



AIR QUALITY FORECASTING AND EVALUATION IN THE US

ICAC SHANDONG DELEGATION

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Overview

Brief Introduction to SC&A

Air Quality Evaluation/Modeling

Air Quality Forecasting/AirNow

SC&A Company Overview

- Small business environmental and energy consulting firm
- Practice areas
 - Nuclear & Radiation Sciences
 - Air Quality & Climate Change
 - Environment, Health, & Safety
 - Emergency Preparedness & Response
 - Advanced Technology
 - Communications and Information Systems
- Air Quality and Climate Change Clients include U.S. EPA, state and local agencies, other government organizations, and regional air quality organizations.
- Includes international air quality and climate change work

Clean Air Act

- [T]he Clean Air Act of 1970 is complex and demanding enough to keep lawyers, engineers, and environmentalists busy for all of their lifetimes. It seems to me we have created a maze into which only the foolhardy attempt to enter and from which only the exhausted, depleted, and defeated emerge.”
Senator Barry Goldwater
122 Cong. Reg 512476 (Daily Ed. July 26, 1976)

SC&A Support of CAA Programs

- Federal Permit Programs
 - ▣ New Source Review
 - ▣ Title V
- National Ambient Air Quality Standards
 - ▣ Implementation
 - ▣ New Source Performance Standards (NSPS)
 - ▣ Control Technique Guidelines (CTG)
- Regional Haze
- Air Toxics
 - ▣ National Emission Standards for Hazardous Air Pollutants (NESHAP)
 - ▣ Residual Risk

Other SC&A Air Quality/Climate Change Experience

- National Air Toxics Assessment
- Support to Indian Tribes
- Greenhouse Gas Emission Inventories and Reduction Strategies
- Climate Action Planning
 - ▣ State
 - ▣ Local
 - ▣ International

Climate Action Planning in China

- Provided training on greenhouse gas mitigation planning in Guangdong, Shanghai and Taiyuan, including:
 - ▣ GHG inventory and forecasting
 - ▣ Common data sources and how to address data gaps
 - ▣ Selecting applicable GHG mitigation policies
 - ▣ Quantifying costs and GHG reductions of various policies

Air Quality Evaluation - Modeling

Air Quality Modeling

- EPA Guideline on Air Quality Models (40 CFR 51, Appendix W)
- The Guideline is used by the EPA, states, tribes, and industry to prepare and review permits for new sources of air pollution.
- State and tribal air agencies also use the Guideline to revise their plans detailing strategies for reducing emissions and improving air quality known as State or Tribal Implementation Plans.

Air Quality Modeling

- Dispersion Models
 - ▣ AMS/EPA Regulatory Model (AERMOD)
 - ▣ CALINE3, CAL3QHC/CAL3QHCR (Mobile Source Impacts)
- Photochemical Grid Models
 - ▣ Community Multiscale Air Quality (CMAQ) Model
 - ▣ Comprehensive Air Quality Model with Extensions (CAMx)
 - ▣ Regional Modeling System for Aerosols and Deposition (REMSAD)
- Receptor Models
 - ▣ Chemical Mass Balance (CMB)
 - ▣ UNMIX
 - ▣ Positive Matrix Factorization (PMF)

Air Quality Models - AERMOD

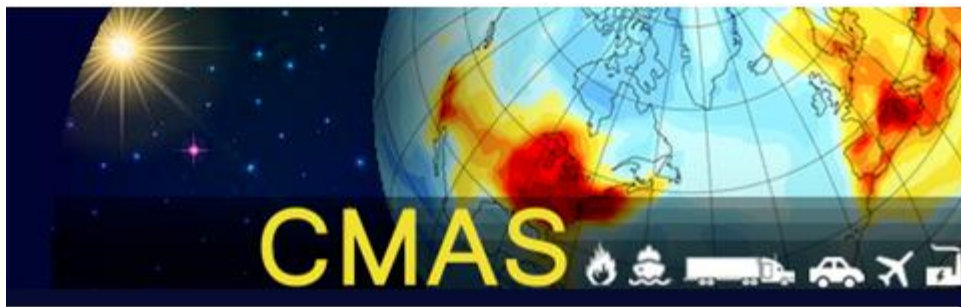
- Appendix W recommended/required model for:
 - ▣ Point, volume, and area sources;
 - ▣ Buoyant, elevated line sources (e.g., aluminum reduction plants);
 - ▣ Mobile sources;
 - ▣ Surface, near-surface, and elevated releases;
 - ▣ Rural or urban areas;
 - ▣ Simple and complex terrain;
 - ▣ Transport distances over which steady- state assumptions are appropriate, up to 50km;
 - ▣ 1-hour to annual averaging times; and
 - ▣ Continuous toxic air emissions.

