Air Dispersion Modeling Challenges in Demonstrating Compliance with $PM_{2.5}$ and NO_2 NAAQS in Louisiana

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Topics

- ***NSR Permitting Process***
- ***Modeling Challenges for Short-term NAAQS***
- ***State-Specific Permitting Issues***
- ***Conclusions***











NSR Permitting Process

NSR Permitting Basics

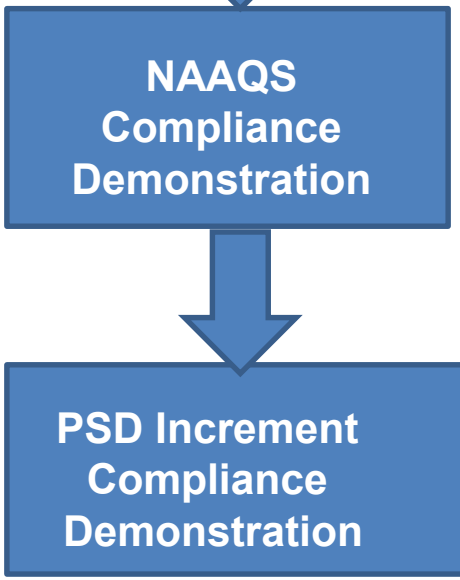
- ***Major Sources and modifications*** require NSR permits
- For any NSR permitting in attainment areas, ***NAAQS Compliance Demonstration*** and ***PSD Increment Compliance Demonstration*** are critical requirements for permit approval
- ***Air Dispersion Modeling*** is used for both demonstrations

