Indoor Environmental Quality

EQ.P1 Air Quality in Naturally Ventilated and Conditioned Spaces

Prerequisite

Applicability	Verification Required		
All projects; however, implementation may be more challenging for existing schools.	⊗ at Design Review	⊗ at Construction Review	○ at Performance Review

Intent: Establish a minimum level of indoor air quality to protect student and staff health and improve performance and attendance.

Establishing a minimum level of indoor air quality positively impacts student and teacher performance, can reduce absenteeism, and avoid the potential for long and short-term health problems. Implementing the prerequisites and credits in this section will provide a foundation for providing clean, breathable air in your school. Excellent indoor air quality starts during construction and continues throughout operation or the school.

Requirement

Prerequisite	Utilize the information provided under prerequisite II.P2 Microclimate Based Design to determine whether it is optimum for the school to be mechanically or naturally, ventilated and conditioned. Follow the minimum requirements outlined below for naturally ventilated and conditioned spaces and EQ.P2 for mechanically (and mixed mode) ventilated and conditioned spaces.
	EQ.P1.1All naturally ventilated spaces must meet the following two ASHRAE Standards: ASHRAE Standard 62.1, §5.1 and §5.6: Comply with the standard, in addition to designing spaces not to exceed carbon dioxide levels according to ASHRAE Standard 62.1 Appendix C for classrooms or 700 ppm, whichever is more stringent. The natural ventilation systems must be engineered and modeled to demonstrate sufficient outdoor air ventilation and thermal comfort to assist convective air movement, and to provide back-up ventilation when indoor pollutant episodes occur. Each naturally ventilated space enclosed by four walls must have a carbon monoxide detector if adjacent to vehicle loading zones and parking lots, and a carbon dioxide sensor/detector within the ventilation zone (3 to 6 feet above the floor) that are programmed to be triggered at 700 ppm. ASHRAE Standard 55: Comply with the thermal comfort standards for naturally ventilated buildings found within the established ranges for Hawaii's Climate Zone. Projects may comply through using section 5.3 Optional Method for Determining Acceptable Thermal Conditions in Naturally Conditioned Spaces.

Implementation

Hawaii's climate is ideal for utilizing natural ventilation and conditioning methods. For naturally ventilated spaces that have no outside air from mechanical ventilation, provide documentation that the requirements of ASHRAE are met. The requirements include the maximum distance from a window or ventilation opening and the minimum size of ventilation openings. Doors are not acceptable natural ventilation openings.

It is particularly important that spaces are designed to ensure that harmful air pollutants do not build up and create health, productivity and comfort problems in classrooms.

Natural ventilation systems must be engineered to demonstrate sufficient thermal comfort and outdoor air ventilation, including meeting the rates required to reduce carbon dioxide levels to no higher than 700 ppm. Spaces shall adhere to natural ventilation guidelines such as:

- Maximize wind-induced ventilation by siting the ridge of a building perpendicular to prevailing trade winds.
- Generally, naturally ventilated buildings should be narrow.
- Generally, each room should have two separate supply and exhaust openings. Locate exhaust high above inlet to maximize stack effect. Orient windows across the room and offset from each other to maximize mixing within the room while minimizing the obstructions to airflow within the room.
- Provide ridge vents.
- Consider the use of clerestories, jalousie windows, or vented skylights.
- Provide attic ventilation.
- Consider the use of fan-assisted cooling strategies.
- Consider open staircases that provide stack effect ventilation, but observe all fire and smoke precautions for enclosed stairways.

Design the building envelope in accordance with the current American National Standards Institute (ANSI)/ASHRAE 55. The standard specifies conditions in which a specified fraction of the occupants will find

the environment thermally ac .able. Comfort conditions for naturally ve .ted buildings are included in the standard.

Verification

For projects seeking verification through the CHPS Verified Program (Pg 12), compliance documentation is required at design review and Construction review.

Design Review Requirements	
EQ.P1	Construction drawings must include diagrams and calculations showing that the design meets the natural ventilation requirements. Include tables showing floor and window ratio's of each room or if an engineered system, include outputs of CFD (Computational Fluid Dynamics) analysis.
EQ.P1	Construction drawings must show required carbon monoxide monitors and installation details (sensitivity and height above floor).
EQ.P1	Construction drawings must include a table with seasonal temperatures and humidity design criteria, and metabolic rates for each space. Provide supporting documentation with PMV/PPD calculations, and/or ASHRAE Comfort Tool results that standards have been met.
Construction Review Requirements	
EQ.P1	Submit pictures(s) of carbon monoxide monitors installed at appropriate heights and a sample of classrooms with operable windows open.

Resources

ANSI/ASHRAE Standard 62.1, Ventilation for Acceptable Indoor Air Quality.

ANSI/ASHRAE Standard 62.1 User's Manual.

ANSI/ASHRAE Standard 62.1 Mechanical Ventilation Calculation Worksheet

ANSI/ASHRAE Standard 62.1 Appendix C: Rationale for Minimum Physiological Requirements for Respiration Air Based on CO2 Concentration

ANSI/ASHRAE Standard 55CHPS Best Practices Manual, Volume II: Guideline TC13: Cross Ventilation; Guideline TC15: Stack Ventilation; Guideline TC16: Ceiling Fans.

Indoor Environmental Quality

EQ.P2 Air Quality in Mechanically Ventilated and Conditioned Spaces

Prerequisite

Applicability	Verification Required		
All projects; however, implementation may be more challenging for existing schools.	⊗ at Design Review	⊗ at Construction Review	○ at Performance Review

Intent: Establish a minimum level of indoor air quality to protect student and staff health and improve performance and attendance.

Establishing a minimum level of indoor air quality positively impacts student and teacher performance, can reduce absenteeism, and avoid the potential for long and short-term health problems. Implementing the prerequisites and credits in this section will provide a foundation for providing clean, breathable air in your school. Excellent indoor air quality starts during construction and continues throughout operation or the school.

Requirement

Prerequisite	Utilize the information provided under Prerequisite II.P52 Microclimate Based Design to determine whether it is optimum for the school to be mechanically or naturally ventilated and conditioned. Follow the minimum requirements outlined below for both mechanically and mixed mode ventilated and conditioned spaces:
	EQ.P2.1 Minimum Outdoor Ventilation Rates – Outdoor air ventilation rates shall be no less than those required and calculated according to ASHRAE 62.1 §6.1 and 6.2. Utilize the ASHRAE 62.1 spreadsheet for calculating required rates. The outdoor air ventilation rate that is greatest shall be applied to each space, or follow a local code or ordinance, whichever is more stringent. The HVAC system shall provide continuous outside air ventilation to each space during occupied hours including all full- and part-load conditions. The design shall ensure that the ventilation system operates in continuous mode during occupied hours and is not readily defeated. For multiple spaces served by variable air volume (VAV) systems, provide one of the following options: Option 1: Ensure that the minimum supply setting of each VAV box be no less than the design outdoor ventilation rate calculated for each space. The box must be controlled so that the minimum required airflow is maintained at all times when the space is occupied, even when the fan has modulated to its minimum capacity. The outside air intake damper to the VAV air handling unit shall also modulate to maintain the minimum design outdoor ventilation rate regardless of the total quantity of air that is supplied as the fan modulates from its full capacity to its minimum capacity air flow setting. Additionally, if the following rooms have significant pollutant sources; art classrooms, darkrooms, kitchens and kitchenettes, locker rooms, copy printing rooms, science lab classrooms, woodwork shops and/or other classrooms, the pollutants shall be exhausted directly to the outside and not re-circulated. Local contaminate exhaust in rooms such as fume hoods may meet this requirement. The exhaust airflow rates shall be no less than current ASHRAE 62.1 § 6.2.8.

	Option 2: Provide demand control ventilation so that the minimum supply setting of each VAV box and the position of the outside air damper to the VAV air handling unit are modulated based on the CO2 levels in each space to ensure that an adequate quantity of outside air is supplied at all times regardless of the actual cooling load as the fan modulates from its full capacity down to its minimum capacity air flow setting. Option 3: Provide a dual path dedicated outside air system so that conditioned outside air is supplied independently from the VAV air distribution system to ensure that an adequate quantity of outside air is supplied at all times regardless of the changes in the cooling load.
Prerequisite	EQ.P2.2 HVAC systems and equipment shall meet the requirements of ASHRAE Standard 62.1, §5, which addresses among other things exhaust location, air distribution, controls, the design of condensate pans, outside air intakes, and the mold resistance of air stream surfaces.
Prerequisite	EQ.P2.3 Do not install duct liners to maintain clean ducts and avoid particulate accumulation and/or mold in the ductwork.
Prerequisite	EQ.P2.4 Design the building envelope and mechanical systems to provide optimal comfort and energy efficiency. Comply with the current ASHRAE *Standard 55* for thermal comfort standards within established ranges for Hawaii's Climate Zone.
Prerequisite	EQ.P2.5 A minimum level of filtration is necessary to reduce the health risks associated air contaminants from outdoors. Replace all HVAC filtration media immediately prior to occupancy. Filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 8 or higher, excluding unit ventilators, which can have MERV 7. Filters should be installed in outdoor air intakes.
Prerequisite	EQ.P2.6 For projects with the intent of providing mixed mode ventilation, comply with both the minimum requirements for naturally ventilated spaces (EQ.P1) and mechanically ventilated spaces (EQ.P2). Optimize the various methods to work only during the appropriate times of year through manual programming by a facility manager, or through providing permanent signage in classrooms next to thermostats for staff.
Prerequisite	EQ.P2.7 Ninety percent (90%) for new schools and new school buildings, and seventy five percent (75%) for major renovations, of all classrooms shall have an operable window(s) per classroom that is reasonably accessible to the occupants, i.e., precludes use of ladders to adjust the window opening.
Prerequisite	EQ.P2.8 Provide a separate temperature control for each classroom with an independent temperature sensor or thermostat that can automatically and/or manually be adjusted to the conditions in the individual classroom. The thermostat shall be located near the teaching station and have a controlled range of set points.
Prerequisite	EQ.P2.9 Jalousie windows traditionally used in Hawaii's schools to take advantage of trade winds for natural ventilation may not be installed in mechanically ventilated or mixed mode projects unless an air tight seal can be verified.

Implementation

EQ.P2.1-3

Throughout this credit, ventilation air means the designed outside air flow rate for maximum occupancy.

Controls shall be specified that operate the HVAC fans to provide outside air ventilation continuously during occupied hours, whether or not there is a need for heating or cooling. Thermostats with an "automatic" setting do not meet this requirement, since in this mode, the fans cycle on and off according to demands for heating or cooling.

For mixed mode projects, the HVAC shall be operated continuously during working hours except during scheduled maintenance and emergency repairs or during periods for which the school district can demonstrate that the quantity of outdoor air supplied by non-mechanical means meets the outdoor air supply rate required by ASHRAE Standard 62.1, §5.2 (climate is suitable and an acceptable means for natural ventilation is provided).

The construction documents shall include design details and control sequences presented in a manner allowing that compliance with the prerequisite may be verified. In addition to information on the contract documents, calculations used to determine the most stringent outside air ventilation rate shall be signed and submitted by a professional engineer. ASHRAE 62.1 Mechanical Ventilation Calculation Worksheet shall be completed by project engineers verifying that each space meets the minimum outdoor air quantities according to ASHRAE 62.1 calculations, whichever are greatest. The spreadsheet shall show that the outside air quantity in each room served by an HVAC system meets the minimum outside air quantity for the space. For multiple spaces, the spreadsheet shall show that the minimum outside air quantities are met in each space including during times when all VAV boxes are turned down to their minimum flow positions. A completed table shall be compiled by project engineers and included in the project drawings and design documentation. The table shall list for each room: the HVAC system ID number and HVAC type, and the minimum outside air flow rate, the rooms air classification and all exhaust fans. These drawings and documents including the table and electronic spreadsheet shall be submitted for verification. Minimum outside air quantities for all spaces shall be verified during HVAC system Testing and Balancing and included in minimum Commissioning requirements when all when all VAV boxes are turned down to their minimum flow positions.

