APPENDIX A

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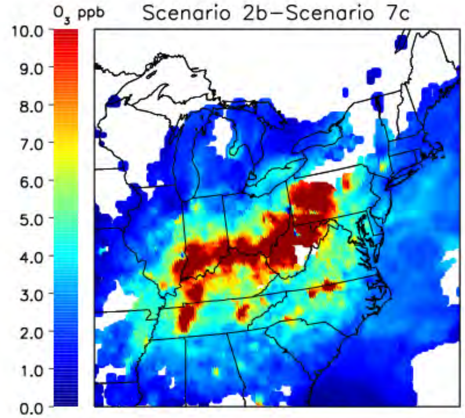
Maryland's Proposal for a Collaborative Solution to the Ozone Transport Problem

September 2014 Update

Technical and Policy Framework for Resolving the Issue Through Complementary "Good Neighbor" and "Attainment" SIPs



Tad Aburn, Air Director, MDE

Air Directors Technical Collaborative – September 4, 2014

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Topics

- Background
- Why is Maryland Pushing so Hard for "Good Neighbor" Partnerships?
- Technical Analyses to Date
  - Maryland's Modeling and Analysis of Emissions Data
- Maryland's efforts to further reduce emissions from local mobile sources and other emission sectors
- Our Ask of Upwind States
- Timing and Future Efforts
- Discussion

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Background – Ozone Transport

- Many, many balls in the air
  - Supreme Court has acted
    - Not real clear on what happens next
  - "Expand the OTR" Petition under Section 176A of the Clean Air Act (CAA)
  - Challenges to EPA over large nonattainment areas (CAA Section 107)
  - Challenges to EPA over "Good Neighbor" SIPs (CAA Section 110A2D)
  - EPA's Transport Rule Process
  - A collaborative effort between upwind and downwind states to address the ozone transport issue
- Remainder of this presentation will focus on the collaborative effort

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Background – The Collaborative

- On August 6, 2013- Approximately 30 Air Directors participated in a call to begin a technical collaboration on ozone transport in the East
- There was discussion … and general agreement … on beginning technical analyses of a scenario (called “Phase 1”) that would try and capture the progress that could be achieved if:
  - The EPA Tier 3 and Low Sulfur Fuel program is effectively implemented
  - The potential changes in the EGU sector from shutdowns and fuel switching driven by MATS, low cost natural gas and other factors were included
  - The potential changes in the ICI Boiler sector driven by Boiler MACT and low cost natural gas were also included
  - There was also general agreement that, at some point, Commissioner level discussions may take place
- In early April 2014, preliminary discussions between Commissioners began
  - Discussions continue … potential meeting in October

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Why Is MD Pushing So Hard

- Only state East of the Mississippi designated as a "Moderate" nonattainment area by EPA
- Baltimore is the only nonattainment area in the East required to submit an "Attainment" SIP by June of 2015
  - This SIP must be supported by an "Attainment Demonstration"
    - The Attainment Demonstration must be based upon photochemical modeling and other technical analyses
    - It must show that monitors in the Baltimore area are expected to comply with the ozone standard by 2018
- We have enough modeling and technical analysis completed to understand what Maryland needs in it's plan to bring the State into attainment
  - This analysis also shows that most other areas in the East should also attain

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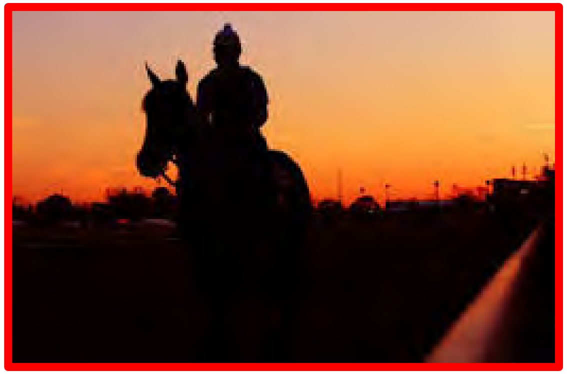
The Key Elements of Maryland's Plan

- Number 1 Need – The Tier 3 Mobile Source and Fuel Standards
  - The most important new program to reduce high ozone in Maryland
- Number 2 – Additional local reductions in Maryland and close-by neighboring states to reduce mobile source emissions
  - New mobile source efforts in the Ozone Transport Region and new Maryland control programs are on the books or in the works
- Number 3 - Good Neighbor SIPs or Commitments to address transport
  - Analysis shows that if power plants in upwind states simply run the controls that have already been purchased … during the core ozone season … and planned retirements occur … that transport for the current ozone standard will be addressed



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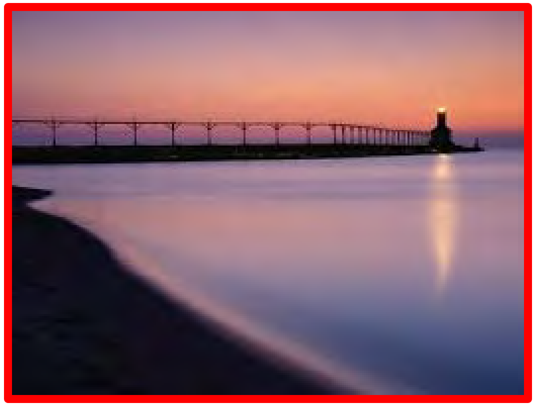
Addressing Mobile Sources and …

… *"along the I-95 corridor" controls*

- Maryland's modeling looks at more than just upwind power plants
- New federal control programs for mobile sources, like the Tier 3 vehicle and fuel standards, are critical
- Maryland's plan … and the modeling … includes new controls just in the OTR like:
  - California car programs
  - Aftermarket catalyst initiatives
  - RACT requirements
  - Consumer products and paints
  - Diesel Inspection and Maintenance
  - Non-traditional control efforts
  - Many more



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Modeling the Maryland Plan

- Maryland has conducted preliminary modeling of the Plan and believes that the Plan will allow MD to come very close to meeting the 75 ppb ozone standard
  - Will most likely also allow most other areas in the East to attain the standard by 2018
- MD's modeling has been conducted primarily with the OTC platform that uses 2007 as the base year and 2018 as the attainment year
  - MD is updating the modeling to use the newer platform based upon EPA modeling efforts
    - This platform uses 2011 as the base year and 2018 as the attainment year
- Based upon early comparisons, it appears that modeling with the new platform will generate consistent results and may, in many areas, show even greater ozone benefits

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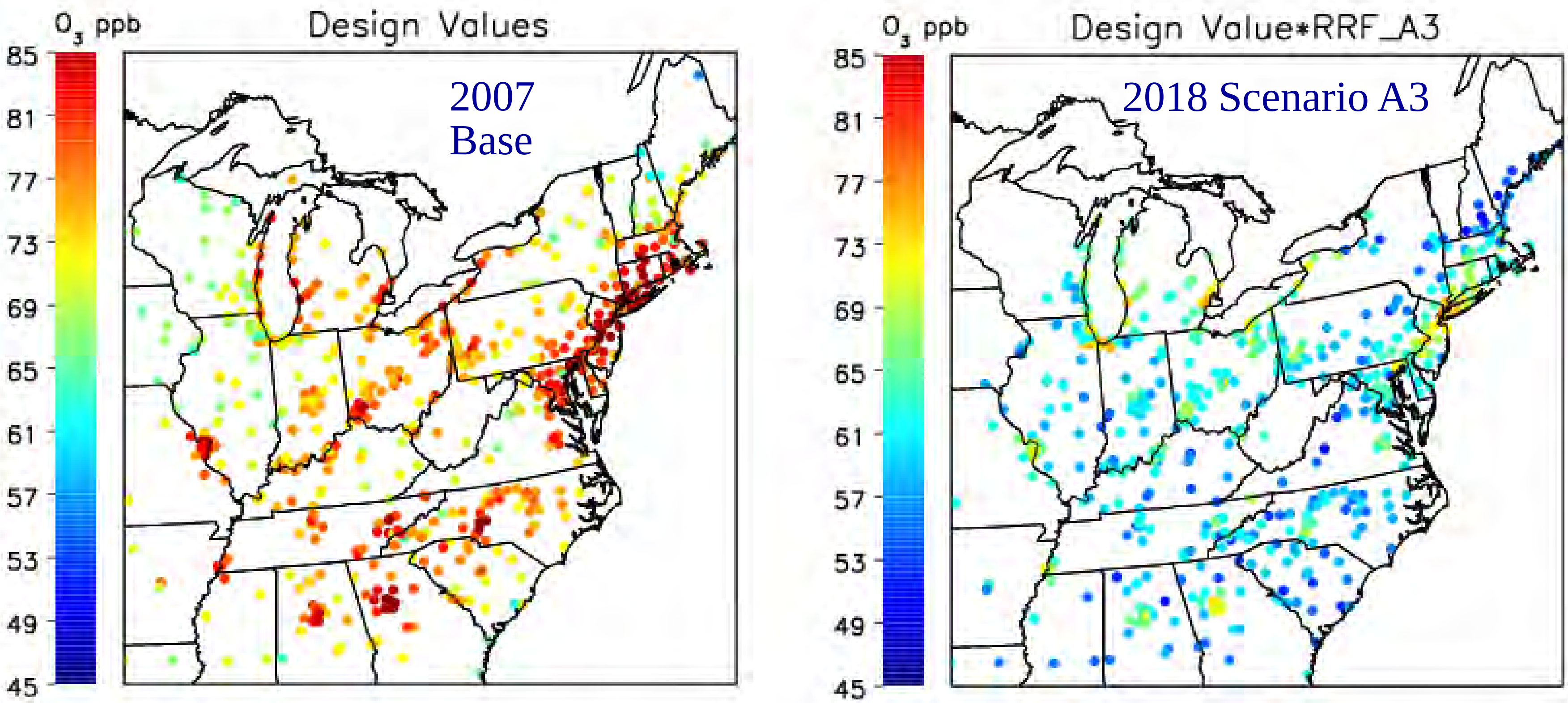
The Bottom Line

Maryland's plan is currently being modeled as "Attainment Run #3" or "Scenario A3"

Before Scenario A3 | After Scenario A3



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Bottom Line by Monitor

… Before and After Scenario A3

County	Design Value 2007	After Scenario A3 2018
Harford, MD	90.7	74.7
Prince Georges, MD	85.3	65.1
Fairfield, CT	88.7	70.8
New Castle, DE	81.3	66.3
Bucks, PA	90.7	76.8
Suffolk, NY	88.0	71.0
Camden, NJ	87.5	74.2
Fairfax, VA	85.3	66.9
Franklin, OH	84.7	69.7
Fulton County, GA	90.3	73.7
Wayne, MI	81.3	74.5
Sheboygan, WI	83.3	70.8
Mecklenberg Co, NC	87.0	67.6
Knoxville, TN	80.7	70.7
Jefferson County, KY	80.0	67.0
Lake County, IN	77.5	77.4
Cook County, IL	77.0	75.0

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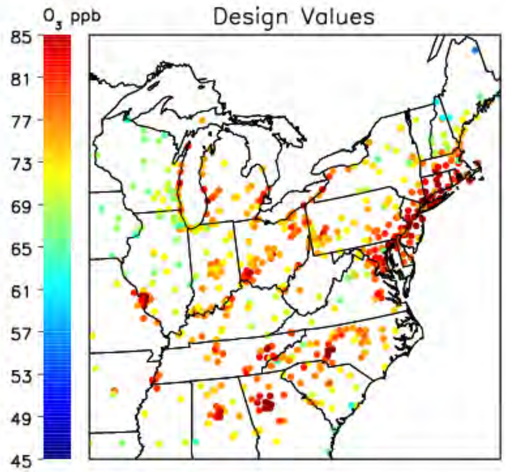
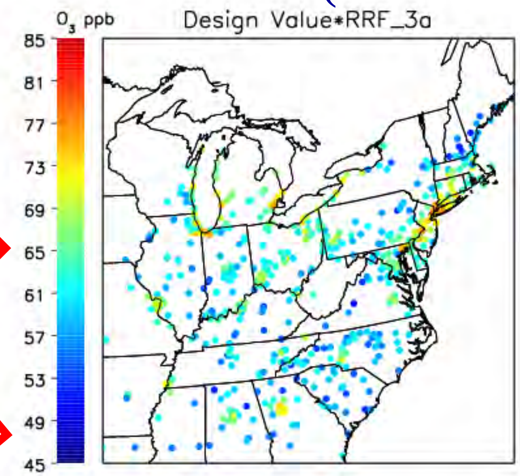
Building the Clean Air Plan

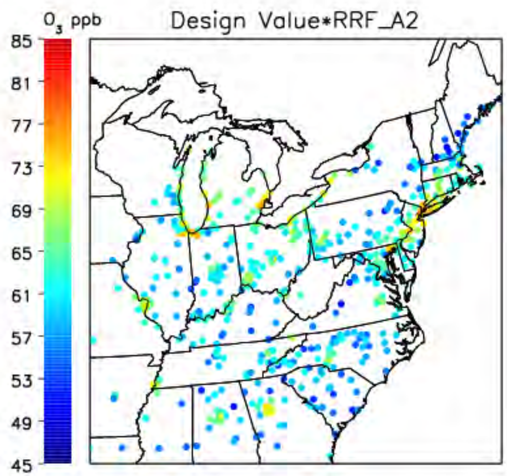
The 2007 Base



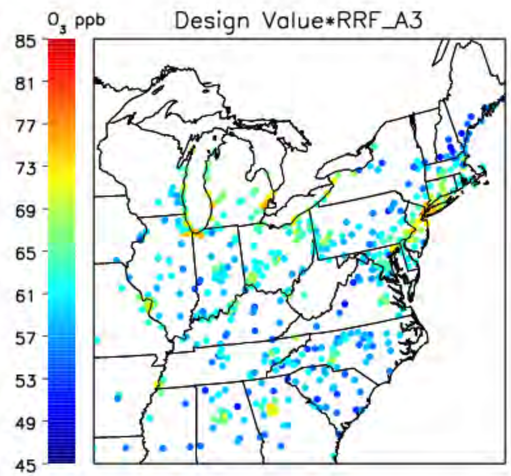
Add the regional controls across the East (Scenario 3a)



Add the “OTR” controls along I 95 corridor (Scenario A2)



Add the new controls just in MD (Scenario A3)



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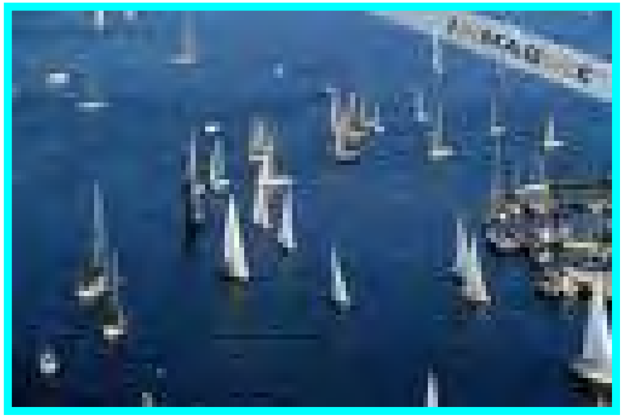
Updated CMAQ Chemistry?

- For years, Maryland and the University of Maryland have been analyzing model performance aloft, where most transport takes place … Not always great
- Also analyzing measured data to look at mobile source inventories
- In 2011, the Discover AQ field study in the Mid-Atlantic provided new unique data aloft
- U of M has analyzed aloft chemistry and found some problems with nitrogen chemistry
  - Fails to carry NOx reduction benefits downwind
- Working on new aloft chemistry concepts … Also looking at inconsistencies in mobile source inventories
  - Will show small, but important additional benefits from regional scale NOx strategies
  - Maybe an extra 1 or 2 ppb benefit in Maryland



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A Little More Detail

- Scenario A3 includes control measures to address local emissions and transport. It includes the following:
  - Implementation of the federal Tier 3 vehicle and fuel standards across the East
  - Implementation of all "on-the-books" federal control programs across the East
  - Implementation of new and old "Inside the Ozone Transport Region" control measures like the new OTC Aftermarket Catalyst initiative and continued implementation of California car standards
  - Implementation of new local measures in certain states like Maryland, Connecticut and New York
  - Good Neighbor SIPs or commitments from 10 upwind states to insure that power plants run previously purchased controls during the core summer ozone season

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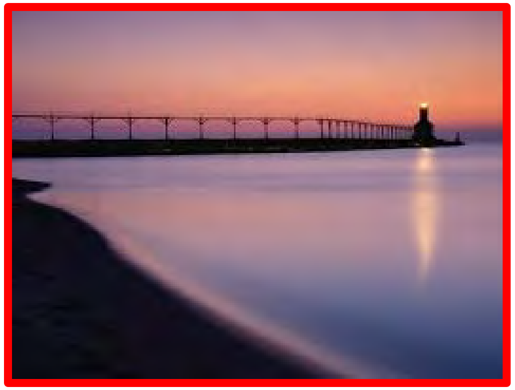
Running Power Plant Controls Effectively

- Maryland and several other states have analyzed power plant (Electric Generating Unit or EGU) emissions data from Continuous Emissions Monitors (CEMS) to see how well existing pollution controls are being run



- Changes in the energy market, a regulatory system that is driven by ozone season tonnage caps and inexpensive NOx allowances have created an unexpected situation where many EGU operators can meet ozone season tonnage caps without operating their control technologies efficiently
  - Sometimes not at all

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How the EGU Data Analysis Was Built

- Maryland began the data analyses in late 2012
  - Looked at EGUs in the 9 upwind states named in the 176A Petition (IL, IN, KY, NC, MI, OH, TN, VA, WV) … MD and PA
- Shared a draft with Air Directors on April 21, 2013
  - The April 2012 package focused on a bad ozone episode (8 days) in 2011
  - Received comments from numerous states
- Shared a second draft with Air Directors on May 13, 2013
  - This package added a second bad ozone episode in 2012 (10 days) and updated earlier materials – additional comments received
- The 2011 and 2012 episodes analyzed capture two of the worst ozone periods in 2011 and 2012
  - Other states, like Wisconsin and Delaware have done similar analyses and reached similar conclusions
- Third updated, data packages to Air Directors soon
- Using West Virginia EGUs as an example
  - West Virginia has an interesting story

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Summary of Generation in WV - 2012

- Total number of units = 60
- Total heat input capacity = 173,267MMBTU/hr = 17,586 MW
- Total State MW Capacity in %
  - Total number of Coal units = 35 = 88%
  - Total number of NG units = 20 = 9%
  - Total number of other (oil, etc.) units = 5 = 3%
  - Total number of Nuclear units = 0 = 0%
- Total Capacity Coal = 15,489 MW
  - 15 units with SCR = 11,755 MW = 76%
  - 4 units with SNCR = 496 MW = 3%
  - 16 units without SCR/SNCR = 3,237 MW = 21%

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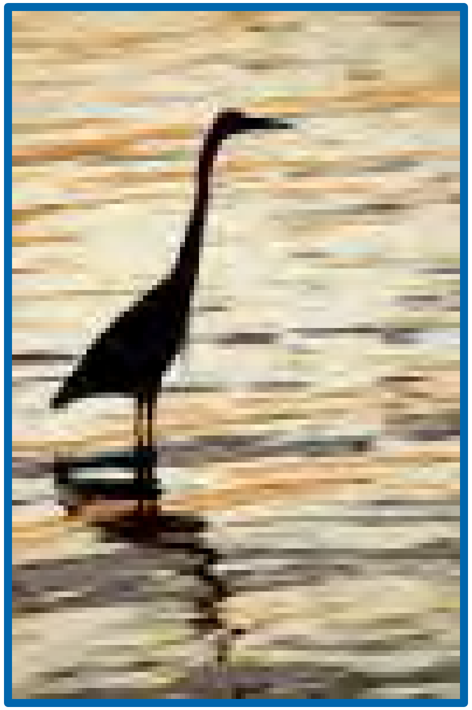
Summary of Generation in WV - 2018

- Total number of units = 39
- Total heat input capacity = 143,851 MMBTU/hr = 14,493 MW
- Total State MW Capacity in %
  - Total number of Coal units = 19 = 90%
  - Total number of NG units = 20 = 10%
  - Total number of other (oil, etc.) units = = 0%
  - Total number of Nuclear units = 0 = 0%
- Total Capacity Coal = 12,946 MW
  - 15 units with SCR = 11,648 MW = 90%
  - 2 units with SNCR = 191 MW = 1.5%
  - 2 units without SCR/SNCR = 1,107 MW = 8.5%



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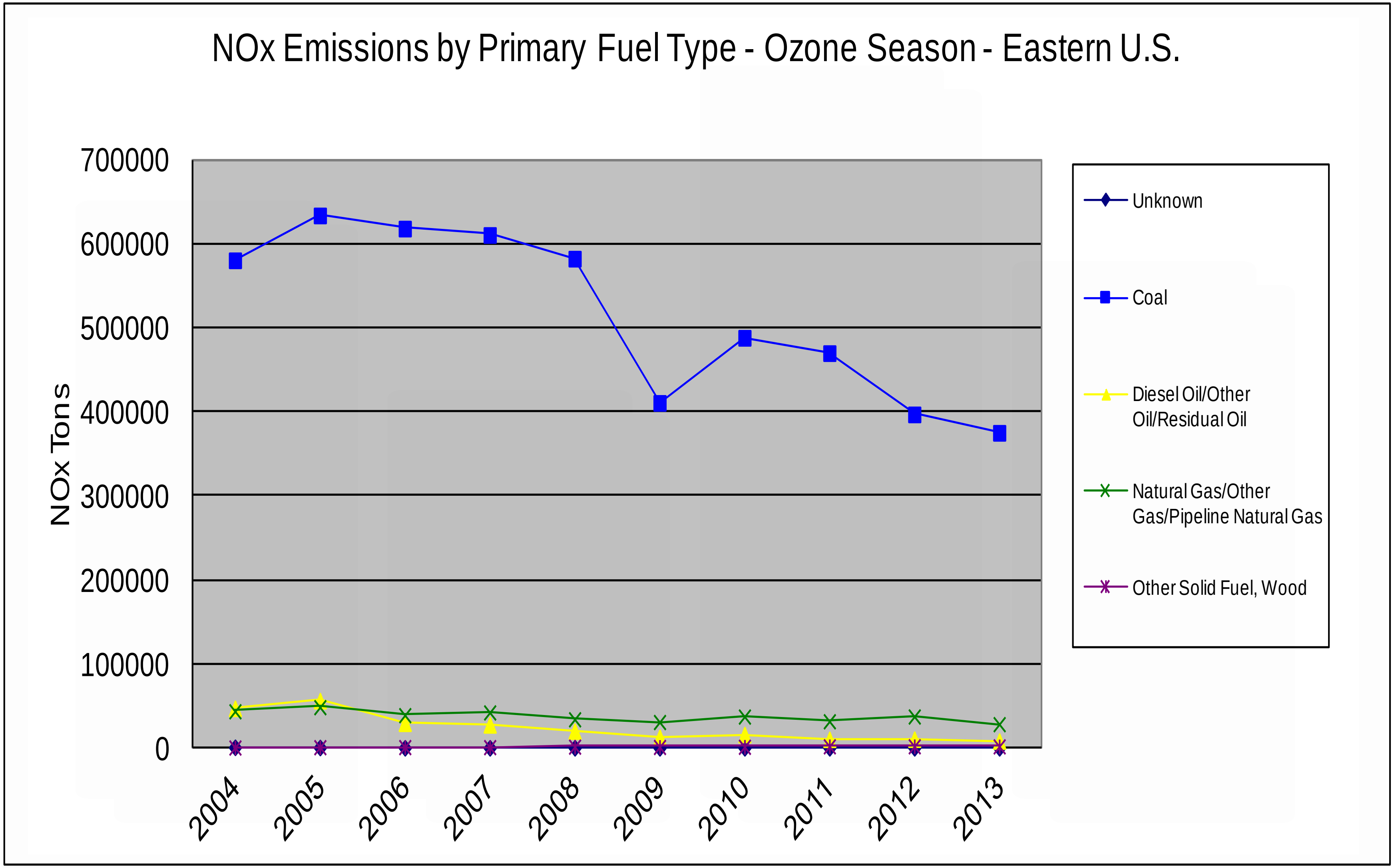
The MD Analyses Focus on Coal



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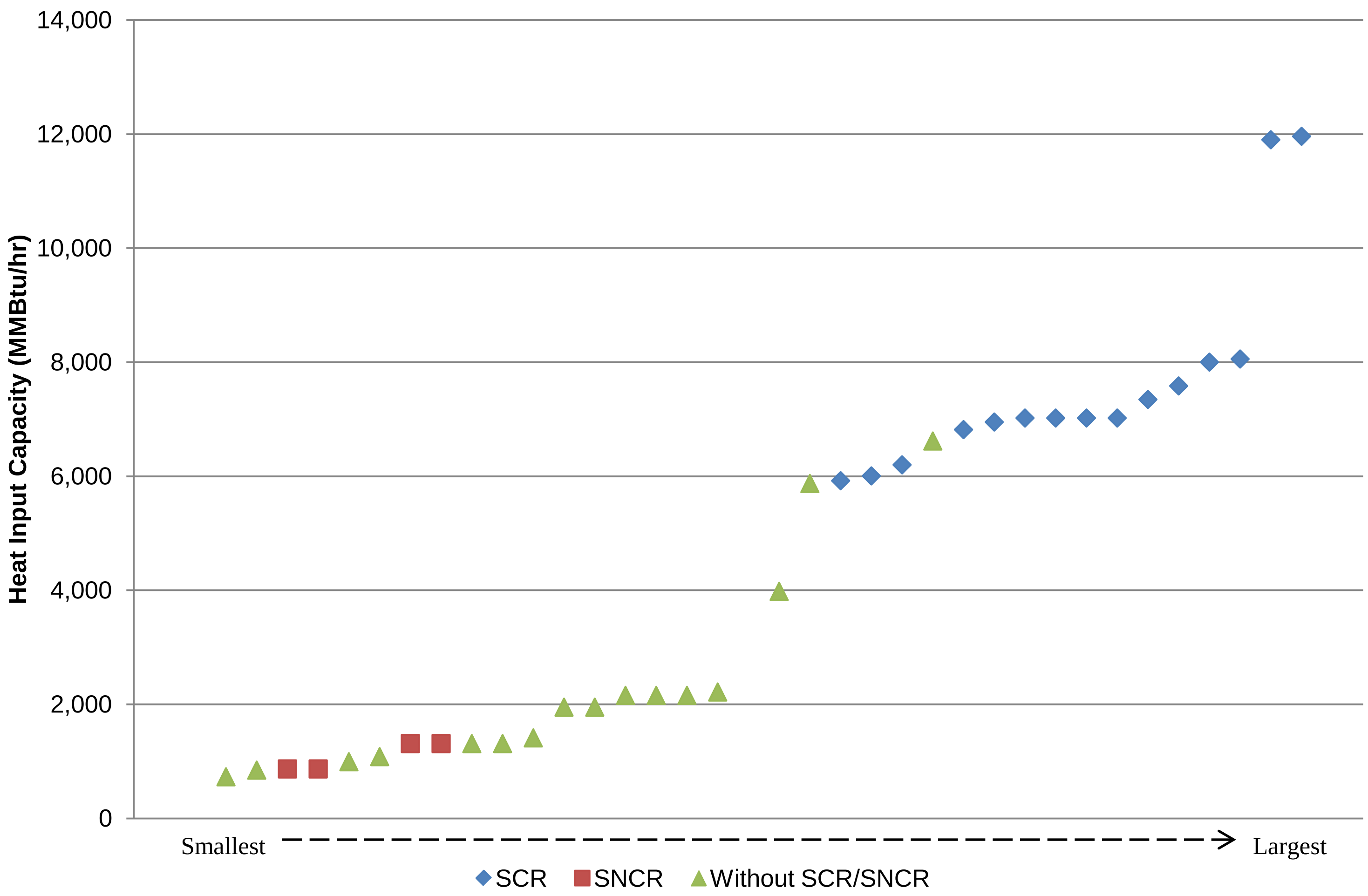
Controls on Coal WV Units - 2012

… by size … smallest to largest



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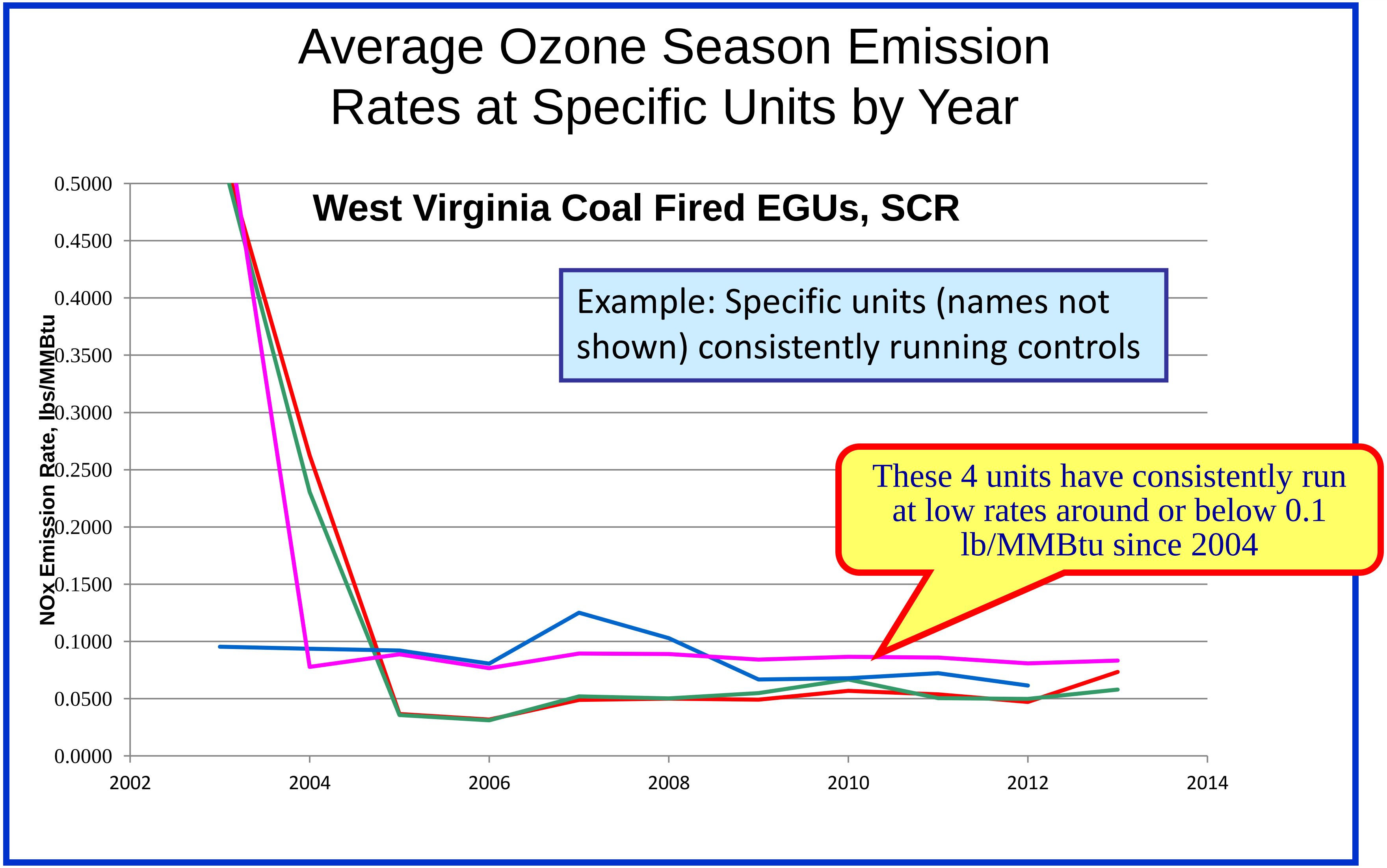
Running Controls



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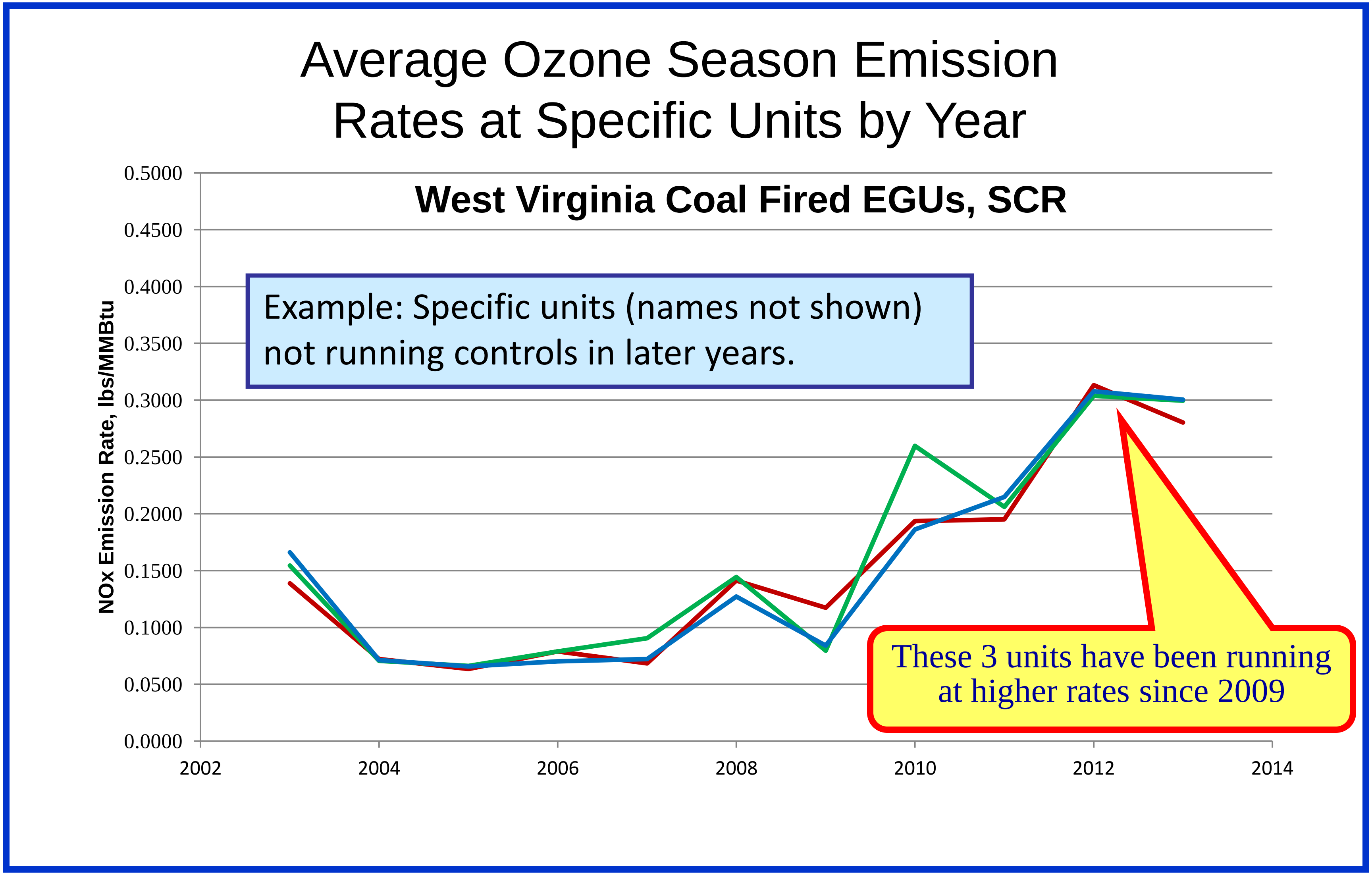
Not Running Controls as Well



