EPA Ozone Transport Workshop
April 8, 2015

NJ DEP Experience and Recommendations for EGUs

William O'Sullivan, Director
Division of Air Quality
NJ Department of Environmental Protection
Bill.o'sullivan@dep.nj.gov
(609) 984 - 1484

What will I address?

A. NJ EGU NOx Control Experience

B. Refining Cost Effectiveness Determinations

C. Things EPA can do to help states attain the Ozone NAAQS

   1. Revise CSAPR
   2. Require real RACT
   3. Require good "good neighbor SIPs"

What Matters for EGU NOx Emissions?

1. No SCR on coal units that will continue to operate
2. Not running existing SCR on coal units
3. Conversion to gas or oil without good NOx control
4. Peaking gas/oil turbines with high NOx
5. Uncontrolled diesels with extremely high NOx used for demand side management (DSM)
6. Emissions on high ozone days.

A. NJ EGU NOx Control Experience

1. 6 Coal Units - SCR
2. 1 Coal Unit - Converted to gas with SNCR
3. 3 Coal Units – Replace(d) with gas turbines with SCR
4. Gas Boilers - SNCR
5. Oil boilers – Convert(ed) to gas with SNCR

6. Old gas/oil turbines – simple cycle peakers
   a. About 800 MW – SCR or other control added
   b. About 3700 MW – Shutdown by 5/1/15

7. New gas turbines – about 4000 MW – LNB & SCR

8. Behind meter uncontrolled diesels
   a. Limited to blackouts and brownouts unless SCR
   b. DSM requires SCR

9. NOx performance limits – daily average

B. Relative Cost Effectiveness of EGU NOx Control (Based on annual tons reduced)

1. Operating Existing Coal SCR – less than $500/ ton

2. Add SCR to Coal EGU – about $5,000 / ton

3. Add SCR to Peaking Gas Turbine – about $50,000 / ton

The Problem with Annual NOx Cost Effectiveness

1. Annual NOx not relevant for an 8 hour ozone NAAQS

2. Fails to address NOx from peakers or low capacity boilers

3. Need metric for high ozone days

Better Ways to Evaluate Cost

1. $/MW instead of $/MWhr or $/ton
   - Capacity payments are based on MW.
   - Most MW capacity is used on high ozone days.

2. $/ozone day ton of NOx
   - Reducing ozone day tons needed
   - SCR on a peaking gas turbine may be more cost effective than SCR on a base load coal unit, if annual costs are applied only to ozone day tons of NOx removed.

EGU Things EPA can do to help States Attain the Ozone NAAQS

1. Significantly lower CSAPR ozone season NOx cap.

2. Require operation of existing NOx control
   a. In CSAPR,
   b. As RACT, and
   c. In good neighbor SIPs.

3. Set daily state EGU NOx caps, or require daily performance standards for NOx.

4. Require SCR NOx control for behind the meter DSM diesels.

5. Require LNB and SNCR (or equivalent) when converting coal units to gas or distillate oil.

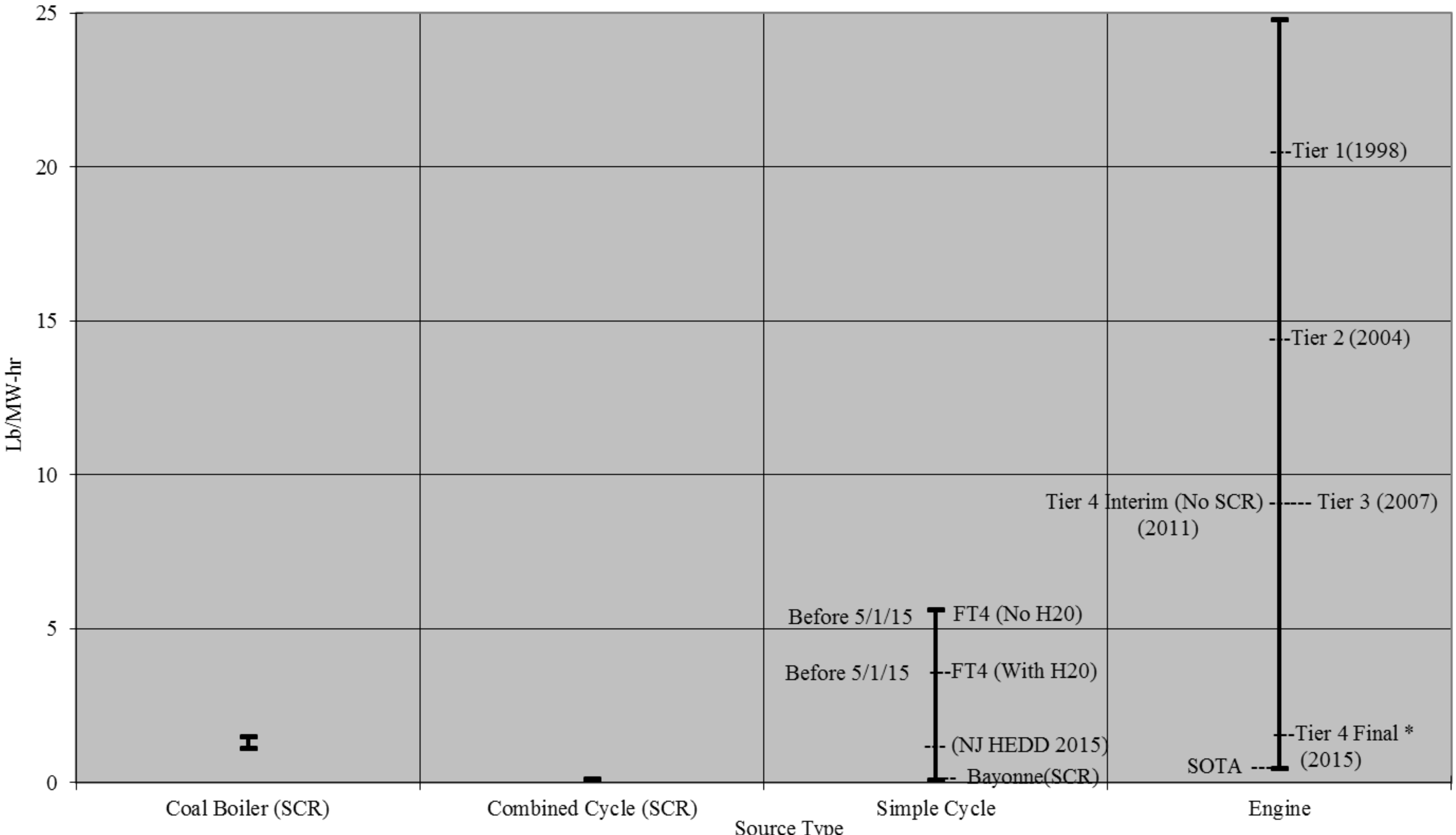
6. Require SCR (or equivalent) on all coal units that continue operation after 2017.

