California-EPA
Air Resources Board
Compliance Training Section

Presents

Course #296
Health Risk Assessments and Dispersion Modeling

Presented By
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Recognition

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- David Harris (Santa Barbara APCD)
- Greg Harris, Steven Yee & Tony Servin (ARB SSD)
- Kerby Zozula (Ventura County APCD)
Overview

• Intended Audience
  – New Air Pollution Regulators
  – Environmental Compliance Professionals
  – Consultants

• Assumptions
  – Little to no experience with Dispersion Modeling and Health Risk Assessments

• Focus
  – Modeling for AB-2588
Overview

• Regulation and Regulators
  − Federal
  − State
  − Local

• History of Environmental Law
  − CAA 1970
  − CAA 1990
  − CEQA
  − AB-2588
Overview

• Types of Sources
  – Point
  – Area
  – Volume
Overview

• Why do we model
  – Federal Laws
  – State laws
  – Local District Rules and Policies

• Types of Modeling Tools
  – Prioritization
  – Screening
  – Refined
Overview

• Meteorological Data
  – Why do we need it
  – What is valid
  – Sources of data
  – Choosing the right data
Overview

- Exercises
  - Prioritization
  - Met Data
  - AERMET
  - AERMOD
  - HARP On-Ramp
  - HARP
Regulatory Agencies

- **US EPA**
  - Divided into Regions

- **California Air Resources Board**

- **California Air Districts**
  - Air Quality Management Districts (AQMD)
  - Air Pollution Control Districts (APCD)

- **California Air Pollution Control Officers Association**
California Air Basins (15)

- North Coast
- Lake County
- San Francisco Bay
- North Central Coast
- South Central Coast
- South Coast
- San Diego County
- San Joaquin Valley
- Great Basin Valleys
- Mojave Desert
- Salton Sea
- Northeast Plateau
- Sacramento Valley
- Mountain Counties
- Lake Tahoe
California Air Pollution Control

Air Districts (35)
Regulations
Air Pollution Regulation

1955 Air Pollution Control Act
1963 Clean Air Act of 1963
1966 Clean Air Act Amendments of 1966
1969 Clean Air Act Amendments of 1969
1970 Clean Air Act Amendments of 1970
1976 Toxic Substances Control Act of 1976
1976 Cal Environmental Quality Act
1987 AB-2588
1990 Clean Air Act Amendments of 1990
Why Do We Model
Why Do We Model

• Federal Laws
  – National Ambient Air Quality Standards (NAAQS)
  – Prevention of Significant Deterioration (PSD)
  – To substantiate that the increased emissions from a new or modified source will not cause or contribute to a violation of the Ambient Air Quality Standard
  – Criteria Pollutants
Why Do We Model

• State Laws
  - CEQA
    - Effects of development on air emissions
    - District may be responsible agency
  - AB-2588
    - Emissions of Toxic Air Contaminates (TACs)
    - Evaluate effects of emissions on public health
AB-2588 - The Air Toxics “Hot Spots” Information and Assessment Act
Types of Modeling Tools
Types of Modeling Tools

• Prioritization
  – CAPCOA Air Toxics “Hot Spots” Facility Prioritization Guideline.

• Screening Tool
  – San Joaquin Screening Tools
  – South Coast Screening Tools
  – SCREEN3
  – AERSCREEN
Types of Modeling Tools

- Refined Models
  - ISCST3
  - AERMOD
  - HARP
  - HARP On-Ramp
  - Lakes AERMOD View
  - Breeze AERMOD
  - BEEST AERMOD
  - Surfer AERMOD View
Fun with Toxics
Prioritization Exercise 1

A facility operates one 95 MMBtu/hr natural gas-fired boiler with an ultra-low NOx burner and SCR. The facility has indicated that the boiler runs 16 hours a day at full fire 365 days per year.
Prioritization Exercise 2

A facility operates rock screening system. The facility has indicated that the system processes a maximum of 250 tons of material per hour and 50,000 tons of material per year. This results in a maximum of 0.23 pounds of PM$_{10}$ per hour and 46 pounds of PM$_{10}$ per year.
Meteorological Data

- Meteorological Data
  - Why do we need it
  - What is valid
  - Sources of data
  - Met data for you (Exercise)
Meteorological Data

• Valid Types of Data

National Oceanic and Atmospheric Administration (NOAA) - National Climate Data Center (NCDC)

• Integrated Surface Hourly Database (ISHD)
  - Hourly observations
  - TD-3505

• Automated Surface Observation Stations (ASOS)
  - Minute-by-minute observation
  - TD-6405
Meteorological Data

