OBJECTIVE AND SIGNIFICANCE: In recent years, especially since COVID, there has been increased attention focused on indoor air quality. Under this project, HNEI contracted Miller Kelley Architects (MKThink) to evaluate room air quality. Field measurements and computer simulation were used to assess CO_2 concentrations in several room and HVAC typologies.

BACKGROUND: In past research activities under this subaward (2019-2021), the Hawaiʻi Natural Energy Institute and its collaborators, MKThink and RoundhouseOne, explored the optimization of space utilization to maximize energy efficiency while maintaining comfortable indoor conditions.

In 2022, MKThink was tasked with using computational fluid dynamics (CFD) modeling to evaluate whether methods could be developed to inform instructors about how to maintain high quality indoor air quality in real time. A key project objective of the 2022 phase was to identify and validate methodologies to improve indoor air quality (IAQ) and air circulation in a variety of building typologies. While the Computer Vision technologies were validated in previously reported-upon work at the Bishop Museum, the focus of this phase of the 2022 work plan was to monitor and model indoor air quality at Kapolei Middle School in Kapolei, Hawaiʻi.

PROJECT STATUS/RESULTS: MKThink developed 6 classroom test cases to be field tested and simulated, varying in classroom type, mechanical ventilation, and cooling system types. Thirty-two sensors were installed in the six classrooms, measuring CO_2, temperature, humidity, VOC, as well as door, window, and HVAC operating states. Outdoor ambient CO_2, temperature, humidity, wind speed, and direction data were also collected.

CO_2 levels were evaluated by room type (in-building with exposed perimeter, and portable) and HVAC type (unit ventilator, packaged AC, multi-zone central AC), on an average hourly and daily basis and over the study period. A database platform created by MKThink, known as "4daptive", housed all of the data collected between January and May 2022. Figure 1 are samples of visual analytic tools available in 4daptive to begin to identify issues for which to dive more deeply into.

Field data has been collected and is being stored and evaluated using the 4daptive database. At the present, the CFD modeling is being refined and finalized for comparison with field data.

The project is expected to be completed by early 2023.

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Average CO2 Levels for All Sensors in Classroom P11

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