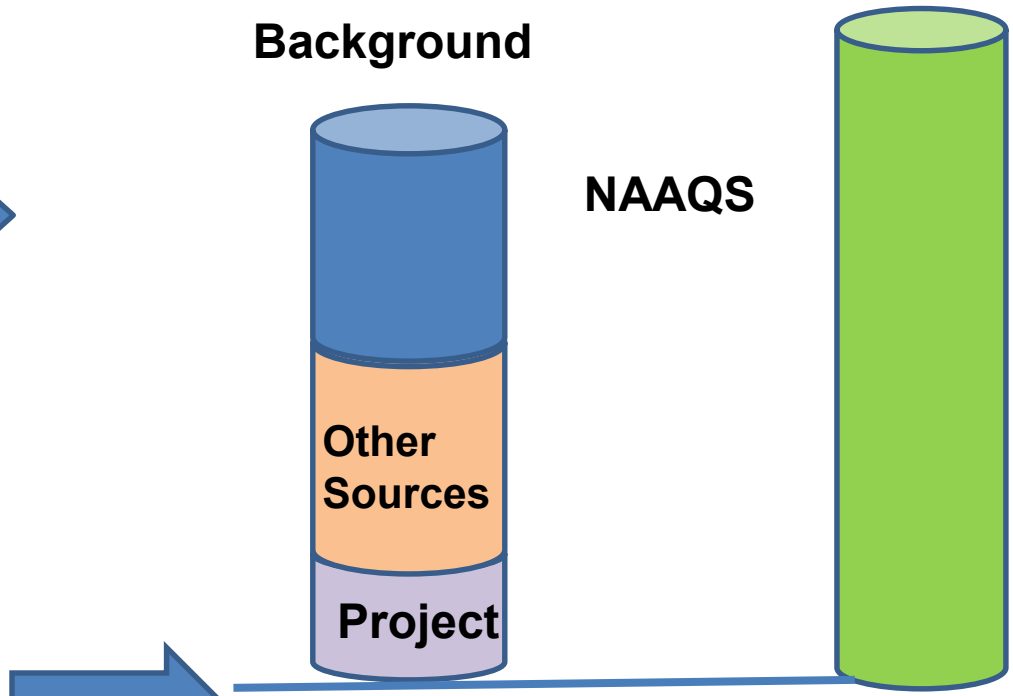




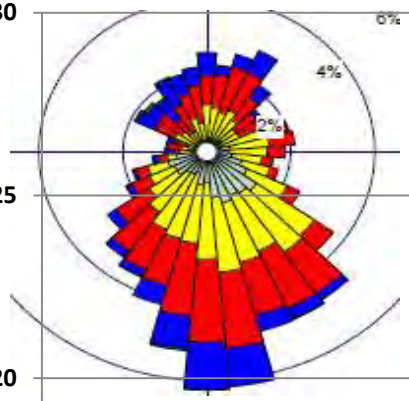

NSR Modeling Basics

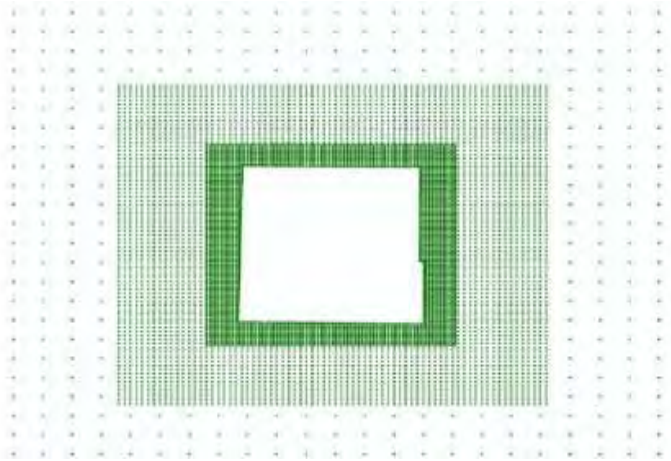
Yes





Concept of 1-hour NO2 NAAQS





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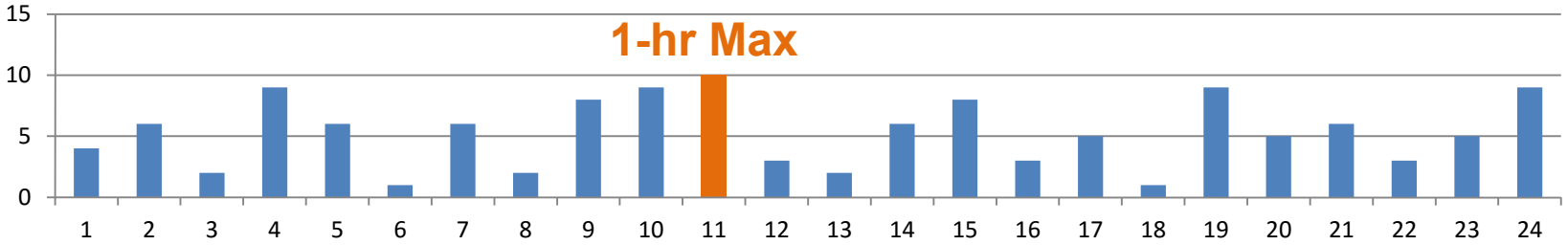
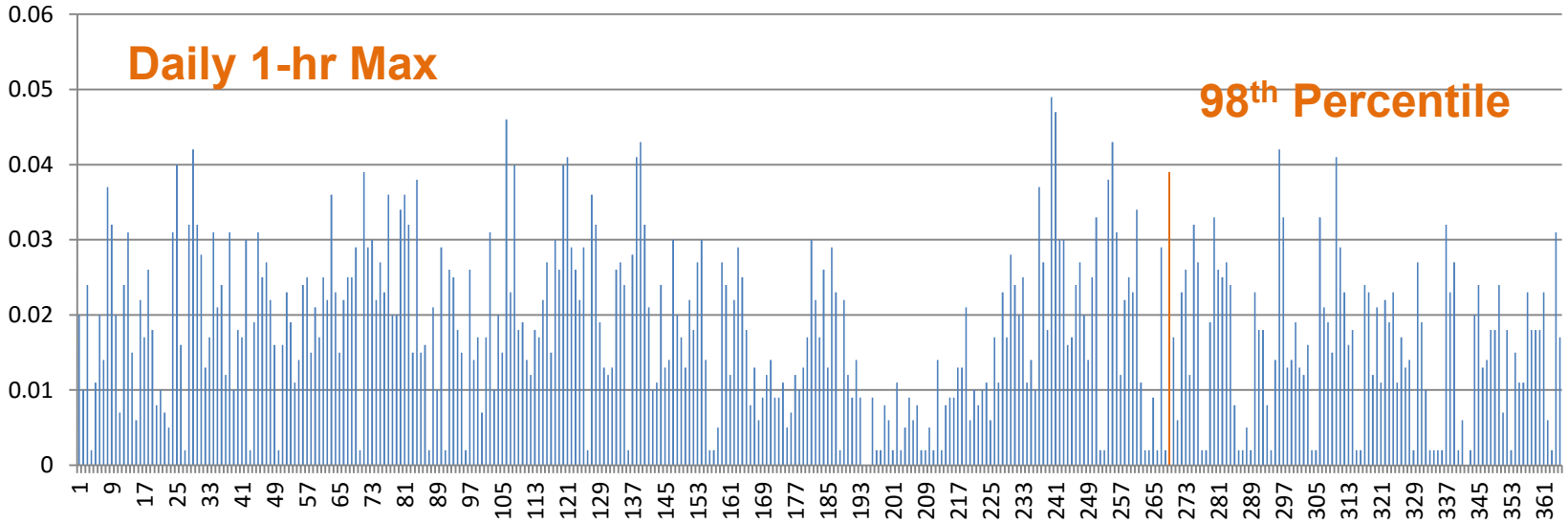




Design Background Concentration (ppm)	
2012	0.033
2013	0.035
2014	0.034
Average	0.0340











Modeling Challenges for Short Term NAAQS

Modeling Challenges – Short Term Statistical Standards

- ***Short Term Emission Profiles***
  - Start-up/Shutdowns and cycling operations
- ***Cumulative Modeling Data Availability***
  - How complete is the data?
- ***Representative Background Concentration***
  - Is the ambient air monitoring data representative of the air quality near the proposed facility





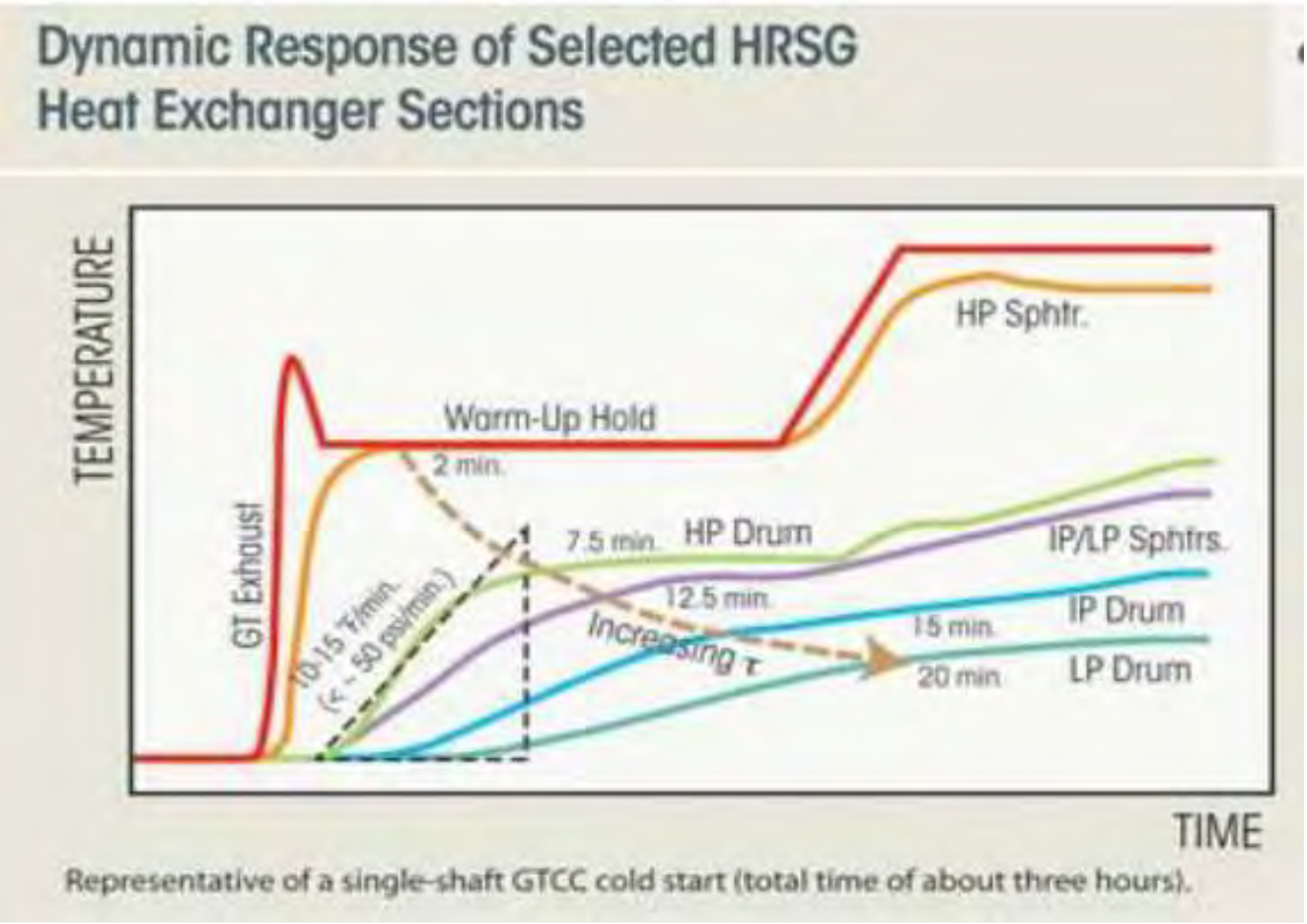






Short Term Emission Profile

Short Term Emission Profiles



Representative of a single-shaft GTCC cold start (total time of about three hours).






