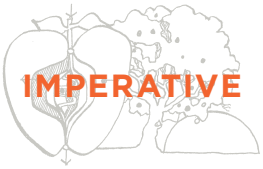
HEALTH AND HAPPINESS

HEALTHY INTERIOR ENVIRONMENT



BUILDING	✓
RENOVATION	✓
LANDSCAPE + INFRASTRUCTURE	✓

INTENT

To improve occupant health by reducing or eliminating indoor pollutants.

REQUIREMENTS

To promote good indoor air quality, a project must create a Healthy Indoor Environment Plan that explains how the project will achieve an exemplary indoor environment including the following:

- Compliance with the current version of ASHRAE 62, or international equivalent
- Smoking must be prohibited within the project boundary
- Results from indoor air quality (IAQ) tests before and nine months after occupancy
- Compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010 (or international equivalent) for all interior building products that have the potential to emit Volatile Organic Compounds
- Dedicated exhaust for kitchens, bathrooms and janitorial areas
- An entry approach that reduces particulates tracked in through shoes
- An outline of a cleaning protocol that uses cleaning products that comply with the EPA Design for Environment label (or international equivalent)

CHANGES IN 3.0

All interior building products that have potential to emit VOCs must comply with the CDPH Standard Method v1.1-2010 or international equivalent.

All cleaning products used must comply with the EPA's Design for the Environment (DfE) label requirements or international equivalent.

CLARIFICATIONS

VENTILATION AND MONITORING REQUIREMENTS

- Ventilation rates must be designed to comply with the current version of ASHRAE 62.
- CO Monitors must be installed and calibrated to 9 ppm (parts per million) or in Transects L3-L6, +2 ppm from outdoor levels.
- CO_2 Monitors must be installed and calibrated to 1000 ppm or, in Transects L3-L6, +500 ppm from outdoor levels.
- Both temperature and humidity should be monitored; no levels are specified.

"Another glorious day, the air as delicious to the lungs as nectar to the tongue."

John Muir, *My First Summer in the Sierra*

AIR QUALITY TESTING

The following protocols are intended to serve as a guide for indoor air quality (IAQ) testing professionals:

Testing protocols

Testing should follow testing protocols consistent with the United States Environmental Protection Agency's Compendium of Methods for the Determination of Air Pollutants in Indoor Air, or equivalent methods.

Indoor testing

All indoor tests should occur, hile building occupants continue their normal activities:

- For a minimum of four hours in each area
- In the anticipated breathing zones of people using the space (approximately 1 m or 3 ft. above the floor for seated people and 1.5 m or 5 ft. above the floor for standing people)

Indoor sample points

Commercial and institutional buildings

- Should include at least one data set per 25,000 ft.^{2} (approximately 2,325 m^2) or one data set per each contiguous floor area, whichever is larger
- Should include areas with the least ventilation and greatest presumed source strength
- Should include sampling points for each distinct use area.