Air Quality Models - AERMOD

- Inputs
 - ▣ Emission rates
 - ▣ Release characteristics
 - ▣ Location/coordinates
 - ▣ Nearby building/structure location and dimensions
 - ▣ Meteorological data
- Receptors
 - ▣ Cartesian grid receptor networks
 - ▣ Polar grid networks
 - ▣ Distinct
 - ▣ Elevated receptor heights

Air Quality Models - CMAQ

- CMAQ includes state-of-the-science capabilities for conducting urban to regional scale simulations of multiple air quality issues, including tropospheric ozone, fine particles, toxics, acid deposition, and visibility degradation.
- Open source framework - available on GitHub
- Active Support from U.S. EPA and International Modeling Community



Air Quality Models - CMAQ

- CMAQ consists of a suite of programs for conducting air quality model simulations. CMAQ brings together three kinds of models:
 - ▣ A meteorology model to represent weather.
 - ▣ Emission models to represent human-made and naturally occurring pollutants in the atmosphere.
 - ▣ A chemistry transport model to simulate the fate of air pollutants under varying atmospheric conditions.



Air Quality Models - CAMx

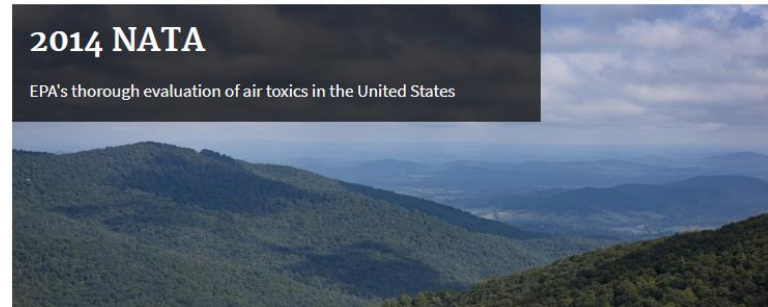
- CAMx is a state-of-the-science photochemical grid model that comprises a "one-atmosphere" treatment of tropospheric air pollution over spatial scales ranging from neighborhoods to continents
- Treats a variety of inert and chemically active pollutants - photochemical gases, particulates, mercury and toxics
- Developed and maintained by Ramboll Environ
- An open-source system available at zero cost

Air Toxics Evaluation - Models

- Human Exposure Model (HEM3)
 - Assesses risks from inhalation of air toxics
 - AERMOD
 - Meteorological data
 - Population data
 - Pollutant health reference value library
 - HEM4 under development using open source framework

Air Toxics Evaluation - NATA

- National Air Toxics Assessment (NATA)
 - Nationwide assessment of inhalation risks from:
 - Stationary sources
 - Non-point sources
 - Mobile sources
 - Risks at census tract level
 - Ability to determine pollutants of concern and sources of pollutants
 - Screening-level assessment



Emission Inventories

- EPA requires states to develop and submit inventories (50 CFR part 51, subpart A)
- EPA has developed many inventory-related resources and tools

Air Emissions Inventory Guidance Documents



MOtor Vehicle Emission Simulator (MOVES)

AP-42: Compilation of Air Emissions Factors

Air Emissions Inventory Improvement Program (EIIP)