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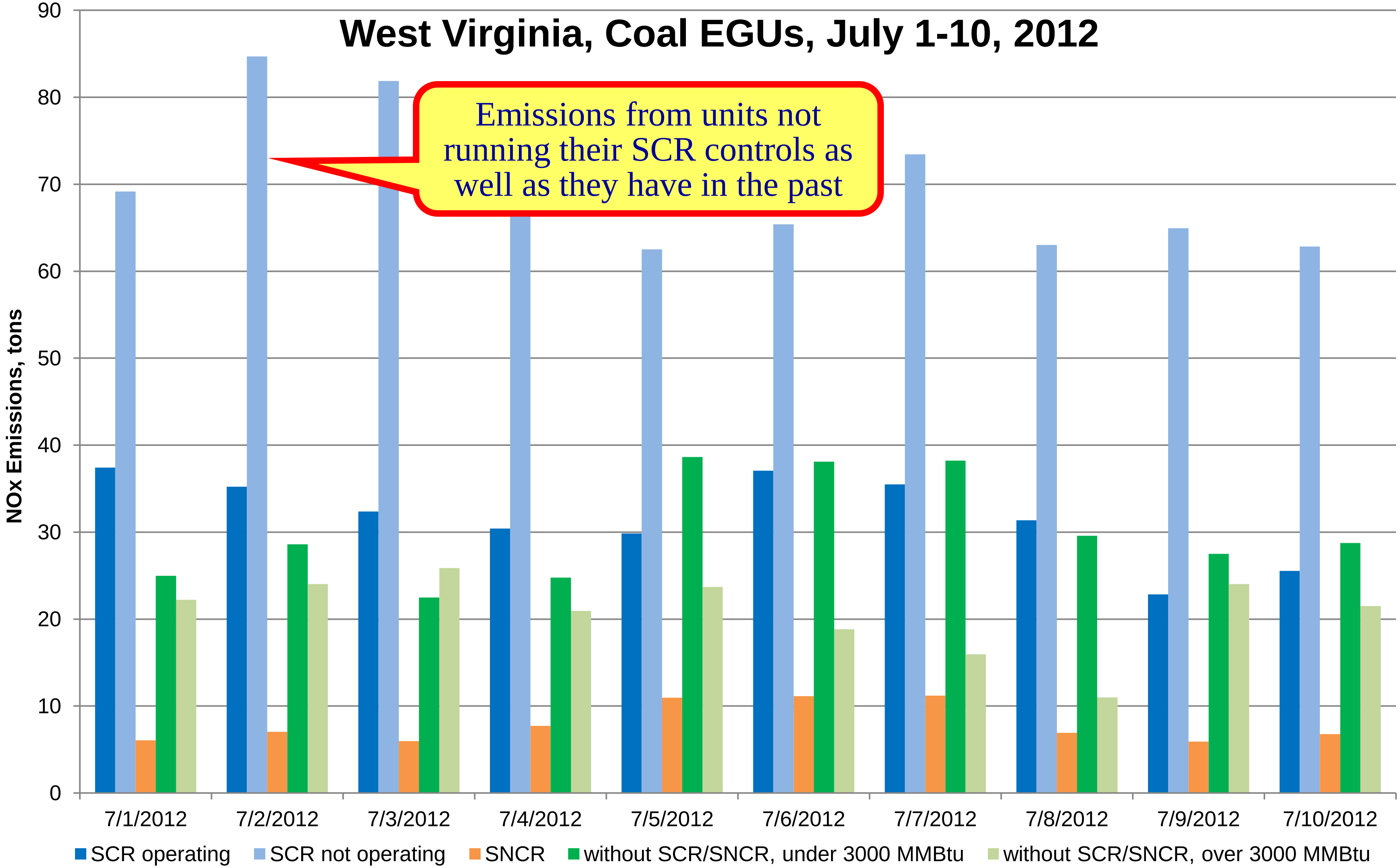
Actual Emissions – July 1 to 10, 2012



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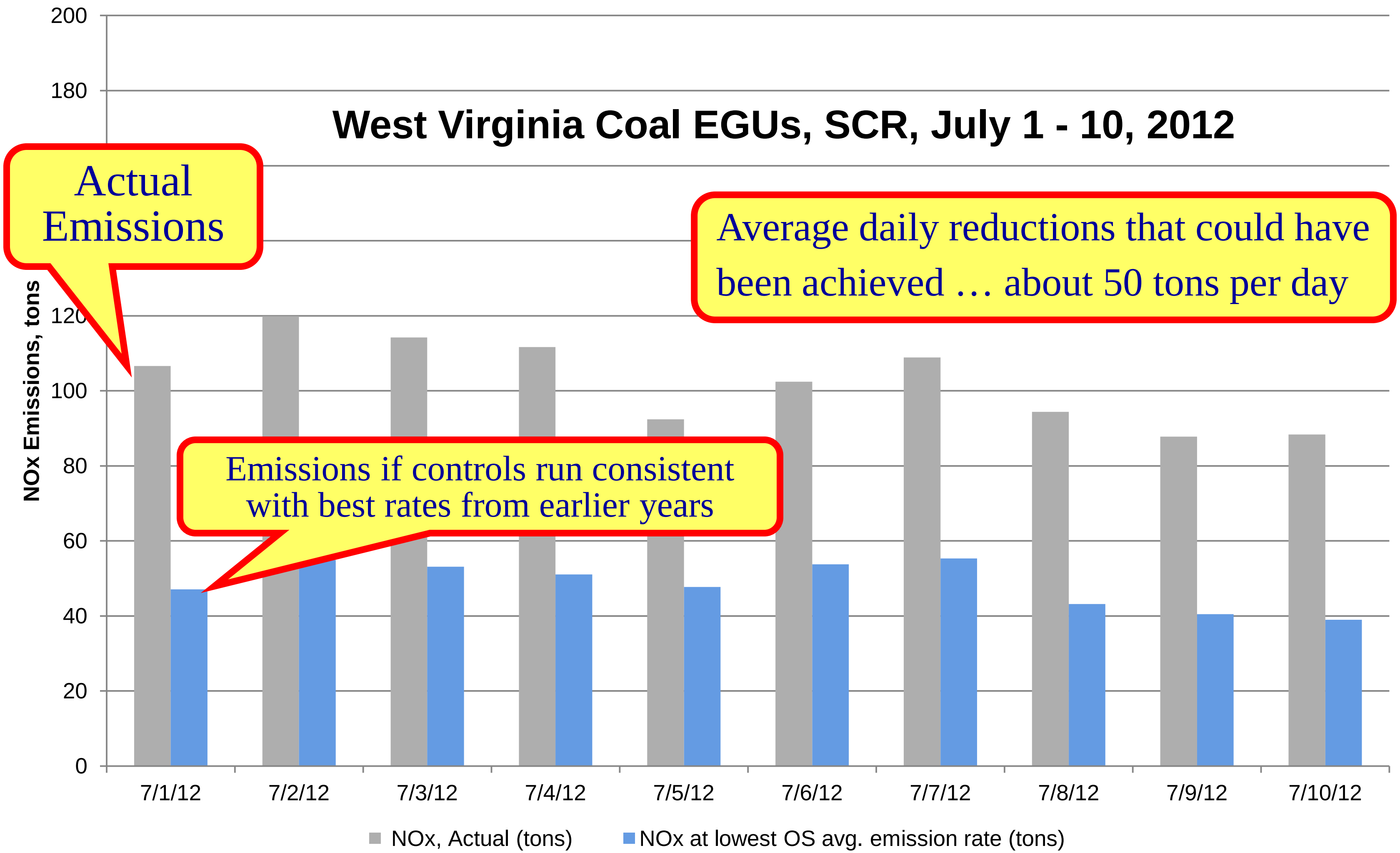
Reductions That Could Have Been Achieved



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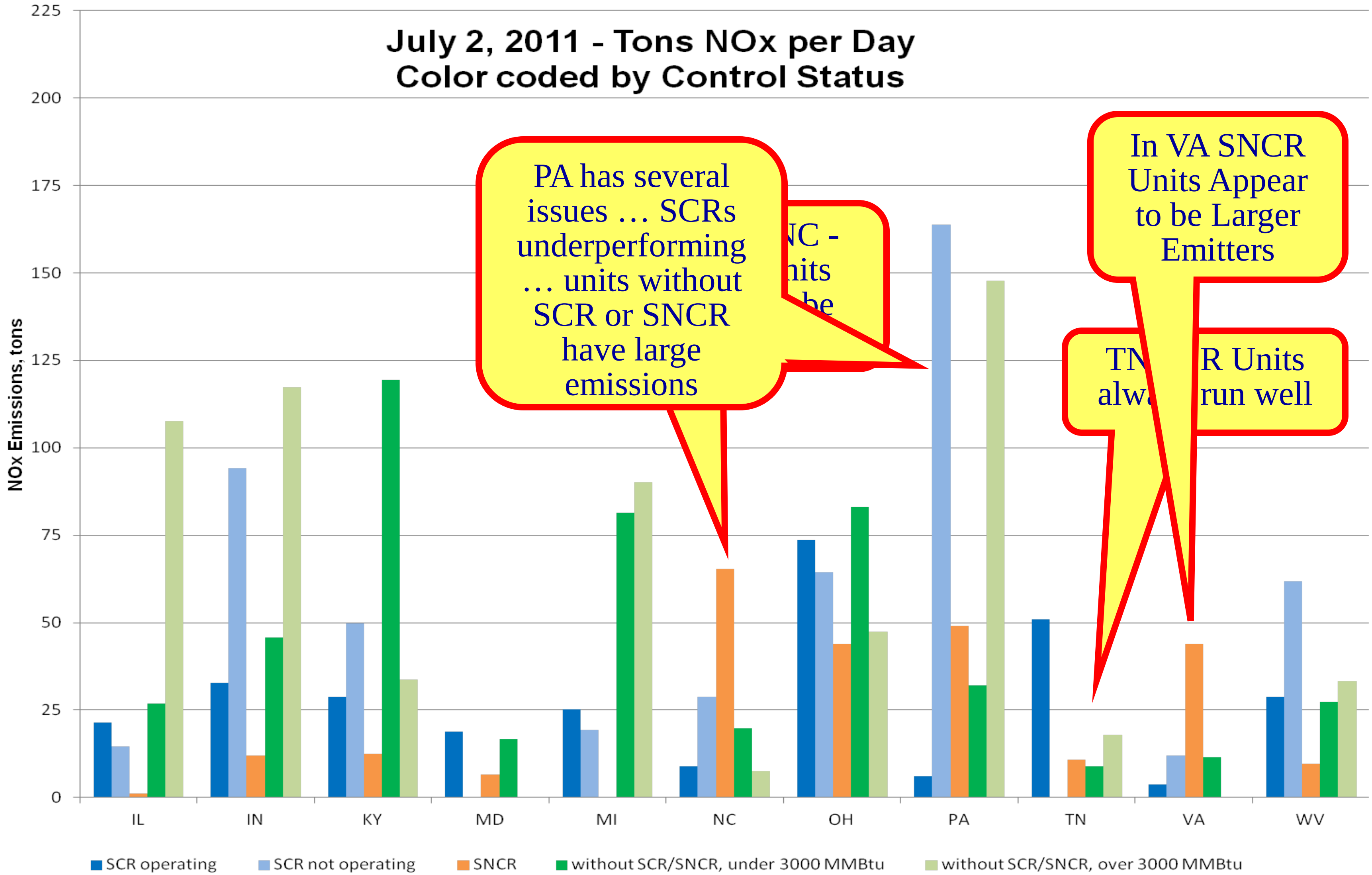
11 State Emissions



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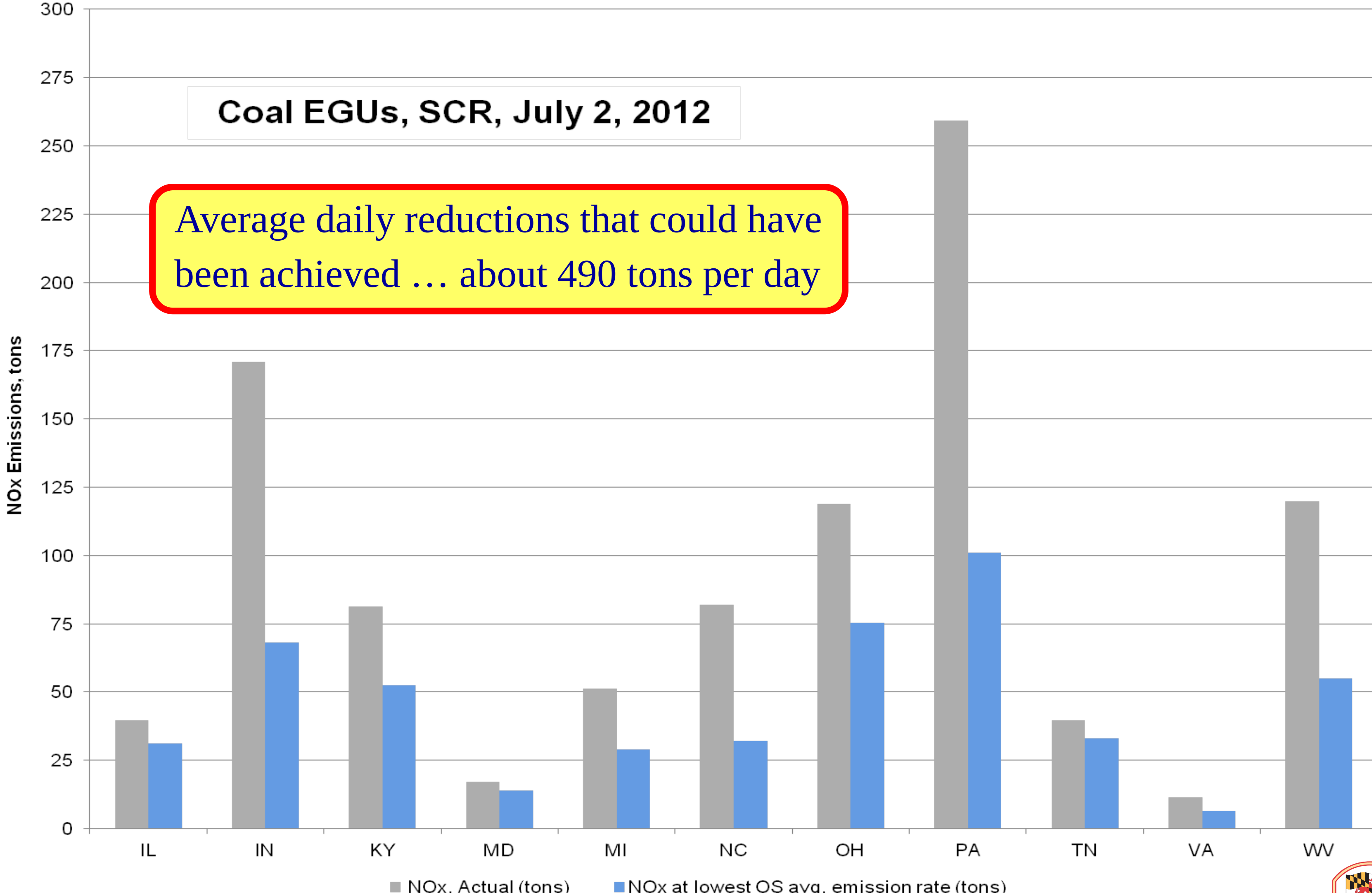
Reductions That Could Have Been Achieved

…11 State Total



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How Might This Affect Ozone?

- Maryland has performed several very preliminary model runs to look at how much running EGU controls inefficiently might increase ozone levels
- Three runs:
  - Scenario 2B – A worst case run
    - Assumes SCR and SNCR controls are not run at all
  - Scenario 3B – A worst data run
    - Assumes SCR and SCR units all run at worst rates seen in CAMD data - 2005 to 2012
  - Scenario 3C – Based upon CAMD data analysis for EGU performance in 2011 and 2012
    - Assumes that units that had higher ozone season emission rates were operating at the best ozone season rates observed since 2005

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These are Preliminary Runs …

… as the modeling improves some of the details will change, but the overall conclusions will not

- These are sensitivity runs
  - They are not perfect, but they are clearly meaningful and policy relevant
- From our 2007 platform
  - One month screening runs
  - Input data continues to be enhanced

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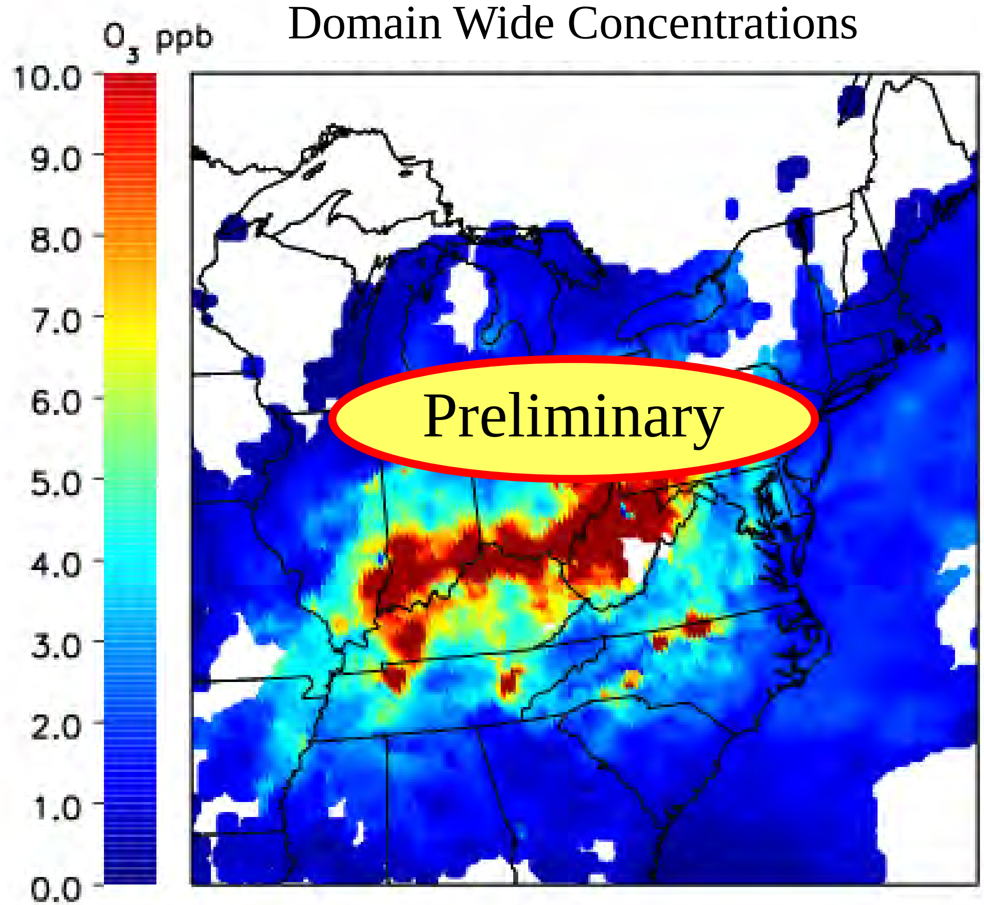
Lost Ozone Benefits – Worst Case

… no SCR or SNCR controls run at all

- Difference plot between … 2018 with and without controls



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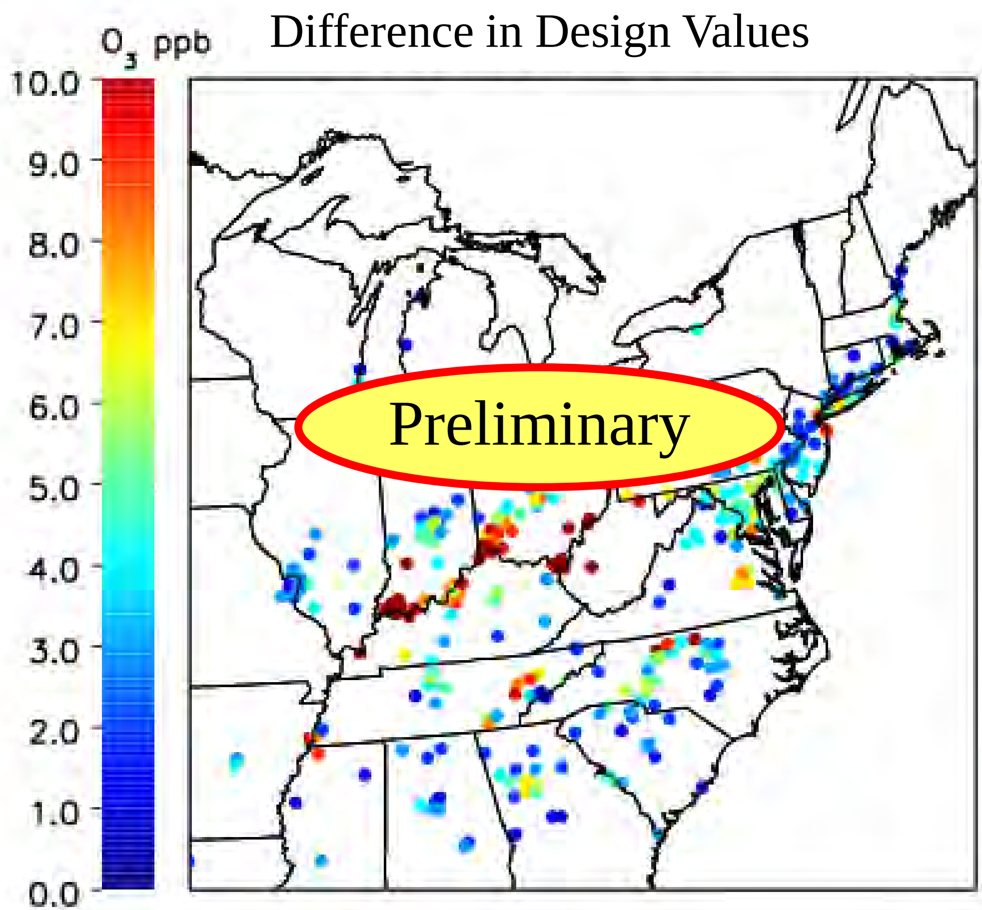
Lost Ozone Benefits – Worst Case

… no SCR or SNCR controls run at all

- Difference plot … DVs … 2018 with and without controls



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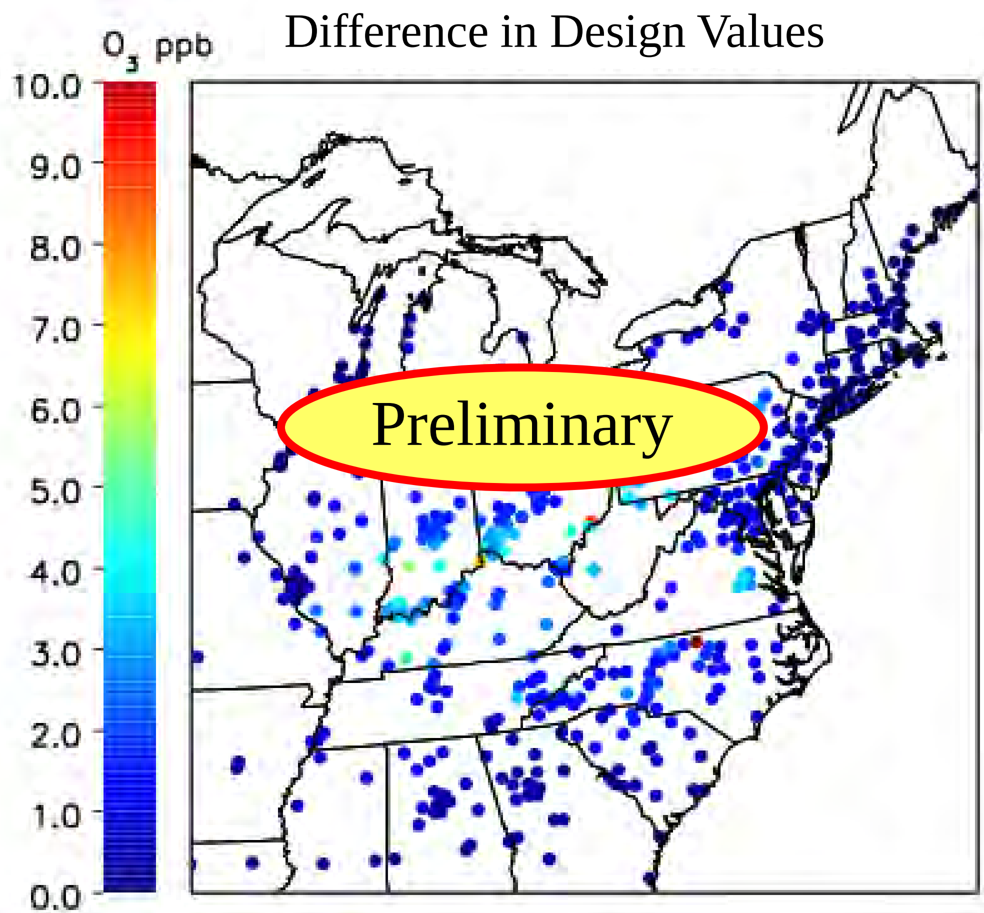
Lost Ozone Benefits – Worst Data

… SCR or SNCR controls run at highest rates in CAMD data

- Difference plot … DVs … 2018 with and without controls



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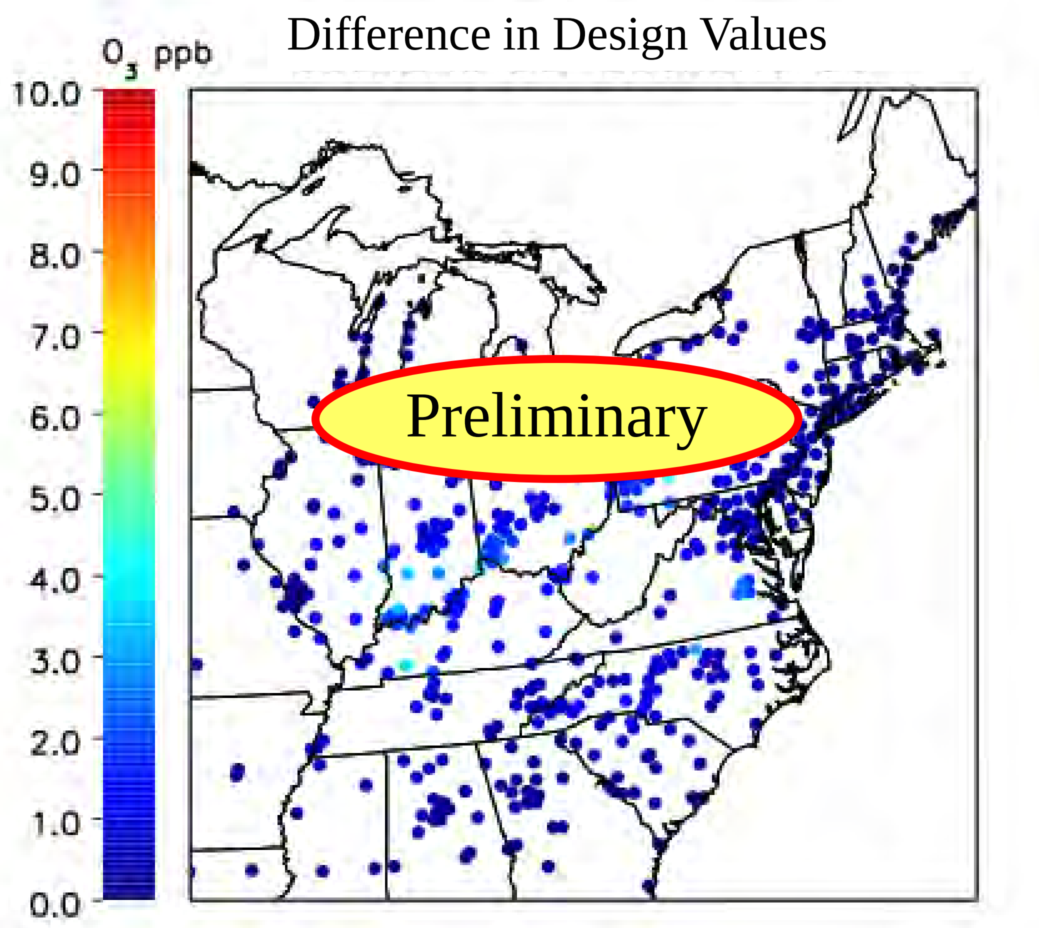
Lost Ozone Benefits – 2011/2012

… based upon 2011 and 2012 CAMD EGU performance data

- Difference plot … DVs … 2018 with and without controls



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Lost Ozone Benefit in PPB

Most Difficult Monitors	Increased Ozone in 2018 – 3 EGU Control Scenarios		
County	Worst Case – No SCRs or SNCRs (Scenario 2B)	Using worst rate CAMD Data (Scenario 3B)	Using actual 2011/2012 Data (Scenario 3C)
Harford, MD	4.3	1.2	0.5
Prince Georges, MD	4.6	1	0.5
Fairfield, CT	2	0.3	0.1
New Castle, DE	3.8	0.8	0.4
Bucks, PA	3.1	0.6	0.4
Suffolk, NY	2	0.4	0.2
Camden, NJ	2.7	0.5	0.3
Fairfax, VA	4.4	1	0.5
Franklin, OH	5	[illegible]	1
Fulton County, GA	2.3	0.3	0.2
Wayne, MI	1.6	0.5	0.2
Sheboygan, WI	1.5	0.1	0.1
Mecklenberg Co, NC	4.1	1.8	1.2
Knoxville, TN	4	0.7	0.5
Jefferson County, KY	6.7	2	1.5
Lake County, IN	1.1	0.2	0.1
Cook County, IL	0.8	0.2	0.1

Preliminary

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Lost Ozone Benefit – Clean Monitors

… EPA will propose a new ozone standard soon … 60 to 70 ppb range … designations to most likely be based upon 2014 to 2016 or 2015 to 2017 data

Preliminary

Projected to be Clean in 2018 … Potentially at Risk		Increased Ozone in 2018 – 3 EGU Control Scenarios		
County	2018 – Controls Running Well (Scenario 3A)	SCRs or SNCRs (Scenario 2B)	Using worst rate CAMD Data (Scenario 3B)	Using actual 2011/2012 Data (Scenario 3C)
Blair, PA	58.7	76.5	64	62.7
Armstrong, PA	66.4	79.8	70.7	68.8
Washington, OH	60.1	80.5	68.9	66.2
Warren, OH	68.8	79.8	72.1	70.9
Kanawa, WV	64.5	80.2	67.8	66.3
Monogolia, WV	61.4	77.1	64.4	63.1
Oldham, KY	67.2	77.1	70.2	69.1
Boone, KY	57.5	77.2	64.7	61.6
Campbell, KY	61.6	71.3	64.3	63.3
Greene, IN	61.8	84.4	67.3	65.2
Vanderburgh, IN	62.3	74.0	65.8	64.7
Person, NC	60.2	78.1	71.7	63.6
Garrett, MD	58.7	75.9	62.6	61.1

Greater than 70 ppb | 65 to 70 ppb | 60 to 65 ppb

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Next Steps With this Modeling

- Run for full ozone season
- Run some regional sensitivity tests
- Run with enhanced chemistry and mobile source adjustments from research
  - This will show slightly greater loss of benefit from not always running controls effectively
- Run with 2011/2018 Platform ASAP
- Work with the Midwest Ozone Group (MOG) on this issue
  - Modeling and potential solution
- Continue to refine as part of the Maryland Attainment SIP

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So where do we go from here?

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Maryland's Push

… can we work together to submit complementary SIPs?

- The current modeling tells us we are very close to meeting the 75 ppb ozone standard
- New modeling between now and the first half of 2015 will support, supplement and strengthen this conclusion
- EPA's process will not resolve this issue before 2015
- In 2015 … areas like Baltimore owe Attainment SIPs and modeling
- All states owe "Good Neighbor" SIPs
  - They were actually due in 2011
- Maryland is pushing …very hard … on "A package of complementary Attainment and Good Neighbor SIPs" to be finalized in late 2014 or early 2015
  - We have been pushing this since early 2013

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How Do We Move Forward?