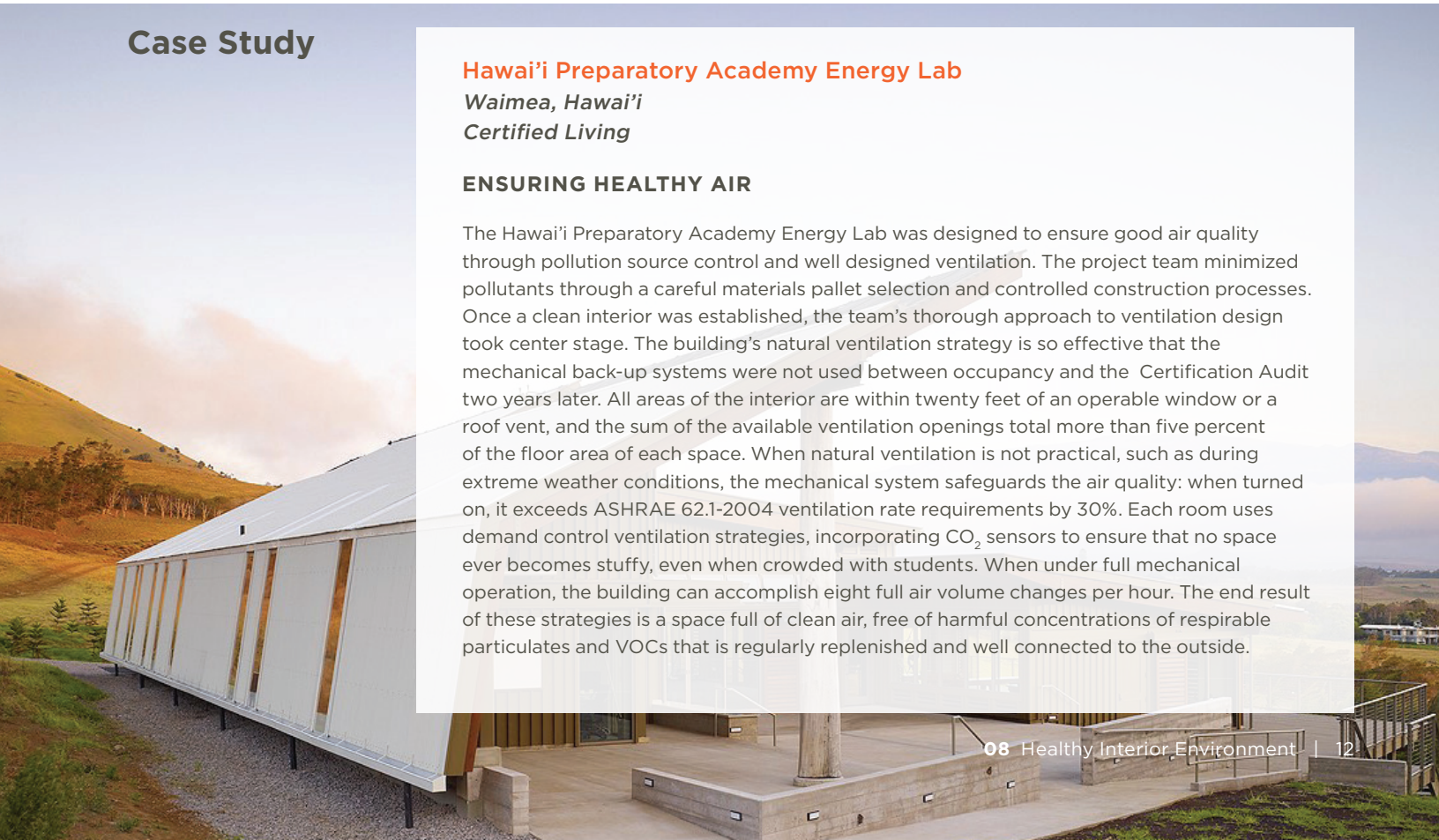
Single-family residential projects, should provide

- One data set for each 190 m^2 (2,000 ft.^{2})

Multi-family residential projects should provide

- One data set from a representative unit
- One data set per other major use areas (common room, hall, etc.)

Case Study



Hawai'i Preparatory Academy Energy Lab

Waimea, Hawai'i
Certified Living

ENSURING HEALTHY AIR

The Hawai'i Preparatory Academy Energy Lab was designed to ensure good air quality through pollution source control and well designed ventilation. The project team minimized pollutants through a careful materials pallet selection and controlled construction processes. Once a clean interior was established, the team's thorough approach to ventilation design took center stage. The building's natural ventilation strategy is so effective that the mechanical back-up systems were not used between occupancy and the Certification Audit two years later. All areas of the interior are within twenty feet of an operable window or a roof vent, and the sum of the available ventilation openings total more than five percent of the floor area of each space. When natural ventilation is not practical, such as during extreme weather conditions, the mechanical system safeguards the air quality: when turned on, it exceeds ASHRAE 62.1-2004 ventilation rate requirements by 30%. Each room uses demand control ventilation strategies, incorporating CO_2 sensors to ensure that no space ever becomes stuffy, even when crowded with students. When under full mechanical operation, the building can accomplish eight full air volume changes per hour. The end result of these strategies is a space full of clean air, free of harmful concentrations of respirable particulates and VOCs that is regularly replenished and well connected to the outside.

Outdoor sample points
One outdoor control sample should be collected

- For all buildings where three or more samples are collected
- Within 1.5 m (4 ft.) of the outdoor air inlet of the building
- Along with notes about weather and wind conditions

Pre-occupancy test conditions
The first air quality test reflects the relative influence of design and construction and provides a baseline for the occupants for ongoing comparison over time. It should occur

- Prior to installing FF&E (fixtures, furnishing, and equipment) items.
- After all pollution-generating construction activities are completed. Prohibited activities include:
  - Sanding drywall, cutting or sanding wood, painting or other wet product application, installing of furnishings, cleaning of any kind
  - Commissioning, smoke test, fire damper testing or TAB work

  Note: Unpacking boxes, limited final finish trim work and nonpolluting punch list work may be acceptable.