7. Require SCR (or equivalent) on peaking gas and oil turbines in nonattainment areas.

8. Add cost benefit calculation procedures to address ozone day NOx emissions.

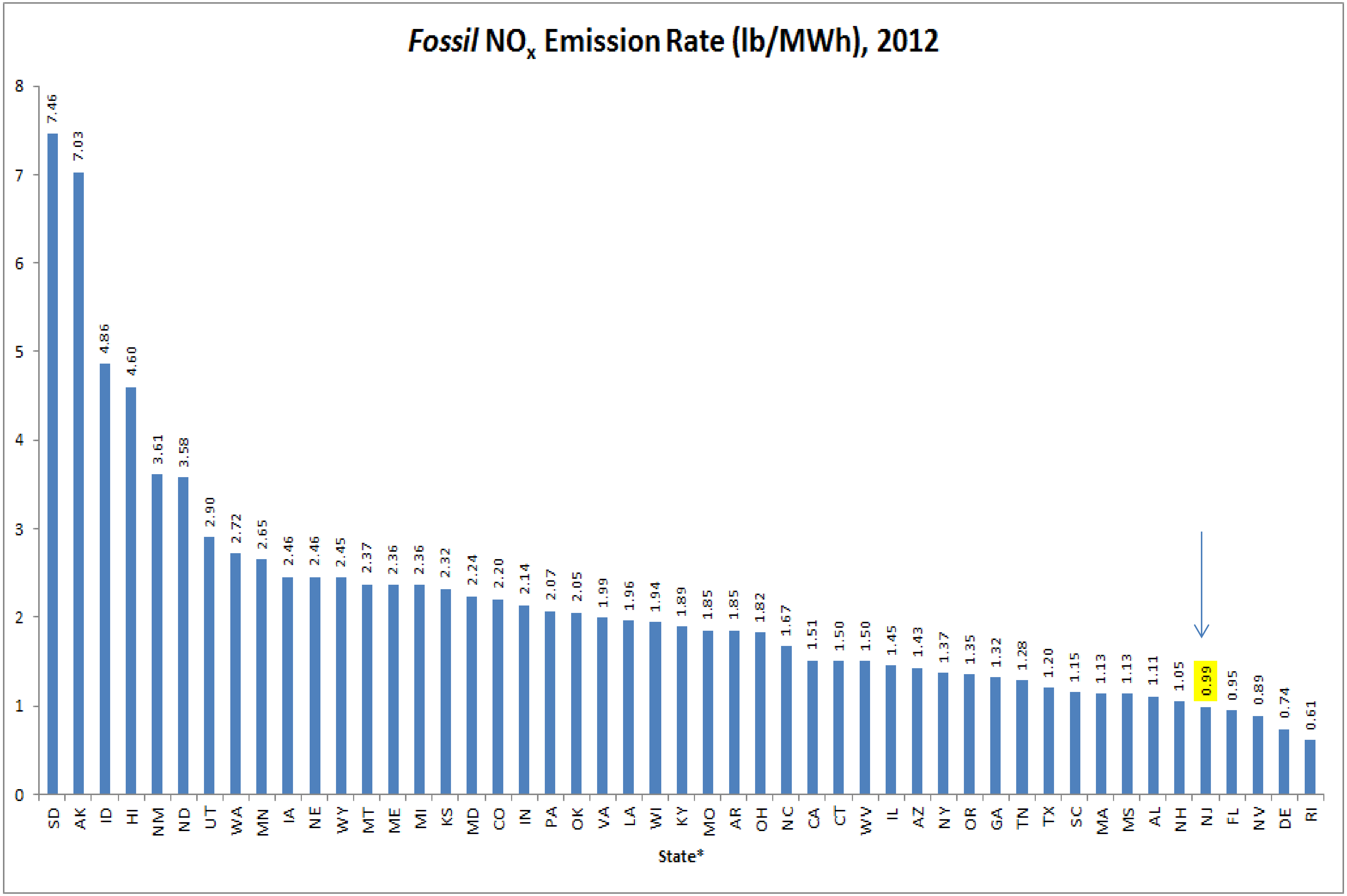
9. Not allow SIP modelling of future ozone to give credit for SCR controlled NOx, unless the SCR is required to be operated. (SNCR also)

