.1 lpm (no pressure specified; no performance requirement)
<p>* EPA 1992 standard for toilets applies to both commercial and residential models.</p> <p>** In addition to EPA requirements, the American Society of Mechanical Engineers standard for public lavatory faucets is 0.5 gpm at 60 psi (ASME A112.18.1-2005). This maximum has been incorporated into the national Uniform Plumbing Code and the International Plumbing Code.</p> <p>*** EPA 1992 standard for toilets applies to both commercial and residential models.</p> <p>**** Residential shower compartment (stall) in dwelling units: The total allowable flow rate from all flowing showerheads at any given time, including rain systems, waterfalls, bodysprays, bodyspas and jets, must be limited to the allowable showerhead flow rate as specified above (2.5 gpm) per shower compartment, where the floor area of the shower compartment is less than 2,500 square inches. For each increment of 2,500 square inches of floor area thereafter or part thereof, an additional showerhead with total allowable flow rate from all flowing devices equal to or less than the allowable flow rate as specified above must be allowed. Exception: Showers that emit recirculated nonpotable water originating from within the shower compartment while operating are allowed to exceed the maximum as long as the total potable water flow does not exceed the flow rate as specified above.</p>		

The following fixtures, fittings and appliances are outside the scope of the water use reduction calculation:

- Commercial Steam Cookers
- Commercial Dishwashers
- Automatic Commercial Ice Makers
- Commercial (family-sized) Clothes Washers
- Residential Clothes Washers
- Standard and Compact Residential Dishwashers



## 1. Benefits and Issues to Consider

Project teams in Europe may encounter difficulty using the baseline and reference values in global language. These baseline values are based upon U.S. policies such as the EPA Act 1992 and do not take into account differences in water pressure in Europe. As a result, flush and flow rate values based upon relevant Comité Européen de Normalisation (CEN) standards for water closets, urinals, showerheads, lavatory faucets, kitchen sink faucets and valves have been provided for use by project teams in Europe. These project teams may also use high-performance values from the Well system for prerequisite compliance.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional information on environmental and economic issues related to this prerequisite.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this prerequisite.

## 3. Summary of Referenced Standards

### EN 200:2008 Sanitary Tapware—Single Taps and Combination Taps for Water Supply Systems of Type 1 and Type 2- General Technical Specification

<http://www.cen.eu/CEN>

European Standard EN 200:2008 specifies the field of application for pillar taps, bib taps, single and multi-hole combination taps; and the dimensional, leak tightness, pressure resistance, hydraulic performance, mechanical strength, endurance, and acoustic characteristics of various types of taps and provides test methods to verify these characteristics. This standard applies to draw-off taps for use with sanitary appliances installed in rooms used for bodily hygiene and in kitchens.

### EN 246:2003 Sanitary Tapware—General specifications for Flow Rate Regulators

<http://www.cen.eu/CEN>

European Standard EN 246:2003 specifies the performance criteria related to the health and environmental protection of people for sanitary taps and their related accessories used for the water supply. The performance requirements are expressed in terms of mechanical endurance, flow rate, effectiveness and level of acoustic pressure. This standard includes and makes reference to the corresponding test methods and the evaluation of conformity of the product to this standard.

### EN 817:2008 Sanitary Tapware— Mechanical Mixing Valves (PN 10) – General Technical Specifications.

<http://www.cen.eu/CEN>

European Standard EN 817:2008 specifies the dimensional, leak-tightness, pressure resistance, hydraulic performance, mechanical strength, endurance, and acoustic characteristics with which mechanical mixing valves need to comply and the test methods to verify these characteristics. This standard applies to mechanical mixing valves for use with sanitary appliances installed in rooms used for bodily hygiene and in kitchens.

WE	
NC	Prerequisite 1
SCHOOLS	Prerequisite 1
CS	Prerequisite 1

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WE	
NC	Prerequisite 1
SCHOOLS	Prerequisite 1
CS	Prerequisite 1

#### EN 997:2012– WC Pans and WC Suites with Integrated Tap

<http://www.cen.eu/CEN>

European Standard EN 997:2012 specifies constructional and performance requirements together with test methods for close-coupled suites, one-piece, and independent WC pans with integral trap used for personal hygiene manufactured from glazed ceramics or stainless steel.

#### EN 1112:2008 for Sanitary Tapware– Shower Outlets for Sanitary Tapware for Water Supply Systems Type 1 and Type 2 – General Technical Specifications

<http://www.cen.eu/CEN>

European Standard EN 1112:2008 specifies the dimensional, leak-tightness, mechanical, hydraulic, and acoustic characteristics with which shower outlets shall comply and the procedures for testing these characteristics. This standard applies to shower heads and hand showers of any material used for the ablutionary purpose intended for equipping and supplementing sanitary tapware for baths and showers.

See the LEED 2009 Green Building Design and Construction Reference Guide for a summary of additional standards referenced in this prerequisite.

## 4. Implementation

Projects in Europe may establish a baseline for the prerequisite by using either the values listed in credit language or values from the Europe standards listed in Table 1.

The Well standards values in Table 1 typically exceed the Europe standards values. Well is a European labeling system that helps consumers identify water efficient products. The Well website also lists products that meet European Standards, at <http://www.well-online.eu/>. Well and other low-flow plumbing fixtures, fittings, and appliances can be installed in the same manner as conventional plumbing fixtures, fittings, and appliances.

In addition to Well, national or regional labeling programs are acceptable if they meet or exceed the amounts listed in Table 1.

Project teams may choose to select fixtures that are recognized by a water fixture labeling program. This is not a requirement but an optional strategy to ensure a high level of performance in addition to the specified water efficiency. In the U.S., the WaterSense label has been recommended. In Europe, the European Water Label is more widely available. An up to date list of International Water Labeling Programs equivalent to WaterSense has been compiled for LEED v4 and can be found at <http://www.usgbc.org/resources/international-water-labeling-programs>.

Commercial Fixtures, Fittings, and Appliances	Europe Standards Baseline	Well Standards Baseline
Commercial toilets	6 liters per flush (lpf)**	4 to 5 lpf**
Commercial urinals	4 lpf	1 lpf
Commercial lavatory (restroom) faucets	9 liters per minute (lpm)* private applications only (hotel or motel guest rooms, hospital patient rooms) 1.9 lpm* all others except private applications 9 lpm* for metering faucets	4 to 6 lpm* private applications only (hotel or motel guest rooms, hospital patient rooms)
For projects with commercial pre-rinse spray valves, the flow rate must comply with the asME a112.18.1 standard of 6 lpm or less.		

Residential Fixtures, Fittings, and Appliances	Europe Standards Baseline	Well Standards Baseline
Residential toilets	6 lpf**	4 to 5 lpf**
Residential lavatory (bathroom) faucets	9 lpm*	
Residential kitchen faucet		
Residential showerheads	10 lpm* per shower stall***	
<p>* When measured at a flowing water pressure of 3 bar</p> <p>** Bidets must meet the baseline for private lavatory faucets</p> <p>***Residential shower compartment (stall) in dwelling units: The total allowable flow rate from all flowing showerheads at any given time, including rain systems, waterfalls, bodysprays, bodyspas and jets, must be limited to the allowable showerhead flow rate as specified above 10 lpm per shower compartment, where the floor area of the shower compartment is less than 1.5 square meters. For each increment of 1.5 square meters of floor area thereafter or part thereof, an additional showerhead with total allowable flow rate from all flowing devices equal to or less than the allowable flow rate as specified above must be allowed. Exception: Showers that emit recirculated non-potable water originating from within the shower compartment while operating are allowed to exceed the maximum as long as the total potable water flow does not exceed the flow rate as specified above.</p> <p>The water use requirements listed in this table are based on the following standards: EN 997:2012; EN 1112:1998; EN 246:2003; EN 200:2008; and EN 817:2008</p>		

WE	
NC	Prerequisite 1
SCHOOLS	Prerequisite 1
CS	Prerequisite 1

See the LEED 2009 Green Building Design and Construction Reference Guide for additional implementation guidance related to this prerequisite.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this prerequisite.

## 6. Calculations

There are no additional calculations associated with this credit. See LEED 2009 Green Building Design and Construction Reference Guide for calculations associated with this prerequisite.

## 7. Documentation Guidance

See the LEED 2009 Green Building Design and Construction Reference Guide for documentation guidance related to this prerequisite.

## 8. Examples

See the LEED 2009 Green Building Design and Construction Reference Guide for an example detailing the treatment of different fixture groups by occupancy type.

## 9. Exemplary Performance

This prerequisite is not eligible for exemplary performance under the Innovation in Design Section of the LEED 2009 Green Building Design and Construction rating system.

## 10. Regional Variations

See the LEED 2009 Green Building Design and Construction Reference Guide for regional variations associated with this prerequisite.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this credit.

## 12. Resources

See the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this prerequisite.

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WE	
NC	Prerequisite 1
SCHOOLS	Prerequisite 1
CS	Prerequisite 1

## Websites

### European Commission, Drinking Water

[http://ec.europa.eu/environment/water/water-drink/index\\_en.html](http://ec.europa.eu/environment/water/water-drink/index_en.html)

The European Commission offers an overview on drinking water legislation and implementation.

### European Commission, Study of Water Efficiency Standards

[http://ec.europa.eu/environment/water/quantity/pdf/Water%20efficiency%20standards\\_Study2009.pdf](http://ec.europa.eu/environment/water/quantity/pdf/Water%20efficiency%20standards_Study2009.pdf)

The European Commission's Study of Water Efficiency Standards advocates for water standards and efficiency devices in Europe.

### European Commission, Water Blueprint

[http://ec.europa.eu/environment/water/blueprint/index\\_en.htm](http://ec.europa.eu/environment/water/blueprint/index_en.htm)

The European Commission's Water Blueprint outlines actions that concentrate on implementation of water legislation and provides recommendations for water conservation in Europe.

### European Federation of National Associations of Water and Wastewater Services (EUREAU)

[www.eureau.org](http://www.eureau.org)

EUREAU provides relevant water policy and water standard information for Europe.

### European Union

<http://europa.eu>

The European Union's webpage provides a directory and information related to European standards within this prerequisite.

### Water Label

<http://www.europeanwaterlabel.eu>

The water label scheme is a resource for project teams to find and compare water efficient products.

### Well

<http://www.well-online.eu/>

Well is a product classification and labeling system of the European sanitary valve industry, which informs and provides customers with information to make conscious purchasing decisions, thus promoting responsible water usage.

## 12. Definitions

**Graywater** is untreated household waste water which has not come into contact with toilet waste. Graywater typically includes used water from bathtubs, showers, bathroom wash basins, and water from clothes-washer and laundry tubs, though definitions may vary. Some states and local authorities also allow kitchen sink wastewater to be included in graywater. Project teams should comply with the graywater definition established by the authority having jurisdiction in the project area.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional definitions of terms identified in this prerequisite.

## WATER EFFICIENT LANDSCAPING

## WE CREDIT 1

	NC	SCHOOLS	CS
Credit	WE Credit 1	WE Credit 1	WE Credit 1
Points	2-4 points	2-4 points	2-4 points

### Intent

To 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

#### NC, SCHOOLS & CS

#### OPTION 1. Reduce by 50% (2 points)

Reduce potable water consumption for irrigation by 50% from a calculated midsummer baseline case or using the month with the highest irrigation demand.

Reductions must be attributed to any combination of the following items:

- Plant species, density and microclimate factor
- Irrigation efficiency
- Use of captured rainwater
- Use of recycled wastewater
- Use of water treated and conveyed by a public agency specifically for nonpotable uses

Groundwater seepage that is pumped away from the immediate vicinity of building slabs and foundations may be used for landscape irrigation to meet the intent of this credit. However, the project team must demonstrate that doing so does not affect site stormwater management systems.

OR

#### OPTION 2. No Potable Water Use or Irrigation<sup>1</sup> (4 points)

Meet the requirements for Option 1.

AND

#### PATH 1

Use only captured rainwater, recycled wastewater, recycled graywater or water treated and conveyed by a public agency specifically for nonpotable uses for irrigation.

OR

#### PATH 2

Install landscaping that does not require permanent irrigation systems. Temporary irrigation systems used for plant establishment are allowed only if removed within a period not to exceed 18 months of installation.

<sup>1</sup> If the percent reduction of potable water is 100% AND the percent reduction of total water is equal to or greater than 50%, both Option 1 & Option 2 are earned.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

WE	
NC	Credit 1
SCHOOLS	Credit 1
CS	Credit 1

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

There are no standards referenced for this credit.

## 4. Implementation

See the LEED 2009 Green Building Design and Construction Reference Guide for complete implementation guidance, including Steps 1–4 and 6.

Step 5. Effective and efficient watering practices should read as follows:

- Regularly check irrigation systems for efficient and effective operation; verify watering schedules and duration on a monthly basis.
- Use drip, micromist, and subsurface irrigation systems where applicable; use smart irrigation controllers throughout. Provide computer-controlled monitoring and schedule modifications from a central location.
- Do not irrigate plants or turf during winter months.
- Do not irrigate shrubs during fall, winter, or spring months.
- To prevent mold growth, make sure irrigation systems do not allow buildings to become saturated or water to be introduced into building air intakes. Systems should be designed to keep water away from buildings.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## 6. Calculations

See the LEED 2009 Green Building Design and Construction Reference Guide for calculations regarding this credit. The following should replace the first bullet under Standard Assumptions and Variables:

- All calculations are based on irrigation during the month with the highest irrigation demand. The evapotranspiration rate (ET<sub>o</sub>) for the month with the greatest irrigation demand should be determined by the project's landscape designer based on local climate data; project teams may also refer to the International Water Management Institute (<http://www.iwmi.cgiar.org/WAtlas/Default.aspx>) or the EPA Water Budget Data Finder in determining the peak watering month with the greatest irrigation demand ([http://www.epa.gov/WaterSense/new\\_homes/wb\\_data\\_finder.html](http://www.epa.gov/WaterSense/new_homes/wb_data_finder.html)).

## 7. Documentation Guidance

See the LEED 2009 Green Building Design and Construction Reference Guide for documentation guidance related to this credit.

## 8. Examples

See the LEED 2009 Green Building Design and Construction Reference Guide for an example of implementing a rainwater harvesting system to reduce potable water used for irrigation on a project. The example is applicable to projects using the month with the highest irrigation demand rather than July.

WE	
NC	Credit 1
SCHOOLS	Credit 1
CS	Credit 1

## 9. Exemplary Performance

This credit is not eligible for exemplary performance under the Innovation in Design section of the LEED 2009 rating system.

## 10. Regional Variations

Much of the world is faced with increasing demands on existing water supplies, making it important to landscape sites appropriately for the climate. Landscaping should fit the site's climate and microclimate, sun exposure, soil type, drainage, and topography.

In hot, dry climates, emphasize drought-tolerant plants and xeriscape designs that mimic the natural landscape. Reducing or eliminating turf grass will lessen the demand on potable water. If turf grass is desired, select a species that can endure drought.

In hot, humid, and temperate climates, use native plants combined with rain or moisture sensors to avoid unnecessary watering during wet seasons. The use of captured rainwater can help eliminate the use of potable water for irrigation.

In cold climates, install hardy, native plants that will survive the winter months. Rain or moisture sensors will help prevent excessive watering.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this credit.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

### Websites

#### EPA Water Budget Data Finder

[http://www.epa.gov/WaterSense/new\\_homes/wb\\_data\\_finder.html](http://www.epa.gov/WaterSense/new_homes/wb_data_finder.html)

U.S. EPA provides guidance in determining the peak watering month with the greatest irrigation demand.

#### International Water Management Institute

<http://www.iwmi.cgiar.org/WAtlas/Default.aspx>

This organization provides monthly evapotranspiration and rainfall data worldwide.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional resources related to this credit.

## 13. Definitions

**Month with the highest irrigation demand** is the maximum monthly delta between evapotranspiration rate (ET<sub>o</sub>) and mean monthly rainfall.

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of other terms used in this credit.

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## WATER USE REDUCTION

	NC	SCHOOLS	CS
Credit	WE Credit 3	WE Credit 3	WE Credit 3
Points	2-4 points	2-4 points	2-4 points

### Intent

To further increase water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems.

### Requirements

#### NC, SCHOOLS & CS

Employ strategies that in aggregate use less water than the water use baseline calculated for the building (not including irrigation).

The minimum water savings percentage for each point threshold is as follows:

Percentage Reduction	Points
30%	2
35%	3
40%	4

Calculate the baseline according to the commercial and/or residential baselines outlined below.<sup>1</sup> Calculations are based on estimated occupant usage and must include only the following fixtures and fixture fittings (as applicable to the project scope): water closets, urinals, lavatory faucets, showers, kitchen sink faucets and pre-rinse spray valves. Projects in Europe may use the values defined by European standards.

Commercial Fixtures, Fittings, and Appliances	Current Baseline (IP)	Current Baseline (SI)
Commercial toilets	1.6 gallons per flush (gpf)* Except blow-out fixtures: 3.5 (gpf)	6 liters per flush (lpf)* Except blow-out fixtures: 13 lpf
Commercial urinals	1.0 (gpf)	4 lpf
Commercial lavatory (restroom) faucets	2.2 gallons per minute (gpm) at 60 pounds per square inch (psi), private applications only (hotel or motel guest rooms, hospital patient rooms) 0.5 (gpm) at 60 (psi)** all others except private applications 0.25 gallons per cycle for metering faucets	8.5 liters per minute (lpm) at 4 bar (58 psi), private applications only (hotel or motel guest rooms, hospital patient rooms) 2.0 lpm at 4 bar (58 psi), all others except private applications 1 liter per cycle for metering faucets
Showerheads	2.5 (gpm) at 80 (psi) per shower stall****	9/5 lpm at 5 bar (58 psi)
For projects with commercial pre-rinse spray valves, the flow rate must comply with the asME a112.18.1 standard of 1.6 gpm or less.		

<sup>1</sup> Table adapted from information developed and summarized by the U.S. Environmental Protection Agency (EPA) Office of Water based on requirements of the Energy Policy Act (EPAct) of 1992 and subsequent rulings by the Department of Energy, requirements of the EPAct of 2005, and the plumbing code requirements as stated in the 2006 editions of the Uniform Plumbing Code or International Plumbing Code pertaining to fixture performance.

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## WE CREDIT 3

### NC, SCHOOLS & CS (continued)

Residential Fixtures, Fittings, and Appliances	Current Baseline (IP)	Current Baseline (SI)
Residential toilets	1.6 (gpf)***	6 liters per flush (lpf)* Except blow-out fixtures: 13 lpf
Residential lavatory (bathroom) faucets	2.2 (gpm) at 60 psi	4 lpm 8.5 lpm at 4 bar (58 psi), private applications only (hotel or motel guest rooms, hospital patient rooms)
Residential kitchen faucet		2.0 lpm at 4 bar (58 psi), all others except private applications 1 liter per cycle for metering faucets
Residential showerheads	2.5 (gpm) at 80 (psi) per shower stall****	flow rate ≤ 6.1 lpm (no pressure specified; no performance requirement)

\* EPA 1992 standard for toilets applies to both commercial and residential models.

\*\* In addition to EPA requirements, the American Society of Mechanical Engineers standard for public lavatory faucets is 0.5 gpm at 60 psi (ASME A112.18.1-2005). This maximum has been incorporated into the national Uniform Plumbing Code and the International Plumbing Code.

\*\*\* EPA 1992 standard for toilets applies to both commercial and residential models.

\*\*\*\* Residential shower compartment (stall) in dwelling units: The total allowable flow rate from all flowing showerheads at any given time, including rain systems, waterfalls, bodysprays, bodyspas and jets, must be limited to the allowable showerhead flow rate as specified above (2.5 gpm) per shower compartment, where the floor area of the shower compartment is less than 2,500 square inches. For each increment of 2,500 square inches of floor area thereafter or part thereof, an additional showerhead with total allowable flow rate from all flowing devices equal to or less than the allowable flow rate as specified above must be allowed. Exception: Showers that emit recirculated nonpotable water originating from within the shower compartment while operating are allowed to exceed the maximum as long as the total potable water flow does not exceed the flow rate as specified above.

The following fixtures, fittings and appliances are outside the scope of the water use reduction calculation:

- Commercial Steam Cookers
- Commercial Dishwashers
- Automatic Commercial Ice Makers
- Commercial (family-sized) Clothes Washers
- Residential Clothes Washers
- Standard and Compact Residential Dishwashers

## 1. Benefits and Issues to Consider

Refer to the Benefits and Issues section of WE Prerequisite 1 in this supplement.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

Refer to the Referenced Standards section of WE Prerequisite 1 in this supplement.

## 4. Implementation

Refer to the Implementation section of WE Prerequisite 1 in this supplement.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## 6. Calculations

There are no additional calculations associated with this credit. See LEED 2009 Green Building Design and Construction Reference Guide for calculations associated with this prerequisite. s:

## 7. Documentation Guidance

See the LEED 2009 Green Building Design and Construction Reference Guide for documentation guidance related to this credit.

