Analysis of Ambient Air Monitoring Data for New Source Review Permitting
A Texas Perspective

Presented at:
A&WMA Gulf Coast Chapter Meeting
October 6th, 2015

Presented by
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- Importance of Monitoring Data in NSR Permitting
- Available Monitoring Data in Texas
- Selection of Monitor(s) for Background Concentration
- Refinements in Background Concentrations
NSR Permitting

Why is ambient air quality data important?
Ambient air quality determines whether the project is in an *Attainment* or *Non-attainment* area.

For any NSR permitting in attainment areas, the **NAAQS Compliance Demonstration** is a critical requirement for permit approval.

Existing ambient air monitoring data provides the **Background Air Concentration**, which is one of the elements of NAAQS compliance demonstration.
Role of Background Concentration in NSR Permitting

Does the Project Impact Exceed SIL?

Yes

NAAQS Compliance Demonstration

PSD Increment Compliance Demonstration

NAAQS

Background

Other Sources

Project

NAAQS

Yes
Regulatory Definition of Background Concentration

USEPA Definition

“Air contaminant concentrations present in the ambient air that are not attributed to the source or site being evaluated.”

(Ref: 50 CFR 51 Appendix W)

TCEQ Definition

“Air contaminant concentrations present in the ambient air that are not attributed to the source or site being evaluated”

(Ref: Air Quality Modeling Guidelines APDG 6232 April 2015)
What is Background Concentration?

EPA Description of Background Concentration

“Background air quality includes pollutant concentrations due to natural sources, nearby sources other than the one(s) under consideration, and unidentified sources.”

(Ref: 50 CFR 51 Appendix W)

TCEQ Description of Background Concentration

“The purpose of representative background monitoring concentrations is to account for sources not explicitly modeled in an air dispersion modeling analysis.”

“The ambient monitor selected should be “conservative” or “representative” of the area near the source.

“Near” means within 1 km of the location of maximum cumulative impact. Monitoring data within 10 km is also acceptable.

(Ref: Air Quality Modeling Guidelines APDG 6232 April 2015)
Ambient Monitoring Data Requirements for NSR

- **Availability:**
  - Is the ambient air monitoring data available near the proposed project? If not then what do you do?

- **Validity:**
  - Is the available ambient air monitoring data of acceptable quality? How to determine?

- **Representativeness:**
  - Is the ambient air monitoring data representative of the air quality near the proposed facility?
Available Ambient Air Monitoring Data in Texas
EPA & TCEQ Ambient Monitoring network

Monitoring Data Since 90’s

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx</td>
<td>46</td>
</tr>
<tr>
<td>SO2</td>
<td>28</td>
</tr>
<tr>
<td>CO</td>
<td>27</td>
</tr>
<tr>
<td>PM$_{10}$</td>
<td>43</td>
</tr>
<tr>
<td>PM$_{2.5}$</td>
<td>103</td>
</tr>
<tr>
<td>Ozone</td>
<td>73</td>
</tr>
<tr>
<td>Toxics</td>
<td>35</td>
</tr>
<tr>
<td>Total</td>
<td>355</td>
</tr>
</tbody>
</table>

Ref: Five Year Ambient Monitoring Network Assessment (2015)

Data Sources:
EPA Airdata
www.epa.gov/airquality/airdata/

TCEQ GeoTAM
www17.tceq.texas.gov/tamis/
A World of Solutions

Texas Coastal Areas – NOx Monitoring Network

This map was generated by the Office of Compliance and Enforcement, Monitoring Division of the Texas Commission on Environmental Quality and is for informational purposes only and may not be prepared for or be suitable for legal, engineering, or surveying purposes. It does not represent an on-the-ground survey and represents only the approximate relative position as of Tuesday, May 05, 2015 for property boundaries. For information concerning this map, contact the Monitoring Division at (512) 233-1710.

Source: 2013 Emissions Inventory Point Source and 2011 Emissions Inventory Non-Point Source

Texas Commission on Environmental Quality
Office of Compliance and Enforcement
Monitoring Division
PO Box 12087
Austin, Texas 78711-3087

Tuesday, May 05, 2015
Texas Coastal Areas – PM$_{10}$ Monitoring Network

Monitoring Sites
- Active PM$_{10}$ Sites
- Inactive PM$_{10}$ Sites
- Urbanized Area

PM$_{10}$ (TPY)
- 0.001 - 576.06
- 576.07 - 1159.11
- 1159.12 - 1734.17
- 1734.18 - 2312.23

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Source: 2010 Emissions Inventory Point Source and 2011 Emissions Inventory Non-Point Source

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Office of Compliance and Enforcement
Monitoring Division
PO Box 12567
Austin, Texas 78711-3067

Tuesday, March 10, 2015
Central Texas Areas – NOx Monitoring Network

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Source: 2013 Emissions Inventory Point Source and 2011 Emissions Inventory Non-Point Source.
Central Texas Areas – SO2 Monitoring Network

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Source: 2013 Emissions Inventory Point Source and 2011 Emissions Inventory Non-Point Source

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Monitoring Division
PO Box 13087
Austin, Texas 78711-3087
Tuesday, March 17, 2016
Central Texas Areas – PM$_{2.5}$ Monitoring Network

PM$_{2.5}$ Contributions

- **8,153.255 Point Source**
- **64,364.37 Area Source**
- **3,070.53 On-Road Mobile Source**
- **5,162.35 Non-Road Mobile Source**

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Source: 2013 Emissions Inventory Point Source and 2011 Emissions Inventory Non-Point Source

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Tuesday, March 17, 2015
NO₂ Design Background Values for Monitors in Texas