- Clearly continue the technical collaboration
- Continue Commissioner level discussions when needed
- Begin more serious discussion on making sure EGU controls are run effectively when needed to reduce high ozone levels
- Maryland's push …
  - Upwind and downwind states submit a package of complementary SIPs in 2015
    - Attainment SIPs from states like Maryland
    - Good Neighbor SIPs from others
    - Supported by collaborative modeling
  - Could "trump" an EPA Transport Rule, alter the 110A2D challenges and the 176A Petition and influence any "CSAPR 2" initiative

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Running EGU Controls Effectively

- Maryland has heard from many Air Directors that they are interested in looking at this issue
- MOG has expressed an interest in working with us on this issue
- Discussion between several Air Directors has already started
  - We can build from those ongoing discussions
- Key Issues
  - How to define ”run the controls”?
  - What time frame? – the ozone season? – the core ozone season?
  - How to implement?
    - Good Neighbor SIPs
    - Voluntary agreements with sources
    - Permits
    - Section 126 Petitions
    - Other mechanisms

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Timing

- Maryland Straw Proposal
  - 2014 to Spring 2015
    - Technical collaboration and stakeholder discussions continue
  - Summer 2014 to Spring 2015
    - Commissioner level discussions
  - End of 2014
    - Technical work to support "Complementary Package of SIPs" approaches near "SIP Quality" status
  - Spring 2015 - States submit SIPs
    - This timing works for MD's SIP, but may also be critical if the "State Solution" is to influence an EPA transport rule, the 176A Petition or son or daughter of CSAPR

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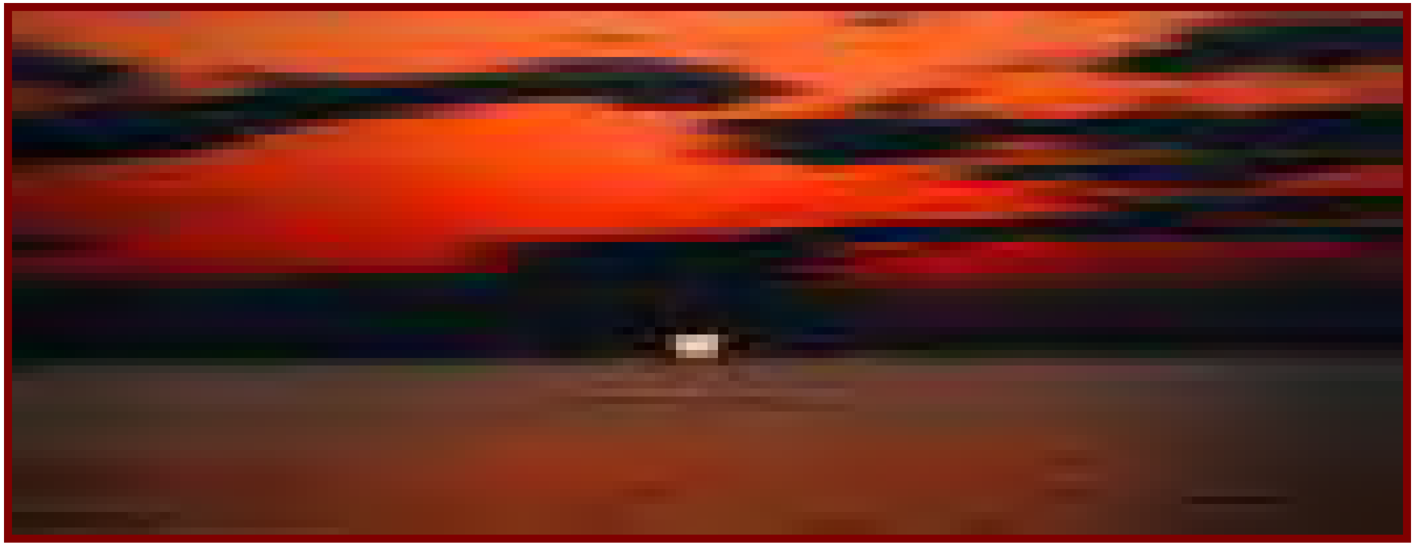
Thanks



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EGU Data Package #3
Operation of Existing SCR, SNCR

Illinois

Sample of draft data and analyses developed by the Maryland Department of the Environment

Contact: Tad Aburn, Air Director, MDE
(410) 537-3255

September 18, 2014

Purpose

- Maryland is the only Moderate nonattainment area in the East for the 75 ppb ozone standard.
  - This means that Maryland is the only state required to submit an attainment SIP
  - Only state required to perform attainment modeling.
- We are now beginning to build our "SIP Quality" modeling platform.
- One major issue that our data analyses have uncovered is that many EGU units appear to not be running their control equipment in recent years as efficiently as they have demonstrated they can do in earlier years. This issue is driven by recent changes in the energy market, reduced coal capacity, inexpensive allowances and a regulatory structure driven by ozone season caps not daily performance. In many states, including Maryland, this has lead to controls not always being used efficiently on the days when they are needed the most … this is perfectly legal.
- This is a critical issue that we would like to continue to discuss with you. There appears to be an interest from the private sector to discuss this issue and see if a common sense fix can be designed. Maryland believes this fix would be relatively cost-effective compared to the capital cost of the control technologies.
- MDE has focused our analyses on two of the worst large, regional scale ozone episodes from recent years: July 1-8, 2011 and July 1-10, 2012.
- The primary data used in these analyses include:
  - CEMS data from CAMD
  - Emissions and projection data from ERTAC
  - Other data we have received from individual states
- More detailed data and analyses and spreadsheets are available upon request.

How the Data Analyses Were Built

- Maryland began the data analyses in late 2012
  - Looked at EGUs in the 9 upwind states named in the 176A Petition (IL, IN, KY, MI, NC, OH, TN, VA, WV) … MD and PA
- Shared a draft package with Air Directors on April 21, 2014
  - This package focused on a bad ozone episode: July 1 – 8, 2011
- Shared a second draft package with Air Directors on May 13, 2014
  - This package focused on second bad ozone episode: July 1 – 10, 2012
  - This package also included update to specific material after receiving comments from numerous states
- The 2011 and 2012 episodes analyzed capture two of the worst regional ozone periods in 2011 and 2012
  - Other states, like Wisconsin and Delaware have done similar analyses and reached similar conclusions
- This is the third draft package, and builds on to the prior two draft packages, while incorporating input from individual states and updates to ERTAC.
- This third draft package also includes preliminary photochemical modeling performed by MDE to look at the potential loss of ozone reduction benefits.

Help Us QA the Data

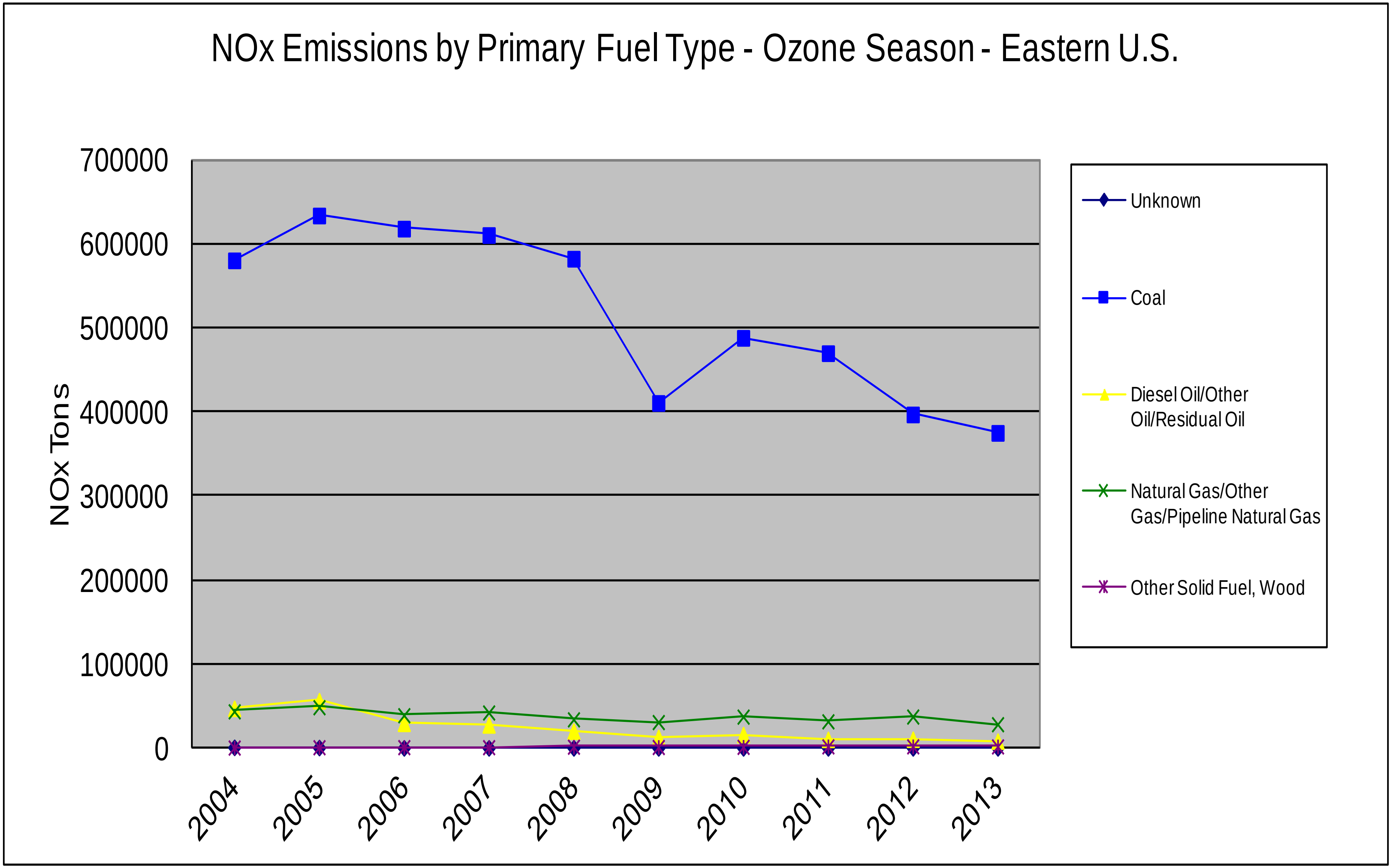
- We have used readily available data, like the CAMD and ERTAC data, but we recognize that these data sources can be out of date, or not include recent changes.
  - We hope you can help us with making sure we have the best possible data.

- This package reflects recently updated data, including but not limited to:
  - CAMD updates
  - May 8, 2014 ERTAC updates
  - PA comments to OTC, forwarded to MDE, Spreadsheets detailing "EGU Shutdowns, EGU Controls and New Natural Gas Power Projects" for the state of PA. Sent from Randy Bordner, Environmental Group Manager - Bureau of Air Quality, PA Department of Environmental Protection to Andy Bodnarik, OTC. Received as FWD from Andy Bodnarik on 4/23/2014
  - VA comments to MDE, "Electric Generation Sector Summary for Virginia" received from Thomas R. Ballou, Director - Office of Air Data Analysis and Planning, VA Department of Environmental Quality on 5/12/2014

Part 1

Background:
Generation in 2012 and 2018
Projected Changes

Why Coal?


NOx Emissions by Primary Fuel Type - Ozone Season - Eastern U.S.
NOx Tons
700000
600000
500000
400000
300000
200000
100000
0
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Unknown
Coal
Diesel Oil/Other Oil/Residual Oil
Natural Gas/Other Gas/Pipeline Natural Gas
Other Solid Fuel, Wood

Illinois EGUs, 2012

- Total number of units = 241
- Total heat input capacity = 374,711 MMBtu/hr = 52,118 MW
- Total State MW Capacity in %
  - **Total number of Coal units = 50 = 40%**
  - Total number of NG units = 156 = 34%
  - Total number of other (oil, etc.) units = 24 = 2%
  - Total number of Nuclear units = 11= 24%
- **Total Capacity Coal = 20,914 MW**
  - 16 units with SCR = 7,318 MW = 35%
  - 14 units with SNCR = 8,166 MW = 39%
  - 20 units without SCR/SNCR = 5,430 MW = 26%

Basis – CAMD (as of 5/13/2014), NEI (for Nuclear), ERTAC (5/6/2014, 5/8/2014)

Capacity and Fuel: 2012 to 2018

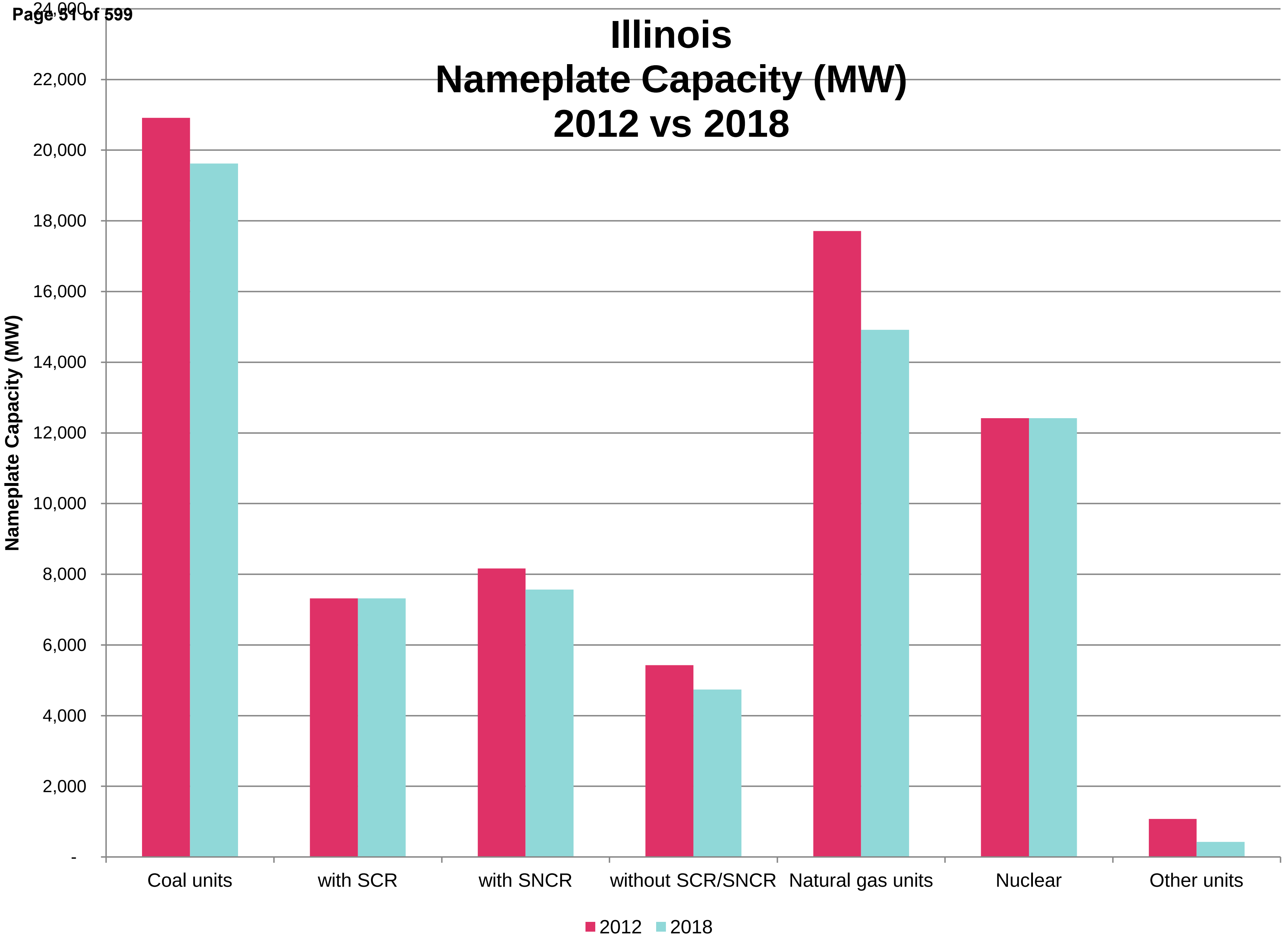
A detailed review of ERTAC data for 2018 was completed, and an evaluation of the following characteristics performed.

- Total Number of units
- Heat input capacity - MMBtu/hr
- Nameplate capacity – MW
- Presence of advanced post combustion controls – SCR, SNCR
- Fuel switching
- Shutdown, retirements

Illinois EGUs, 2018

- Total number of units = 216
- Total heat input capacity = 327,468 MMBtu/hr = 47,381 MW
- Total State MW Capacity in %
  - **Total number of Coal units = 44 = 41%**
  - Total number of NG units = 148 = 32%
  - Total number of other (oil, etc.) units = 13 = 1%
  - Total number of Nuclear units = 11 = 26%
- **Total Capacity Coal = 19,623 MW**
  - 16 units with SCR = 7,318 MW = 37%
  - 12 units with SNCR = 7,568 MW = 39%
  - 16 units without SCR/SNCR = 4,738 MW = 24%

Basis – ERTAC (5/6/2014, 5/8/2014), NEI (for Nuclear)



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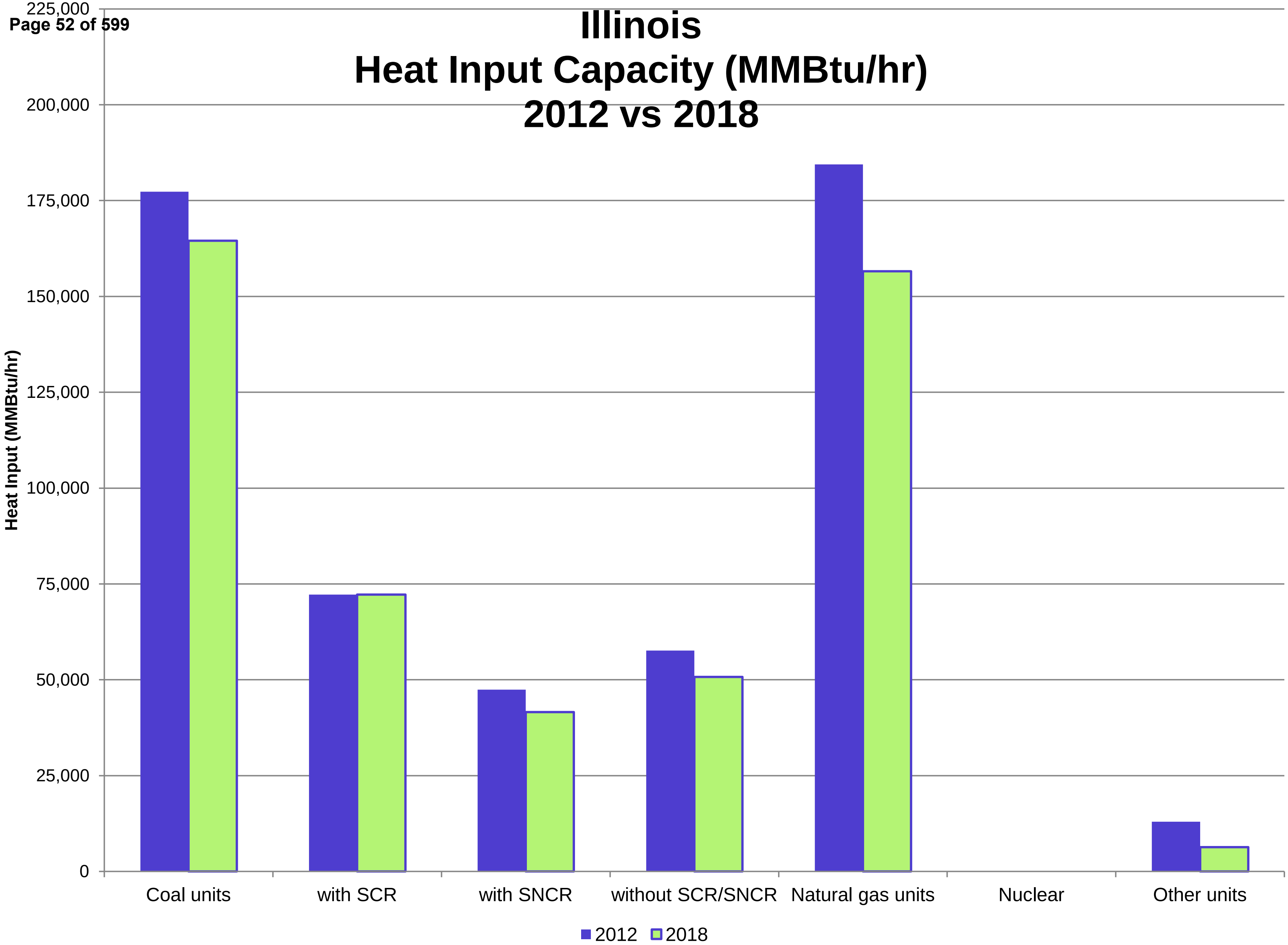
Illinois
Heat Input Capacity (MMBtu/hr)
2012 vs 2018



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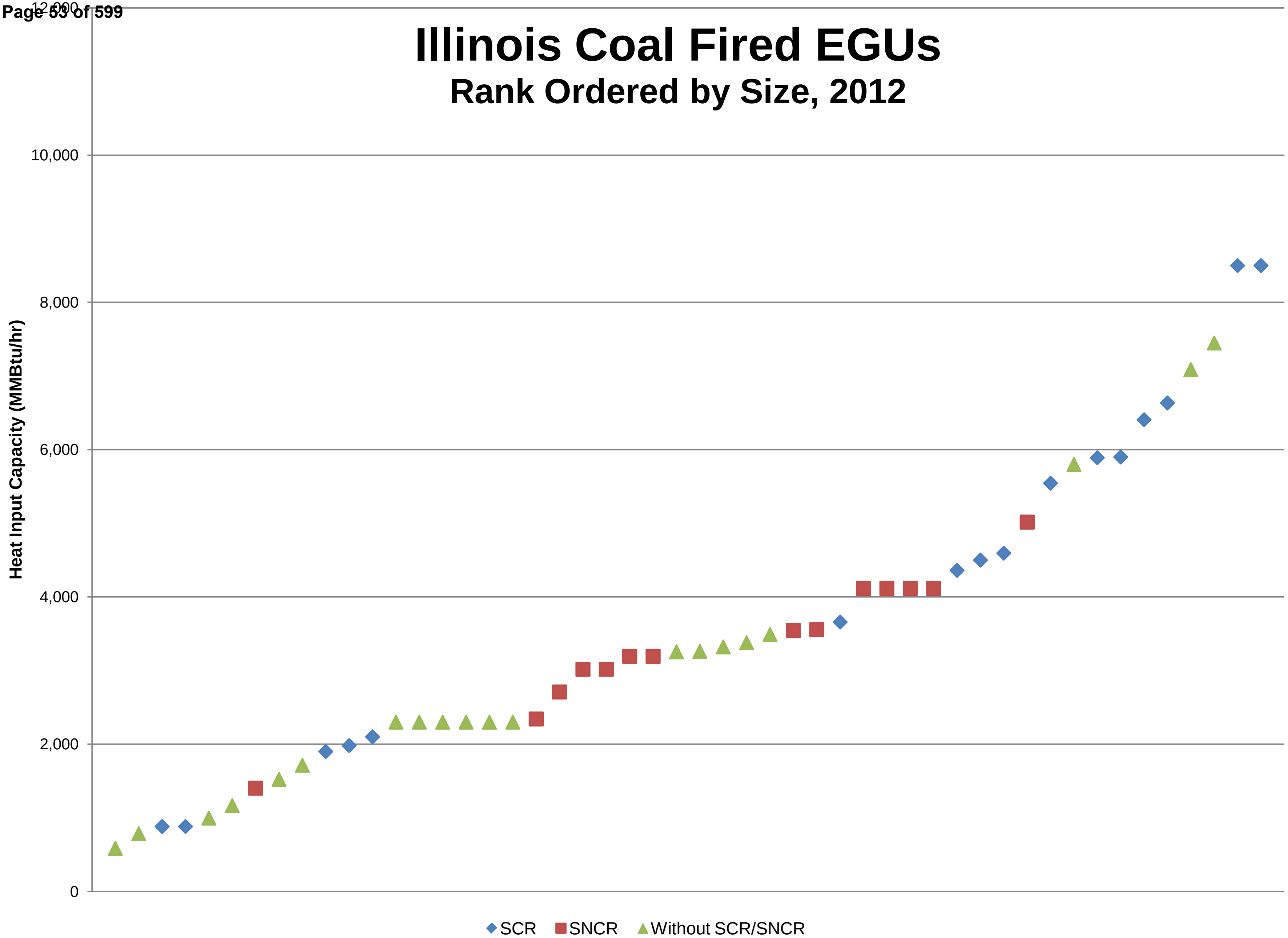
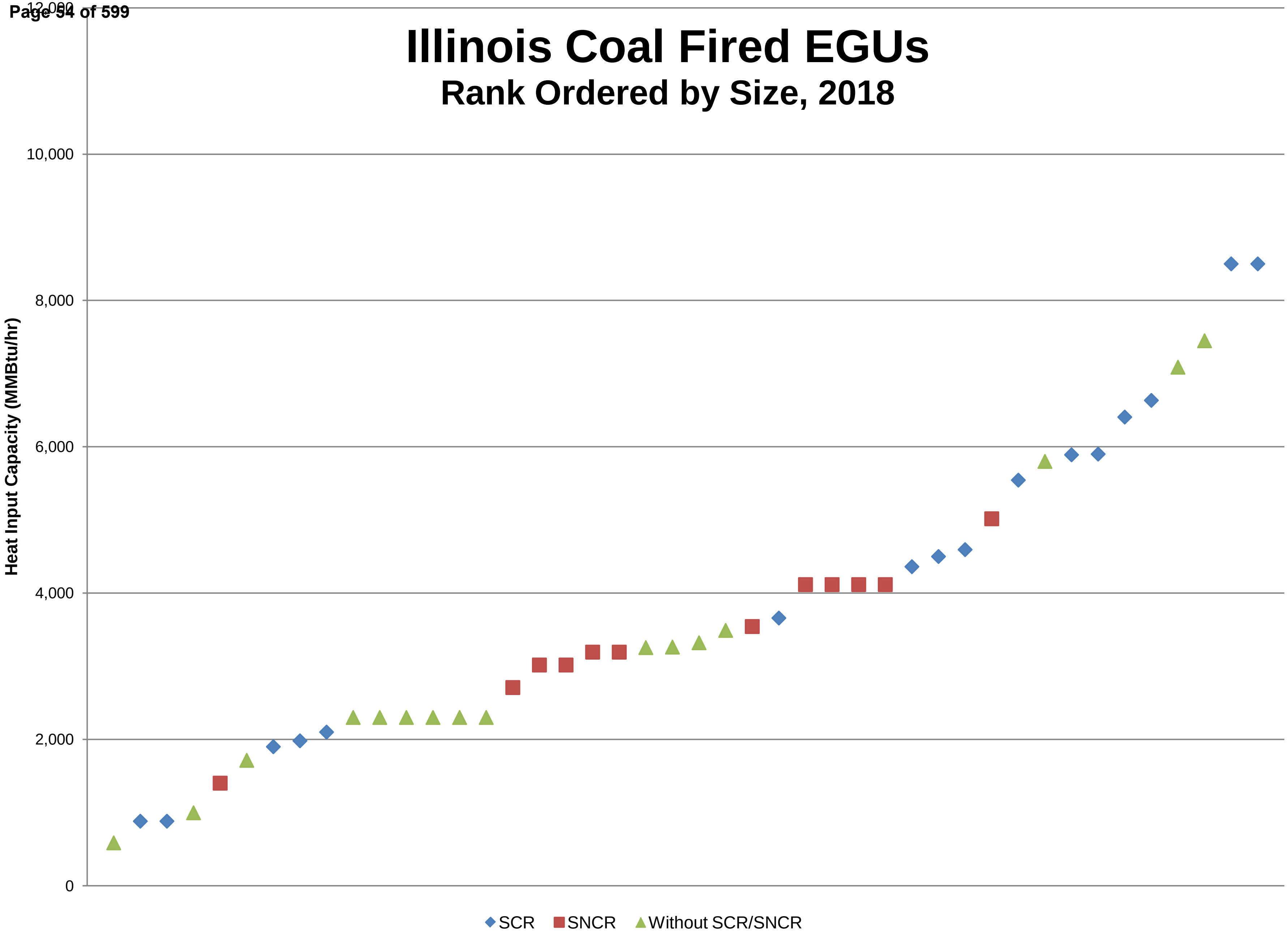

Illinois Coal Fired EGUs
Rank Ordered by Size, 2012
Heat Input Capacity (MMBtu/hr)
12,000
10,000
8,000
6,000
4,000
2,000
0
SCR
SNCR
Without SCR/SNCR



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IL : Large (> 3000 MMBtu/hr) Coal-Fired EGU NOx Emissions Rate Analysis

	Facility Name	Unit ID	Lowest OS Emission Rate Year	Lowest OS Emission Rate (lbs/MMBtu)	2007 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2007 OS ER (% Change)	2011 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2011 OS ER (% Change)	Comments/ ERTAC Closure Date
Controlled with SCR	Baldwin Energy Complex	1	2009	0.0535	0.0565	6	0.0578	8	
	Baldwin Energy Complex	2	2010	0.0509	0.0570	12	0.0588	16	
	Coffeen	1	2011	0.0495	0.0810	64	0.0495	0	
	Coffeen	2	2008	0.0524	0.0861	64	0.0661	26	
	Duck Creek	1	2009	0.0736	0.1137	54	0.0955	30	
	E D Edwards	3	2009	0.0445	0.0786	77	0.0488	10	
	Havana	9	2008	0.029	0.0305	5	0.0769	165	
	Kincaid Station	1	2009	0.0608	0.064	5	0.2119	249	
	Kincaid Station	2	2009	0.06	0.0612	2	0.1987	231	
	Prairie State	1	2012	0.0678	N/A	N/A	N/A	N/A	New 2012
	Prairie State	2	2012	0.1937	N/A	N/A	N/A	N/A	New 2012
Controlled with SNCR	Joliet 29	71	2012	0.0858	0.1078	26	0.1304	52	
	Joliet 29	72	2012	0.086	0.108	26	0.1304	52	
	Joliet 29	81	2011	0.0966	0.1129	17	0.0966	0	
	Joliet 29	82	2011	0.0978	0.1135	16	0.0978	0	
	Joliet 9	5	2012	0.1023	0.3099	203	0.2965	190	
	Powerton	51	2012	0.0924	0.417	351	0.2101	127	
	Powerton	52	2012	0.0921	0.4069	342	0.2098	128	
	Powerton	61	2012	0.0923	0.4109	345	0.2139	132	
	Powerton	62	2012	0.0925	0.4154	349	0.2113	128	
	Will County	3	2012	0.0809	0.1393	72	0.1338	65	
	Will County	4	2012	0.0762	0.1309	72	0.1103	45	
No Controls or Fuel Switches by 2019	Baldwin Energy Complex	3	2012	0.0877	0.0879	0	0.0921	5	
	E D Edwards	2	2011	0.195	0.2485	27	0.1950	0	
	Newton	1	2007	0.0877	0.0877	0	0.1016	16	
	Newton	2	2007	0.0901	0.0901	0	0.1075	19	
	Waukegan	7	2012	0.1117	0.1180	6	0.1414	27	
	Waukegan	8	2012	0.1114	0.1157	4	0.1333	20	
	Wood River Power Station	5	2012	0.1431	0.1463	2	0.1462	2	
Retiring by 2017	Crawford	7	2012	0.0902	0.1227	36	0.1328	47	Has SNCR, retire 9/1/2012
	Crawford	8	2012	0.11	0.1517	38	0.1787	62	Has SNCR, retire 9/1/2012
	Fisk	19	2008	0.1149	0.13	13	0.1401	22	9/1/2012

IL: Small (< 3000 MMBtu/hr) Coal-Fired EGU NOx Emissions Rate Analysis

	Facility Name	Unit ID	Lowest OS Emission Rate Year	Lowest OS Emission Rate (lbs/MMBtu)	2007 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2007 OS ER (% Change)	2011 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2011 OS ER (% Change)	Comments/ ERTAC Closure Date
Controlled with SCR	Dallman	4	2011	0.0447	N/A	N/A	0.0447	0	
	Dallman	31	2007	0.0938	0.0938	0	0.1056	13	
	Dallman	32	2008	0.0846	0.1013	20	0.1454	72	
	Dallman	33	2012	0.0621	0.07	13	0.1067	72	
	Marion	4	2004	0.0706	0.1142	62	0.137	94	
Controlled with SNCR	Marion	123	2006	0.0656	0.0876	34	0.0926	41	
No Controls or Fuel Switches by 2019	Hennepin Power Station	1	2007	0.1069	0.1069	0	0.1352	26	
	Hennepin Power Station	2	2007	0.1058	0.1058	0	0.1342	27	
	Joppa Steam	1	2009	0.1178	0.1242	5	0.1244	6	
	Joppa Steam	2	2009	0.1193	0.1246	4	0.1254	5	
	Joppa Steam	3	2012	0.1068	0.1208	13	0.1129	6	
	Joppa Steam	4	2012	0.1055	0.1216	15	0.1125	7	
	Joppa Steam	5	2007	0.11	0.11	0	0.1135	3	
	Joppa Steam	6	2007	0.1101	0.1101	0	0.1135	3	
	Wood River Power Station	4	2011	0.1271	0.1431	13	0.1271	0	
Retiring by 2017	E D Edwards	1	2011	0.1939	0.2487	28	0.1939	0	12/31/2017
	Vermilion Power Station	1	2012	0.056	0.2697	382	N/A	N/A	11/1/2012
	Vermilion Power Station	2	2012	0.0577	0.2694	367	N/A	N/A	11/1/2012

