LEED Building Design and Construction
Activity #8 – Indoor Environmental Quality (EQ)
Before completing this Activity Read: Reference Guide for Building Design and Construction v4 – Pages 596-775

Note the following abbreviations are used in this activity:
NC LEED BD+C: New Construction and Major Renovation
CS LEED BD+C: Core and Shell Development
S LEED BD+C: Schools
R LEED BD+C: Retail
DC LEED BD+C: Data Centers
WDC LEED BD+C: Warehouses and Distribution Centers
HOS LEED BD+C: Hospitality
HC LEED BD+C: Healthcare

Although the LEED BD+C reference guide does not number the LEED prerequisites and credits, for this exercise they have been numbered in the order presented in the credit category.

Fill-In, Multiple Choice, Matching

1. Test your knowledge of how well you know the names of the credits for the Indoor Environmental Quality (EQ) credit category:

LEED BD+C: NC, CS, S, R, DC, WDC, HOS, HC	
Credit	Name
P1	
P2	
C1	
C2	
C3	
C4	
C5	
C6	
C7	
C8	
LEED BD+C: NC, S, DC, WDC, HOS, HC	
C9	
LEED BD+C: Schools	
P3	

2. Match the intent shown below to the prerequisite or credit:

LEED BD+C: NC, CS, S, R, DC, WDC, HOS, HC

Credit	ANS
EQ – P1	
EQ – P2	
EQ – C1	
EQ – C2	
EQ – C3	
EQ – C4	
EQ – C5	
EQ – C6	
EQ – C7	
EQ – C8	

LEED BD+C: NC, S, DC, WDC, HOS, HC

Credit	ANS
EQ – C9	

LEED BD+C: Schools

Credit	ANS
EQ – P3	

	INTENT
A	To establish better quality indoor air in the building after construction and during occupancy.
B	To reduce concentrations of chemical contaminants that can damage air quality, human health, productivity, and the environment.
C	To provide classrooms that facilitate teacher-to-student and student-to-student communication through effective acoustic design.
D	To promote occupants' productivity, comfort, and well-being by providing high-quality lighting.
E	To provide workspaces and classrooms that promote occupants' well-being, productivity, and communications through effective acoustic design.
F	To contribute to the comfort and well-being of building occupants by establishing minimum standards for indoor air quality (IAQ).
G	To give building occupants a connection to the natural outdoor environment by providing quality views.
H	To promote occupants' comfort, well-being, and productivity by improving indoor air quality.
I	To promote the well-being of construction workers and building occupants by minimizing indoor air quality problems associated with construction and renovation.
J	To promote occupants' productivity, comfort, and well-being by providing quality thermal comfort.
K	To prevent or minimize exposure of building occupants, indoor surfaces, and ventilation air distribution systems to environmental tobacco smoke.
L	To connect building occupants with the outdoors, reinforce circadian rhythms, and reduce the use of electrical lighting by introducing daylight into the space.

3. High-quality indoor environments also enhance _____, decrease _____, improve the building's value, and reduce _____ for building designers and owners.

4. List the design strategies and environmental factors addressed by the Indoor Environmental Quality (EQ) credit category that influence the way people learn, work, and live:

   1.

   2.

   3.

   4.

5. For many of the credits in the EQ category, compliance is based on the percentage of _____ area that meets the credit requirements.

6. All spaces in a building must be categorized as either _____ or _____.

7. List examples of spaces that are typically unoccupied:

   1.

   2.

   3.

   4.

   5.

8. Occupied spaces are further classified as _____ occupied or _____ occupied, based on the _____ of the occupancy.

9. Regularly occupied spaces are enclosed areas where people normally spend time, defined as more than _____ hour of continuous occupancy per person per day, on average; the occupants may be seated or standing as they work, study, or perform other activities.

10. Complete the table:

Space	**Regularly occupied**	**nonregularly occupied**
Gymnasium		
Hotel front desk		
School classroom		
Bank teller station		
Break room		
Copy room		
Restroom		
Stairway		
Locker room		
Auditorium		
Study carrel		
Residential bathroom		

11. Occupied spaces, or portions of an occupied space, are further categorized as _____ or shared _____, based on the number of occupants and their activities.

12. Occupied spaces can also be classified as _____ or _____ occupied, based on the concentration of occupants in the space.

13. A densely occupied space has a design occupant density of _____ people or more per _____ square feet, or _____ square feet or less per person. Occupied spaces with a lower density are _____ occupied.

14. Complete Table 1. Space types in EQ credits

Table 1. Space types in EQ credits

Space Category	Prerequisite or credit
	• Minimum Indoor Air Quality Performance, ventilation rate procedure and natural ventilation procedure • Minimum Indoor Air Quality Performance, monitoring requirements • Enhanced Indoor Air Quality Strategies, Option 1 C • Enhanced Indoor Air Quality Strategies, Option 1 D • Enhanced Indoor Air Quality Strategies, Option 1 E • Enhanced Indoor Air Quality Strategies, Option 2 B • Enhanced Indoor Air Quality Strategies, Option 2 E • Indoor Air Quality Assessment, Option 2, Air Testing (sampling must be representative of all occupied spaces) • Thermal Comfort (New Construction, Schools, Retail, Hospitality), design requirements • Acoustic Performance (New Construction, Data Centers, Warehouses and Distribution Centers, Hospitality)
	• Thermal Comfort, design requirements (Data Centers) • Interior Lighting, Option 2, strategy A • Interior Lighting, Option 2, strategy D • Interior Lighting, Option 2, strategy E • Interior Lighting, Option 2, strategy G • Interior Lighting, Option 2, strategy H • Daylight • Quality Views
	• Thermal Comfort, control requirements • Interior Lighting, Option 1
	• Thermal Comfort, control requirements • Interior Lighting, Option 1
	• Enhanced Indoor Air Quality Strategies, Option 2 C

15. Complete Table 2. Rating-system-specific space classifications

Table 2. Rating-system-specific space classifications

Rating system	Space type	Prerequisite or credit
	Classroom and core learning spaces	• Minimum Acoustic Performance • Acoustic Performance (Schools)
	Guest rooms	• Interior Lighting* • Thermal Comfort, control requirements*
	Patient rooms	• Thermal Comfort, control requirements • Interior Lighting, Option 2, Lighting Quality
	Staff areas	• Interior Lighting, Option 2, Lighting Quality
	Perimeter area	• Daylight • Quality Views
	Inpatient units	• Quality Views
	Office areas	• Thermal Comfort, design requirements • Quality Views
	Areas of bulk storage, sorting, and distribution	• Thermal Comfort, design requirements • Quality Views
	Office and administrative areas	• Thermal Comfort, control requirements • Interior Lighting, Option 2, Lighting Quality
	Sales areas	• Interior Lighting, Option 2, Lighting Quality

*Hotel guest rooms are excluded from the credit requirements.

16. EQ Prerequisite Minimum Indoor Air Quality Performance requirements:
NC, CS, S, R, DC, WDC, HOS
Meet the requirements for both ventilation and monitoring.

Ventilation

Ventilation Mode	Required Standard
Mechanically Ventilated Spaces	ASHRAE Standard _____
Naturally Ventilated Spaces	ASHRAE Standard _____

What ASHRAE Standard 62.1-2010 procedure must be used to determine the minimum outdoor air intake flow for mechanical systems or a local equivalent, whichever is more stringent?

What ASHRAE Standard 62.1-2010 procedure must be used to determine the minimum outdoor air opening and space configuration requirements flow for natural ventilation or a local equivalent, whichever is more stringent?

What flow diagram must be followed to confirm that natural ventilation is an effective strategy for the project?

