



LEED Dynamic Plaque Testing: Instrumentation for the “Human Experience” Credits

The United States Green Building Council (USGBC) developed the LEED Dynamic Plaque in 2015. The plaque displays an ongoing LEED performance



score, with annual LEED recertification and benchmarking. It is a way for visitors, and occupants to view building performance. This gives valuable feedback to owners and building managers to make educated decisions to optimize the building for people, profit, and the environment. The five categories that are scored are energy, water, waste, transportation, and the human experience. Each one of the categories is explained in detail in the LEED Dynamic Plaque User Manual¹. GrayWolf instrumentation can be applied to the indoor air quality (IAQ) measurement parameters of interest for the human experience category.

Human experience, air testing

For the human experience, total volatile organic compounds (TVOCs) and carbon dioxide (CO₂) must be measured within every 12-month period and within a representative location of a building (for each 25,000 ft², 2325 m²). TVOCs must be monitored in micrograms per cubic meter (µg/m³) and CO₂ in parts per million (ppm). There are three ways that measurements can be obtained, either by fixed sensors, portable sensors, or samples to be sent out to a laboratory.

Providing data in all categories is not a requirement, but doing so will lead to a more accurate and comprehensive score. Participants can update the data more frequently than identified above. Your performance score is as dynamic as the data it receives.

TVOC levels must be below the LEED V4 BD+C concentration of 500 µg/m³ (200 µg/m³ for healthcare facilities). For TVOCs LEED prefers measurements following EPA TO-1, EPA TO-15, EPA TO-17, EPA Compendium Method IP-1, and/or ISO 16000-6, which all utilize air samples sent to a laboratory for gas chromatography and mass spectrometry (GCMS) analysis. These tests are time exhausting, and can be expensive. Photoionization detectors (PIDs) are also an approved method for measuring TVOCs. When using a PID, the measurements must be taken for a minimum of four hours within the breathing zone, between 3 and 6 ft (90 and 180 cm) above the floor. Multiple measurements during the sampling period are required. Unlike sending out samples for analysis this will yield immediate results, and high frequency data-logging (as rapidly as capturing a data sample every second) may provide more representative results if VOC levels vary in the tested space over the sampling period.

Note that not all PIDs are appropriate for IAQ air monitoring. Of the 6 PID sensors that GrayWolf offers, only two (both low range, good stability) would be recommended for the LEED Dynamic Plaque application. The wrong PID might provide poor, unreliable results. Frequent user calibration of the PID sensors would also be prudent for this application.

There are two ways to monitor CO₂; one year of indoor levels for each location, or perform an indoor air quality audit. When performing the indoor air quality audit, the test must occur when the HVAC system starts at the normal start time and deliver outdoor air at the minimum rate during normal occupied hours. The CO₂ measurements must also be taken for a minimum of four hours within the breathing zone of 3 and 6 ft (90 and 180 cm) above the floor. There must be multiple CO₂

¹ The LEED Dynamic Plaque User Manual. USGBC. August 2015.





measurements taken during the 4-hour testing period, each with a *minimum* of 30 minute intervals.

For CO₂ concentrations² on US projects, LEED references ASHRAE Standard 62.1-2010 “or a local equivalent (whichever is more stringent)”. As per appendix C of ASHRAE 62.1, when steady state CO₂ concentrations remain about 700 ppm above outdoor concentrations the indicative minimum ventilation rate will typically lead to a satisfactory occupant experience. Outdoor CO₂ concentrations can vary, often higher in urban areas, but current worldwide averages are approximately 400 ppm³.

Projects outside the US may alternatively use CEN Standards EN 15251-2007 and EN13779-2007. EN 15251⁴ has four different categories of CO₂ concentrations ranging from 350ppm (best) to >800 ppm above outdoor concentrations. EN13779-2007⁵ also has four separate categories for CO₂ concentrations above the outdoor air values, ranging from <400 ppm to >1000 ppm.



GrayWolf unit installed with CO₂ (dual wave NDIR) and TVOC (PID) sensors. Easily portable, a tripod kit or security monitoring case are available for trend logging in the “occupied zone”.

Utilizing a GrayWolf meter with a non- dispersive infrared (NDIR) sensor for CO₂ and a low range, low limit of detection PID for TVOCs will satisfy the needs for testing. These sensors are specifically sourced by GrayWolf for indoor air quality (IAQ) applications, delivering high accuracy, precision, measurements. The sensors also have very rapid response and stabilization times which is important for quick checks of the local outdoor air levels.

LEED states that for the indoor air survey there must be a narrative describing the procedures, dates, times, and results from each test. This is something that GrayWolf excels in. There is the ability to give descriptive names of the data files, along with text notes for additional narrative, and even ability to add photos/videos/audio along with the recorded data.

CO₂, and TVOC data can be shared through a spreadsheet, which can be found in the Data Input section of the leedon.io software and easily populated from GrayWolf’s WolfSense® PC software.

² <http://www.usgbc.org/credits/retail-new-construction/v4-draft/eqp>

³ <http://www.esrl.noaa.gov/gmd/ccgg/trends/>

⁴ EN 15251-2007: Indoor Environmental Input Parameters for Design and Assessment of Energy Performance of Buildings Addressing Indoor Air Quality, Thermal Environment Lighting and Acoustics. Annex B1, Table B4.

⁵ EN 13779: Ventilation for non-residential buildings -Performance requirement for ventilation and room-conditioning systems. Table A10. April 2007.

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