

Draft Air Monitoring Equipment Proposal Details

Type of Site	General Pollutant Type	Specific Pollutant Type	Sampling Method	Equipment Type	Analysis Method	Sampling Frequency
Portable Trailer	Particulate Matter	PM ₁₀ ¹	Louvered PM10 Inlet ²	MetOne BAM 1020 ^{3,4} or similar	Beta Attenuation ⁵	Continuous
		PM _{2.5} ⁶	Very sharp cut cyclone ⁷	MetOne BAM 1020 or similar	Beta Attenuation	Continuous
		Black Carbon ⁸	Aethalometer ⁹	Magee Scientific AE33 ¹⁰ or similar	Optical Absorption ¹¹	Continuous
		Organic Carbon/Elemental Carbon ¹²	Total Carbon Sampler ¹³	Magee Scientific TCA-08 or similar ¹⁴	Combustion/CO ₂ Detection ¹⁵	Continuous
		Toxic Metals ¹⁶	To be determined	Filter Based Sampler ¹⁷	To be determined	Samples (e.g 3 hours, 12 hours, 24 hours); Requires Lab Analysis
	Gaseous	Nitrogen Oxides ¹⁸ (NO _x /NO ₂)	Sensor	T200UP or similar ¹⁹	Photolytic - Chemiluminescence ²⁰	Continuous
		Ozone ²¹	Sensor	TAPI 400E ²² or FEM equivalent	Ultraviolet Absorption ²³	Continuous
	Toxics Chemicals	VOC ²⁴ - EPA TO-15 ²⁵ Compound List including BTEX ²⁶	6L Pressurized Canisters ²⁷	Xontek Model 901 Canister Sampler ²⁸ or similar	U.S. EPA TO-15 ²⁵	Samples (e.g 3 hours, 12 hours, 24 hours); Requires Lab Analysis
		Carbonyls (Aromatics; Aldehydes) ²⁹	DNPH Cartridges ³⁰	Xontek Toxic Air Sampler ³¹ or similar	U.S. EPA TO-11A ³²	Samples (e.g 3 hours, 12 hours, 24 hours); Requires Lab Analysis
	Meteorological (Weather)	Wind Direction	Sensor	MetOne Weather Station ³³ or similar	Multiple	Continuous
		Wind Speed				
		Temperature				
		Humidity				
Low Cost Sensor ³⁴	PM _{2.5}	Multiple	Purple Air ³⁵ , Clarity ³⁶ , or similar	Particle Counter ³⁷	Continuous	
	PM ₁₀					
Stand Alone Professional/ Mid-Grade equipment	Gaseous & Particulate Matter	Multi-pollutants	Multiple sensor	Aeroqual AQY-1 ³⁸ or similar	Multiple	Continuous
	Particulate Matter	PM ₁₀	Very sharp cut cyclone ⁷	Met One BAM 1020 ⁴ or similar	Beta Attenuation ⁵	Continuous
		PM _{2.5}	Very sharp cut cyclone ⁷	Met One BAM 1020 ⁴ or similar	Beta Attenuation ⁵	Continuous
		Black Carbon ⁸	Aethalometer ⁹	Magee AE33 ¹⁰ or similar	Optical Absorption ¹¹	Continuous
		Toxic Metals ¹⁶	TBD	Filter Based Sampler ¹⁷	TBD	Samples (e.g 3 hours, 12 hours, 24 hours); Requires Lab Analysis
Low Cost	Particulate Matter	PM ₁₀	Sensor	Purple Air ³⁵ , Clarity ³⁶ , or similar	Particle Counter ³⁷	Continuous
		PM _{2.5}				
	Gaseous	Ozone ²¹	Sensor	TAPI 430 ³⁹ or similar	Ultraviolet Absorption ²³	Continuous

¹ PM₁₀: Particulate matter with a width that is smaller than 10 micron, or about one-fifth the width of a human hair; examples of PM₁₀ are dust, dirt, and other particles that are large enough to be seen by a naked eye (<https://www.epa.gov/pm-pollution/particulate-matter-pm-basics>)