Monitoring
Mechanically Ventilated Spaces

<table>
<tr><th>Variable Air Volume (VAV)</th><th>Constant-volume</th></tr>
<tr><td>Provide a direct outdoor airflow measurement device capable of measuring the minimum outdoor air intake flow.</td><td>Balance outdoor airflow to the design minimum outdoor airflow rate</td></tr>
<tr><td>Measure with +/- _____ accuracy</td><td rowspan="2">Install a _____ transducer on the supply fan, an airflow _____, or similar _____ device.</td></tr>
<tr><td>Alarm if varies by _____</td></tr>
</table>

Naturally Ventilated Spaces
Meet one of the following strategies:

<table>
<tr><th>Strategy 1</th><th>Strategy 2</th><th>Strategy 3</th></tr>
<tr><td>Direct _____ airflow measurement device</td><td>automatic indication devices on all natural ventilation _____</td><td>Monitor carbon dioxide (CO_2) concentrations within each _____ zone.</td></tr>
<tr><td>Accuracy of +/- _____</td><td rowspan="2">An alarm must indicate when any one of the openings is closed during _____ hours.</td><td>CO_2 monitors must be between _____ and _____ feet above the floor and within the thermal zone.</td></tr>
<tr><td>Alarm if varies by _____</td><td>Audible or visual or alert BAS if CO_2 concentration exceeds setpoint by more than _____</td></tr>
</table>

Core and Shell Only
Mechanical ventilation systems installed during core and shell construction must be capable of meeting projected ventilation levels and monitoring based on the requirements of _____ future tenants.

Residential Only
In addition to the requirements above, if the project building contains residential units, each dwelling unit must meet all of the following requirements.

_____ combustion appliances (e.g., decorative logs) are not allowed.

Carbon monoxide monitors must be installed on _____ floor of each unit.

All indoor fireplaces and woodstoves must have _____ glass enclosures or doors that seal when closed.

Any indoor fireplaces and woodstoves that are not _____ combustion or _____ -vented must pass a backdraft potential test to ensure that depressurization of the combustion appliance zone is less than _____ Pa.

Space- and water-heating equipment that involves combustion must be designed and installed with closed combustion (i.e., sealed supply air and exhaust ducting) or with power-vented exhaust, or located in a _____ utility building or _____ -air facility.

For projects in high-risk areas for radon, EPA _____ Zone 1 (or local equivalent for projects outside the U.S.), design and construct any dwelling unit on levels one through four above grade with radon-_____ construction techniques. Follow the techniques prescribed in EPA Building Radon Out; NFPA 5000, Chapter 49; International Residential Code, Appendix F; CABO, Appendix F; ASTM E1465; or a _____ equivalent, whichever is most _____.

Healthcare

Meet the following requirements for both ventilation and monitoring.

Ventilation

Ventilation Mode	Required Standard
Mechanically Ventilated Spaces	ASHRAE Standard _____; 2010 _____ Areas not covered by 170 or FGI use: ASHRAE Standard _____
Naturally Ventilated Spaces	ASHRAE Standard _____

What flow diagram must be followed to confirm that natural ventilation is an effective strategy for the project?

Monitoring

Mechanically Ventilated Spaces

direct outdoor airflow measurement device capable of measuring the minimum outdoor air intake flow
Measure with +/- _____ accuracy
Alarm if varies by _____

Naturally Ventilated Spaces

Meet one of the following strategies:

Strategy 1	**Strategy 2**	**Strategy 3**
Direct _____ airflow measurement device	automatic indication devices on all natural ventilation _____	Monitor carbon dioxide (CO_2) concentrations within each _____ zone.
Accuracy of +/- _____	An alarm must indicate when any one of the openings is closed during _____ hours.	CO_2 monitors must be between _____ and _____ feet above the floor and within the thermal zone.
Alarm if varies by _____		Audible or visual or alert BAS if CO_2 concentration exceeds setpoint by more than _____

17. List the factors that contribute to maintaining good indoor air quality (IAQ):

    1.

    2.

    3.

18. The standards for EQ Prerequisite Minimum Indoor Air Quality Performance were chosen because they strike a balance between providing _____ air and maintaining _____ efficiency.

19. List the three methods that can be used to provide ventilation to building spaces:

    1.

    2.

    3.

20. To help in determining whether natural ventilation is feasible for a building or space what should the project team reference?

21. To determine the minimum amount of outdoor air that must be supplied by each mechanical ventilation system what must be completed in ASHRAE Standard 62.1-2010?

22. In what mode does the worst-case condition occur? Why?

23. Variables required for the ventilation rate procedure:

Abbreviation	Name
_____	zone air distribution effectiveness
_____	total design airflow rate at condition analyzed
_____	primary air fraction of supply air at condition analyzed
_____	system ventilation efficiency
_____	fraction of local recirculated air that is representative of system return air

24. List the zones that the ventilation rate procedure differs for:

    1.

    2.

    3.

25. For single-zone systems or 100% outdoor air systems, use the calculator provided by _____ or a _____-generated spreadsheet. The _____ spreadsheet is not applicable to these systems and should _____ be used to perform the ventilation calculations.

26. For multiple-zone systems, use the _____ spreadsheet.

27. Energy _____ software may also be used to perform ventilation rate procedure calculations for all three system types.

28. Abbreviation Name
    MERV _____

29. For a mechanically ventilated building or space, if the project is in a nonattainment area (not meeting the EPA air quality standard) for fine particulate matter (PM2.5) what is the filters minimum efficiency reporting values (MERV) that must be installed?

30. For a mechanically ventilated building or space, if the project is in an area where ozone exceeds the most recent three-year average, annual fourth-highest daily maximum eight-hour average ozone concentration of 0.107 ppm, what must be installed?

31. For VAV systems a direct outdoor airflow measurement device must measure the _____ flow rate.

32. For constant volume (CV) systems, _____ ensures that the correct amount of outdoor air is being supplied to the building.

33. List the information required for each naturally ventilated space:

    1.

    2.

    3.

34. CO_2 sensors must be located in the breathing zone which is _____ to _____ feet above finished floor.

35. ASHRAE Standard 62.1–2010, Section 6.4, requires naturally ventilated spaces to include a mechanical ventilation system unless one of the following exceptions applies:

    Ventilation openings comply with Section 6.4 and are _____ open.

    Ventilation openings comply with Section 6.4 and have _____ that prevent them from being closed during times of expected occupancy.

    The naturally ventilated zone is not served by _____ or _____ equipment.

    The system is an engineered natural ventilation system approved by the _____ having jurisdiction

36. List the three main types of mechanical ventilation systems:

    1.

    2.

    3.

37. Because of the complexity of the calculations for multiple-zone recirculating systems, project teams must use the _____ spreadsheet, or energy modeling software to perform the ventilation rate procedure calculations and determine the amount of outdoor air required at the system level.

38. EQ Prerequisite Environmental Tobacco Smoke Control requirements:
NC, CS, R, DC, WDC, HOS, HC

Prohibit smoking _____ the building.

Prohibit smoking outside the building except in designated smoking areas located at least _____ feet from all:

1.

2.

3.

Also prohibit smoking outside the property line in spaces used for _____ purposes.

Signage must be posted within _____ feet of all building _____ indicating the no-smoking policy.

Residential Only
Option 1. No Smoking
Meet the requirements above.

OR

Option 2. Compartmentalization of Smoking Areas

Prohibit smoking inside all _____ areas of the building.

The prohibition must be communicated in building rental or lease agreements or condo or coop association covenants and restrictions. Make provisions for _____.

Prohibit smoking outside the building except in _____ smoking areas located at least _____ feet from all entries, outdoor air intakes, and operable windows. The no-smoking policy also applies to spaces outside the property line used for business purposes.

If the requirement to prohibit smoking within 25 feet _____ be implemented because of code, provide documentation of these regulations.

Signage must be posted within _____ feet of all building entrances indicating the no-smoking policy.

Each unit must be compartmentalized to prevent excessive leakage between units:

_____ all exterior doors and operable windows in the residential units to minimize leakage from outdoors.

Weather-strip all doors leading from residential units into _____ hallways.

Minimize uncontrolled pathways for the transfer of smoke and other indoor air pollutants between residential units by _____ penetrations in the walls, ceilings, and floors and by sealing vertical chases (including utility chases, garbage chutes, mail drops, and elevator shafts) adjacent to the units.

Demonstrate a maximum leakage of _____cubic feet per minute per square foot at _____ Pa of enclosure (i.e., all surfaces enclosing the apartment, including exterior and party walls, floors, and ceilings).

Schools

_____ smoking on site.

_____ must be posted at the property line indicating the _____-smoking policy.

39. EQ Prerequisite Minimum Acoustic Performance applies to: _____

40. EQ Prerequisite Minimum Acoustic Performance requirements:

HVAC Background Noise

Area	Maximum noise level from HVAC (dBA)
Classrooms and core learning spaces	

List the acceptable standards for recommended methodologies and best practices:

1. ANSI Standard _____

2. 2011 HVAC Applications ASHRAE _____

3. AHRI Standard _____

Exterior Noise
For high-noise sites (peak-hour Leq above _____ dBA during school hours), implement acoustic treatment and other measures to minimize noise intrusion from exterior sources and control sound transmission between classrooms and other core learning spaces. Projects at least _____ mile from any significant noise source (e.g., aircraft overflights, highways, trains, industry) are _____.