Short Term Emission Profiles

			NOx Emissions			
Minute	GT Condition	GT Load	Uncontrolled (Lb/Hr)	Uncontrolled (Lbs)/min	Control Efficiency	Controlled (Lbs/min)
1	0 to 20% Load Ramp Up	0.0%	10.000	0.17	0%	0.17
2	0 to 20% Load Ramp Up	10.0%	10.000	0.17	0%	0.17
3	0 to 20% Load Ramp Up	20.0%	11.000	0.18	0%	0.18
4	Low Speed Hold	20.0%	14.000	0.23	0%	0.23
5	Low Speed Hold	20.0%	15.000	0.25	0%	0.25
6	Low Speed Hold	20.0%	16.000	0.27	0%	0.27
7	High Speed Hold	20.0%	25.000	0.42	0%	0.42
8	High Speed Hold	20.0%	30.000	0.50	0%	0.50
9	High Speed Hold	20.0%	35.000	0.58	0%	0.58
10	High Speed Hold	20.0%	40.000	0.67	0%	0.67
11	High Speed Hold	20.0%	60.000	1.00	0%	1.00
12	Op Mode 1	20.0%	70.000	1.17	0%	1.17
13	Op Mode 1	20.0%	70.000	1.17	0%	1.17
14	Op Mode 1	20%	70.000	1.17	0%	1.17
15	Op Mode 1	20%	70.000	1.17	0%	1.17
16	Op Mode 1	20%	70.000	1.17	50%	0.58
17	Ramp to Op Mode 2	20%	80.000	1.33	50%	0.67
18	Ramp to Op Mode 2	20%	90.000	1.50	90%	0.15
19	Op Mode 2	20%	100.000	1.67	90%	0.17
20	OP Mode 2	20%	100.000	1.67	90%	0.17
			Averaged Hourly Emissions			
			Maximum Hourly Emissions			











Data Availability for Cumulative Modeling

Cumulative Modeling Data Availability

- NAAQS modeling require ***"other" sources*** within AOI + 50 KM
- Data from EDMS is ***not directly usable*** for modeling
- Typical Issues are ***lack of emission data and stack parameters***
- Some data are ***questionable***
- Need to ***be careful in selection of modeling parameters*** for "other" sources






Cumulative Modeling Data Availability

Missing Parameter	Sum of Missing Parameters
Diameter	339
Discharge Area	1,940
Exit Gas Flow Rate	391
Exit Gas Temperature	272
Exit Gas Velocity	382
Height	255
Hours of Operation (hours/yr)	8
Max Operating Rate	277
Normal Operating Rate	308
Grand Total	**4,172**






A Recent Case Study






Representative 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)

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)





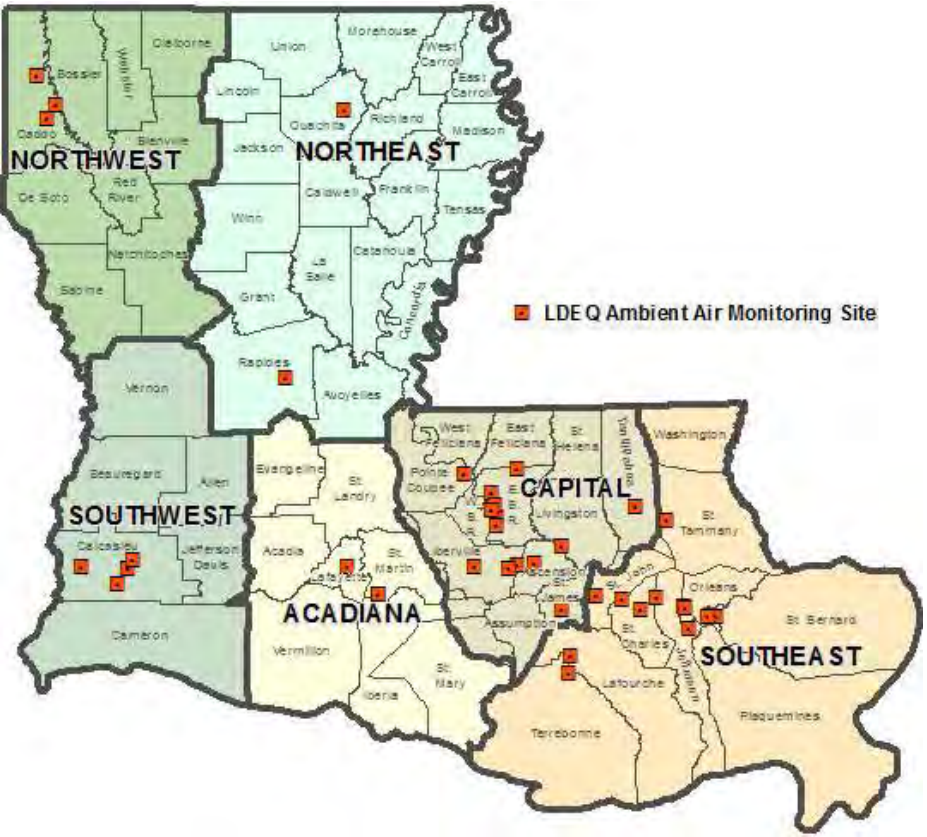

Ambient Monitoring Data Requirements for NSR

- ***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 is of acceptable quality? How to determine?
- ***Representativeness:***
  - Is the ambient air monitoring data representative of the air quality near the proposed facility?






EPA & LDEQ Ambient Monitoring network



Monitoring Data Since 90's

NOx	9
SO2	6
CO	2
PM_{10}	5
$PM_{2.5}$	17
Ozone	21
Total	**60**

Ref: Five Year Ambient Monitoring Network Assessment (2015)

Data Sources:

EPA Airdata

www.epa.gov/airquality/airdata/

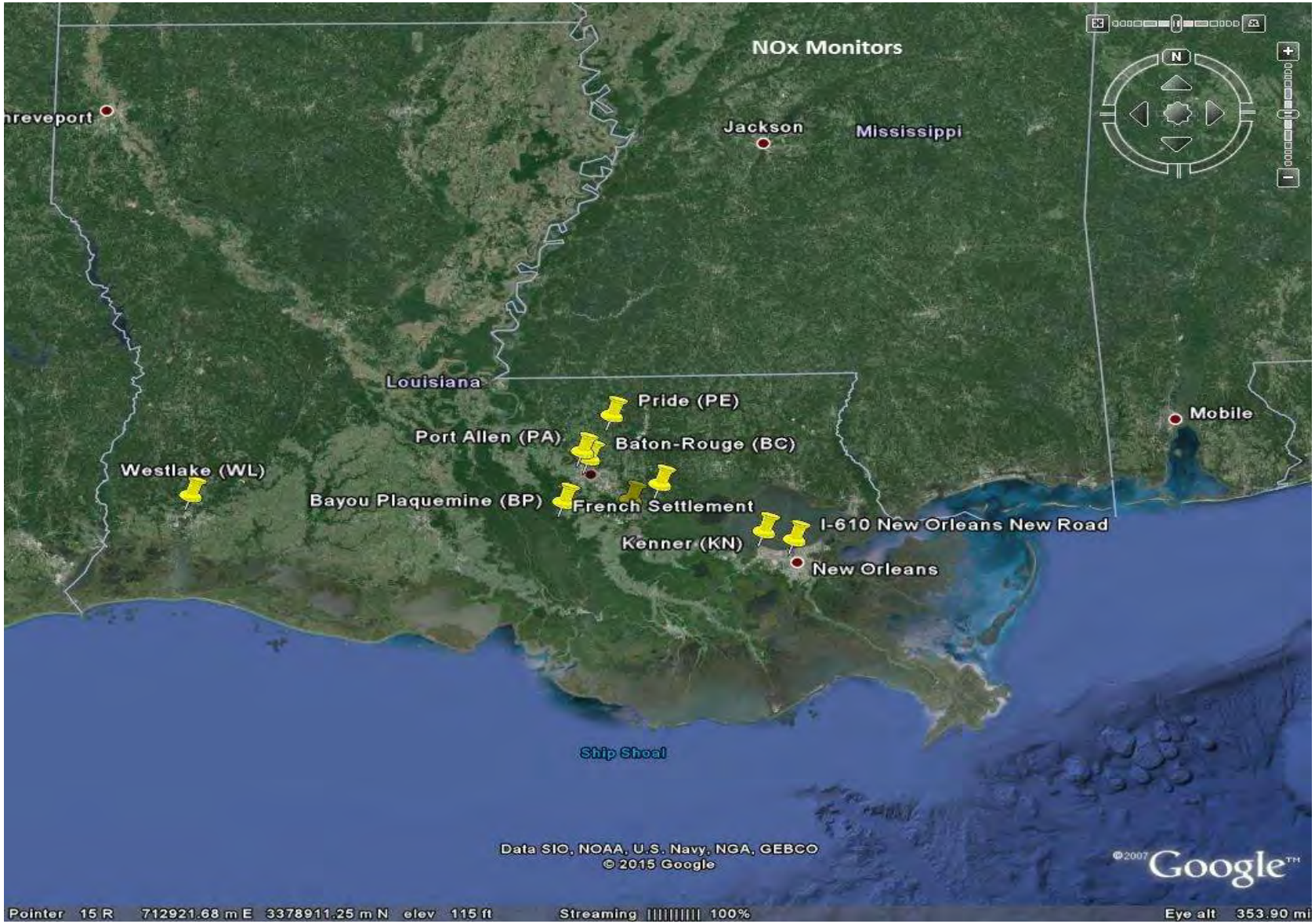
LDEQ

http://www.deq.louisiana.gov/portal/DIVISIONS/Assessment/AirFieldServices/AmbientAirMonitoringProgram/AmbientAirMonitoringDataandReports.aspx