## 8. Examples

See the LEED 2009 Green Building Design and Construction Reference Guide for an example detailing the treatment of different fixture groups by occupancy type.

## 9. Exemplary Performance

See the LEED 2009 Green Building Design and Construction Reference Guide for information about Exemplary Performance related to this credit.

## 10. Regional Variations

See the LEED 2009 Green Building Design and Construction Reference Guide for regional variations associated with this credit.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this credit.

## 12. Resources

Refer to the Benefits and Issues section of WE Prerequisite 1 in this supplement.

## 13. Definitions

Refer to the Definitions section of WE Prerequisite 1 in this supplement.

WE	
NC	Credit 3
SCHOOLS	Credit 3
CS	Credit 3

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# ENERGY AND ATMOSPHERE

## EA OVERVIEW

### Overview

See the LEED 2009 Green Building Design and Construction Reference Guide for additional guidance.

**Buildings are a major consumer of energy and electricity across the globe and lowering energy consumption in buildings is a significant goal of LEED. The ACPs in the Energy and Atmosphere credit category allow for the use of local equivalents to make energy reduction and renewable energy consumption attainable goals for Europe.**

### Global ACPs













Because energy modeling is a very complex process that involves the use of computer-generated models and stringent energy standards, project teams outside the U.S. seeking to use an alternative to ANSI/ASHRAE/IESNA Standard 90.1–2007 in EA Prerequisite 2 (Minimum Energy Performance) and EA Credit 1 (Optimize Energy Performance) must first submit to a review process, as outlined later in this document.

Project teams seeking to achieve EA Credit 6 (Green Power) may now purchase renewable power from local sources as long as it meets the major Green-e Energy program criteria.

### Europe ACPs

EA Credit 6 (Green Power) is expanded to define acceptable equivalents to the Green-e equivalent electricity program in Europe.

 **Table 1.** EA Credits with Alternative Compliance Paths

Credit	Title	NC	Schools	CS
<b>EA Prerequisite 1</b>	Fundamental Commissioning of Building Energy Systems			
<b>EA Prerequisite 2</b>	Minimum Energy Performance			
<b>EA Prerequisite 3</b>	Fundamental Refrigerant Management			
<b>EA Credit 1</b>	Optimize Energy Performance			
<b>EA Credit 2</b>	On-site Renewable Energy			
<b>EA Credit 3</b>	Enhanced Commissioning			
<b>EA Credit 4</b>	Enhanced Refrigerant Management			
<b>EA Credit 5</b>	Measurement and Verification			
<b>EA Credit 5.1</b>	Measurement and Verification—Base Building			
<b>EA Credit 5.2</b>	Measurement and Verification—Tenant Submetering			
<b>EA Credit 6</b>	Green Power	 	 	 

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## MINIMUM ENERGY PERFORMANCE

## EA PREREQUISITE 2

	NC	SCHOOLS	CS
Prerequisite	EA Prerequisite 2	EA Prerequisite 2	EA Prerequisite 2
Points	Required	Required	Required

### Intent

To establish the minimum level of energy efficiency for the proposed building and systems to reduce environmental and economic impacts associated with excessive energy use.

### Requirements

#### NC, SCHOOLS & CS

The project must establish an energy performance rating goal for the facility design using EPA's Target Finder rating tool.

#### OPTION 1. Whole Building Energy Simulation

Demonstrate a 10% improvement in the proposed building performance rating for new buildings or a 5% improvement in the proposed building performance rating for major renovations to existing buildings compared with the baseline building performance rating.

Calculate the baseline building performance rating according to the building performance rating method in Appendix G of ANSI/ASHRAE/IESNA Standard 90.1-2007 (with errata but without addenda<sup>1</sup>) using computer stimulation model for the whole building project. Projects outside the U.S. may use a USGBC approved equivalent standard.

Appendix G of Standard 90.1-2007 requires that the energy analysis done for the building performance rating method include all energy costs associated with the building project. To achieve points using this credit, the proposed design must meet the following criteria:

- Compliance with the mandatory provisions (Sections 5.4, 6.4, 7.4, 8.4, 9.4 and 10.4) in Standard 90.1-2007 (with errata but without addenda<sup>1</sup>) or USGBC approved equivalent.
- Inclusion of all the energy costs within and associated with the building project.
- Comparison against a baseline building that complies with Appendix G of Standard 90.1-2007 (with errata but without addenda) or USGBC approved equivalent. The default process energy cost is 25% of the total energy cost for the baseline building. If the building's process energy cost is less than 25% of the baseline building energy cost, the LEED submittal must include 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).

<sup>1</sup> Project teams wishing to use ASHRAE approved addenda for the purposes of this prerequisite may do so at their discretion. Addenda must be applied consistently across all LEED credits.

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## EA PREREQUISITE 2

Regulated (nonprocess) energy includes lighting (for the interior, parking garage, surface parking, façade, or building grounds, except as noted above), heating, ventilating, and air conditioning (HVAC) 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.

Process loads must 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 (ANSI/ASHRAE/IESNA Standard 90.1-2007 G2.5) or USGBC approved equivalent to document measures that reduce process loads. Documentation of process load energy savings must include a list of the assumptions made for both the base and the proposed design, and theoretical or empirical information supporting these assumptions.

Projects in California may use Title 24-2005, Part 6 in place of ANSI/ASHRAE/IESNA Standard 90.1-2007 Option 1.

OR

### OPTION 2. Prescriptive Compliance Path: Advanced Energy Design Guide for K-12 School Buildings

Comply with all of the prescriptive measures identified in the Advanced Energy Design Guide for K-12 school buildings. Comply with all applicable criteria as established in the Advanced Energy Design Guide for the climate zone in which the building is located. Projects outside the U.S. may use ANSI/ASHRAE/IESNA Standard 90.1-2007 Appendices B and D to determine the appropriate climate zone.

Projects using Option 2 must be less than 200,000 square feet (18,000 square meters).

OR

### OPTION 3. Prescriptive Compliance Path: Advanced Buildings™ Core Performance™ Guide

Comply with the prescriptive measures identified in the Advanced Buildings™ Core Performance™ Guide developed by the New Buildings Institute. The building must meet the following requirements:

- Less than 100,000 square feet (9,300 square meters).
- Comply with Sections 1, Design Process Strategies, and 2, Core Performance Requirements.
- Health care, warehouse and laboratory projects are ineligible for this path.

Projects outside the U.S. may use ANSI/ASHRAE/IESNA Standard 90.1-2007 Appendices B and D to determine the appropriate climate zone.



## 1. Benefits and Issues to Consider

Refer to the Benefits and Issues section of EA Credit 1 in this supplement.

## 2. Related Credits

See the Related Credits section in EA Credit 1 in this supplement.

## 3. Summary of Referenced Standards

Refer to the Summary of Referenced Standards section in EA Credit 1 in this supplement.

## 4. Implementation

Refer to the Implementation section in EA Credit 1 in this supplement.

## 5. Timeline and Team

Refer to the Timeline and Team section in EA Credit 1 in this supplement.

## 6. Calculations

Refer to the Calculations section in EA Credit 1 in this supplement.

## 7. Documentation Guidance

Refer to the Documentation Guidance section in EA Credit 1 in this supplement.

## 8. Examples

Refer to the Examples section in EA Credit 1 in this supplement.

## 9. Exemplary Performance

This prerequisite is not eligible for exemplary performance under the Innovation in Design section of the LEED 2009 rating system.

## 10. Regional Variations

Refer to the Regional Variations section in EA Credit 1 in this supplement.

## 11. Operations and Maintenance Considerations

Refer to the Operations and Maintenance Considerations section in EA Credit 1 in this supplement.

## 12. Resources

See EA Credit 1 in the LEED 2009 Green Building Design and Construction Reference Guide for additional resources.

## 13. Definitions

Refer to the definitions section EA Credit 1 in this supplement.

EA	
NC	Prerequisite 2
SCHOOLS	Prerequisite 2
CS	Prerequisite 2

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## OPTIMIZE ENERGY PERFORMANCE

## EA CREDIT 1

	NC	SCHOOLS	CS
Credit	EA Credit 1	EA Credit 1	EA Credit 1
Points	1-19 points	1-19 points	1-19 points

### Intent

To achieve increasing levels of energy performance beyond the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use.

### Requirements

#### NC, SCHOOLS & CS

Select 1 of the 3 compliance path options described below. Project teams documenting achievement using any of the 3 options are assumed to be in compliance with EA Prerequisite 2: Minimum Energy Performance.

#### OPTION 1. Whole Building Energy Simulation (1-19 points)

Demonstrate a percentage improvement in the proposed building performance rating compared with the baseline building performance rating. Calculate the baseline building performance according to Appendix G of ANSI/ASHRAE/IESNA Standard 90.1-2007 (with errata but without addenda<sup>1</sup>) using a computer simulation model for the whole building project. Projects outside the U.S. may use a USGBC approved equivalent standard. The minimum energy cost savings percentage for each point threshold is as follows:

New Buildings	Existing Building Renovations	Points
12%	8%	1
14%	10%	2
16%	12%	3
18%	14%	4
20%	16%	5
22%	18%	6
24%	20%	7
26%	22%	8
28%	24%	9
30%	26%	10
32%	28%	11
34%	30%	12
36%	32%	13
38%	34%	14
40%	36%	15
42%	38%	16
44%	40%	17
46%	42%	18
48%	44%	19

#### NC, SCHOOLS & CS (continued)

<sup>1</sup> Project teams wishing to use ASHRAE approved addenda for the purposes of this prerequisite may do so at their discretion. Addenda must be applied consistently across all LEED credits.

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## EA CREDIT 1

Appendix G of ANSI/ASHRAE/IESNA Standard 90.1-2007 requires that the energy analysis done for the building performance rating method include all the energy costs associated with the building project. To achieve points under this credit, the proposed design must meet the following criteria:

- Compliance with the mandatory provisions (Sections 5.4, 6.4, 7.4, 8.4, 9.4 and 10.4) in Standard 90.1-2007 (with errata but without addenda) or USGBC approved equivalent.
- Inclusion of all the energy costs within and associated with the building project.
- Comparison against a baseline building that complies with Appendix G of Standard 90.1-2007 (with errata but without addenda) or USGBC approved equivalent. The default process energy cost is 25% of the total energy cost for the baseline building. If the building's process energy cost is less than 25% of the baseline building energy cost, the LEED submittal must include 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 (nonprocess) energy includes lighting (for the interior, parking garage, surface parking, façade, or building grounds, except as noted above), heating, ventilating and air conditioning (HVAC) (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 this credit, process loads must be identical for both the baseline building performance rating and the proposed building performance rating. However, project teams may follow the exceptional calculation method (ANSI/ASHRAE/IESNA Standard 90.1-2007 G2.5) or USGBC approved equivalent to document measures that reduce process loads. Documentation of process load energy savings must include a list of the assumptions made for both the base and proposed design, and theoretical or empirical information supporting these assumptions.

Projects in California may use Title 24-2005, Part 6 in place of ANSI/ASHRAE/IESNA Standard 90.1-2007 Option 1.

OR

### OPTION 2. Prescriptive Compliance Path: Advanced Energy Design Guide for K-12 School Buildings (1 point)

Comply with all the prescriptive measures identified in the Advanced Energy Design Guide for K-12 School buildings. Project teams must comply with all applicable criteria as established in the Advanced Energy Design Guide for the climate zone in which the building is located. Projects outside the U.S. may use ANSI/ASHRAE/IESNA Standard 90.1-2007 Appendices B and D to determine the appropriate climate zone.

- Projects using Option 2 must be less than 200,000 square feet (18,000 square meters).

NC, SCHOOLS & CS (continued)

OR

**OPTION 3. Prescriptive Compliance Path: Advanced Buildings™ Core Performance™ Guide (1-3 points)**

Comply with the prescriptive measures identified in the Advanced Buildings™ Core Performance™ Guide developed by the New Buildings Institute. The building must meet the following requirements:

- Less than 100,000 square feet (9,300 square meters).
- Comply with Sections 1, Design Process Strategies, and 2, Core Performance Requirements.

Points achieved under Option 3 (1 point):

- 1 point is available for all projects (office, school, public assembly, and retail projects) less than 100,000 square feet (9,300 square meters) that comply with Sections 1 and 2 of the Core Performance Guide.
- Up to 2 additional points are available to projects that implement performance strategies listed in Section 3, Enhanced Performance. For every 3 strategies implemented from this section, 1 point is available.
- The following strategies are addressed by other aspects of LEED and are not eligible for additional points under EA Credit 1:
  - 3.1 — Cool Roofs
  - 3.8 — Night Venting
  - 3.13 — Additional Commissioning

Projects outside the U.S. may use ANSI/ASHRAE/IESNA Standard 90.1-2007 Appendices B and D to determine the appropriate climate zone.

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EA	
NC	Credit 1
SCHOOLS	Credit 1
CS	Credit 1

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

See the LEED 2009 Green Building Design and Construction Reference Guide for a summary of ANSI/ASHRAE/IESNA Standard 90.1–2007, referenced in this credit.

Any local alternative to ANSI/ASHRAE/IESNA Standard 90.1–2007 must be approved by USGBC as an equivalent standard, using the process described in the Implementation section.

### ANSI/ASHRAE/IESNA Standard 90.1–2007, Appendixes B and D

American National Standards Institute

American Society of Heating, Refrigerating and Air-Conditioning Engineers

Illuminating Engineering Society of North America

[www.ashrae.org](http://www.ashrae.org)

Appendix B of the standard identifies U.S. and global climate zones. Appendix D provides U.S. and global climatic data that can be used to determine the climate zone for the project location.

## 4. Implementation

### Option 1

The following process is used to determine the equivalency of a local standard to ANSI/ASHRAE/IESNA Standard 90.1–2007.

1. A group interested in determining equivalency of a particular standard should email a request to USGBC through [commonlanguage@usgbc.org](mailto:commonlanguage@usgbc.org).
2. USGBC will collaborate with the group to establish a method for creating an equivalency study and a timeline for completion.
3. The group will conduct the study.
4. USGBC will review the study and bring its recommendation to the LEED International Roundtable with approval by the LEED Steering Committee.
5. Typically, the group putting forward the standard will cover the cost of the study and USGBC review.
6. Priority of USGBC review will be determined based on market transformation potential and representation of the country on the LEED International Roundtable.
7. Approval of equivalency will be determined by the LEED Steering Committee and communicated to the group.
8. Upon approval by the LEED Steering Committee, the equivalency will be made available to projects through a USGBC-administered LEED Interpretation.

Additional information on the LEED International Roundtable can be found at [www.usgbc.org](http://www.usgbc.org).

## Option 2 or 3

If Option 2 or 3 is selected, identify the proper climate zone for the project location by using ANSI/ASHRAE/IESNA Standard 90.1–2007, Appendixes B and D.

Appendix B, Table B-3, gives the climate zones of major U.S. and Canadian cities and select international cities, plus the thermal criteria and climate type definitions for each zone. If the project location is not included in Table B-3, use the climate zone definitions in Table B-4.

Appendix D provides a more extensive list of U.S., Canadian, and international cities. The data in this appendix can be used to determine the proper climate zone for the project location.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional implementation guidance.

EA	
NC	Credit 1
SCHOOLS	Credit 1
CS	Credit 1

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit. Project teams wishing to use a local equivalent should contact USGBC early in the design phase to ensure that the alternative standard is acceptable.

## 6. Calculations

See the LEED 2009 Green Building Design and Construction Reference Guide for calculations associated with this credit.

## 7. Documentation Guidance

Any local alternative to ANSI/ASHRAE/IESNA Standard 90.1–2007 is desired must be determined equivalent to the U.S. standard, as described in the Implementation section.

See the LEED 2009 Green Building Design and Construction Reference Guide for documentation guidance related to this credit.

## 8. Examples

A project team in Beijing consults ANSI/ASHRAE/IESNA Standard 90.1–2007, Appendix B, to determine the appropriate climate zone for compliance with Option 3 of the credit.

Table B-3 does not give a climate zone for Beijing. The project team finds Beijing in Table D-2, which lists the values for heating degree-days to base 65°F (HDD65) as 5252, and cooling degree-days to base 50°F (CDD50) as 4115. The team uses these values to determine Beijing's climate zone as defined in Appendix B, Section B2 and Table B-4.

The project team finds that Beijing is in a “moist climate” because its warmest month has a mean temperature higher than 72°F (22.2°C) and is therefore too warm to be a “marine climate,” and annual rainfall data indicate that the city is not in a “dry climate.”

Finally, the project team uses the values found in Table D-2 for HDD65 (5252) and CDD50 (4115) in Table B-4 and determines that Beijing is in Zone 4A (“mixed-humid”) because the CDD50 value is 4500 or less, and the HDD65 value is between 3600 and 5400.

## 9. Exemplary Performance

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance on exemplary performance for this credit.

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EA	
NC	Credit 1
SCHOOLS	Credit 1
CS	Credit 1

## 10. Regional Variations

See the LEED 2009 Green Building Design and Construction Reference Guide for regional variations associated with this credit.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this credit.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

See the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this credit.

## 13. Definitions

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms used in this credit.



## GREEN POWER

## EA CREDIT 6

	NC	SCHOOLS	CS
Credit	EA Credit 6	EA Credit 6	EA Credit 6
Points	2 points	2 points	2 points

### Intent

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

### Requirements

#### NC, SCHOOLS & CS

Engage in at least a 2-year renewable energy contract to provide at least 35% of the building's electricity from renewable sources, as defined by the Center for Resource Solutions' Green-e Energy product certification requirements or an equivalent.

All purchases of green power shall be based on the quantity of energy consumed, not the cost.

If the green power is not Green-e Energy certified, equivalence must exist for both major Green-e Energy program criteria: 1) current green power performance standards, and 2) independent, third-party verification that those standards are being met by the green power supplier over time. Projects in Europe may use EKO Energy or Guarantees of Origin (GOs) with additional parameters.

#### OPTION 1. Determine Baseline Electricity Use

Use the annual electricity consumption from the results of EA Credit 1: Optimize Energy Performance.

OR

#### OPTION 2. Estimate Baseline Electricity Use

Use the US Department of Energy's Commercial Buildings Energy Consumption Survey (CBECS) database to determine the estimated electricity use.

School districts can purchase green power on a centralized basis and allocate the green power to a specific project. However, the same power cannot be credited to another LEED project. Submit a letter from the company owner attesting to this.

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EA	
NC	Credit 6
SCHOOLS	Credit 6
CS	Credit 6

## 1. Benefits and Issues to Consider

While acknowledging the difficulty of identifying the exact source of green energy in every region, this credit requires that the off-site-generated renewable energy used for the building and its site be certified by the Green-e program or its equivalent for electricity, and Green-e Climate or its equivalent for other energy consumption.

Within Europe, EKOenergy is considered an acceptable equivalent to the Green-e program for electricity. EKOenergy is a network of European environmental NGOs promoting the consumption and production of renewable electricity. The EKOenergy electricity certification scheme represents the best available pan-European option for the sustainable and additional consumption of renewable electricity within Europe. EKOenergy certifies renewable electricity that goes beyond the regulations of European directives and national governments of Europe.

Guarantees of Origin (GOs) are an acceptable equivalent to the Green-e program for electricity if additional requirements are met with regards to location of power generation, hydropower and biomass in Europe. GOs are energy purchasing mechanisms which provide a means of transparent purchasing and tracking of energy generation that build awareness and demand for energy products. GOs are the tracking certificate regulated in Article 15 of EU Directive 2009/28/EC on the promotion of the use of energy from renewable sources. This directive mandates that all European Union member countries allow for the issuance of GOs in order to prove to end-consumers that a given share or quantity of energy was produced from renewable sources. The directive also ensures that (1) the energy source for a renewable GO must meet certain requirements to be defined as renewable and (2) the renewable energy producer must undergo application and verification process by member countries. The designated national GO issuing bodies shall put in place appropriate mechanisms to ensure that GOs are issued, transferred, and cancelled electronically and are accurate, reliable, and fraud-resistant. Information included on the GO includes but may not be limited to:

The energy source from which the energy was produced and the start and end dates of production.

- Whether it relates to: Electricity, Heating, or Cooling
- The identity, location, type and capacity of the installation where the energy was produced.
- Whether and to what extent the installation has benefited from investment support, whether and to what extent the unit of energy has benefited in any other way from a national support scheme, and the type of support scheme.
- The date on which the installation became operational.
- The date and country of issue and a unique identification number.