Reverberation Time
Classrooms and Core Learning Spaces < 20,000 cubic feet
Compliance with ANSI Standard _____, Part 1, Acoustical Performance Criteria Design Requirements and Guidelines for Schools

Option 1
For each room
Total surface area of acoustic:

1. = or exceeds _____ ceiling area of the room (excluding
2. _____,
3. _____, and _____).

Materials must have an NRC of _____ or higher to be included in the calculation.

OR

Option 2
Confirm through calculations described in ANSI Standard _____ that rooms are designed to meet _____ time requirements as specified in that standard.

Classrooms and Core Learning Spaces ≥ 20,000 cubic feet
Meet the recommended reverberation times for classrooms and core learning spaces described in the _____ Construction Technology Update No. 51, Acoustical Design of Rooms for Speech (2002), or a local equivalent for projects outside the U.S.

Exceptions
Exceptions to the requirements because of a _____ scope of work or to observe _____ preservation requirements will be considered.

41. List sources of noise that impinge of concentration in core learning spaces:
    1.
    2.
    3.
    4.
    5.

42. List the acoustic performance areas addressed by EQ Prerequisite Minimum Acoustic Performance:
    1.
    2.
    3.

43. List examples of significant noise sources (within ½ mile of the face of the building):
    1.
    2.
    3.
    4.
    5.

44. If peak-hour L_{eq} measurements exceed _____ dBA, the project is considered a high-noise site and the team must implement noise reduction measures.

45. List the frequencies that sound absorptive coefficients must be used to determine the sound absorption properties of absorptive materials and reverberation times:
    1.
    2.
    3.

46. Use the room _____ to determine whether the reverberation time requirements are defined by the ANSI or NRC-CNRC standard.

47. EQ Enhanced Indoor Air Quality Strategies requirements:
    Option 1. Enhanced IAQ Strategies (1 point)

    Comply with the following requirements, as applicable.

Mechanically ventilated spaces:	Naturally ventilated spaces:	Mixed-mode systems:
A. entryway systems; B. interior cross-contamination prevention; and C. filtration	A. entryway systems; and B. natural ventilation design calculations.	A. entryway systems; B. interior cross-contamination prevention; and C. filtration D. natural ventilation design calculations. E. mixed-mode design calculations.

A. Entryway Systems
Install permanent entryway systems at least _____ feet long in the primary direction of travel to capture dirt and particulates entering the building at _____ used exterior _____.
Acceptable entryway systems include permanently installed:

1.

2.

3.

that allow for cleaning underneath, _____ mats, and any other materials manufactured as entryway systems with equivalent or better performance. Maintain all on a _____ basis.

Warehouses and Distribution Centers only
Entryway systems are _____ required at doors leading from the exterior to the _____ dock or _____ but must be installed between these spaces and adjacent office areas.

Healthcare only
In addition to the entryway system, provide _____ entryway vestibules at high-volume building entrances.

B. Interior Cross-Contamination Prevention
Exhaust areas where hazardous _____ or _____ may be present

Exhaust rates:
Determined in EQ Prerequisite Minimum Indoor Air Quality Performance or
A minimum of _____ cfm per square foot,
to create _____ pressure, when doors to the room are _____ .

Each Space:
_____ -closing doors
_____ -to-deck partitions or _____ -lid ceiling

C. Filtration
Each ventilation system that supplies outdoor air to _____ spaces must have particle filters or air-cleaning devices that meet one of the following filtration media requirements:
MERV of _____ or higher, in accordance with ASHRAE Standard _____;
Or
Class _____ or higher as defined by CEN Standard EN 779-2001

_____ all air filtration media _____ completion of construction and _____ occupancy.

D. Natural Ventilation Design Calculations
Demonstrate that the system design for occupied spaces employs the appropriate strategies in CIBSE Applications Manual _____, March 2005, Natural Ventilation in Non-Domestic Buildings, Section 2.4

E. Mixed-Mode Design Calculations
Demonstrate that the system design for occupied spaces complies with _____ Applications Manual _____–2000, Mixed Mode Ventilation.

Option 2. Additional Enhanced IAQ Strategies (1 point)

Comply with the following requirements, as applicable.

Mechanically ventilated spaces (select one):	Naturally ventilated spaces (select one):	Mixed-mode systems (select one):
A. exterior contamination prevention; B. increased ventilation; C. carbon dioxide monitoring; or D. additional source control and monitoring.	A. exterior contamination prevention; D. additional source control and monitoring; or E. natural ventilation room by room calculations.	A. exterior contamination prevention; B. increased ventilation; D. additional source control and monitoring; or E. natural ventilation room-by-room calculations.

A. Exterior Contamination Prevention

Design the project to _____ and _____ the entry of pollutants into the building. Ensure through the results of computational _____ dynamics modeling, Gaussian _____ analyses, wind _____ modeling, or tracer _____ modeling that outdoor air contaminant concentrations at outdoor air _____ are below the thresholds listed in Table 1.

Table 1. Maximum concentrations of pollutants at outdoor air intakes

Pollutants	Maximum concentration	Standard
Those regulated by National Ambient Air Quality Standards (NAAQS)	Allowable annual average OR 8-hour or 24-hour average where an annual standard does not exist OR Rolling 3-month average	National Ambient Air Quality Standards (NAAQS)

B. Increased Ventilation

Increase breathing zone outdoor air ventilation rates to all occupied spaces by at least _____ above the minimum rates as determined in EQ Prerequisite Minimum Indoor Air Quality Performance.

C. Carbon Dioxide Monitoring

Monitor CO_2 concentrations within all _____ occupied spaces. CO_2 monitors must be between _____ and _____ feet above the floor. CO_2 monitors must have an audible or visual indicator or alert the building automation system if the sensed CO_2 concentration _____ the setpoint by more than _____. Calculate appropriate CO_2 setpoints using methods in ASHRAE 62.1–2010, Appendix C.

D. Additional Source Control and Monitoring

For spaces where air contaminants are likely, evaluate _____ sources of additional air contaminants besides CO_2. Develop and implement a _____ plan to reduce the likelihood of contaminant release. Install monitoring systems with sensors designed to detect the specific contaminants. An _____ must indicate any unusual or unsafe conditions.

E. Natural Ventilation Room-by-Room Calculations

Follow _____, Section 4, Design Calculations, to predict that _____-by-room airflows will provide effective natural ventilation.

48. EQ Credit Low-Emitting Materials requirements:
This credit includes requirements for product manufacturing as well as project teams. It covers_____ (VOC) emissions into _____ air and the VOC _____ of materials, as well as the _____ methods by which indoor VOC emissions are determined.

Different materials must meet different requirements to be considered compliant for this credit. The building interior and exterior are organized in seven categories, each with different thresholds of compliance.

The building interior is defined as everything within the _____ membrane.

The building exterior is defined as everything outside and inclusive of the primary and secondary _____ system, such as waterproofing membranes and air- and water-resistive barrier materials.

Option 1. Product Category Calculations
Achieve the threshold level of compliance with emissions and content standards for the number of product categories listed in Table 2.

Complete Table 1. Thresholds of compliance with emissions and content standards for 7 categories of materials

Table 1. Thresholds of compliance with emissions and content standards for 7 categories of materials

Category	Threshold	Emissions and content requirements
Interior paints and coatings applied on site	At least 90%, by volume, for emissions; _____ for VOC content	General Emissions Evaluation for paints and coatings applied to walls, floors, and ceilings VOC content requirements for wet applied products
Interior adhesives and sealants applied on site (including flooring adhesive)	At least 90%, by volume, for emissions; _____ for VOC content	General Emissions Evaluation VOC content requirements for wet applied products
Flooring		General Emissions Evaluation
Composite wood	_____ not covered by other categories	Composite Wood Evaluation
Ceilings, walls, thermal, and acoustic insulation		General Emissions Evaluation **Healthcare, Schools** only Additional insulation requirements
Furniture (include in calculations if part of scope of work)	At least 90%, by _____	Furniture Evaluation
Healthcare and Schools Projects only: Exterior applied products	At least 90%, by _____	Exterior Applied Products

Complete Table 2. Points for number of compliant categories of products

Table 2. Points for number of compliant categories of products	
Compliant categories	**Points**
New Construction, Core and Shell, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality projects without furniture	
New Construction, Core and Shell, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality projects with furniture	
Schools, Healthcare without furniture	
Schools, Healthcare with furniture	

Option 2. Budget Calculation Method
If some products in a category do not meet the criteria, project teams may use the budget calculation method (Table 3).

