

## Air Pollution Basics Curriculum

*Goal:* To help federal, state, local, and tribal air professionals, as well as communities, build their knowledge base and capacity to conduct various duties in compliance with the applicable Clean Air Act (CAA) requirements.

*Audience:* This curriculum is intended for newly hired federal, state, local, and tribal air professionals, as well as communities. The audience for this curriculum is considered broad and includes any person who needs a basic knowledge of key concepts before taking courses under the job-specific curricula (e.g., permitting or air quality planning).

*Learning Objectives:* The learning objectives are intended to provide a broad foundational knowledge of air pollution and regulatory concepts required for success in job-specific curricula and duties.

- Identify key historic episodes and events that led to the passage of air pollution control legislation
  - Major influences that affected the development of air quality management programs in state, local and tribal air agencies across the US
- Highlight air pollution control successes since the 1970 passage of the CAA
  - The trends and factors that have caused large reductions in air pollutants
- List and describe the types of air pollutants regulated under the CAA
  - Criteria pollutants
    - Ozone
    - Particulate matter (coarse and fine)
    - Nitrogen dioxide
    - Sulfur dioxide
    - Lead
    - Carbon monoxide
  - Criteria pollutant precursors
  - Greenhouse gases
  - Hazardous air pollutants (HAPs)
    - List of air toxics
- Generally describe typical sources of anthropogenic air pollution, including but not limited to:
  - Point sources
  - Nonpoint sources
  - Onroad/nonroad sources

- Events (wildfires, prescribed fires, agricultural sources)
- Generally describe biogenic and geogenic sources of air pollution
- Explain the health and environmental effects of air pollutants for:
  - Each of the 6 criteria air pollutants
  - HAPs
  - Greenhouse gases
  - Trends in levels of these pollutants
- Explain basic concepts in environmental sciences related to air pollution
  - Basic concepts of pollutant emissions
    - Pollutants emitted directly
    - Precursor emissions that transform in the atmosphere
  - Atmospheric science
    - Overview of basic meteorology and atmospheric chemistry
      - Inert and chemically reactive pollutants
      - Influence of weather and climate, including inversions
      - Pressure (including altitude) and temperature effects
    - Dispersion (fate and transport) of primarily emitted pollutants (SO<sub>2</sub>, CO, Pb, PM<sub>10</sub>, direct PM<sub>2.5</sub>, NO<sub>2</sub>)
    - Differences between ground-level and stratospheric ozone
      - Basics of ground-level ozone formation chemistry (precursors, etc.)
      - Basics of stratospheric ozone formation
    - Secondary PM<sub>2.5</sub> formation
      - Chemical species
      - Spatial and temporal nature of formation
    - Visibility impairment (Regional haze)
  - Overview of air pollution across the US
    - Monitoring data—spatial patterns, seasonal, diurnal patterns
    - Modeled data—spatial patterns, seasonal, diurnal patterns
    - Spatially fused air quality information—spatial patterns, seasonal, diurnal patterns
  - Basics of interactions between meteorology and air pollution
  - Gas law, light properties
  - Pollutant source measurements and associated techniques
    - Continuous vs. episodic (e.g., CEMS vs. Stack test)
  - Scientific evaluation of health and environmental impacts of air pollution
    - Dose/response
    - Epidemiological data versus controlled studies

- Acute versus chronic effects
  - Pathway from emissions to air quality to health impacts
    - How this pathway informs the air quality management cycle
- Describe common engineering practices and technologies used to control or minimize air pollutant impacts
  - Control of stationary source emissions
    - Process changes
    - Control technologies for particulate matter and gaseous emissions
  - Control of mobile source emissions
  - Prescribed burning practices
- Outline relevant information in the CAA on the following:
  - The CAA's structure
  - Major concepts, to include:
    - Criteria pollutants and National Ambient Air Quality Standards (NAAQS)
    - Designation of areas as attainment or nonattainment
    - State and tribal implementation plans
    - General and transportation conformity
    - Interstate transport
    - Regional haze
    - Air toxics
    - Acid rain program
    - Permitting
    - Stationary source standards for HAPs
    - New Source Performance Standards
    - Waste incinerator rules
- Outline the steps in the National Ambient Air Quality Standards (NAAQS)-setting process
  - Evaluation of scientific evidence
  - Evaluation of air quality data
  - Risk and exposure assessment
  - Policy assessment
  - The form and level of a standard
  - Rulemaking process, including opportunities for public comment
    - Timing
  - Regulatory impact analyses
  - Risk communication