GOs are further standardized via the European Energy Certificate System (EECS) provided by the Association of Issuing Bodies (AIB.) The EECS makes trade, cancelation, and use of GOs standardized across Europe. GOs have no inherent price except for the price given to GOs by the supply and demand market and are the carrier of electricity attributes.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

### 3. Summary of Referenced Standards

#### EU Directive 2004/8/EC on the promotion of cogeneration based on a useful heat demand in the internal energy market

[http://europa.eu/legislation\\_summaries/energy/energy\\_efficiency/l27021\\_en.htm](http://europa.eu/legislation_summaries/energy/energy_efficiency/l27021_en.htm)

EU Directive 2004/8/EC facilitates the installation and operation of electrical cogeneration plants (a technology allowing the production in one process of heat and electricity) in order to save energy and combat climate change.

#### EU Directive 2009/28/EC on the promotion of the use of energy from renewable sources

[http://europa.eu/legislation\\_summaries/energy/renewable\\_energy/en0009\\_en.htm](http://europa.eu/legislation_summaries/energy/renewable_energy/en0009_en.htm)

EU Directive 2009/28/EC establishes a common framework for the production and promotion of energy from renewable sources. The Directive is part of a package of energy and climate change legislation which provides a legislative framework for community targets for greenhouse gas emission savings. It encourages energy efficiency, energy consumption from renewable sources, the improvement of energy supply, and the economic stimulation of a dynamic sector in Europe.

#### RECs International

[www.recs.org](http://www.recs.org)

RECs International is a non-profit organization that strives for a transparent pan-European renewable energy market, facilitated by commonly accepted and harmonized tracking systems. A list of major European providers and members of the organization, as well as information on GOs is available on RECs International's website.

#### The Association of Issuing Bodies

<http://www.aib-net.org>

The Association of Issuing Bodies (AIB) is an independent body focused on facilitating the international exchange of energy certificates, based upon the European Energy Certificate System (EECS). The AIB can be a good source for information related to GOs and trading renewable energy certificates in Europe. The AIB lists national regulators whom issue standardized European GOs on their website.

### 4. Implementation

Project teams in Europe may purchase a quantity of GOs equal to 35% of the predicted annual electricity consumption over a 2-year period either all at once or in contracted installments. If the GOs are purchased all at once, this will be equivalent to 70% of predicted annual electricity consumption.

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

### 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

### 6. Calculations

#### Default Electricity Consumption

Project teams using Option 2 that wish to use a local benchmark based on source energy from their country's national or regional energy agency must submit proof that the local benchmark represents a statistically significant sample of the building type being referenced and that the

EA	
NC	Credit 6
SCHOOLS	Credit 6
CS	Credit 6

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EA	
NC	Credit 6
SCHOOLS	Credit 6
CS	Credit 6

benchmarking process is repeatable. The benchmark should include at least 30 buildings of the project's building type, and the data should be weather normalized and account for internal and external loads. To determine whether a local baseline is equivalent to CBECS, review the regressions and models used in CBECS, at [http://www.eia.gov/emeu/cbecs/tech\\_end\\_use.html](http://www.eia.gov/emeu/cbecs/tech_end_use.html).

The local benchmarking tool should be managed by a reputable source, such as a local government agency or regulatory body. Additional information on the technical background of the CBECS baseline for project teams using an alternative baseline can be found at [http://www.eia.gov/emeu/cbecs/technical\\_information.html](http://www.eia.gov/emeu/cbecs/technical_information.html).

Projects are encouraged to submit a Credit Interpretation Request (CIR) prior to referencing a local benchmarking tool in place of CBECS to ensure acceptability of the local baseline. If no local benchmarking tool is available, project teams may continue to use CBECS to establish a baseline for this option.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional calculations related to this credit.

## 7. Documentation Guidance

Upload GO documentation, including as applicable:

- Narrative explaining that renewable energy installation is not in a nature reserve area.
- Rating of hydropower facility under the Water Framework Directive or proof of certification under a sustainable hydropower label.
- Country of EU biomass origin.
- Proof of GO cancellation

See the LEED 2009 Green Building Design and Construction Reference Guide for additional documentation guidance related to this credit

## 8. Examples

A project team decides to purchase off-site renewable energy through a provider certified by EKOenergy. The team visits the EKOenergy website and references the How to Buy EKOenergy page at <http://www.ekoenergy.org/where-can-i-buy-it>. The team contacts EKOenergy Secretariat for purchasing options.

## 9. Exemplary Performance

See the LEED 2009 Green Building Design and Construction Reference Guide for exemplary performance related to this credit

## 10. Regional Variations

Renewable energy certificates (RECs) make it possible to substitute green energy even if the project does not have access to green power through the local utility or a competitive electricity marketer. RECs are now widely available in nearly all U.S. states but less prevalent in other countries. Projects outside the U.S. have the option of meeting this credit either by establishing Green-e equivalency, as detailed in the Implementation section of the LEED 2009 Green Building Design and Construction Reference Guide, or by purchasing U.S.-based Green-e certified RECs.

## 11 Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this credit.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

### Websites

#### **EU Directive 2000/60/EC establishing a framework for the community action in the field of water policy (The Water Framework Directive)**

[http://europa.eu/legislation\\_summaries/environment/water\\_protection\\_management/l28002b\\_en.htm](http://europa.eu/legislation_summaries/environment/water_protection_management/l28002b_en.htm)

This Framework-Directive has a number of objectives, such as preventing and reducing pollution, promoting sustainable water usage, environmental protection, improving aquatic ecosystems and mitigating the effects of floods and droughts. Its ultimate objective is to achieve “good ecological and chemical status” for all Community waters by 2015.

#### **EU Directive 2004/8/EC on the promotion of cogeneration based on a useful heat demand in the internal energy market**

[http://europa.eu/legislation\\_summaries/energy/energy\\_efficiency/l27021\\_en.htm](http://europa.eu/legislation_summaries/energy/energy_efficiency/l27021_en.htm)

EU Directive 2004/8/EC facilitates the installation and operation of electrical cogeneration plants (a technology allowing the production in one process of heat and electricity) in order to save energy and combat climate change.

#### **EU Directive 2009/28/EC on the promotion of the use of energy from renewable sources**

[http://europa.eu/legislation\\_summaries/energy/renewable\\_energy/en0009\\_en.htm](http://europa.eu/legislation_summaries/energy/renewable_energy/en0009_en.htm)

EU Directive 2009/28/EC establishes a common framework for the production and promotion of energy from renewable sources. The Directive is part of a package of energy and climate change legislation which provides a legislative framework for community targets for greenhouse gas emission savings. It encourages energy efficiency, energy consumption from renewable sources, the improvement of energy supply, and the economic stimulation of a dynamic sector in Europe.

#### **Natura 2000**

<http://ec.europa.eu/environment/nature/natura2000/>

Natura 2000 is the centerpiece of EU nature & biodiversity policy. It is an EU-wide network of nature protection areas established under the 1992 Habitats Directive. The aim of the network is to assure the long-term survival of Europe's most valuable and threatened species and habitats. It is comprised of Special Areas of Conservation designated by EU member countries under the Habitats Directive, and also incorporates Special Protection Areas which they designate under the 1979 Birds Directive. The establishment of this network of protected areas also fulfils a Community obligation under the UN Convention on Biological Diversity.

#### **RECs International**

[www.recs.org](http://www.recs.org)

RECs International is a non-profit organization that strives for a transparent pan-European renewable energy market, facilitated by commonly accepted and harmonized tracking systems. A list of major European providers and members of the organization, as well as information on GOs is available on RECs International's website.

#### **The Association of Issuing Bodies**

<http://www.aib-net.org>

EA	
NC	Credit 6
SCHOOLS	Credit 6
CS	Credit 6

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EA	
NC	Credit 6
SCHOOLS	Credit 6
CS	Credit 6

The Association of Issuing Bodies (AIB) is an independent body focused on facilitating the international exchange of energy certificates, based upon the European Energy Certificate System (EECS.). The AIB can be a good source for information related to GOs and trading renewable energy certificates in Europe. The AIB lists national regulators whom issue standardized European GOs on their website.

See the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this credit.

### 13. Definitions

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms used in this credit.

# MATERIALS AND RESOURCES

## MR OVERVIEW

### OVERVIEW

See the LEED 2009 Green Building Design and Construction Reference Guide for additional guidance.

The responsible harvest or extraction of materials used in building products is of universal importance, as is the way they are transported to the project site.

### Global ACPs




Because some transportation methods cause significantly less environmental harm than others, a new option has been added to MR Credit 5 (Regional Materials) to allow for items that are shipped long distances via rail and water. The option involves calculating a weighted total distance rather than using a simple 500-mile (800-kilometer) radius.

Project teams in areas lacking formal recycling infrastructure often struggle to achieve the requirements of the Construction Waste Management credit (MR Credit 2). While no requirements have changed for this credit, additional guidance has been included to help project teams in these areas.

### Europe ACPs

There are currently no Europe ACPs available in the MR Category. However, MR Credit 5 (Regional Materials) includes an exemplary performance point for a reduced material sourcing distance that better reflects standard practice in Europe.

 **Table 1.** MR Credits with Alternative Compliance Paths

Credit	Title	NC	Schools	CS
<b>MR Prerequisite 1</b>	Storage and Collection of Recyclables			
<b>MR Credit 1.1</b>	Building Reuse—Maintain Existing Walls, Floors, and Roof			
<b>MR Credit 1</b>	Building Reuse—Maintain Existing Walls, Floors, and Roof			
<b>MR Credit 1.2</b>	Building Reuse—Maintain Interior Nonstructural Elements			
<b>MR Credit 2</b>	Construction Waste Management			
<b>MR Credit 3</b>	Materials Reuse			
<b>MR Credit 4</b>	Recycled Content			
<b>MR Credit 5</b>	Regional Materials			
<b>MR Credit 6</b>	Rapidly Renewable Materials			
<b>MR Credit 7</b>	Certified Wood			
<b>MR Credit 6</b>	Certified Wood			

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## CONSTRUCTION WASTE MANAGEMENT

## MR CREDIT 2

	NC	SCHOOLS	CS
Credit	MR Credit 2	MR Credit 2	MR Credit 2
Points	1-2 points	1-2 points	1-2 points

### Intent

To divert construction and demolition debris from disposal in landfills and incineration facilities. Redirect recyclable recovered resources back to the manufacturing process and reusable materials to appropriate sites.

### Requirements

#### NC, SCHOOLS & CS

Recycle and/or salvage nonhazardous 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 comingled. 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. The minimum percentage debris to be recycled or salvaged for each point threshold is as follows:

Recycled or Salvaged	Points
50%	1
75%	2

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

MR	
NC	Credit 2
SCHOOLS	Credit 2
CS	Credit 2

## 1. Benefits and Issues to Consider

Projects in areas lacking formalized construction waste recycling infrastructure often struggle to achieve this credit because it can be difficult to find waste haulers who can document that construction debris has been successfully diverted from a landfill. For projects in these areas, it is particularly important to have a construction waste management plan that clearly defines how construction and demolition waste is to be handled.

Projects in locations without formalized construction waste recycling infrastructure can achieve this credit by implementing alternative diversion strategies such as donation to local non-profit organizations and sale of excess materials to the local community.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

There are no standards referenced for this credit.

## 4. Implementation

When developing a construction waste management plan, identify strategies to divert waste from the landfill. Waste does not have to be brought to a formal recycling facility, but can be diverted through informal means including donation or reuse. Determine the method for measuring the amount of waste both generated and diverted from the project site (by weight or volume).

Prior to construction, indicate in the bid documents that the main contractor should separate recyclable waste from non-recyclable waste in order to more easily track diverted waste. Recyclable waste can also be separated by type on-site in areas where local recyclers do not have the capacity or ability to sort waste once it has been removed from the site. By sorting waste on-site, project teams may find it easier to donate or reuse materials.

When waste is collected from the site, document the amount removed and the method of landfill diversion; verify that waste haulers certify that waste is being diverted.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional implementation guidance related to this credit.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## 6. Calculations

There are no additional calculations associated with this credit. See the LEED 2009 Green Building Design and Construction Reference Guide for calculations associated with this credit.

## 7. Documentation Guidance

When documenting waste removal from a project site located in an area without formal infrastructure, be sure that the waste hauler issues a receipt with a detailed breakdown of the waste to be diverted. It is recommended that the receipt contain at least the following information:

- Name of the entity removing the waste
- Address
- Phone number
- Email
- The date when the waste was collected
- The person responsible for collecting the waste
- A statement mentioning how the waste is going to be treated (donated, sold, recycled or reused)


If the waste hauler has no formal receipt, the contractor can provide a letter signed by the waste hauler with the above mentioned information.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional documentation guidance related to this credit.

## 8. Examples

A project in rural Argentina donated a portion of the waste generated during construction to a local non-profit foundation so it could be re-sold to help fund that organization's mission. The waste was collected by a hauling company, which verified the amount of waste collected and how it will be diverted.

**Figure 1.** Construction waste documentation for donated waste

Cristina Fernandez 13 September, 2014	
A quién corresponda,	
Por medio de la presente confirmamos que hemos recibido la cantidad de 4,5 metros cúbicos de madera, según Rto. 137542, que serán venta a granel en nombre de la Fundación de la Familia Salinas para financiar su misión.	
Saluda atentamente,	<div style="border: 1px solid black; padding: 5px;">Translation: September 13, 2014 To whom it may concern: We hereby confirm that we have received 4.5 cubic meters of wood, per receipt 137542, that shall be sold on behalf of the Salinas family foundation to fund their mission.</div>
Cristina Fernandez	
	
ACME Hauling, Inc. 642 Calle Verde <a href="mailto:info@acmehauling.net.ar">info@acmehauling.net.ar</a>	

See the LEED 2009 Green Building Design and Construction Reference Guide for an example detailing a construction waste management plan developed by a contractor prior to the construction process.

MR	
NC	Credit 2
SCHOOLS	Credit 2
CS	Credit 2

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MR	
NC	Credit 2
SCHOOLS	Credit 2
CS	Credit 2

## 9. Exemplary Performance

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance on exemplary performance for this credit.

## 10. Regional Variations

See the LEED 2009 Green Building Design and Construction Reference Guide for regional variations associated with this credit.

## 11 Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this credit.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

See the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this credit.

## 13. Definitions

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms identified in this credit.

## REGIONAL MATERIALS

## MR CREDIT 5

	NC	SCHOOLS	CS
Credit	MR Credit 5	MR Credit 5	MR Credit 5
Points	1-2 points	1-2 points	1-2 points

### Intent

To 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

#### NC, SCHOOLS & CS

Use building materials or products that have been extracted, harvested or recovered, as well as manufactured, within a specified distance of the project site for a minimum of 10% or 20%, based on cost, of the total materials value. If only a fraction of a product or material is extracted, harvested, or recovered and manufactured locally, then only that percentage (by weight) must contribute to the regional value. The minimum percentage regional materials for each point threshold is as follows:

Regional Materials	Points
10%	1
20%	2

#### OPTION 1

All building materials or products have been extracted, harvested or recovered, as well as manufactured within a 500 mile (800 kilometer) radius of the project site.

OR

#### OPTION 2

Building materials or products shipped by rail or water have been extracted, harvested or recovered, as well as manufactured within a 500 mile (800 kilometer) total travel distance of the project site using a weighted average determined through the following formula:

$$\frac{(\text{Distance by rail}/3) + (\text{Distance by inland waterway}/2) + (\text{Distance by sea}/15) + (\text{Distance by all other means})}{4} \leq 500 \text{ miles [800 kilometers]}$$

Mechanical, electrical and plumbing components and specialty items such as elevators and equipment must not be included in all calculations. Include only materials permanently installed in the project. Furniture may be included if it is included consistently in MR Credit 3: Materials Reuse through MR Credit 7: Certified Wood.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

MR	
NC	Credit 5
SCHOOLS	Credit 5
CS	Credit 5

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

There are no standards referenced for this credit.

## 4. Implementation

See the LEED 2009 Green Building Design and Construction Reference Guide for implementation guidance related to this credit.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## 6. Calculations

Follow the instructions in the LEED 2009 Green Building Design and Construction Reference Guide for determining the total materials cost, the percentage of regional materials in assembly items, and the total percentage of local materials used in the project.

Option 2 considers the total weighted distance that the project's materials have traveled by rail or water, from extraction or harvest through manufacturing to installation at the project site. The project team must determine the means of transportation for each leg of that journey.

Calculate the weighted average of materials transported to the project site according to the following equation:

$$\text{Total weighted distance} = (DR/3) + (DI/2) + (DS/15) + DO$$

where

DR= distance by rail

DI = distance by inland waterway

DS= distance by sea

DO= distance by other transportation modes

If the result is 500 miles (800 kilometers) or less, the material qualifies as a regional product.

## 7. Documentation Guidance

As a first step in preparing to complete the LEED Online documentation requirements, work through the following measures. Refer to LEED Online for the complete descriptions of all required documentation.

1. Compile a list of product purchases manufactured, extracted, or harvested regionally.
2. Record manufacturers' names and product costs for all applicable materials installed at the project site.
3. Record distances and transportation modes for each product, from extraction or harvest through fabrication and delivery to the project site.

- Where appropriate, retain cutsheets that document materials’ origin and manufacture within a 500-mile (800-kilometer) total weighted distance of the project site.
- Where appropriate, maintain a list of materials costs, excluding labor and equipment, for CSI Divisions 03-10, 31 (Section 31.60.00 Foundations), and 32 (Sections 32.10.00 Paving, 32.30.00 Site Improvements, and 32.90.00 Planting); including Division 12 is optional.

MR	
NC	Credit 5
SCHOOLS	Credit 5
CS	Credit 5

### 8. Examples

A project in Berlin has imported wood from Norway. The wood was harvested in a forest outside Harestua and transported by truck to Oslo, where it was placed on a ship bound for Germany. Upon arriving at port in Kiel, Germany, the wood was loaded onto a train to Leipzig, where it was milled for use on the project. The finished wood product was transported by truck to the project site in Berlin.

First, the team determines the travel distances for each leg of the trip (Figure 1).

**Figure 1.** Example transport of wood from harvest to project site (generated using Google® Maps)



Then the team divides each distance by the divisors in the total weighted distance equation (see Calculations), as shown in Table 1. Transport by truck falls under “other” and thus has no divisor.

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MR	
NC	Credit 5
SCHOOLS	Credit 5
CS	Credit 5

**Table 1.** Example determination of weighted distance for wood products

Mode	Leg	Actual distance	Calculation	Weighted distance
Truck	Harestua to Oslo	41 km (25 miles)	41 (25)	41 km (25 miles)
Ship	Oslo to Kiel	682 km (424 miles)	682/15 (424/15)	45 km (28 miles)
Rail	Kiel to Leipzig	454 km (285 miles)	454/3 (285/3)	151 km (95 miles)
Truck	Leipzig to Berlin (project)	190 km (118 miles)	190 (118)	190 km (118 miles)
Total		1367 km (852 miles)		427 km (266 miles)

Because the total weighted distance traveled is less than 500 miles (800 km), the wood qualifies as a regional material.

## 9. Exemplary Performance

Projects may be awarded an innovation credit for exemplary performance by selecting materials within 100 miles (160 kilometers) of the project site and by achieving a total value of regionally harvested, extracted and manufactured materials of 20% or more within this radius, based on cost.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional exemplary performance measures associated with this credit.

## 10. Regional Variations

See the LEED 2009 Green Building Design and Construction Reference Guide for regional variations associated with this credit.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this credit.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

See the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this credit.

## 13. Definitions

An **inland waterway** is a navigable body of water, such as a river, canal, or lake, that is deep, wide, and slow enough for a vessel to pass.



# INDOOR ENVIRONMENTAL QUALITY

## IEQ OVERVIEW

### Overview

See the LEED 2009 Green Building Design and Construction Reference Guide for additional guidance.

Approaches to indoor environmental quality issues often vary by country. Because of differences in climate, ventilation systems, and environmental standards, many of the prescribed approaches to the credits in the Indoor Environmental Quality section have been difficult to apply outside the U.S. New language allows for local equivalents to many of the standards referenced in IEQ credits.

### Global ACPs

IEQ Prerequisite 1 (Indoor Air Quality Performance) and its associated credits now have multiple alternatives to help project teams outside the U.S. earn points while maintaining the technical rigor and stringency of the requirements. Many project teams will be able to use CEN standards in place of the ASHRAE; others may choose a local equivalent to ASHRAE. CEN standards and local equivalents are also available for IEQ Credits 6.2, 7, 7.1, and 7.2 (Thermal Comfort).

Project teams outside the U.S. can now use local equivalent standards for air filtration during and after construction when seeking to achieve IEQ Credits 3 and 3.1 (Construction Indoor Air Quality Management Plan During Construction) and 5 (Indoor Chemical and Pollutant Source Control). IEQ Credit 4.3 (Low-Emitting Materials—Flooring Systems) accommodates products that meet widely used VOC testing requirements.