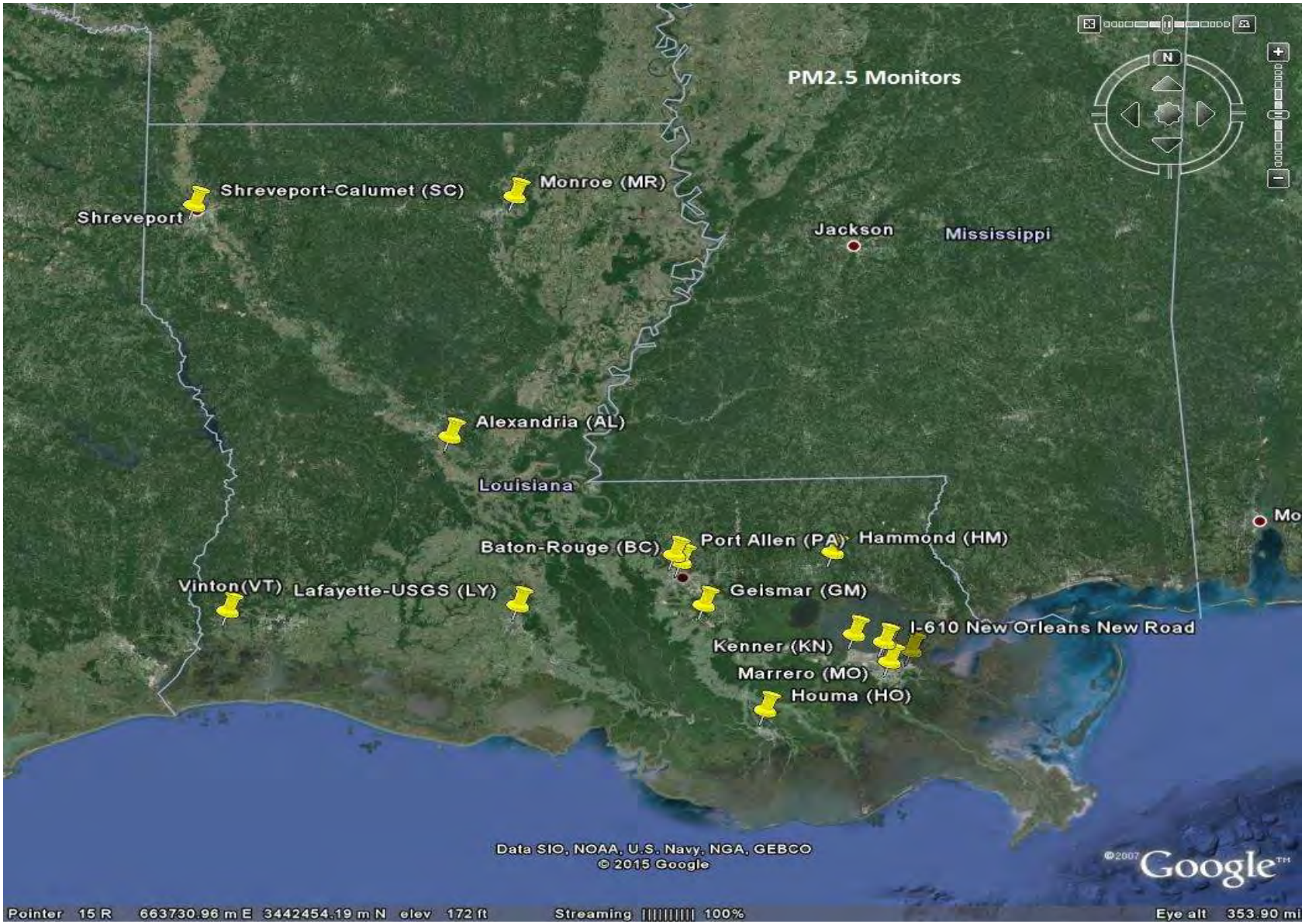




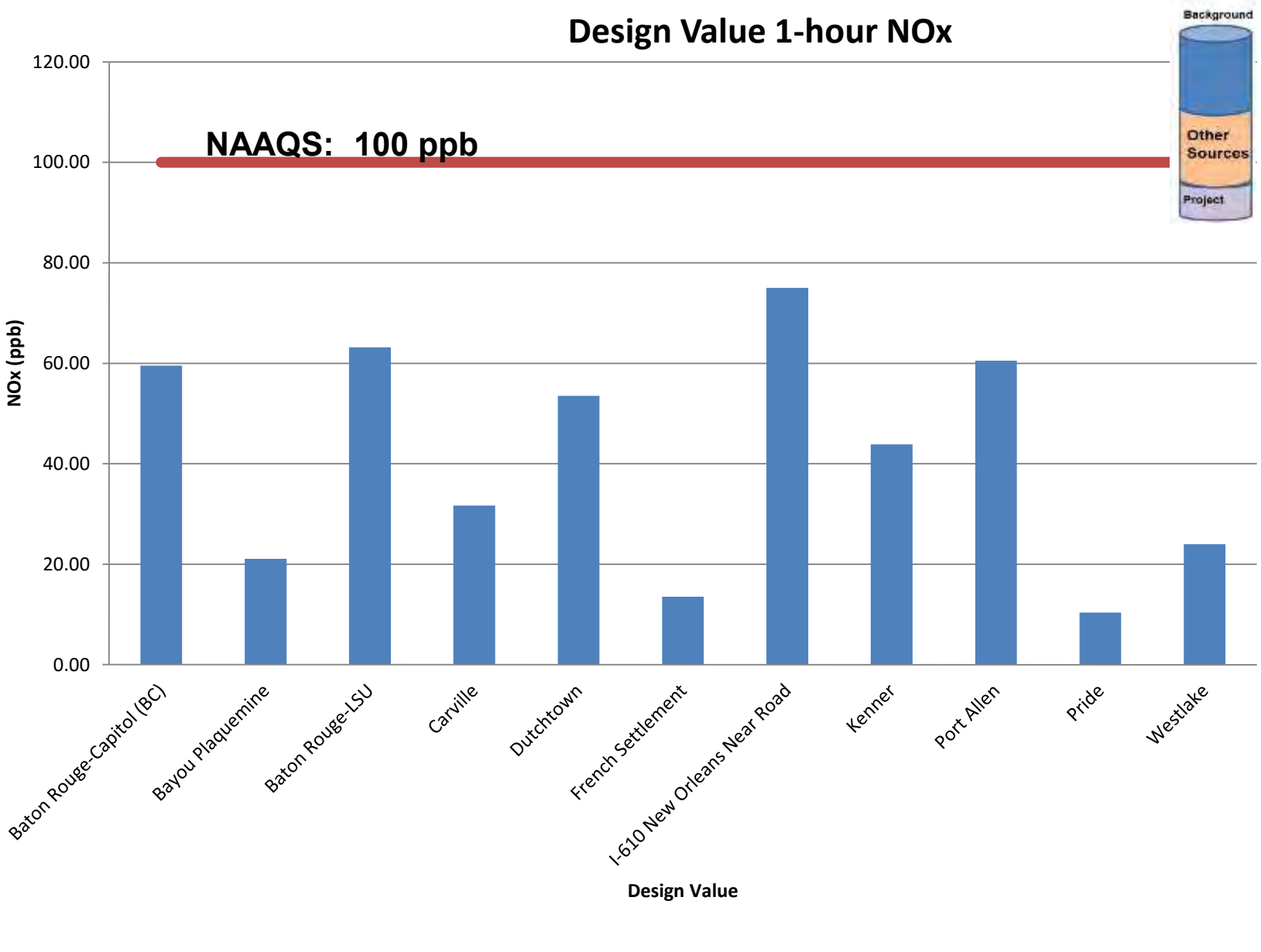

NO_X Monitoring Network



$PM_{2.5}$ Monitoring Network



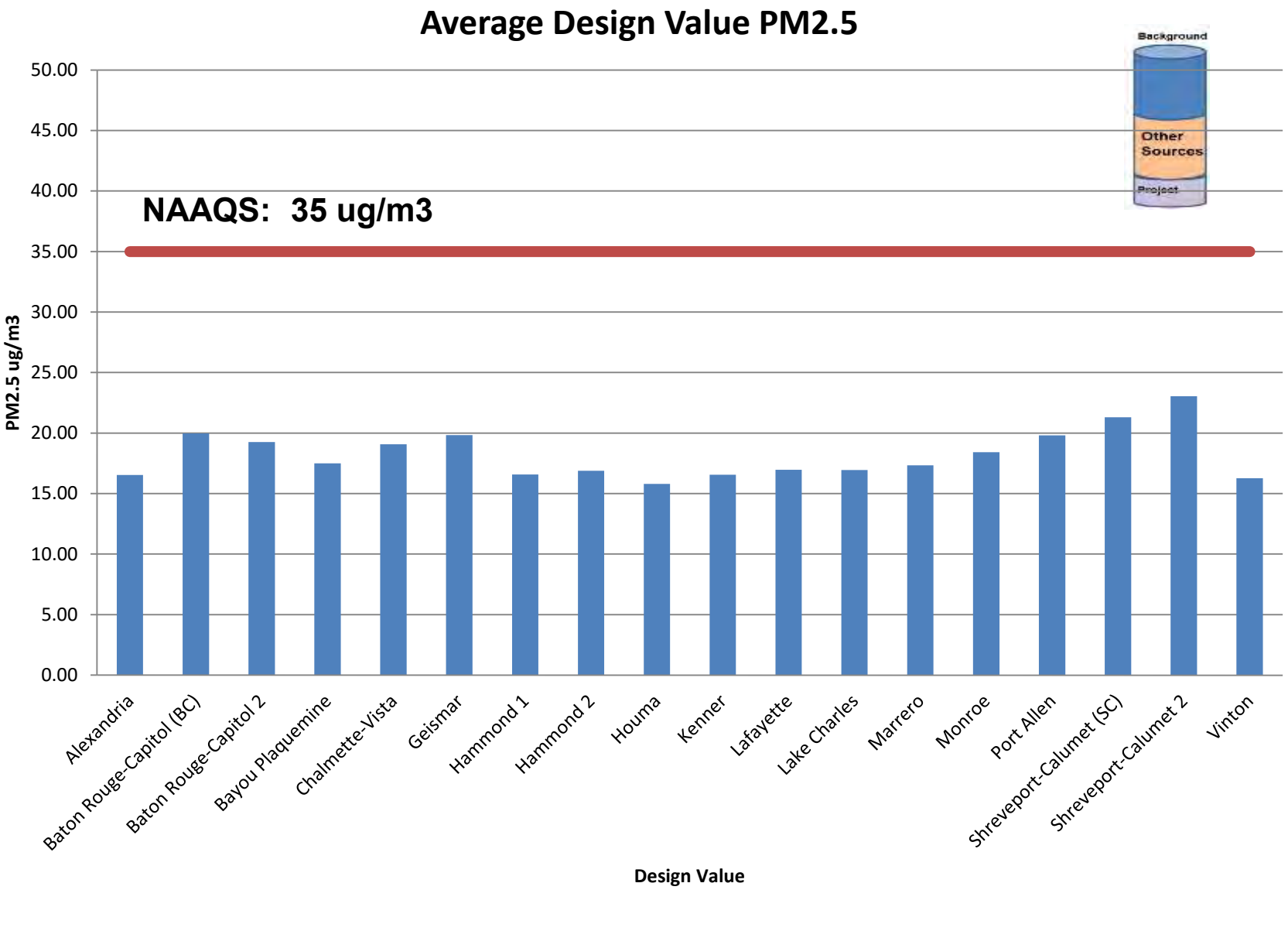
NO_2 Design Background Values for Monitors in Louisiana