- Explain implementation of the NAAQS
  - Basic CAA timeline for implementation requirements
  - Design value process
  - Initial designation of areas as attainment, nonattainment, and attainment/unclassifiable
    - Area classifications for applicable NAAQS
    - Designation of areas of Indian country
  - Exceptional Events program
    - Treatment of:
      - Wildfire
      - Prescribed fire
      - Wind-blown dust
      - Agricultural burning
  - Redesignation process
  - Roles of state, local and tribal air agencies
  - State and Tribal Implementation Plans (SIPs and TIPS)
  - The Tribal Air Rule and Treatment-As-State for tribes
  - Use of monitoring and modelling data
  - Overview of the Advance Program
- Define air pollution transport and Regional Haze
  - Broad history of interstate transport program to address regional ozone and PM<sub>2.5</sub> problems
  - Visibility and the CAA
  - Regional Haze Program and what processes and pollutants cause it
    - Regional Haze Rule overview
- Define operating permit and New Source Review programs
  - Title V
  - NSR (PSD vs. Non-attainment)
    - New vs. Existing Sources
    - Differences between major, minor, and synthetic minor sources
    - Actions taken for sources within attainment vs. nonattainment areas
- Describe the roles/responsibilities of air agencies under the CAA
  - State/Local
    - Approved
    - Delegated
  - Federal (EPA and other Federal agencies)
  - Tribal

- Explain the requirements for Federal coordination on air quality issues
- Describe how the EPA estimates the economic value of health benefits from reducing pollution
  - Use of the CO-Benefits Risk Assessment (COBRA) health impacts screening and mapping tool
  - Use of the Environmental Benefits Mapping and Analysis Program-Community Edition (BenMAP-CE) tool
  - Multipollutant considerations in air pollution strategies
- Explain the difference between ambient air monitoring and source testing, including regulatory requirements and constraints concerning data use
- Describe the basic principles for ambient air monitoring
  - Objectives for use of monitoring data
  - What is measured in the ambient air
    - Particles
    - Gases
    - Meteorology
  - Location for EPA monitoring requirements
  - Meteorological impacts on ambient air measurements
  - How the CAA defines ambient air and what must be measured
    - Criteria pollutants
    - HAPs
  - Measurement Methods
    - Federal Reference Methods
    - Federal Equivalent Methods
    - Non-regulatory methods
  - Quality assurance in using ambient air monitoring data
  - State annual air monitoring plan
  - The role of citizen science
- Define the Air Quality Index (AQI) and its regulatory basis
- Describe the basic principles for emission inventories
  - Overview of differences between types of emissions inventories, such as NEI and TRI, and greenhouse gas inventory
  - Overview of the types of emissions inventories and their purposes (more details on this provided in the EI Foundational curriculum)
  - Goals, purpose, and uses of the National Emissions Inventory (NEI)

- Sources covered under emission inventory data categories
- Describe the basic principles for air quality modelling and its applications
  - Why conduct air quality modeling?
  - Types of air quality models
  - How air quality models are used for different purposes
    - Attainment planning
    - Emissions inventories
    - PSD/NSR compliance demonstrations
    - Conformity
    - Research
  - The main types of inputs into air quality models
    - Source characterization and emissions inputs
    - Meteorological data
    - Terrain data
  - Model performance evaluations
  - Supporting analysis techniques for modeling assessments
    - Trajectories
    - Wind/pollution roses
- Describe the health assessment components of the air toxics program
  - Assessment of risk
  - Regulatory framework
  - Risk communication
  - Use of monitoring and modelling data
  - Estimates of air toxics public health risks
    - Cancer
    - Non-cancer
- Define the air toxics control program
  - Maximum Achievable Control Technology (MACT)
  - Generally Available Control Technology (GACT)
  - Residual Risk
- Explain the process of compliance and enforcement
  - Source testing
  - Emissions standards compliance demonstration
  - Inspections and audits
  - Enforcement mechanisms

- Define quality assurance and quality control
  - Developing Data Quality Objectives
  - Organizational Responsibility
  - Documentation
  - Audits
  - Reports
  
- Describe tools and resources available for public health messaging
  - AirNow
  - Air Trends
  - Air Data
  - Air Quality Flag Program
  - Sensors
  - Wildfire guide
  - Smoke Sense
  - NATA
  - EJ Screen
  
- List ways the public can participate in the regulatory process
  - Opportunities for public comment at the federal, state and local levels
  - Tribal outreach and consultation
  - Public hearings
  - Petitions (e.g., Title V)
  
- Identify basic issues related to environmental justice