New Jersey NOx Emission Comparison 4/8/15



1. Engines limited to blackouts and brownouts unless equipped with SCR
2. FT4 Turbines without SCR must shut down by 5/1/15

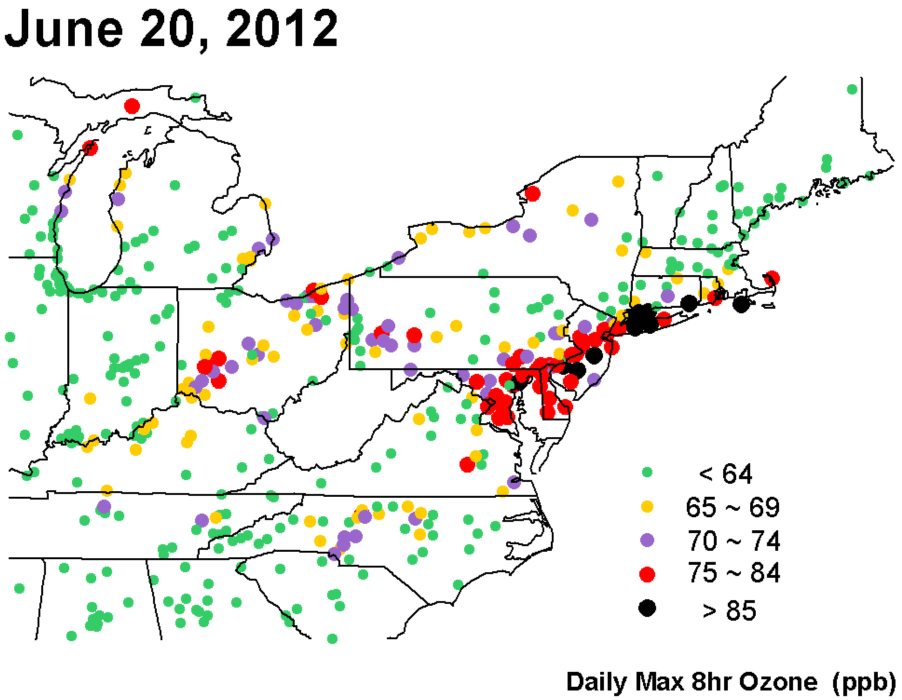
* (SCR or Equivalent)