Complete Table 3. Points for percentage compliance, under budget calculation method

Table 3. Points for percentage compliance, under budget calculation method	
Percentage of total	**Points**

Complete the table. The budget method organizes the building interior into six assemblies:

	Healthcare, Schools:

Include _____ in the calculations if it is part of the _____ of work. Walls, ceilings, and flooring are defined as building _____ products; each layer of the assembly, including paints, coatings, adhesives, and sealants, must be evaluated for compliance. Insulation is tracked separately.

Determine the total percentage of compliant materials according to Equation 1.

Equation 1. Total percentage compliance

$$\text{Total \% compliant for projects without furniture} = \frac{(\text{\% compliant walls} + \text{\% compliant ceilings} + \text{\% compliant flooring} + \text{\% compliant insulation})}{4}$$

$$\text{Total \% compliant for projects with furniture} = \frac{(\text{\% compliant walls} + \text{\% compliant ceilings} + \text{\% compliant flooring} + \text{\% compliant insulation}) + (\text{\% compliant furniture})}{5}$$

Equation 2. System percentage compliant

$$\text{Flooring, walls, ceilings, insulation \% compliant} = \frac{(\text{compliant surface area layer 1} + \text{compliant surface area layer 2} + \text{compliant surface area layer 3} + \ldots)}{\text{total surface area of layer 1} + \text{total surface area of layer 2} + \text{total surface area of layer 3} + \ldots} \times 100$$

Equation 3. Furniture systems compliant, using ANSI/BIFMA evaluation

$$\text{\% compliant for furniture} = \frac{0.5 \times \text{cost compliant with §7.6.1 of ANSI/BIFMA e3-2011} + \text{cost compliant with §7.6.2 of ANSI/BIFMA e3-2011}}{\text{total furniture cost}} \times 100$$

Calculate surface _____ of assembly layers based on the manufacturer's documentation for application.

If _____ of an assembly meets the criteria, the system counts as _____ compliant.

If less than _____ of an assembly meets the criteria, the assembly counts as _____ compliant.

Manufacturers' claims. Both first-party and third-party statements of product compliance must follow the guidelines in _____, Section 8. Organizations that certify manufacturers' claims must be accredited under _____ Guide 65.

Laboratory requirements. Laboratories that conduct the tests specified in this credit must be accredited under _____ for the test methods they use.

Emissions and Content Requirements

To demonstrate compliance, a product or layer must meet all of the following requirements, as applicable.

Inherently nonemitting sources.

List examples of products that are inherently nonemitting sources of VOCs:

1. 5.
2. 6.
3. 7
4. 8.

These products are considered fully _____ without any VOC emissions testing if they do not include integral organic based surface _____, _____, or _____.

General emissions evaluation. Building products must be tested and determined compliant in accordance with _____ Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.

The default scenario is the _____ scenario.

The manufacturers or third-party certification must state the exposure scenario used to determine compliance. Claims of compliance for wet-applied products must state the amount applied in _____ per _____.

Manufacturers' claims of compliance with the above requirements must also state the range of total VOCs after _____ days (336 hours), measured as specified in the _____ Standard Method v1.1:
0.5 mg/m3 or less;
between 0.5 and 5.0 mg/m3; or
5.0 mg/m3 or more.

Additional VOC content requirements for wet-applied products.

Product	**Standard(s)**
Paints and coatings wet-applied on site	OR
Adhesives and sealants wet-applied on site	

For projects in North America, _____ chloride and _____ may not be intentionally added in paints, coatings, adhesives, or sealants.

Composite Wood Evaluation. Composite wood, as defined by the California Air Resources Board, Airborne Toxic Measure to Reduce Formaldehyde Emissions from Composite Wood Products Regulation, must be documented to have low _____ emissions that meet the _____ Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) _____ or no _____ formaldehyde resins.

_____and _____ architectural _____ more than _____ year old at the time of _____ is considered compliant, provided it meets the requirements for any site-applied paints, coatings, adhesives, and sealants.

Furniture evaluation. _____furniture and furnishing items must be tested in accordance with ANSI/_____ Standard Method M7.1–2011. Comply with ANSI/_____ e3-2011 Furniture Sustainability Standard, Sections 7.6.1 and 7.6.2, using either the _____ modeling approach or the _____ factor approach.

Model the test results using the _____ plan, _____ office, or _____ scenario in ANSI/_____ M7.1, as appropriate.

_____-approved equivalent testing methodologies and contaminant thresholds are also acceptable.

For _____furniture, use the standard school classroom model in CDPH Standard Method v1.1. Documentation submitted for furniture must indicate the modeling _____ used to determine compliance.

_____and _____ furniture more than _____ year old at the time of use is considered compliant, provided it meets the requirements for any site-applied paints, coatings, adhesives, and sealants.

Healthcare, Schools only
Additional insulation requirements. _____ insulation products may contain no _____ formaldehyde, including _____ formaldehyde, _____ formaldehyde, and _____ phenol formaldehyde.

Exterior applied products. Adhesives, sealants, coatings, roofing, and waterproofing materials applied on site must meet the VOC limits of BOTH:

1.

2.

Small containers of adhesives and sealants subject to _____ or _____ consumer product VOC regulations are _____.

Two materials are prohibited and do not count toward total percentage compliance:
_____-mopped asphalt for roofing, and
_____ tar sealants for parking lots and other paved surfaces.

49. EA Credit Low-Emitting Materials uses a holistic systems approach that rewards teams for _____ compliance, recognizing compliance of product _____ even if some of their elements do not meet the applicable standard.

50. Specifying _____ compliant products is the easiest way to ensure that the credit requirements are met and the building will have the lowest possible emissions.

51. EA Credit Low-Emitting Materials, Option 2 allows project teams to substitute a _____ product if necessary.

52. List the interior materials that must be specified, as applicable to the project's scope of work:

1.	6.
2.	7.
3.	8.
4.	9.
5.	10.

Complete Table 4. Determine if the two products meet the VOC budget requirement:

Table 4. SCAQMD Rule 1113							
Regulation	Product type	General emissions criteria met?	Volume installed (L)	Allowable VOC content	Actual VOC content	VOC budget	
						Baseline case (g)	Design case (g)
SCAQMD Rule 1113	Faux finishing coatings—trowel-applied coatings	YES	50	350	450		
SCAQMD Rule 1113	Clear wood finishes—sanding sealers	YES	55	275	150		
VOC budget baseline case total (g)							
VOC budget design case total (g)							

53. EA Credit Low-Emitting Materials Exemplary Performance:

    Option 1. Earn all points and reach _____ of products.

    Option 2. Reach _____ of products.

54. EQ Credit Construction Indoor Air Quality Management Plan requirements:
    Develop and implement an indoor air quality (IAQ) management plan for the _____ and _____ phases of the building.

    The plan must address all of the following.
    During construction, meet or exceed all applicable recommended control measures of the Sheet Metal and Air Conditioning National Contractors Association (_____) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008–2008, Chapter 3.

    Protect _____ materials stored on-site and installed from moisture damage.

    Do not operate _____ installed _____-handling equipment _____ construction unless filtration media with a minimum efficiency reporting value (MERV) of _____, as determined by ASHRAE _____ , with errata (or equivalent filtration media class of F5 or higher, as defined by CEN Standard EN 779–2002, Particulate Air Filters for General Ventilation, Determination of the Filtration Performance), are installed at each _____ air grille and return or transfer _____ inlet opening such that there is no bypass around the filtration media.

    Immediately _____ occupancy, _____ all filtration media with the final design filtration media, installed in accordance with the manufacturer's recommendations.

    Prohibit the use of _____ products _____the building and within _____ feet (7.5 meters) of the building _____during construction.

Healthcare

Moisture. Develop and implement a _____plan to protect stored on-site and installed absorptive materials from moisture damage.

Immediately _____from site and properly dispose of any materials susceptible to microbial growth and replace with new, undamaged materials. Also include strategies for protecting the building from moisture intrusion and preventing occupants' exposure to _____ spores.

