Soliciting Feedback

- **What:** A technical assistance document is being developed for continuous carbonaceous aerosol (e.g. black carbon) monitoring.
  - In consultation with instrument manufacturers and early adopters.
  - Appendix includes SOPs for select commercial instruments.
- **Why:** There is growing interest in integrating carbonaceous aerosol measurements into air quality monitoring networks, particularly for fossil fuel and biomass burning information.
- **Next steps:** EPA is interested in hearing what state, local, and tribal authorities think before final publication.

CONTINUOUS MONITORING OF CARBONACEOUS AEROSOLS

Technical Assistance Document (TAD)

EPA

What are Carbonaceous Aerosols?

Carbonaceous aerosol species make up a significant portion of aerosol mass and contribute to adverse health and climate impacts.

Total Carbon (TC) = OC + EC ≈ OC + BC

Carbonaceous aerosols are made up of:

- **Black carbon** (BC) and **elemental carbon** (EC), commonly called **soot**, are strongly light absorbing. *BC and EC are more strongly correlated with negative health impacts than unspeciated particulate matter (PM).*
- **Organic carbon** (OC) includes compounds primarily containing carbon, hydrogen, and oxygen, which typically reflect light.

EC and BC are similar, but not exactly equal. BC and EC are defined by the monitoring method used. **This TAD covers BC monitoring techniques**.

Why Monitor Carbonaceous Aerosols?

Source Identification: BC measurements can help identify the **portion of PM attributed to traffic, wildfires,** and other sources.

Health: BC, due to its small size, can penetrate deep into the lungs. Understanding ambient concentrations supports **analysis of health endpoints**.

Climate: BC is a short-lived climate pollutant with significant warming potential. Monitoring provides **trends** and confirms **emissions reductions over time**.

What are the Sources?

In the United States, the primary sources of BC and EC are **transportation**, particularly diesel exhaust, and **biomass burning**, including wildfires and prescribed burning.

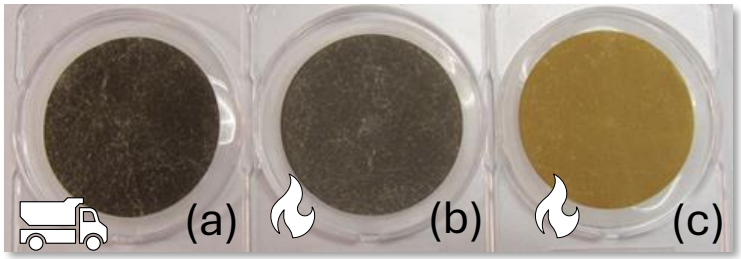

Figure 1. Filter samples from (a) diesel exhaust, (b) biomass burning (flaming), and (c) biomass burning (smoldering). Adapted from U.S. EPA report to Congress on Black Carbon; photo courtesy of Desert Research Institute.

What Instruments are Included?

The TAD covers **continuous measurements** for select commercial instruments that currently report to the U.S. EPA Air Quality System (AQS).

Instrument	Species	Technique
AE33 Aethalometer®	BC	Optical adsorption
BC 1060 Black Carbon Monitor	BC	Optical adsorption
TCA08 Total Carbon Analyzer	TC	Thermal analysis
CASS (AE33 + TCA08)	BC and TC; OC calculated	Optical absorption + thermal analysis

Monitoring Equipment Specifications

Optical absorption analysis measures BC via the attenuation of light.

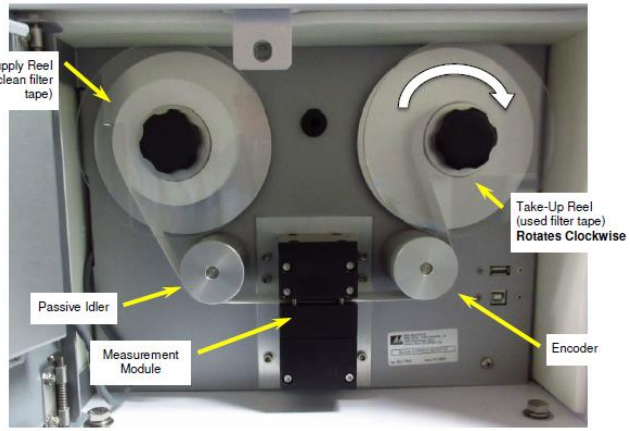

Figure 2. Internal view of a standard optical analysis instrument.

	AE33 Aethalometer	BC 1060 Black Carbon Monitor	TCA08 Total Carbon Analyzer
Weather-proof shelter	Required	Not required	Required
Altitude	Up to 3,000 m, (extended to 5,000 m with external pump)	Not evaluated by manufacturer	Up to 3,000 m
Temperature range	10–40°C	-20–50°C	10–35°C
Relative humidity range	5-95%	0-95%	30-80%
Power supply	100–240 VAC	100–240 VAC	100–240 VAC
Power consumption	25 W average	70 W max	1,500 W
Dimensions	Standard 19”/6U rack mount	12.0” (h) × 14.0” (w) × 14.5” (d)	Standard 19”/6U rack mount

TAD Topics

Methods overview including underlying **scientific principles** and **formulas**.

Monitoring objectives, including **network design** and **siting considerations**.

Installation best practices, including information about **shelters**, **inlets** and **separators**, sample stream **dryers**, and **temperature** and **pressure** considerations.

Operations and system maintenance, including information about expendable and spare **parts**, **maintenance schedules**, and recommended **quality control checks** for leaks and flows.

Data quality planning and quality assurance, including **storage**, **review**, and **reporting** to U.S. EPA.

Literature review summarizing the state of the science on **health**, **measurement techniques** and comparisons, **source apportionment** and regional and special purpose monitoring examples.

Example Data Use Cases

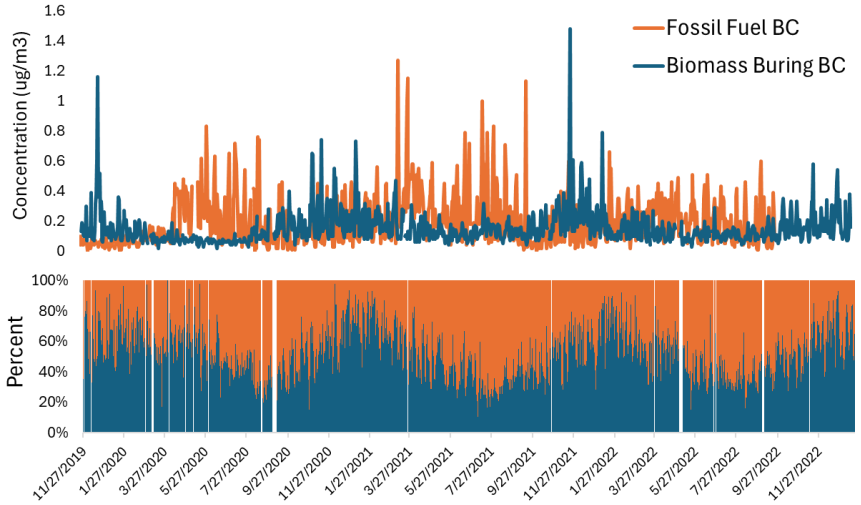

Figure 3. Source apportionment of aerosol at HU-Beltsville, Maryland, using BC measurements. From the U.S. EPA Continuous Carbon Dashboard.