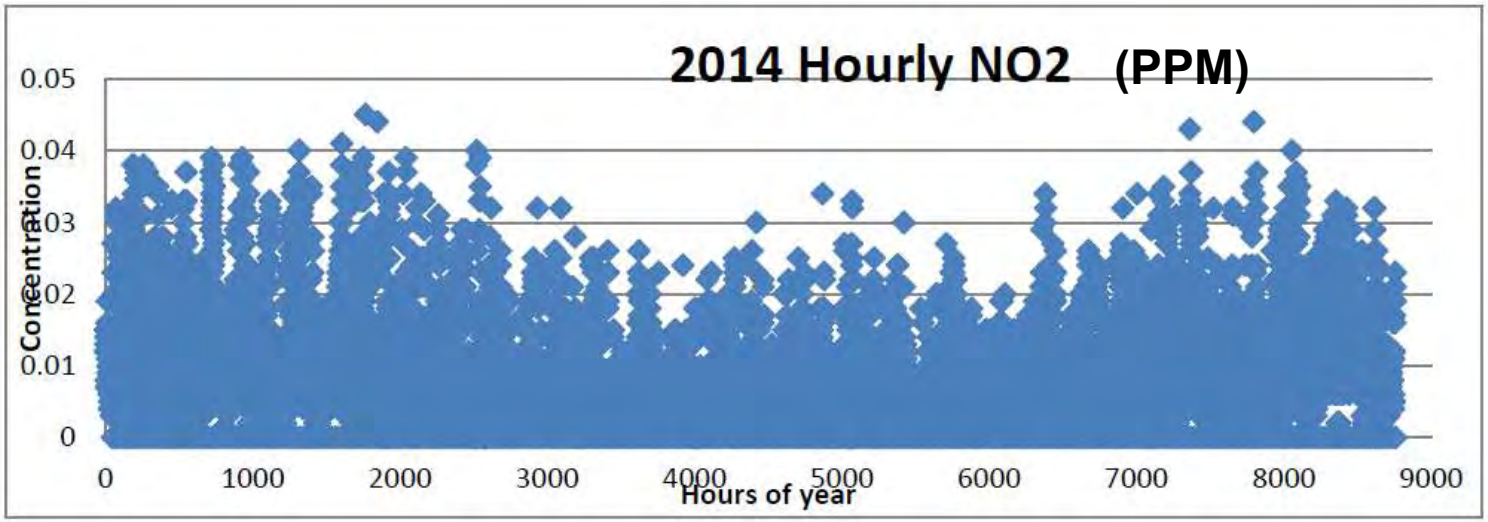


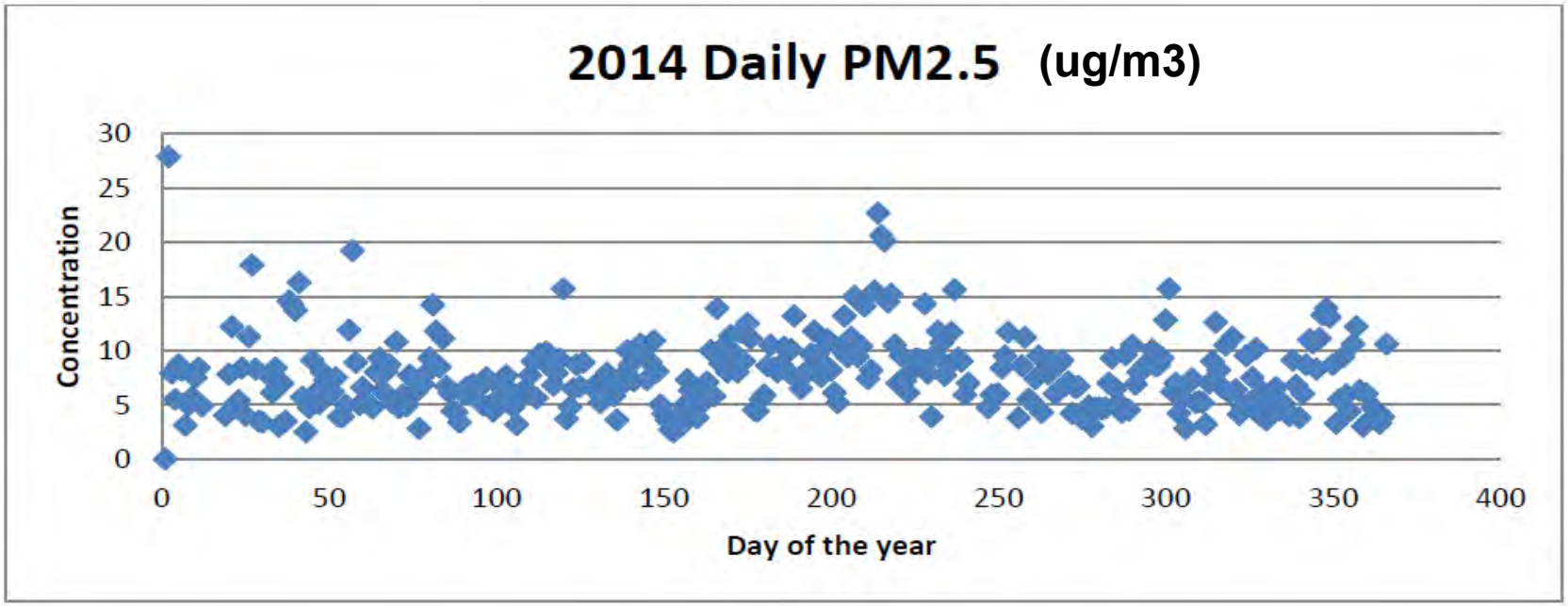



PM2.5 Design Background Values for Monitors in Louisiana



Variability of Hourly and Daily Average Data





Valid Ambient Air Monitoring Data for NSR Permitting

- 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 NO2):