Particulates. Do not operate permanently installed air-handling equipment during construction unless filtration media with a minimum efficiency reporting value (MERV) of _____, as determined by ASHRAE _____, with errata (or equivalent filtration media class of F5 or higher, as defined by CEN Standard EN 779–2002, Particulate Air Filters for General Ventilation, Determination of the Filtration Performance), are installed at each _____ air grille and return or transfer _____ inlet opening such that there is no bypass around the filtration media.

Immediately _____ occupancy, _____ all filtration media with the final design filtration media, installed in accordance with the manufacturer's recommendations.

VOCs. Schedule construction procedures to _____ exposure of absorbent materials to _____ emissions. Complete _____ and _____ before storing or installing "_____" materials, which may accumulate pollutants and release them over time. Store fuels, solvents, and other sources of VOCs _____ from absorbent materials.

Outdoor emissions. For _____ projects involving waterproofing, repairing asphalt roofing, _____ parking lots, or other outdoor activities that generate high _____ emissions, develop a plan to _____ fumes and avoid infiltration to occupied spaces. Comply with the procedures established by _____, Asphalt Fume Exposures during the Application of Hot Asphalt to Roofs (Publication 2003–112).

Tobacco. Prohibit the use of tobacco products _____ the building and within _____ feet (7.5 meters) of the building _____ during construction.

Noise and vibration. Develop a _____ based on the British Standard (BS 5228) to reduce _____ emissions and _____ from construction equipment and other nonroad _____ by specifying low-noise emission design or the lowest decibel level available that meets performance requirements in the British Standard. Construction crews must wear _____ protection in areas where sound levels exceed _____ dB for extended periods.

Infection control. For renovations and additions adjacent to occupied facilities or phased occupancy in new construction, follow the _____ 2010 Guidelines for Design and Construction of Health Care Facilities and the Joint Commission on Standards to establish an _____ infection control team comprising the _____, _____, and _____ to evaluate infection control _____ and document the required precautions in a project-specific _____. Use the infection control risk assessment standard published by the American Society of Healthcare Engineering and the U.S. Centers for Disease Control and Prevention (_____) as a guideline to assess _____ and to select _____ procedures for construction activities.

55. List the SMACNA guidelines that apply to EQ Credit Construction Indoor Air Quality Management Plan:

    1.

    2.

    3.

    4.

    5.

56. Write the SMACNA Guideline next to each description:

	Prevent circulation of contaminated air when cutting concrete or wood, sanding drywall, installing VOC-emitting materials, or performing other activities that affect IAQ in other work spaces.
	Maintaining a clean job site results in fewer IAQ contaminants to manage.
	Keep sources of contaminants out of the building and have a plan to eliminate any that are introduced.
	Sequence construction activities to reduce air quality problems in new construction projects. For major renovations, coordinate construction activities to minimize or eliminate disruption of operations in occupied areas.
	Keep contaminants out of the HVAC system. Do not run permanently installed equipment if possible, or maintain proper filtration if it is used.

57. EQ Credit Indoor Air Quality Assessment requirements:
    Select one of the following two options, to be implemented _____ construction ends and the building has been completely _____. All interior _____, such as millwork, doors, paint, carpet, acoustic tiles, and movable furnishings (e.g., workstations, partitions), must be installed, and major _____ punch list items must be finished. The _____ cannot be combined.

    Option 1. Flush-Out (1 point)
    Path 1. _____ Occupancy
    Install _____ filtration media and perform a building _____ by supplying a total air volume of _____ cubic feet of outdoor air per _____ of _____ floor area while maintaining an internal temperature of at least _____°F and no higher than _____°F and relative humidity no higher than _____.

    OR

    Path 2. _____ Occupancy
    If occupancy is desired before the flush-out is completed, the space may be occupied only after delivery of a minimum of _____ cubic feet of outdoor air per square foot of gross floor area while maintaining an internal temperature of at least _____°F and no higher than _____°F and relative humidity no higher than _____. Once the space is occupied, it must be ventilated at a minimum rate

of _____ cubic foot per minute (cfm) per square foot of outdoor air or the _____ minimum outdoor air rate determined in EQ Prerequisite Minimum Indoor Air Quality Performance, whichever is greater. During each day of the flush-out period, ventilation must begin at least _____ hours before occupancy and continue during occupancy. These conditions must be maintained until a total of _____ cubic feet per square foot of outdoor has been delivered to the space.

Option 2. Air Testing (2 points)
After construction ends and before occupancy, but under _____conditions typical for _____, conduct baseline IAQ testing using protocols consistent with the methods listed in Table 1 for all occupied spaces.

Use current versions of _____ standard methods, _____ compendium methods, or _____ methods, as indicated.

Laboratories that conduct the tests for chemical analysis of formaldehyde and volatile organic compounds must be accredited under _____17025 for the test methods they use. Retail projects may conduct the testing within 14 days of occupancy.

Demonstrate that contaminants do not exceed the concentration levels listed in Table 1.
Complete Table 1. Maximum concentration levels, by contaminant and testing method

Table 1. Maximum concentration levels, by contaminant and testing method

Contaminant	**Maximum concentration**	**Maximum concentration (Healthcare only)**	**ASTM and U.S. EPA methods**	**ISO method**
	27 ppb	16.3 ppb	ASTM D5197; EPA TO-11 or EPA Compendium Method IP-6	ISO 16000-3
_____ (PM10 for all buildings; PM2.5 for buildings in EPA nonattainment areas, or local equivalent)	PM10: 50 micrograms per cubic meter PM2.5: 15 micrograms per cubic meter	20 micrograms per cubic meter	EPA Compendium Method IP-10	ISO 7708
_____ (for buildings in EPA nonattainment areas)	0.075 ppm	0.075 ppm	ASTM D5149 - 02	ISO 13964
Total volatile organic compounds (_____ s)	500 micrograms per cubic meter	200 micrograms per cubic meter	EPA TO-1, TO-15, TO-17, or EPA Compendium Method IP-1	ISO 16000-6
Target chemicals listed in _____ Standard Method v1.1, Table 4-1, except formaldehyde	CDPH Standard Method v1.1–2010, Allowable Concentrations, Table 4-1	CDPH Standard Method v1.1–2010, Allowable Concentrations, Table 4-1	ASTM D5197; EPA TO-1, TO-15, TO-17	ISO 16000-3, 16000-6
Carbon monoxide (_____)	9 ppm; no more than 2 ppm above outdoor levels	9 ppm; no more than 2 ppm above outdoor levels	EPA Compendium Method IP-3	ISO 4224

ppb = parts per billion; ppm = parts per million; µg/cm = micrograms per cubic meter

Conduct all measurements _____ occupancy but during normal occupied hours, with the building _____ system started at the _____ daily start time and operated at the _____ outdoor airflow rate for the occupied mode throughout the test.

For each sampling point where the concentration _____ the limit, take corrective action and _____ for the noncompliant contaminants at the same sampling points. _____ until all requirements are met.

58. _____ can occur during the flush-out, provided none of the commissioning procedures introduce contaminants into the space and none of the flush-out procedures circumvent the commissioning process.

59. EQ Credit Indoor Air Quality Assessment, Option 1, uses the _____ square footage of _____ space in the building to calculate the total cubic feet of air required.

60. Determine the total amount of Flush-out outdoor air volume required for EQ Credit Indoor Air Quality Assessment, Option 1, for a building that is 100' x 100'.

61. A project will be using two 5000 cfm air-handlers capable of delivering 100% outdoor air while maintaining 60–80ºF and 60% relative humidity 24 hours per day to perform a building flush-out. If the building is three floors with 12' between each floor and the building footprint is 80' x 120' how many days will it take to complete the flush-out?

62. EQ Credit Thermal Comfort requirements:
Meet the requirements for both thermal comfort _____ and thermal comfort _____.

Option 1. ASHRAE Standard _____
Design heating, ventilating, and air-conditioning (_____) systems and the building _____ to meet the requirements of ASHRAE Standard _____, Thermal Comfort Conditions for Human Occupancy, with errata or a local equivalent.

For _____, demonstrate compliance with ASHRAE HVAC Applications Handbook, 2011 edition, Chapter 5, Places of Assembly, Typical Natatorium Design Conditions, with errata.

Data Centers only
Meet the above requirements for _____ occupied spaces.

WAREHOUSES AND DISTRIBUTION CENTERS
Meet the above requirements for _____ portions of the building.