Finally, local equivalent standards can be used for IEQ Prerequisite 2 (Environmental Tobacco Smoke Control prerequisite) and Prerequisite 3 and Credit 9 (Acoustic Performance) for Schools projects.







### Europe ACPs

Incorporated in the Global ACPs is a LEED Interpretation providing further guidance on designing parking garage ventilation in Case 1, Option 2 of EQ Prerequisite 1 (Minimum Air Quality Performance). This may be particularly helpful for projects in Europe, where local code typically specifies contaminant limits for this space type in lieu of a constant exhaust rate. Additionally, naturally ventilated projects may now use the German workplace regulation Arbeitsstaettenrichtlinie ASR 5 in place of ASHRAE 62.1-2007, paragraph 5.1.

Projects in Europe may use a local equivalent standard for blower door testing in Option 2, Case 2 of EQ Prerequisite 2 (Environmental Tobacco Smoke Control).












































Finally, products in Europe are commonly tested for VOCs using an emissions-based rather than content-based approach. Projects in Europe may thus find it easier to follow the requirements of LEED v4 EQ Credit: Low-Emitting Materials in lieu of the Low-Emitting Materials credits in LEED 2009. This is made available via an approved global credit substitution.

 **Table 1.** IEQ Credits with Global Alternative Compliance Paths

Credit	Title	NC	Schools	CS
<b>IEQ Prerequisite 1</b>	Minimum Indoor Air Quality Performance	 	 	 

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## IEQ OVERVIEW

Credit	Title	NC	Schools	CS
<b>IEQ Prerequisite 2</b>	Environmental Tobacco Smoke (ETS) Control	 		 
<b>IEQ Prerequisite 3</b>	Minimum Acoustical Performance			
<b>IEQ Credit 1</b>	Outdoor air Delivery Monitoring			
<b>IEQ Credit 2</b>	Increased Ventilation			
<b>IEQ Credit 3.1</b>	Construction Indoor Air Quality Management Plan During Construction			
<b>IEQ Credit 3</b>	Construction Indoor Air Quality Management Plan During Construction			
<b>IEQ Credit 3.2</b>	Construction Indoor Air Quality Management Plan Before Occupancy			
<b>IEQ Credit 4.1</b>	Low-Emitting Materials—Adhesives and Sealants			
<b>IEQ Credit 4.2</b>	Low-Emitting Materials—Paints and Coatings			
<b>IEQ Credit 4.3</b>	Low-Emitting Materials—Flooring Systems	 		 
<b>IEQ Credit 4.4</b>	Low-Emitting Materials—Composite Wood and Agrifiber Products			
<b>IEQ Credit 4.5</b>	Low-Emitting Materials—Furniture and Furnishings			
<b>IEQ Credit 4.6</b>	Low-Emitting Materials—Ceiling and Wall Systems			
<b>IEQ Credit 5</b>	Indoor Chemical and Pollutant Source Control			
<b>IEQ Credit 6.1</b>	Controllability of Systems—Lighting			
<b>IEQ Credit 6.2</b>	Controllability of Systems—Thermal Comfort			
<b>IEQ Credit 6</b>	Controllability of Systems —Thermal Comfort			
<b>IEQ Credit 7.1</b>	Thermal Comfort —Design			
<b>IEQ Credit 7</b>	Thermal Comfort —Design			
<b>IEQ Credit 7.2</b>	Thermal Comfort —Verification			
<b>IEQ Credit 8.1</b>	Daylight and Views—Daylight			
<b>IEQ Credit 8.2</b>	Daylight and Views—Views			
<b>IEQ Credit 9</b>	Enhanced Acoustical Performance			
<b>IEQ Credit 10</b>	Mold Prevention			

## MINIMUM INDOOR AIR QUALITY PERFORMANCE

## IEQ PREREQUISITE 1

	NC	SCHOOLS	CS
Prerequisite	IEQ Prerequisite 1	IEQ Prerequisite 1	IEQ Prerequisite 1
Points	Required	Required	Required

### Intent

To 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

#### NC, SCHOOLS & CS

#### CASE 1. Mechanically Ventilated Spaces

Mechanical ventilation systems must be designed using the ventilation rate procedure as defined by ASHRAE 62.1-2007, or the applicable local code, whichever is more stringent.

#### OPTION 1. ASHRAE Standard 62.1-2007 or Non-U.S. Equivalent

Meet the minimum requirements of Sections 4 through 7 of ASHRAE Standard 62.1-2007, Ventilation for Acceptable Indoor Air Quality (with errata but without addenda). Projects outside the U.S. may use a local equivalent to Sections 4 through 7 of ASHRAE Standard 62.1-2007.

OR

#### OPTION 2. CEN Standards EN 15251: 2007 and EN 13779: 2007

Projects outside the U.S. may earn this prerequisite by meeting the minimum requirements of Annex B of Comité Européen de Normalisation (CEN) Standard EN 15251: 2007, Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics; and the requirements of CEN Standard EN 13779: 2007, Ventilation for nonresidential buildings, Performance requirements for ventilation and room conditioning systems, excluding Section 7.3 – Thermal environment, 7.6 – Acoustic Environment, A.16, and A.17.

#### CASE 2. Naturally Ventilated Spaces

Naturally ventilated buildings must comply with ASHRAE Standard 62.1-2007, Paragraph 5.1 (with errata but without addenda<sup>1</sup>). Projects in Europe may use Arbeitsstaettenrichtlinie ASR 5 as a local equivalent to ASHRAE Standard 62.1-2007, paragraph 5.1.

<sup>1</sup> Project teams wishing to use ASHRAE approved addenda for the purposes of this prerequisite may do so at their discretion. Addenda must be applied consistently across all LEED credits.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

IEQ	
NC	Prerequisite 1
SCHOOLS	Prerequisite 1
CS	Prerequisite 1

## 1. Benefits and Issues to Consider

CEN Standards EN 13779: 2007 and EN 13779:2007 provide an alternative to ASHRAE 62.1-2007 in areas in which these two CEN standards are more commonly specified.

Whereas the ventilation approach prescribed in ASHRAE 62.1-2007 includes specific exhaust rates for parking garages, these rates are not common outside the U.S. In places where CEN standards EN 15251 and EN 13779 are commonly used in place of ASHRAE 62.1, local codes are referred to for ventilation of spaces such as parking garages making it difficult for projects to comply with the existing credit requirements. In such cases, project teams may opt to pursue a demand-controlled ventilation strategy for parking garages that incorporates local code information regarding expected traffic, parking size, average vehicle emissions, acceptable exhaust or ventilation rates, and permitted concentration levels, in lieu of supplying a high rate of minimum exhaust. This has been determined to be an acceptable alternative to prerequisite compliance for this space type.

German Workplace Regulation Arbeitsstaettenrichtlinie ASR 5 provides an alternative to ASHRAE 62.1-2007, paragraph 5.1 for projects using natural ventilation in Europe.

In January, 2012, ASR 5 was officially replaced in Germany by Workplace Rule ASR 3.6. Projects designed and built after ASR 3.6 was released are subject to different ventilation requirements under that rule but may still meet the requirements of ASR 5 and therefore be eligible for this ACP. Project teams should consider the ventilation requirements in place at the time the project was designed and built before choosing to use the ACP for ASR 5.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional information on environmental and economic issues related to this prerequisite.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this prerequisite.

## 3. Summary of Referenced Standards

### Arbeitsstaettenrichtlinie ASR 5

[http://www.arbeitsschutz.nibis.de/seiten/themen/klass\\_gru/docs/Lueftung\\_ASR5.pdf](http://www.arbeitsschutz.nibis.de/seiten/themen/klass_gru/docs/Lueftung_ASR5.pdf)

This German workplace regulation for ventilation established requirements for building ventilation in Germany from 1975-2012. The Natural Ventilation requirements in this standard are an acceptable alternative to ASHRAE 62.1-2007, paragraph 5.1 for the purposes of this prerequisite.

### CEN Standard EN15251: 2007, Annex B, Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics

<http://www.cen.eu>

This standard outlines the parameters used in many EU countries to design and assess energy performance of buildings. Annex B of the standard, when used in conjunction with the identified sections of CEN Standard EN 13779: 2007, is considered equivalent to ASHRAE 62.1-2007 for the purposes of this prerequisite.

### CEN Standard EN 13779: 2007, Ventilation for nonresidential buildings, Performance requirements for ventilation and room conditioning systems

Comité Européen de Normalisation

<http://www.cen.eu>

This standard identifies the requirements for ventilation and room-conditioning systems and is used in conjunction with CEN Standard EN 15251: 2007, Annex B. All sections of this standard are applicable except Sections 7.3, Thermal environment; 7.6, Acoustic Environment; A.16; and A.17;

these topics are addressed elsewhere in the LEED rating system.

## 4. Implementation

### Mechanically Ventilated Spaces

#### OPTION 1

Local standards for projects outside the United States will be compared with ASHRAE 62.1-2007 in terms of scope, metrics, and thresholds. Project teams that wish to ensure acceptance of a proposed equivalent to ASHRAE 62.1-2007 prior to submission for review may choose to submit a Formal Inquiry for a Credit Interpretation Ruling for a single project, or a LEED Interpretation for multi-project use.

In order to demonstrate equivalency using a local standard, the local standard must address all of the critical requirements of ASHRAE 62.1-2007, Sections 4-7 identified below.

#### **Outdoor Air Quality** (ASHRAE 62.1-2007, Section 4):

This section requires that design team investigate and document outdoor air quality in the geographic area surrounding the building site and at the site itself.

#### **Particulate Matter Removal Requirements** (ASHRAE 62.1-2007, Section 5.9):

This section requires that particulate matter filters or air cleaners be placed upstream of all cooling coils or other wetted surfaces through which air is supplied to occupied spaces.

#### **Air Classification and Recirculation Requirement** (ASHRAE 62.1-2007, Section 5.17):

This section classifies air leaving each space or location (return, transfer, or exhaust) based on the relative contaminant concentrations in the air. The section also defines limitations on recirculation of air based on its classification.

#### **Design Outdoor Air Rate requirements** (ASHRAE 62.1-2007, Section 6.2):

This section outlines the minimum outdoor air intake rates required for all occupied spaces and the Ventilation Rate Procedure (VRP), which is used to calculate these rates. The VRP is a prescriptive procedure in which the design outdoor air intake flows are determined based on space type/application, occupancy level, floor area, and system type. The procedure calculates the outdoor airflow required in the breathing zone, for the zone, and at the system level.

The procedure accounts for zone air distribution effectiveness (ASHRAE 62.1-2007, Section 6.2.2.2) based on the supply air delivery method and the supply air temperature for the space under consideration.

The procedure accounts for system ventilation effectiveness (ASHRAE 62.1-2007, Section 6.2.3 – 6.2.5) based on the various air-handling units supplying outdoor air to the building or a combination of spaces. Specific requirements are included for multiple zone recirculating systems (ASHRAE 62.1-2007, Section 6.2.5) to account for the mixture of re-circulated air and outdoor air to more than one zone/space.

#### **Exhaust Ventilation** (ASHRAE 62.1-2007, Section 6.2.8)

This section requires provision of exhaust airflow for specific space types.

#### **Indoor Air Quality Procedure** (ASHRAE 62.1-2007, Section 6.3)

To use the IAQ Procedure or claim equivalency with the IAQ Procedure, follow the Pilot Credit language from Pilot Credit 68, available in the LEED Pilot Credit library on the website at [www.usgbc.org/pilotcredits](http://www.usgbc.org/pilotcredits).

#### OPTION 2

IEQ	
NC	Prerequisite 1
SCHOOLS	Prerequisite 1
CS	Prerequisite 1

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IEQ	
NC	Prerequisite 1
SCHOOLS	Prerequisite 1
CS	Prerequisite 1

Meet the minimum requirements of Annex B of CEN Standard EN 15251: 2007, and the requirements of CEN Standard EN 13779: 2007, except Section 7.3 – Thermal environment, 7.6 – Acoustic Environment, A.16, and A.17.

Annex B of CEN Standard EN 15251:2007 identifies multiple components for determining the recommended outdoor air ventilation rate of a mechanically ventilated building.

To determine the appropriate amount of outdoor air needed in a building, EN 15251:2007 uses a calculation based on recommended ventilation rates for diluting emissions from people and building materials.

To determine the ventilation rate: Use Table B.1 in Annex B of CEN Standard EN 15251:2007 to find the appropriate percentage of dissatisfied building occupants and select Category I, II, or III based on the building design and applicable local codes. Then, determine the appropriate building emissions level corresponding to the materials used in the building. Table B.2 provides recommended ventilation rates for various space types.

#### Parking Garage Ventilation

A Global ACP allows CEN standards EN 15251: 2007 and EN 13779: 2007 to be used as an alternative to ASHRAE 62.1-2007 in Case 1, Option 2 of this prerequisite. These standards provide minimum outdoor air requirements for most spaces but refer to local codes for spaces such as enclosed parking garages. In such cases demand-controlled ventilation is an acceptable alternative ventilation approach for parking garages in lieu of constant exhaust rates. The demand-controlled ventilation strategy for the parking garage should include the following:

- Consider the number of cars expected to be operating in the garage at any given time and the length of time a car remains in operation in the parking garage.
- Consider the emission rates associated with the car exhaust for the average car.
- Identify the primary contaminant(s) of concern in the parking garage (this may include CO, NOx, SOx, PM or other contaminants).
- Modulate airflow such that contaminant levels are maintained below the specified contaminant concentration limit and corresponding exposure period. All contaminant concentration limits must be based on local code or some other national or international cognizant authority. These limits should be justified by the project team. If the contaminant is carbon monoxide, it is recommended that the concentration not exceed a 35 ppm time-weighted average (8 hours) and not exceed 50 ppm at any one time.

This approach is also acceptable for projects pursuing hazardous exhaust requirements in IEQ Credit 5: Indoor Chemical and Pollutant Source Control.

See the 2009 Green Building Design and Construction Reference Guide for further implementation guidance.

#### Naturally Ventilated Spaces

For projects using ASR 5, use the ASR Table 3.1.3. Ventilation cross sections for natural ventilation to determine the size of openings required in each space and the maximum distance from the openings that can be considered naturally ventilated. Compare the calculation results with the design and revise, if necessary, to ensure that all spaces meet the requirements of the standard.

See the 2009 Green Building Design and Construction Reference Guide for further implementation guidance.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this prerequisite. Project teams wishing to use a local equivalent should contact USGBC early in the design phase to ensure that the alternative standard is acceptable.

## 6. Calculations

To show compliance for mechanically ventilated spaces, use the calculations in the selected standard's user manual and the IEQ calculators located in Credit Resources in LEED Online.

## 7. Documentation Guidance

As a first step in preparing to complete the LEED Online documentation requirements, work through the following measures. Refer to LEED Online for the complete descriptions of all required documentation.

- For projects using Case 1, Option 1,
  - Demonstrate that the local standard is equivalent to ASHRAE 62.1-2007, Sections 4-7, by addressing each of the critical requirements identified in Implementation.
    - If the local standard contains deviations or omissions for sections specified under Implementation, provide relevant information to justify the omissions or deviations, or explain that the project will follow the ASHRAE standard for the specific requirement.
    - Requirements not relevant to the proposed building type do not need to be included in the equivalency review.
    - Demonstrate compliance with the applicable sections of the local standard.
- For projects using Case 1, Option 2, demonstrate compliance with the applicable sections of CEN Standards EN 15251: 2007 and EN 13779: 2007; see Calculations.
- For Core & Shell projects, create a description of future tenants, space types, and expected uses. Core & Shell projects may use the default population number provided in the standard; all other projects are expected to use the design population.
- For projects using ASR 5, prepare a summary table for the naturally ventilated spaces. Include the room or zone name, room group and system type, floor area, natural ventilation opening area, opening area as percentage of floor area, and confirmation that the space meets the maximum permissible space depth to ceiling height requirement.

## 8. Examples

### Parking Garage Ventilation

A project team in Romania is pursuing IEQ Prerequisite 1: Minimum Indoor Air Quality Performance using Case 1, Option 2, CEN standards EN 15251:2007 and EN 13779:2007. The project team identifies local code requirements for parking garages, which specify a limited minimum outdoor air exhaust rate but include carbon monoxide (CO) exposure limits.

To meet local code and the prerequisite requirements, the project team decides to design a system with CO detectors that control exhaust to limit the CO concentration. The system calculates an 8 hour weighted-average for CO to ensure concentrations do not exceed a 35 ppm for an 8 hour exposure and also ensure that concentration at any time does not exceed 50 ppm. When designing the system, the project team places the sensors in the locations with the highest expected

IEQ	
NC	Prerequisite 1
SCHOOLS	Prerequisite 1
CS	Prerequisite 1

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IEQ	
NC	Prerequisite 1
SCHOOLS	Prerequisite 1
CS	Prerequisite 1

concentrations with two sensors per proximity zone. The CO monitoring system activates additional exhaust and sets off an alarm in the central control room if the limits are exceeded. As a result of this strategy, the project team does not need to supply a constant level of exhaust airflow to the garage for achievement of the prerequisite.

#### ASR 5

The following is an example of a project using Arbeitsstaettenrichtlinie ASR 5 to determine if its spaces meet the minimum requirements of this prerequisite.

Zone	Room Group & System Type	Floor Area (m²)	Natural Ventilation Opening Area (supply and equally large exhaust) (cm²)	Opening Area as Percentage of Floor Area (%)	Is Distance to Opening Within Maximum Allowable Depth of Space?
General Office	A, I	740	156077	211	Yes
Training Room	A, I	70	14865	212	Yes
Break Room	A, I	20	5575	279	Yes

## 9. Exemplary Performance

This prerequisite is not eligible for exemplary performance under the Innovation in Design section of the LEED 2009 rating system.

## 10. Regional Variations

There are no regional variations associated with this prerequisite.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for information on Operations and Maintenance considerations relating to the ventilation rate procedure.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

### Websites

#### Appendix B, Summary of Selected Air Quality Guidelines in ASHRAE Standard 62.1-2010, "Ventilation for Acceptable Indoor Air Quality"

<http://www.ashrae.org>

Appendix B includes guideline values for indoor concentration and exposure for potential contaminants of concern. It is an informative appendix only that provides further background information for when using the IAQ procedure. Concentration and exposure values are summarized from cognizant authorities or peer-reviewed studies but must be considered in the project context.

#### Comité Européen de Normalisation

<http://www.cen.eu>

CEN seeks to foster the European economy in global trading, the welfare of European citizens, and the environment by removing trade barriers for European industry and consumers. It provides a platform for the development of European standards and other technical specifications. To purchase CEN standards, visit the Products section on the CEN website.

#### European Commission – Transport & Environment – Road Vehicles

<http://ec.europa.eu/environment/air/transport/road.htm>

This resource provides an overview of pollutant emissions for light-duty and heavy-duty vehicles in Europe, including a review of relevant European standards and directives.



## WHO Air Quality Guidelines – Second Edition

<http://www.euro.who.int/en/publications/abstracts/air-quality-guidelines-for-europe>

This World Health Organization document, first published in 1987 and updated with advancements in risk assessment methodology, summarizes guidelines and exposure levels for indoor air quality contaminants. Its aim is to provide a basis for protecting public health from adverse effects of air pollutants and to eliminate or reduce exposure to those pollutants that are known or likely to be hazardous to human health or wellbeing. Chapter 5.5 includes further background on recommended exposure levels for carbon monoxide.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional resources related to this prerequisite.

## 13. Definitions

**Demand-controlled ventilation** is a ventilation strategy that adjusts the rate of outdoor air supply to a space in response to monitored indoor air quality conditions. It is often used with the goal of maintaining air quality while conserving energy.

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms used in this prerequisite.

IEQ	
NC	Prerequisite 1
SCHOOLS	Prerequisite 1
CS	Prerequisite 1

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## ENVIRONMENTAL TOBACCO SMOKE (ETS) CONTROL

## IEQ PREREQUISITE 2

	NC	SCHOOLS	CS
Prerequisite	IEQ Prerequisite 2	IEQ Prerequisite 2	IEQ Prerequisite 2
Points	Required	Required	Required

### Intent

To eliminate exposure of building occupants, indoor surfaces, and ventilation air distribution systems to environmental tobacco smoke (ETS).

### SCHOOLS

Prohibit smoking in the building.

Prohibit on-property smoking within 25 feet (8 meters) from entries, outdoor air intakes and operable windows. Provide signage to allow smoking in designated areas, prohibit smoking in designated areas or prohibit smoking on the entire property.

### NC & CS

#### OPTION 1

Prohibit smoking in the building.

Prohibit on-property smoking within 25 feet (8 meters) of entries, outdoor air intakes and operable windows. Provide signage to allow smoking in designated areas, prohibit smoking in designated areas or prohibit smoking on the entire property.

OR

#### OPTION 2

##### CASE 1. Non-Residential Projects

Prohibit smoking in the building except in designated smoking areas.