- Design Background Concentration
- Annual NAAQS

Ambient Monitoring Data from Texas Monitors

Houston-Sugar Land-Baytown

El Paso

53 ppb
NO$_2$ Design Background Values for Monitors in Texas

Ambient Monitoring Data from Texas Monitors

- El Paso: NO$_2$ (ppb)
- Tyler: NO$_2$ (ppb)

1-Hour NAAQS: 100 ppb
PM2.5 Design Background Values for Monitors in Texas

Ambient Monitoring Data from Texas Monitors

- Corpus Christi: 35 ug/m³
- El Paso: 24-Hour NAAQS

Design Background Concentration

PM2.5 (ug/m³)
PM2.5 Design Background Values for Monitors in Texas

**Design Background Concentration**

**Annual NAAQS**

12 ug/m³

**Ambient Monitoring Data from Texas Monitors**

Houston-Sugar Land-Baytown

Austin-Round Rock
Variability of Hourly and Daily Average Data

2014 Hourly NO2 (PPM)

2014 Daily PM2.5 (ug/m3)
Since 1980, HRM-member companies have invested over $30M in air monitoring. HRM operates nine air monitors in the region (http://hrm.radian.com/)

This data is shared with the TCEQ, the City of Houston and Harris County. Also shared with citizens, elected officials and other agencies

Criteria Air Pollutants
- Ozone; Particulate Matter; Oxides of Nitrogen; Carbon Monoxide; Sulfur Dioxide; VOC; and Lead

Meteorology
Validity of the Data
• USEPA provides criteria of “valid data” in 40 CFR 50
  – Appendix N (PM$_{2.5}$); Appendix S (NO$_2$); Appendix T (SO$_2$)

**Example**

*Preferred (1-hour NO$_2$):*

• 75% daily data capture for each day and 75% data capture for each quarter and all four quarters are complete

*Minimum (1-hour NO$_2$):*

• 50% data capture in any quarter

• Need to conduct a prescribed data substitution tests
  – Highest daily maximum 1-hour value - conservative
Hourly NO$_2$ Data Capture in Texas Monitors
CY 2014
Hourly PM$_{2.5}$ Data in Texas Monitors
CY 2014
Selection of Monitor(s) for Background Concentration
**Monitor Nearby (within 10 km)**
Use the data from that monitor

**No Nearby Monitor but a Single Monitor in County**
Use the data from that monitor but need to show it is representative for capturing “other” sources not explicitly modeled

**No Nearby Monitor but Multiple Monitors in County**
Select the monitor which is either “representative” or “conservative” for the project site based on urban/rural, emissions within 10 km radius
**What if there are no monitors in the County?**

- Use the data from an adjacent county or any other county "**representative**" or "**conservative**" of the expected ambient air quality near the project
  - Terrain and landuse
  - Population data (as a measure of mobile and area source emissions)
- Type of emission sources and emission rates

<table>
<thead>
<tr>
<th>Location</th>
<th>County Population (2010 Census)</th>
<th>Landuse</th>
<th>NOx Emissions (tpy) within 10 km</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposed Site</td>
<td>20000</td>
<td>Light Industrial</td>
<td>300</td>
<td>-</td>
</tr>
<tr>
<td>Proposed Monitor 1</td>
<td>25000</td>
<td>Light Industrial</td>
<td>410</td>
<td>Representative</td>
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<tr>
<td>Proposed Monitor 2</td>
<td>210,000</td>
<td>High Industrial</td>
<td>1500</td>
<td>Conservative</td>
</tr>
</tbody>
</table>

**Wind rose showing sources affecting the monitor - optional**
Refinement of Background Concentration
Case Studies
TCEQ Refinement – Option 1

• Exclude the hours of data when the monitor is within 90 degree arc from the source(s)

• Recalculate the design value based on remaining hours of data

Design Background Concentration

Before: 25.3 ppb
After: 22.7 ppb
Change: 10.3%
• Identify the receptors with >significant concentrations from the project

• Determine the subset of meteorological conditions associated with these hours of impacts

• Screen the monitoring data for this subset of meteorological conditions from hourly monitoring data

• Use this screened monitoring data to estimate the background concentration
Find a monitor that is **not affected** by the point sources being explicitly modeled

**How?**

*Model the sources* at the monitor and make a judgment based on the impact

And/or

*Analyze the wind pattern* and make qualitative assessment
Temporal Pairing of Monitored and Modeled Data?

Need detailed evaluation and buy in from agencies
Project-Specific Ambient Ratio for 1-hr NO2?

Average Hourly NO\textsubscript{X}(PPB) vs. Average Hourly NO\textsubscript{2}/NO\textsubscript{X} Ratio

<table>
<thead>
<tr>
<th>Cumulative Impact (ppb)</th>
<th>Site-Specific ARM</th>
<th>ARM2</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>0.65</td>
<td>1.0</td>
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<tr>
<td>50</td>
<td>0.45</td>
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<tr>
<td>100</td>
<td>0.27</td>
<td>0.72</td>
</tr>
<tr>
<td>200</td>
<td>0.20</td>
<td>0.35</td>
</tr>
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</table>

ARM2 Figure Ref: “ARM2’d to the Teeth What’s New with ARM2? By Richard Hamel; 11th Modelers Conference, August 12th, 2015”
- Ambient air quality data near project site deserves attention in early stages of the project

- USEPA/TCEQ databases are good sources of data – Large number of monitors in Texas

- Approach should be not to be too conservative in selection of monitor

- Refinement in background concentration may be needed in some projects – Resource intensive - Get TCEQ involved early
Thanks for Your Patience

Questions?

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