**EVALUATION OF MINIATURE, IN-SITU GAS SENSORS USING THE DYNAMIC ENVIRONMENTAL SIMULATION CHAMBER (DESC)**

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Air pollution has a significant influence on humans, animal life and the environment. The impact is increased for higher air pollution rates and can span shorter life expectation, lung diseases, and possible birth defects. To limit pollution exposure to the public, the United States Environmental Protection Agency (U.S. EPA) instituted the National Ambient Air Quality Standard (NAAQS). Moreover, the U.S. EPA is monitoring ambient air quality with fixed and mobile stations in order to understand local scale air pollution changes over time and develop a network for the citizens. These monitoring stations are capable of highly accurate measurements with laboratory grade technologies. However, if the number of stations are considered to allow for a dense monitoring network, the currently deployed technologies are not cost-effective. Furthermore, to maintain these highly technical devices, specialized professionals are required, adding further to the cost of operation. Meanwhile, miniature, low-cost (<$1000) gas sensor technologies are becoming available on the market in growing numbers. Application of these sensors could potentially decrease the cost of monitoring stations. The trade-off between the total station cost and the measurement accuracy must be well maintained since the accuracy and sensitivity of low-cost sensors has not yet reached the in-situ gas analyzers. In general, over the past couple of years usage of low-cost sensors as well as their accuracy has been increased. Nevertheless, the sensors need to be assessed to determine response, accuracy, possible interferences, operating ranges, response time, etc.

This study aims to determine and increase the accuracy of the miniature; low-cost sensors compared to the reference gas analyzers and characterize the sensor responses due to the meteorological events as well as possible cross-sensitivities to other substances. With the aim of assessing the sensor, the Dynamic Environmental Simulation Chamber (DESC) was built at the Center of Alternative Fuels Engine and Emissions (CAFEE) Sensor Laboratory at West Virginia University. The torus-shaped pipe assembly is able to simulate ambient air conditions such as temperature changes, humidity and barometric pressure levels, wind speeds, and gas concentrations. In the first step, this study focused on carbon dioxide (CO2) sensors including the Senseair K30 (range 10000ppm), FIGARO FG-030 (range 5000ppm), and COZIR (range 2000ppm). All these sensors are based on nondispersive infrared detection (NDIR) technology which has interference with CO, humidity, temperature, and pressure. The test matrix was developed using design of experiments methods to understand the effects of the conditions and cross-interfering gases. Fourier-transform infrared spectroscopy (FTIR) was used as a reference gas analyzer to compare sensor responses. The DESC provides the capability to study in a future step various gas sensors and sensor technologies to gain a better understanding of sensor responses, and sensitivities, as well as application opportunities and limitations.