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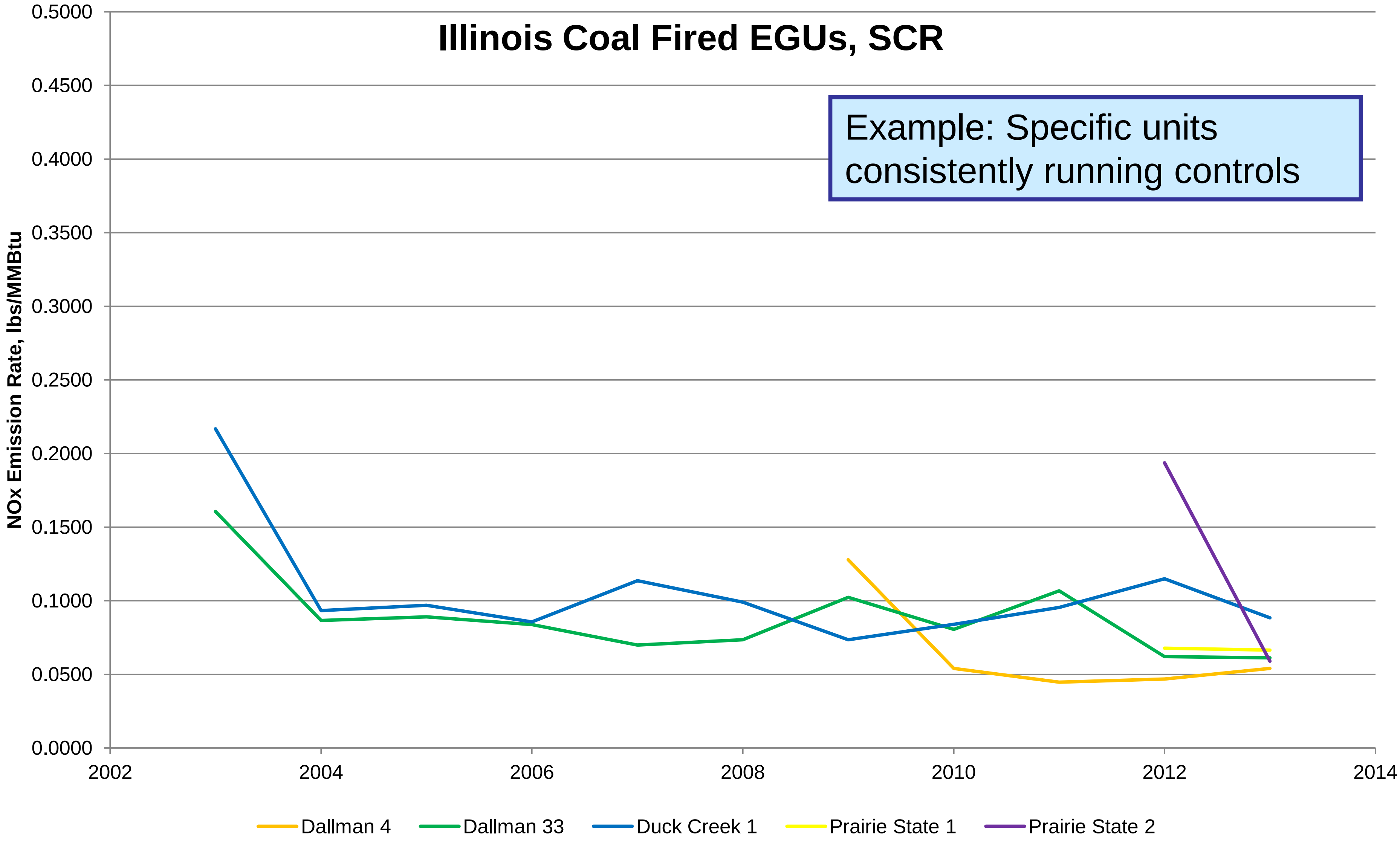
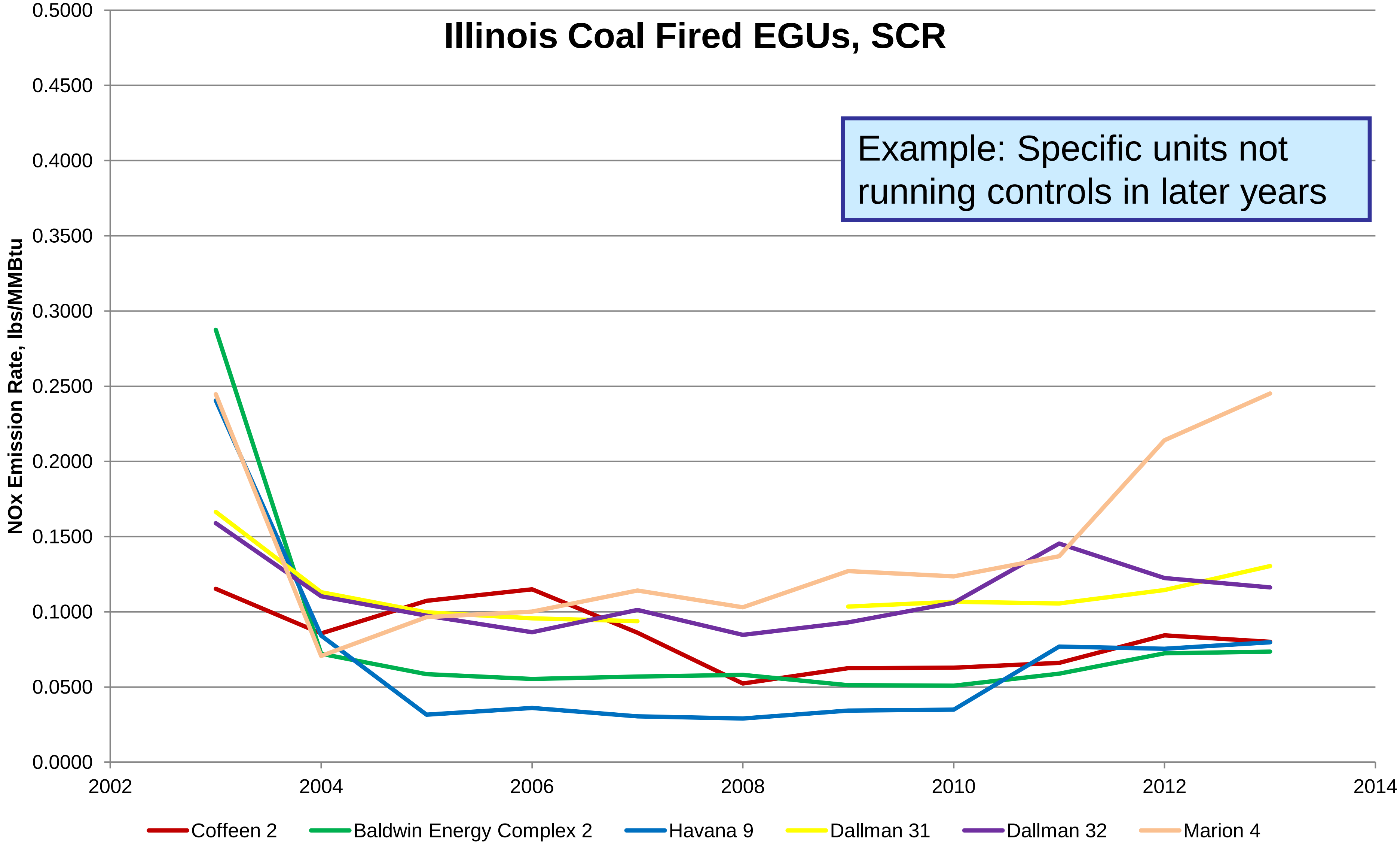
Part 2

Operation of Controls: Changes in Control Efficiency 2003 to 2013

Average Ozone Season Emission Rates at Specific Units by Year



Average Ozone Season Emission Rates at Specific Units by Year



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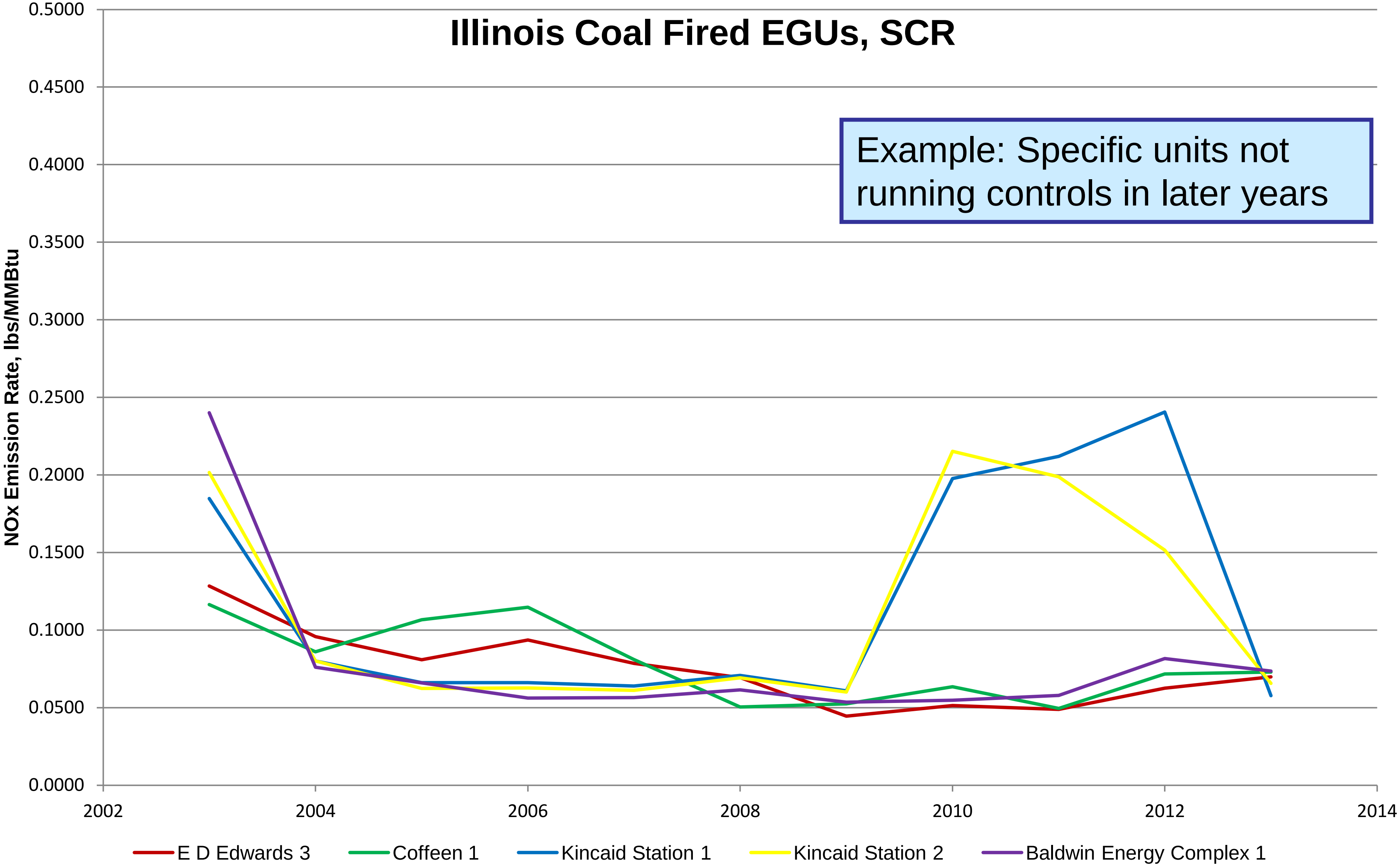
Average Ozone Season Emission Rates at Specific Units by Year



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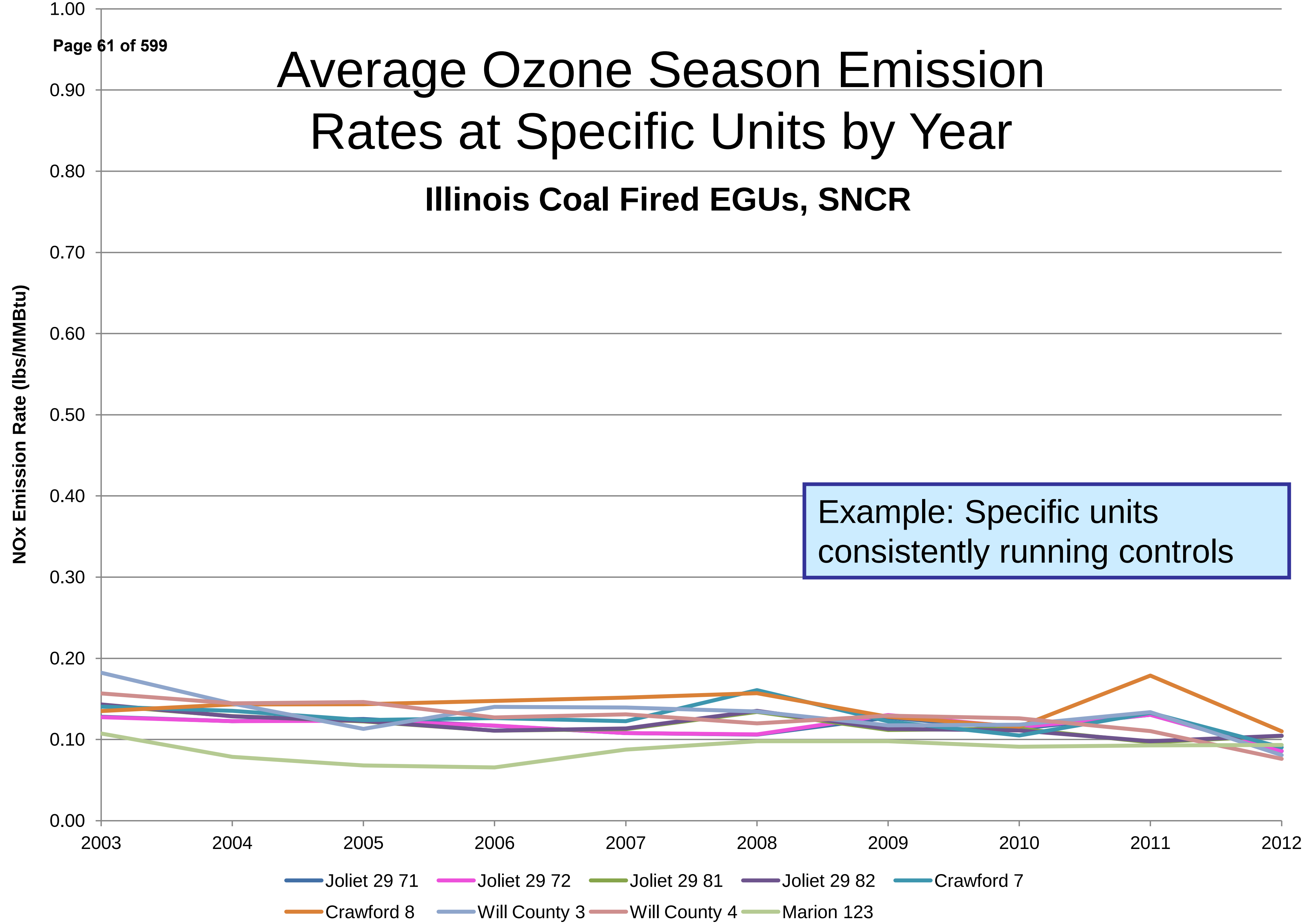

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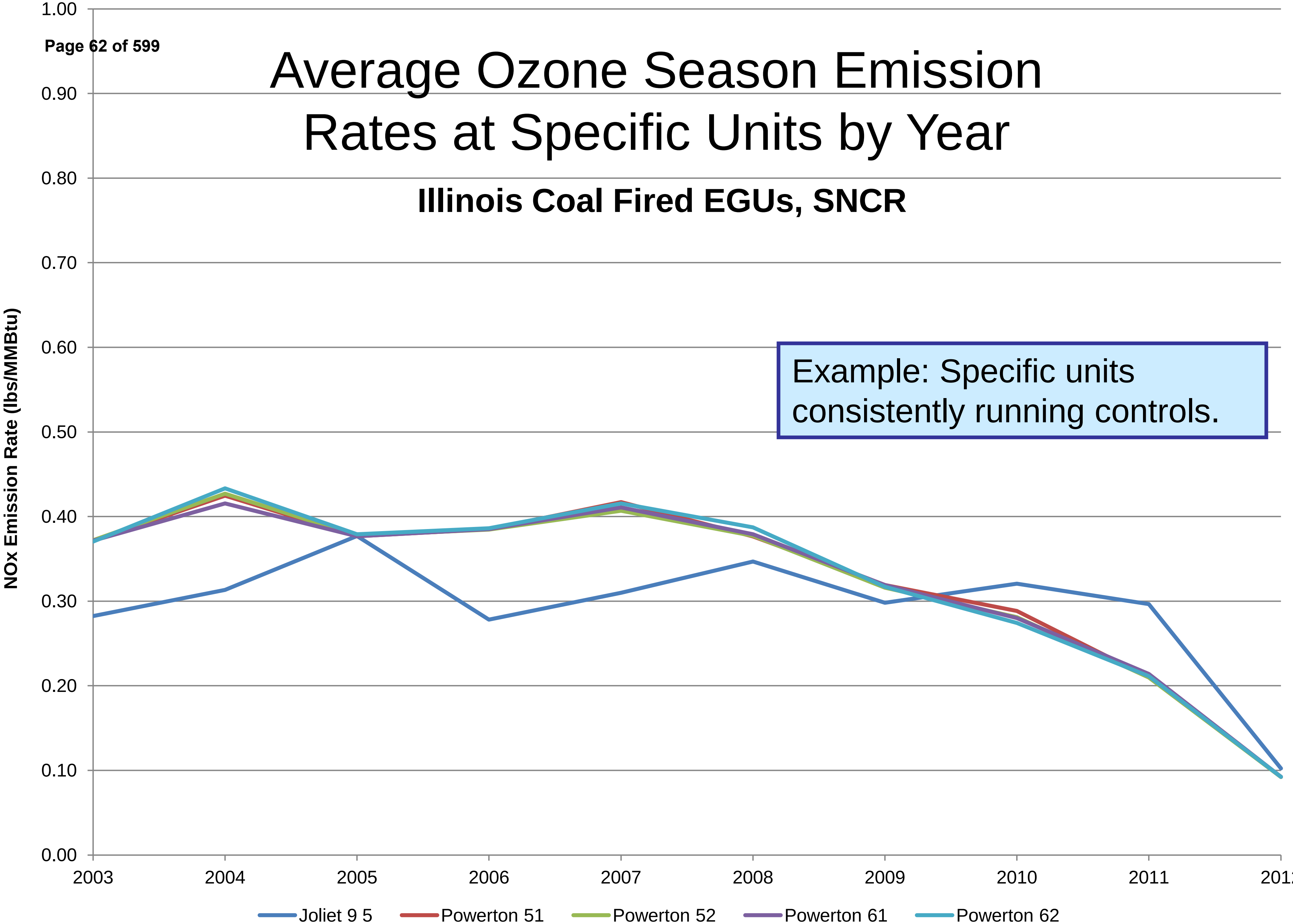
Average Ozone Season Emission Rates at Specific Units by Year

Illinois Coal Fired EGUs, SNCR



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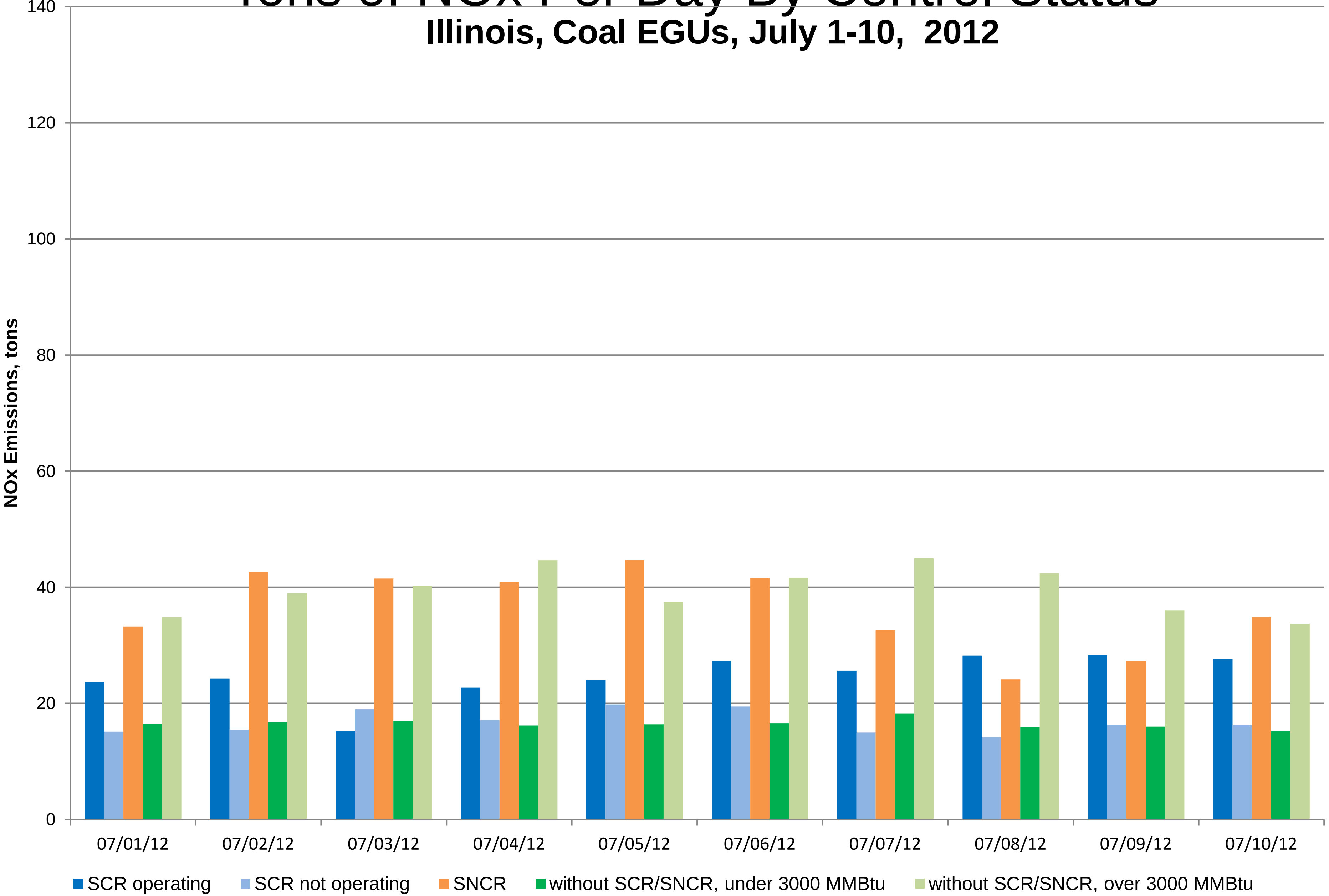
Part 3

July 1 to 10, 2012 Ozone Episode:

Analysis of Emissions and Controls

Tons of NOx Per Day By Control Status

Illinois, Coal EGUs, July 1-10, 2012



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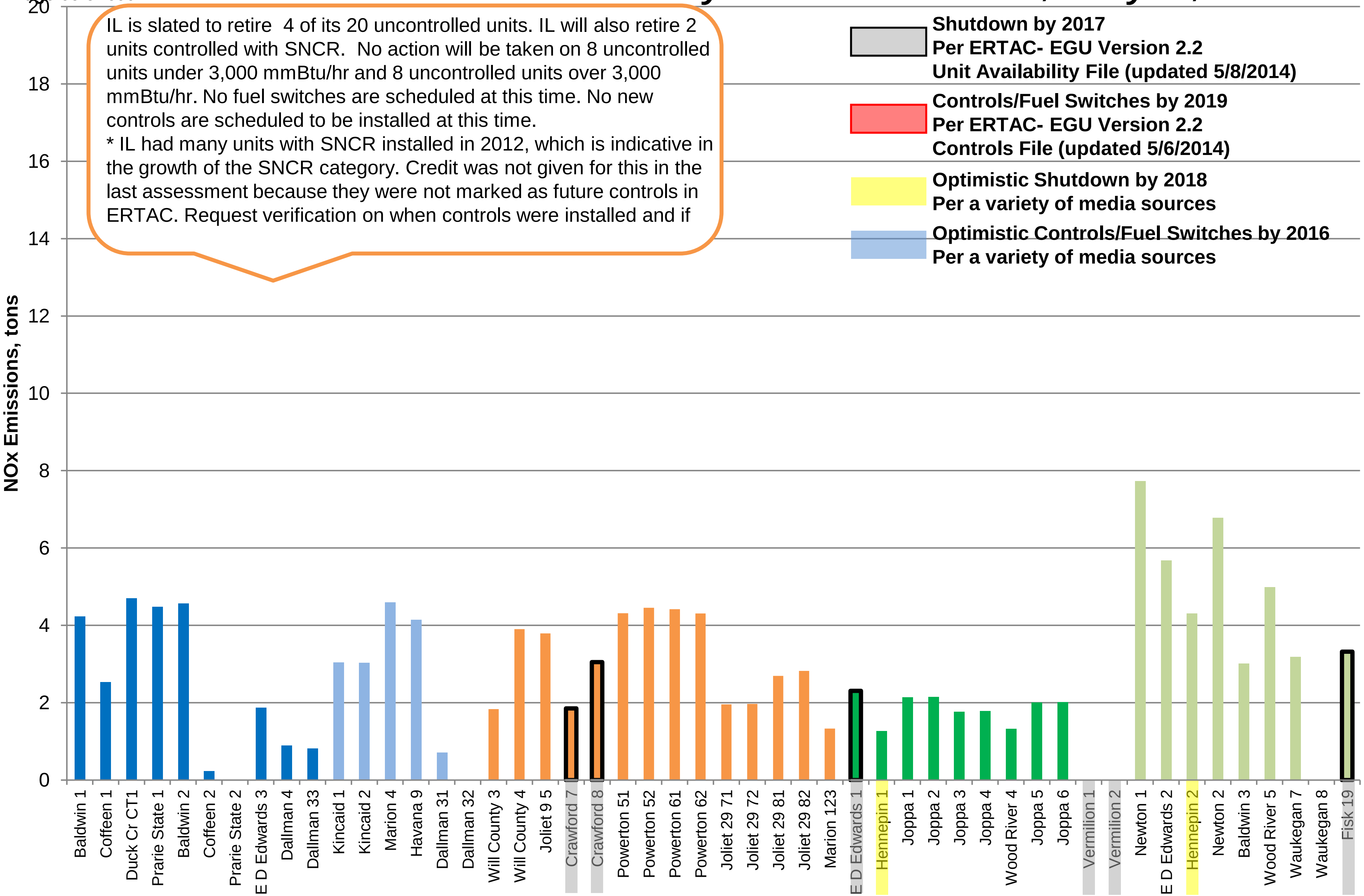
IL - Tons of NOx Per Unit By Control Status, July 2, 2012



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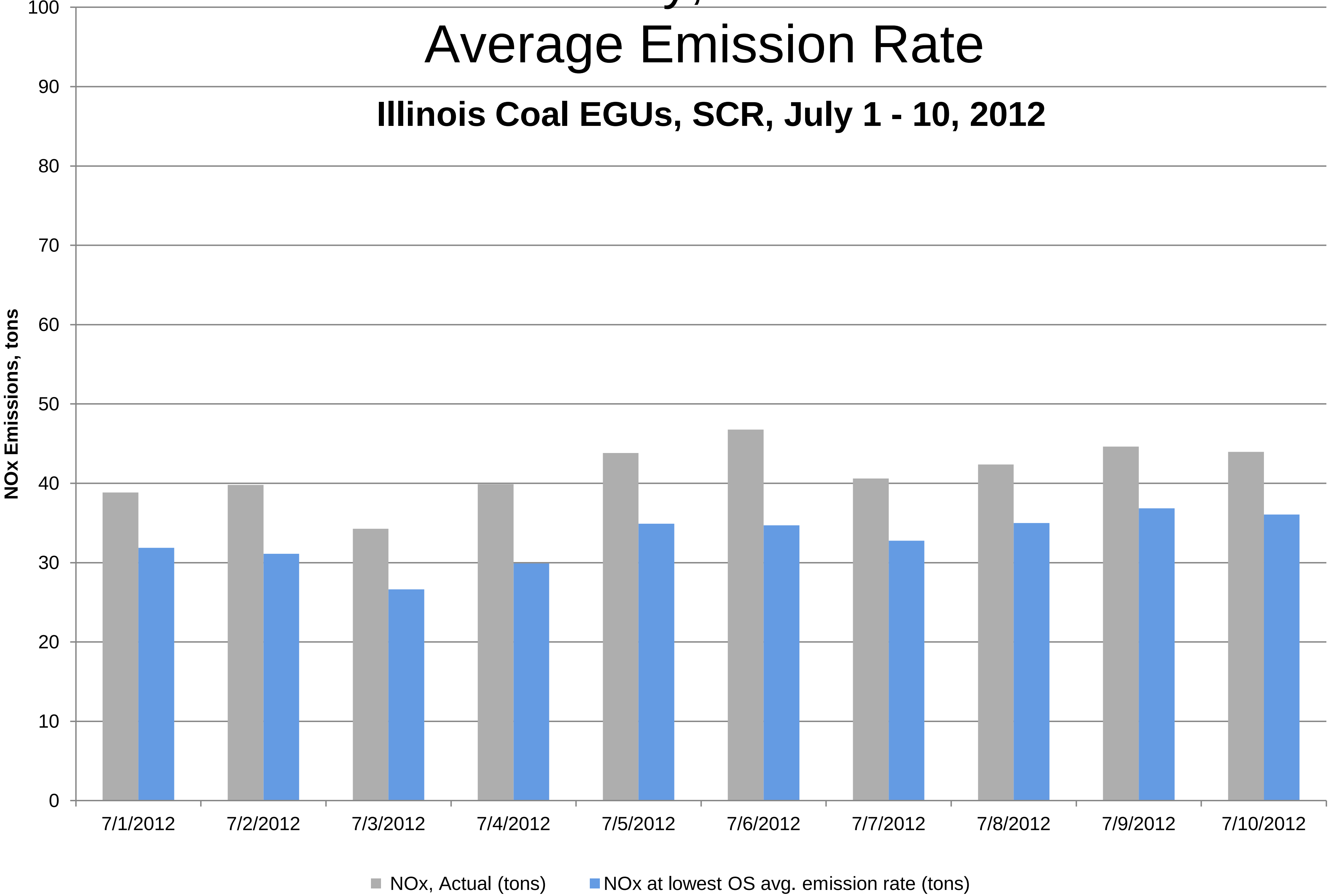
Tons of NOx Per Day, Actual vs. Lowest OS Average Emission Rate



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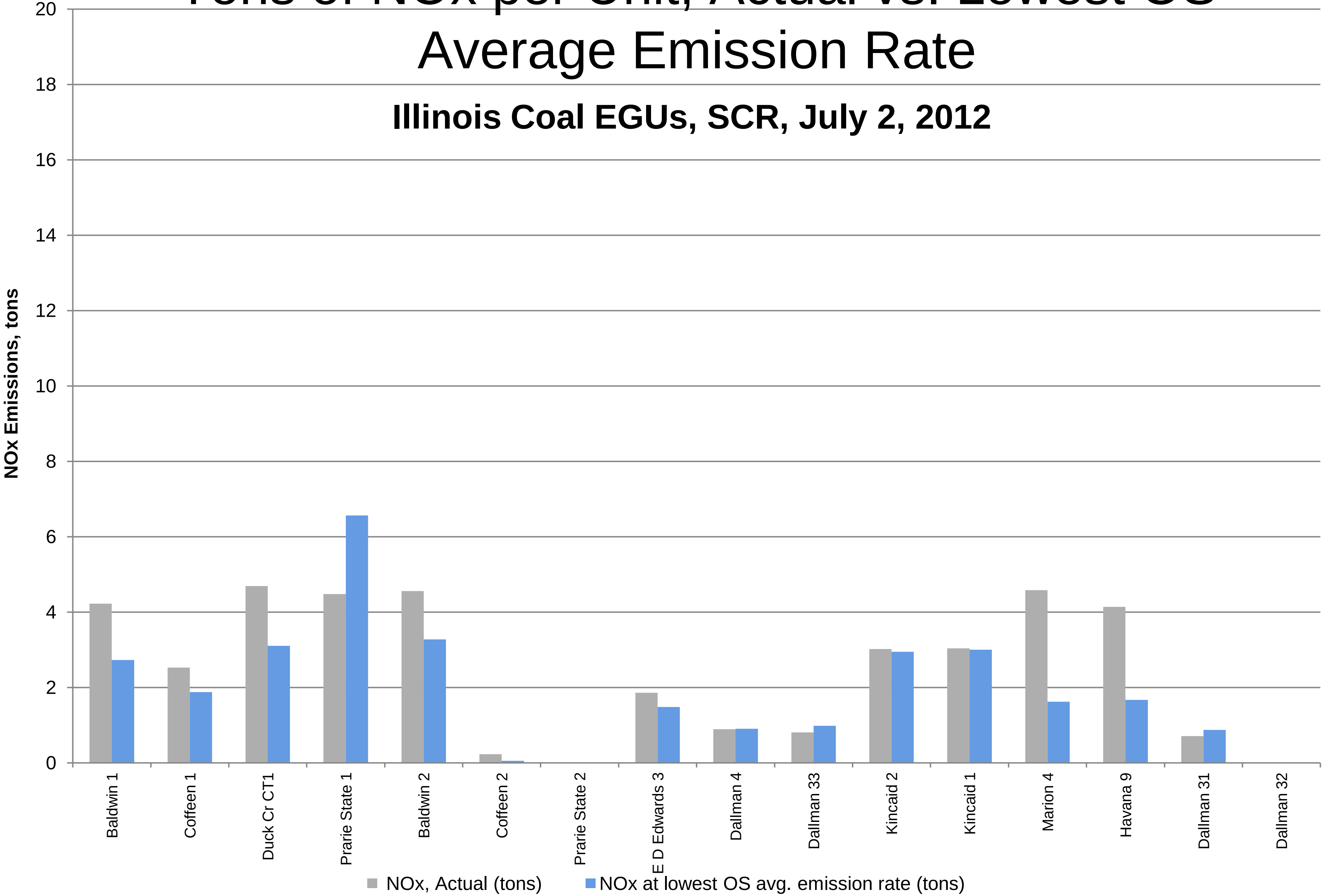
Tons of NOx per Unit, Actual vs. Lowest OS Average Emission Rate