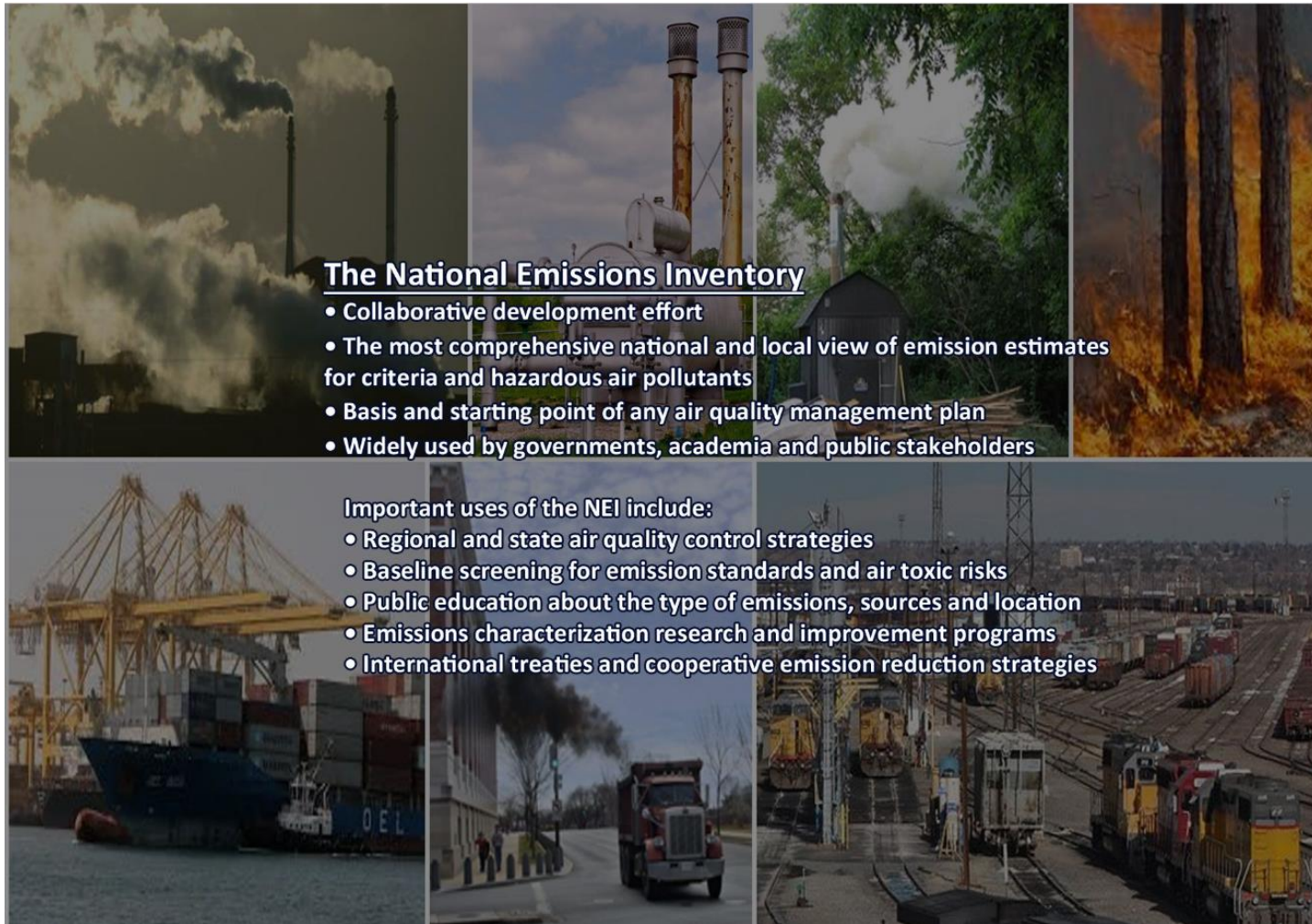
Emissions Inventory System (EIS) Gateway

Compliance and Emissions Data Reporting Interface (CEDRI)

WebFIRE

Electronic Reporting Tool (ERT)

National Emissions Inventory (NEI)