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

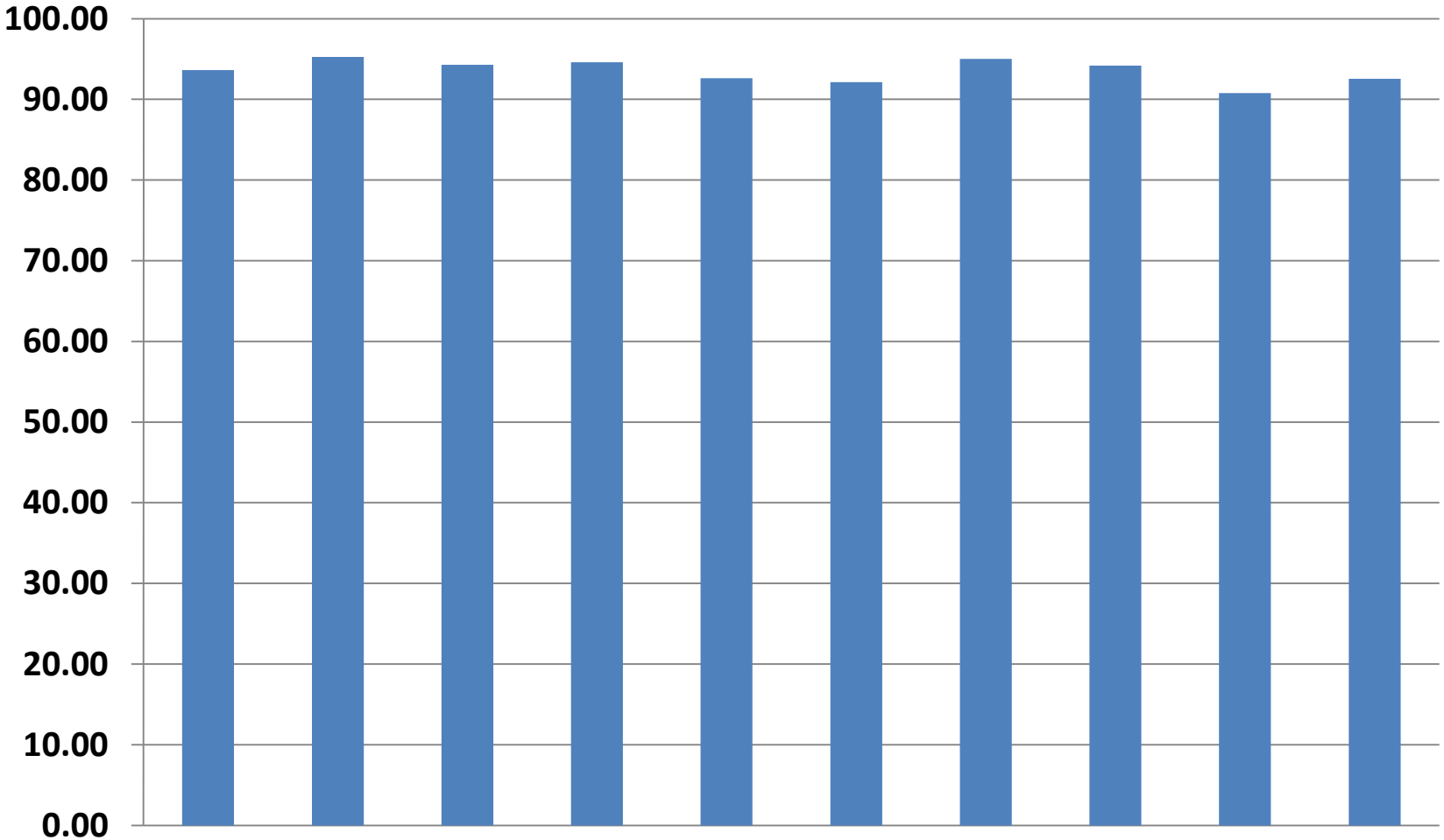
Minimum (1-hour NO2):

- 50% data capture in any quarter
- Need to conduct a prescribed data substitution tests
  - Highest daily maximum 1-hour value - conservative