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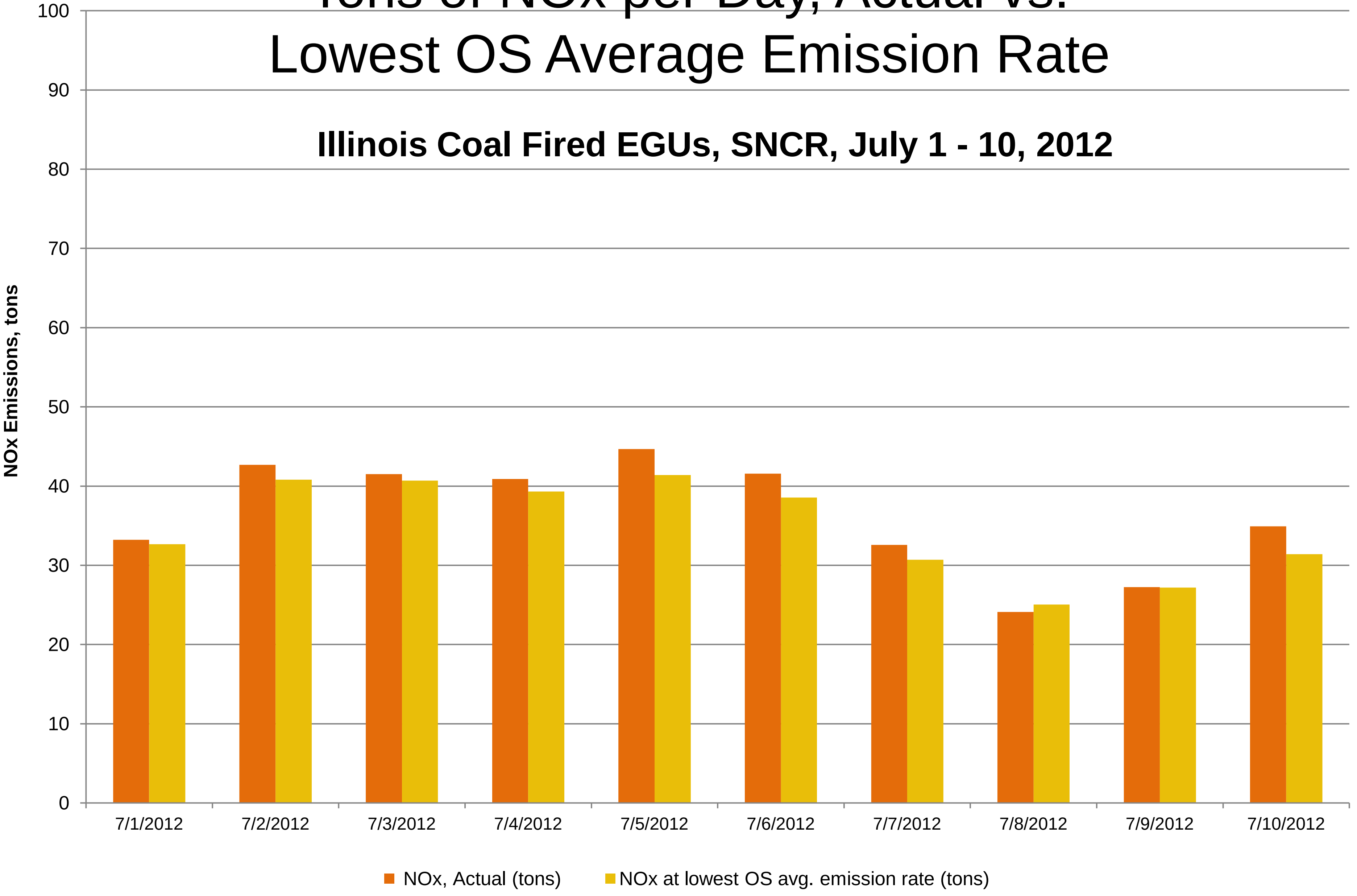
Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate



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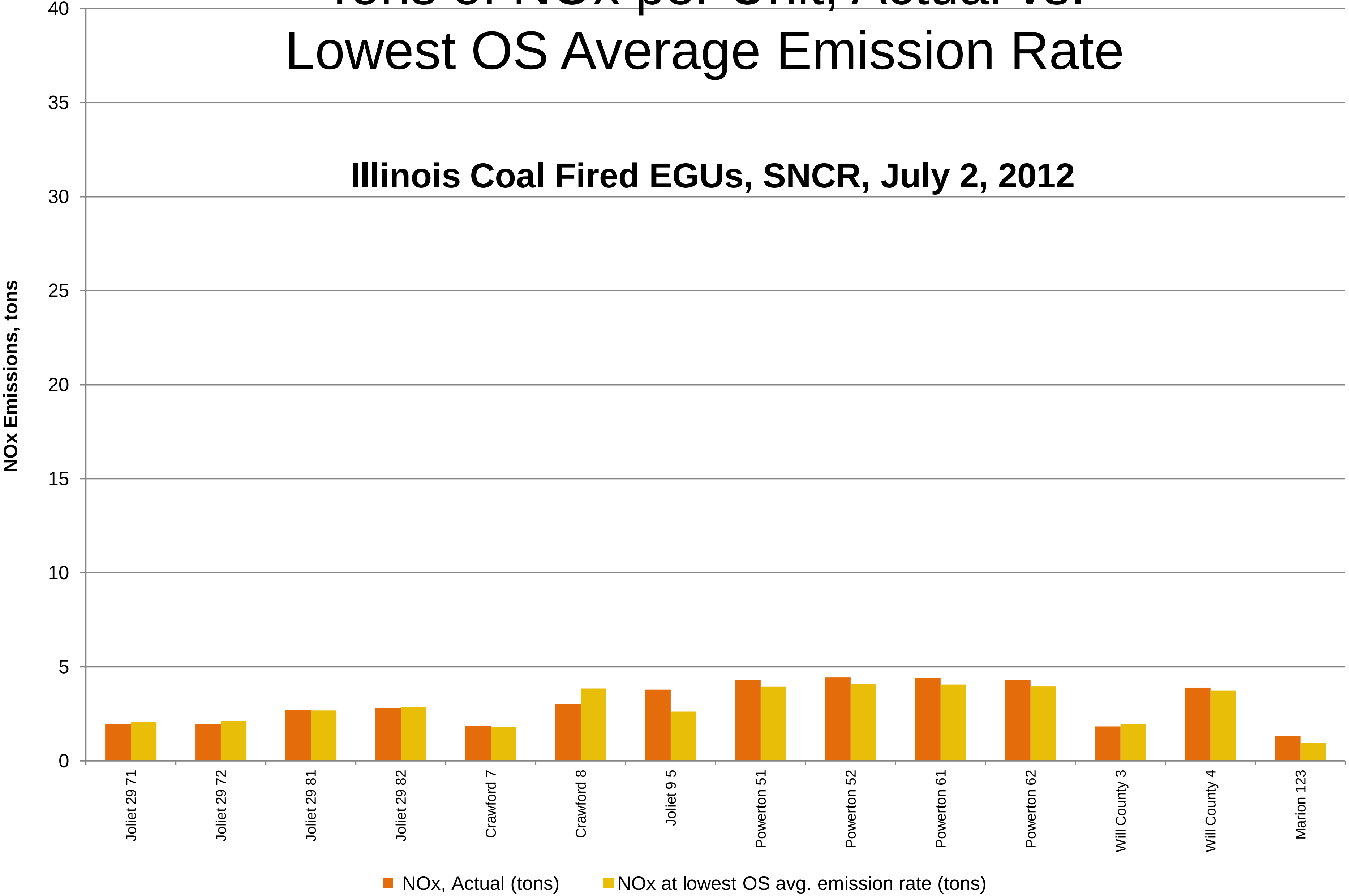
Tons of NOx per Unit, Actual vs. Lowest OS Average Emission Rate



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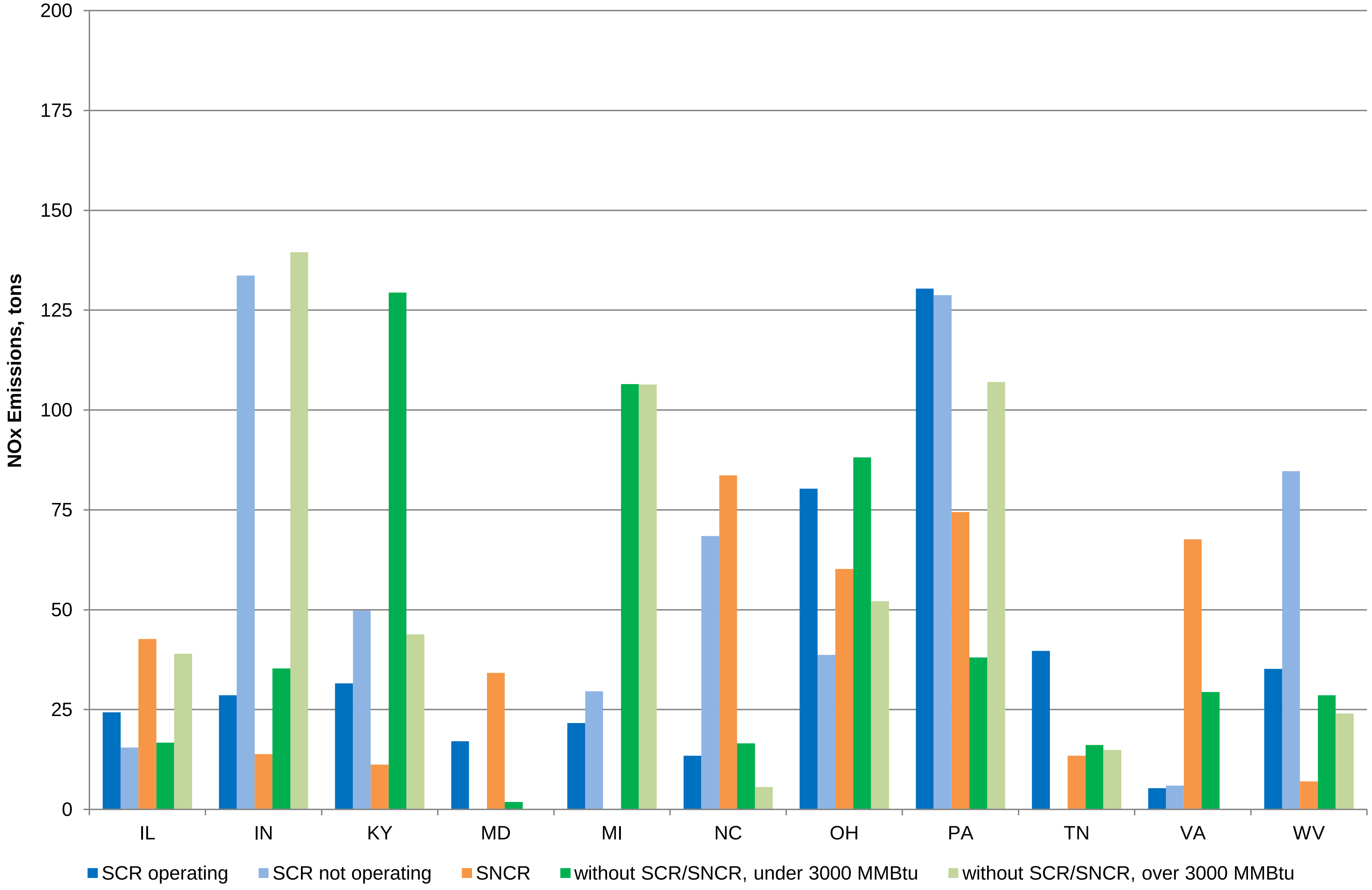
July 2, 2012 – Tons of NOx per State by Control Status



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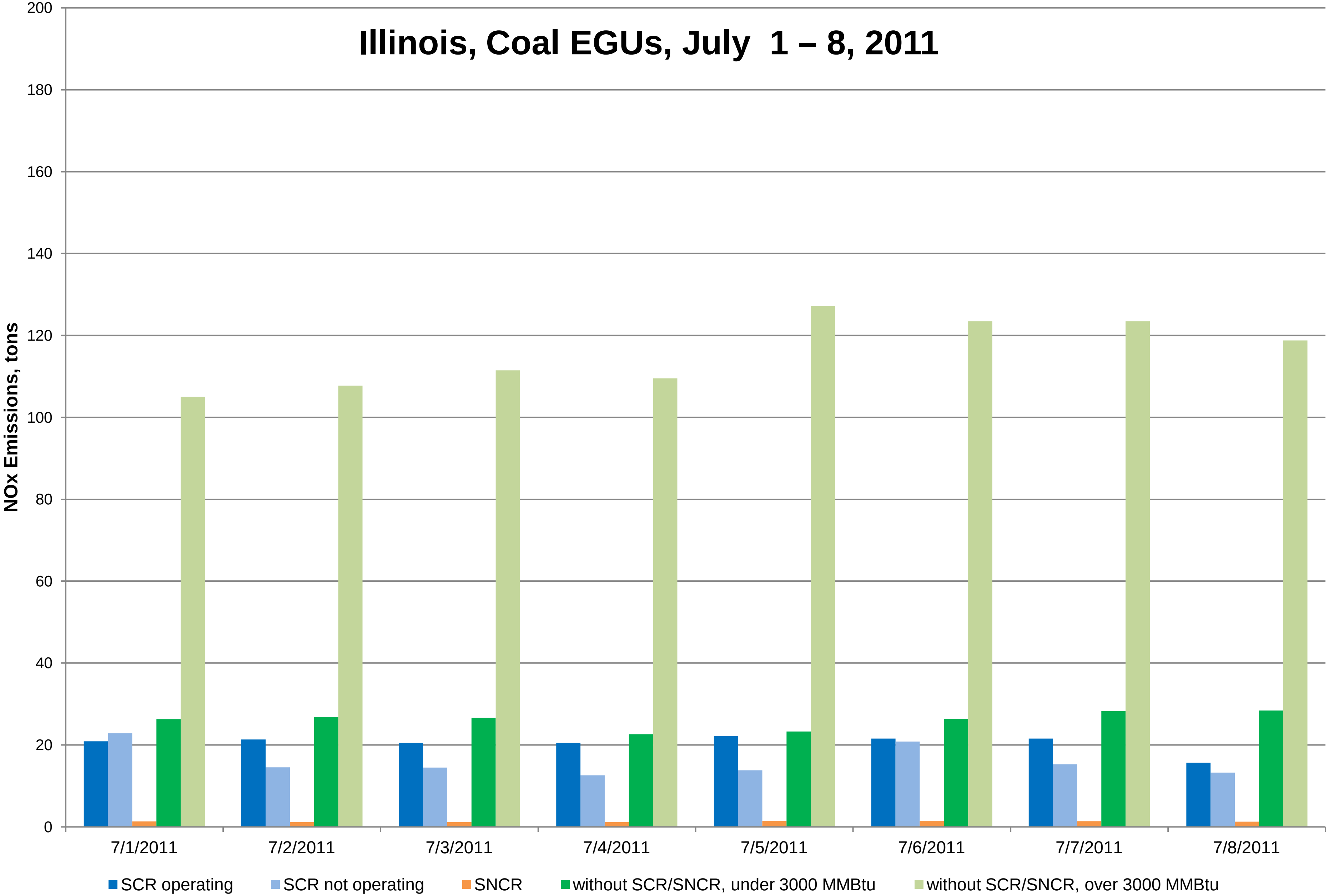
Part 4

July 1 to 8, 2011 Ozone Episode:

Analysis of Emissions and Controls

Tons of NOx per Day By Control Status



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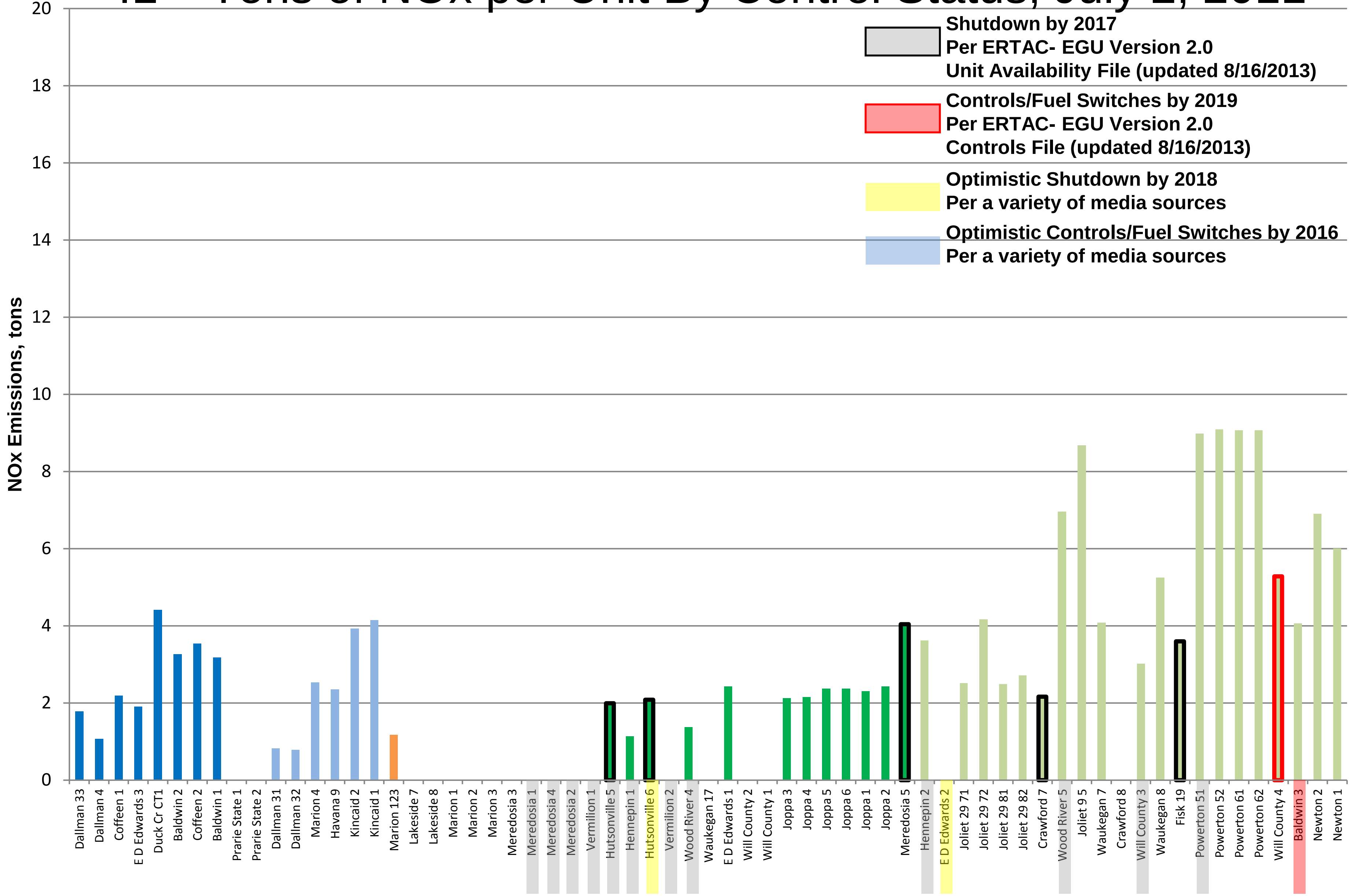
IL – Tons of NOx per Unit By Control Status, July 2, 2011



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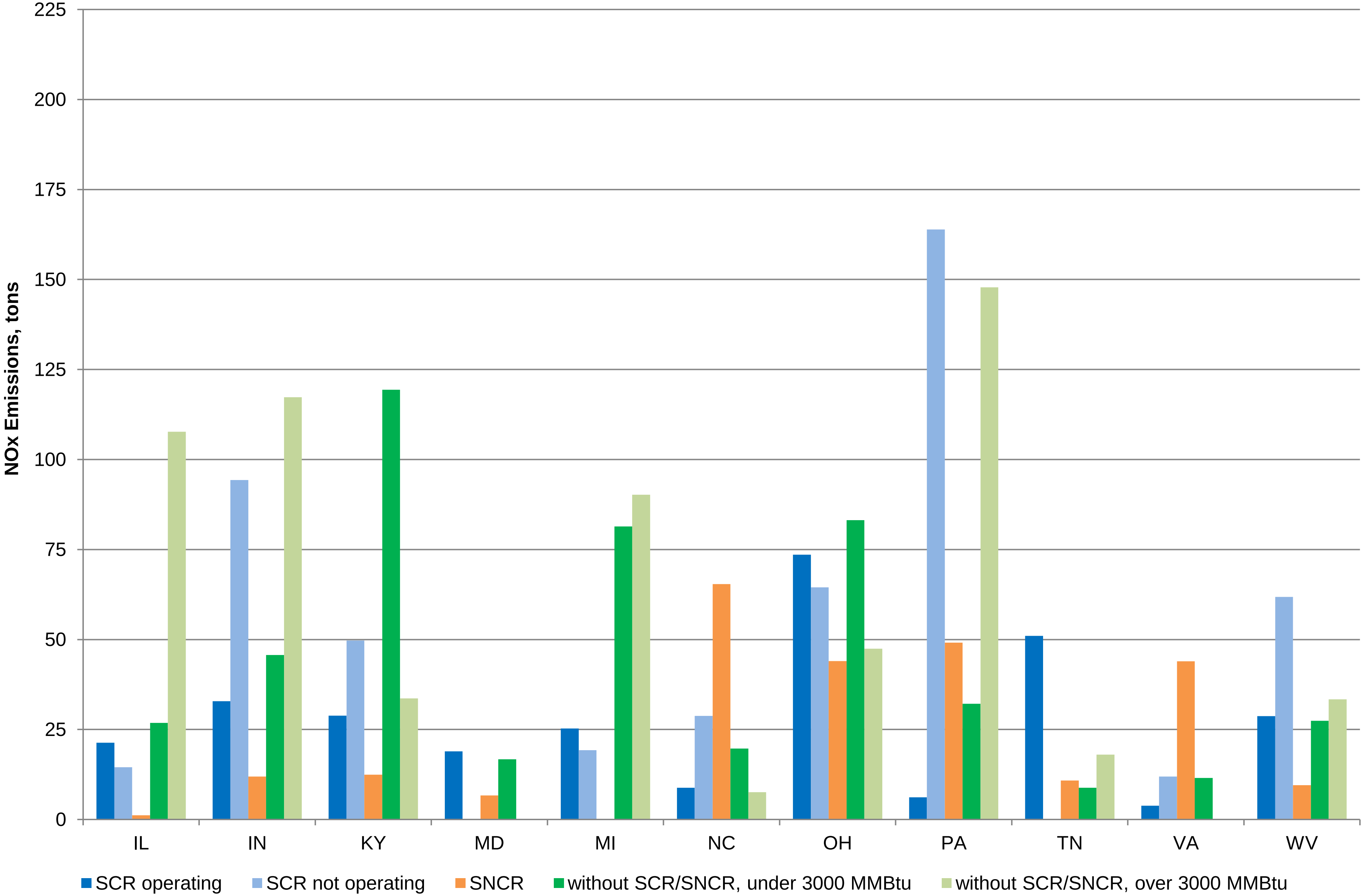
July 2, 2011 - Tons NOx per State by Control Status



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Part 5

11 State Totals

July 1 to 8, 2011 Ozone Episode:

Analysis of Emissions and Controls

11 Upwind States, 2012

- Total number of units = 1,432
- Total heat input capacity = 2,730,239 MMBtu/hr
  = 304,354 MW
- Total MW Capacity in %
  - **Total number of Coal units = 547 = 55%**
  - Total number of NG units = 672 = 25%
  - Total number of other (oil, etc.) units = 173 = 6%
  - Total number of Nuclear units = 40 = 14%
- **Total Capacity Coal = 165,910 MW**
  - 156 units with SCR = 88,783 MW = 53%
  - 114 units with SNCR = 27,561 MW = 17%
  - 277 units without SCR/SNCR = 49,566 MW = 30%

Basis – CAMD (as of 5/13/2014), NEI (for Nuclear), ERTAC (5/6/2014, 5/8/2014)

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11 Upwind States, 2018

- Total number of units = 1,199
- Total heat input capacity = 2,449,194 MMBtu/hr
  = 274,300 MW
- Total MW Capacity in %
  - **Total number of Coal units = 361 = 49%**
  - Total number of NG units = 686 = 32%
  - Total number of other (oil, etc.) units = 115 = 5%
  - Total number of Nuclear units = 37 = 14%
- **Total Capacity Coal = 134,121 MW**
  - 166 units with SCR = 93,776 MW = 70%
  - 60 units with SNCR = 17,868 MW = 13%
  - 135 units without SCR/SNCR = 22,477 MW = 17%

Basis – ERTAC (5/6/2014, 5/8/2014), NEI (for Nuclear)

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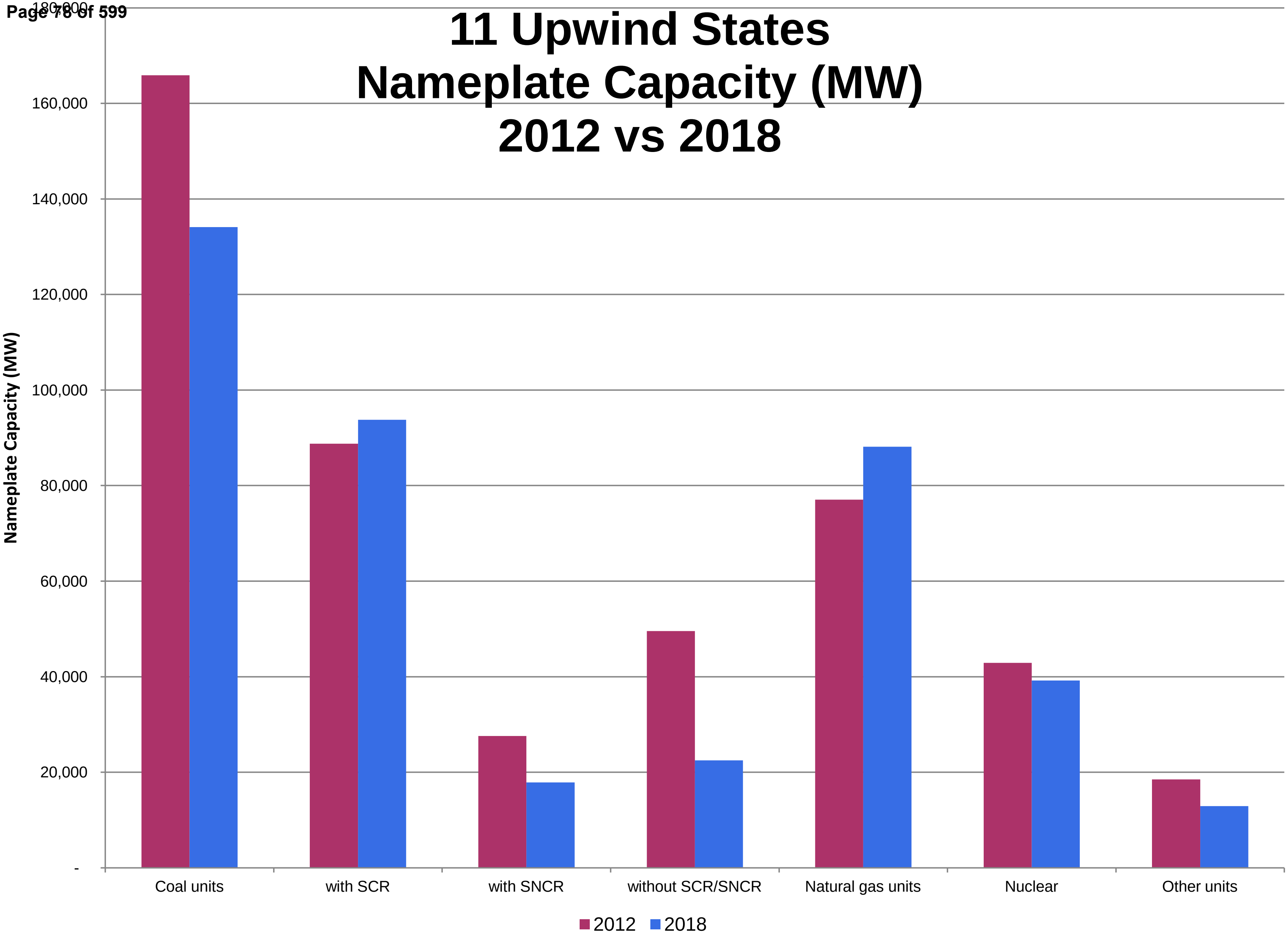
11 Upwind States Nameplate Capacity (MW) 2012 vs 2018



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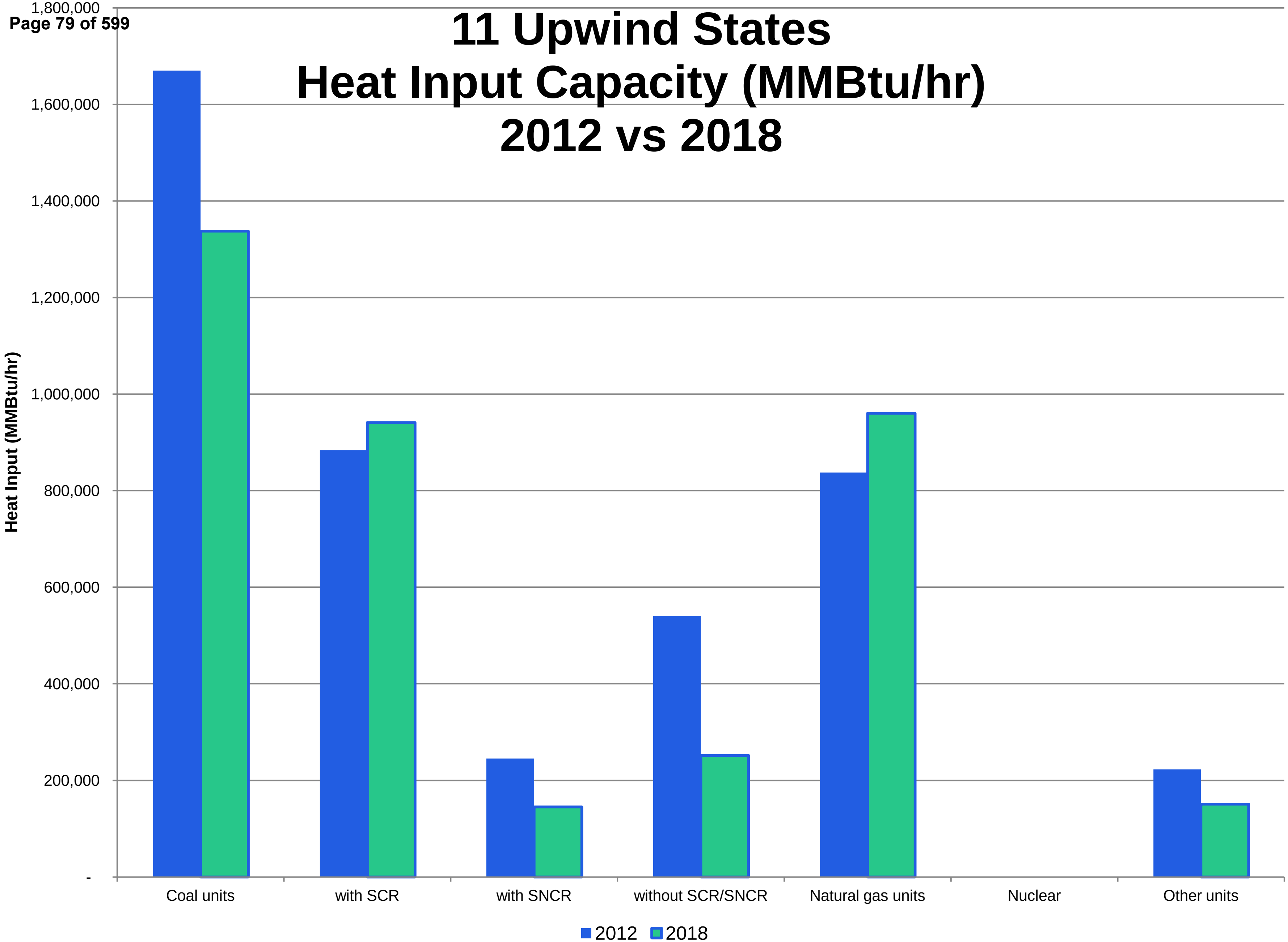