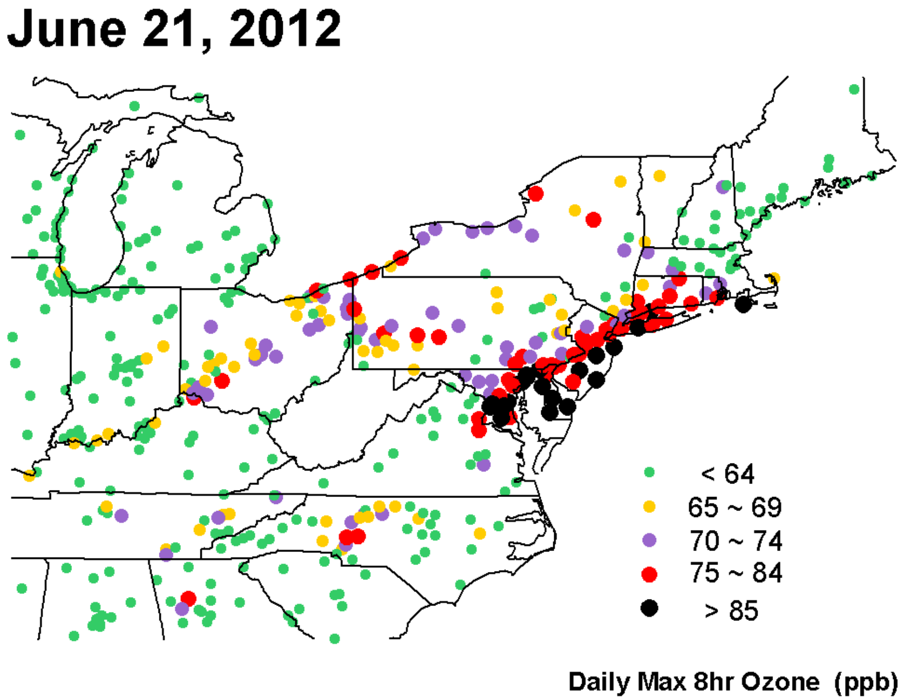


*excluding VT due to marginal amount of fossil generation

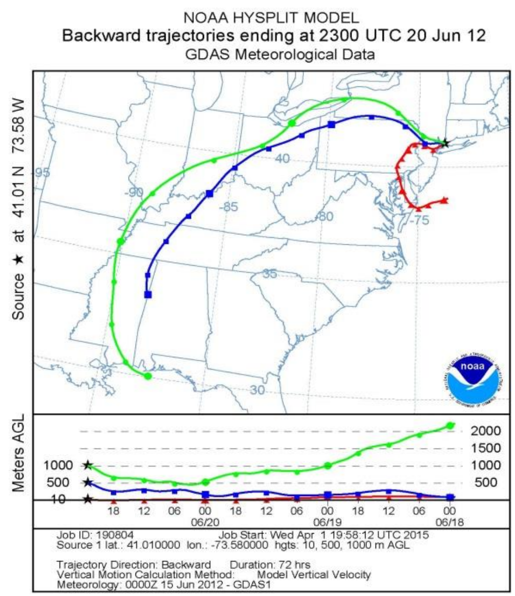
Source: **USDOE/EIA**

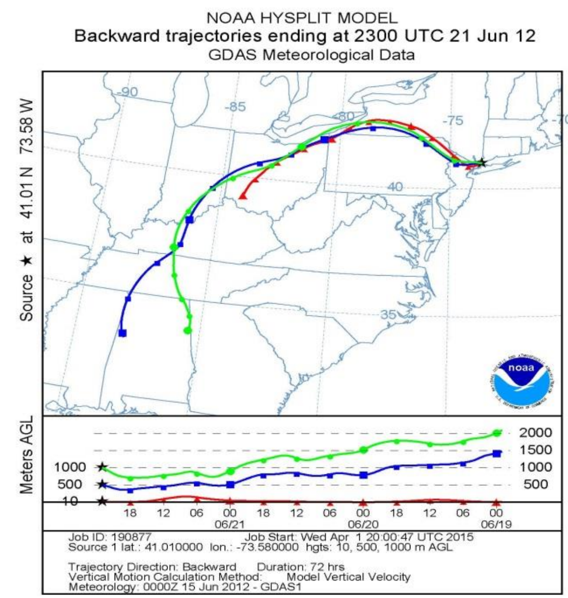
Ozone Air Quality
June 20 – 21, 2012