In regularly occupied areas of the building's bulk storage, sorting, and distribution areas, include one or more of the following design alternatives:

_____ flooring;

_____ fans;

_____ systems, such as nighttime air, heat venting, or wind flow;

_____ active cooling (refrigerant or evaporative-based systems) or heating systems; and

_____, hard-wired fans that provide air movement for occupants' comfort.

other equivalent thermal _____ strategy.

Thermal Comfort Control
Provide individual thermal comfort controls for at least _____ of individual occupant spaces.
Provide group thermal comfort controls for all shared _____ spaces.

Thermal comfort controls allow occupants, whether in individual spaces or shared multioccupant spaces, to adjust at least _____ of the following in their local environment:
List:

1.

2.

3.

4.

Hospitality only
Guest rooms are assumed to provide adequate thermal comfort controls and are therefore _____ included in the credit calculations.

Retail only
Meet the above requirements for at least _____ of the individual occupant spaces in _____ and _____ areas.

HEALTHCARE
Provide individual thermal comfort controls for every _____ room and at least _____ of the remaining individual occupant spaces. Provide _____ thermal comfort controls for all shared multioccupant spaces.

Thermal comfort controls allow occupants, whether in individual spaces or shared multioccupant spaces, to adjust at least _____ of the following in their local environment:
List:

1.

2.

3.

4.

63. List the primary factors that affect human comfort:
    1.
    2.
    3.
    4.
    5.
    6.

64. List the factors of human comfort that thermal comfort controls should allow occupants to control:
    1.
    2.
    3.
    4.

65. List examples of eligible thermal comfort controls:
    1.
    2.
    3.
    4.
    5.
    6.

66. List examples of ineligible thermal comfort controls:
    1.
    2.

67. List examples of zero-energy strategies used for natural conditioning:
    1.
    2.
    3.

68. EQ Credit Interior Lighting requirements:
    Select one or both of the following two options.

    Option 1. Lighting _____ (1 point)

    For at least _____ of individual _____spaces, provide individual lighting controls that enable occupants to adjust the lighting to suit their individual tasks and preferences, with at least _____ lighting levels or scenes (on, off, midlevel). Midlevel is _____ to _____ of the maximum illumination level (not including daylight contributions).

    For all shared multioccupant spaces, meet all of the following requirements.

Have in place _____ control systems that enable occupants to adjust the lighting to meet _____ needs and preferences, with at least _____ lighting levels or scenes (on, off, midlevel).

Lighting for any presentation or projection wall must be _____controlled.

Switches or manual controls must be located in the _____ space as the controlled luminaires. A person _____ the controls must have a _____ line of sight to the controlled luminaires.

Hospitality only
Guest rooms are assumed to provide adequate lighting controls and are therefore _____ included in the credit calculations

AND/OR
Option 2. Lighting _____ (1 point)

Choose _____ of the following strategies.

A. For all regularly occupied spaces, use light fixtures with a _____ of less than 2,500 cd/m2 between 45 and 90 degrees from nadir. Exceptions include wallwash fixtures properly aimed at walls, as specified by manufacturer's data, indirect uplighting fixtures, provided there is no view down into these uplights from a regularly occupied space above, and any other specific applications (i.e. adjustable fixtures).

B. For the entire project, use light sources with a _____ of 80 or higher. Exceptions include lamps or fixtures specifically designed to provide colored lighting for effect, site lighting, or other special use.

C. For at least 75% of the total connected lighting load, use light sources that have a _____ (or L70 for LED sources) of at least 24,000 hours (at 3-hour per start, if applicable).

D. Use _____ overhead lighting for 25% or less of the total connected lighting load for all regularly occupied spaces.

E. For at least 90% of the regularly occupied floor area, meet or exceed the following thresholds for area weighted average surface _____: 85% for ceilings, 60% for walls, and 25% for floors.

F. If _____ is included in the scope of work, select furniture finishes to meet or exceed the following thresholds for area-weighted average surface _____: 45% for work surfaces, and 50% for movable partitions.

G. For at least 75% of the regularly occupied floor area, meet a ratio of average _____ surface illuminance (excluding fenestration) to average _____ plane (or surface, if defined) illuminance that does not exceed _____. Must also meet strategy E, strategy F, or demonstrate area-weighted surface reflectance of at least 60% for walls.

H. For at least 75% of the regularly occupied floor area, meet a ratio of average _____ illuminance (excluding fenestration) to _____ surface illuminance that does not exceed 1:10. Must also meet option E, option F, or demonstrate area-weighted surface reflectance of at least 85% for ceilings.

RETAIL
For at least _____ of the individual occupant spaces in _____ and _____ areas, provide individual lighting controls.

In _____ areas, provide controls that can reduce the _____ light levels to a midlevel (_____ to _____ of the maximum illumination level not including daylight contributions).

HEALTHCARE
Provide individual lighting controls for at least _____ of individual occupant spaces in _____ areas.

For at least _____ of _____ positions, provide lighting controls that are readily accessible from the patient's _____.

In multioccupant patient spaces, the controls must be _____ lighting controls.

In private rooms, also provide exterior window _____, _____, or curtain _____ that are readily accessible from the patient's _____. Exceptions include in-patient _____care, _____, and psychiatric patient rooms.

For all shared multioccupant spaces, provide multizone control systems that enable occupants to adjust the lighting to meet _____ needs and preferences, with at least _____ lighting levels or scenes (on, off, midlevel). Midlevel is 30% to 70% of the maximum illumination level (not including daylight contributions).

69. The credit encourages lighting quality in multiple ways.

Minimizing light fixture luminance (strategy A) helps reduce disability and discomfort _____; the threshold, 2,500 candela per square meter, was selected because research by the Light Right Consortium found that above that level, glare became objectionable.

Using light sources with a _____ rendering index above _____ (strategy B) helps approximate _____ light.

Using light sources with long lamp _____ (strategy C) can lengthen the period over which the _____ of the lighting design is maintained; it also reduces maintenance costs and lowers material and resource inputs. A lamp life of _____ hours promotes the use of longer-life fluorescents.

Designing spaces with less _____ -only overhead lighting (strategy D) helps minimize glare, reduces the perceived brightness of the direct luminaires, and reduces _____ between ceiling and luminaire.

Specifying surfaces with _____ reflectance (strategies E and F) helps make the space brighter through reflection, minimizing the difficulty of viewing light documents on dark surfaces; the specific surface reflectance values for ceilings, walls, and floors are above the standard industry assumptions of 80, 50, and 20, respectively, as recommended in the latest edition of the Illuminating Engineering Society (IES) Lighting Handbook.

Designing for an illuminance ratio less than _____ (strategies G and H) minimizes the amount of _____ that occupants experience between their work surface and the ceiling and wall surfaces around them; the _____ illuminance ratio represents one log scale difference in lighting levels (human eyes are logarithmic, but illuminance is linear).

70. Complete Table 1. Strategies for Option 2, Lighting Quality

Table 1. Strategies for Option 2, Lighting Quality

Strategy	Scope	Exceptions, exclusions
A.	All light fixtures located in regularly occupied spaces	• Wallwash fixtures properly aimed at walls, as specified by manufacturer • Indirect uplighting fixtures, provided there is no view down into these uplights from a regularly occupied space above • Any other specific applications (e.g., adjustable fixtures)
B.	All light fixtures	• Lamps or fixtures specifically designed to provide colored lighting for effect • Site lighting • Any other special use
C.	_____ connected lighting load	---
D.	_____ connected lighting load	---
E.	_____ regularly occupied floor area	---
F.	_____ furniture used for work surfaces	---
G.	_____ regularly occupied floor area	---
H.	_____ regularly occupied floor area	---

71. For EQ Credit Interior Lighting, Option 1, residential units must have _____ lighting control for each individual occupant and multioccupant space. For example, a bedroom is listed as individual occupancy. A _____ light in the bedroom or an overhead light with manual _____ control would be acceptable.

72. EQ Credit Daylight requirements:
Provide manual or automatic (with manual override) _____-control devices for all regularly occupied spaces.

Select one of the following three options.

Option 1. Simulation: Spatial Daylight Autonomy and Annual Sunlight Exposure (2–3 points, 1-2 points Healthcare)

Demonstrate through annual computer simulations that spatial daylight autonomy$_{300/50\%}$ (sDA$_{300/50\%)}$ of at least 55%, 75%, or 90% is achieved. Use _____ occupied floor area.