The National Emissions Inventory

- Collaborative development effort
- The most comprehensive national and local view of emission estimates for criteria and hazardous air pollutants
- Basis and starting point of any air quality management plan
- Widely used by governments, academia and public stakeholders

Important uses of the NEI include:

- Regional and state air quality control strategies
- Baseline screening for emission standards and air toxic risks
- Public education about the type of emissions, sources and location
- Emissions characterization research and improvement programs
- International treaties and cooperative emission reduction strategies

Air Quality Forecasting - AirNow

AirNow

- “One-stop” source for air quality data - local, state, national, and world views
- Partnership of the U.S. Environmental Protection Agency, National Oceanic and Atmospheric Administration (NOAA), National Park Service, NASA, Centers for Disease Control, and tribal, state, and local air quality agencies
- The U.S. Forest Service and NOAA provide fire and smoke data

AirNow

The screenshot displays the AirNow website interface. At the top, there is a blue navigation bar with the AirNow logo on the left and menu items: AirNow, AQI & Health, Fires, Maps & Data, Education, International, and Resources. A search icon is on the far right. Below the navigation bar is a dark grey banner with an alert: "Alert The new AirNow.gov - system status" and a search box: "Get Current and Forecasted Air Quality for Your Area" with a text input field containing "ZIP Code, City, or State" and a search icon.

The main content area is titled "Explore Maps & Data" and includes a "Back to top" button. It features a grid of seven feature tiles:

- Interactive Map:** Display current and forecast air quality conditions across the U.S. Drill down to explore data at individual monitors.
- Fires:** Explore current locations of wildfires, smoke plumes, and air quality monitors. Includes advisories and health information about wildfires.
- Embassies and Consulates:** Explore data from air quality monitors at select U.S. embassies and consulates around the world.
- Archives:** Find air quality maps and data for yesterday, last month, or last year.
- AirCompare:** Compare air quality by county to help with planning a vacation or relocating to a different city.
- EPA's Air Data:** Access air quality data from U.S. air monitors dating back to 1980. Create graphical displays, technical reports, or data files.