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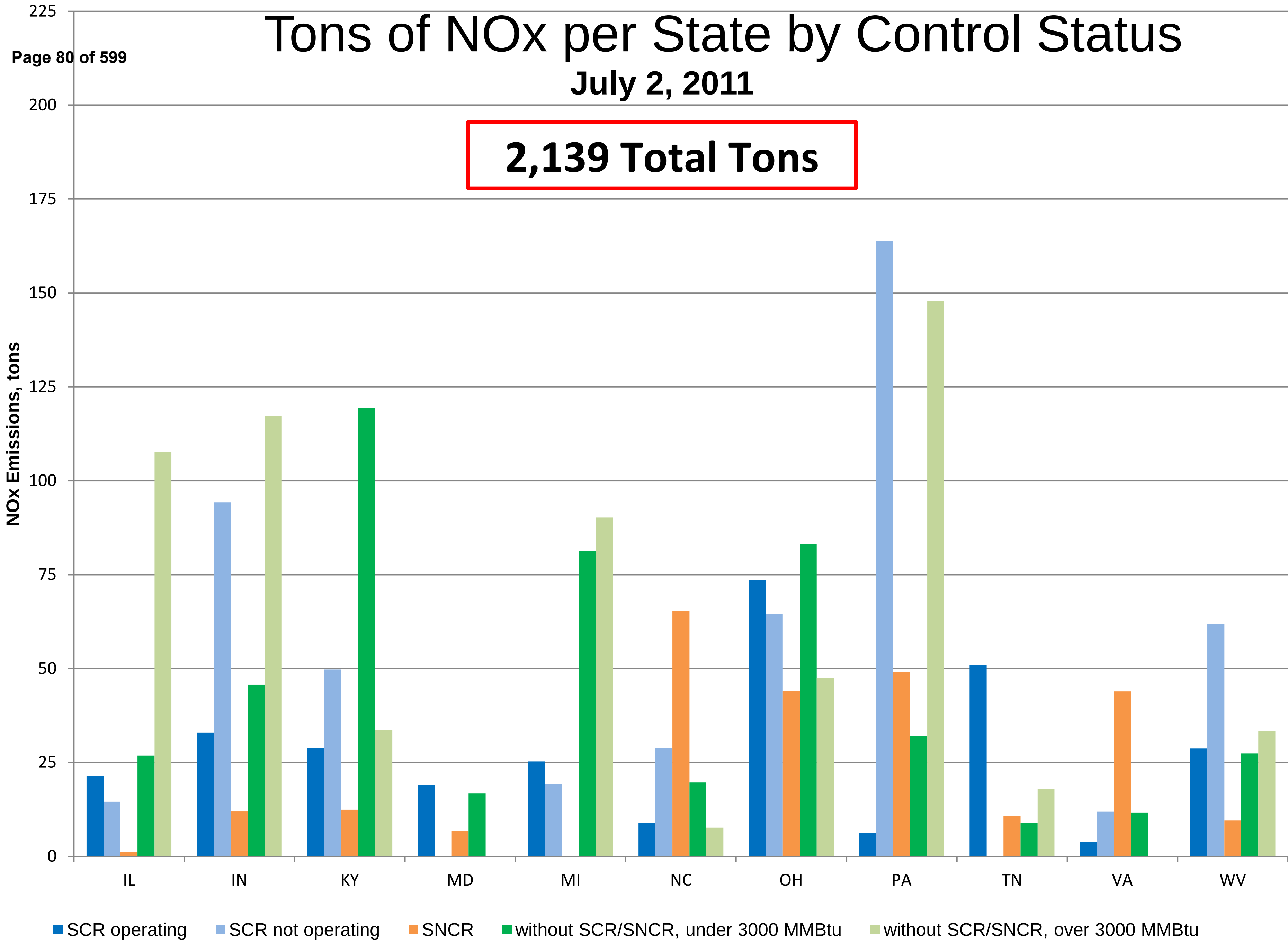
Tons of NOx per State by Control Status

July 2, 2011



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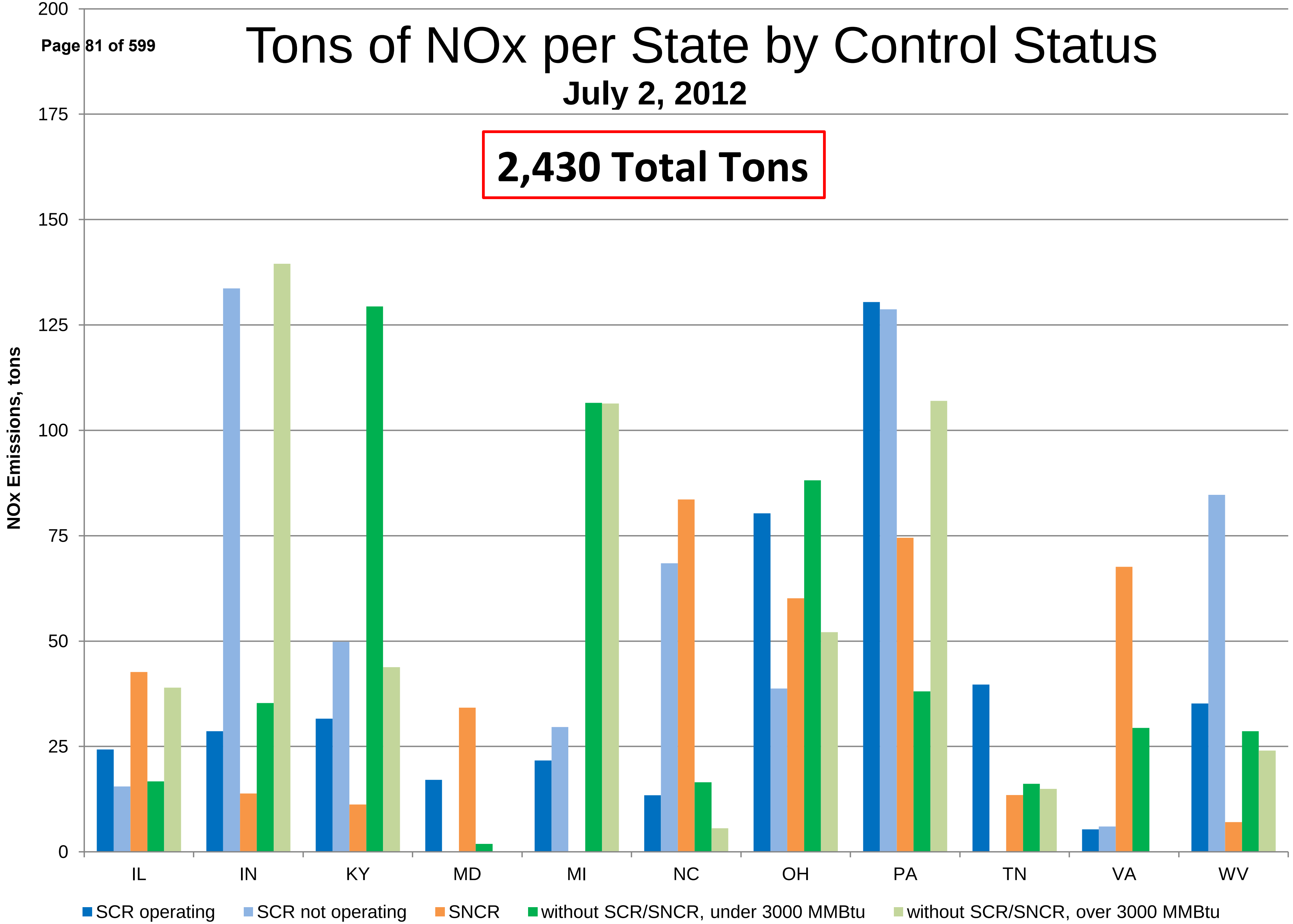
Tons of NOx per State by Control Status

July 2, 2012



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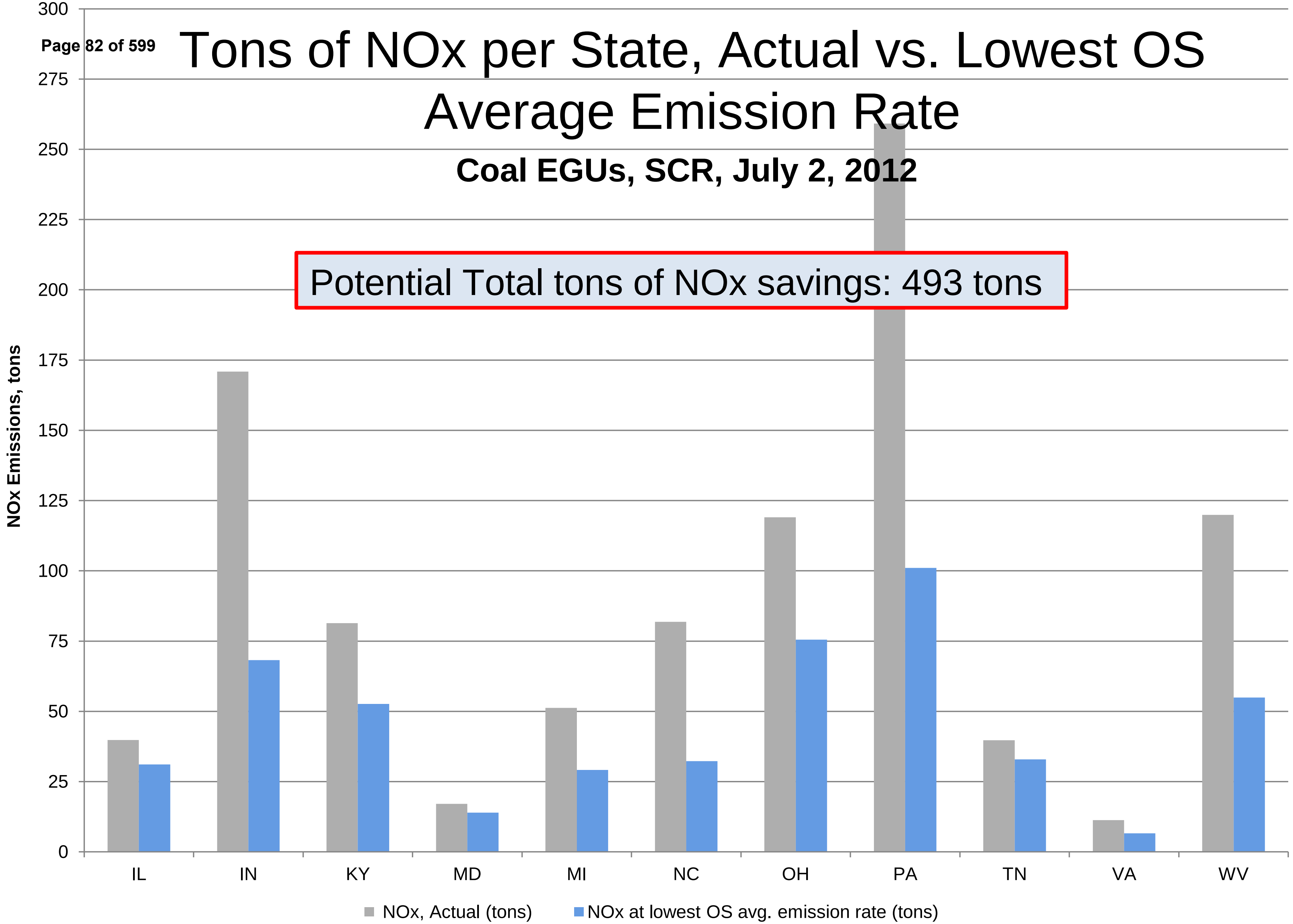
Tons of NOx per State, Actual vs. Lowest OS Average Emission Rate

Coal EGUs, SCR, July 2, 2012



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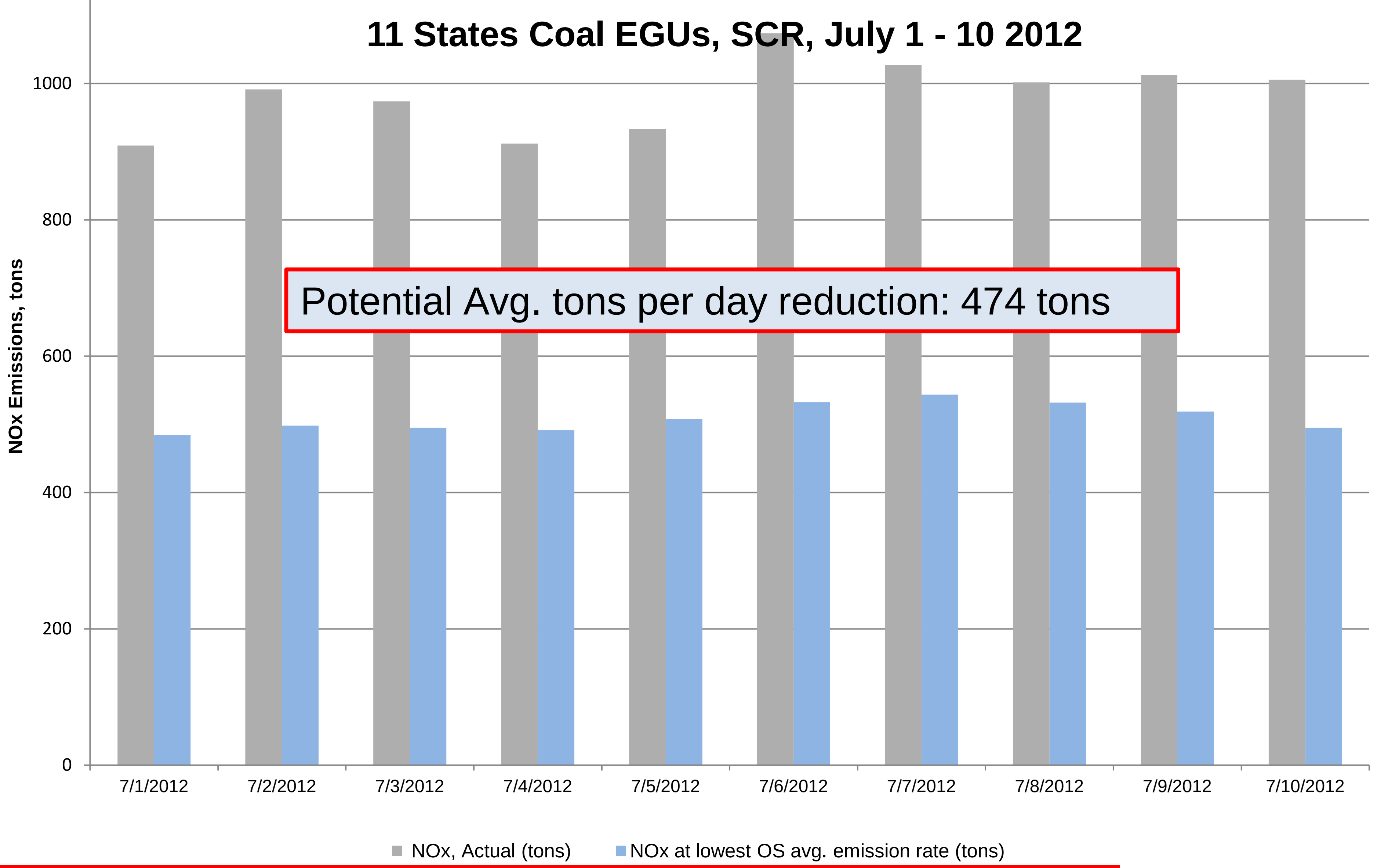
Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate



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11 State Summary

After performing similar analysis of EGUs in IL, IN, KY, MD, MI, NC, OH, PA, TN, VA and WV, the following potential total tons of lost NOx reductions was calculated:

- On July 2, 2012 actual NOx emissions in the 11 states (listed above) was 991 tons
  - If EGUs in those states were to have run their controls at the best rates observed in the data, emissions would have been 498 tons
  - This represents a single day loss of NOx reductions of 493 tons on that day
- During the 10 day episode between July 1 and 10, 2012 actual NOx emissions in the 11 states (listed above) was 9,840 tons
  - If EGUs in those states were to have run their controls at the best rates observed in the data, emissions would have been 5,099 tons
  - This represents a loss of NOx reductions of 4,741 tons over that 10-day episode

Part 6

Potential Lost Ozone Benefits from Controls Running Less Effectively in Recent Years

Preliminary Photochemical Modeling

Illinois Monitors

How Might This Affect Ozone?

- Maryland has performed several very preliminary model runs to look at how much running EGU controls inefficiently might increase ozone levels
- Three runs:
  - Scenario 2B – A worst case run
    - Assumes SCR and SNCR controls are not run at all
  - Scenario 3B – A worst data run
    - Assumes SCR and SCR units all run at worst rates seen in CAMD data - 2005 to 2012
  - Scenario 3C – Based upon CAMD data analysis for EGU performance in 2011 and 2012
    - Assumes that units that had higher ozone season emission rates were operating at the best ozone season rates observed since 2005

Lost Ozone Benefits
Potential PPB Increases

Illinois Monitors	Potential Increased Ozone in 2018 – 3 EGU Control Scenarios		
County	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Adams	1.9	0.5	0.3
Champaign	3.5	1.3	0.8
Clark	11.9	4.2	2.4
Cook	0.8	0.2	0.1
Cook	0.9	0.1	0.1
Cook	0.9	0.2	0.1
Cook	1.1	0.2	0.1
Cook	0.7	0.2	0.1
Cook	1.5	0.3	0.1
Cook	1.0	0.2	0.1
Cook	1.5	0.3	0.1
Cook	1.0	0.3	0.1
Cook	0.9	0.2	0.1
Cook	0.8	0.1	0.1
DuPage	0.9	0.2	0.1
Effingham	7.5	2.3	1.5
Hamilton	6.5	2.4	1.6
Jersey	2.3	0.4	0.2
Kane	1.3	0.2	0.1

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Lost Ozone Benefits
Potential PPB Increases

Illinois Monitors	Potential Increased Ozone in 2018 – 3 EGU Control Scenarios		
County	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Lake	1.3	0.2	0.1
Lake	1.3	0.2	0.1
Macon	2.7	1.0	0.8
Macoupin	2.4	0.9	0.7
Madison	2.4	0.4	0.2
Madison	2.1	0.3	0.2
Madison	2.1	0.3	0.2
McHenry	1.3	0.2	0.1
McLean	3.8	1.3	0.9
Peoria	2.9	0.7	0.3
Peoria	2.6	0.6	0.3
Randolph	6.3	2.6	0.6
Rock Island	1.0	0.1	0.1
Saint Clair	2.3	0.3	0.1
Sangamon	3.4	1.8	1.4
Will	1.6	0.3	0.1
Winnebago	1.6	0.2	0.1
Winnebago	1.5	0.2	0.1

DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Lost Ozone Benefit – 2018 Design Values

… EPA will propose a new ozone standard soon … 60 to 70 ppb range … designations to most likely be based upon 2014 to 2016 or 2015 to 2017 data

Projected to be Clean in 2018 … Potentially at Risk		Increased Ozone in 2018 – 3 EGU Control Scenarios		
Illinois Counties	**2018 – Controls Running Well (Scenario 3A)**	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Adams	57.6	59.5	58.1	57.9
Champaign	56.7	60.1	58.0	57.5
Clark	54.3	66.2	58.5	56.7
Cook	76.1	76.9	76.3	76.2
Cook	75.2	76.1	75.3	75.3
Cook	73.9	74.8	74.1	74.0
Cook	73.5	74.5	73.6	73.5
Cook	73.2	73.9	73.4	73.3
Cook	71.3	72.8	71.6	71.4
Cook	68.8	69.7	69.0	68.8
Cook	68.7	70.2	69.0	68.8
Cook	67.6	68.6	67.9	67.6
Cook	65.6	66.5	65.8	65.6
Cook	62.9	63.7	63.0	63.0
DuPage	63.1	64.0	63.3	63.2
Effingham	58.9	66.3	61.1	60.4
Hamilton	58.4	64.9	60.8	59.9
Jersey	60.5	62.8	60.9	60.7
Kane	62.2	63.6	62.4	62.4

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Lost Ozone Benefit – 2018 Design Values

… EPA will propose a new ozone standard soon … 60 to 70 ppb range … designations to most likely be based upon 2014 to 2016 or 2015 to 2017 data

Projected to be Clean in 2018 … Potentially at Risk		Increased Ozone in 2018 – 3 EGU Control Scenarios		
Illinois Counties	**2018 – Controls Running Well (Scenario 3A)**	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Lake	67.3	68.6	67.4	67.3
Lake	64.8	66.1	65.0	64.9
Macon	61.6	64.3	62.6	62.3
Macoupin	58.6	61.0	59.5	59.3
Madison	68.1	70.5	68.5	68.3
Madison	64.7	66.9	65.0	64.9
Madison	64.5	66.6	64.8	64.6
McHenry	60.2	61.5	60.4	60.3
McLean	60.5	64.3	61.8	61.4
Peoria	63.9	66.8	64.6	64.3
Peoria	58.2	60.8	58.8	58.5
Randolph	60.1	66.4	62.7	60.7
Rock Island	57.8	58.8	57.9	57.9
Saint Clair	64.3	66.6	64.6	64.5
Sangamon	60.6	63.9	62.4	62.0
Will	59.1	60.7	59.4	59.2
Winnebago	59.5	61.1	59.7	59.6
Winnebago	57.8	59.3	58.0	57.9

DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

EGU Data Package #3

Operation of Existing SCR, SNCR

Indiana

Sample of draft data and analyses developed by the Maryland Department of the Environment

Contact: Tad Aburn, Air Director, MDE
(410) 537-3255

September 18, 2014

Purpose

- Maryland is the only Moderate nonattainment area in the East for the 75 ppb ozone standard.
  - This means that Maryland is the only state required to submit an attainment SIP
  - Only state required to perform attainment modeling.
- We are now beginning to build our "SIP Quality" modeling platform.
- One major issue that our data analyses have uncovered is that many EGU units appear to not be running their control equipment in recent years as efficiently as they have demonstrated they can do in earlier years. This issue is driven by recent changes in the energy market, reduced coal capacity, inexpensive allowances and a regulatory structure driven by ozone season caps not daily performance. In many states, including Maryland, this has lead to controls not always being used efficiently on the days when they are needed the most … this is perfectly legal.
- This is a critical issue that we would like to continue to discuss with you. There appears to be an interest from the private sector to discuss this issue and see if a common sense fix can be designed. Maryland believes this fix would be relatively cost-effective compared to the capital cost of the control technologies.
- MDE has focused our analyses on two of the worst large, regional scale ozone episodes from recent years: July 1-8, 2011 and July 1-10, 2012.
- The primary data used in these analyses include:
  - CEMS data from CAMD
  - Emissions and projection data from ERTAC
  - Other data we have received from individual states
- More detailed data and analyses and spreadsheets are available upon request.

How the Data Analyses Were Built

- Maryland began the data analyses in late 2012
  - Looked at EGUs in the 9 upwind states named in the 176A Petition (IL, IN, KY, MI, NC, OH, TN, VA, WV) … MD and PA
- Shared a draft package with Air Directors on April 21, 2014
  - This package focused on a bad ozone episode: July 1 – 8, 2011
- Shared a second draft package with Air Directors on May 13, 2014
  - This package focused on second bad ozone episode: July 1 – 10, 2012
  - This package also included update to specific material after receiving comments from numerous states
- The 2011 and 2012 episodes analyzed capture two of the worst regional ozone periods in 2011 and 2012
  - Other states, like Wisconsin and Delaware have done similar analyses and reached similar conclusions
- This is the third draft package, and builds on to the prior two draft packages, while incorporating input from individual states and updates to ERTAC.
- This third draft package also includes preliminary photochemical modeling performed by MDE to look at the potential loss of ozone reduction benefits.

Help Us QA the Data

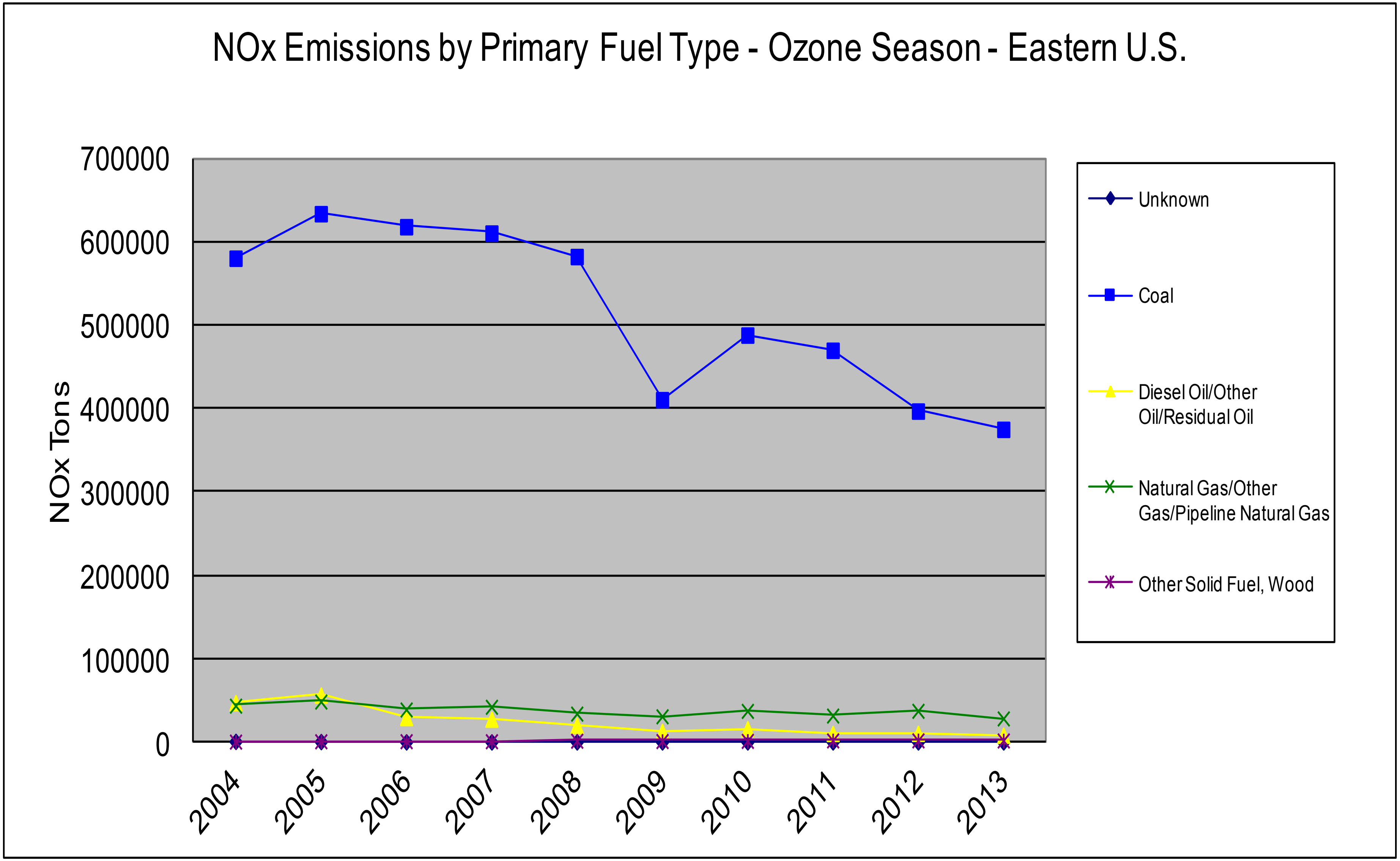
- We have used readily available data, like the CAMD and ERTAC data, but we recognize that these data sources can be out of date, or not include recent changes.
  - We hope you can help us with making sure we have the best possible data.

- This package reflects recently updated data, including but not limited to:
  - CAMD updates
  - May 8, 2014 ERTAC updates
  - PA comments to OTC, forwarded to MDE, Spreadsheets detailing "EGU Shutdowns, EGU Controls and New Natural Gas Power Projects" for the state of PA. Sent from Randy Bordner, Environmental Group Manager - Bureau of Air Quality, PA Department of Environmental Protection to Andy Bodnarik, OTC. Received as FWD from Andy Bodnarik on 4/23/2014
  - VA comments to MDE, "Electric Generation Sector Summary for Virginia" received from Thomas R. Ballou, Director - Office of Air Data Analysis and Planning, VA Department of Environmental Quality on 5/12/2014

Part 1

Background:
Generation in 2012 and 2018
Projected Changes

Why Coal?



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Indiana EGUs, 2012

- Total number of units = 139
- Total heat input capacity = 275,841 MMBtu/hr = 26,389 MW
- Total State MW Capacity in %
  - **Total number of Coal units = 63 = 76%**
  - Total number of NG units = 67 = 22%
  - Total number of other (oil, etc.) units = 9 = 2%
  - Total number of Nuclear units = 0 = 0%
- **Total Capacity Coal = 20,236 MW**
  - 24 units with SCR = 10,504 MW = 52%
  - 5 units with SNCR = 748 MW = 4%
  - 34 units without SCR/SNCR = 8,984 MW = 44%

Basis – CAMD (as of 5/13/2014), NEI (for Nuclear), ERTAC (5/6/2014, 5/8/2014)

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Capacity and Fuel: 2012 to 2018

A detailed review of ERTAC data for 2018 was completed, and an evaluation of the following characteristics performed.

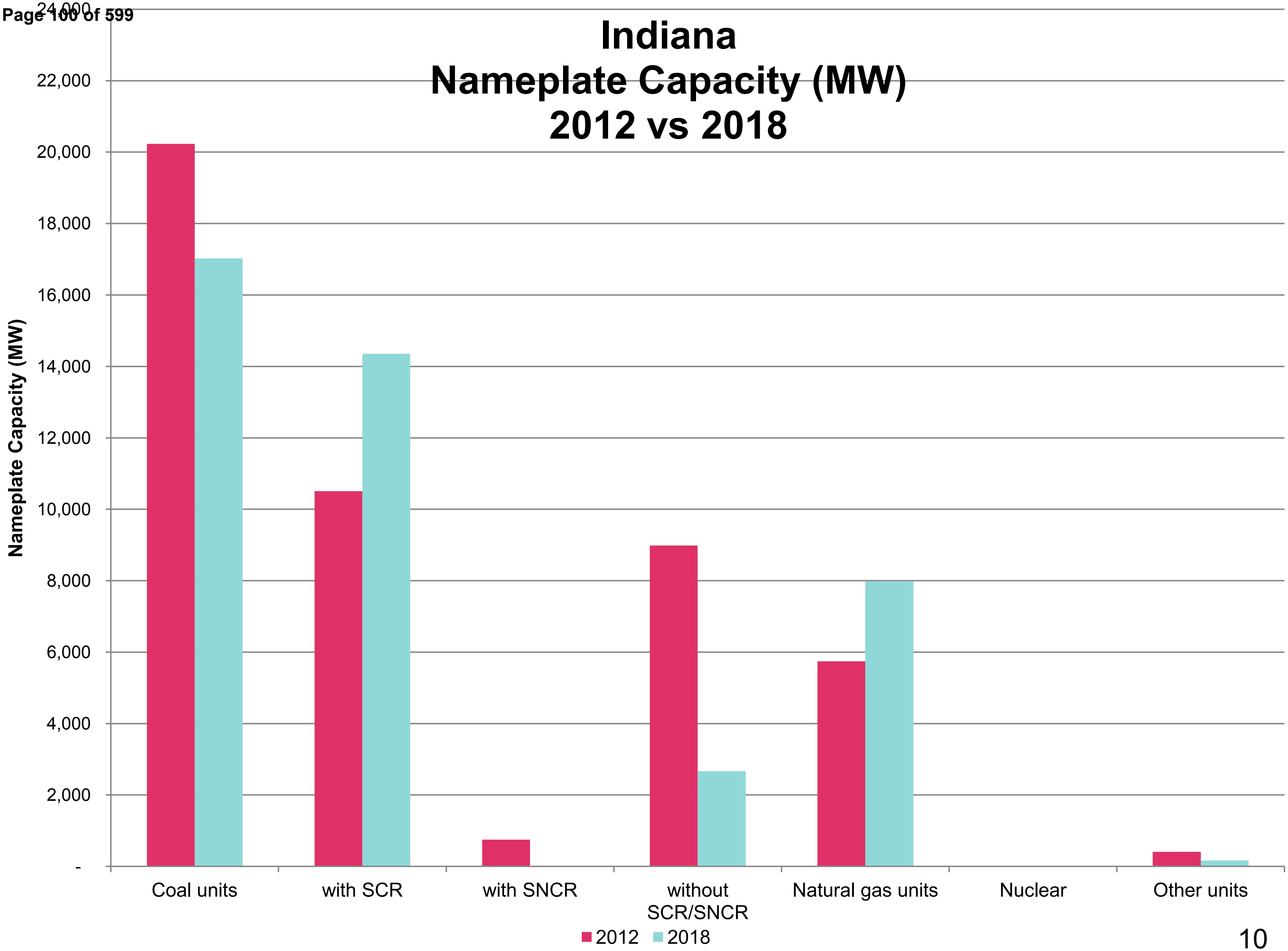
- ❖ Total Number of units
- ❖ Heat input capacity - MMBtu/hr
- ❖ Nameplate capacity – MW
- ❖ Presence of advanced post combustion controls – SCR, SNCR
- ❖ Fuel switching
- ❖ Shutdown, retirements

Indiana EGUs, 2018

- Total number of units = 124
- Total heat input capacity = 263,834 MMBtu/hr = 25,372 MW
- Total State MW Capacity in %
  - **Total number of Coal units = 39 = 68%**
  - Total number of NG units = 81 = 31%
  - Total number of other (oil, etc.) units = 4 = 1%
  - Total number of Nuclear units = 0 = 0%
- **Total Capacity Coal = 17,227 MW**
  - 29 units with SCR = 14,357 MW = 83%
  - 0 units with SNCR = 0 MW = 0%
  - 10 units without SCR/SNCR = 2,870 MW = 17%

Basis – ERTAC (5/6/2014, 5/8/2014), NEI (for Nuclear)