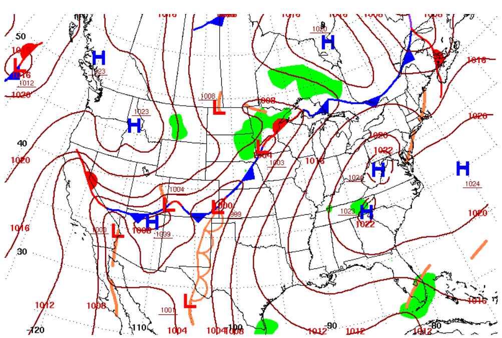




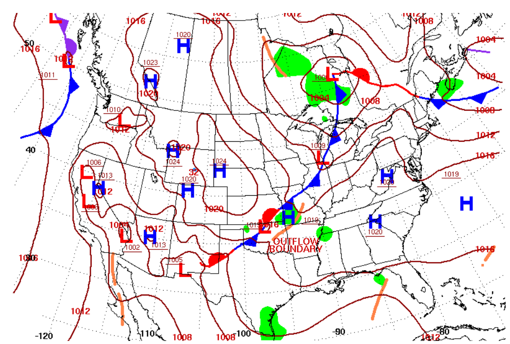
Wind Trajectories
June 20 – 21, 2012



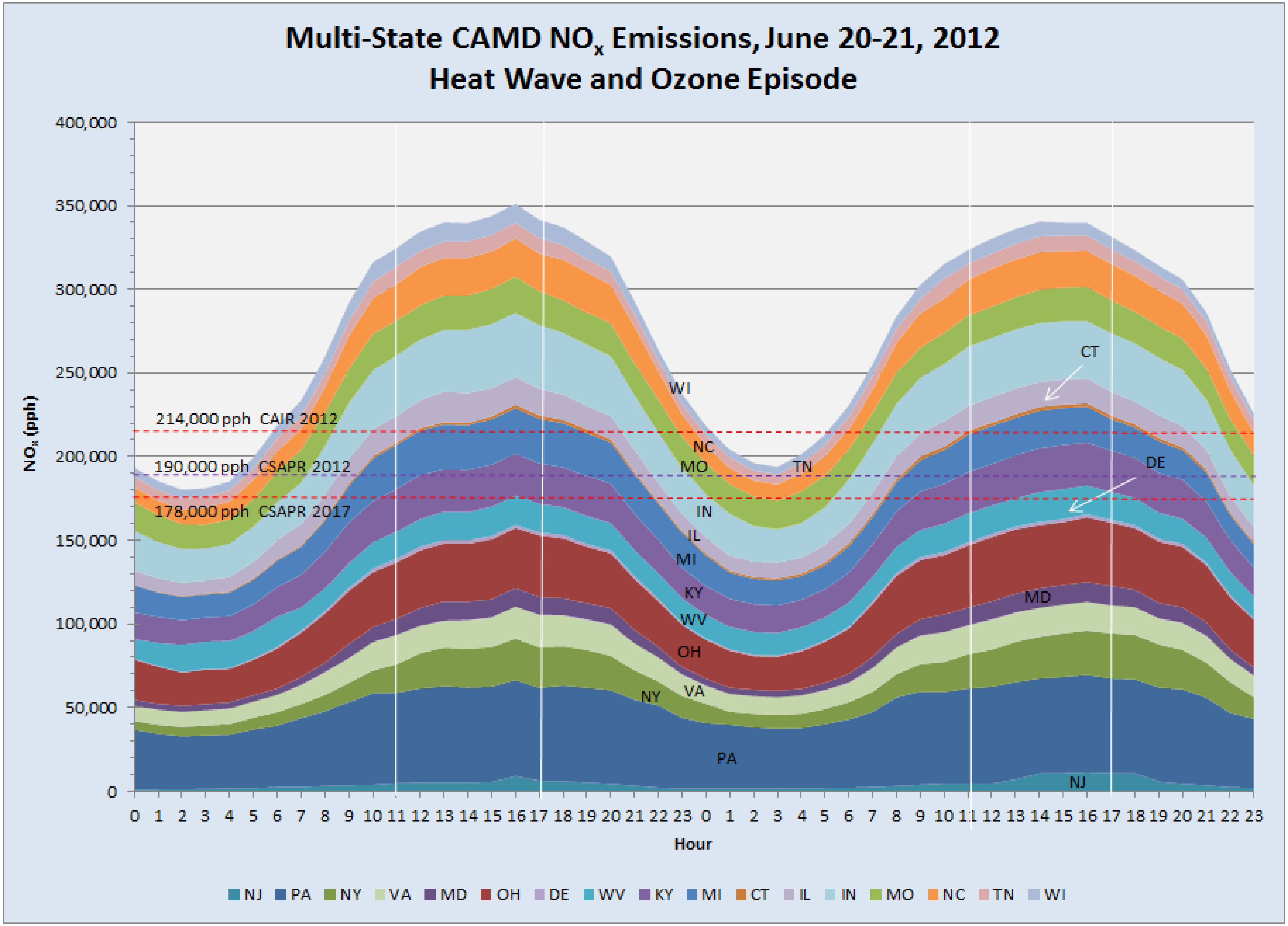




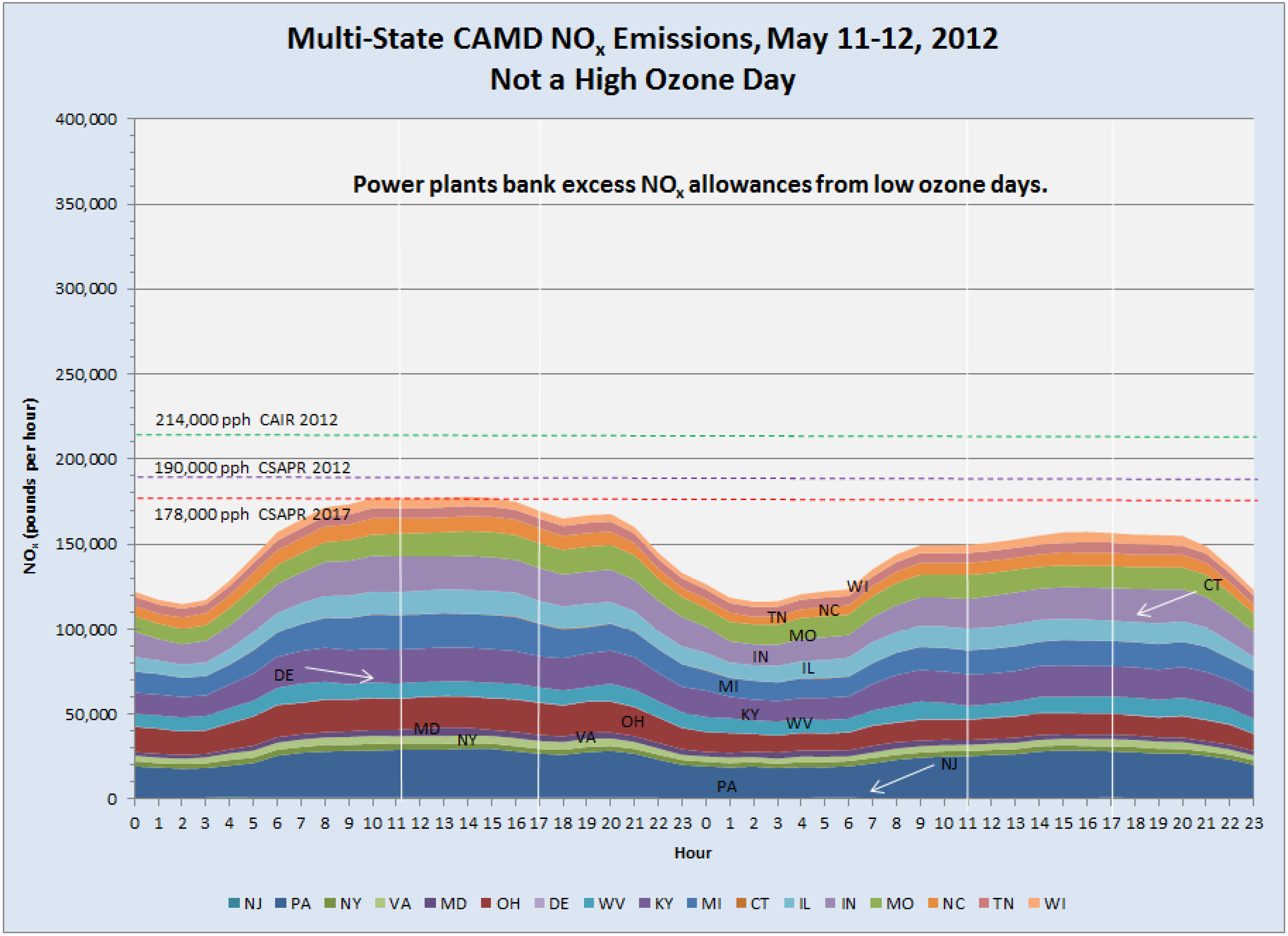
Surface Weather Map at 7:00 A.M. E.S.T.



