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WDNR Analyzes Low-Cost, Portable Air Monitors

Between August and September of 2017, the Wisconsin Department of Natural Resources (WDNR) conducted a field analysis evaluating the performance of low-cost air quality sensor devices (i.e., hand-held air monitors). On May 17, 2018, WDNR released a summary of the results from that analysis, and the results are a mixed bag.

WDNR evaluated four devices for measuring particulate matter, specifically the Thermo 2025i (FRM), Met One 1020 (BAM), TAPI T640X (T640x), and Dylos DC 1100 Pro-C. Information about each device is summarized in the following table:

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Device	Federal Reference Method (FRM) / Federal Equivalence Method (FEM)?	Measurement Increment	Data Units	Measurement Principle
FRM	Y	1 day	µg/m ³	Mass of particles on a filter
BAM	Y	1 hour	µg/m ³	Radiation transmission through filter containing particles
T640X	Y	5 seconds	µg/m ³	Light scatter from particles in sample chamber
Dylos	N	1 minute	# particles / 0.01 ft ³	Light scatter from particles in sample chamber

In terms of measuring PM_{2.5} concentrations, the instruments were found to have a wide range of biases, with one monitor exhibiting a positive bias of 122.7%. The remaining monitors were more accurate but still exhibited significant biases. A summary of those findings is below:

Comparison	N	Test concentrations (µg/m ³)	Reference concentrations (µg/m ³)	N*	Average bias* (%)
BAM-FRM	51	8.2	9.5	49	-13.2
T640X-FRM	48	10.9	9.7	47	14.1
Dylos-FRM	46	21.5	9.6	45	122.7

WDNR’s conclusions from the analysis are carefully worded and avoid providing an endorsement of any of the four monitors. WDNR notes that the timing of higher pollution peaks generally corresponded well among all instruments. However, WDNR also noted flaws in the Dylos system that are reflected in the biases associated with the unit.

Low-cost, handheld air monitors have been getting more attention as a tool for use by “citizen scientists,” ENGOs, regulators, and neighborhood associations. The *Milwaukee Journal Sentinel* recently purchased and deployed such sensors for a story it developed concerning air pollution from a stationary source. The devices are widely available on the internet—just search Amazon. EPA has a website devoted to providing information to the public about these devices and has been conducting its own evaluations of the performance of portable sensors. Monitors are being used to gauge fence line conditions around the Superior Refinery to, among other things, monitor air quality following a recent explosion/fire event. Still, significant questions remain as the regulatory role of these monitors, the standards by which the results

will be compared, and whether the results will be admissible in court proceedings. Portable air quality sensors will receive much attention in the foreseeable future.

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