Prohibit on-property smoking within 25 feet (8 meters) of entries, outdoor air intakes and operable windows. Provide signage to allow smoking in designated areas, prohibit smoking in designated areas or prohibit smoking on the entire property.

Provide designated smoking rooms designed to contain, capture and remove ETS from the building. At a minimum, the smoking room must be directly exhausted to the outdoors, away from air intakes and building entry paths, with no recirculation of ETS-containing air to nonsmoking areas and enclosed with impermeable deck-to-deck partitions and operated at a negative pressure, compared with the surrounding spaces, of at least an average of 5 Pascals (Pa) (0.02 inches of water gauge) and a minimum of 1 Pa (0.004 inches of water gauge) when the doors to the smoking rooms are closed.

Verify performance of the smoking rooms' differential air pressures by conducting 15 minutes of measurement, with a minimum of 1 measurement every 10 seconds, of the differential pressure in the smoking room with respect to each adjacent area and in each adjacent vertical chase with the doors to the smoking room closed. Conduct the testing with each space configured for worst-case conditions of transport of air from the smoking rooms (with closed doors) to adjacent spaces.

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## NC &amp; CS (continued)

## CASE 2. Residential and Hospitality Projects

Prohibit smoking in all common areas of the building.

Locate any exterior designated smoking areas, including balconies where smoking is permitted, at least 25 feet (8 meters) from entries, outdoor air intakes and operable windows opening to common areas.

Prohibit on-property smoking within 25 feet (8 meters) of entries, outdoor air intakes and operable windows. Provide signage to allow smoking in designated areas, prohibit smoking in designated areas or prohibit smoking on the entire property.

Weather-strip all exterior doors and operable windows in the residential units to minimize leakage from outdoors.

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.

Weather-strip all doors in the residential units leading to common hallways to minimize air leakage into the hallway<sup>1</sup>.

Demonstrate acceptable sealing of residential units by a blower door test conducted in accordance with ANSI/ASTM-E779-03, Standard Test Method for Determining Air Leakage Rate By Fan Pressurization. Projects outside the U.S. may use a local equivalent to ANSI/ASTM-E779-03, Standard Test Method for Determining Air Leakage Rate By Fan Pressurization. Projects in Europe may use EN 13829:2002 Thermal Performance of buildings – Determination of air permeability of buildings – Fan pressurization method.

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. Residential units must demonstrate less than 1.25 square inches leakage area per 100 square feet (8 square centimeters of leakage area per 10 square meters) of enclosure area (i.e., sum of all wall, ceiling and floor areas).

<sup>1</sup> 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, Case 1, considering the residential unit as the smoking room.

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this prerequisite.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this prerequisite.

## 3. Summary of Referenced Standards

### EN 13829:2002 Thermal Performance of buildings – Determination of Air Permeability of Buildings – Fan Pressurization Method

<http://www.en-standard.eu/search/>

Based on ISO 9972: 1996, this standard defines the measurement of air permeability of buildings or parts of buildings. It specifies the use of mechanical pressurization or depressurization of a building and describes the measurement of the resulting air flow rates and air leakage of single-zone building envelopes

## 4. Implementation

Local standards for projects outside the United States will be compared with ANSI/ASTM-E779-03 in terms of scope, metrics, and thresholds. Project teams that wish to ensure acceptance of a proposed equivalent to ANSI/ASTM-E779-03 prior to submission for review may choose to submit a Formal Inquiry for a Credit Interpretation Ruling for a single project, or a LEED Interpretation for multi-project use.

Any local alternative standard to ANSI/ASTM-E779-03 must provide at least the following information:

- Air-change rate
- Air-leakage rate
- Test pressure difference

### OPTION 2. CASE 2. Residential and Hospitality Projects (NC and CS Only)

Project teams in Europe may demonstrate acceptable sealing of residential units by conducting a blower door test conducted in accordance with EN 13829:2002 Thermal Performance of buildings – Determination of Air Permeability of Buildings – Fan Pressurization Method in lieu of ANSI/ASTM-E779-03.

Prepare the HVAC system to conduct the test. All devices taking air to or removing air from the outside must be turned off. Sealing the mechanical ventilation systems is often necessary. Sealing may involve:

- Air terminal devices
- Air intake and exhaust
- Main ducts.

Doors and windows in the building envelope must be closed. All intentional openings in the building envelope dedicated to HVAC systems must be treated according to the measurement method.

Use the sampling methodology defined in EN 13829: 2002 Chapter 5, Section 5.1 Measurement Conditions. Residential units must demonstrate less than 1.25 square inches of leakage area per

IEQ	
NC	Prerequisite 2
SCHOOLS	Prerequisite 2
CS	Prerequisite 2

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IEQ	
NC	Prerequisite 2
SCHOOLS	Prerequisite 2
CS	Prerequisite 2

100 square feet (8 square centimeters of leakage area per 10 square meters) of enclosure area (i.e., sum of all wall, ceiling and floor areas).

It is good practice to use multiple locations across the building envelope for pressure measurement, such as across each façade. A good location avoids exterior corners and complex architectural features and should be close to the middle of the exterior wall. Buildings more than three stories, or 25.5 feet (7.5 meters), high must have exterior pressures measured at multiple heights on the exterior walls.

See the 2009 Green Building Design and Construction Reference Guide for additional implementation guidance related to this prerequisite.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this prerequisite. Project teams wishing to use a local equivalent should contact USGBC early in the design phase to ensure that the alternative standard is acceptable.

## 6. Calculations

There are no calculations required for this prerequisite.

## 7. Documentation Guidance

See the LEED 2009 Green Building Design and Construction Reference Guide for documentation guidance related to this prerequisite.

## 8. Examples

See the LEED 2009 Green Building Design and Construction Reference Guide for an example on installing a compliant smoking room.

## 9. Exemplary Performance

This prerequisite is not eligible for exemplary performance under the Innovation in Design section of the LEED 2009 rating system.

## 10. Regional Variations

Many countries in Europe have instituted nationwide smoke-free legislation. According to the European Commission, Ireland, the UK, Greece, Bulgaria, Malta, Spain and Hungary generally have the strictest provisions with a complete ban on smoking in enclosed public places, on public transport and in workplaces, with only limited exceptions allowed. Individual cities or towns may also have their own laws. Consult local laws before establishing a smoking policy for the project building.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this prerequisite.

## 12. Resources

See the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this prerequisite.

## Websites

### **EN 13829:2002 Thermal Performance of buildings – Determination of Air Permeability of Buildings – Fan Pressurization Method**

<http://www.en-standard.eu/search/>

Based on ISO 9972: 1996, this standard defines the measurement of air permeability of buildings or parts of buildings. It specifies the use of mechanical pressurization or depressurization of a building and describes the measurement of the resulting air flow rates and air leakage of single-zone building envelopes

### **European Union Council Recommendation of 30 November 2009 on smoke-free environments (2009/C 296/02)**

[http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009H1205\(01\)&from=EN](http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009H1205(01)&from=EN)

This recommendation was adopted to encourage EU member states to act with regard to smoke-free environments. These recommended actions including laws to protect those in public places, workplaces and public transit from exposure to tobacco smoke, as well as educational efforts to warn against the dangers of tobacco smoke.

### **ISO 9972:1996 Thermal insulation – Determination of building airtightness – Fan pressurization method**

[http://www.iso.org/iso/iso\\_catalogue/catalogue\\_ics/catalogue\\_detail\\_ics.htm?csnumber=17879](http://www.iso.org/iso/iso_catalogue/catalogue_ics/catalogue_detail_ics.htm?csnumber=17879)

This is the standard upon which EN 13829 was based. It provides guidance on the measurement of air leakage of buildings or part of buildings including measurement of air flow rates over indoor-outdoor static pressure differences.

Overview of smoke-free legislation and its implementation in the EU [http://ec.europa.eu/health/tobacco/docs/smoke-free\\_legislation\\_overview\\_en.pdf](http://ec.europa.eu/health/tobacco/docs/smoke-free_legislation_overview_en.pdf)

Provides a detailed overview of smoking legislation in the EU by country and further organized by type of legislation.

### **Report on the implementation of the Council Recommendation of 30 November 2009 on Smoke-free Environments (2009/C 296/02)**

[http://ec.europa.eu/health/tobacco/docs/smoke-free\\_implementation\\_report\\_en.pdf](http://ec.europa.eu/health/tobacco/docs/smoke-free_implementation_report_en.pdf)

This document, released in February 2012, reports on implementation of Council Recommendation 2009/C 296/02 based upon self-reporting by 27 member states. It provides further information on the economic effects and human health effects of various legislation on second-hand smoke exposure.

### **Smoke Free Environments in Europe**

[http://ec.europa.eu/health/tobacco/smoke-free\\_environments/index\\_en.htm](http://ec.europa.eu/health/tobacco/smoke-free_environments/index_en.htm)

Provides general information on smoke-free legislation in the EU, including the status of smoke-free regulations, a review of council recommendations, and related documents and press releases.

## **13. Definitions**

**Air-change rate** is the air-leakage rate in volume per hour divided by the building space volume, expressed in identical volume units.

**Air-leakage rate** is the volume of air movement across the building envelope over a unit of time.

**Test pressure difference** is the measured pressure difference across the building envelope.

IEQ	
NC	Prerequisite 2
SCHOOLS	Prerequisite 2
CS	Prerequisite 2

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of other terms used in this prerequisite.



## MINIMUM ACOUSTICAL PERFORMANCE

## IEQ PREREQUISITE 3

	NC	SCHOOLS	CS
Prerequisite	IEQ Prerequisite 3	IEQ Prerequisite 3	IEQ Prerequisite 3
Points	NA	Required	NA

### Intent

To provide classrooms that are quiet so that teachers can speak to the class without straining their voices and students can effectively communicate with each other and the teacher.

### Requirements

#### SCHOOLS

##### Background Noise

Achieve a maximum background noise level<sup>1</sup> from heating, ventilating and air conditioning (HVAC) systems in classrooms and other core learning spaces of 45 dBA.

##### AND

##### Reverberation Time

Design classrooms and other core learning spaces to include sound-absorptive finishes to sufficiently limit reverberation in classrooms and other core learning spaces.

#### CASE 1. Classrooms and Core Learning Spaces < 20,000 Cubic Feet (560 Cubic Meters)

For classrooms and core learning spaces less than 20,000 cubic feet (560 cubic meters), options for compliance include:

##### OPTION 1. Minimum NRC

For each room, confirm that the total surface area finished with a material with a Noise Reduction Coefficient (NRC) of 0.70 or higher equals or exceeds the total ceiling area (excluding lights, diffusers and grilles).

##### OR

##### OPTION 2. Compliance with ANSI Standard S12.60-2002 or Non-U.S. Equivalent

Confirm through calculations described in ANSI Standard S12.60-2002 that rooms are designed to meet reverberation time requirements as specified in that standard. Projects outside the U.S. may use a local equivalent to ANSI Standard S12.60-2002.

#### CASE 2. Classrooms and Core Learning Spaces ≥ 20,000 Cubic Feet (560 Cubic Meters)

For classrooms and core learning spaces 20,000 cubic feet (560 Cubic Meters) or greater, confirm through calculations described in ANSI Standard S12.60-2002 that rooms are designed to have a reverberation time of 1.5 seconds or less. Projects outside the U.S. may use a local equivalent to ANSI Standard S12.60-2002.

<sup>1</sup> Recommended methodologies and best practices for mechanical system noise control are described in Annex B of ANSI Standard S12.60-2002 and the 2007 HVAC Applications ASHRAE Handbook, Chapter 47 on Sound and Vibration Control (with errata but without addenda).

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

IEQ	
NC	NA
SCHOOLS	Prerequisite 3
CS	NA

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this prerequisite.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this prerequisite.

## 3. Summary of Referenced Standards

No new standards are referenced; see the LEED 2009 Green Building Design and Construction Reference Guide for a summary of the ANSI Standard S12.60–2002.

## 4. Implementation

Local standards for projects outside the United States will be compared with ANSI Standard S12.60–2002 in terms of scope, metrics, and thresholds. Project teams that wish to ensure acceptance of a proposed equivalent to ANSI Standard S12.60–2002 prior to submission for review may choose to submit a Formal Inquiry for a Credit Interpretation Ruling for a single project, or a LEED Interpretation for multi-project use.

Any local alternative standard must meet the reverberation time requirements of ANSI S12.60–2002. Maximum reverberation times are provided in the Calculations section and depend on the volume of the classroom.

See the 2009 Green Building Design and Construction Reference Guide for additional implementation guidance on how to reduce background noise, reverberation time, HVAC noise and room noise.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this prerequisite. Project teams wishing to use a local equivalent should contact USGBC early in the design phase to ensure that the alternative standard is acceptable.

## 6. Calculations

To be compliant with ANSI Standard S12.60–2002, the reverberation time of core learning spaces must not exceed the following maximums:

**Table 1.** Maximum reverberation time (RT) for core learning spaces

Enclosed volume	RT (seconds)
< 10,000 cubic feet (280 cubic meters)	0.6
10,000–20,000 cubic feet (280–560 cubic meters)	0.7
> 20,000 cubic feet (560 cubic meters)	1.5

To calculate the RT for a room, use the method described in the LEED 2009 Green Building Design and Construction Reference Guide.

## 7. Documentation Guidance

See the LEED 2009 Green Building Design and Construction Reference Guide for documentation guidance related to this prerequisite.

## 8. Examples

See the LEED 2009 Green Building Design and Construction Reference Guide for examples of calculating the reverberation time of a room.

## 9. Exemplary Performance

This prerequisite is not eligible for exemplary performance under the Innovation in Design section of the LEED 2009 rating system.

## 10. Regional Variations

Regional factors can influence ambient noise around school buildings. For example, wind, atmospheric fog, and water vapor all have the potential to affect environmental sound transmission. The use of natural ventilation may require additional noise control because of open pathways between exterior and interior spaces.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this prerequisite.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

See the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this prerequisite.

## 13. Definitions

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms used in this prerequisite.

IEQ	
NC	NA
SCHOOLS	Prerequisite 3
CS	NA

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.



## OUTDOOR AIR DELIVERY MONITORING

## IEQ CREDIT 1

	NC	SCHOOLS	CS
Credit	IEQ Credit 1	IEQ Credit 1	IEQ Credit 1
Points	1 point	1 point	1 point

### Intent

To provide capacity for ventilation system monitoring to help promote occupant comfort and well-being.

### Requirements

#### NC, SCHOOLS & CS

Install permanent monitoring systems to ensure that ventilation systems maintain design minimum requirements. Configure all monitoring equipment to generate an alarm when the airflow values or carbon dioxide (CO<sub>2</sub>) levels vary by 10% or more from the design values via either a building automation system alarm to the building operator or a visual or audible alert to the building occupants.

AND

#### CASE 1. Mechanically Ventilated Spaces

Monitor CO<sub>2</sub> concentrations within all densely occupied spaces i.e., those with a design occupant density of 25 people or more per 1,000 square feet (95 square meters). CO<sub>2</sub> monitors must be between 3 and 6 feet (between 1 and 2 meters) above the floor.

Provide a direct outdoor airflow measurement device capable of measuring the minimum outdoor air intake flow with an accuracy of plus or minus 15% of the design minimum outdoor air rate, based on the value determined in IEQ Prerequisite 1: Minimum Indoor Air Quality Performance, for mechanical ventilation systems where 20% or more of the design supply airflow serves nondensely occupied spaces.

#### CASE 2. Naturally Ventilated Spaces

Monitor CO<sub>2</sub> concentrations within all naturally ventilated spaces. CO<sub>2</sub> monitors must be between 3 and 6 feet (between 1 and 2 meters) above the floor. One CO<sub>2</sub> sensor may be used to monitor 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.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

IEQ	
NC	Credit 1
SCHOOLS	Credit 1
CS	Credit 1

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

**CEN Standard EN15251: 2007, Annex B, Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics**

Comité Européen de Normalisation

<http://www.cen.eu>

This standard outlines the parameters used in many EU countries to design and assess energy performance of buildings. Annex B of the standard, when used in conjunction with the identified sections of CEN Standard EN 13779: 2007, is considered equivalent to ASHRAE 62.1–2007 for the purposes of this credit.

**CEN Standard EN 13779: 2007, Ventilation for nonresidential buildings, Performance requirements for ventilation and room conditioning systems**

Comité Européen de Normalisation

<http://www.cen.eu>

This standard identifies the requirements for ventilation and room-conditioning systems and is used in conjunction with CEN Standard EN 15251: 2007, Annex B. All sections of this standard are applicable except Sections 7.3, Thermal environment; 7.6, Acoustic Environment; A.16; and A.17.

## 4. Implementation

Local standards for projects outside the United States will be compared with ASHRAE 62.1–2007 in terms of scope, metrics, and thresholds. Project teams that wish to ensure acceptance of a proposed equivalent to ASHRAE 62.1–2007 prior to submission for review may choose to submit a Formal Inquiry for a Credit Interpretation Ruling for a single project, or a LEED Interpretation for multi-project use.

If a local equivalent to ASHRAE 62.1 – 2007 was selected in IEQ Prerequisite 1 to determine the design minimum outdoor air rate, ensure that the same equivalent standard is used in this credit.

See the LEED 2009 Green Building Design and Construction Reference Guide for implementation guidance.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## 6. Calculations

There are no calculations required for this credit.

## 7. Documentation Guidance

As a first step in preparing to complete the LEED Online documentation requirements, work through the following measures. Refer to LEED Online for the complete descriptions of all required documentation.

- Indicate the locations of airflow monitors and CO<sub>2</sub> sensors on floor plans, schematics, and elevations (where applicable). Incorporate checks of ventilation systems into mechanical schedules.
- Commission ventilation systems and monitor them for excess energy use.
- Check alarm systems for mechanical ventilation systems to verify settings according to either CEN Standard EN 13779: 2007 or the local equivalent to ANSI/ASHRAE 62.1–2007.
- Calibrate any building automation systems used in the project according to manufacturers' guidelines. Routine function checks of alarm systems are recommended.

IEQ	
NC	Credit 1
SCHOOLS	Credit 1
CS	Credit 1

## 8. Examples

There are no examples for this credit.

## 9. Exemplary Performance

This credit is not eligible for exemplary performance under the Innovation in Design section of the LEED 2009 rating system.

## 10. Regional Variations

See the LEED 2009 Green Building Design and Construction Reference Guide for information on regional variations associated with this credit.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for information on Operations and Maintenance considerations relating to this credit.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

### Websites

#### Comité Européen de Normalisation

<http://www.cen.eu>

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See the LEED 2009 Green Building Design and Construction Reference Guide for additional resources related to this credit.

## 13. Definitions

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms used in this credit.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.





## INCREASED VENTILATION

## IEQ CREDIT 2

	NC	SCHOOLS	CS
Credit	IEQ Credit 2	IEQ Credit 2	IEQ Credit 2
Points	1 point	1 point	1 point

### Intent

To provide additional outdoor air ventilation to improve indoor air quality (IAQ) and promote occupant comfort, well-being and productivity.

### Requirements

#### NC, SCHOOLS & CS

#### CASE 1. Mechanically Ventilated Spaces

##### OPTION 1. ASHRAE Standard 62.1-2007 or Non-U.S. Equivalent

Increase breathing zone outdoor air ventilation rates to all occupied spaces by at least 30% above the minimum rates required by ASHRAE Standard 62.1-2007 (with errata but without addenda<sup>1</sup>) as determined by IEQ Prerequisite 1: Minimum Indoor Air Quality Performance. Projects outside the U.S. may use a local equivalent to ASHRAE Standard 62.1-2007 if the same is used for IEQ Prerequisite 1: Minimum Indoor Air Quality Performance.

OR

##### OPTION 2. CEN Standard EN 15251: 2007

Projects outside the U.S. may earn this credit by increasing breathing zone outdoor air ventilation rates to all occupied spaces by at least 30% above the minimum rates required by Annex B of Comité Européen de Normalisation (CEN) Standard EN 15251: 2007, Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics as determined by IEQ Prerequisite 1: Minimum Indoor Air Quality Performance.

#### CASE 2. Naturally Ventilated Spaces<sup>2</sup>

Determine that natural ventilation is an effective strategy for the project by following the flow diagram process shown in Figure 2.8 of the CIBSE Applications Manual 10: 2005, Natural Ventilation in Non-domestic Buildings.

AND

##### OPTION 1. CIBSE or Non-U.S. Equivalent

Show that the natural ventilation systems design meets the recommendations set forth in the CIBSE manuals appropriate to the project space.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

- 1 Project teams wishing to use ASHRAE approved addenda for the purposes of this credit may do so at their discretion. Addenda must be applied consistently across all LEED credits.
- 2 The core and shell buildings that are designed to be naturally ventilated must provide the capability for the tenant build-out to meet the requirements of this credit.