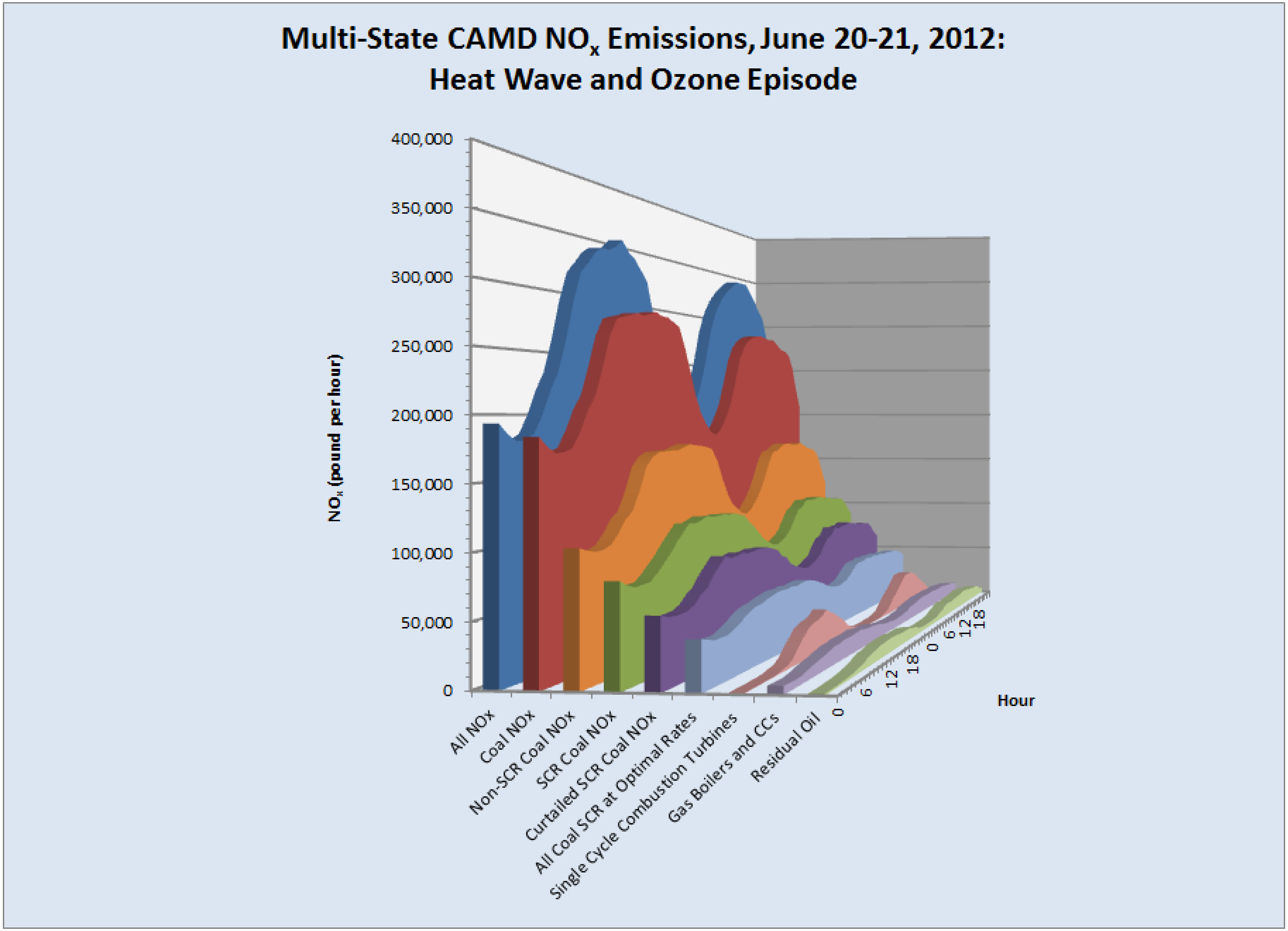
Surface Weather Map at 7:00 A.M. E.S.T.