² A special type of inlet that separate and filter out particulate matter that are larger than the desired size; for example, a PM₁₀ inlet allows scientist to focus on particulate matter smaller than 10 micron (<https://bgi.mesalabs.com/wp-content/uploads/sites/35/2015/02/Accessories.20FEB2015.pdf>)

³ MetOne, Inc. is an Oregon-based company that makes particulate matter samplers and weather sensors for many industries including air monitoring

⁴ BAM1020 is one of the MetOne's most popular particulate matter sampler and is deployed worldwide to many different air monitoring organizations (<https://metone.com/products/bam-1020/>)

⁵ Beta attenuation is a method that helps calculate the amount of particulate matter by detecting its absorption of a small amount of radioactivity (<https://www.thermofisher.com/us/en/home/industrial/environmental/environmental-learning-center/air-quality-analysis-information/beta-attenuation-technology-particulate-matter-measurement.html>)

⁶ PM_{2.5}: Particulate matter with a width that smaller than 2.5 micron and is 20 times smaller than the width of a human hair; it is harder to be seen by a naked eye because of its small size, but enough PM_{2.5} presents in the air can reduced visibility in pristine area like national parks; smoke and soot are examples of PM_{2.5} (<https://www.epa.gov/pm-pollution/particulate-matter-pm-basics>)

⁷ A special type of inlet that separate and filter out particles larger than PM_{2.5} so that scientist can focus on the particles smaller than PM_{2.5} (<https://bgi.mesalabs.com/pm2-5-very-sharp-cut-cyclone-vscc/>)

⁸ Black carbon is an airborne particle emitted from combustion process (gas and diesel engine, power plants, etc.); it is part of PM_{2.5} (<https://www.epa.gov/air-research/black-carbon-research>)

⁹ An aethalometer is an instrument that determines the amount of black carbon by using the method described in footnote 11 (https://www.arm.gov/publications/tech_reports/handbooks/aeth_handbook.pdf)

¹⁰ Magee Scientific is a Berkeley, California-based company that invented the first generation of aethalometer; AE33 is the latest model of aethalometer Magee Scientific offers (<https://mageesci.com/our-products/ae33/>)

¹¹ A method that detects black carbon by using light transmission through a filter where black carbon is collected (https://www.arm.gov/publications/tech_reports/handbooks/aeth_handbook.pdf)

¹² Organic carbon an airborne particle emitted from vegetation burning and some fossil fuel combustion; elemental carbon is the breakdown of organic carbon at a high temperature (i.e. large forest fire, high temperature combustion); elemental carbon is closely related to black carbon (https://www.arm.gov/publications/tech_reports/handbooks/aeth_handbook.pdf)

¹³ Total carbon analyzer is an instrument that measures the total amount of carbon present in an air sample; it helps determine the different type and source of PM_{2.5} air pollution

¹⁴ TCA08 is a total carbon analyzer manufactured by Magee Scientific (<https://mageesci.com/our-products/tca08/>)

¹⁵ A method that converts all carbon-related compounds into carbon dioxide, which is then used to calculate the total amount of carbon in an air sample

¹⁶ A high amount of metal and mineral (e.g. calcium, copper, iron, manganese, potassium, zinc, lead, mercury, etc.) is toxic to human and animals despite the fact some of these metals and minerals are essential for healthy bodies (https://www.epa.gov/sites/production/files/2014-11/documents/human_health_effects.pdf)

¹⁷ A sampler that uses removable filter to collects PM₁₀ or PM_{2.5} as an air stream passes through the filter; the filter is then sent to a laboratory for analysis to calculate the amount of particulate matter collected

¹⁸ Nitrogen oxides (NO_x) is one of the byproducts of fossil fuel combustion; nitrogen dioxides (NO₂) is one of the NO_x and is one of the criteria air pollutants designated by the U.S. Environmental Protection Agency because it irritates human respiratory system (<https://www.epa.gov/no2-pollution>)