Indiana
Nameplate Capacity (MW)
2012 vs 2018



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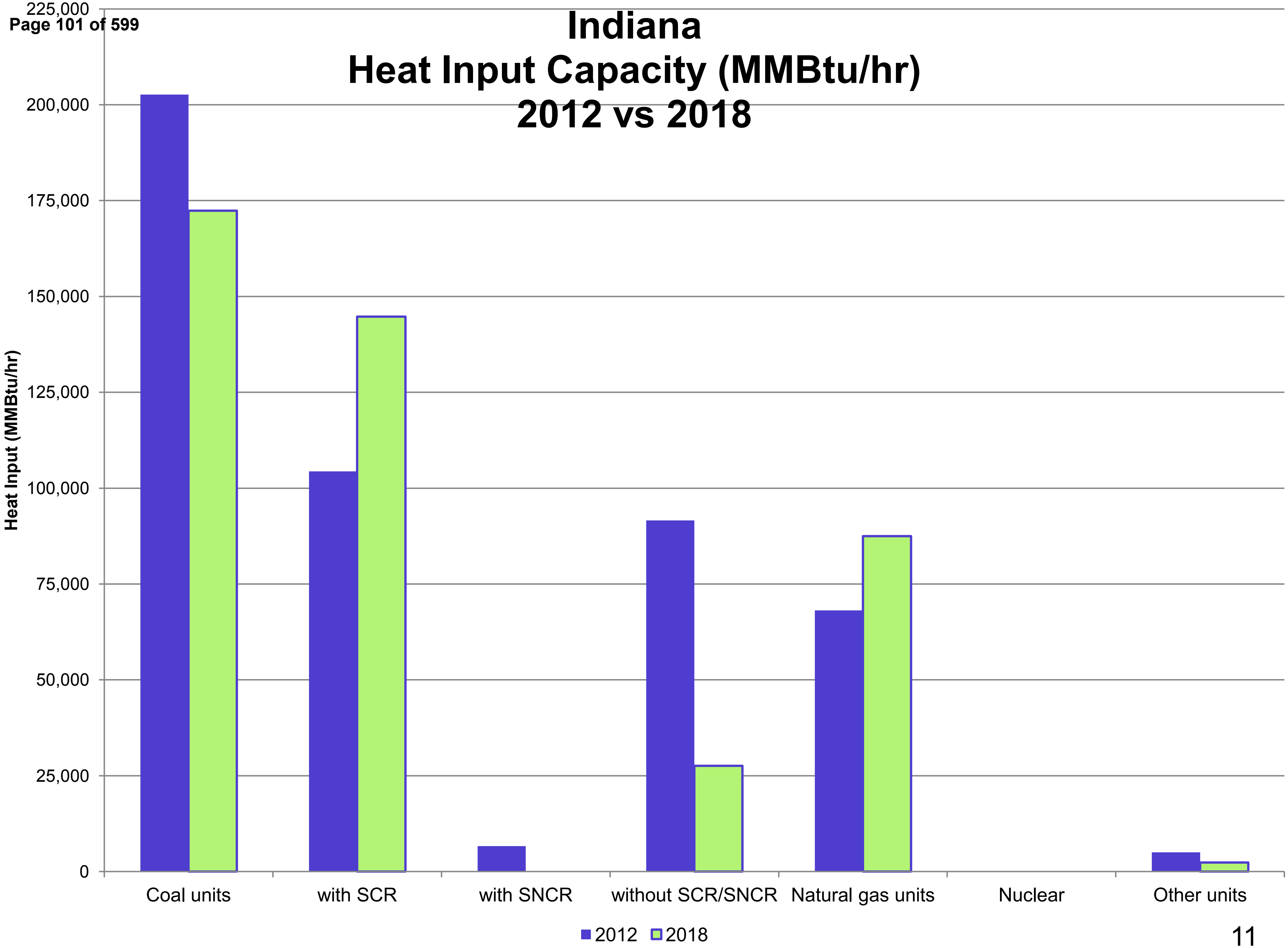
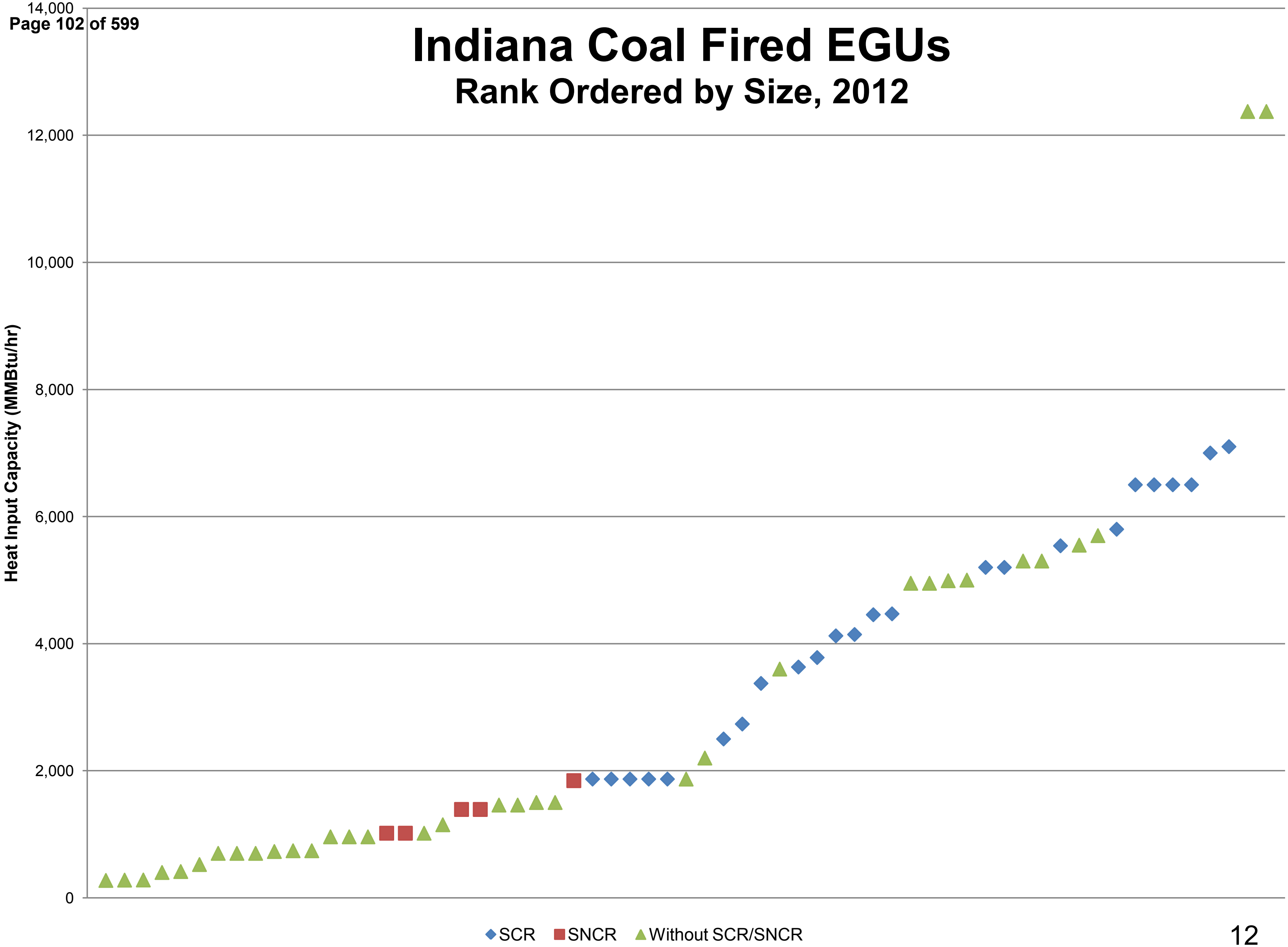
Indiana
Heat Input Capacity (MMBtu/hr)
2012 vs 2018



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Indiana Coal Fired EGUs
Rank Ordered by Size, 2012



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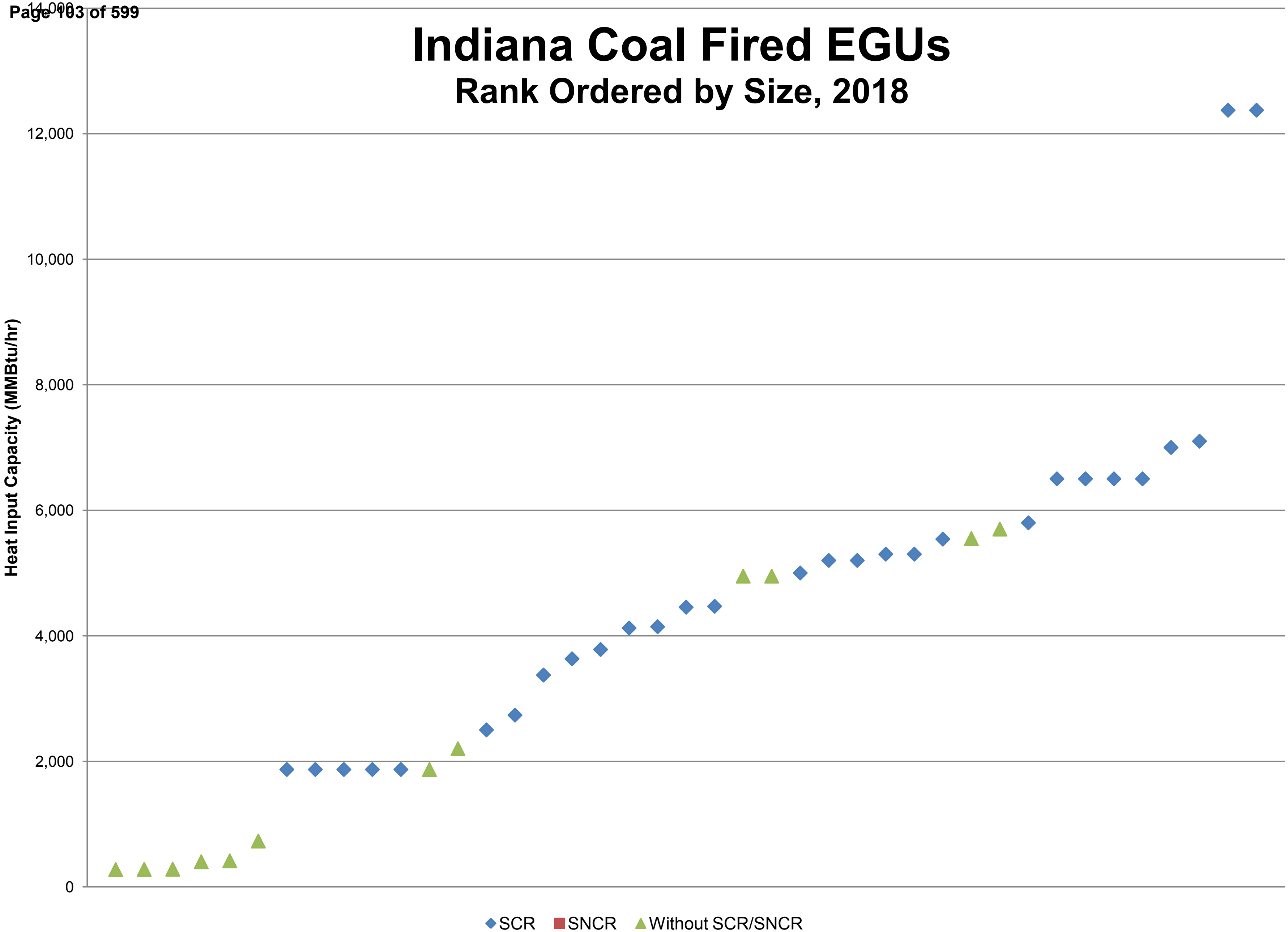


DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

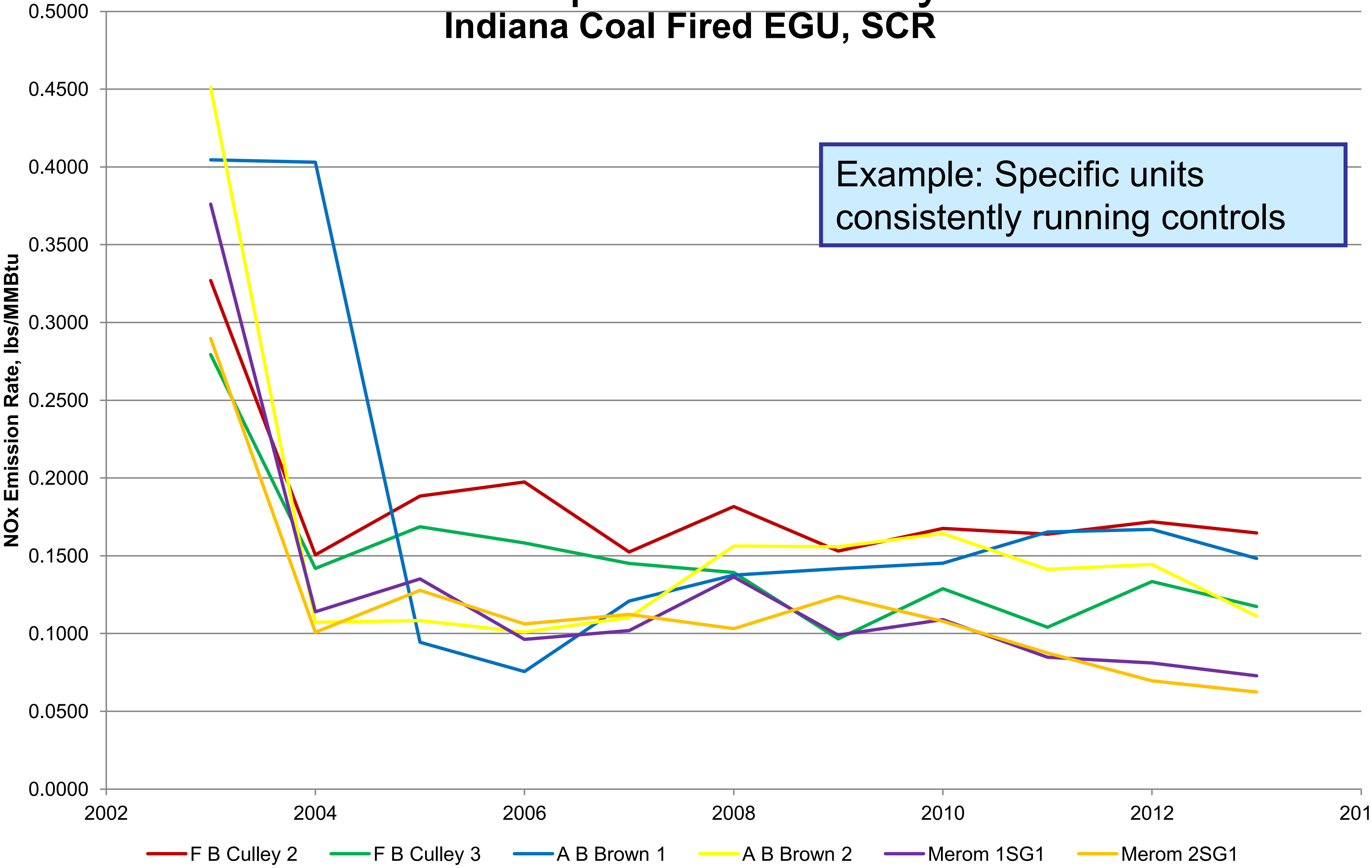
	Facility Name	Unit ID	Lowest OS Emission Rate Year	Lowest OS Emission Rate (lbs/MMBtu)	2007 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2007 OS ER (% Change)	2011 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2011 OS ER (% Change)	Comments/ ERTAC Closure Date
Controlled with SCR	A B Brown	1	2006	0.0756	0.1209	60	0.1652	119	
	A B Brown	2	2006	0.1009	0.1103	9	0.1413	40	
	Alcoa Allowance	4	2007	0.0948	0.0948	0	0.1377	45	
	Bailly Generating Station	8	2012	0.1223	0.4533	271	0.1348	10	
	F B Culley	3	2009	0.0965	0.1451	50	0.1041	8	
	Gibson	1	2007	0.0343	0.0343	0	0.1801	425	
	Gibson	2	2006	0.0672	0.1426	112	0.2182	225	
	Gibson	3	2005	0.0659	0.095	44	0.1663	152	
	Gibson	4	2008	0.0632	0.0893	41	0.1485	135	
	Gibson	5	2007	0.0597	0.0597	0	0.1825	206	
	Harding Street Station	70	2007	0.0666	0.0666	0	0.0771	16	
	Merom	1SG1	2012	0.0811	0.1019	26	0.0848	5	
	Merom	2SG1	2012	0.0696	0.1123	61	0.0875	26	
	Michigan City	12	2005	0.092	0.1307	42	0.1106	20	
	Petersburg	2	2004	0.0424	0.1279	202	0.1732	308	
	Petersburg	3	2005	0.0466	0.0939	102	0.1229	164	
	R M Schahfer	14	2005	0.1073	0.1588	48	0.1100	3	
Controlled with SNCR	N/A								
Adding Controls or Fuel Switches by 2019	Bailly Generating Station	7	2012	0.126	0.4818	282	0.1306	4	SCR (2015)
	Cayuga	1	2009	0.2308	0.2728	18	0.2867	24	SCR (2015)
	Cayuga	2	2009	0.2251	0.2904	29	0.2736	22	SCR (2015)
	Rockport	MB1	2005	0.2045	0.2164	6	0.2372	16	SCR (2017)
	Rockport	MB2	2005	0.2044	0.2140	5	0.2431	19	SCR (2019)
No Controls or Fuel Switches by 2019	Clifty Creek	6	2005	0.2417	0.3254	35	0.3848	59	
	Petersburg	4	2009	0.226	0.2464	9	0.2292	1	
	R M Schahfer	15	2012	0.1428	0.2547	78	0.1539	8	
	R M Schahfer	17	2007	0.1619	0.1619	0	0.1798	11	
	R M Schahfer	18	2007	0.1661	0.1661	0	0.1860	12	
Retiring by 2017	Tanners Creek	U4	2012	0.2157	0.2431	13	0.2565	19	

	Facility Name	Unit ID	Lowest OS Emission Rate Year	Lowest OS Emission Rate (lbs/MMBtu)	2007 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2007 OS ER (% Change)	2011 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2011 OS ER (% Change)	Comments/ ERTAC Closure Date
Controlled with SCR	Clifty Creek	1	2005	0.0735	0.178	142	0.1869	154	
	Clifty Creek	2	2005	0.075	0.1734	131	0.1895	153	
	Clifty Creek	3	2005	0.0742	0.1577	113	0.1889	155	
	Clifty Creek	4	2004	0.2077	0.2991	44	0.379	82	
	Clifty Creek	5	2004	0.2197	0.3094	41	0.3846	75	
	Edwardsport	CTG1	2012	0.1116	N/A		N/A		New 2012
	F B Culley	2	2004	0.1505	0.1524	1	0.1639	9	
Controlled with SNCR	N/A								
No Controls or Fuel Switches by 2019	Petersburg	1	2010	0.2114	0.2557	21	0.2639	25	
	Purdue-Wade Utility	2	2012	0.3995	0.4049	1	0.4169	4	
	Purdue-Wade Utility	5	2011	0.0943	0.1004	6	0.0943	0	
	R Gallagher	2	2007	0.319	0.319	0	0.3417	7	
	R Gallagher	4	2006	0.266	0.3369	27	0.334	26	
	Whitewater Valley	1	2004	0.2339	0.2945	26	0.252	8	
	Whitewater Valley	2	2004	0.2344	0.2883	23	0.2544	9	
Retiring by 2017	Harding Street Station	50	2009	0.209	0.3036	45	0.2439	17	SNCR retire 2015
	Harding Street Station	60	2009	0.2141	0.2276	6	0.2526	18	SNCR retire 2015
	Tanners Creek	U1	2009	0.2685	0.3103	16	0.2875	7	SNCR retire 2015
	Tanners Creek	U2	2009	0.2699	0.3064	14	0.2858	6	SNCR retire 2015
	Tanners Creek	U3	2010	0.2668	0.3108	16	0.2921	9	SNCR retire 2015
	Edwardsport	7-1	2009	0.5555	0.6076	9	N/A	--	2012
	Edwardsport	7-2	2007	0.4841	0.4841	0	N/A	--	2012
	Edwardsport	8-1	2007	0.5614	0.5614	0	N/A	--	2012
	Frank E Ratts	1SG1	2012	0.2021	0.4824	139	0.2547	26	12/1/2017
	Frank E Ratts	2SG1	2012	0.2063	0.4531	120	0.2585	25	12/1/2017
	IPL Eagle Valley	3	2010	0.4087	0.5545	36	0.4714	15	4/30/2017
	IPL Eagle Valley	4	2012	0.3011	0.4293	43	0.3805	26	4/30/2017
	IPL Eagle Valley	5	2010	0.2374	0.3046	28	0.3003	26	4/30/2017
	IPL Eagle Valley	6	2010	0.2424	0.3010	24	0.3048	26	4/30/2017
	New Energy Corp	U-4000	2006	0.33	0.37	12	0.38	15	2012
	Purdue-Wade Utility	1	2007	0.3805	0.3805	0	0.4251	12	2012
	Wabash River	2	2009	0.3269	0.3431	5	0.3621	11	12/1/2017
	Wabash River	3	2008	0.343	0.3439	0	0.3659	7	12/1/2017
	Wabash River	4	2012	0.292	0.3426	17	0.3589	23	12/1/2017
	Wabash River	5	2008	0.3447	0.3491	1	0.3720	8	12/1/2017
	Wabash River	6	2010	0.2989	0.3368	13	0.3622	21	12/1/2017

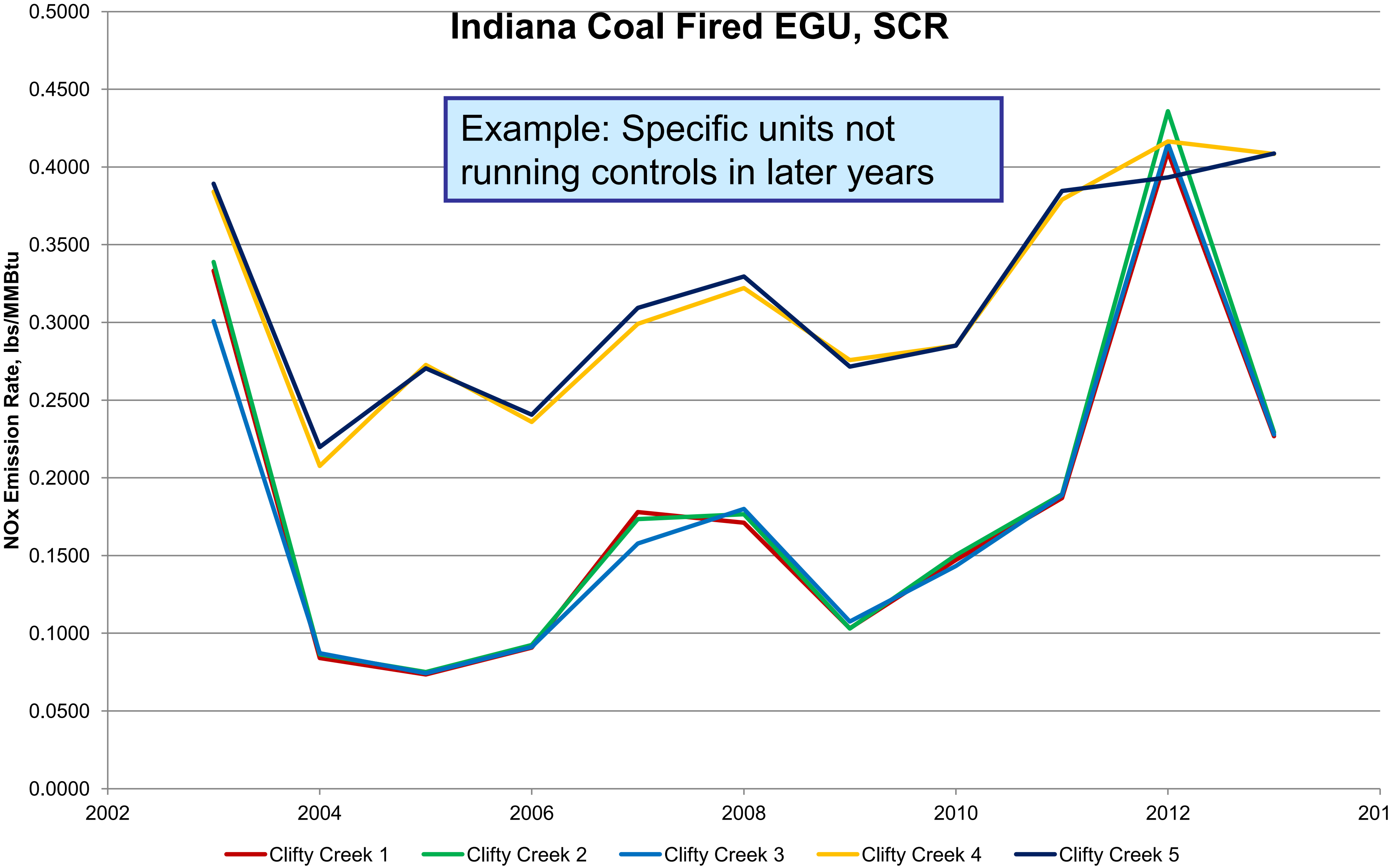
Part 2

Operation of Controls: Changes in Control Efficiency 2003 to 2013

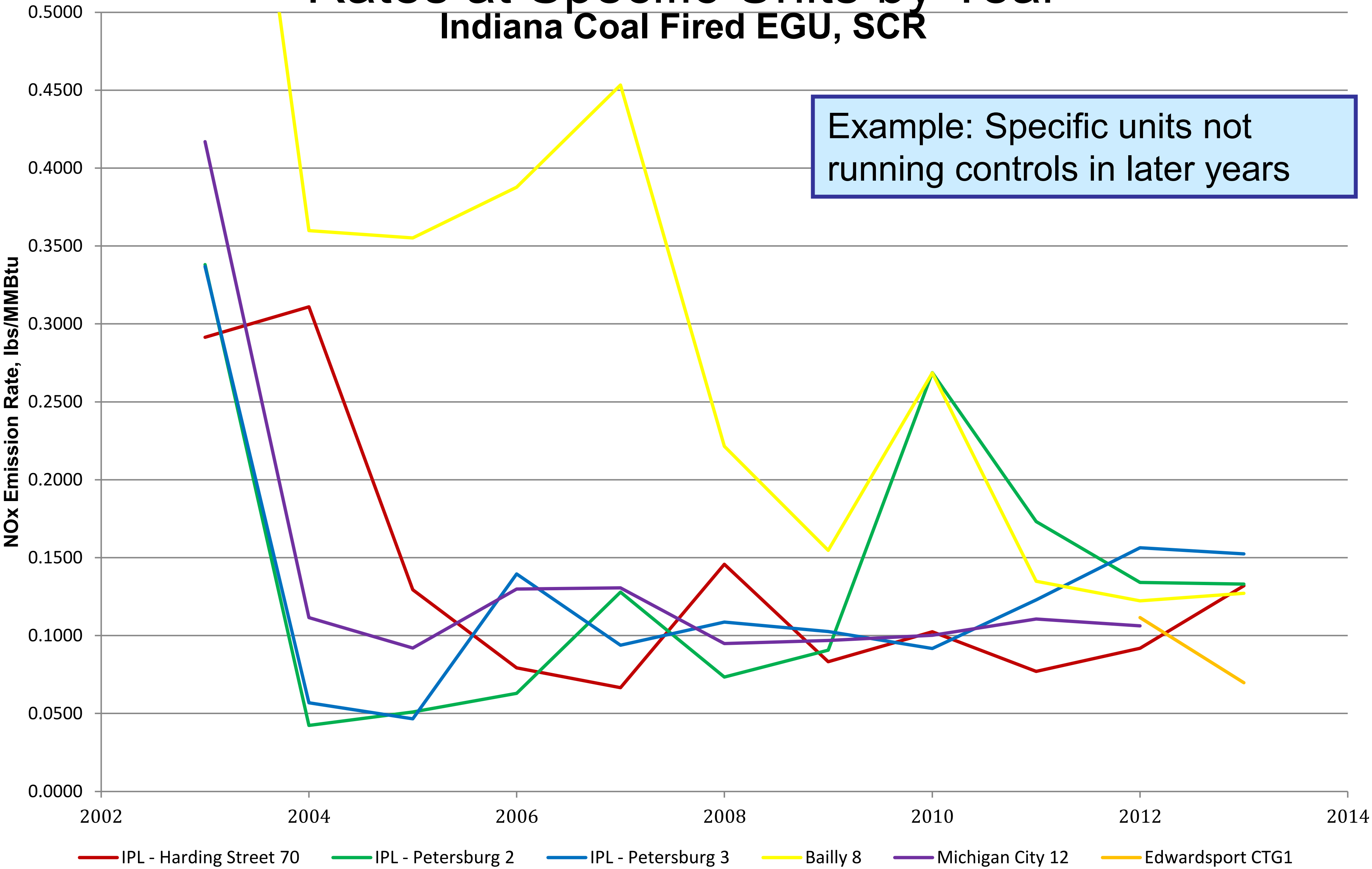
Average Ozone Season Emission Rates at Specific Units by Year



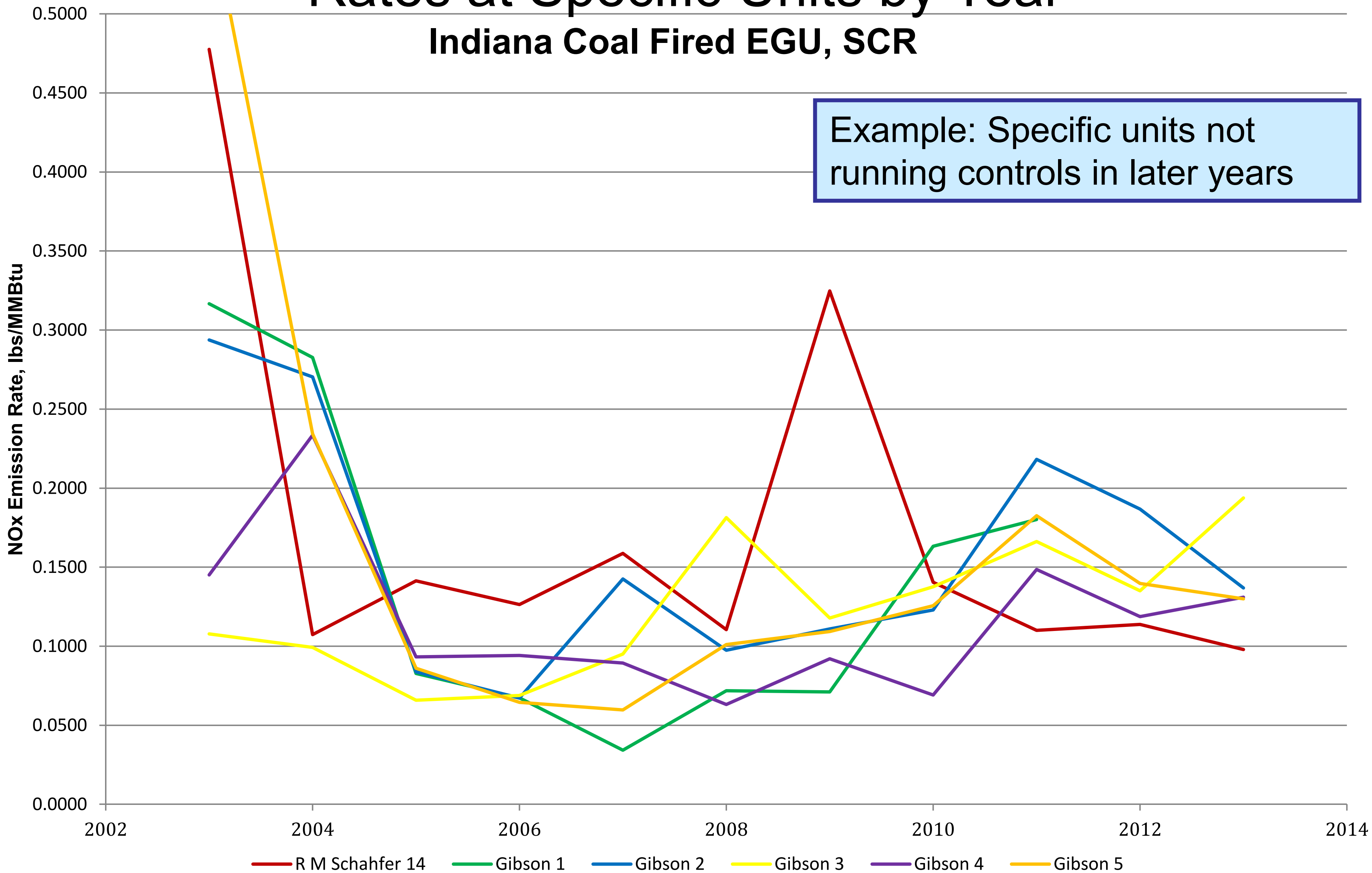
Average Ozone Season Emission Rates at Specific Units by Year