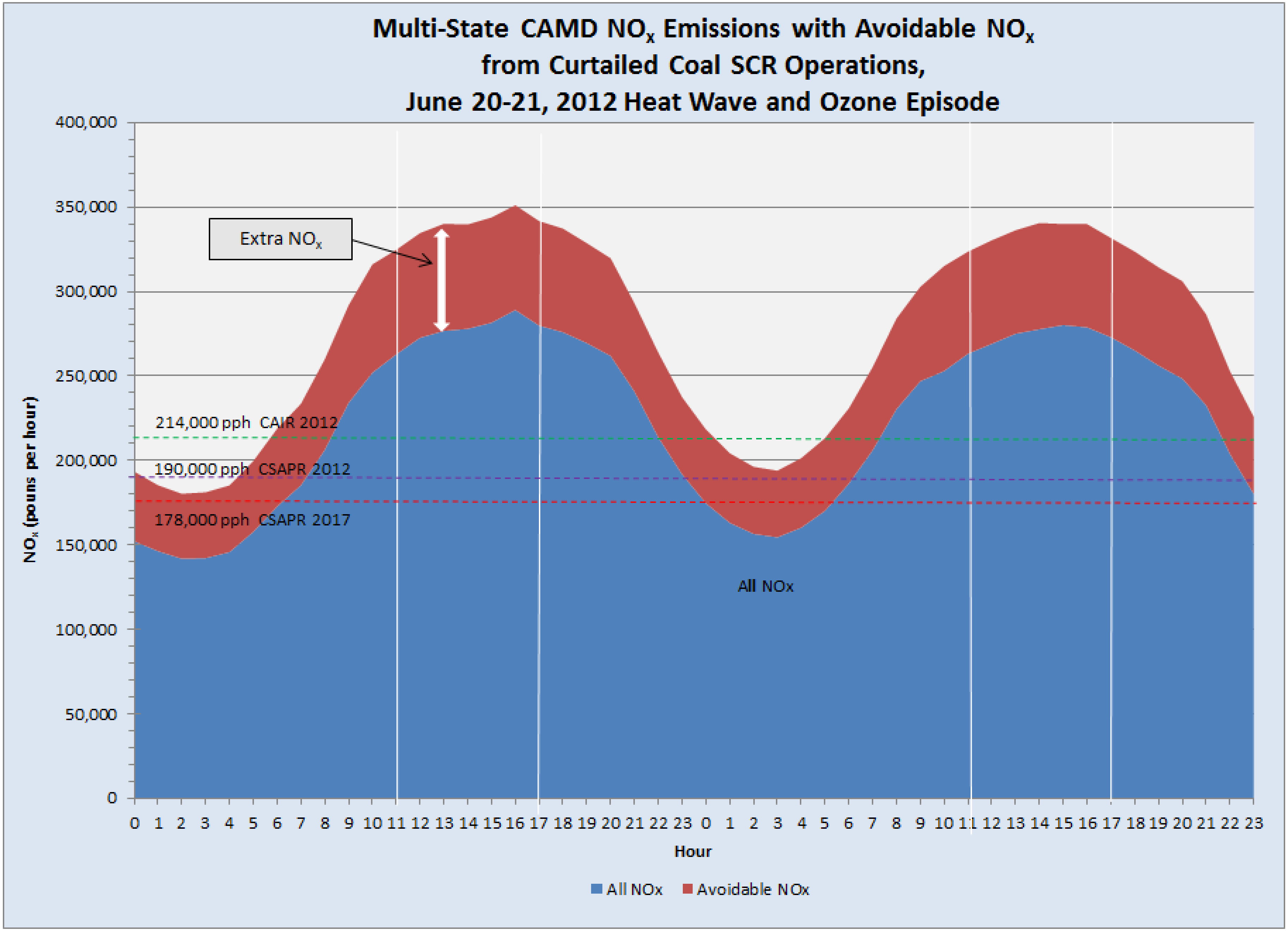


Multi-State CAMD NO_x Emissions, June 20-21, 2012
Heat Wave and Ozone Episode
NO_x (pph)
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
214,000 pph CAIR 2012
190,000 pph CSAPR 2012
178,000 pph CSAPR 2017
WI
NC
MO
TN
IN
IL
MI
KY
WV
OH
VA
NY
PA
NJ
MD
CT
DE
Hour
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
NJ PA NY VA MD OH DE WV KY MI CT IL IN MO NC TN WI