## IEQ CREDIT 2

### NC, SCHOOLS & CS (continued)

#### PATH 1

Use CIBSE Applications Manual 10: 2005, Natural Ventilation in Non-domestic Buildings. Projects outside the U.S. may use a local equivalent.

OR

#### PATH 2

Use CIBSE AM 13:2000, Mixed Mode Ventilation. Projects outside the U.S. may use a local equivalent.

OR

#### OPTION 2. Airflow Model

Use a macroscopic, multizone, analytic model to predict that room-by-room airflows will effectively naturally ventilate, defined as providing the minimum ventilation rates required by ASHRAE Standard 62.1-2007 section 6 (with errata but without addenda<sup>1</sup>), for at least 90% of occupied spaces. Projects outside the U.S. may use Annex B of Comité Européen de Normalisation (CEN) Standard EN 15251: 2007 or a local equivalent to section 6 of ASHRAE Standard 62.1-2007 to define the minimum ventilation rates.

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

**CEN Standard EN15251: 2007, Annex B, Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics**

Comité Européen de Normalisation

<http://www.cen.eu>

This standard outlines the parameters used in many EU countries to design and assess energy performance of buildings. Annex B of the standard, when used in conjunction with the identified sections of CEN Standard EN 13779: 2007, is considered equivalent to ASHRAE 62.1-2007 for the purposes of this credit.

## 4. Implementation

### Mechanically Ventilated Spaces

Local standards for projects outside the United States will be compared with ASHRAE 62.1-2007 in terms of scope, metrics, and thresholds. Project teams that wish to ensure acceptance of a proposed equivalent to ASHRAE 62.1-2007 prior to submission for review may choose to submit a Formal Inquiry for a Credit Interpretation Ruling for a single project, or a LEED Interpretation for multi-project use.

If a local equivalent to ASHRAE 62.1 – 2007 was selected in IEQ Prerequisite 1 to determine the design minimum outdoor air rate, ensure that the same equivalent standard is used in this credit.

### Naturally Ventilated Spaces

Local standards for projects outside the United States will be compared with the CIBSE Applications Manual 10: 2005 in terms of scope, metrics, and thresholds. Project teams that wish to ensure acceptance of a proposed equivalent to the CIBSE Applications Manual 10:2005 prior to submission for review may choose to submit a Formal Inquiry for a Credit Interpretation Ruling for a single project, or a LEED Interpretation for multi-project use.

Project teams may demonstrate compliance in either of two ways:

- \* Use a local equivalent to the compliance path in the CIBSE Applications Manual 10: 2005 (AM10), Chapter 2, which specifies the opening sizes for operable windows, trickle vents, and louvers.
- \* Demonstrate, via a macroscopic, multizone analytic model, that room-by-room airflow rates meet the minimum ventilation rates required by CEN Standard EN 15251: 2007, Annex B, or a local equivalent to ASHRAE Standard 62.1-2007, Section 6.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional implementation guidance.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit. Project teams wishing to use a local equivalent should contact USGBC early in the

IEQ	
NC	Credit 2
SCHOOLS	Credit 2
CS	Credit 2

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IEQ	
NC	Credit 2
SCHOOLS	Credit 2
CS	Credit 2

design phase to ensure that the alternative standard is acceptable.

## 6. Calculations

### Mechanically Ventilated Spaces

Use the calculations in the selected standard's user manual and the IEQ Prerequisite 1 calculators, available on the LEED Resources & Tools page of the USGBC website. The same calculations are used to document IEQ Prerequisite 1.

See the LEED 2009 Green Building Design and Construction Reference Guide for calculations associated with this credit.

## 7. Documentation Guidance

See the LEED 2009 Green Building Design and Construction Reference Guide for documentation guidance related to this credit.

## 8. Examples

There are no examples for this credit.

## 9. Exemplary Performance

This credit is not eligible for exemplary performance under the Innovation in Design section of the LEED 2009 rating system.

## 10. Regional Variations

See the LEED 2009 Green Building Design and Construction Reference Guide for regional variations associated with this credit.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this credit.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

### Websites

#### Comité Européen de Normalisation

<http://www.cen.eu>

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See the LEED 2009 Green Building Design and Construction Reference Guide for additional resources related to this credit.

## 13. Definitions

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms used in this credit.

## CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT PLAN— DURING CONSTRUCTION

## IEQ CREDIT 3-3.1

	NC	SCHOOLS	CS
Credit	IEQ Credit 3.1	IEQ Credit 3.1	IEQ Credit 3
Points	1 point	1 point	1 point

### Intent

To reduce indoor air quality (IAQ) problems resulting from construction or renovation and promote the comfort and well-being of construction workers and building occupants.

### Requirements

#### NC, SCHOOLS & CS

Develop and implement an (IAQ) management plan for the construction and preoccupancy 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, 2nd Edition 2007, ANSI/SMACNA 008-2008 (Chapter 3).
- Protect stored on-site and installed absorptive materials from moisture damage.
- If permanently installed air handlers are used during construction, filtration media must be used at each return air grille that meets one of the following criteria below. Replace all filtration media immediately prior to occupancy.
  - Filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 as determined by ASHRAE Standard 52.2-1999 (with errata but without addenda).
  - Filtration media is Class F5 or higher, as defined by CEN Standard EN 779-2002, Particulate air filters for general ventilation, Determination of the filtration performance.
  - Filtration media with a minimum dust spot efficiency of 30% or higher and greater than 90% arrestance on a particle size of 3–10 µg.

#### SCHOOLS

- Prohibit smoking inside the building and within 25 feet (8 meters) of building entrances once the building is enclosed.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

IEQ	
NC	Credit 3.1
SCHOOLS	Credit 3.1
CS	Credit 3

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

### CEN Standard EN 779: 2002, Particulate air filters for general ventilation, Determination of the filtration performance

Comité Européen de Normalisation

<http://www.cen.eu>

This standard outlines the parameters used in many EU countries for determining filter class for all filtration media.

## 4. Implementation

### HVAC Protection

Protect all HVAC equipment from both dust and odors and seal all duct and equipment openings with plastic. If the system must be operated to maintain service to occupied portions of the building or to protect finished work, protect the return (negative pressure) side of the system. If the returns cannot be closed, install and maintain temporary filters over the grilles and openings. All filtration media must be Class F5 or higher or have a minimum dust spot efficiency of 30% and at least 90% arrestance on a particle size of 3–10 µg. If an unducted plenum over the construction zone must be used, isolate it by having all ceiling tiles in place. Check for leaks in the return ducts and air handlers and make needed repairs promptly. The contractor should avoid using the mechanical rooms for construction storage.

See the 2009 Green Building Design and Construction Reference Guide for additional implementation guidance.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## 6. Calculations

There are no calculations required for this credit.

## 7. Documentation Guidance

See the LEED 2009 Green Building Design and Construction Reference Guide for documentation guidance related to this credit.

## 8. Examples

See the LEED 2009 Green Building Design and Construction Reference Guide for an example of an indoor air quality management plan. Ensure that the plan includes HVAC protection and specifies filters that are Class F5 or higher or have a minimum dust spot efficiency of 30% and at least 90% arrestance on a particle size of 3–10 µg.

## 9. Exemplary Performance

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance on exemplary performance for this credit.

## 10. Regional Variations

There are no regional variations applicable to this credit.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this credit.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

See the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this credit.

## 13. Definitions

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms used in this credit.

IEQ	
NC	Credit 3.1
SCHOOLS	Credit 3.1
CS	Credit 3

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## LOW-EMITTING MATERIALS—ADHESIVES AND SEALANTS

## IEQ CREDIT 4.1

	NC	SCHOOLS	CS
Credit	IEQ Credit 4.1	IEQ Credit 4.1	IEQ Credit 4.1
Points	1 point	1 point	1 point

### Intent

To 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

#### NC & CS

All adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) must comply with the following requirements as applicable to the project scope<sup>1</sup>:

- Adhesives, Sealants and Sealant Primers must comply with South Coast Air Quality Management District (SCAQMD) Rule #1168. Volatile organic compound (VOC) limits listed in the table below 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 and asphalt adhesives	50	Special purpose contact adhesive	250
Drywall and panel adhesives	50	Structural wood member adhesive	140
Cove base adhesives	50	Sheet applied rubber lining operations	850
Multipurpose construction adhesives	70	Top and 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, nonporous	250		
Architectural, porous	775		
Other	750		

<sup>1</sup> The use of a VOC budget is permissible for compliance with this credit.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

IEQ CREDIT 4.1

NC & CS (continued)

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

Aerosol Adhesives	VOC Limit
General purpose mist spray	65% VOCs by weight
General purpose web spray	55% VOCs by weight
Special purpose aerosol adhesives (all types)	70% VOCs by weight

SCHOOLS

All adhesives and sealants installed in the building interior (defined as inside the weatherproofing system and applied on-site) must meet the testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

Schools projects may choose from IEQ Credits 4.1-4.6 for a maximum of 4 points.

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

No new standards are referenced; see the LEED 2009 Green Building Design and Construction Reference Guide for a summary of the standards referenced in this credit.

## 4. Implementation

### Credit Substitution

Project teams may use LEED v4 EQ Credit: Low-Emitting Materials, Option 2. Budget Calculation Method in place of the full LEED 2009 Low-Emitting Materials credit suite (IEQ Credit 4.1-4.4 for New Construction and Core & Shell, IEQc4.1-4.6 for Schools). The LEED v4 credit includes emissions-based material testing requirements that are more widely used in Europe and may thus be easier to obtain.

All credits in the LEED 2009 credit suite must be substituted to be eligible. Projects taking this approach should consult the LEED v4 for Building Design and Construction Reference Guide for implementation guidance related to this credit. See <http://www.usgbc.org/articles/use-v4-credits-your-v2009-project> for further information on credit substitution.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional implementation guidance related to this credit.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## 6. Calculations

There are no additional calculations associated with this credit. See LEED 2009 Green Building Design and Construction Reference Guide for calculations associated with this credit.

## 7. Documentation Guidance

See the LEED 2009 Green Building Design and Construction Reference Guide for documentation guidance related to this credit.

## 8. Examples

There are no examples associated with this credit.

## 9. Exemplary Performance

This credit is not eligible for exemplary performance under the Innovation in Design Section of the LEED 2009 Green Building Design and Construction rating system.

## 10. Regional Variations

There are no regional variations associated with this credit.

IEQ	
NC	Credit 4.1
SCHOOLS	Credit 4.1
CS	Credit 4.1

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

IEQ	
NC	Credit 4.1
SCHOOLS	Credit 4.1
CS	Credit 4.1

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## 12. Resources

See the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this credit.

Websites

### LEED 2009 to LEED v4 Credit Substitution Table

<http://www.usgbc.org/resources/2009-v4-credit-substitution-bdc>

This resource lists the credits and prerequisites in LEED v4 that may be used by LEED 2009 project teams in lieu of the related LEED 2009 credit. It also includes any further stipulations associated with a particular credit substitution, for instance the number of points available. Additional credit substitutions will be added to the table as they are identified.

## 13. Definitions

See LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms identified in this credit.

## LOW-EMITTING MATERIALS—PAINTS AND COATINGS

## IEQ CREDIT 4.2

	NC	SCHOOLS	CS
Credit	IEQ Credit 4.2	IEQ Credit 4.2	IEQ Credit 4.2
Points	1 point	1 point	1 point

### Intent

To 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

#### NC & CS

Paints and coatings used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) must comply with the following criteria as applicable to the project scope<sup>1</sup>:

- Architectural paints and coatings applied to interior walls and ceilings must not exceed the volatile organic compound (VOC) content limits established in Green Seal Standard GS-11, Paints, 1st Edition, May 20, 1993.
- Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates must not exceed the VOC content limit of 250 g/L established in Green Seal Standard GC-03, Anti-Corrosive Paints, 2nd Edition, January 7, 1997.
- Clear wood finishes, floor coatings, stains, primers, and shellacs applied to interior elements must 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.

#### SCHOOLS

All paints and coatings installed in the building interior must meet the testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

Schools projects may choose from IEQ Credits 4.1-4.6 for a maximum of 4 points.

<sup>1</sup> The use of a VOC budget is permissible for compliance with this credit.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

IEQ	
NC	Credit 4.2
SCHOOLS	Credit 4.2
CS	Credit 4.2

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

No new standards are referenced; see the LEED 2009 Green Building Design and Construction Reference Guide for a summary of the standards referenced in this credit

## 4. Implementation

Credit Substitution

Project teams may use LEED v4 EQ Credit: Low-Emitting Materials, Option 2. Budget Calculation Method in place of the full LEED 2009 Low-Emitting Materials credit suite (IEQ Credit 4.1-4.4 for New Construction and Core & Shell, IEQc4.1-4.6 for Schools). The LEED v4 credit includes emissions-based material testing requirements that are more widely used in Europe and may thus be easier to obtain.

All credits in the LEED 2009 IEQc4 credit suite must be substituted to be eligible. Projects taking this approach should consult the LEED v4 for Building Design and Construction Reference Guide for implementation guidance related to this credit. See <http://www.usgbc.org/articles/use-v4-credits-your-v2009-project> for further information on credit substitution.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional implementation guidance related to this credit.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## 6. Calculations

There are no additional calculations associated with this credit. See LEED 2009 Green Building Design and Construction Reference Guide for calculations associated with this credit.

## 7. Documentation Guidance

See the LEED 2009 Green Building Design and Construction Reference Guide for documentation guidance related to this credit.

## 8. Examples

There are no examples associated with this credit.

## 9. Exemplary Performance

This credit is not eligible for exemplary performance under the Innovation in Design Section of the LEED 2009 Green Building Design and Construction rating system.

## 10. Regional Variations

There are no regional variations associated with this credit.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## 12. Resources

See the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this credit.

Websites

### LEED 2009 to LEED v4 Credit Substitution Table

<http://www.usgbc.org/resources/2009-v4-credit-substitution-bdc>

This resource lists the credits and prerequisites in LEED v4 that may be used by LEED 2009 project teams in lieu of the related LEED 2009 credit. It also includes any further stipulations associated with a particular credit substitution, for instance the number of points available. Additional credit substitutions will be added to the table as they are identified.

## 13. Definitions

See LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms identified in this credit.

IEQ	
NC	Credit 4.2
SCHOOLS	Credit 4.2
CS	Credit 4.2

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.





## LOW-EMITTING MATERIALS—FLOORING SYSTEMS

## IEQ CREDIT 4.3

	NC	SCHOOLS	CS
Credit	IEQ Credit 4.3	IEQ Credit 4.3	IEQ Credit 4.3
Points	1 point	1 point	1 point

### Intent

To 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

#### NC & CS

#### OPTION 1

All flooring must comply with the following as applicable to the project scope:

- All carpet installed in the building interior must meet one of the following requirements:
  - Meets the testing and product requirements of the Carpet and Rug Institute Green Label Plus.
  - Maximum VOC concentrations are less than or equal to those specified in the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda, using the office scenario as defined in Table 7.5 within the practice. The additional VOC concentration limits listed in Section 9.1a must also be met.
  - Maximum VOC concentrations meet the California requirements specified above based on the following:
    - California Department of Public Health (CDPH) Standard Method V1.1-2010 using test results obtained at the 14 day time point.
    - Projects outside the U.S. may use the German AgBB/DIBt testing method and all testing methods based on AgBB/DIBt method (GUT, EMICODE, Blue Angel) using test results obtained at the 3 day or 7 day or 14 day time point. For caprolactam, if test results obtained at the 3 day or 7 day time point is used, the emission concentration must be less than 1/2 of the concentration limit specified above because the emission may not have peaked at the measured time points.

If a European testing method (AgBB/DIBt GUT, EMICODE, Blue Angel) had used parameters for calculating test results different from those specified in the referenced California method, then the European test results for carpets or floorings need to be converted into California air concentrations by multiplication with 0.7.
- All carpet cushion installed in the building interior must meet the requirements of the Carpet and Rug Institute Green Label program.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

## IEQ CREDIT 4.3

- All carpet adhesive must meet the requirements of IEQ Credit 4.1: Adhesives and Sealants, which includes a volatile organic compound (VOC) limit of 50 g/L (0.4 lb/gal).
  - All hard surface flooring installed in the building interior must meet one of the following requirements:
    - Meet the requirements of the FloorScore standard (current as of the date of this rating system, or more stringent version) as shown with testing by an independent third-party.
    - Demonstrate maximum VOC concentrations less than or equal to those specified in the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda, using the office scenario as defined in Table 7.5 within the practice.
    - Maximum VOC concentrations meet the California requirements specified above based on the following:
      - California Department of Public Health (CDPH) Standard Method V1.1-2010 using test results obtained at the 14 day time point.
      - Projects outside the U.S. may use the German AgBB/DIBt testing method and all testing methods based on AgBB/DIBt method (GUT, EMICODE, Blue Angel) using test results obtained at the 3 day or 7 day or 14 day time point. For caprolactam, if test results obtained at the 3 day or 7 day time point is used, the emission concentration must be less than 1/2 of the concentration limit specified above because the emission may not have peaked at the measured time points.

If a European testing method (AgBB/DIBt GUT, EMICODE, Blue Angel) had used parameters for calculating test results different from those specified in the referenced California method, then the European test results for carpets or floorings need to be converted into California air concentrations by multiplication with 0.7.

  - Mineral-based finish flooring products such as tile, masonry, terrazzo, and cut stone without integral organic-based coatings and sealants and unfinished/untreated solid wood flooring qualify for credit without any IAQ testing requirements. However, associated site-applied adhesives, grouts, finishes and sealers must be compliant for a mineral-based or unfinished/untreated solid wood flooring system to qualify for credit.
- Concrete, wood, bamboo and cork floor finishes such as sealer, stain and finish must meet the requirements of South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1, 2004.
- Tile setting adhesives and grout must meet South Coast Air Quality Management District (SCAQMD) Rule 1168. VOC limits correspond to an effective date of July 1, 2005 and rule amendment date of January 7, 2005.
- For carpet adhesive, concrete, wood, bamboo and cork floor finishes, and tile setting adhesives, compliance can be demonstrated with test results of:

## IEQ CREDIT 4.3

- Total volatiles fraction, based on one of the following, provided that water and exempt compounds are subtracted from total volatiles test results and the mass VOC content is calculated consistent with SCAQMD Rule 1113 and Rule 1168:
  - ASTM D2369
  - EPA method 24
  - ISO 11890 part 1
- Total volatile organic compounds fraction, based on one of the following, provided that all VOCs with a boiling point up to 280°C (536°F) are included, and exempt compounds are subtracted from total volatiles test results and the mass VOC content is calculated consistent with SCAQMD Rule 1113 and Rule 1168:
  - ASTM D6886
  - ISO 11890 part 2

OR

### OPTION 2

All flooring elements installed in the building interior must meet the testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

Mineral-based finish flooring products such as tile, masonry, terrazzo, and cut stone without integral organic-based coatings and sealants and unfinished/untreated solid wood flooring qualify for credit without any IAQ testing requirements. However, associated site-applied adhesives, grouts, finishes and sealers must be compliant for a mineral-based or unfinished/untreated solid wood flooring system to qualify for credit.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

IEQ	
NC	Credit 4.3
SCHOOLS	Credit 4.3
CS	Credit 4.3

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

### AgBB: Health-related Evaluation of Emissions of Volatile Organic Compounds (VOC and SVOC) from Building Products

Umwelt Bundes Amt

<http://www.umweltbundesamt.de/produkte-e/bauprodukte/agbb.htm>

This is the German method for VOC testing and evaluation. The evaluation scheme sets quality standards relevant to health for future manufacture of indoor building products and fosters the development of products with particularly low emissions. It is not aimed at subsequent evaluation of products already installed.

### ASTM D2369: Standard Test Method for Volatile Content of Coatings

<http://www.astm.org/>

According to the ASTM website, “This test method is the procedure of choice for determining volatiles in coatings for the purpose of calculating the volatile organic content in coatings under specified test conditions. The weight percent solids content (nonvolatile matter) may be determined by difference. This information is useful to the paint producer and user and to environmental interests for determining the volatiles emitted by coatings.”

### ASTM D6886: Standard Test Method for Speciation of the Volatile Organic Compounds (VOCs) in Low VOC Content Waterborne Air-Dry Coatings by Gas Chromatography

<http://www.astm.org/>

According to the ASTM website, “This test method is for the determination of the weight percent of individual volatile organic compounds in low VOC content waterborne latex air-dry coatings. The method is intended primarily for analysis of waterborne coatings in which the material VOC content is below 5 weight percent. The method has been used successfully with higher VOC content waterborne coatings.”

### California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers

<http://www.cal-iaq.org/>

This is the emissions-testing standard for California. The practice applies to any material belonging to a product category generally used in an enclosed indoor environment. Examples include paints, other architectural coatings, sealants, adhesives, wall coverings, floor coverings, wood paneling, and furniture components, whether used in public and commercial office buildings, schools, medical buildings, residences, or other building types.