ASHRAE Standard 62.1 §5 and 6 has a number of requirements to improve the effectiveness of outside air ventilation systems. Some of these requirements apply to the design of equipment and manufacturers. The design engineer shall check with manufacturers to verify that the equipment that is specified, complies with the requirements. Some manufacturers identify product lines or equipment as complying with Standard 62.1. Specifications shall specify that the HVAC system provides a slope in condensate pans so that water does not stand, provides access for cleaning coils and other components, and makes sure that air stream surfaces are not porous including the requirement that insulation is not placed on internal air stream surfaces except for sound attenuation insulation that may be placed selectively on the inside of HVAC ducts if it is certified to meet ASTM C 1071 and ASTM C 1104 for surface erosion resistance and water vapor sorption.

Duct insulation should be located on the outside of ductwork, unless it is being installed for the purpose of attenuating sound, and there is no other means of attenuation sound. Duct liners may not be installed as they have been known to deteriorate over time and absorb moisture, leading to the release of particles in the ducts that can be blown into classrooms and offices.

Locating air intakes away from sources of potential air pollution will ensure that indoor air quality is not compromised by diesel fumes or exhaust air from ventilation, cooling towers, kitchen, or HVAC systems. Be particularly careful to locate air intakes away from areas where school buses and other vehicles may be idling.

Provide drawings showing all air intake openings. Clearly identify hazardous and noxious contaminant sources on the drawings and bubble each air intake with a 50 ft. diameter circle (25 ft. radius) on the drawings.

Where intake openings front on a street or public way, measure the horizontal distance from the centerline of the street or public way to the air intake. If an air intake is within 25 ft. of vents, chimneys, plumbing vents, exhaust fans, cooling towers, streets, alleys, parking lots and loading docks, then show that it is at least 2 feet below the contaminant source and 10 feet away horizontally from the nearest edge of the air intake to the nearest edge of the contaminant source. Indicate the horizontal and vertical distances from the contaminant source in the drawings.

EQ.P2.4

Indoor design temperature a. .umidity for general comfort applications .ll be determined in accordance with the current American National Standards Institute (ANSI)/ASHRAE 55. The standard specifies conditions in which a specified fraction of the occupants will find the environment thermally acceptable. Provide a summary that identifies each thermally controlled zone and the temperature and humidity control ranges and method of control used for each zone.

The design should also consider other important factors such as minimizing temperature differences between exterior surfaces and interior walls, decreasing the temperature variation between floors and ceilings, and decreasing the velocity of air flow such as drafts.

EQ.P2.5

Reference specification sections for installation of filters with MERV 8 or higher. The schools maintenance plan should include a filter schedule that includes all air handling units, roof top units, unit ventilators, etc. and the rating of filters used for each piece of equipment.

EQ.P2.7

Enable teachers to have reasonable control of the thermal environment within their classrooms. Operable windows are important for personal comfort and have been shown to improve student performance.

Provide at least one operable window in each classroom. Train teachers how to properly use the HVAC controls in their rooms and how opening doors and windows affect the HVAC system. Operable windows are important for both personal comfort and operation if for example, power loss occurs and mechanical ventilation can not be provided,

Reference specifications for operable windows. Designate the CSI number, section, and page number that highlight compliance with this requirement. For the purposes of this part of the credit, classrooms are:

- General classrooms
- Art rooms
- Music rooms
- Science rooms
- Computer rooms
- Special needs, remedial, and collaborative space
- Industrial technology spaces
- Work and family studies spaces

Submit floor plans with operable windows in each classroom highlighted and provide a brief narrative stating how many windows meet this requirement.

EQ.P2.8

A high performance school is a comfortable place to learn. Temperature and humidity are important factors in maintaining occupant comfort. A comfortable and healthy indoor environment increases productivity and learning and reduces absenteeism. Increased humidity can induce mold growth, which leads to indoor air quality concerns.

Individual classrooms will vary in temperature depending on their orientation, glazing apertures, occupancy, and the effectiveness of the heating or cooling systems. Provide individual systems to allow teachers to regulate the lighting and temperature of their classrooms.

Submit specifications showing adjustable thermostats in the classroom types listed above. Classrooms are defined as in the bulleted list above.

Verification

For projects seeking verification through the CHPS Verified Program (Pg 12), compliance documentation is required at design review and construction review.

Design Review Requirements	
EQ.P2	Construction drawings must include mechanical schedules with minimum required outside air CFM rates and MERV level by air handler type. Include the ASHRAE 62.1 Mechanical Ventilation Calculation Worksheet. Mechanical drawings should indicate requirements.
EQ.P2.4	Construction drawings must include a table with seasonal temperatures and humidity design criteria, and metabolic rates for each space. Provide supporting documentation with PMV/PPD calculations, and/or ASHRAE Comfort Tool results that standards have been met.
EQ.P2	Construction drawings must show air intake openings and clearly identify hazardous and noxious contaminant sources on the drawings (e.g. bus and vehicle loading areas, ventilation exhaust locations).
Construction Review Requirements	
EQ.P2	Submit pictures(s) of features installed and a sample of classrooms with operable windows open.

Resources

ANSI/ASHRAE Standard 62.1, Ventilation for Acceptable Indoor Air Quality.

ANSI/ASHRAE Standard 62.1 User's Manual.

ANSI/ASHRAE Standard 62.1 Mechanical Ventilation Calculation Worksheet

ANSI/ASHRAE Standard 55

CHPS Best Practice Manual Volume II Design: HVAC Chapter

Indoor Environmental Quality

EQ.P3 Construction IAQ Management — Prerequisite

Applicability	Verification Required		
EQ.P3.1 applies to both occupied renovations and new schools that are constructed next to occupied schools. EQ.P3.2 and 3.3 apply to all projects.	⊗ at Design Review	⊗ at Construction Review	○ at Performance Review

Intent: Provide good indoor air quality practices throughout construction to protect student and staff health and improve performance and attendance.

A high level of indoor air quality starts during design, is implemented during construction, and maintained during operation.

Requirement

Prerequisite	EQ.P3.1 During construction meet the recommended Design Approaches of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) *IAQ Guideline for Occupied Buildings Under Construction*, 2007, Chapter 3. Include the erosion and sedimentation control measures to minimize site dust during occupied renovations.
Prerequisite	EQ.P3.2 If installing a new duct system, follow the SMACNA guidelines for "Duct Cleanliness for New Construction Guidelines" according to **advanced** levels of cleanliness. Of specific importance are the following: • Specify that ductwork be sealed when transported to the construction site. • Store ductwork in clean, dry conditions and keep sealed while it is stored. • Wipe down internal surfaces of ductwork immediately prior to installation to remove dust. • Seal open ends on completed ductwork and overnight work-in-progress. • During installation, protect ductwork waiting to be installed with surface wrapping, etc. • During construction, seal HVAC supply and return openings to protect them from construction dust infiltration (e.g., from drywall installation or wood floor sanding).

Prerequisite

EQ.P3.3 Implement one of the following methods after construction is complete and all casework and major finish materials have been installed on floors, walls, and ceilings to remove indoor pollutants prior to occupancy. The option chosen is likely dependent on humidity levels, whether the project is naturally or mechanically ventilated and conditioned, and the timing of occupancy. The method must be reflected in the construction drawings, specifications and contracts.

Option 1: Prior to occupancy, flush out each space with outside air (no return air). The maximum amount of outside air (the design outside air flow rate for maximum occupancy) must be provided not less than continuously (i.e. 24 hrs) for seven days. It should be noted that the maximum amount of ventilation provided by an HVAC system may be limited not only by the system's capacity but also by the temperature and humidity of the outdoor air. Relative humidity must be maintained no higher than 60% throughout the flush out (likely with air conditioning).

Option 2: Flush out of each space separately with 3,500 ft^3 of outdoor air per ft^2 of the floor area to remove indoor pollutants. The space may then be occupied provided that it is ventilated at a rate of 0.30 cfm/ft2 of outside air or the design minimum outside air rate calculated under EQ.P1/ EQ.P2, whichever is greater, a minimum of 3 hours prior to occupancy and during occupancy, until the total of 14,000 ft3/ft2 of outside air has been delivered to each space. If occupied, thermal comfort must be maintained during occupied hour, per the criteria in current ASHRAE Standard 55. Internal temperatures must remain above 60°F and relative humidity no higher than 60%.

Option 3: All rooms in the school must be inspected and tested for health and thermal comfort by a trained technician or a certified Industrial Hygienist before occupancy. The report must be reviewed and approved by a certified Industrial Hygienists (i.e. certified by the American Council of Government and Industrial Hygienists (ACGIH)) and include that the following elements have been met:

- Each classroom has been tested to show that the ventilation rate meets minimum code required ventilation rate and receives continuous ventilation during occupancy, per Title 8, Sec. 5142.
- Each classroom has been tested to show that the particulate matter, PM 10, has been measured to be 20 micrograms per cubic meter or less than the outdoor levels and the PM 2.5 12 micrograms per cubic meter or less than outdoor levels.
- Each classroom has been tested to show that the carbon monoxide has been measured and is less than 9 parts per million but not greater than 2 ppm above outdoor levels.
- Each classroom has been tested to show that the carbon dioxide has been measured and is less than 200 ppm above outdoor CO_2 levels nearby. The room must be unoccupied during testing, and testing should occur during at least one rush-hour period.
- Each classroom has been tested to show that formaldehyde has been measured and is less than 20 micrograms per cubic meter.
- Each classroom has been tested to show that total volatile organic compounds have been measured and are less than 200 micrograms per cubic meter.
- Each classroom has been tested to show that the temperature and relative humidity have been measured and are within the criteria in current ASHRAE Standard 55.

- Each classroom has been inspected and observed to ensure that there are no health or safety concerns from any chemical, moisture and odor sources in or near the classrooms.

Under this option, in the event a space fails, take corrective action and retest the space until compliant. Do not "bake out" the building by increasing the temperature of the space.

Post-occupancy ventilation: When the contractor is required to perform touch-up (including furniture after occupancy) work involving products with chemical emissions, provide temporary construction ventilation during application and extend the building flush out by a minimum of 4 days after touch-up application, with 100% tempered outside air for 24 hours each day or retest the affected area

Implementation

EQ.P3.1

For new schools constructed on new school sites there are no requirements.

For new schools constructed next to occupied schools, the construction process (and demolition process if the existing school is later torn down) will create dust, fumes, and exhaust from activities such as site grading, pouring of the foundation, framing, enclosing the walls and roof, landscaping, installation of stormwater and utility systems, and paving. The construction team must have a communications plan in place to alert school occupants to potential exposures. Additionally, there must be an occupant complaint system in place when construction activities are creating nuisance dust, fumes, and exhaust. Furthermore, if warranted, the construction team should consider protecting the occupied school's outdoor air intakes to prevent entrainment of pollutants.

Reference specifications for a communication plan between the construction team and building occupants regarding complaints, concerns, and predicted changes to IAQ. The plan must consider communications from occupants as well as to occupants. And the plan must consider whether protection of outdoor air intakes is necessary for the project Designate the CSI number, section, and page number that highlight compliance with this requirement.

For occupied renovations, provide photographs (at least six), taken at various times during construction, with a narrative for each photo describing compliance with SMACNA guidelines as follows:

- Construction areas that were isolated from adjacent non-construction areas using temporary walls, plastic sheeting, or other vapor retarding barriers.
- Construction areas that were maintained at a negative air pressure compared to surrounding non-construction areas.
- Recirculating air ducts that were temporarily capped and sealed (appropriate filters may be used if nuisance particulates are the only contaminant of concern).
- Supply air systems that were operated with filters in place.

For occupied renovations, applicants must implement containment procedures for dusts, gases, fumes, and other pollutants created as part of any planned construction, addition to, or renovation of a school building. Containment procedures must follow the SMACNA *IAQ Guidelines for Occupied Buildings Under Construction.* All bids received for school construction or renovations must include the cost of planning and execution of containment of construction pollutants consistent with the SMACNA guidelines. The plan must include a plan for communicating information about procedures, protective measures, and construction schedules from the construction team to the building occupants. Additionally, there must be an occupant complaint systems in place when construction activities are creating nuisance dust, fumes, and exhaust.