Post-occupancy test conditions
The second air quality test accounts for furniture and related items, as well as for personal effects. It should occur

- At least nine months after occupancy
- While occupied and operated normally for 24 hours prior to and during all testing
- During normal working hours with at least 75% of building occupants present

Systems conditions during tests
Ventilation systems should
- Operate in normal occupancy mode

Central HVAC systems should
- Not be in air economizer mode (more than minimum outdoor air introduced during cooling cycle when cool outdoor air is available)
- Operate with the minimum outdoor air required by the local jurisdiction
- Operate with all doors and windows closed for 24 hours prior to testing except during ingress and egress

Natural ventilation systems should
- Open windows the minimum amount needed to maintain minimum ventilation rates and comfort conditions
- Be documented by the building facilities/operations manager and confirmed by the IAQ testing firm

Electrical systems should
- Remain on during testing

At the completion of each testing period
- The prime building contractor must provide to the IAQ testing firm a written document stating that the above conditions were met during testing.
- The IAQ testing firm should be given unrestricted access to the HVAC system monitoring data that will be used to complete the final IAQ post-occupancy testing.

Final Testing Report
The final IAQ testing report should include:

- Date, times, and locations tested. Include location testing criteria.
- Executive summary
- Descriptions of sampling methods and conditions, including:
  - Instruments used—name, model number and use
  - Calibration certifications of the test equipment used
  - Airflow sampling rates
  - Environmental lab accreditations, qualifications and certifications
  - Qualifications of testing staff
  - Approximate number of occupants and occupant activities,
  - HVAC system configuration
  - Windows status (i.e. amount open) and weather
  - Unusual conditions or events prior to or during the testing
- Written confirmation from prime contractor that the relevant "test conditions" and "systems conditions" (above) were met
- Findings
- Environmental lab report
- Interpretation of the lab report and findings
- Conclusions and recommendations

Maximum Allowable Concentrations
The following thresholds are intended to serve as a guide for IAQ professionals. Though these concentrations may not be exceeded, there may be circumstances in which smaller concentrations of certain substances pose a health risk, in which case the Institute recommends project teams meet the lower levels. If the IAQ testing reveals concentrations of any substances exceeding the limits listed below, the project team must put in place an action plan to reduce exposure to requirement levels. Concentration thresholds:

- Formaldehyde less than 50 ppb (parts per billion)
- PM2.5 less than 12 $\mu g/m^3$ (microgram per meter cubed)
- PM10 less than 150 $\mu g/m^3$
- Total Volatile Organic Compounds (TVOCs) less than 500 $\mu g/m^3$
- 4-Phenylcyclohexane less than 3 $\mu g/m^3$
- Carbon monoxide less than 9 ppm (parts per million)
- Ozone < 51 ppb
- Carbon dioxide less than 750 ppm
- Nitrogen dioxide less than 0.053 ppm over a 24-hour period

Phased Construction
If a project will be occupied in phases as construction is completed, pre-occupancy air quality testing must occur separately and in sequence to ensure that each space is tested prior to occupancy. This means that there will be multiple rounds of testing to include with documentation.

If spaces have identical construction and ventilation systems, one or two pre-occupancy tests for each type of space may be sufficient. The final (post-occupany) tests should be conducted nine months after the building is fully occupied.

Equivalent Methods
At the discretion of the project's IAQ professional, project teams may use equivalent methods to the United States Environmental Protection Agency, Compendium of Methods for the Determination of Air Pollutants in Indoor Air. See Resources.

CDPH CONFORMANT CERTIFICATIONS

Projects outside the US may use products tested and certified under a standard that conforms to CDPH SM v-1.1-2010. Teams may use one of the standards listed below or make the case for conformance of another standard through the Dialogue.

Examples
- SCS Indoor Advantage Gold, EC 10.2 Standard Addendum
- FloorScore, EC 10.2 Standard Addendum
- Collaborative for High Performance Schools (CHPS), Procedures and Standards for Product Inclusion Version
- NSF 332
- UL Greenguard Gold, UL 2818 and UL 2821

ENTRY APPROACHES

Project teams should keep in mind that the Healthy Interior Environment Imperative is performance-based and is assessed through indoor air quality testing. Dirt walk-off systems should be scaled appropriately and tailored for each project's specific programmatic requirements and foot traffic demand. The project plan should demonstrate compliance with the intent and make a case for any divergence from the specific requirements below.

All Projects
The following entry approach requirements apply to all projects:
- All primary entrances should have both exterior and interior dirt walk-off systems
- Interior mats, whether temporary or permanently installed, must be cleaned at least weekly, though twice weekly is preferable in heavily trafficked areas, per the American Lung Association.

"Imagine trying to live without air. Now imagine something worse."

Amy Reed, *Clean*