### California Department of Public Health (CDPH) Standard Method V1.1-2010

<http://www.cdph.ca.gov/>

This is the emissions-testing and evaluation standard for California Specification Section 01350. The standard is applicable to the full range of building products including paints and adhesives that can be tested in small-scale chambers.

## **EPA Test Method 24, Determination of Volatile Matter Content, Water Content, Density, Volume Solids, and Weight Solids of Surface Coatings**

<http://www.epa.gov/>

EPA Test Method 24 provides testing parameters for identifying volatile content in coatings. This testing method references several ASTM sampling methods.

## **ISO 11890-1: 2007, Paints and varnishes, Determination of volatile organic compound (VOC) content, Part 1, Difference method**

<http://www.iso.org/>

According to the ISO website, “ISO 11890-1:2007 specifies a method for the determination of the volatile organic compound (VOC) content of paints, varnishes and their raw materials. This part may be used where the expected VOC content is greater than 15 % by mass. When the expected VOC content is greater than 0,1 % by mass and less than 15 % by mass, ISO 11890-2 should be employed.”

## **ISO 11890-2: 2006, Paints and varnishes, Determination of volatile organic compound (VOC) content, Part 2, Gas-chromatographic method**

<http://www.iso.org/>

According to the ISO website, “ISO 11890-2:2006 specifies a method for the determination of the volatile organic compound (VOC) content of paints, varnishes and their raw materials. ISO 11890-2 is preferred if the expected VOC content is greater than 0,1 % by mass and less than about 15 % by mass. When the VOC content is greater than about 15 % by mass, the less complicated method given in ISO 11890-1 may be used.”

## **4. Implementation**

### **AgBB/DIBt Method**

If the German AgBB/DIBt testing method or a testing method based on AgBB/DIBt method (GUT, EMICODE, Blue Angel) is used, use test results from the three-day, seven-day, or 14-day time point.

### **Credit Substitution**

Project teams may use LEED v4 EQ Credit: Low-Emitting Materials, Option 2. Budget Calculation Method in place of the full LEED 2009 Low-Emitting Materials credit suite (IEQ Credit 4.1-4.4 for New Construction and Core & Shell, IEQc4.1-4.6 for Schools). The LEED v4 credit includes emissions-based material testing requirements that are more widely used in Europe and may thus be easier to obtain.

All credits in the LEED 2009 IEQc4 credit suite must be substituted to be eligible. Projects taking this approach should consult the LEED v4 for Building Design and Construction Reference Guide for implementation guidance related to this credit. See <http://www.usgbc.org/articles/use-v4-credits-your-v2009-project> for further information on credit substitution.

See the Implementation section of IEQ Credit 4.1 in the LEED 2009 Green Building Design and Construction Reference Guide for complete implementation guidance related to this credit.

## **5. Timeline and Team**

See the Timeline and Team section of IEQc4.1 in the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## **6. Calculations**

There are no calculations required for this credit.

IEQ	
NC	Credit 4.3
SCHOOLS	Credit 4.3
CS	Credit 4.3

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

IEQ	
NC	Credit 4.3
SCHOOLS	Credit 4.3
CS	Credit 4.3

## 7. Documentation Guidance

As a first step in preparing to complete the LEED Online documentation requirements, work through the following measures. Refer to LEED Online for the complete descriptions of all required documentation.

- Maintain a list of each carpet, carpet cushion, and carpet adhesive installed in the building interior. Record the VOC content for each adhesive. If a European testing method has been selected, ensure that it meets the testing requirements outlined in the rating system.
- Maintain a list of each hard surface flooring product, tile setting adhesive, finishes, and grout installed in the building interior. Record the VOC content for each tile setting adhesive and grout.





## 8. Examples

### AgBB/DIBt Method

A project team in Paris wants to use a linoleum flooring product that is marked with both the Blue Angel and the GUT logos. The team compares the product data sheet with the referenced testing standards. The product meets the AgBB/DIBt VOC testing standards and therefore qualifies for credit.

**Figure 1.** Example product data sheet on emissions

## LINOLEUM

Produktbeschreibung nach EN 548		Marmorette 2.5mm	Marmorette 3.2mm
Belagsart	EN 548	Linoleum mit LPX Finish	Linoleum mit LPX Finish
Musterung		marmoriert	marmoriert
Gesamtdicke	EN 428	2,5 mm	3,2 mm
Unterschicht		Jutegewebe	Jutegewebe
Klassifizierung	EN 685	Klasse 23/34/42	Klasse 23/34/42
Rollenbreite	EN 426	200 cm	200 cm
Rollenlänge	EN 426	20–31 m	20–31 m
Gesamtgewicht	EN 430	2900 g / m²	3800 g / m²
Sicherheit	Brandverhalten	EN 13501-1  Cfl – s1 *	Cfl – s1 *
	Rutschsicherheit Arbeitsbereich	BGR 181 R 9	R 9
	Rutschhemmung BFU	bfu Reglement GS 1 Klasse	
	Gleitwiderstand	EN 13893  DS (> 0,30)	DS (> 0,30)
	Blauer Engel	RAL-UZ 38 Ja	Ja
	REACH	enthält keine Stoffe die in der SVHC-Liste enthalten sind	enthält keine Stoffe die in der SVHC-Liste enthalten sind
Funktion	Allgemein Bauaufsichtliche Zulassung	Z-156.604-376 geeignet für die Verwendung in Aufenthaltsräumen	geeignet für die Verwendung in Aufenthaltsräumen
	Trittschallverbesserungsmaß	ISO 140-8 4 dB	6 dB
	Resteindruck	EN 433 ≤ 0,15 mm	≤ 0,15 mm
	Farbechtheit	ISO 105-B02 Stufe ≥ 6	Stufe ≥ 6
	Durchgangswiderstand	EN 1081 –	–
	Standortisolation	VDE 0100 > 200 kOhm	> 200 kOhm
	Aufladungsspannung Begehtest	EN 1815 ca. 2,0 kV	ca. 2,0 kV
	Wärmedurchlasswiderstand	EN 12667 0,015 m² K / W	0,018 m² K / W
	Wärmeableitung	EN 12524 0,17 W / mK	0,17 W / mK
	Chemikalienbeständigkeit	EN 423  Mineralöl- und Fettbeständigkeit und kurzzeitig beständig gegen verdünnte Säuren	Mineralöl- und Fettbeständigkeit und kurzzeitig beständig gegen verdünnte Säuren
	Stuhlrollen	EN 425  geeignet (Typ W)	geeignet (Typ W)
	Biegsamkeit	EN 435-A Ø 40 mm	Ø 50 mm



CE	Hergestellt von:	Marmorette 2.5mm	Marmorette 3.2mm
		EN 14041 : 2004 05 1658-CPD-1003	EN 14041 : 2004 05 1658-CPD-1003



IEQ	
NC	Credit 4.3
SCHOOLS	Credit 4.3
CS	Credit 4.3

## 9. Exemplary Performance

This credit is not eligible for exemplary performance under the Innovation in Design section of the LEED 2009 rating system.

## 10. Regional Variations

European VOC testing methods often vary from those used in the United States. If a European testing method has been selected, ensure that it follows the parameters of the referenced California testing methods. If the European testing methods and calculations differ, multiply the European test results for carpets or floorings by 0.7.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this credit.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

### Websites

#### **ASTM International**

<http://www.astm.org>

#### **Blue Angel**

[http://www.blauer-engel.de/en/blauer\\_engel/index.php](http://www.blauer-engel.de/en/blauer_engel/index.php)

#### **California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers**

<http://www.cal-iaq.org/>

#### **California Department of Public Health**

<http://www.cdph.ca.gov/>

#### **EMICODE**

<http://www.emicode.com/index.php?id=1&L=1>

#### **GUT**

<http://www.pro-dis.info/gut.html>

#### **International Organization for Standardization (ISO)**

<http://www.iso.org>

#### **LEED 2009 to LEED v4 Credit Substitution Table**

<http://www.usgbc.org/resources/2009-v4-credit-substitution-bdc>

This resource lists the credits and prerequisites in LEED v4 that may be used by LEED 2009 project teams in lieu of the related LEED 2009 credit. It also includes any further stipulations associated with a particular credit substitution, for instance the number of points available. Addition credit substitutions will be added to the table as they are identified.

#### **Umwelt Bundes Amt**

<http://http://www.umweltbundesamt.de>

## 13. Definitions

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms identified in this credit.



## LOW-EMITTING MATERIALS—COMPOSITE WOOD AND AGRIFIBER PRODUCTS

## IEQ CREDIT 4.4

	NC	SCHOOLS	CS
Credit	IEQ Credit 4.4	IEQ Credit 4.4	IEQ Credit 4.4
Points	1 point	1 point	1 point

### Intent

To 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

#### NC & CS

Composite wood and agrifiber products used on the interior of the building (i.e., inside the weatherproofing system) must contain no added urea-formaldehyde resins. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies must not contain added urea-formaldehyde resins.

Composite wood and agrifiber products are defined as particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates and door cores. Materials considered fixtures, furniture and equipment (FF&E) are not considered base building elements and are not included.

#### SCHOOLS

All composite wood and agrifiber products installed in the building interior must meet the testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

Schools projects may choose from IEQ Credits 4.1-4.6 for a maximum of 4 points.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

IEQ	
NC	Credit 4.4
SCHOOLS	Credit 4.4
CS	Credit 4.4

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

No new standards are referenced; see the LEED 2009 Green Building Design and Construction Reference Guide for a summary of the standards referenced in this credit

## 4. Implementation

Credit Substitution

Project teams may use LEED v4 EQ Credit: Low-Emitting Materials, Option 2. Budget Calculation Method in place of the full LEED 2009 Low-Emitting Materials credit suite (IEQ Credit 4.1-4.4 for New Construction and Core & Shell, IEQc4.1-4.6 for Schools). The LEED v4 credit includes emissions-based material testing requirements that are more widely used in Europe and may thus be easier to obtain.

All credits in the LEED 2009 IEQc4 credit suite must be substituted to be eligible. Projects taking this approach should consult the LEED v4 for Building Design and Construction Reference Guide for implementation guidance related to this credit. See <http://www.usgbc.org/articles/use-v4-credits-your-v2009-project> for further information on credit substitution.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional implementation guidance related to this credit.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## 6. Calculations

There are no additional calculations associated with this credit. See LEED 2009 Green Building Design and Construction Reference Guide for calculations associated with this credit.

## 7. Documentation Guidance

See the LEED 2009 Green Building Design and Construction Reference Guide for documentation guidance related to this credit.

## 8. Examples

There are no examples associated with this credit.

## 9. Exemplary Performance

This credit is not eligible for exemplary performance under the Innovation in Design Section of the LEED 2009 Green Building Design and Construction rating system.

## 10. Regional Variations

There are no regional variations associated with this credit.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## 12. Resources

See the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this credit.

Websites

### LEED 2009 to LEED v4 Credit Substitution Table

<http://www.usgbc.org/resources/2009-v4-credit-substitution-bdc>

This resource lists the credits and prerequisites in LEED v4 that may be used by LEED 2009 project teams in lieu of the related LEED 2009 credit. It also includes any further stipulations associated with a particular credit substitution, for instance the number of points available. Addition credit substitutions will be added to the table as they are identified.

## 13. Definitions

See LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms identified in this credit.

IEQ	
NC	Credit 4.4
SCHOOLS	Credit 4.4
CS	Credit 4.4

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.



## LOW-EMITTING MATERIALS—FURNITURE AND FURNISHINGS

## IEQ CREDIT 4.5

	NC	SCHOOLS	CS
Credit	NA	IEQ Credit 4.5	NA
Points	NA	1 point	NA

### Intent

To 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

#### SCHOOLS

Classroom furniture including all student and teacher desks, tables and seats that was manufactured, refurbished or refinished within 1 year prior to occupancy must meet 1 of the requirements below. Salvaged and used furniture that is more than 1 year old at the time of occupancy is excluded from the credit requirements.

#### OPTION 1

Furniture and seating must be GREENGUARD Children and Schools certified

OR

#### OPTION 2

Calculated indoor air concentrations that are less than or equal to those listed in Table 1 for furniture systems and seating determined by a procedure based on the EPA Environmental Technology Verification (ETV) Large Chamber Test Protocol for Measuring Emissions of VOCs and Aldehydes (September 1999) testing protocol conducted in an independent air quality testing laboratory.

**Table 1.** Maximum Indoor Air Concentrations

Chemical Contaminant	Classroom Furniture	Seating
Total VOCs	0.5 mg/m <sup>3</sup>	0.25 mg/m <sup>3</sup>
Formaldehyde	50 parts per billion	25 parts per billion
Total aldehydes	100 parts per billion	50 parts per billion
4—Phenylcyclohexene (4-PCH)	0.0065 mg/m <sup>3</sup>	0.00325 mg/m <sup>3</sup>

OR

#### OPTION 3

Calculated indoor air concentrations that are less than or equal to those established in Table 1 for furniture systems and seating determined by a procedure based on ANSI/BIFMA M7.1-2007 and ANSI/BIFMA X7.1-2007 testing protocol conducted in an independent third-party air quality testing laboratory.

Schools projects may choose from IEQ Credits 4.1-4.6 for a maximum of 4 points.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

IEQ	
NC	NA
SCHOOLS	Credit 4.5
CS	NA

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

No new standards are referenced; see the LEED 2009 Green Building Design and Construction Reference Guide for a summary of the standards referenced in this credit

## 4. Implementation

Credit Substitution

Project teams may use LEED v4 EQ Credit: Low-Emitting Materials, Option 2. Budget Calculation Method in place of the full LEED 2009 Low-Emitting Materials credit suite (IEQc4.1-4.6 for Schools). The LEED v4 credit includes emissions-based material testing requirements that are more widely used in Europe and may thus be easier to obtain.

All credits in the LEED 2009 credit suite must be substituted to be eligible. Projects taking this approach should consult the LEED v4 for Building Design and Construction Reference Guide for implementation guidance related to this credit. See <http://www.usgbc.org/articles/use-v4-credits-your-v2009-project> for further information on credit substitution.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional implementation guidance related to this credit.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## 6. Calculations

There are no additional calculations associated with this credit. See LEED 2009 Green Building Design and Construction Reference Guide for calculations associated with this credit.

## 7. Documentation Guidance

See the LEED 2009 Green Building Design and Construction Reference Guide for documentation guidance related to this credit.

## 8. Examples

There are no examples associated with this credit.

## 9. Exemplary Performance

This credit is not eligible for exemplary performance under the Innovation in Design Section of the LEED 2009 Green Building Design and Construction rating system.

## 10. Regional Variations

There are no regional variations associated with this credit.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## 12. Resources

See the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this credit.

Websites

### LEED 2009 to LEED v4 Credit Substitution Table

<http://www.usgbc.org/resources/2009-v4-credit-substitution-bdc>

This resource lists the credits and prerequisites in LEED v4 that may be used by LEED 2009 project teams in lieu of the related LEED 2009 credit. It also includes any further stipulations associated with a particular credit substitution, for instance the number of points available. Additional credit substitutions will be added to the table as they are identified.

## 13. Definitions

See LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms identified in this credit.

IEQ	
NC	NA
SCHOOLS	Credit 4.5
CS	NA

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.





## LOW-EMITTING MATERIALS—CEILING AND WALL SYSTEMS

## IEQ CREDIT 4.6

	NC	SCHOOLS	CS
Credit	NA	IEQ Credit 4.6	NA
Points	NA	1 point	NA

### Intent

To 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

#### SCHOOLS

All gypsum board, insulation, acoustical ceiling systems and wall coverings installed in the building interior must meet the testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

Schools projects may choose from IEQ Credits 4.1-4.6 for a maximum of 4 points.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

IEQ	
NC	NA
SCHOOLS	Credit 4.6
CS	NA

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

No new standards are referenced; see the LEED 2009 Green Building Design and Construction Reference Guide for a summary of the standards referenced in this credit

## 4. Implementation

Credit Substitution

Project teams may use LEED v4 EQ Credit: Low-Emitting Materials, Option 2. Budget Calculation Method in place of the full LEED 2009 Low-Emitting Materials credit suite (IEQc4.1-4.6 for Schools). The LEED v4 credit includes emissions-based material testing requirements that are more widely used in Europe and may thus be easier to obtain.

All credits in the LEED 2009 IEQc4 credit suite must be substituted to be eligible. Projects taking this approach should consult the LEED v4 for Building Design and Construction Reference Guide for implementation guidance related to this credit. See <http://www.usgbc.org/articles/use-v4-credits-your-v2009-project> for further information on credit substitution.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional implementation guidance related to this credit.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## 6. Calculations

There are no additional calculations associated with this credit. See LEED 2009 Green Building Design and Construction Reference Guide for calculations associated with this credit.

## 7. Documentation Guidance

See the LEED 2009 Green Building Design and Construction Reference Guide for documentation guidance related to this credit.

## 8. Examples

There are no examples associated with this credit.

## 9. Exemplary Performance

This credit is not eligible for exemplary performance under the Innovation in Design Section of the LEED 2009 Green Building Design and Construction rating system.

## 10. Regional Variations

There are no regional variations associated with this credit.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## 12. Resources

See the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this credit.

Websites

### LEED 2009 to LEED v4 Credit Substitution Table

<http://www.usgbc.org/resources/2009-v4-credit-substitution-bdc>

This resource lists the credits and prerequisites in LEED v4 that may be used by LEED 2009 project teams in lieu of the related LEED 2009 credit. It also includes any further stipulations associated with a particular credit substitution, for instance the number of points available. Additional credit substitutions will be added to the table as they are identified.

## 13. Definitions

See LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms identified in this credit.

IEQ	
NC	NA
SCHOOLS	Credit 4.6
CS	NA

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.



## INDOOR CHEMICAL AND POLLUTANT SOURCE CONTROL

## IEQ CREDIT 5

	NC	SCHOOLS	CS
Credit	IEQ Credit 5	IEQ Credit 5	IEQ Credit 5
Points	1 point	1 point	1 point

### Intent

To minimize building occupant exposure to potentially hazardous particulates and chemical pollutants.

### Requirements

#### NC, SCHOOLS & CS

Design to minimize and control the entry of pollutants into buildings and later cross-contamination of regularly occupied areas through the following strategies:

- Employ permanent entryway systems at least 10 feet (3 meters) long in the primary direction of travel to capture dirt and particulates entering the building at regularly used exterior entrances. Acceptable entryway systems include permanently installed grates, grills and slotted systems that allow for cleaning underneath. Roll-out mats are acceptable only when maintained on a weekly basis by a contracted service organization or school maintenance staff.
- Sufficiently exhaust each space where hazardous gases or chemicals may be present or used (e.g. garages, housekeeping and laundry areas, science laboratories, prep rooms, art rooms, shops of any kind, and copying and printing rooms) to create negative pressure with respect to adjacent spaces when the doors to the room are closed. For each of these spaces, provide self-closing doors and deck-to-deck partitions or a hard-lid ceiling. The exhaust rate must be at least 0.50 cubic feet per minute (cfm) per square foot (0.15 cubic meters per minute per square meter), with no air recirculation. The pressure differential with the surrounding spaces must be at least 5 Pascals (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, each ventilation system that supplies outdoor air shall comply with the following:
  - Particle filters or air cleaning devices shall be provided to clean the outdoor air at any location prior to its introduction to occupied spaces.
  - These filters or devices shall meet one of the following criteria:
    - Filtration media is rated a minimum efficiency reporting value (MERV) of 13 or higher in accordance with ASHRAE Standard 52.2.
    - Filtration media is Class F7 or higher, as defined by CEN Standard EN 779: 2002, Particulate air filters for general ventilation, Determination of the filtration performance.
    - Filtration media has a minimum dust spot efficiency of 80% or higher and greater than 98% arrestance on a particle size of 3–10 µg.
  - Clean air filtration media shall be installed in all air systems after completion of construction and prior to occupancy.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

IEQ	
NC	Credit 5
SCHOOLS	Credit 5
CS	Credit 5

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

**CEN Standard EN 779: 2002, Particulate air filters for general ventilation, Determination of the filtration performance**

<http://www.cen.eu>

This standard outlines the parameters used in many EU countries for determining filter class for all filtration media.

## 4. Implementation

In mechanically ventilated buildings, ensure that all installed filtration media are rated Class F7 or higher or have a minimum dust spot efficiency of 80% and at least 98% arrestance on a particle size of 3–10 µg.

Spaces where hazardous gases or chemicals may be present (e.g. parking garages, housekeeping and laundry areas, copying and printing rooms) may be ventilated by using either a minimum exhaust rate of 0.50 cfm per square foot (2.54 l/s per square meter) or by using the exhaust rates determined in IEQ Prerequisite 1: Minimum Indoor Air Quality Performance.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional implementation guidance related to this credit.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## 6. Calculations

There are no calculations required for this credit.