Reference specifications for an Indoor Air Quality Management Plan that addresses SMACNA control measures for maintaining good indoor air quality on the job site. The specifications should indicate who is

responsible for implementing IAQ management plan, and the plan s ld address depressurizing work areas, ongoing housekeeping, scheduling of construction activity to lower impacts of IAQ problems on workers and building occupants, and the method of communication between construction team and building occupants regarding complaints, concerns, and predicted changes to IAQ. Designate the CSI number, section, and page number that highlight compliance with this requirement.

EQ.P3.2

This construction practice will improve indoor air quality by minimizing the amount of indoor pollutants that are distributed and retained by the surface materials and ventilation systems during construction.

Read the SMACNA guidelines and reference specification sections for duct protection including specific references to SMACNA Duct Cleanliness Guidelines Advanced Levels. Designate the CSI number, section, and page number showing compliance with this requirement. Provide photographs taken at various times during construction, with a narrative for each photo describing compliance with SMACNA Duct Cleanliness advanced levels.

EQ.P3.3

The flush out option selected should be reflected in the projects plans, specifications and contracts, including details under the TAB and control sequences sections. The specifications should be developed utilizing the CHPS Best Practices Manual Volume on Design guidelines for building flush out.

Verification

For projects seeking verification through the CHPS Verified Program (Pg 12), compliance documentation is required at design review and construction review.

Design Review Requirements	
EQ.P3	Construction drawings must include Indoor Air Quality management features.
Construction Review Requirements	
EQ.P3	Submit pictures, taken at various times during construction, with a narrative for each photo describing compliance with the various requirements.
EQ.P3.3	Submit a narrative describing implementation of the flush out option chosen, pictures and sign-off from the Contractor that it took place.

Resources

ASHRAE Standard 62.1Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings Under Construction, 2008.
http://www.smacna.org/bookstore/index.cfm?fuseaction=search_results&product_id=210

Sheet Metal and Air Conditioning Contractors' National Association, Inc., (SMACNA) Duct Cleanliness for New Construction Guidelines; © SMACNA 2000 http://www.smacna.org/technical/index.cfm?fuseaction=papers

Indoor Environmental Quality

EQ.P4 Moisture Management — Prerequisite

Applicability	Verification Required		
All projects.	⊗ at Design Review	⊗ at Construction Review	○ at Performance Review

Intent: Achieve good indoor air quality to protect student and staff health and improve performance and attendance.

Due to health risks associated with mold and microbial growth, and the damage caused to buildings by water infiltration, all surface grades, drainage systems, and HVAC condensate must be designed to move water away from buildings and their foundations.

Requirement

Prerequisite	EQ.P4.1 Drainage - Design surface grades to slope away from the building(s), and the building foundation to drain away rainwater, and HVAC condensate to prevent ponding, pooling or otherwise saturating the building envelope or foundation. Rain leaders, or downspouts, must be directed to infiltration structures, landscape features, on site storage, rain gardens, or daylight - provided that surface drainage moves water well away from the building and does not result in unintended ponding or pooling. For mechanically ventilated and conditioned projects, the condensate removal systems that rely on gravity drainage are strongly preferred to systems that use pumps due to the reduced maintenance associated with gravity systems. The project is prohibited from specifying HVAC systems that use evaporation drip pans for condensate removal.
Prerequisite	EQ.P4.2 Lawn irrigation systems shall be designed to prevent spray on building walls.
Prerequisite	EQ.P4.3 Mold Prevention - Building materials, especially gypsum wallboard, wood, porous insulation, paper, and fabric, should be kept dry to prevent the growth of mold and bacteria. Cover these materials to prevent rain damage, and if resting on the ground, use spacers to allow air to circulate between the ground and the materials. Water damaged materials should be dried within 24 hours. Due to the possibility of mold and bacterial growth, materials susceptible to moisture that are damp or wet for more than 24 hours must be discarded. Immediately remove materials showing signs of mold and mildew, including any with moisture stains, from the site and properly dispose of them. Replace moldy materials with new, undamaged materials.

Implementation

Construction activities can affect indoor air quality long after the building is occupied. Being careful to protect building materials from moisture and removing water-damaged materials are important practices in the prevention of mold growth in new buildings.

Permanent irrigation systems t spray on buildings can cause structura image and mold growth. Do not install irrigation systems in locations where they may spray directly onto buildings. Note: This requirement only applies to schools with permanent irrigation systems.

Verification

For projects seeking verification through the CHPS Verified Program (Pg 12), compliance documentation is required at design review and construction review.

Design Review Requirements	
EQ.P4	Construction drawings must include a site plan showing required drainage, and diagrams and details of condensate system must show drain tap and gravity drainage system.
EQ.P4.2	Construction drawings must include irrigation plans showing that sprinkler ranges do not intersect with buildings.
Construction Review Requirements	
EQ.P4	Submit pictures taken at various times during construction, with a narrative for each photo describing techniques for protecting building materials from mold and moisture damage.

Resources

ANSI/GREENGUARDMold and Moisture Management Standard for New Construction
www.greenguard.org/Default.aspx?tabid=111

Indoor Environmental Quality

EQ.P5 View Windows — Prerequisite

Applicability	Verification Required		
This credit applies to all new classrooms, libraries and administration areas. Renovation projects that involve window replacement can meet this prerequisite by modifying existing window configurations that do not conform to the requirements to configurations that do meet the requirements for this credit. Schools with special needs facilities may request an exemption or variance based on circumstances.	⊗ at Design Review	○ at Construction Review	○ at Performance Review

Intent: To provide a connection between indoor spaces and the outdoor environment through the introduction of sunlight and views into the occupied areas of the building.

View windows are essential to areas where students and staff will be working for extended periods of time. Ample and interesting views have consistently been found to increase student performance. Distant views enable the occupants of the room to relax their eyes, which is especially beneficial to computer users and younger children who are still developing their visual capabilities.

Requirement

Prerequisite	EQ.P5.1 Provide direct line of sight to view glazing from 70% of the combined floor area of core classrooms, library reading rooms, and administration areas. To qualify, a space shall have view glazing area equal to or greater than 7% of the floor area. View glazing shall be transparent, but not translucent, and only include window area above 2.5 ft and below 7.5 ft from the floor. The total width of view windows shall be greater than 1% of the floor area.

Implementation

Determine the total floor area of spaces for which this requirement applies by creating a table listing the classrooms, library reading rooms and administrative areas. Like spaces may be listed just once. A like space is one with the same physical configuration, including windows.

For each space in the list determine how much of the floor area qualifies for the view credit. Two considerations come into play: the view window area and the total width of the view windows. Each of these limit how much of the area qualifies, as explained below:

- To determine the maximum qualifying area based on the view window area, divide the view window area by 7%.
- To determine the maximum qualifying area based on the width of the view windows, divide the total width of view windows by 1%.

For each space the qualifying floor area is the lesser of the total floor area, the maximum floor area based on view window area, or the maximum floor area based on view window width. Sum the qualifying area and compare to the total area. If it is greater than 70%, then the school project qualifies, otherwise it does not.

Example Calculation

Question: A new school has 30 like classrooms each with a floor area of 960 ft². Each classroom has view windows with an total area of 60 ft² and a total width of 9 ft. The school also has six larger 1,040 ft² classrooms with 70 ft² view windows with a total width of 10.5 ft. The 2,600 ft² library reading area has 200 ft² of view windows with a total width of 25 ft. The 2,000 ft² administration area has 150 ft² of view windows with a total width of 18 ft. Does this school qualify for the view windows credit and how much of the floor area qualifies as having view windows?

Answer: The total floor area of classrooms, administration areas and library reading rooms is 39,640 ft² (see column D in Table 3). To meet the prerequisite, at least 70% of the floor area of these spaces shall have view windows, or a total of 35,676 ft². The qualifying floor area must be determined for each space based on the total view window area and the total width of the view windows. For the smaller classrooms, the maximum qualifying floor area based on view window area is 857 ft² or 60 ft² divided by 7%. The maximum qualifying floor area based on window width is 900 ft or 9 ft divided by 1%/ft. The qualifying area is the smaller of these numbers or 857 ft². For the larger classrooms, the qualifying area is 1,000 ft²; 2,500 ft² for the library reading area; and 1,800 ft² for the administration areas. The total qualifying area is 36,010 ft² or 91%. See Table 3 for details of the calculation.

Table 3 – Example Calculation of View Window Credit

A	B	C	D	E	F	G	H	I	J
				For each space					
Space	Size (ft²)	Number of spaces	Total area (ft²)	View window area (ft²)	Maximum Floor Area based on view window area (ft²)	Total width of view windows (ft)	Maximum floor area based on view window width	Qualifying floor area per space (ft²)	Total qualifying floor area (ft²)
Classroom type 1	960	30	28,800	60	857	9	900	857	25,710
Classroom type 2	1040	6	6,240	70	1,000	10.5	1,050	1000	6,000
Library reading room	2600	1	2,600	200	2,857	25	2,500	2500	2,500
Administration	2000	1	2,000	150	2142	18	1,800	1800	1,800
Totals			39,640						36,010
Percent									91%

Verification

For projects seeking verification through the CHPS Verified Program (Pg 12), compliance documentation is required at design review only.

Design Review Requirements	
EQ.P5	Construction drawings must include required calculations for view windows. Fulfill this requirement by completing the HI-CHPS Plan Sheet. Plans and sections will be used for verification.

Resources

LEED™ *Reference Guide*: Indoor Environmental Quality Credit 8.2: Daylight and Views.

Indoor Environmental Quality

EQ.P6 Daylighting and Glare — Prerequisite

Applicability	Verification Required		
All projects.	⊗ at Design Review	○ at Construction Review	○ at Performance Review

Intent: Provide high quality daylighting in classrooms to enhance student performance and to improve student productivity through quality daylighting designs that minimize glare and direct sunlight penetration.

Daylighting is fundamentally important to high performance design, and should be the primary source of light in classrooms. Daylighting has a number of advantages, including improved occupant productivity, improved connection to the outdoors, improved health, energy savings, and quality of light.

Requirement

Prerequisite	EQ.P6.1 Design spaces to optimize daylight while preventing glare by controlling direct sunlight ingress with blinds, shades, overhangs, lightshelves, translucent material, or other effective means. Use either of the following three metrics to document achievement of this credit: • No direct sunlight can strike the teaching surfaces or a work plane located 4 ft. or more inside the exterior walls at 9:00AM, 12:00PM and 3:00PM on the winter and summer solstice and the equinox. **OR** • The maximum illuminance to average illuminance ratio cannot exceed 15 at 9:00AM, 12:00PM and 3:00PM on the winter and summer solstice and the equinox. **OR** • The maximum Daylight Autonomy for the daylit spaces must be below 5% for all daylit spaces. Skylights and roof monitors shall meet the requirements of no direct sun penetration as described above, unless they have diffusing devices. Include a control strategy to automatically turn off or dim the electric lights when adequate daylighting is available in a given daylit space.

Implementation

Direct Sunlight Penetration

The requirements for direct sunlight penetration shall be verified by one of the following methods:

- A physical model should be placed on a heliodon or otherwise positioned so that the sun angles represent the dates and times specified in EQ.P6.1. Verify by photograph that the 9 conditions do not have any direct sunlight on the workplane or teaching wall.

- A model may be set up in ɔmputer based tool that can calculate su. ıt on interior surfaces. Verify be rendering images or task plane illuminance calculations that the 9 conditions do not have any direct sunlight on the workplane or teaching wall.
- Manually calculate the sun profile angles and show that the criteria are satisfied for the dates and times specified in EQ.P6.1. Illustrate that any shading strategies provide complete direct sunlight control for the 9 conditions specified.
- Perform an incremental maximum Daylight Autonomy calculation using 300fc or other recommended target illuminance x 10. The DA_{max} should be 5% or less for no more than 5% of the workplane points.

For any manually controlled shading devices included in the above calculations (ie. Blinds, roller-shades), provide documentation that can be given to users and informing of optimal use of shading devices, namely ensuring they are not left down when there is plentiful daylight.