• Valid Types of Data

National Oceanic and Atmospheric Administration (NOAA) - National Climate Data Center (NCDC)

• Quality Controlled Local Climate Data (QCLCD)
  - Hourly data
  - Cloud cover not reported as a numerical value
  - Wind speed is represented in knots instead of mph
  - Has to be converted to SAMSON format
Meteorological Data

• Valid Types of Data

National Oceanic and Atmospheric Administration (NOAA) – Earth System Research Laboratory (ESRL)

– Upper Air Data
– 7 sites in California
– Winds and temperature aloft
Meteorological Data

• Valid Quantities of Data
  • Federal EPA
    - Prevention of Significant Deterioration (PSD)
    - 1 year of onsite data
    - 5 consecutive years of offsite data
    - No more than 10% missing data per quarter
  • AB-2588, CEQA, District NSR
    - 1 year if most conservative
    - 5 consecutive years of offsite data
Your Met Stations KML Exercise
Downloading Your Met Data
QA/QC Your Met Data
ISH Data Abbreviation Tool
Your First AERMET Run
AERMET Multi-Year Utility

AERMET View™
AERMOD Meteorological Preprocessor

Version 8.1.0

Multi-Year Files Utility

Specify Met Data Files to be Combined into the Multi-Year File:

<table>
<thead>
<tr>
<th>Year</th>
<th>Station #</th>
<th>Met Data File</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Save Multi-Year Met Data File As:

Format: 

# of Files: 0

Tip

This utility can combine more than one year of met data into one single multi-year file. The following file formats are supported: SCRAM surface met data, CD144 surface met data, SAMSON surface met data and TD-6201 upper air met data. The Multi-Year file can then be processed using AERMET View.
Your First AERMOD Run
AERMOD Exercise 1
HARP On-Ramp Exercise
HARP Exercise
Detailed Risk Plots

HARP OnRamp Menu

Step 0 - Start New Project
Step 1 - Import Model Input File
Step 2 - Import Model Plot files
Step 3 - Import Transaction File
Step 4 - Add Emissions
Step 5 - Source Reference
Step 6 - Create HARP file(s)
Create Simple Risk Plots
Create Detailed Risk Plots
Close Menu

Import HARP Output file

Significant Digits
- 3 digit

File Type
- Acute
- Chronic
- Cancer

File Location

Plot File Format
- BEEST
- Surfer
- LAKES

Import HARP Output File
Import HARP Receptor File
Create Plot Files
Close Form
Detailed Risk Plots
AERMOD Exercise 2
HARP On-Ramp Exercise 2

Step 1 of 5: Select Modeling System and Default Settings

Modeling System

- AERMOD
- ISC3
- ARB’s screening meteorological file was used (Set Screening mode to ON)
- CALPUFF

CSV (Select this option if the air dispersion model that was used is not listed above. To import your data, you will need to manually format your files into comma-separated values.)

Default Settings

HARP requires information that may not be part of your dispersion run. Choose the settings that are appropriate for your dispersion run. The information on this screen will be used to fill in the data gaps.

Coordinate System
- UTM WGS 84
- UTM NAD 83
- UTM NAD 27
- Teste Albers NAD83
- None

CO/AB/DIS
- County: 34
- Air Basin: SV
- District: SAC

Zone
- 10

CA is 10 or 11
Additional Tools

• Gaussian Dispersion Model

Gaussian Dispersion Model

This spreadsheet can be used to calculate the concentration of a single pollutant from a point source. It is intended to be used to introduce the math used in dispersion modeling programs. Although this is a simple example, the equations used in this spreadsheet are the same used in practice.

\[ C(x, y, z) = \frac{Q}{2 \pi \sigma_u \sigma_v \sigma_w} \exp \left( -\frac{x^2}{2 \sigma_u^2} - \frac{y^2}{2 \sigma_v^2} - \frac{z^2}{2 \sigma_w^2} \right) \]

The diagrams above are illustrations of the type of emissions plume that was talking about. There is a stack that is emitting something. The exhaust plume may be hotter than the surrounding air and it may be moving faster. For the sake of this exercise, we’ll assume that the wind is blowing and that the terrain surrounding the emissions source is flat and level. As you can see, there are two graphs that look like bell curves at separate points in the plume. That is in fact what they are, the math that produces a bell curve is called a Gaussian distribution.

Although this is a relatively simple-looking equation, there is a fair amount of math that has to be done to derive each of the parameters that you see. So let’s go over what all of this stuff means, then we’ll start working everything out.
Additional Tools

San Joaquin Valley APCD
Procedure for Downloading & Processing NCDC Meteorological Data

San Joaquin Valley APCD’s Dispersion Modeling Training Manual
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