Data Capture in Louisiana Monitors

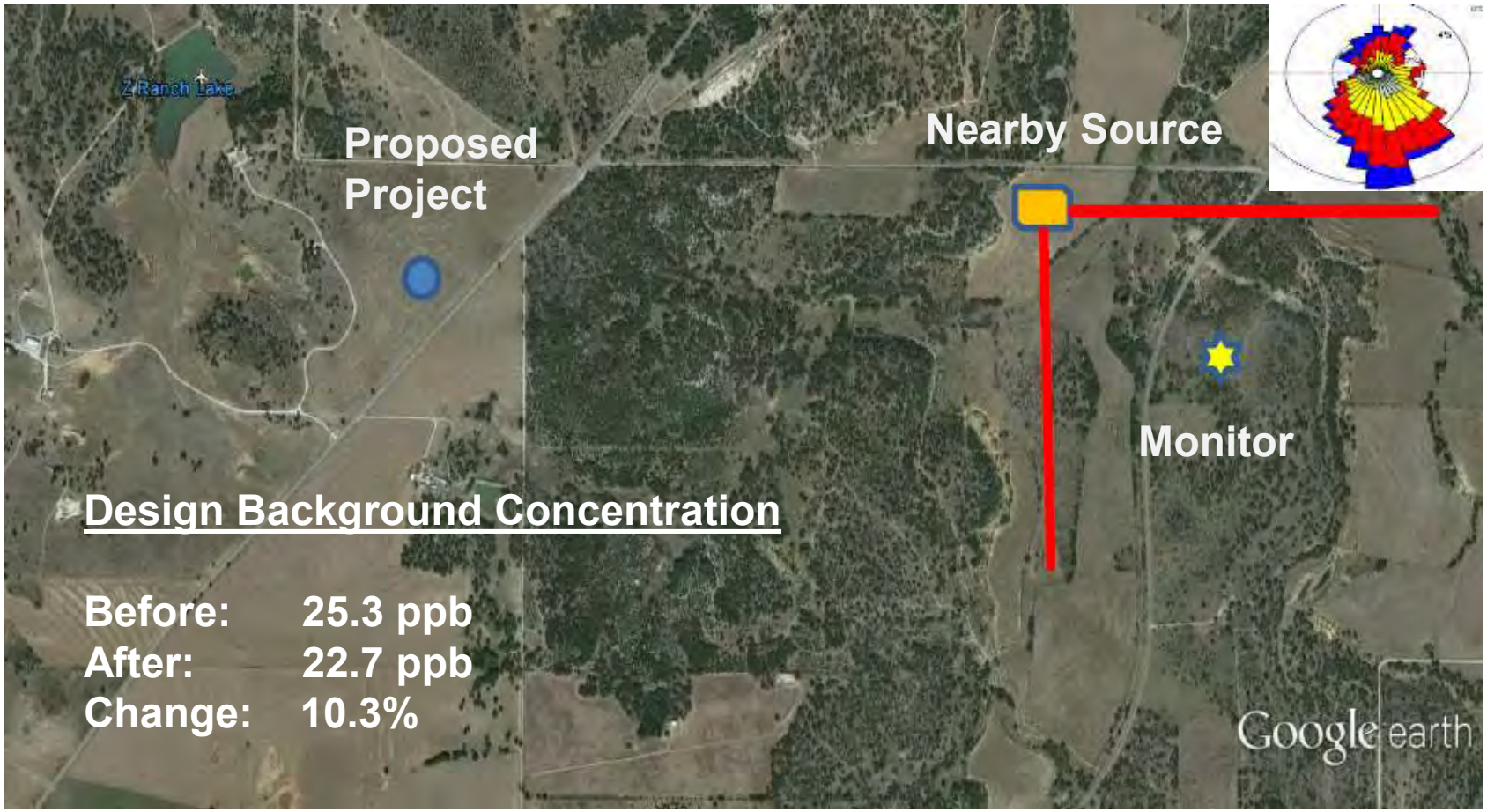


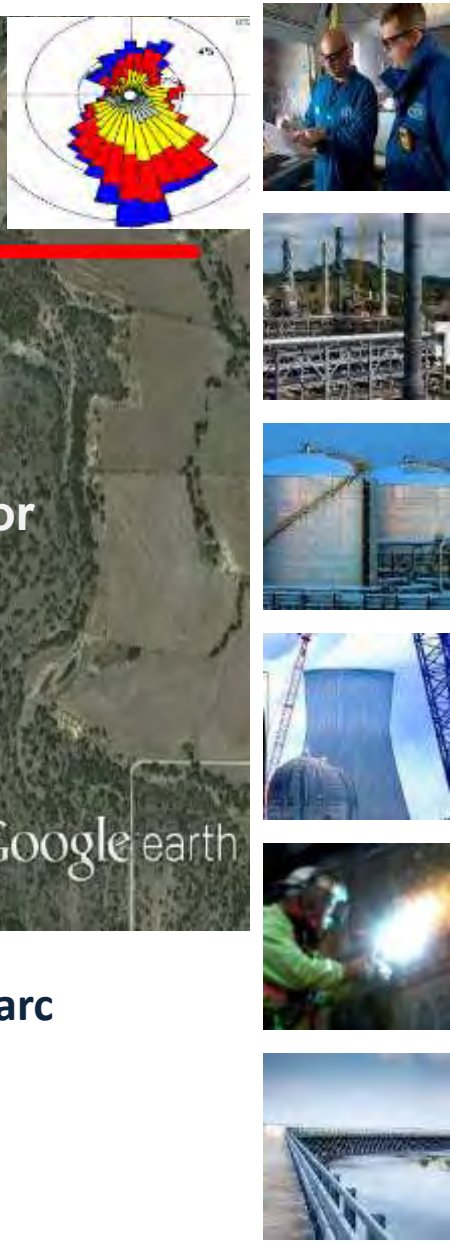
Hourly NO_2 Data Capture in Louisiana Monitors
CY 2014






Background Concentration Refinement – Option 1

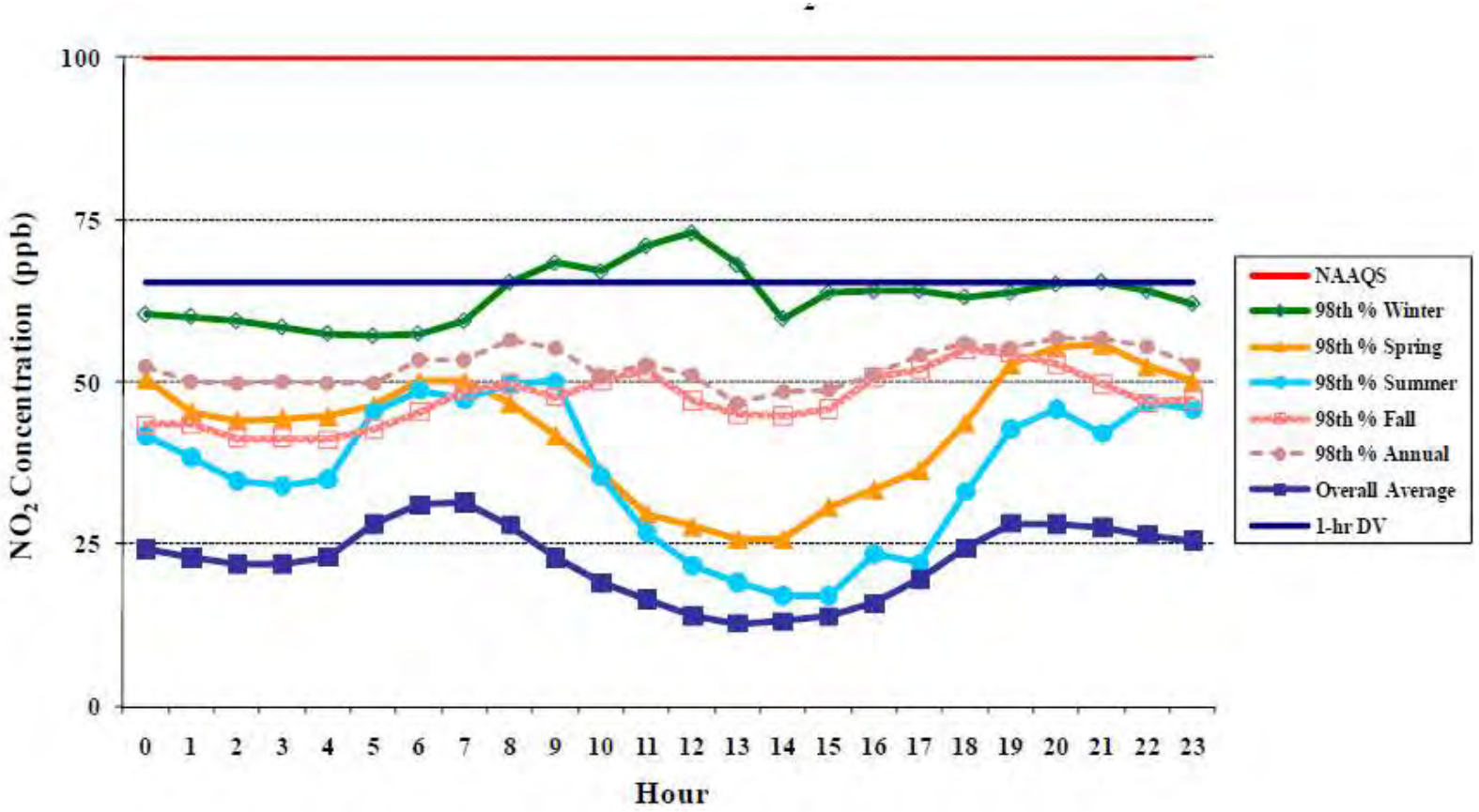




- Exclude the hours of data when the monitor is within 90 degree arc from the source(s)
- Recalculate the design value based on remaining hours of data

Background Concentration Refinement – Option 2

Temporal Pairing of Monitored and Modeled



Need detailed evaluation and buy in from agencies











State-Specific Permitting Issues

“Permitting Gumbo” – Ingredients

- Client’s Needs/Goals
- Agencies
  - LDEQ
  - EPA
  - LDNR
  - USACE
  - LDWF
  - FAA
  - Parish/Local Governments
- Environmental Assessment Statement
- Parish/Local Ordinances and Standards
- Wetlands/Coastal Zone/Levee Districts






“Permitting Gumbo” – Recipe

- Agencies and Client Needs/Goals
  - Design Elements and Milestones
- Environmental Assessment Statement
  - Siting, Alternatives, Environmental Considerations
- EPA and LDEQ
  - NAAQS, Emission Standards and Air Modeling
- Parish/Local Ordinances and Standards
- Wetlands/Coastal Zone/Levee Districts
- LDWF
  - Eagle Nests
- FAA
  - Stack Heights






"Permitting Gumbo" – Simmer

Ingredients interact to create the flavors

- Impacts of Meeting the Requirements of Various Federal, State and Local Agencies
  - Location
  - Stack Heights
  - Modeling
  - Emission Standards
- Keep the Pot Stirred
  - Communication with Client and Agencies
- Serve over Rice
  - Don't Overcook the Rice = Meet that Due Date!






Conclusions






Conclusions

- Evaluate the permitting challenges for short term standards early in the project
- Background monitoring data may be an issue in some locations – Develop strategy for refinement
- Allot significant resources and time for processing data for other sources for cumulative modeling
- State specific issues need to be addressed






Thanks for Your Patience






Questions?

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