Healthcare projects should use the _____ area determined under EQ Credit Quality Views. Points are awarded according to Table 1.

Complete Table 1. Points for daylit floor area: Spatial daylight autonomy

Table 1. Points for daylit floor area: Spatial daylight autonomy			
C, CS, S, R, DC, WDC, HOS		**HC**	
sDA (regularly occupied floor area)	**Points**	**sDA (perimeter floor area)**	**Points**

AND
Demonstrate through annual computer simulations that annual sunlight exposure$_{1000,250}$ (ASE$_{1000,250}$) of no more than _____ is achieved. Use the regularly occupied floor area that is daylit per the sDA$_{300/50\%}$ simulations.

The sDA and ASE calculation grids should be no more than _____ feet square and laid out across the regularly occupied area at a work plane height of _____ inches above finished floor (unless otherwise defined). Use an hourly time-step analysis based on typical meteorological year data, or an equivalent, for the nearest available weather station. Include any permanent interior obstructions. Moveable furniture and partitions may be excluded.

Core and Shell only
If the _____ in the space will not be completed, use the following default surface reflectances: 80% for ceilings, 20% for floors, and 50% for walls. Assume that the _____ floor plate, except for the core, will be regularly occupied space.

OR

Option 2. Simulation: Illuminance Calculations (1-2 points)
Demonstrate through computer modeling that illuminance levels will be between 300 lux and 3,000 lux for _____ a.m. and _____ p.m., both on a clear-sky day at the _____ , for the floor area indicated in Table 2. Use _____ occupied floor area. Healthcare projects should use the _____ area determined under EQ Credit Quality Views.

Complete Table 2. Points for daylit floor area: Illuminance calculation

Table 2. Points for daylit floor area: Illuminance calculation			
C, CS, S, R, DC, WDC, HOS		**HC**	
Percentage of regularly occupied floor area	**Points**	**Percentage of perimeter floor area**	**Points**

Calculate illuminance intensity for sun (direct component) and sky (diffuse component) for clear-sky conditions as follows:
Use typical meteorological year data, or an equivalent, for the _____ available weather station. Select one day within _____ days of September _____ and one day within _____ days of March _____ that represent the _____sky condition.

Use the _____of the hourly value for the two selected days.

Exclude _____or _____ from the model. Include any _____ interior obstructions. Movable furniture and _____ may be excluded.

Core and Shell only
Assume the following default surface reflectances if the _____ in the space will not be completed: 80% for ceilings, 20% for floors, and 50% for walls. Assume that the entire floor plate, except for the core, will be regularly occupied space.

OR

Option 3. Measurement (2-3 points, 1-2 Healthcare)

Achieve illuminance levels between _____ lux and _____ lux for the _____ area indicated in Table 3.

Complete Table 3. Points for daylit floor area: Measurement

Table 2. Points for daylit floor area: Measurement			
C, CS, S, R, DC, WDC, HOS		**HC**	
Percentage of regularly occupied floor area	**Points**	**Percentage of perimeter floor area**	**Points**

With furniture, fixtures, and equipment in place, measure illuminance levels as follows:
Measure at appropriate work _____ height during any hour between _____ a.m. and _____ p.m.
Take one measurement in any _____ occupied month, and take a second as indicated in Table 4.
For spaces larger than _____ square feet, take measurements on a maximum _____ foot square grid.
For spaces _____ square feet or smaller, take measurements on a maximum _____ foot square grid.

Table 4. Timing of measurements for illuminance	
If first measurement is taken in …	**Take second measurement in …**
January	May- September
February	June- October
March	June-July, November-December
April	August -December
May	September-January
June	October-February
July	November-March
August	December-April
September	December-January, May-June
October	February-June
November	March-July
December	April-August

73. List examples of passive solar design strategies that can improve daylight penetration and distribution:
    1.
    2.
    3.
    4.

74. List the acceptable glare control devices:
    1.
    2.
    3.
    4.
    5.
    6.

75. List the unacceptable glare control devices:
    1.
    2.
    3.
    4.
    5.
    6.

76. EQ Credit Quality Views requirements:
    New Construction, Core and Shell, schools, Retail, Data Centers, Hospitality

    Achieve a direct _____ of sight to the outdoors via vision glazing for _____ of all regularly occupied floor area. View glazing in the contributing area must provide a _____ image of the exterior, not obstructed by _____, _____, patterned glazing, or added _____ that distort color balance.

    Additionally, _____ of all regularly occupied floor area must have at least _____ of the following four kinds of views:
    _____ lines of sight to vision glazing in different directions at least _____ degrees apart;
    views that include at least _____ of the following: (1) flora, fauna, or sky; (2) movement; and (3) objects at least _____ feet (7.5 meters) from the exterior of the glazing;
    _____ views located within the distance of three times the head height of the vision glazing; and
    views with a view factor of _____ or greater, as defined in “Windows and Offices; A Study of Office Worker Performance and the Indoor Environment.”

    Include in the calculations any permanent _____ obstructions. Movable furniture and partitions may be _____.

    Views into interior _____ may be used to meet up to _____ of the required area.

WAREHOUSES AND DISTRIBUTION CENTERS
For the office portion of the building, meet the requirements above.

For the bulk storage, sorting, and distribution portions of the building, meet the requirements above for _____ of the regularly occupied floor area.

HEALTHCARE
For inpatient units (_____), meet the requirements above (1 point).

For other areas, configure the building floor plates such that the floor area within _____ feet of the _____ exceeds the perimeter area requirement (Table 1), and meet the requirements above for the perimeter area (1 point).

Complete Table 1. Minimum compliant perimeter area, by floor plate area

Table 1. Minimum compliant perimeter area, by floor plate area

Floor plate area		**Perimeter area**	
(square feet)	**(square meters)**	**(square feet)**	**(square meters)**
Up to _____	Up to 1400	_____	682
20,000	1800	8,785	816
25,000	2300	10,087	937
30,000	2800	11,292	1049
35,000	3300	12,425	1154
40,000	3700	13,500	1254
45,000	4200	14,528	1349
_____ and larger	4600 and larger	_____	1441

77. Building occupants who can visually connect with outdoor environments while performing everyday tasks experience greater satisfaction, attentiveness, and _____.

78. Designing for quality views involves consideration of building _____ and site design, facade, and _____ layout.

79. _____ design enables project teams to identify potential compromises.

80. List examples of elements that meet the view quality requirement:

    1.

    2.

    3.

    4.

81. Movement (feature 2) includes such activities as people _____, cars _____on the street, and _____ moving through the water. Movement of plants and trees from _____ does not qualify.

82. What reference is used to determine the view factor?

83. To perform calculations for EQ Credit Daylight and EQ Credit Quality Views see the daylight and quality views calculator provided by _____.

84. List the spaces that can be excluded from the view requirements:

    1.

    2.

    3.

    4.

85. EQ Credit Quality Views Exemplary Performance
    New Construction, Core and Shell, Schools, Retail, Data Centers, Hospitality
    Meet the requirements for _____ of all regularly occupied area.

    Warehouses and Distribution Centers
    Meet the requirements for _____ of the regularly occupied floor area in the office portion of the building, and for _____ of the regularly occupied floor area in the bulk storage, sorting, and distribution portions of the building.

    Healthcare
    For inpatient areas, meet the requirements for _____ of the regularly occupied floor area.
    For noninpatient areas, exceed the area requirements in Table 1 by _____ or more.

86. EQ Credit Acoustic Performance requirements:
    NC, DC, WDC, HOS
    For all occupied spaces, meet the following requirements, as applicable, for _____ background noise, sound _____, _____ time, and sound reinforcement and _____.

    HVAC Background Noise
    Achieve maximum background noise levels from heating, ventilating, and air conditioning (HVAC) systems per 2011 _____ Handbook, HVAC Applications, Chapter 48, Table 1; AHRI Standard 885-2008, Table 15; or a local equivalent. Calculate or measure sound levels.

    For measurements, use a sound level meter that conforms to _____ S1.4 for type 1 (precision) or type 2 (general purpose) sound measurement instrumentation, or a local equivalent.

    _____ with design criteria for HVAC noise levels resulting from the sound transmission paths listed in ASHRAE 2011 Applications Handbook, Table 6; or a local equivalent.

    Sound Transmission
    Meet the composite sound transmission class (_____) ratings listed in Table 1, or local building code, whichever is _____ stringent.