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- ¹⁹ Teledyne API is a global market leader in air quality and process gas monitoring instrumentation headquartered in San Diego, CA"; T200UP is one of Teledyne API's latest NO₂ analyzer (<http://www.teledyne-api.com/products/nitrogen-compound-instruments/t200up>)
- ²⁰ A method converts NO₂ into other chemical compound for detection by a sensor
- ²¹ Ground-level ozone (O₃) is formed from NO_x and other chemical compounds; it triggers many health symptoms and is one of the U.S. EPA criteria pollutants (<https://www.epa.gov/ground-level-ozone-pollution>)
- ²² T400 is Teledyne API's latest generation of ozone monitor (<http://www.teledyne-api.com/products/oxygen-compound-instruments/t400>)
- ²³ A method to determine the amount of O₃ using the absorption of ultraviolet light
- ²⁴ Volatile Organic Compound (VOC) is gas compound that can be emitted from many everyday products (e.g. furniture, paint, glue, household cleaner); outdoor, it is one of the ingredients needed to form smog, which includes ground level ozone; indoor, it can trigger adverse health reaction (<https://www.epa.gov/indoor-air-quality-iaq/technical-overview-volatile-organic-compounds>)
- ²⁵ U.S. EPA Toxic Organic method #15 (TO-15) is a laboratory analytical method that detects some specific VOC compounds (https://www.epa.gov/sites/production/files/2015-07/documents/epa-to-15_0.pdf)
- ²⁶ Benzene, toluene, ethylbenzene and xylene are collectively known as BTEX; these toxic compounds are commonly associated with natural gas, gasoline, and other petroleum products (<https://www.aeroqual.com/what-is-btex>)
- ²⁷ Canister is a metal container that holds air sample until it is analyzed by a laboratory
- ²⁸ Xontek is a company that makes "ambient air samplers for Environmental Professionals for over 25 years"; Model 901 is a "programmable sampler" that "collect volatile organic compounds in ambient air" (<http://xontek.com/901.html>)
- ²⁹ Carbonyl is compounds that are grouped their special carbon-oxygen chemical bond; while some carbonyl compounds are harmless and safe for human consumption (e.g. oil of cinnamon), other carbonyl compound like formaldehyde may be carcinogenic (<https://www.britannica.com/science/aldehyde/Other-carbonyl-compounds-of-industrial-use>, <https://www.cancer.org/cancer/cancer-causes/formaldehyde.html>)
- ³⁰ Dinitrophenylhydrazine (DNPH) cartridge is a special sampling medium that captures carbonyl compounds so that it can be analyzed by a laboratory
- ³¹ Toxic Air Sampler (Model 924) is an air sampler that collects toxic air samples with a DNPH cartridge (<http://xontek.com/924.html>)
- ³² U.S. EPA Toxic Organic method #11 (TO-11) is a laboratory analytical method that targets a set of toxic compound different from TO-15 (<https://www3.epa.gov/ttnamti1/files/ambient/airtox/to-11ar.pdf>)
- ³³ A weather station can measure many different type of weather factors like wind, temperature, humidity; these factors can affect air pollution measurements and help scientist determine the source of pollution (<https://metone.com/products/general-purpose-weather-station/>)
- ³⁴ Low cost sensors are considerably less expensive than traditional sensors; however, data quality may not be as reliable
- ³⁵ PurpleAir is one of the new generation, low cost sensors capable of measuring PM₁₀, PM_{2.5} (<https://www.purpleair.com/sensors>)
- ³⁶ Clarity is another example of low cost sensor; it can measure a number of air pollution in addition to PM_{2.5} (<https://clarity.io/solution>)
- ³⁷ Particle counter uses light, commonly in the form of laser, to determine the number of particles in an air sample
- ³⁸ Aeroqual is "mid-grade" sensor that can measure multiple types of air pollution (e.g. ozone, nitrogen dioxide, particulate matter) (<https://www.aeroqual.com/product/agy-micro-air-quality-station>)
- ³⁹ Model 430 is a compact ozone analyzer offered by Teledyne API (<http://www.teledyne-api.com/products/process-ozone-instruments/430>)