Daylight Responsive Lighting Controls

Compliance with the requirement shall be verified by one of the following methods:

- For photosensor based systems; documentation showing location of sensors and lighting zones, and setpoint and commissioning information for the system.
- For occupant education approach; a manual to be provided to the building occupants describing the daylighting intent of the space and function of all daylighting, lighting and shading devices.

Verification

For projects seeking verification through the CHPS Verified Program (Pg 12), compliance documentation is required at design review only.

Design Review Requirements	
EQ.P6	Construction drawings must show required photocontrols, sensors, lighting zones and set points.
EQ.P6	Provide PDF results of a daylight simulation model, a computer based simulation model, a physical model, or manually calculated sunlight penetration in the classrooms to avoid direct sunlight on teaching surfaces and work planes.

Resources

CHPS Best Practices Manual: Volume II: Daylighting and Fenestration Design Chapter.

Advanced Lighting Guidelines: 2003 Edition: www.newbuildings.org/lighting.htm

AGI32 Lighting Design Software: www.agi32.com/

DAYSIM Daylighting Analysis Software: http://irc.nrc-cnrc.gc.ca/ie/lighting/daylight/daysim_e.html

DOE-2 Building Energy Use and Cost Analysis Software: http://doe2.com/

Ecotect: http://ecotect.com/

EnergyPlus Building Energy Simulation Program: http://gundog.lbl.gov/

Equest: www.doe2.com/equest

Lightscape: http://usa.autodesk.com

The Daylighting Collaborative is a clearinghouse of best practices and resources about daylighting: http://www.daylighting.org.

Indoor Environmental Quality

EQ.P7 Minimum Acoustical Performance — Prerequisite

Applicability	Verification Required		
This prerequisite applies to all newly constructed classrooms and can be incorporated into classroom renovation projects depending on the scope of the project and existing conditions. For new construction, the design of the classroom and the materials specified should ensure compliance.	⊗ at Design Review	○ at Construction Review	○ at Performance Review

Intent: Provide classrooms with adequate acoustical environments.

Student learning suffers in acoustically poor environments. Excess noise and highly reverberant spaces can make it difficult, and sometimes impossible, for students and teachers to communicate. The background noise environment is characterized by a noise level measured in A-weighted decibels (dBA). The reverberation is described by a reverberation time, which is the time (in seconds) it takes for the sound to drop 60 decibels in level after the source of the sound has ceased.

Requirement

Prerequisite	EQ.P7.1 Unoccupied classrooms must meet the following design requirements: For each classroom and core learning space, document that the reverberation time meets the requirements of ANSI S12.60 for Acoustical Performance Criteria, Design Requirements and Guidelines for Schools. Calculations are to assume a fitted out and furnished but unoccupied classroom, and Design all walls, roof-ceiling and floor-ceiling assemblies separating classrooms and other core learning spaces to meet the Sound Transmission Class (STC) requirements as defined in ANSI Standard S12.60-2010, except windows which must meet an STC rating of at least 35 (jalousie windows are exempt from this requirement), and Design the entire ceiling to be treated with acoustical material having a noise reduction coefficient, NRC (average sound absorption coefficient) of not less that 0.70 excluding items such as light fixtures, HVAC grilles / diffusers and ceiling grid, and Design classrooms and other core learning spaces to meet an Leq 40dBA for HVAC system noise in an unoccupied classroom during normal hours of classroom operation, and Floor-ceiling assemblies over classrooms must meet Impact Insulation Class (IIC) of 50 or greater where occupied space is over a classroom. There are multiple carpet and non-carpet strategies to achieving this performance level.

Implementation

For each classroom and core learning space, document that the combined total area of acoustical wall panels, ceiling finishes, and other sound-absorbent finishes equals or exceeds the total area requirements relative to

ceiling heights as called out Table C.1 of ANSI S12.60. Calculatic are to assume a fitted out and furnished but unoccupied classroom. Provide narrative describing measures taken to limit sound transmission between core learning spaces and the following adjacencies:

- Other core learning spaces
- Bathrooms
- Corridors
- Offices, conference rooms
- Music rooms
- Mechanical equipment rooms
- Cafeterias, gymnasiums,

The narrative should address the following:

- Demising wall constructions
- Interior glazing assemblies
- Door constructions
- Operable partition constructions, including STC rating, if available.
- Measures taken to limit noise transmission through sound paths, including:
  - Open plenums above core learning spaces
  - Connecting doors between core learning spaces
  - Ceiling air return grilles into open plenums
  - "Cross-talk" via mechanical ductwork
  - Special circumstances or considerations regarding the project

A "core learning space" as defined by ANSI, and accepted by HI-CHPS is "spaces for educational activities where the primary functions are teaching and learning and where good speech communication is critical to a student's academic achievement. These spaces include, but are not limited to, classrooms, (enclosed or open plan), instructional pods or activity areas, group instruction rooms, gymnasiums, conference rooms, libraries, offices, speech clinics, offices used for educational purposes and music rooms for instruction, practice and performance."

Document compliance in classrooms and other core learning spaces using the methodology listed in the 2007 (or most recent version) HVAC Applications ASHRAE Handbook, Chapter 47 on Sound and Vibration Control. Commercially available programs using the ASHRAE Algorithms are acceptable. Documentation must include typical classrooms as well as core learning spaces such as art, science and gym and music spaces utilizing alternative materials and constructions.

To provide a realistic and representative measurement method for both steady-state HVAC noise and time varying exterior environmental noise, the A-weighted equivalent level (Leq) shall be used. The Leq is the steady sound level that contains the same acoustic energy as the actual time-varying sound level during the measurement period.

Reverberation time can be estimated by the following formula:

$$RT(60) = \frac{0.05 \cdot V}{\sum S \cdot \alpha}$$

Where V is the volume of the space in ft3, S is the surface area of each room surface in ft2 and a is the associated sound absorption coefficient at a given frequency. Absorption coefficients of common interior surface materials are provided in the ASA Classroom Acoustics a resource for creating learning environments with desirable listening conditions (ASA 2000) and by most manufacturers of interior finish products. The Noise Reduction Coefficient (NRC) is the arithmetic mean of sound absorption coefficients at the 250, 500, 1000 and 2000 Hz octave band center frequencies, which happen to be the bands at which the majority of the energy from human speech is contained.

The reverberation time can be measured in a space by popping a balloon and using a meter designed for that purpose. The reverberation times of interest are taken at octave band center frequencies of 500, 1000, and 2000 Hz.

Cross Category & Other Considerations

Site Selection: When selecting the site and building orientation for a school, consider the current and future exterior noise pollution surrounding the potential site that will affect indoor acoustics such as busy traffic corridors and, trains, and/or airport activities.

Enhanced Acoustic Systems (teacher microphones and speakers): A classroom that meets the reverberation time and dBA requirements set for in this credit should not require enhanced classroom audio systems. However, there may be circumstances, such as the health of the teacher that may require sound amplification. If installing sound amplification systems consider the new levels of noise that may be transmitted between classroom walls, ceilings and floors and necessary improvements or upgrades to ensure the noise does not affect neighboring classes. Also consider the maintenance and user training of such systems. Improperly maintained systems can lead to poorer speech communication between teacher and student than without the system.

Verification

For projects seeking verification through the CHPS Verified Program (Pg 12), compliance documentation is required at design review only.

Design Review Requirements	
EQ.P7	Provide PDF of the report from a qualified acoustical consultant verifying that classrooms have been designed to meet the relevant requirements including 1) measures taken to limit sound transmission between core learning spaces and adjacent spaces, 2) proof of floor-ceiling assemblies that meet the IIC of 50 or greater, 3) compliance with sound and vibration control requirements outlined in the HVAC Applications ASHRAE Handbook, Chapter 47, and 4) calculations showing compliance with ANSI S12.60.
EQ.P7	Construction drawings should reflect measures taken to meet the required acoustic levels.

Resources

Hawaii Department of Education EDSPECS Chapter 4 Acoustic Design Criteria: http://fssb.k12.hi.us/educational_specifications.htm

National Clearinghouse for Educational Facilities: http://www.edfacilities.org/

Acoustical Society of America: http://asa.aip.org/ and http://asa.aip.org/classroom/booklet.html

American National Standards Institute: www.ansi.org/

American Speech-Language-Hearing Association: http://www.asha.org

ANSI Standard S12.60 Annex B

Indoor Environmental Quality

EQ.P8 Minimum Low-Emitting Materials — Prerequisite

Applicability	Verification Required		
All projects.	⊗ at Design Review	⊗ at Construction Review	○ at Performance Review

Intent: Provide classrooms with acceptably low indoor air concentrations of harmful volatile organic chemicals that derive from building products and materials used indoors.

Many common building products and materials used indoors in the construction of educational facilities and other buildings are sources of volatile organic chemicals (VOCs). When emitted to indoor air, these pollutants are inhaled by occupants. Such inhalation exposures can result in adverse health effects. These effects include sensory and upper respiratory irritation, pulmonary irritation, asthma, damage to organ systems and neurological and reproductive systems, and increased risk of cancer. Exposure to airborne VOCs is an especially important issue for schools as children may be more susceptible than adults. In order to reduce the potential for adverse effects due to inhalation exposures to VOCs, it is important to specify and utilize products and materials in the construction of the interiors of classrooms and other educational buildings that have low emissions of VOCs that are known to be harmful.

It is required that paints and coatings, adhesives, sealants, and wood products in the project be low-emitting. Projects can claim further points for other product categories in EQ.C4.

Requirement

Prerequisite	EQ.P8.1 Paints & Coatings: All paints and architectural coatings totaling 90% or more of the total volumes of such products applied in the project's interior shall meet the requirements described herein. Products shall meet the VOC content requirements in the applicable category of South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings (amended July 2007, or current version). Products in this category include, but are not limited to sealers, stains, clear wood finishes, floor sealers and coatings, waterproofing sealers, primers, flat paints and coatings, non-flat paints and coatings, and rust preventative coatings. Further, all such products shall comply with the requirements of the Safe Drinking Water and Toxic Enforcement Act of 1986 and the most current list of chemicals (Proposition 65, CA Office of Environmental Health and Hazardous Assessment). Products that are labeled or would require labeling under this law are not eligible for this credit. Further all paints and coatings normally applied to walls, ceilings, floors or trim shall be tested and evaluated for emissions of VOCs of concern with respect to chronic inhalation exposures following the specifications of the current version of the California Department of Public Health's (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers. The product shall be applied to the appropriate plate or gypsum board panel and tested individually (i.e., not as part of a multi-coat assembly). Flooring sealers and paints shall be modeled to the school classroom using the manufacturer's specified coverage and the classroom flooring area. Wall applied paints and coatings shall be modeled using the manufacturer's specified coverage and the classroom wall paint and wall coverings area. Ceiling applied paints and coatings shall be modeled similarly using the ceiling area. Wood stains and finishes and trim applied paint shall be modeled similarly using the area of the classroom door plus the area of the wall base (i.e., 11.6 m^2).
Prerequisite	EQ.P8.2 Composite Wood and Agrifiber Products: The purpose of this requirement is to reduce a major indoor source of formaldehyde typically found in conventional construction. At least 90%, by area, of the composite wood and agrifiber products installed onsite in the project's interior shall meet either one or both of the requirements described herein. Composite wood products in this category are defined in the California Air Resources Board (CARB) Airborne Toxic Control Measure (ATCM) to Reduce Formaldehyde Emissions from Composite Wood Products (Sections 93120-93120.12, Title 17, California Code of Regulations). The fibers may be wood, straw, bamboo, or similar cellulosic material (e.g., agrifiber). The affected products include hardwood plywood, plywood with decorative softwood veneer, laminated products with a composite wood core or platform, particleboard, medium density fiberboard (MDF), and finished goods fabricated from these products (e.g., doors, trim or molding, cabinetry, counter tops). All such products shall be manufactured with no-added formaldehyde based resins and shall meet the emission requirements established by the ATCM for such products. Alternately, the products shall employ ultra-low emitting formaldehyde (ULEF) resins as defined by the ATCM and shall meet the emission requirements established by the ATCM for such products. Conformance of no-added formaldehyde and ULEF products under this option shall be demonstrated by formaldehyde emission test results and chain-of-custody documentation as required by the ATCM, or equivalent. Structural plywood, structural panels, oriented strand board, structural lumber, glue laminated timber, prefabricated wood joists, and finger jointed lumber, are excluded

	from ...s prerequisite and these requirements.
Prerequisite	EQ.P8.3 Adhesives & Sealants: All adhesives and sealants used on the project in quantities of 2.5 gal (10 liters) or more and totaling 90% or more of the total volumes of such products applied in the project's interior shall meet the requirements described herein. Products in this category include but are not limited to carpet, resilient and wood flooring adhesives; base cove adhesives; ceramic tile adhesives; drywall and panel adhesives; aerosol adhesives; adhesive primers; acoustical sealants; fire-stop sealants; HVAC duct sealants, sealant primers; and caulks. Note that structural adhesives are excluded, and sealers including concrete floor sealers and other waterproofing sealers are treated under Option 2. All included products shall meet the VOC content requirements in the applicable category of South Coast Air Quality Management District (SCAQMD) Rule 1168, *Adhesive and Sealant Applications* (amended January 2005, or current version). Further, all flooring, wall covering and wall base adhesives and sealants shall be tested and evaluated for emissions of VOCs of concern with respect to chronic inhalation exposures following the specifications of the current version of the California Department of Public Health's (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version. The product shall be applied to the appropriate plate or gypsum board panel and tested with the product surface exposed directly to chamber air (i.e., not as part of an assembly). Flooring adhesives and sealants shall be modeled to the school classroom using the manufacturer's specified coverage and the classroom flooring area. Wall applied adhesives and sealants shall be modeled using the manufacturer's specified coverage and the classroom wall paint and wall coverings area. Wall base adhesives shall be modeled similarly using the wall base area.