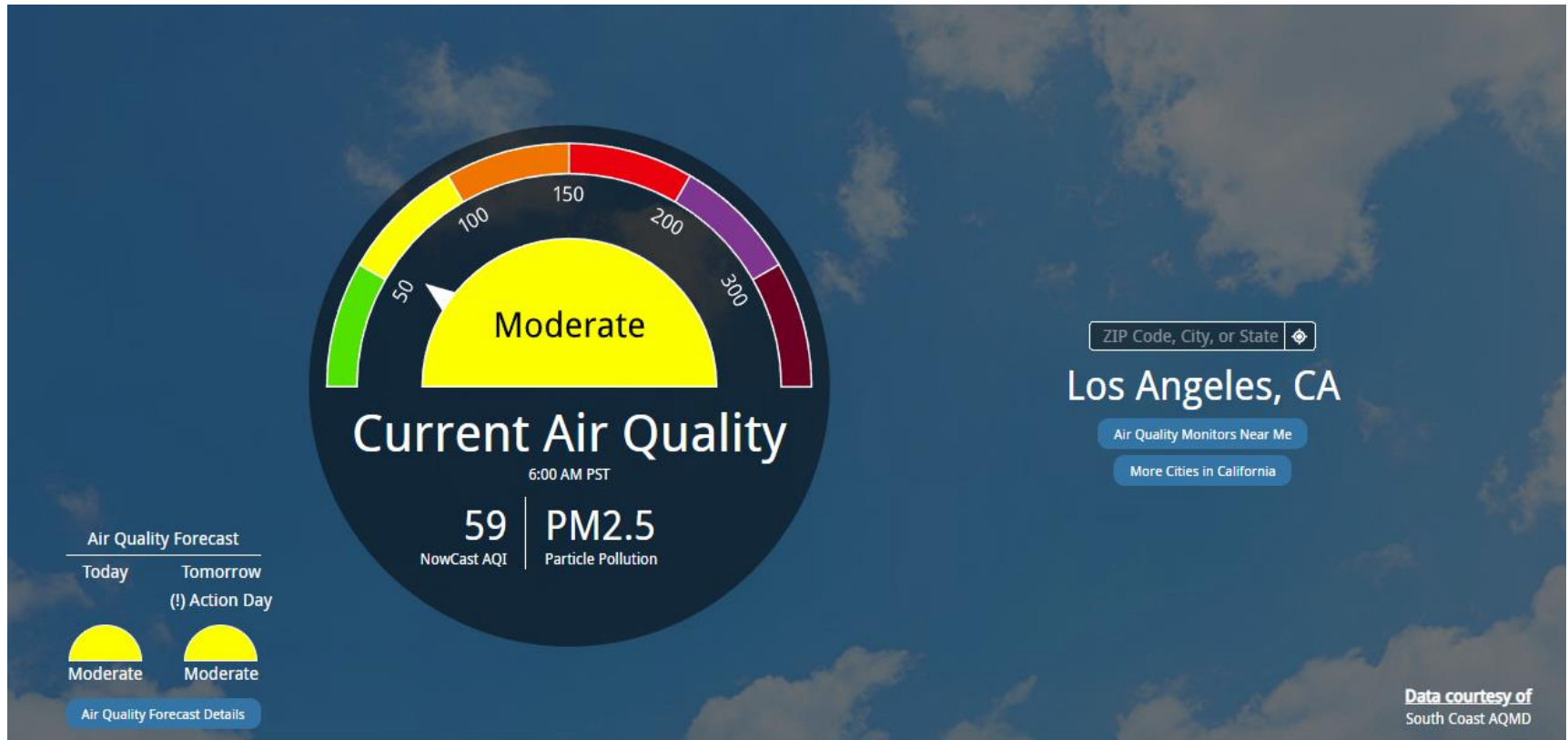
Air Quality Index

Daily AQI Color	Values of Index
Good Green	0 to 50
Moderate Yellow	51 to 100
Unhealthy for Sensitive Groups Orange	101 to 150
Unhealthy Red	151 to 200
Very Unhealthy Purple	201 to 300
Hazardous Maroon	301 and higher

- AirNow uses the official U.S. Air Quality Index (AQI)
- AQI is a color-coded index designed to communicate whether air quality is healthy or unhealthy.

AirNow – Local Air Quality

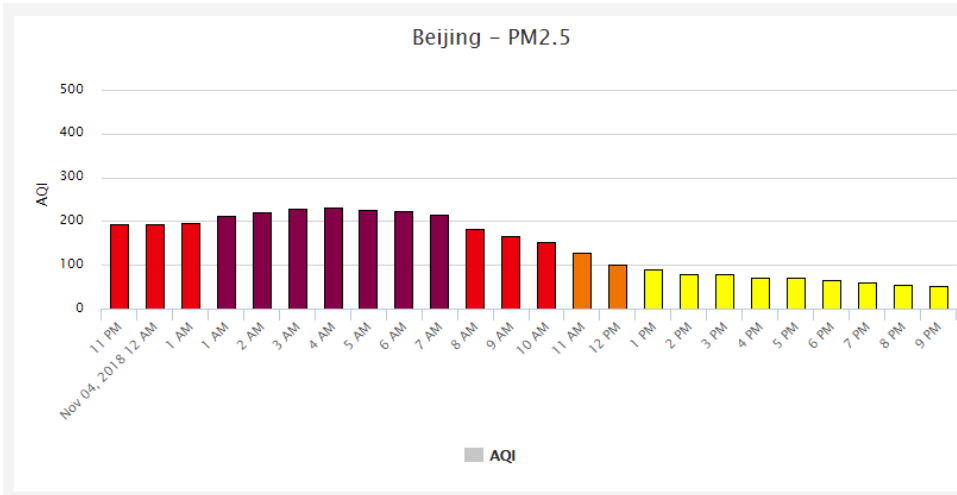
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AirNow – International Data

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- The Department of State provides data from U.S. Embassies and Consulates.



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