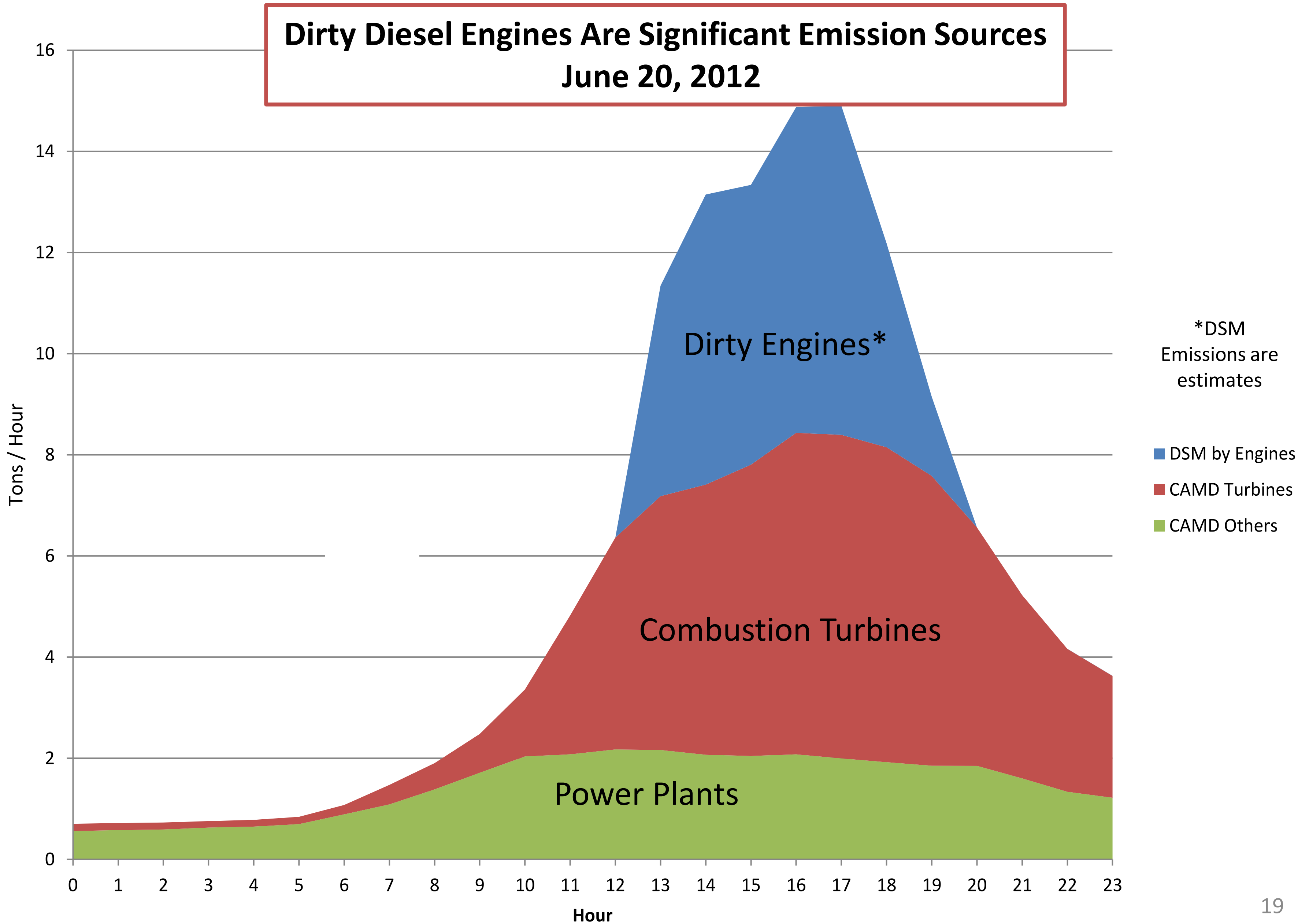


Multi-State CAMD NO_x Emissions, May 11-12, 2012
Not a High Ozone Day
Power plants bank excess NO_x allowances from low ozone days.
214,000 pph CAIR 2012
190,000 pph CSAPR 2012
178,000 pph CSAPR 2017
NO_x (pounds per hour)
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour
DE
MD
NY
VA
OH
PA
NJ
MI
KY
WV
IN
IL
MO
TN
NC
WI
CT
NJ PA NY VA MD OH DE WV KY MI CT IL IN MO NC TN WI


Multi-State CAMD NO_x Emissions, June 20-21, 2012:
Heat Wave and Ozone Episode
NO_x (pound per hour)
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
All NOx
Coal NOx
Non-SCR Coal NOx
SCR Coal NOx
Curtailed SCR Coal NOx
All Coal SCR at Optimal Rates
Single Cycle Combustion Turbines
Gas Boilers and CCs
Residual Oil
Hour
0
6
12
18
0
6
12
18


Multi-State CAMD NO_x Emissions with Avoidable NO_x
from Curtailed Coal SCR Operations,
June 20-21, 2012 Heat Wave and Ozone Episode
Extra NO_x
214,000 pph CAIR 2012
190,000 pph CSAPR 2012
178,000 pph CSAPR 2017
All NOx
NO_x (pouns per hour)
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour
All NOx
Avoidable NOx

Demand Side Management



Draft 4-8-15

Illustrative Example – Different types of Cost Evaluations for NOx

Where accounting for emission reduction benefits are limited to times relevant to the Air Quality concern

Scenario	$/ton for NOx Emissions Reduction During Benefit Period			SCR Capital Costs
	Traditional – Annual	Ozone Season (1)	30 days of high ozone (2)	$ / KW
1. Add SCR to coal EGU used all year	$5,000/ton	$12,000/ton	$60,000/ton	$188 - $273 (3)
2. Add SCR to peaking gas turbine used 30 days per ozone season	$50,000/ton	$50,000/ton	$50,000/ton	$78 - $125 (4)

(1) Cumulative ozone damage to vegetation. Also, relevant to maintenance of ozone NAAQS.

(2) Days of high ozone, when NOx reductions most beneficial.

(3) Data from February 5, 2014 presentation "Coal Plant Retirements and Market Impacts" presented by Metin Celebi of the Brattle Group to Wartsila Flexible Power Symposium 2014 – Vail, Colorado; $188/KW for 600 MW unit, $234/KW for 200 MW unit; $273/KW for 50 MW unit. All data is in 2011 dollars.

(4) Data from the owner of (2) New Jersey peaking turbine facilities that installed SCR in 2014; $78/KW for (1) 72 MW turbine, $125/KW for (4) 20.5 MW turbines