Implementation

CHPS expects the burden of testing and compliance to be on the manufacturer. Design teams are encouraged to specify materials from approved lists as referenced in the resources section, and not to be burdened with understanding the specific testing procedures and VOC limits. CHPS pre-approves products that meet these criteria for ease of use by design professionals on approved lists; however, if a design team wishes to use a product that is not listed, the design professional can work with the manufacturer to have the product 3rd party tested and approved.

For the purposes of these requirements, indoor products and materials are defined as materials installed or applied on site inside of a building. Low-VOC impact materials within a selected option shall be used throughout the project including all classroom areas, teaching laboratories, administrative and staff areas, indoor circulation areas, restrooms, and multipurpose areas such as gymnasiums. Shops or other areas requiring specialty finishes may be excluded. Ninety percent (90%) or more of the combined surface area or quantity measure of an entire system (e.g., floor, ceiling, furniture) or the individual components of a system (e.g., wall assembly consisting of three components – insulation, wall panel, and wall covering) shall be comprised of low VOC impact materials in order to receive credit for an option. Unless otherwise specified below, low VOC impact materials shall meet the testing and VOC emission requirements of the current version of the California Department of Public Health's (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers., including any Addenda. The school classroom shall be used as the exposure modeling scenario for evaluating the acceptability of VOC emissions as described in the Standard Practice (CDPH, 2004, Table 7.4). For wet applied products, additional content criteria are specified.

Products requiring testing for VOC emissions may be selected from the CHPS Product Database or acceptable labeling or Construction programs acknowledged on the CHPS web site. Additionally, products not currently listed may be tested by an independent laboratory as prescribed by CHPS. Provided the results of the tests are accepted by CHPS, credit may be obtained assuming all other requirements have been met.

Verification

For projects seeking verification through the CHPS Verified Program (Pg 12), compliance documentation is required at design review and construction review.

Design Review Requirements	
EQ.P8	Construction drawings shall specify the low-emitting products with the maximum allowed VOC concentration levels per product.
Construction Review Requirements	
EQ.P8	Submit receipts, proof of purchase or installation for low-emitting products.

Resources

CHPS Best Practices Manual: Design Volume: Interior Surfaces and Finishes Chapter.

CHPS *Product Database*: http://www.chps.net/dev/Drupal/node/445

South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings: http://www.aqmd.gov/rules/reg/reg11/r1113.pdf

State of California DHS, *Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chamber:* http://www.dhs.ca.gov/iaq/VOCS/Practice.htm

Healthy Building Network Alternatives to Formaldehyde in Pressed Wood Products: http://healthybuilding.net/healthcare/Alternative%20Resin%20Binders.pdf

The following are currently available 3rd-party certifiers of low-emitting material products; check the CHPS web site to determine which listed products are acceptable.

- Carpet and Rug Institute: *Green Label Plus* http://www.carpet-rug.org/commercial-customers/green-building-and-the-environment/green-label-plus/index.cfm.
- Greenguard Environmental Institute: *GREENGUARD Product Emission Standard For Children & Schools* http://www.greenguard.org/Default.aspx?tabid=110
- Scientific Certification Systems: FloorScore: http://www.scscertified.com/iaq/floorscore.html and Indoor Advantage Gold http://www.scscertified.com/iaq/indooradvantage.html

Indoor Environmental Quality

EQ.C1 View Windows — 2 Points

Applicability	Verification Required		
This credit applies to all core classrooms, and administration areas. Renovation projects that involve window replacement can earn this credit by modifying existing window configurations that do not conform to the requirements to configurations that do meet the requirements for this credit.	⊗ at Design Review	○ at Construction Review	○ at Performance Review

Intent: Provide a visual connection to the outdoors.

View windows are essential to areas where students and staff will be working for extended periods of time. Ample and interesting views have consistently been found to increase student performance. Distant views enable the occupants of the room to relax their eyes, which is especially beneficial to computer users and younger children who are still developing their visual capabilities.

Requirement

1-2 points	EQ.C1.1 Provide direct line of sight to view glazing from at least 80% of the combined floor area of core classrooms and administration areas. Access to Views, 80% = 1 point Access to Views, 90% = 2 points To qualify, a space shall have view glazing equal to or greater than 7% of the floor area. View glazing shall be clear and only include window area above 2.5 ft and below 7.5 ft from the floor. The total width of view glazing shall be greater than 1% of the floor area.

Implementation

The documentation requirements are the same as EQ.P5, with the exception that the threshold for this credit is 80% access to views for 1 point, and 90% access to views for 2 points. See EQ.P5 for information on preparing the calculations for this credit.

Verification

For projects seeking verification through the CHPS Verified Program (Pg 12), compliance documentation is required at design review only.

Design Review Requirements	
EQ.C1	Construction drawings must include required calculations for view windows. Fulfill this requirement by completing the HI-CHPS Verified Plan Sheet provided at the point of registration with the HI-CHPS Verified program. Plans and sections will be used for verification. Plans and sections will be used for verification.

Resources

See implementation and resources under EQ.P5 View Windows

LEED™ *Reference Guide*: Indoor Environmental Quality Credit 8.2: Daylight and Views.

The Daylighting Collaborative is a clearinghouse of best practices and resources about daylighting: http://www.daylighting.org.

Indoor Environmental Quality

EQ.C2 Daylighting in Classrooms — 6 Points

Applicability	Verification Required		
All projects. To earn this credit for major renovations, it may be necessary to add skylights or modify the size and location of windows.	⊗ at Design Review	○ at Construction Review	○ at Performance Review

Intent: Provide high quality daylighting in classrooms to enhance student performance.

Daylighting is fundamentally important to high performance design, and should be the primary source of light in classrooms. Daylighting has a number of advantages, including improved occupant productivity, improved connection to the outdoors, improved health, energy savings, and quality of light.

Requirement

1-4 points

Utilize the information provided under Prerequisite II.P2, Microclimate Based Design along with modeling to determine optimum conditions for daylighting.

For all **classroom** spaces, choose one of the following two options:

EQ.C2.1 Multiple Point in Time Approach

1 Point	Achieve >20fc average illuminance for >50% of classroom area
2 Points	Achieve >30fc average illuminance for >50% of classroom area
3 Points	Achieve >40fc average illuminance for >50% of classroom area
4 Points	Achieve >40fc average illuminance for >75% of classroom area

OR

EQ.C2.2 Daylight Autonomy Approach

1 Point	Achieve >40% DA for >50% of occupied area
2 Points	Achieve >60% DA for >50% of occupied area
3 Points	Achieve >80% DA for >50% occupied area
4 Points	Achieve >80% DA for >75% occupied area

**Computer rooms and other spaces where daylight would have an adverse impact on the use of the space are excluded.*

1-2 points	For **support** spaces, choose one of the following two options:

EQ.C2.3 Multiple Point in Time Approach

1 Point	Achieve >30fc average Illuminance for >50% of administration office area
1 Point	Achieve >40fc average Illuminance for >50% of library, cafeteria, auditorium and multi-purpose/commons area

OR

EQ.C2.4 Daylight Autonomy Approach

1 Point	Achieve >60% DA for >50% of administration office area
1 Point	Achieve >60% DA for >50% of library, cafeteria, auditorium and multi-purpose/commons area

**Any spaces where daylight would have an adverse impact on the use of the space are excluded. Provide documentation illustrating impact*

Implementation

EQ.C2.1 and EQ.C2.3 Multiple Point in Time Approach

Option calculations for the requirements may be made with a qualified computer simulation tool.

- Computer Simulation Tool: Any daylighting simulation tool that can perform accurate daylight illuminance calculations for a grid of points under standard CIE skies for the times specified. Commercially available simulation tools include AGI32, Radiance, SPOT, 3DS Max Design, DAYSIM, DIALux
- A minimum analysis grid of 4 ft by 4 ft shall be used. The grid shall be positioned so that no analysis points are located closer than 3 ft to a wall.
- The annual average illumination should be determined by first calculating the workplane average illuminance for 10 design sky conditions: 9AM, 12PM, and 3PM for winter and summer solstice and equinox under a CIE clear sky and 12PM on the equinox under a cloudy sky condition The annual average illuminance is calculated with this formula:

$$E_{avg} = W9 + W12 \times 2 + W3 + (E9 + E12 \times 2 + E3) \times 2 + (S9 + S12 \times 2 + S3) \times 0.5) \times Sunny\ \% + EC12 \times Cloudy\ \%$$

Where:

E_{avg} = estimated annual average illuminance

WX = Sunny winter solstice condition at 9AM, 12PM, and 3PM

EX = Sunny equinox condition at 9AM, 12PM and 3PM

SX = Sunny summer condition at 9AM, 12PM, and 3PM

EX12 = Cloudy equinox condition at 12PM

EQ.C2.2 and EQ.C2.4 Daylight Autonomy Approach

Option calculations for the requirements must be made with a computer simulation tool.

- Computer Simulation Tool: Any daylighting simulation tool that can perform accurate daylight illuminance calculations for a grid of points under standard CIE skies for the times specified. Commercially available simulation tools include AGI32, Radiance, SPOT, 3DS Max Design, DAYSIM, DIALux.

- A minimum analysis grid o ; by 4 ft shall be used. The grid shall be , .tioned so that no analysis points are located closer than 3 ft to a wall.
- A design illuminance of 30fc should be used unless a drastically different illuminance target is recommended – for example 15fc for a computer room or 50fc for a gymnasium.
- A max illuminance of 10x design illuminance should be used.
- "Continuous" calculation method to be used for DA calculations. This method allows for hours that receive partial daylight contribution. For example, when 20fc of daylight is provided and the design illuminance is 30fc this counts for 20/30 or 66% for that time.
- "Incremental" calculation method to be used for DA_{max} calculations. This method only counts hours that completely meet or exceed the design illuminance with daylight.
- The school occupancy schedule and a representative weather file should be used for the annual DA and DA_{max} calculations.

Verification

For projects seeking verification through the CHPS Verified Program (Pg 12), compliance documentation is required at design review only.

Design Review Requirements	
EQ.C2	Construction drawings must identify spaces that qualify as daylit, and the percentage of daylit classrooms. Fulfill this requirement by completing the CHPS Verified Plan Sheet provided at the point of registration with the HI-CHPS Verified program. Plans and sections will be used for verification.
EQ.C2	For each classroom group identified on the HI-CHPS Verified Plan Sheet, provide the required computer based simulation results including point-by-point lighting predictions as appropriate.