Complete Table 1. Maximum composite sound transmission class ratings for adjacent spaces

Table 1. Maximum composite sound transmission class ratings for adjacent spaces		
Adjacency combinations		**STCc**
Residence (within a multifamily residence), hotel or motel room	Residence, hotel or motel room	
Residence, hotel or motel room	Common hallway, stairway	
Residence, hotel or motel room	Retail	
Retail	Retail	
Standard office	Standard office	
Executive office	Executive office	
Conference room	Conference room	
Office, conference room	Hallway, stairway	
Mechanical equipment room	Occupied area	

Reverberation Time
Meet the reverberation time requirements in Table 2 (adapted from Table 9.1 in the Performance Measurement Protocols for Commercial Buildings).

Complete Table 2. Reverberation time requirements

Table 2. Reverberation time requirements		
Room type	**Application**	**T60, at 500 Hz, 1000 Hz, and 2000 Hz**
Apartment and condominium	--	
Hotel/motel	Individual room or suite	
	Meeting or banquet room	
Office building	Executive or private office	
	Conference room	
	Teleconference room	
	Open-plan office without sound masking	
	Open-plan office with sound masking	
Courtroom	Unamplified speech	
	Amplified speech	
Performing arts space	Drama theaters, concert and recital halls	Varies by application
Laboratories	Testing or research with minimal speech communication	
	Extensive phone use and speech communication	

Church, mosque, synagogue	General assembly with critical music program	Varies by application
Library	--	
Indoor stadium, gymnasium	Gymnasium and natatorium	
	Large-capacity space with speech amplification	
Classroom	--	

Sound Reinforcement and Masking Systems
Sound Reinforcement
For all large conference rooms and auditoriums seating more than _____ persons, evaluate whether sound reinforcement and AV playback capabilities are needed.

If needed, the sound reinforcement systems must meet the following criteria:
Achieve a speech transmission index (_____) of at least _____ or common intelligibility scale (_____) rating of at least _____ at representative points within the area of coverage to provide acceptable intelligibility.
Have a minimum sound level of _____ dBA.
Maintain sound-level coverage within +/–_____ dB at the _____ Hz octave band throughout the space.

Masking Systems
For projects that use masking systems, the design levels must not exceed _____ dBA. Ensure that loudspeaker coverage provides uniformity of +/–_____ dBA and that speech spectra are effectively masked.

SCHOOLS
HVAC Background noise
Achieve a background noise level of _____ dBA or less from heating, ventilating, and air-conditioning (HVAC) systems in _____ and other _____ learning spaces. Follow the recommended methodologies and best practices for mechanical system noise control in:
_____ Standard S12.60–2010, Part 1, Annex A.1;
the 2011 HVAC Applications _____ Handbook, Chapter 48, Sound and Vibration Control, with errata;
_____ Standard 885–2008; or a
_____ equivalent.

Sound Transmission
Design classrooms and other core learning spaces to meet the sound transmission class (_____) requirements of _____ S12.60–2010 Part 1, or a local equivalent. _____ windows must have an STC rating of at least _____, unless outdoor and indoor noise levels can be verified to justify a lower rating.

HEALTHCARE
Design the facility to meet or exceed the sound and vibration criteria outlined below, which are adapted from the 2010 _____Guidelines for Design and Construction of Health Care Facilities (“2010 FGI Guidelines”) and the reference document on which it is based, Sound and Vibration Design Guidelines for Health Care Facilities (“2010 SV Guidelines”).

Option 1. Speech Privacy, Sound Isolation, and Background Noise (1 point)
Speech Privacy and Sound Isolation
Design sound isolation to achieve speech _____, acoustical _____, and minimal _____from noise-producing sources. Consider sound levels at both source and receiver locations, the background sound at receiver locations, and the occupants’ acoustical privacy and acoustical

comfort needs. Speech privacy is defined as “techniques…to render speech _____ to casual listeners” (ANSI T1.523-2001, Telecom Glossary 2007).

Design the facility to meet the criteria outlined in the sections of Table 1.2-3, Design Criteria for Minimum Sound Isolation Performance _____ Enclosed Rooms, and Table 1.2-4 Speech Privacy for Enclosed Room and Open-Plan Spaces (in the 2010 FGI Guidelines and 2010 SV Guidelines).

Calculate or measure sound _____ and speech privacy descriptors achieved for representative adjacencies as necessary to confirm compliance with the criteria in the 2010 FGI Guidelines, Sections1.2-6.1.5 and 1.2-6.1.6, and the 2010 SV Guidelines (including the appendix).

Background Noise
Consider background noise levels generated by all building mechanical-electrical-plumbing systems, _____ distribution systems and other _____ noise sources under the purview of the project building design-construction team.

Design the facility to meet the 2010 _____ Guidelines, Table 1.2-2 Minimum-Maximum Design Criteria for Noise in representative interior rooms and spaces.

Calculate or measure sound levels in representative rooms and spaces of each type to confirm compliance with criteria in the above-referenced table using a sound level _____ that conforms to _____ S1.4 for type 1 (precision) or type 2 (general purpose) sound measurement instrumentation. For spaces _____ listed in Table 1.2-2, refer to _____ 2011 Handbook, Chapter 48, Sound and Vibration Control, Table 1.

Option 2. Acoustical Finishes and Site Exterior Noise (1 point)
Meet the requirements for acoustical _____ and site _____ noise.

Acoustical Finishes
Specify materials, products systems installation details, and other design features to meet the _____, Table 1.2-1, Design Room Sound Absorption Coefficients (including associated sections of the appendix) and the 2010 SV Guidelines.

Calculate or measure the average sound _____ coefficients for representative _____ rooms of each type in the building to confirm conformance with the requirements.

Site Exterior Noise
Minimize the effect on building occupants of site _____ noise produced by _____ traffic, aircraft _____, _____, on-site _____, emergency power generators during maintenance testing, outdoor facility _____ and building services equipment, etc. Also minimize effects on the surrounding community from all facility _____ equipment and activities as required to meet (1) local applicable codes or (2) Table 1.2-1 of the 2010 FGI Guidelines, Table 1.2-1, and the 2010 SV Guidelines, Table 1.3-1, whichever is more stringent.

Comply with the 2010 FGI Guidelines for the following noise sources:

_____, A1.3-3.6.2.2;

_____, 2.1-8.3.3.1;

_____ equipment, 2.1-8.2.1.1; and

_____ services, A2.2-5.3

Measure and analyze data to determine the _____ noise classification (_____) of the facility site. See the 2010 _____ Guidelines, Categorization of Health Care Facility Sites by Exterior Ambient Sound, Table A1.2a, and the 2010 SV Guidelines, Table 1.3-1.

Design the building envelope composite _____ rating based on the 2010 _____ Guidelines, Categorization of Health Care Facility Sites by Exterior Ambient Sound, and show conformance with requirements.

For exterior site exposure categories B, C, or D, calculate or measure the sound _____ performance of representative elements of the exterior building envelope to determine the composite sound transmission class (_____) rating for representative _____ sections. Measurements should generally conform to _____ E966, Standard Guide for Field Measurements of Airborne Sound Insulation of Building Façades and Façade Elements, current edition.

87. List the performance areas addressed by EQ Credit Acoustic Performance for NC, DC, WDC, and HOS:

    1.

    2.

    3.

    4.

88. List the performance areas addressed by EQ Credit Acoustic Performance Schools:

    1.

    2.

89. List the performance areas addressed by EQ Credit Acoustic Performance Healthcare:

    1.

    2.

    3.

    4.

90.

Abbreviation	Name
STC	_____
STI	_____
CIS	_____
NC	_____
RC	_____
STCc	_____
NIC	_____

91. List how project teams can verify that the assemblies for each occupied space meet the sound isolation requirements:

    1.

    2.

    3.

92. List the frequencies that reverberation time must be verified:
    1.
    2.
    3.

93. An open-plan office with sound masking is 25’ x 40’ x 12’ high walls. The total sound absorption in the room is A = 725 at 500 Hz. Determine the Reverberation time (RT). Does it meet the T60 credit requirement?

94. Composite sound transmission class (STC) rating is a weighted value for the capacity of a partition to _____ airborne sound. STC rating is calculated by averaging the transmission loss through an entire _____.

95. Speech transmission index (STI) is measured from 0 (totally _____) to 1.0 (perfectly _____).