

FEMP Indoor Environmental Quality Assessments for Schools

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Background

- The Federal Energy Management Program's (FEMP) mission is to support Federal agencies' energy planning and management with technical assistance and resources.
- Pacific Northwest National Laboratory (PNNL) is a Department of Energy lab supporting FEMP on the Energy and Indoor Environmental Quality Program.
- Over the last five years, FEMP and PNNL have been working with the General Services Administration (GSA), Department of Veterans' Affairs (VA), the Bureau of Indian Education (BIE) and Indian Health Services (IHS) to conduct assessments at Federal offices, schools, and hospitals to improve IEQ and energy efficiency.
 - FEMP and PNNL have been collaborating with DOE's Office of Building Technology (BTO) and Lawrence Berkeley National Laboratory (LBNL) on the Healthy + Efficient School Campaign on our school evaluations
- "Audit" approach to studies—snapshot for a quick diagnosis and building and energy planning.

FEMP School Assessments

• Over the last two years we have supported eight schools across the country. They have been conducted remotely, providing training to onsite staff to set up and take down the equipment.



What's an Energy and IEQ Assessment?

- Energy and IEQ assessment A tool to determine how a building's energy systems and indoor environmental conditions are performing and to identify opportunities for improvement.
 - Monitors collect data over a given period.
 - Subjective feedback collected from occupants in a focus group or survey.
 - Data compared to benchmarks to identify improvement potential.
 - Provide customized recommendations to improve energy efficiency and occupant health and comfort.

Indoor environmental quality (IEQ) – The air quality, thermal, acoustical, lighting, and other conditions of a building that impact the health of people who occupy it.



IEQ Assessment Process Overview



Energy Tools

 Asset Score evaluates the energy efficiency of a building based on the building's structure, envelope, heating, cooling, ventilation, and hot water systems.





- Portfolio Manager provides a score based on actual utility data compared to data from other, similar sized schools.
 - This tool is often used for public benchmarking programs.



Building Walkthrough Form

Purpose: Collect existing condition information on the occupancy, HVAC system, lighting, and envelope to be used in the analysis.

- The information required for energy tools can be combined with this process.
- For the recommendations, it is helpful to know what systems currently exist and their conditions.
- Form can be filled out online or on printed hardcopy.
 - A digital form is quicker to transfer data, but some people may prefer a paper version.

BIE School Walk	through Form	
		_
Occupan	су	
2		
What is t ment of	the total student enrol- the school?	
Enter your	answer	
3		
Which da times of pied?	ays of the week and day are the school occu-	
Please no the schoo staff are	ote when students are in ol, when teachers and in the school, any days of	

Focus Group or Survey

A focus group or survey is a tool to connect the measured data to what the buildings occupants experience inside the building. For example, how air quality, thermal conditions, lighting, and noise impact the staff and their students.



Focus Group

- Participant time commitment = 45-60 minutes
- Can glean useful information with a small number of participants.
- When conducted remotely, it is best to have participants at individual computers.

Survey

- Participant time commitment = 5-10 minutes per participant
- Need a minimum number of participants to glean useful information
- Responses are limited to the questions asked with no opportunity to ask follow up or clarifying questions.
- Responses can be collected online

IEQ Monitoring

- For our assessments, we monitor environmental quality for ~5-6 weeks in 10 rooms.
 - Classrooms and learning spaces should be prioritized.
- It is important to have a data retrieval plan. For example, some sites may have limited or no Wi-Fi availability and require monitors that can store and transfer data locally.
- An outdoor monitor is helpful to see how outdoor temperature, humidity, and particulate matter affects indoor conditions.





IEQ Monitor Selection

- **Pricing:** Includes device cost, any associated subscription fees, replacement cost after a few years of use, and any additional equipment needed.
- Intended user: Some devices are intended for researchers and some for consumers.
- Metrics: What is measured by the sensor, for example temperature or carbon dioxide.
- Data storage & transfer: Whether the sensors have internal storage for logging data or if they require a continuous Wi-Fi connection to transfer data.
- User experience: Although difficult to gauge before purchasing, this parameter can make a difference in IEQ assessment success.
- Maintenance: Monitors often require some maintenance or calibration in their lifetime.
- Sensing Accuracy: Includes degree of accuracy and sensing range for metrics.
- Security & IT restrictions: Whether the sensors require the use of software, Wi-Fi, or apps that may conflict with IT restrictions of the site. An external device may be required to access any apps and assist in data transfer.

Questions?

 Reach out to Allison Ackerman (<u>Allison.Ackerman@hq.doe.gov</u>) and Kevin Keene (<u>kevin.keene@pnnl.gov</u>) with any questions or more information about the tools discussed.