Resources

CHPS Best Practices Manual: Volume II: Daylighting and Fenestration Design Chapter.

Advanced Lighting Guidelines: 2003 Edition: www.newbuildings.org/lighting.htm.

SPOT (Free Software Designed to Interface with CHPS): www.archenergy.com/SPOT

3DS Max Design: usa.autodesk.com

AGI32 Lighting Design Software: www.agi32.com/

DAYSIM Daylighting Analysis Software: http://www.nrc-cnrc.gc.ca/eng/projects/irc/daysim.html

DIALux: www.dial.de

DOE-2 Building Energy Use and Cost Analysis Software: doe2.com/

Ecotect: usa.autodesk.com

EnergyPlus Building Energy Simulation Program: gundog.lbl.gov/EP/ep_main.html

Equest: www.doe2.com/equest/

Radiance: radsite.lbl.gov/radiance/

SkyCalc: www.energydesignresources.com/resource/129

The Daylighting Collaborative is a clearinghouse of best practices and resources about daylighting: http://www.daylighting.org.

Indoor Environmental Quality

EQ.C3 Pollutant & Chemical Source Control — 2 Points

Applicability	Verification Required		
All projects; however, applying radon mitigation strategies may be difficult in existing schools.	⊗ at Design Review	⊗ at Construction Review	○ at Performance Review

Intent: Achieve good indoor air quality to protect student and staff health, and improve performance and attendance.

Requirement

1- 2 points	For achieving four strategies below claim one (1) point, and for five strategies claim two (2) points.
Strategy 1	EQ.C3.1 Off-Gassing - Where chemical use occurs, including housekeeping areas, chemical mixing areas, high volume copying/print rooms (over 40,000 pages per month), photolabs, and vocational spaces, use deck-to-deck partitions with dedicated mechanical exhaust to the outdoors (no air recirculation, and negative pressure) at a rate of at least 0.50 cubic feet per minute per square foot, and adequate make up air. These spaces must have negative air pressure when the doors are closed. Negative air pressure is defined as mechanical exhaust to the outdoors at a rate of at least 0.50 cubic feet per minute per square foot. The spaces must maintain a negative pressure of at least 5 Pa (0.02 inches of water gauge) to a minimum of 1 Pa (0.004 inches of water) compared to their immediate environment and when their doors are closed. In photolabs, specify table vents to draw chemical vapors away from the breathing zone of dark room users. Doors to areas where hazardous materials are stored and used must be secured with self-locking and closing mechanisms.
Strategy 2	EQ.C3.2 Walk Off Mats – Provide a walk off mat system at every major outside common entryway to school buildings. Mat systems must be appropriate to the region and at least 16 feet long and spread the full width of the entry. The mat system must consist of one of the following: Non-permanent mats: The district must have at least a two (2) year signed contract or a maintenance policy for non-permanent mats to be deep cleaned per manufacture recommendations periodically during the school year. It is expected that maintenance staff will provide periodic maintenance in between. **OR** Permanent mats: Shall consist of an exterior grate or grill 3-6 feet long that scrapes and provides water drainage, and an interior mat 7-12 feet long that traps and hides dirt and water (including possibly a finisher mat to clean and dry any residual dirt and moisture). Mats must be permanently installed. Any recessed grates, grills or slotted materials must be designed to be able to lift for cleaning. Specify periodic maintenance of walk off mat systems per manufacturer recommendations.

Requirement

Strategy 2 continued...	EQ.C3.3 Control surface dust by providing hard-surfaced paving not less than six feet by six feet at all outside entrances or doorways to any school room (concrete or equivalent), together with covered walkways or entry canopies to keep rain from the walkway surface (see EQ. P4 – Moisture Management (entryways)).
Strategy 3	EQ.C3.4 Electric Ignitions for Gas-Fired Equipment – Specify electric ignitions for the following gas-fired equipment: water heaters, boilers, air-handling units, and cooking stoves.
Strategy 4	EQ.C3.5 Install radon mitigation systems following the U.S. EPA Tools for Schools Mitigation measures. Incorporate radon mitigation in the schools IAQ Management Plan.
Strategy 5	EQ.C3.6 Install a carbon monoxide monitor in occupied spaces served by gas fired appliances, and/or adjacent to parking areas where cars may idle to improve indoor air quality.

Implementation

EQ.C3.1

Design to physically isolate activities associated with chemical contaminants from other locations in the building, and provide dedicated exhaust systems to contain and remove chemical pollutants from source emitters at source locations. Eliminate or isolate high hazard areas and design all housekeeping chemical storage and mixing areas (central storage facilities and janitors closets) to allow for secure product storage. Design copier or print rooms with structural deck-to-deck partitions and dedicated outside exhaust systems.

Provide a letter signed by a professional engineer explaining how the spaces stated in the prerequisite are ventilated to maintain a 1–5 Pa negative pressure, compared to their immediate environment, and are exhausted at a rate of 0.50 cfm/ft^2.EQ.C3.2

Particles tracked into the school on shoes are one of the chief sources of contamination of floors and carpets. Research shows that pesticides, heavy metals, and soil are tracked in on students' shoes. The best way to keep the school free of dust, dirt, and contaminants is to prevent these unwanted items from entering the building in the first place. It is especially important to protect young school children since they are more likely to sit and play on classroom floors and be more directly exposed to contaminants.

EQ.C3.3

Control surface dust by providing walk off mats at major entrances and hard-surfaced paving not less than six feet by six feet at all outside entrances or doorways to any school room (concrete or equivalent), together with covered walkways or entry canopies to keep rain from the walkway surface.

EQ.C3.4

The purpose of this prerequisite is to prohibit standing pilot lights in gas-fired equipment. Under certain conditions, the accumulation of carbon dioxide from unlit pilot lights can cause dangerous air quality conditions for staff and students. Therefore, electric ignitions are required for the equipment listed in this credit.

Reference specification sections for gas-fired equipment that uses electric ignitions to light gas burners.

Special Considerations

Although there is currently not a general consensus among scientists that the effects of electromagnetic fields (EMF) are harmful to humans, certain studies have suggested that exposures may be hazardous, especially to children and developing fetuses. Since the intent of the CHPS rating system is to provide the most

environmentally responsible, althy and productive environments fo ildren and staff, precautionary measures should be considered until definitive cause and effect relationships are scientifically established. Schools districts and design teams should consider:

Not allowing cell phone towers and base stations on school buildings or school property.

Not having above ground transformers within 50ft from outdoor play, exercise and recreation areas.

Providing magnetic field shielding to power cables between transformer/power drop and electrical supply rooms.

Running conduits for the future possibility of fiber optic connections.

Positioning electrical supply rooms and building power supply adjacent to low occupancy areas among other strategies.

Verification

For projects seeking verification through the CHPS Verified Program (Pg 12), compliance documentation is required at design review and construction review.

Design Review Requirements	
EQ.C3.1	Construction drawings shall specify spaces stated in the prerequisite are ventilated to maintain a 1-3 Pa negative pressure, compared to their immediate environment, and are exhausted at a rate of 0.50 cfm/ft2.
EQ.C3.2	Construction drawings shall identify walk-off mats or equivalent track-off mitigation measures at all high volume entrances and lengths.
EQ.C3.3	Construction drawings which identify hard-surfaced paving not less than six feet by six feet at all outside entrances or doorways to any school room.
EQ.C3.4	Construction drawings shall identify electric ignitions to light any gas-fired equipment.
EQ.C3.5	Construction drawings shall include details of radon mitigation system.
EQ.C3.6	Construction drawings must indicate carbon monoxide monitors in required locations.
Construction Review Requirements	
EQ.C3	For all strategies, submit pictures taken at various times during construction, with a narrative for each photo describing techniques for protecting occupants from pollutants and chemicals indoors.

Resources

U.S. EPA Radon in Schools Website: http://www.epa.gov/radon/pubs/schoolrn.html and http://www.epa.gov/radon/states/hawaii.html

U.S. EPA Tools for Schools Radon Mitigation Measures: http://www.epa.gov/iaq/schools/tfs/guideg.html

Radon Prevention in the Design and Construction of Schools and Other Large Buildings: [EPA 625-R-92-016, June 1994] (This document is available in PDF format from EPA's Office of Research and Development - www.epa.gov/ORD/NRMRL/pubs/625r92016/625r92016.htm

Reducing Radon in Schools: A Team Approach [EPA 402-R-94-008, April 1994] at www.epa.gov/radon/pubs/index.html.

Indoor Environmental Quality

EQ.C4 Advanced Low-Emitting Materials — 3 Points

Applicability	Verification Required		
All projects.	⊗ at Design Review	⊗ at Construction Review	○ at Performance Review

Intent: Provide classrooms with acceptably low indoor air concentrations of harmful volatile organic chemicals that derive from building products and building materials used indoors.

Many common building products and building materials used indoors in the construction of educational facilities and other buildings are sources of volatile organic chemicals (VOCs). When emitted to indoor air, these pollutants are inhaled by occupants. Such inhalation exposures can result in adverse health effects. These effects include sensory and upper respiratory irritation, pulmonary irritation, asthma, damage to organ systems and neurological and reproductive systems, and increased risk of cancer. Exposure to airborne VOCs is an especially important issue for schools as children may be more susceptible than adults. In order to reduce the potential for adverse effects due to inhalation exposures to VOCs, it is important to specify and utilize products and materials in the construction of the interiors of classrooms and other educational buildings that have low emissions of VOCs that are known to be harmful. This credit offers points for certain product types that are low emitting, whereas EQ.P8 is a prerequisite that requires paints and coatings, adhesives, sealants, and wood products in the project to be low-emitting.

Requirement

1 point	EQ.C4.1 Flooring Systems: 90% or more of the total floor area of the interior flooring systems of the project shall meet the requirements described herein. Flooring systems include, but are not limited to carpet with its integral adhesive system and integral or separate cushion, if used; resilient flooring; wood flooring; ceramic tile flooring; other mineral-based flooring (either natural or manmade) without any organic component, and concrete flooring. For the purposes of this option, it is assumed that ceramic tile, organic-free mineral-based flooring, and concrete flooring are negligible sources of VOCs and are available for credit without any testing requirements. Flooring systems shall be tested and evaluated for emissions of VOCs of concern with respect to chronic inhalation exposures following the specifications of the CDPH Standard Practice. Each individual flooring system shall be modeled to the Standard Practice school classroom using the classroom flooring area. For systems consisting of more than one distinct layer (e.g., carpet with separate cushion), all layers shall individually meet the requirements of the Standard Practice.
1 point	EQ.C4.2 Ceiling & Wall Systems 90% or more of the total areas of ceiling and wall systems shall meet these requirements. Ceiling and wall systems include but are not limited to ceiling insulation installed within the structural envelope, wall insulation, acoustical ceiling panels, gypsum board wall panels, tackable wall panels, and wall coverings. Ceramic tile and other organic-free metal- or mineral-based wall coverings are available for credit without any testing requirements. Site applied adhesives and sealants and site applied paints and coatings associated with ceiling and wall systems are treated under the prerequisite.

Ceiling and wall systems shall be tested and evaluated for emissions of VOCs of concern with respect to chronic inhalation exposures following the specifications of the CDPH Standard Practice. The separate components or distinct layers of these systems shall be modeled to the Standard Practice school classroom using the classroom ceiling area and/or wall area as appropriate. For systems consisting of more than one distinct layer (e.g., walls comprised of insulation, wall panel and wall covering), all layers shall individually meet the requirements of the Standard Practice.

1 point

EQ.C4.3 Furniture & Furnishings

The purpose of this option is to ensure that new furniture used in classrooms and administrative areas of the project meets the best available emissions standards for furniture. This option is only available if 75% or more of the total number of individual stations (defined as a chair and associated work surface, either desk or chair) are new and/or newly remanufactured/refurbished. All such furniture totaling 90% or more of new individual stations (i.e., combined classroom and administrative stations) shall meet this requirement.