## 7. Documentation Guidance

As a first step in preparing to complete the LEED Online documentation requirements, work through the following measures. Refer to LEED Online for the complete descriptions of all required documentation.

- On floor plans, mark the location and size of all permanent entryway systems and walk-off mats.
- Create a table listing entryway systems.
- Prepare a building maintenance plan that includes a description of cleaning and maintenance for permanent entryway systems and walk-off mats necessary to manage contaminants brought into the building.
- List rooms or areas that require separation.
- Describe the deck-to-deck partitions or hard-lid conditions at rooms known to have contaminants.
- As the project evolves, review and record negative pressure calculations at hazardous

chemical areas to ensure proper depressurization.

- Maintain product literature for filters, showing compliance with the requirements.

## 8. Examples

See the LEED 2009 Green Building Design and Construction Reference Guide for an example detailing an isolation area for hazardous gases or chemicals.

## 9. Exemplary Performance

This credit is not eligible for exemplary performance under the Innovation in Design section of the LEED 2009 rating system.

## 10. Regional Variations

See the LEED 2009 Green Building Design and Construction Reference Guide for regional variations associated with this credit.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this credit.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

### Websites

#### **Appendix B, Summary of Selected Air Quality Guidelines in ASHRAE Standard 62.1-2010, "Ventilation for Acceptable Indoor Air Quality"**

<http://www.ashrae.org>

Appendix B includes guideline values for indoor concentration and exposure for potential contaminants of concern. It is an informative appendix only that provides further background information for when using the IAQ procedure. Concentration and exposure values are summarized from cognizant authorities or peer-reviewed studies but must be considered in the project context.

#### **Comité Européen de Normalisation**

<http://www.cen.eu>

CEN seeks to foster the European economy in global trading, the welfare of European citizens, and the environment by removing trade barriers for European industry and consumers. It provides a platform for the development of European standards and other technical specifications. To purchase CEN standards, visit the Products section on the CEN website.

#### **European Commission – Transport & Environment – Road Vehicles**

<http://ec.europa.eu/environment/air/transport/road.htm>

This resource provides an overview of pollutant emissions for light-duty and heavy-duty vehicles in Europe, including a review of relevant European standards and directives.

#### **WHO Air Quality Guidelines – Second Edition**

<http://www.euro.who.int/en/publications/abstracts/air-quality-guidelines-for-europe>

This World Health Organization document, first published in 1987 and updated with advancements in risk assessment methodology, summarizes guidelines and exposure levels for indoor air quality contaminants. Its aim is to provide a basis for protecting public health from adverse effects of air pollutants and to eliminate or reduce exposure to those pollutants that are known or likely to be hazardous to human health or wellbeing. Chapter 5.5 includes further

IEQ	
NC	Credit 5
SCHOOLS	Credit 5
CS	Credit 5

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IEQ	
NC	Credit 5
SCHOOLS	Credit 5
CS	Credit 5

background on recommended exposure levels for carbon monoxide.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional resources related to this prerequisite.

**13. Definitions**

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms used in this credit.



## CONTROLLABILITY OF SYSTEMS—THERMAL COMFORT

## IEQ CREDIT 6 & 6.2

	NC	SCHOOLS	CS
Credit	IEQ Credit 6.2	IEQ Credit 6.2	IEQ Credit 6
Points	1 point	1 point	1 point

### Intent

To provide a high level of thermal comfort system control<sup>1</sup> by individual occupants or groups in multi-occupant spaces (e.g., classrooms or conference areas) and promote their productivity, comfort and well-being.

### Requirements

#### NC, SCHOOLS & CS

Provide individual comfort controls for 50% (minimum) of the building occupants in workspaces to enable adjustments to meet individual needs and preferences. Operable windows may be used in lieu of controls for occupants located 20 feet (6 meters) inside and 10 feet (3 meters) to either side of the operable part of a window. The areas of operable window must meet the requirements of ASHRAE Standard 62.1-2007 paragraph 5.1 Natural Ventilation (with errata but without addenda<sup>2</sup>).

Provide comfort system controls for all shared multioccupant spaces to enable adjustments that meet group needs and preferences.

Conditions for thermal comfort are described in IEQ Credit 7.1: Thermal Comfort—Design and include the primary factors of air temperature, radiant temperature, air speed and humidity.

#### CS

Core and shell projects that do not purchase and/or install the mechanical system or operable windows (or a combination of both) have not met the intent of this credit.

See Appendix 1 — Default Occupancy Counts for occupancy count requirements and guidance.

- For the purposes of this credit, comfort system control is defined as control over at least 1 of the following primary factors in the occupant's vicinity: air temperature, radiant temperature, air speed and humidity.
- Project teams wishing to use ASHRAE approved addenda for the purposes of this credit may do so at their discretion. Addenda must be applied consistently across all LEED credits.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

IEQ	
NC	Credit 6.2
SCHOOLS	Credit 6.2
CS	Credit 6

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

**CEN Standard EN15251: 2007, Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics**

Comité Européen de Normalisation

<http://www.cen.eu>

This standard outlines the parameters used in many EU countries to design and assess energy performance of buildings. Used in conjunction with ISO Standard 7730: 2005, it is considered equivalent to ASHRAE 55–2004 for the purposes of this credit.

**ISO Standard 7730: 2005, Ergonomics of the thermal environment, Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria**

International Organization for Standardization

<http://www.iso.org>

This standard “presents methods for predicting the general thermal sensation and degree of discomfort (thermal dissatisfaction) of people exposed to moderate thermal environments” and should be used in conjunction with CEN Standard EN 15251: 2007.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional standards referenced in this credit.

## 4. Implementation

See the LEED 2009 Green Building Design and Construction Reference Guide for implementation guidance related to this credit.

## 5. Timeline and Team

During schematic design, building designers should evaluate the building’s orientation and consider how heat gain or loss will affect the occupants. Designers should also consider whether site-specific conditions, such as wind, sound, and odors, may affect the location of operable windows. During design development, locate the thermal comfort controls with the help of electrical and mechanical engineers and the construction or development manager. Consider thermal comfort needs as they pertain to ISO 7730: 2005 and CEN Standard EN 15251: 2007 requirements; survey future occupants’ preferences. Evaluate the controls for each space, considering the specific tools and equipment that occupants will use on a daily basis. When evaluating shared occupant spaces, consider the occupancy schedule.

Post installation commissioning of all thermal comfort systems will ensure proper operation. During building operation, the owner should provide training for building maintenance staff in using the controls. Property management and building engineers should periodically review of comfort control systems to ensure that occupants’ needs are met and that controls are working according to design.

## 6. Calculations

See the LEED 2009 Green Building Design and Construction Reference Guide for calculations relating to this credit.

## 7. Documentation Guidance

See the LEED 2009 Green Building Design and Construction Reference Guide for documentation guidance related to this credit.

## 8. Examples

See the LEED 2009 Green Building Design and Construction Reference Guide for an example detailing an underfloor air distribution system.

## 9. Exemplary Performance

This credit is not eligible for exemplary performance under the Innovation in Design section of the LEED 2009 rating system.

## 10. Regional Variations

See the LEED 2009 Green Building Design and Construction Reference Guide for regional variations associated with this credit.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this credit.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

See the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this credit.

## 13. Definitions

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms used in this credit.

IEQ	
NC	Credit 6.2
SCHOOLS	Credit 6.2
CS	Credit 6

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## THERMAL COMFORT—DESIGN

## IEQ CREDIT 7 & 7.1

	NC	SCHOOLS	CS
Credit	IEQ Credit 7.1	IEQ Credit 7.1	IEQ Credit 7
Points	1 point	1 point	1 point

### Intent

To provide a comfortable thermal environment that promotes occupant productivity and well-being.

### Requirements

#### NC, SCHOOLS & CS

Design heating, ventilating and air conditioning (HVAC) systems and the building envelope to meet the requirements of one of the options below.

#### OPTION 1. ASHRAE Standard 55-2004 or Non-U.S. Equivalent

Meet the requirements of ASHRAE Standard 55-2004, Thermal Environmental Conditions for Human Occupancy (with errata but without addenda<sup>37</sup>). Demonstrate design compliance in accordance with the Section 6.1.1 documentation. Projects outside the U.S. may use a local equivalent to ASHRAE Standard 55-2004 Thermal Comfort Conditions for Human Occupancy Section 6.1.1.

#### OPTION 2. ISO 7730: 2005 & CEN Standard EN 15251: 2007

Projects outside the U.S. may earn this credit by designing heating, ventilating and air conditioning (HVAC) systems and the building envelope to meet the requirements of International Organization for Standardization (ISO) 7730: 2005 Ergonomics of the thermal environment, Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria; and CEN Standard EN 15251: 2007, Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics.

#### SCHOOLS

For natatoriums, demonstrate compliance with the “Typical Natatorium Design Conditions” defined in Chapter 4 (Places of Assembly) of the ASHRAE HVAC Applications Handbook, 2003 edition (with errata but without addenda<sup>1</sup>).

#### CS

The core and shell base building mechanical system must allow for the tenant build-out to meet the requirements of this credit. See Appendix 1 — Default Occupancy Counts for occupancy count requirements and guidance. Project teams that design their project for mechanical ventilation that do not purchase or install the mechanical system are not eligible achieve this credit.

<sup>1</sup> Project teams wishing to use ASHRAE approved addenda for the purposes of this credit may do so at their discretion. Addenda must be applied consistently across all LEED credits.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

IEQ	
NC	Credit 7.1
SCHOOLS	Credit 7.1
CS	Credit 7

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

### **CEN Standard EN15251: 2007, Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics**

Comité Européen de Normalisation

<http://www.cen.eu>

This standard outlines the parameters used in many EU countries to design and assess energy performance of buildings. Used in conjunction with ISO Standard 7730: 2005, it is considered equivalent to ASHRAE 55–2004 for the purposes of this credit.

### **ISO Standard 7730: 2005, Ergonomics of the thermal environment, Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria**

International Organization for Standardization

<http://www.iso.org>

This standard “presents methods for predicting the general thermal sensation and degree of discomfort (thermal dissatisfaction) of people exposed to moderate thermal environments” and should be used in conjunction with CEN Standard EN 15251: 2007.

## 4. Implementation

Local standards for projects outside the United States will be compared with ASHRAE 55–2004 in terms of scope, metrics, and thresholds. Project teams that wish to ensure acceptance of a proposed equivalent to ASHRAE 55–2004 prior to submission for review may choose to submit a Formal Inquiry for a Credit Interpretation Ruling for a single project, or a LEED Interpretation for multi-project use.

In order to demonstrate equivalency using a local standard, the local standard must address all of the critical requirements of ASHRAE 55–2004, identified below.

### **Factors Affecting Thermal Comfort** (ASHRAE 55–2004, Section 5.1):

There are six primary factors for defining conditions for thermal comfort for occupants. The six factors are metabolic (MET) rate, clothing insulation, air temperature, radiant temperature, air speed, and humidity.

In order to demonstrate equivalency, the local standard shall:

- Define acceptable thermal comfort conditions.
- Include a well-defined procedure to determine thermal comfort conditions.
  - The procedure shall define an acceptable thermal comfort zone.
    - At least 80% of occupants must be satisfied within the zone.
  - The procedure shall include the following parameters in the calculation:
    - Operative Temperature or a combination of air temperature and radiant temperature.

- Humidity
- Air Speed
  1. Require a maximum air speed threshold for supply air systems (40 fpm [0.203 meters per second] is recommended but variances are allowed up to 10%).
- Local Thermal Discomfort
  1. Address temperature variations due to draft, vertical temperature differences, and radiant asymmetry. Thresholds for these may differ from ASHRAE 55-2004 within an acceptable range

IEQ	
NC	Credit 7.1
SCHOOLS	Credit 7.1
CS	Credit 7

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit. Project teams wishing to use a local equivalent should contact USGBC early in the design phase to ensure that the alternative standard is acceptable.

## 6. Calculations

There are no calculations required for this credit; however, project teams should be able to describe how thermal comfort conditions were established for the project and how the design of conditioning systems addresses the thermal comfort design.

## 7. Documentation Guidance

As a first step in preparing to complete the LEED Online documentation requirements, work through the following measures. Refer to LEED Online for the complete descriptions of all required documentation.

- For projects using a local equivalent in Option 1, the local standard shall address all the issues identified under Implementation.

If the selected equivalent standard contains deviations or omissions for sections specified under Implementation, provide relevant data to justify the omissions or deviations.

## 8. Examples

See the LEED 2009 Green Building Design and Construction Reference Guide for examples relating to this credit.

## 9. Exemplary Performance

This credit is not eligible for exemplary performance under the Innovation in Design section of the LEED 2009 rating system.

## 10. Regional Variations

See the LEED 2009 Green Building Design and Construction Reference Guide for regional variations associated with this credit.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this credit.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

IEQ	
NC	Credit 7.1
SCHOOLS	Credit 7.1
CS	Credit 7

See the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this credit.

**13. Definitions**

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms used in this credit.



## THERMAL COMFORT—VERIFICATION

## IEQ CREDIT 7.2

	NC	SCHOOLS	CS
Credit	IEQ Credit 7.2	IEQ Credit 7.2	IEQ Credit 7.2
Points	1 point	1 point in addition to IEQ credit 7.1	NA

### Intent

To provide for the assessment of building occupants' thermal comfort over time.

### Requirements

#### NC

Achieve IEQ Credit 7.1: Thermal Comfort—Design.

Provide a permanent monitoring system to ensure that building performance meets the desired comfort criteria as determined by IEQ Credit 7.1: Thermal Comfort—Design.

Agree to conduct a thermal comfort survey of building occupants within 6 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 the standard used for design in IEQ Credit 7.1: Thermal Comfort—Design.

Residential projects are not eligible for this credit.

#### SCHOOLS

Achieve IEQ Credit 7.1: Thermal Comfort—Design

Agree to conduct a thermal comfort survey of building occupants (adults and students of grades 6 and above) within 6 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 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 the standard used for design in IEQ Credit 7.1: Thermal Comfort—Design.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global ACPs or Europe ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction for complete credit information. For the omitted sections, refer to the main reference guide.

IEQ	
NC	Credit 7.2
SCHOOLS	Credit 7.2
CS	NA

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

**CEN Standard EN15251: 2007, Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics**

Comité Européen de Normalisation

<http://www.cen.eu>

This standard outlines the parameters used in many EU countries to design and assess energy performance of buildings. Used in conjunction with ISO Standard 7730: 2005, it is considered equivalent to ASHRAE 55–2004 for the purposes of this credit.

**ISO Standard 7730: 2005, Ergonomics of the thermal environment, Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria**

International Organization for Standardization

<http://www.iso.org>

This standard “presents methods for predicting the general thermal sensation and degree of discomfort (thermal dissatisfaction) of people exposed to moderate thermal environments” and should be used in conjunction with CEN standard EN 15251: 2007.

## 4. Implementation

See the LEED 2009 Green Building Design and Construction Reference Guide for implementation guidance related to this credit.

## 5. Timeline and Team

The design team is primarily responsible for achieving this credit, which is based on the requirements of the standard chosen in IEQ Credit 7.1. Additionally, a member of the building operations team, an owner agent, or a commissioning authority should administer the postoccupancy survey required by this credit.

## 6. Calculations

There are no calculations associated with this credit.

## 7. Documentation Guidance

See the LEED 2009 Green Building Design and Construction Reference Guide for documentation guidance related to this credit.

## 8. Examples

There are no examples for this credit.

## 9. Exemplary Performance

This credit is not eligible for exemplary performance under the Innovation in Design section of the LEED 2009 rating system

## 10. Regional Variations

See the LEED 2009 Green Building Design and Construction Reference Guide for regional variations associated with this credit.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this credit.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

See the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this credit.

## 13. Definitions

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms used in this credit.

IEQ	
NC	Credit 7.2
SCHOOLS	Credit 7.2
CS	NA

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## ENHANCED ACOUSTICAL PERFORMANCE

## IEQ CREDIT 9

	NC	SCHOOLS	CS
Credit	IEQ Credit 9	IEQ Credit 9	IEQ Credit 9
Points	NA	1 point	NA

### Intent

To provide classrooms that facilitates better teacher-to-student and student-to-student communications through effective acoustical design.

### Requirements

#### SCHOOLS

##### Sound Transmission

Design classrooms and other core learning spaces to meet the Sound Transmission Class (STC) requirements of ANSI Standard S12.60-2002, Acoustical Performance Criteria, Design Requirements and Guidelines for Schools, except windows, which must meet an STC rating of at least 35. Projects outside the U.S. may use a local equivalent to ANSI Standard S12.60-2002.

##### AND

##### Background Noise

Reduce background noise level to 40 dBA or less from heating, ventilating and air conditioning (HVAC) systems in classrooms and other core learning spaces.

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IEQ	
NC	NA
SCHOOLS	Credit 9
CS	NA

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

No new standards are referenced; see the LEED 2009 Green Building Design and Construction Reference Guide for a summary of the ANSI Standard S12.60–2002.

## 4. Implementation

Local standards for projects outside the United States will be compared with ANSI Standard S12.60–2002 in terms of scope, metrics, and thresholds. Project teams that wish to ensure acceptance of a proposed equivalent to ANSI Standard S12.60–2002 prior to submission for review may choose to submit a Formal Inquiry for a Credit Interpretation Ruling for a single project, or a LEED Interpretation for multi-project use.

Any local equivalent must meet the sound transmission class requirements established in ANSI Standard S12.60–2002. The standard should have a method for determining the sound transmission class value of building materials used in the school building's core learning spaces and classrooms.

See the 2009 Green Building Design and Construction Reference Guide for additional implementation guidance on how to reduce background noise, and prevent sound transmission from adjacent spaces.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit. Project teams wishing to use a local equivalent should contact USGBC early in the design phase to ensure that the alternative standard is acceptable.

## 6. Calculations

See the LEED 2009 Green Building Design and Construction Reference Guide for calculations relating to this credit.

## 7. Documentation Guidance

See the LEED 2009 Green Building Design and Construction Reference Guide for documentation guidance related to this credit.

## 8. Examples

There are no examples for this credit.

## 9. Exemplary Performance

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance on exemplary performance for this credit.

## 10 Regional Variations

Regional factors that can influence ambient noise around school buildings. For example, wind, atmospheric fog, and water vapor all have the potential to affect environmental sound

transmission. The use of natural ventilation may require additional noise control because of open pathways between exterior and interior spaces.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this credit.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

See the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this credit.

## 13. Definitions

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms used in this credit.

IEQ	
NC	NA
SCHOOLS	Credit 9
CS	NA

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**Air-change rate** is the air-leakage rate in volume per hour divided by the building space volume, expressed in identical volume units.

**Air-leakage rate** is the volume of air movement across the building envelope over a unit of time.

**Bus rapid transit** is an enhanced bus system that operates on exclusive bus lanes or other transit rights-of-way; it is designed to combine the flexibility of buses with the efficiency of rail.

**Green infrastructure** is a soil- and vegetation-based approach to wet weather management that is cost-effective, sustainable, and environmentally friendly. Green infrastructure management approaches and technologies infiltrate, evapotranspire, capture and reuse stormwater to maintain or restore natural hydrologies (U.S. EPA).

An **inland waterway** is a navigable body of water, such as a river, canal, or lake, that is deep, wide, and slow enough for a vessel to pass.

**Low- Impact Development (LID)** is an approach to managing stormwater runoff that emphasizes onsite natural features to protect water quality by replicating the natural land cover hydrologic regime of watersheds and addressing runoff close to its source. Examples include better site design principles, such as minimizing land disturbance, preserving vegetation, and minimizing impervious cover, and design practices like rain gardens, vegetated swales and buffers, permeable pavement, rainwater harvesting, and soil amendments. These engineered practices may require specialized design assistance.

**Manage onsite** refers to capturing and retaining the specified volume of rainfall to mimic natural hydrologic function. Strategies may include evapotranspiration, infiltration, and capture and reuse.

**Month with the highest irrigation demand** is the maximum monthly delta between evapotranspiration rate (ET<sub>o</sub>) and mean monthly rainfall.

**Natural site hydrology** is the natural land cover function of water occurrence, distribution, movement, and balance.

**Public transportation** consists of bus, rail, or other transit services for the general public that operate on a regular, continual basis.

**Rideshare** is a transit service that involves sharing a single vehicle with multiple people, excluding large-scale vehicles such as buses and trains. The rideshare transit facility must include a signed stop and a clearly defined waiting area. Additionally, the rideshare must include an enclosed passenger seating area, fixed route service, fixed fare structure, continuous daily operation, and the ability to pick up and drop off multiple riders. Rideshare vehicles must hold 4 or more passengers, except for human-powered conveyances, which must hold 2 or more passengers.

**Test pressure difference** is the measured pressure difference across the building envelope.