All furniture, both classroom and administrative, shall be tested for VOC emissions following the procedures in ANSI/BIFMA M7.1-2007. Workstations and seating, both classroom and administrative, shall be tested individually. Administrative area and teacher workstations and seating shall be evaluated for VOC emissions using the parameters for an open plan workstation defined in M7.1-2007. Pupil classroom workstations and seating shall be evaluated for emissions using parameters developed for the classroom defined in the CDPH Standard Practice. The furniture parameters are listed in Table 4, below.

Table 4. Modeling parameters and VOC emission guideline requirements for administrative area and teacher workstations and seating and classroom pupil workstations and seating.

	Admin Area & Teacher		Classroom Pupil	
Modeling Parameters	**Workstn**	**Seating**	**Workstn**	**Seating**
Number of units	1	1	27[a]	27[a]
Air Flow rate, m^3/h	15.01[b]	24.84[b]	187[c]	187[c]
Total workstation area, m^2	21.75[d]	n/a[e]	n/a[e]	n/a[e]
VOC Emission Guidelines				
Must meet ANSI/BIFMA X7.1	Yes	Yes	Yes	Yes
Must meet CDPH Std Practice guidelines	Yes	Yes, ¼ CREL[f]	Yes	Yes

a. CDPH Standard Practice specifies 27 occupants per classroom.
b. Air flow rates specified in ANSI/BIFMA M7.1-2007 for open plan workstations and seating.
c. Classroom air flow rate from CDPH Standard Practice.
d. Calculate emission factors for components (work surface, storage, and panel) as described in M7.1 and perform modeling using area for entire workstation. If workstation does not include a component (e.g., panel), the acceptable guideline is reduced by the fraction of that component's defined standard area to the defined total workstation area.
e. Modeling to be performed on a per unit basis, not area
f. Seating in this category is allowed only one half of the guidelines defined in CDPH Standard Practice.

The IAQ acceptance criteria for furniture specified in California Department of General

	Service, Procurement Division RFP DGS-5675 for Open Office Panel Systems (March 3, 2008) shall be used to determine compliance. As described in Sections 5.7.2.1 and 5.7.2.2 of the RFP, compliance with both the limits specified in ANSI/BIFMA X7.1-2007 and the individual VOC (iVOC) limits listed in Table 5.7.2.2.1 of the RFP is required. Note that these iVOC limits are consistent with the limits defined in the CDPH Standard Practice. Administrative area and teacher seating shall be allowed only one-half of the defined limits (e.g., one-quarter of the Standard Practice guidelines). The guideline requirements are summarized in Table 4.

Implementation

CHPS expects the burden of testing and compliance to be on the manufacturer. Design teams are encouraged to specify materials from approved lists as referenced in the resources section, and not to be burdened with understanding the specific testing procedures and VOC limits. CHPS pre-approves products that meet these criteria for ease of use by design professionals on approved lists, however if a design team wishes to use a product that is not listed, the design professional can work with the manufacturer to have the product 3rd party tested and approved.

For the purposes of these requirements, indoor products and materials are defined as materials installed or applied on site inside of a building. Low-VOC impact materials within a selected option shall be used throughout the project including all classroom areas, teaching laboratories, administrative and staff areas, indoor circulation areas, restrooms, and multipurpose areas such as gymnasiums. Shops or other areas requiring specialty finishes may be excluded. Ninety percent (90%) or more of the combined surface area or quantity measure of an entire system (e.g., floor, ceiling, furniture) or the individual components of a system (e.g., wall assembly consisting of three components – insulation, wall panel, and wall covering) shall be comprised of low VOC impact materials in order to receive credit for an option. Unless otherwise specified below, low VOC impact materials shall meet the testing and VOC emission requirements of the California Department of Public Health's (CDPH) *Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Chambers* (2004), including its 2004 Addenda. The school classroom shall be used as the exposure modeling scenario for evaluating the acceptability of VOC emissions as described in the Standard Practice (CDPH, 2004, Table 7.4). For wet applied products, additional content criteria are specified.

Construction documents shall specify the low emitting products to be used on the project and that these meet the requirements defined herein. Products requiring testing for VOC emissions may be selected from the CHPS Product Database or acceptable labeling or certification programs acknowledged on the CHPS web site. Additionally, products not currently listed may be tested by an independent laboratory as prescribed by CHPS. Provided the results of the tests are accepted by CHPS, credit may be obtained assuming all other requirements have been met.

Verification

For projects seeking verification through the CHPS Verified Program (Pg 12), compliance documentation is required at design review and construction review.

Design Review Requirements	
EQ.C4	Construction drawings shall specify the low-emitting products with the maximum allowed VOC concentration levels per product.
Construction Review Requirements	
EQ.C4	Proof of purchase and/or installation is only required if audited during construction review. CHPS recommends records are kept in the event an audit is requested.

Resources

CHPS Best Practices Manual: Design Volume: Interior Surfaces and Finishes Chapter.

CHPS *Product Database*: http://www.chps.net/dev/Drupal/node/445

South Coast Air Quality Management District (SCAQMD) Rule 1168, Adhesive and Sealant Applications: http://www.aqmd.gov/rules/reg/reg11/r1168.pdf

State of California DHS, *Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chamber:* http://www.dhs.ca.gov/iaq/VOCS/Practice.htm

The following are currently available 3rd-party certifiers of low-emitting material products; check the CHPS web site to determine which listed products are acceptable.

- Carpet and Rug Institute: *Green Label Plus* http://www.carpet-rug.org/commercial-customers/green-building-and-the-environment/green-label-plus/index.cfm
- Greenguard Environmental Institute: *GREENGUARD Product Emission Standard For Children & Schools* http://www.greenguard.org/Default.aspx?tabid=110
- Scientific Certification Systems: *FloorScore:* http://www.scscertified.com/iaq/floorscore.html and *Indoor Advantage Gold* http://www.scscertified.com/iaq/indooradvantage.html

Indoor Environmental Quality

EQ.C5 Enhanced Air Quality Measures — 3 Points

Applicability	Verification Required		
All projects. For renovation projects that replace HVAC equipment, specify systems that accept the required filter efficiency without a loss of operating efficiency.	⊗ at Design Review	⊗ at Construction Review	○ at Performance Review

Intent: Prevent dust and microbial growth issues associated with air ducts in mechanically ventilated and conditioned projects.

Plenum returns are easily contaminated with dust, dirt and microbial and fungi growth. Ducted returns, though more expensive upfront, will help prevent such after installation problems and reduce maintenance and repairs.

Because school construction typically occurs over a number of seasons, it is not uncommon for the construction team and sub-contractors to run the heating and cooling systems as interior work on the school is completed. However, this practice can entrain dust and debris into the ductwork especially in areas that use return air to help temper the air for certain spaces. This credit encourages the district to clean ducts by building in access doors where appropriate and to hire a duct cleaning vendor to complete the work.

Enhanced air filtration improves indoor air quality especially for schools located near outdoor particulate sources such as highways. Filtration also protects the HVAC equipment. Filters remove airborne particulate material based on their size, shape and density. Filters are rated by different standards (e.g. arrestance and dust spot, MERV) that measure different aspects of performance. ASHRAE standards use the MERV or Minimum Efficiency Reporting Value (MERV) ratings. The higher rating indicates higher particle capture efficiency and capture of smaller particles. As a filter becomes loaded with captured particles, static pressure will increase across the filter bank, which requires more fan power. It is important to select a filter that is specifically designed for the specific application and to make sure that the HVAC filter enclosures designed to perform with the filter in place without leakage around filter.

Requirement

1-3 points	Naturally Ventilated and Conditioned Spaces – Two points may be claimed for the first measure and one point for the second. EQ.C5.1 Provide all naturally ventilated spaces with permanent signage indicating that windows shall be left open for indoor air quality when occupied, and the carbon dioxide detectors required under EQ.P1 must have sensors or other indication devices that record classroom levels and notify facility management when they exceed 700 ppm. Design teams are encouraged to look at integrating the sensors, controls and reporting mechanism with the schools building or energy management system (EE.P5). (2 points) EQ.C5.2 Provide controls that automatically open any close operable windows in a naturally ventilated classroom when carbon dioxide levels exceed 700 ppm. (1 point)
1 -3 points	Mechanically Ventilated and Conditioned Spaces – One point may be claimed for each measure implemented. EQ.C5.3 Provide access doors for cleaning all supply and return ductwork per ASHRAE 62.1 § 5.14 Access for Inspection, Cleaning and Maintenance, and execute a plan for cleaning ductwork prior to occupancy by students and staff that includes compliance with the National Air Duct Cleaners Association (NADCA) 2006 standards. Consider UV-lamps on the cooling coils and condensate drain pans, especially in areas with dusty outdoor conditions, to inhibit mold growth. (1 point) EQ.C5.4 Install ducted HVAC returns throughout the school in occupied spaces to minimize dust and microbial growth issues. (1 point) EQ.C5.5 Filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 11 or higher, excluding unit ventilators, which can have MERV 7. Filters should be installed in outdoor air intakes. (1 point)

Implementation

EQ.C5.3

Filters meant for occupancy of the building should be put in place after duct cleaning work is complete.

Supply a letter signed by the project's professional engineer certifying that the supply and return ductwork has been designed with access doors to allow for cleaning OR provide mechanical drawings with access doors highlighted for all ductwork in the building. Provide a copy of a purchase order from the school district for the duct cleaning work or an invoice from the duct cleaning company.

EQ.C5.4

Ceiling plenum returns are easily contaminated with dust and microbial growth. Ducted returns help prevent such problems and reduce maintenance and repairs. Provide a letter signed by engineer verifying ducted HVAC returns will be installed.

EQ.C5.5

Filters rated at MERV 11 will ensure very good quality ventilation air by blocking minute particles and allergens. MERV 11 filter has a rating of 99% Arrestance, 70% Efficiency and the ability to filtering 1.0 to 3.0 micron particles size, which included Lead Dust, Humidifier Dust, Mold Spores, Sand Dust, Fabric Fibers, Pollen, Dust Mites, etc. This rating is conducted by ASHRAE standard 52.2. MERV scale range from 1 to 16.

Note: MERV 11 filters do not fit into unit ventilators. Therefore, schools with unit ventilator systems will not qualify for this point. The pressure drop may be greater with MERV 11 filters versus filters with lower MERV ratings, and therefore, more energy may be required to draw air through these filters. There is often a trade off between incremental indoor air quality improvements and energy efficiency that design teams should bear in

mind. This credit may be esp ally desirable in environments where outd air quality is a serious concern, for example near schools in close proximity to heavy traffic.

Reference specification sections for MERV 11 filters in all HVAC air handling systems. Designate the CSI number, section, and page number that highlight compliance with this requirement.

Cross Category Considerations

All HVAC equipment must comply with noise level standards outlined in the acoustic prerequisite IEQ.P7 and DOE standards.

Verification

For projects seeking verification through the CHPS Verified Program (Pg 12), compliance documentation is required at design review and construction review.

Design Review Requirements	
EQ.C5.1	Construction drawings shall include notes for the required permanent signage. The required carbon dioxide detectors under EQ.P1 must include details or notes for the sensors or other indication devices that record classroom levels and notify facility management when they exceed 700 ppm.
EQ.C5.2	Construction drawings shall include controls and details for the required system.
EQ.C5.3	Construction drawings, ideally the mechanical drawings must include access doors highlighted for all ductwork in the building.
EQ.C5.4	Construction drawings must identify ducted returns.
EQ.C5.5	Construction drawings, likely the mechanical schedules must include minimum required filtration levels for all HVAC systems.
Construction Review Requirements	
EQ.C5.1	Submit pictures of the required signage installed.
EQ.C5.3	Provide a copy of a purchase order from the school district for the duct cleaning work or an invoice from the duct cleaning company.
EQ.C5.5	Submit receipts, proof of purchase or installation for required filtration.

Resources

National Air Duct Cleaning Association Standard (NADCA): http://www.nadca.com/

Indoor Environmental Quality

EQ.C6 Post Construction IAQ — 1 Point

Applicability	Verification Required		
All projects.	⊗ at Design Review	⊗ at Construction Review	○ at Performance Review

Intent: Improve indoor air quality by minimizing the amount of indoor pollutants that are distributed and retained by the surface materials and ventilation systems during construction.

Requirement

1 point	EQ.C6.1 Vacuum carpeted and soft surfaces with a certified vacuum or high-efficiency particulate air (HEPA) filter vacuum that meets or exceeds the CRI Seal of Approval/Green Label Vacuum Cleaner Program after construction is complete and prior to occupancy. For phased, occupied renovations, HEPA vacuum the carpet daily in occupied areas, and in areas adjacent to those affected by construction activities.

Implementation

Reference specifications or contracts for vacuuming of carpeted floors prior to full building occupancy using a certified vacuum or high efficiency particulate air (HEPA) filter vacuum that meets or exceeds the CRI Seal of Approval/Green Label Vacuum Cleaner Program. For phased, occupied renovations, or adjacent areas that may be affected by construction activities, submit a signed letter from the Superintendent stating that carpeting in occupied areas of the school will be vacuumed on a daily basis.

Verification

For projects seeking verification through the CHPS Verified Program (Pg 12), compliance documentation is required at design review and construction review.

Design Review Requirements	
EQ.C6	Construction drawings shall include a general construction note for the requirement.
Construction Review Requirements	
EQ.C6	Submit proof of work completed through an invoice from the contractor who performed the work.

Resources

The Carpet and Rug Institute (CRI) Green Label Vacuum Program: http://www.carpet-rug.org/commercial-customers/cleaning-and-maintenance/seal-of-approval-products/vacuums.cfm

Indoor Environmental Quality

EQ.C7 Enhanced Acoustical Performance — 3 Points

Applicability	Verification Required		
All projects.	⊗ at Design Review	⊗ at Construction Review	○ at Performance Review

Intent: To design HVAC systems and classrooms to provide acoustic levels that do not interfere with student and teacher communication.

Student learning suffers in acoustically poor environments. Excess noise from exterior sources, loud HVAC systems, or nearby rooms can make it difficult, and sometimes impossible, for students and teachers to communicate. Poor acoustics affect more children than just those with permanent hearing impairments. Children with learning disabilities, language impairments, or children who are English language learners are also adversely affected by poor acoustics. In addition, children in general do not have fully developed language and auditory skills making quality acoustics very important for learning.

School officials and designers are strongly encouraged to move beyond the prerequisite to achieve background noise levels of NC30 (Noise Criteria) for all classrooms (approximately equivalent to 35 dBA) and sound isolation standards recommended by ANSI (American National Standards Institute). It may not be possible to reach NC30 with unit ventilator systems, so consider HVAC system options other than unit ventilators. If you do opt for unit ventilators; however, it is important to select quieter models that can operate at low speeds.

Important aspects of classroom acoustical design include isolation from exterior noise (wind loads, traffic, and loud outdoor activities), elimination of interior noise (from HVAC systems, foot traffic, and other classrooms), and the use of appropriate wall assembly, window systems, and interior surface materials to minimize sound propagation and reduce reverberation times in the classrooms. The most common sources of interior mechanical noise are the air conditioning and air-handling systems, including ducts, fans, compressors, condensers, and dampers. The selection, location, and isolation of this equipment should be reviewed to minimize its impact on sound-sensitive spaces within school facilities.

Note: The acoustic measures listed in this section are not suitable for the learning environment needed for hearing-impaired children, which requires even further enhancements of the acoustical environment. Refer to the American Speech-Language-Hearing Association for further guidance.

Requirement

	To claim points below, the project must comply with the prerequisite EQ.P7.
1 point	EQ.C7.1 Classrooms and core learning spaces with volumes greater than 20,000 cubic feet must have a 1.5 second reverberation time maximum using the measurement method established by ANSI S12.60.
1 point	EQ.C7.2 Unoccupied classrooms must have a maximum background noise level of no more 35 dBA Leq. Classroom testing must be performed to ensure noise level and reverberation times have been met.
1 point	EQ.C7.3 Add to school commissioning requirements (EE.P2) that background HVAC noise (sound and reverberation) is tested to the requirements set forth in EQ.P7 and EQ.C7.2. Use the ASHRAE Recommended Procedure for Measuring the HVAC System – Induced Noise in a Room.

Implementation

ANSI Standard S12.60-2010 recommends 35 dBA as the maximum allowable background levels for unoccupied school classrooms. Strategies for improving the background noise levels include using HVAC systems that are remotely located and acoustically isolating mechanical equipment from classrooms. In areas with high ambient noise levels from traffic, trains, airports or industry, special construction must be used in the design of the building envelope to provide acceptable sound isolation. To provide a realistic and representative measurement method for both steady-state HVAC noise and time-varying exterior environmental noise, the Noise Equivalent Level (Leq), is measured over a minimum ½-hour period during class session hours, in unoccupied classrooms. The Leq is the equivalent steady-state A-weighted sound level that, in a stated period of time, would contain the same acoustic energy as the time-varying sound level during the same time period.

A "core learning space" as defined by ANSI, and accepted by HI-CHPS is "spaces for educational activities where the primary functions are teaching and learning and where good speech communication is critical to a student's academic achievement. These spaces include, but are not limited to, classrooms, (enclosed or open plan), instructional pods or activity areas, group instruction rooms, gymnasiums, conference rooms, libraries, offices, speech clinics, offices used for educational purposes and music rooms for instruction, practice and performance."

The standard anticipates two primary sources, HVAC equipment and the exterior environmental noise. In order to verify compliance for exterior noise combined with HVAC noise a measurement shall be made in at least two classrooms in each building in the worst case (noisiest) locations on the school site during normal school days and hours. Where the measured ambient noises due to other sources is within 5 dB of the measured overall noise (HVAC and exterior intrusive noise), a measurement of at least ½ hour duration shall be made in at least two classrooms in each building in the worst case (noisiest) locations on the school site during normal school days and hours. In classrooms with no significant exterior noise contributions the HVAC noise can be measured with a short term (15 second) reading in lieu of a formal integrated Leq. If HVAC equipment noise (produced while operating in its maximum condition), is at least 5 dBA above the other ambient noises due to other sources, a longer term Leq measurement is not required. Short-term measurements shall be taken in each classroom.

The reverberation times can be measured in three octave bands with center frequencies of 500, 1000, and 2000 Hz. The arithmetic average value shall be compared to the standard.

Important aspects of classroom acoustical design include isolation from exterior noise (wind loads, traffic, and other loud outdoor activities), elimination of interior noise (from HVAC systems, foot traffic, and other classrooms), and the use of appropriate wall assembly and interior surface materials to minimize sound propagation and reduce reverberation times in the classrooms. The most common sources of interior mechanical noise are the air conditioning and air-handling systems, including ducts, fans, condensers, and

dampers. Architects and engi rs must design to these levels. Verificati nould be integrated with building commissioning.

Conduct tests to ensure acoustic requirements are met. As opposed to testing every classroom, sample classrooms with common types (i.e. finishes, windows, site location, and size) - and classrooms with a shared walls with an abnormally loud spaces (i.e. music) must also be tested to document compliance with the requirements as follows:

- Reverberation time measured in accordance with (ANSI Standard S12.602010). The measurements shall follow procedures in conformance with, or equivalent to, those specified for field tests in Annex A.4. The recommended sound signal is random noise with a bandwidth extending at least from 315 Hz to 3150 Hz. Reverberation times shall be measured at least at the key location noted in E336 of ANSI s12.60 Annex E for each learning space where reverberation times are to be measured.
- Sound Insulation measured in accordance with ASTM E336 and E413.
- Background HVAC noise measured in accordance with ASHRAE Recommended Procedure for Measuring the HVAC System - Induced Noise in a Room.
- Impact Insulation Class measure in accordance with Field Impact Insulation Class (FIIC) rating of a floor/ceiling assembly, prescribed in ASTM E 1007.

Verification

For projects seeking verification through the CHPS Verified Program (Pg 12), compliance documentation is required at design review and construction review.

Design Review Requirements	
EQ.C7.1 and EQ.C7.2	Requirements must be included in acoustical report provided under EQ.P7, and incorporated into construction documents as specified.
EQ.C7.3	Requirements must be included in commissioning plan developed under EE.P2.
Construction Review Requirements	
EQ.C7.2	Submit a PDF of the acoustical testing report and/or letter from consultant confirming testing was completed and the outcome.
EQ.C7.3	Commissioning report provided under EE.P2 must include passing noise measurements.

Resources

National Clearinghouse for Educational Facilities: www.edfacilities.org/.

Acoustical Society of America: http://asa.aip.org/ and http://asa.aip.org/classroom/booklet.html

American National Standards Institute: www.ansi.org/

Indoor Environmental Quality

EQ.C8 Electric Lighting — 3 Points

Applicability	Verification Required		
This credit applies to all new classrooms and can also be earned in renovation projects when classroom lighting is included in the scope of work. Many renovation projects include the installation of new lighting systems, providing an excellent opportunity to install energy efficient, high quality electric lighting that is integrated with the available daylight.	⊗ at Design Review	⊗ at Construction Review	○ at Performance Review

Intent: Provide high quality and flexible classroom lighting.

Progressive learning institutions are rapidly moving to better prepare students for today's high-tech, postindustrial world. Many new forms of learning have gained acceptance, as emerging technologies enhance the quality and efficiency of information delivery. These varied media including video, large-screen interactive presentations, and networked computer access to images and data, place new demands on the physical space. K-12 classrooms must be adaptable to support widely varying media and learning activities.

Requirement

1-3 points	Select four (4) strategies below for two (2) points and six (6) strategies for three (3) points: EQ.C8.1 Provide multi-scene indirect/direct lighting systems for all classrooms, with the exception for specialty classrooms where multi-scene lighting is not required. EQ.C8.2 The lighting system shall operate in two modes: general illumination and A/V. When general illumination is required, daylighting harvesting shall take precedent, if daylight controls are installed. EQ.C8.3 Provide a separately switched lighting system for the teaching wall that provides white board vertical illumination of at least 30 footcandles average with maximum uniformity of 8:1 or better. EQ.C8.4 In general illumination mode, achieve the average illumination at desk level based on classroom type in the most current version of the ANSI/IESNA RP-3-00 - Recommended Practice on Lighting for Educational Facilities. EQ.C8.5 In A/V mode, not including contribution from the teaching wall light, achieve an average illumination at the desk level of between 10 and 20 footcandles for any point in the room greater than 3 ft from the side walls, 10 ft from the front wall and 6 ft from the back wall, while limiting vertical illumination on the projection screen to no more than 7 footcandles at any point on the screen. EQ.C8.6 In indirect/direct mode, controls shall provide at least two levels of uniform lighting both at night and when daylight is available.

Implementation

A lighting computer program shall be used to determine the performance characteristics of the electric lighting system in typical classrooms. Minimum required calculations shall include point-by-point analysis of horizontal illumination levels at desk height in both modes, vertical illumination levels of the teaching wall in general lighting mode, and vertical ambient illumination on the projection screen in A/V mode. Calculations must be

carefully set up to analyze o .he specific tasks or zones as defined ir ; requirement. Use of a lighting analysis program employing radiosity and/or ray tracing is necessary. Some acceptable software packages include Lumen Micro 2000, Lumen Designer, AGI32, Radiance, Desktop Radiance, LightPro, Luxicon and Visual. CHPS may pre-approve typical lighting solutions as meeting the requirements.

It is not uncommon for the chosen lighting manufacturer to provide the calculations for you.

Verification

For projects seeking verification through the CHPS Verified Program (Pg 12), compliance documentation is required at design review and construction review.

Design Review Requirements	
EQ.C8	Construction drawings, particularly the electrical plans must include point-by-point lighting calculations for each classroom type.
EQ.C8	Construction drawings, ideally the electrical schedule must include the required lighting and system features.
Construction Review Requirements	
EQ.C8	Submit receipts, proof of purchase or installation for the required lighting system.
EQ.C8	Submit pictures of installed lighting system in typical classroom.

Resources

CHPS Best Practices Manual Design Guidelines EL2 and EL3

Advanced Lighting Guidelines: 2003 Edition: www.newbuildings.org/lighting.htm.IESNA Lighting Handbook: http://www.iesna.org/handbook/