Average Ozone Season Emission Rates at Specific Units by Year

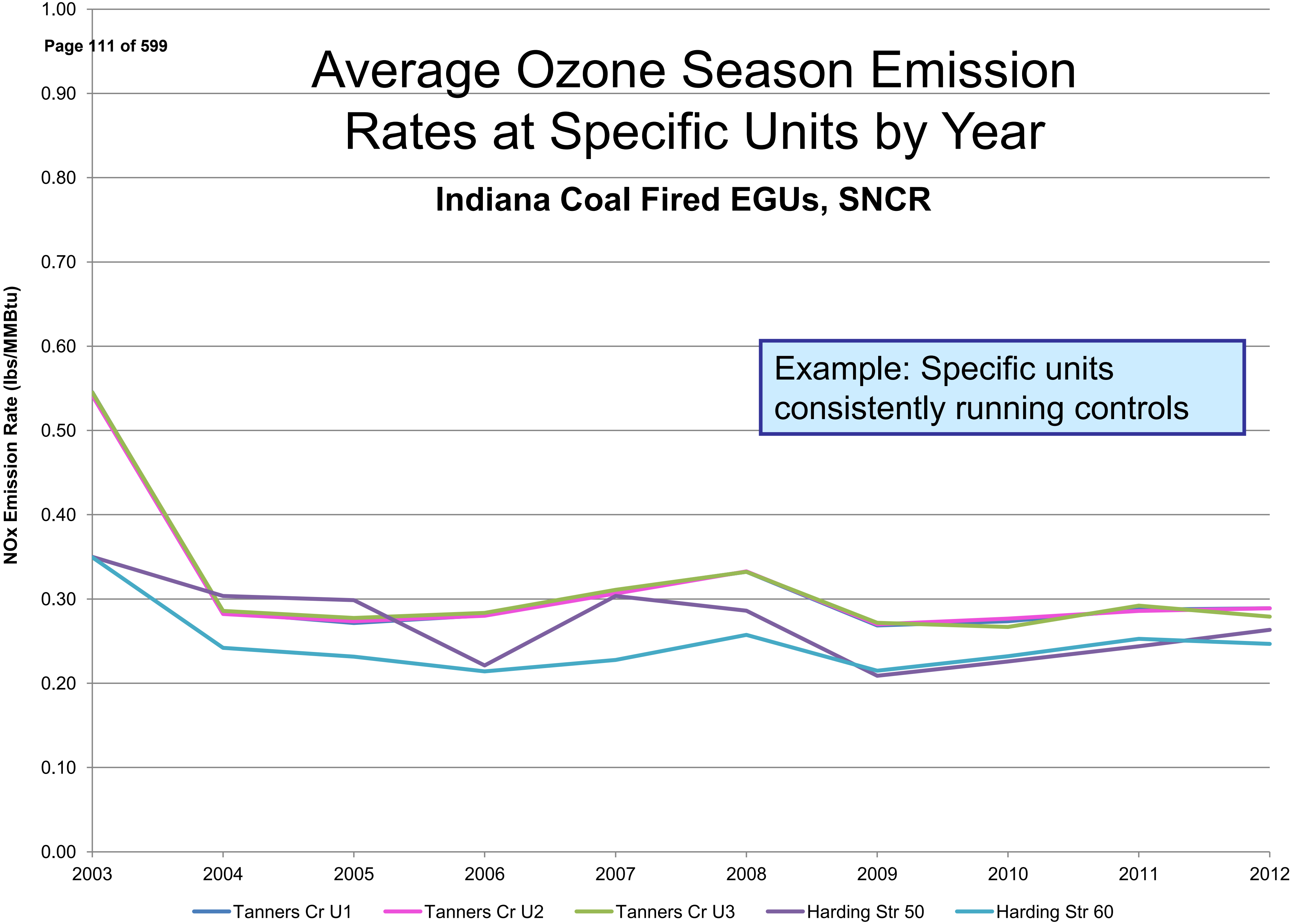


Average Ozone Season Emission Rates at Specific Units by Year



Average Ozone Season Emission Rates at Specific Units by Year

Indiana Coal Fired EGUs, SNCR



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

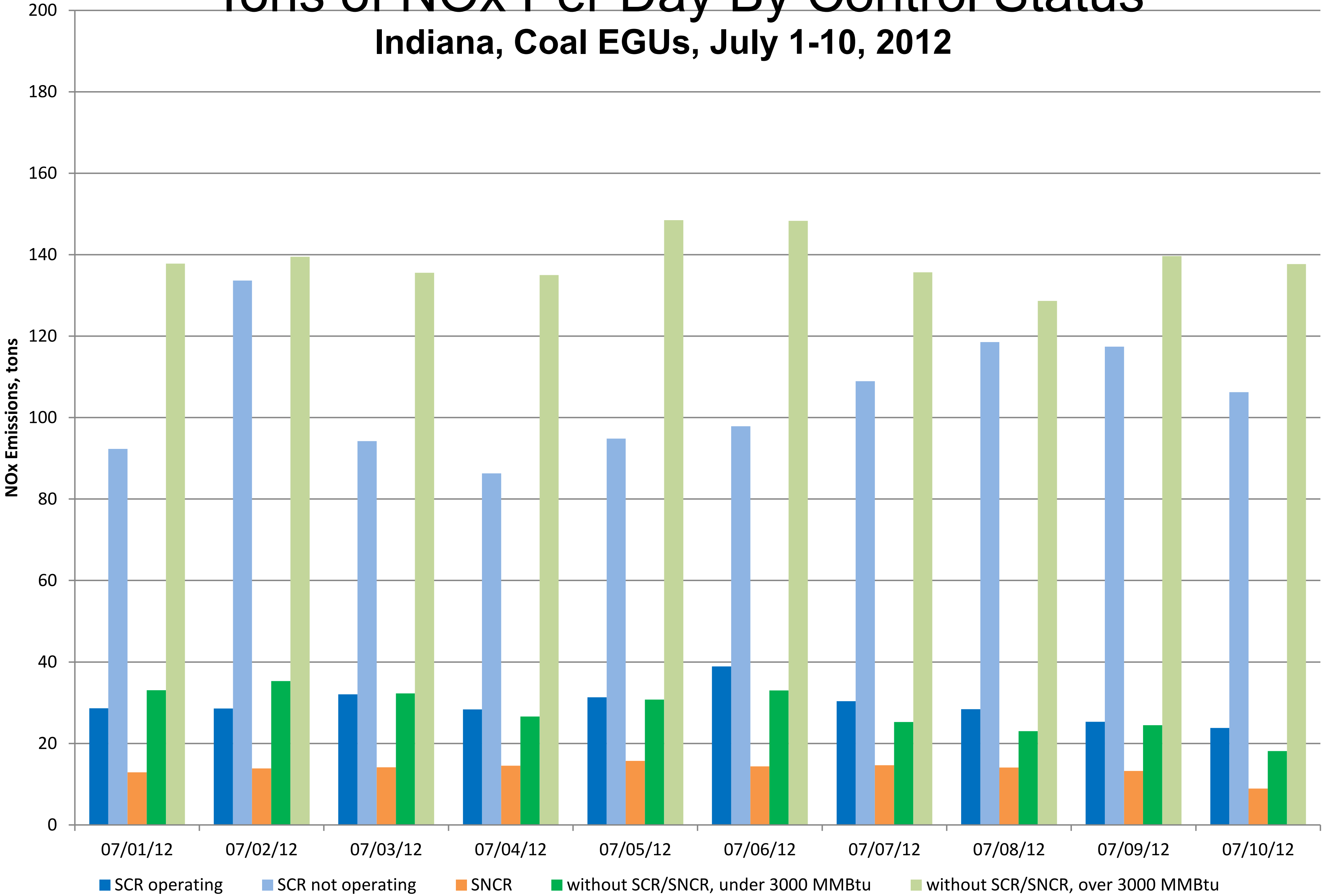
Part 3

July 1 to 10, 2012 Ozone Episode:

Analysis of Emissions and Controls

Tons of NOx Per Day By Control Status

Indiana, Coal EGUs, July 1-10, 2012



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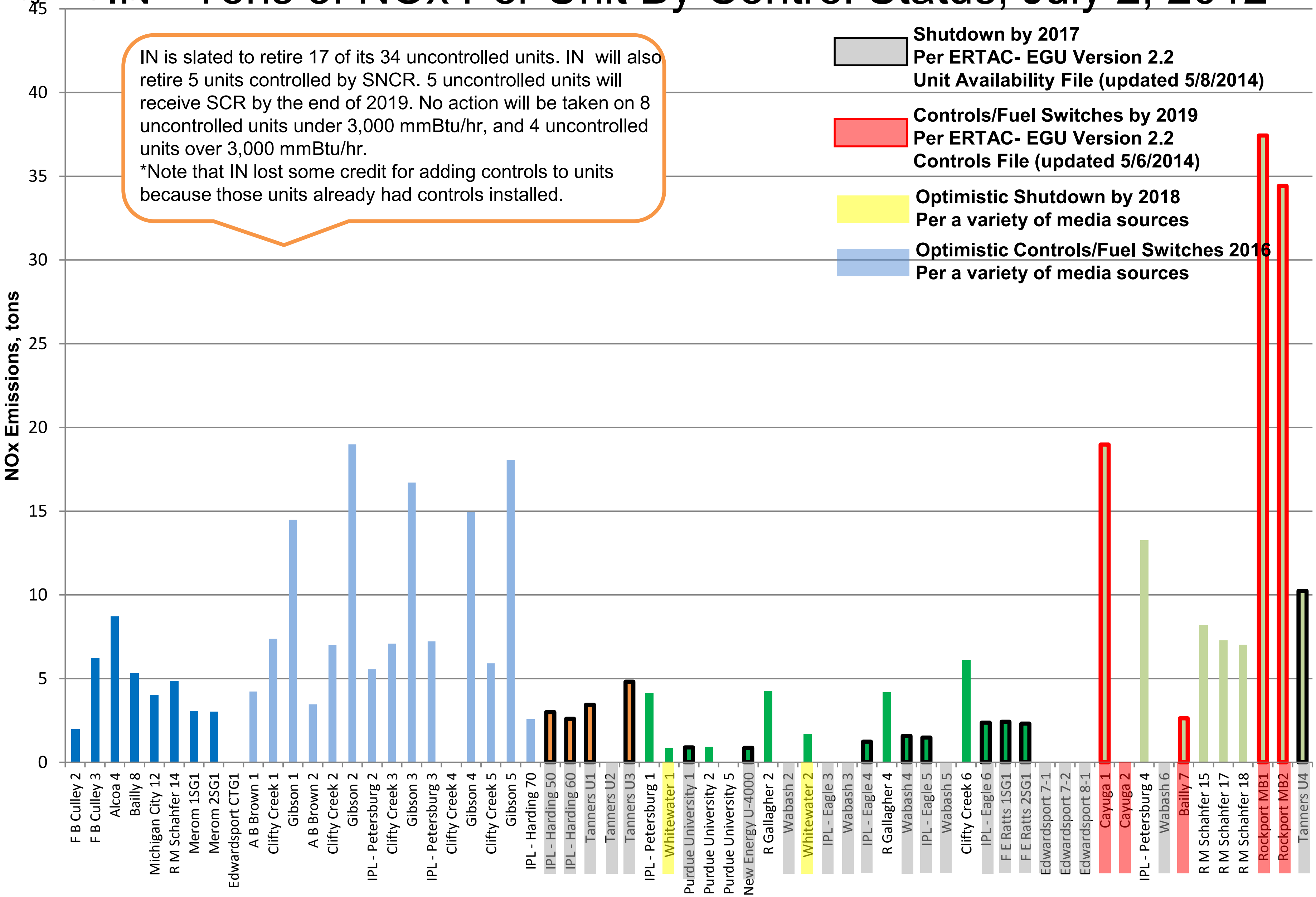
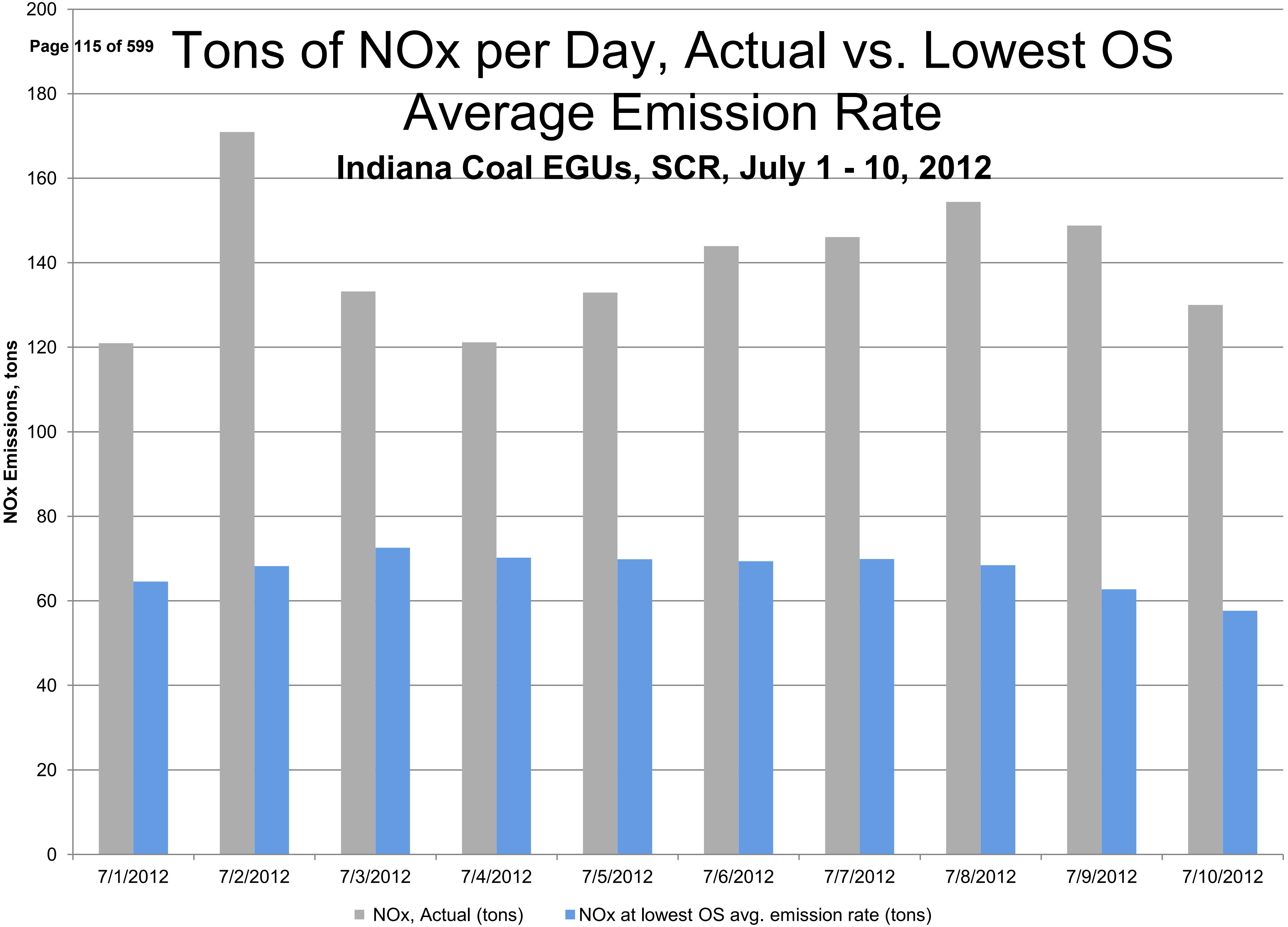
IN - Tons of NOx Per Unit By Control Status, July 2, 2012

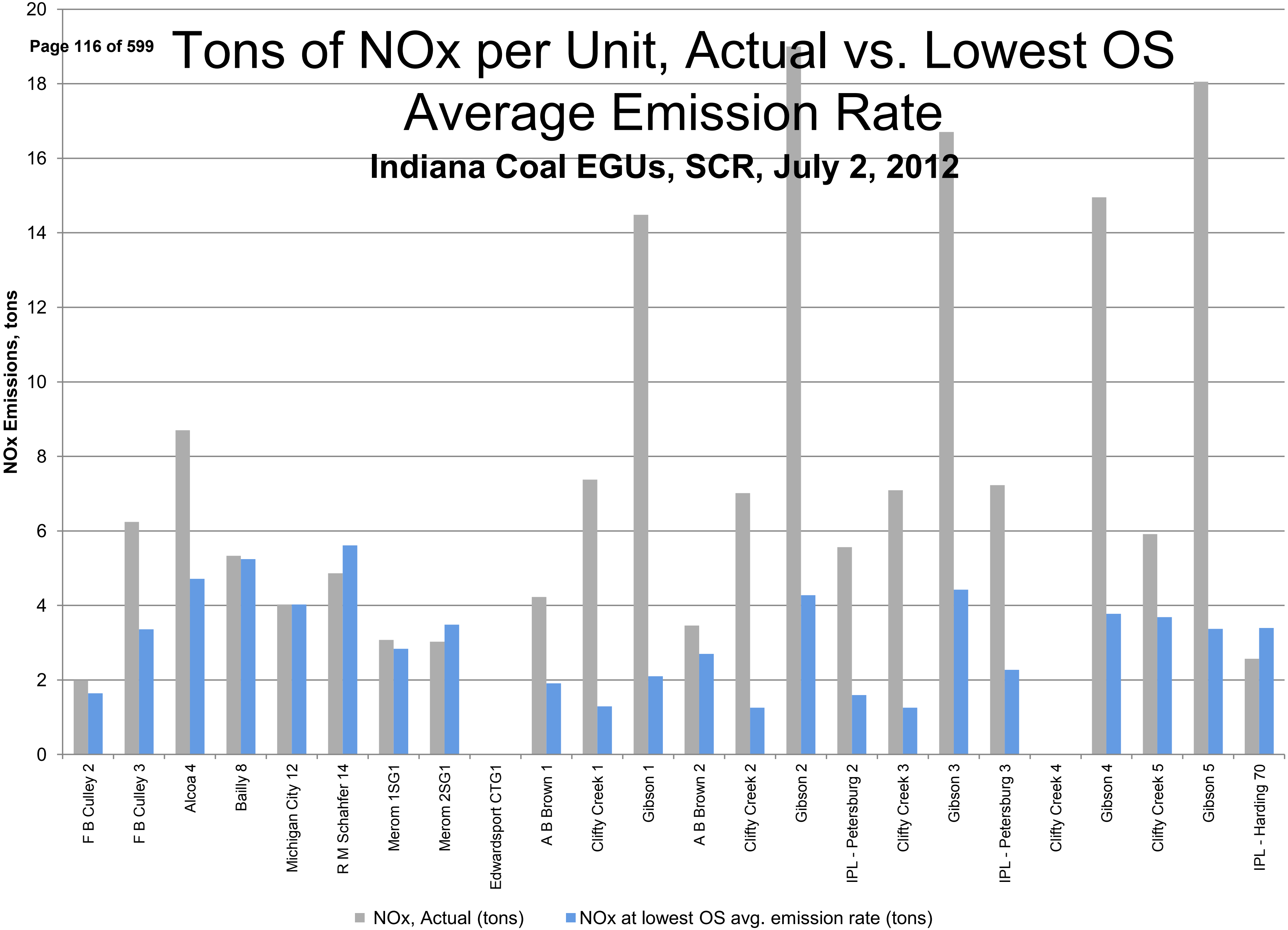


Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate

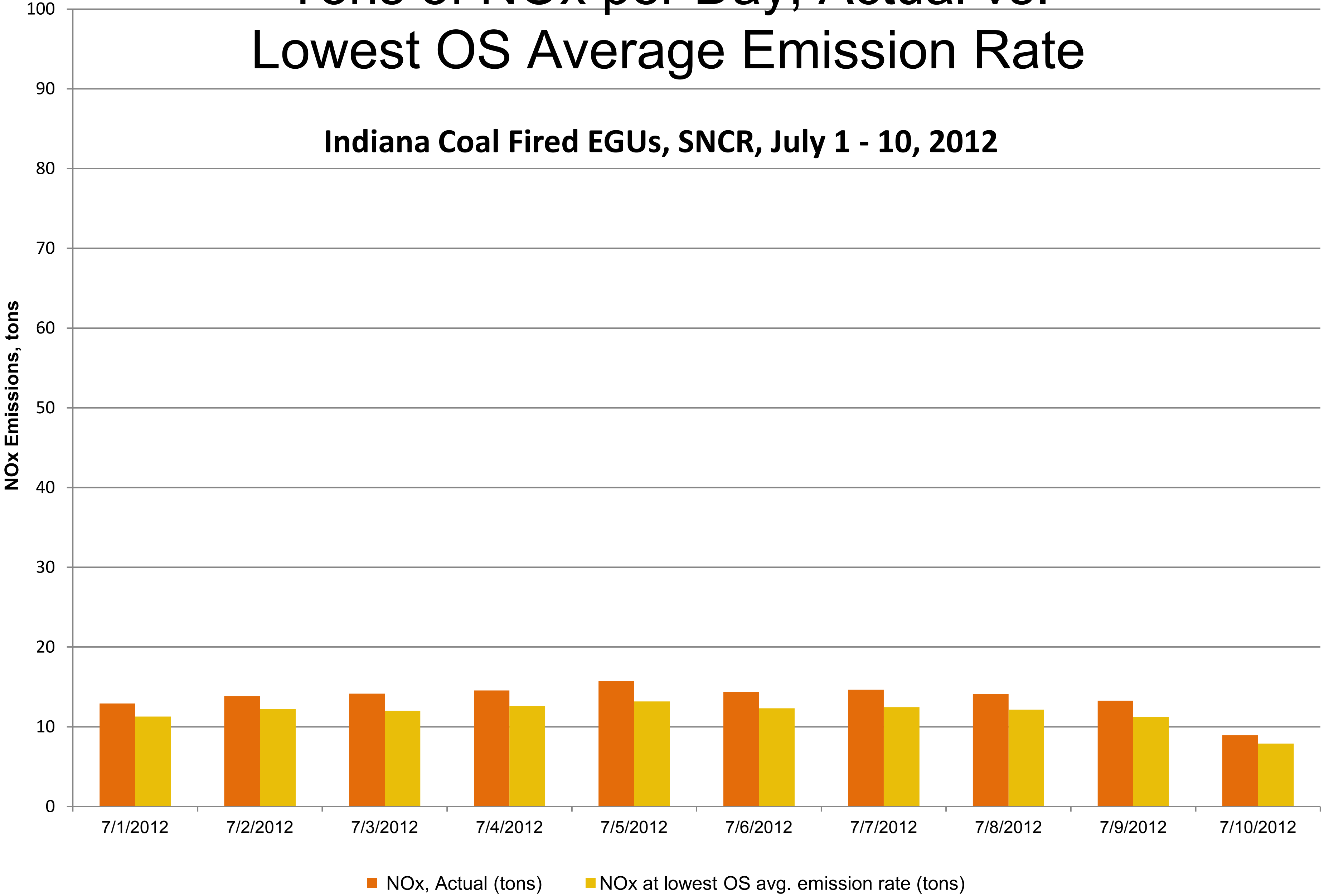
Indiana Coal EGUs, SCR, July 1 - 10, 2012



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

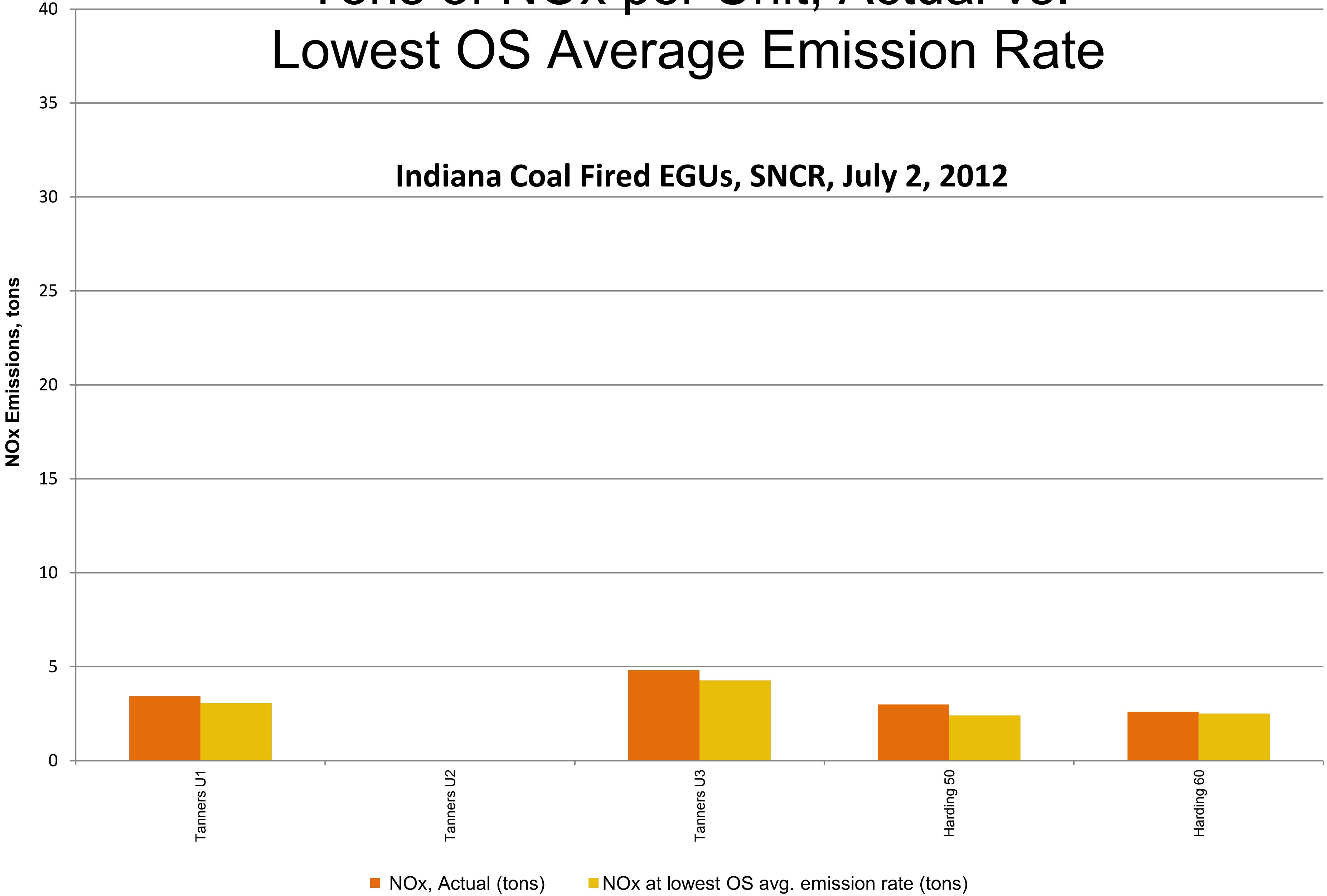

Tons of NOx per Unit, Actual vs. Lowest OS Average Emission Rate
Indiana Coal EGUs, SCR, July 2, 2012
NOx Emissions, tons
20
18
16
14
12
10
8
6
4
2
0
F B Culley 2
F B Culley 3
Alcoa 4
Bailly 8
Michigan City 12
R M Schahfer 14
Merom 1SG1
Merom 2SG1
Edwardsport CTG1
A B Brown 1
Clifty Creek 1
Gibson 1
A B Brown 2
Clifty Creek 2
Gibson 2
IPL - Petersburg 2
Clifty Creek 3
Gibson 3
IPL - Petersburg 3
Clifty Creek 4
Gibson 4
Clifty Creek 5
Gibson 5
IPL - Harding 70
NOx, Actual (tons)
NOx at lowest OS avg. emission rate (tons)

Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate



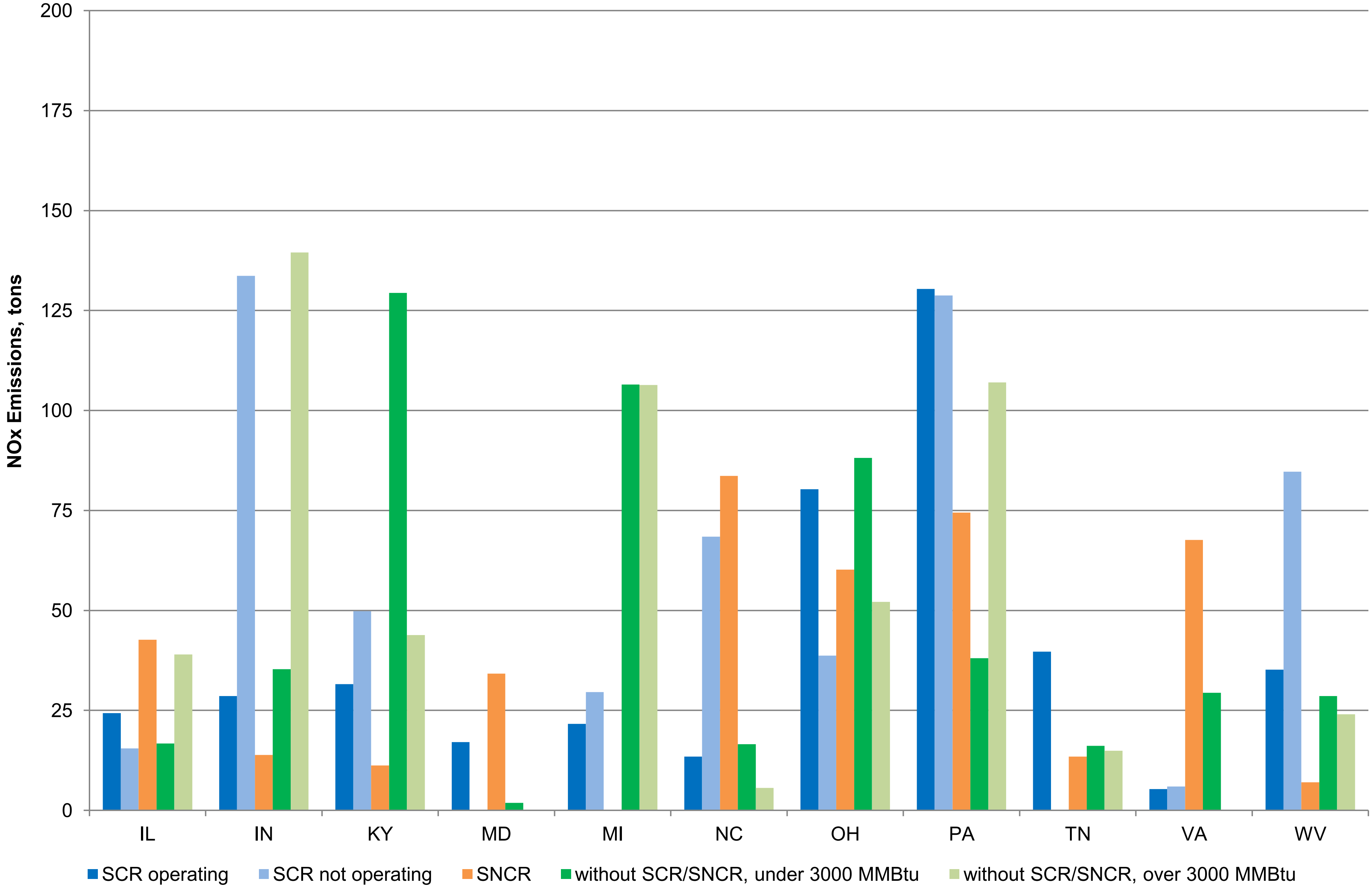
DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Tons of NOx per Unit, Actual vs. Lowest OS Average Emission Rate



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

July 2, 2012 – Tons of NOx per State by Control Status

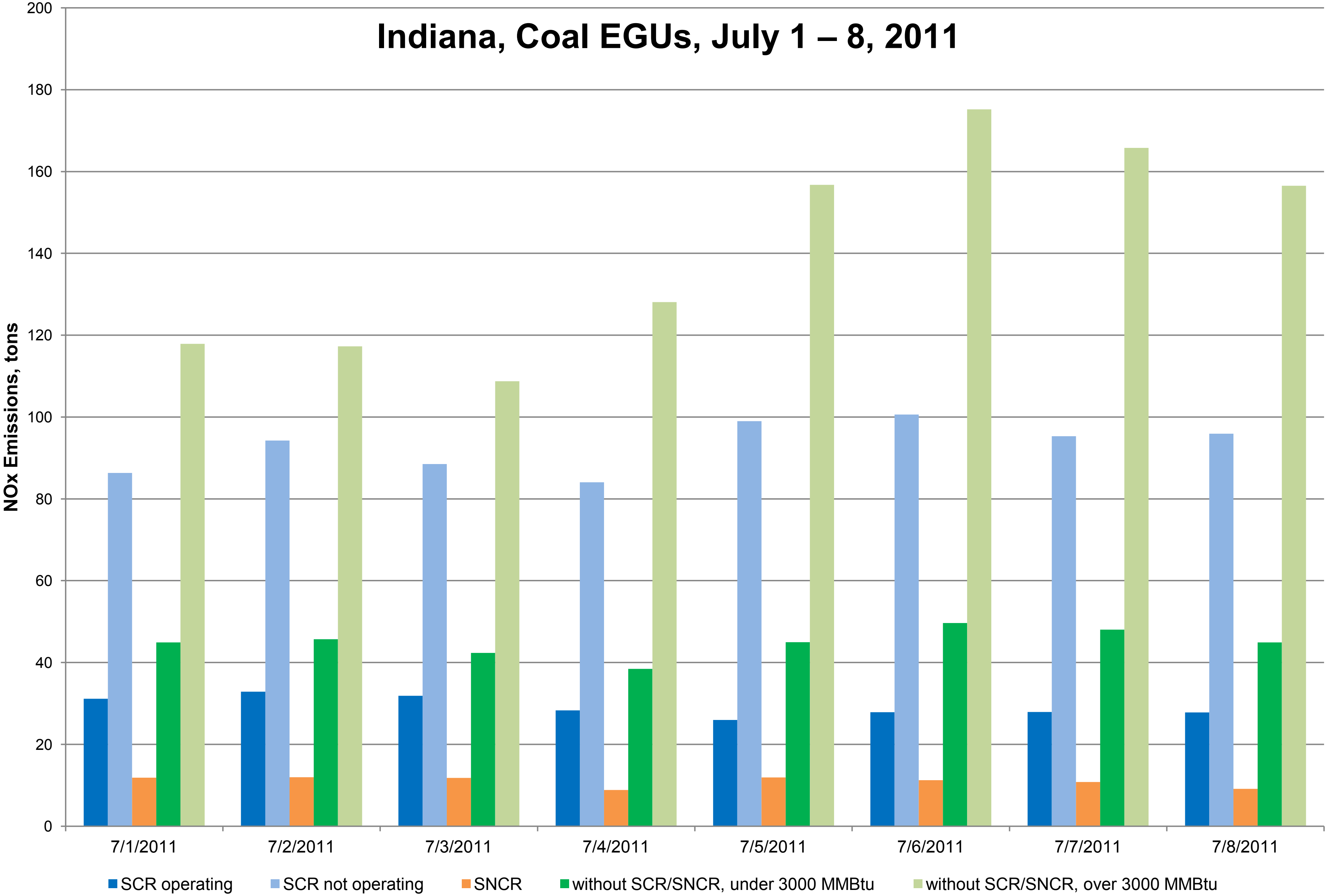


Part 4

July 1 to 8, 2011 Ozone Episode:

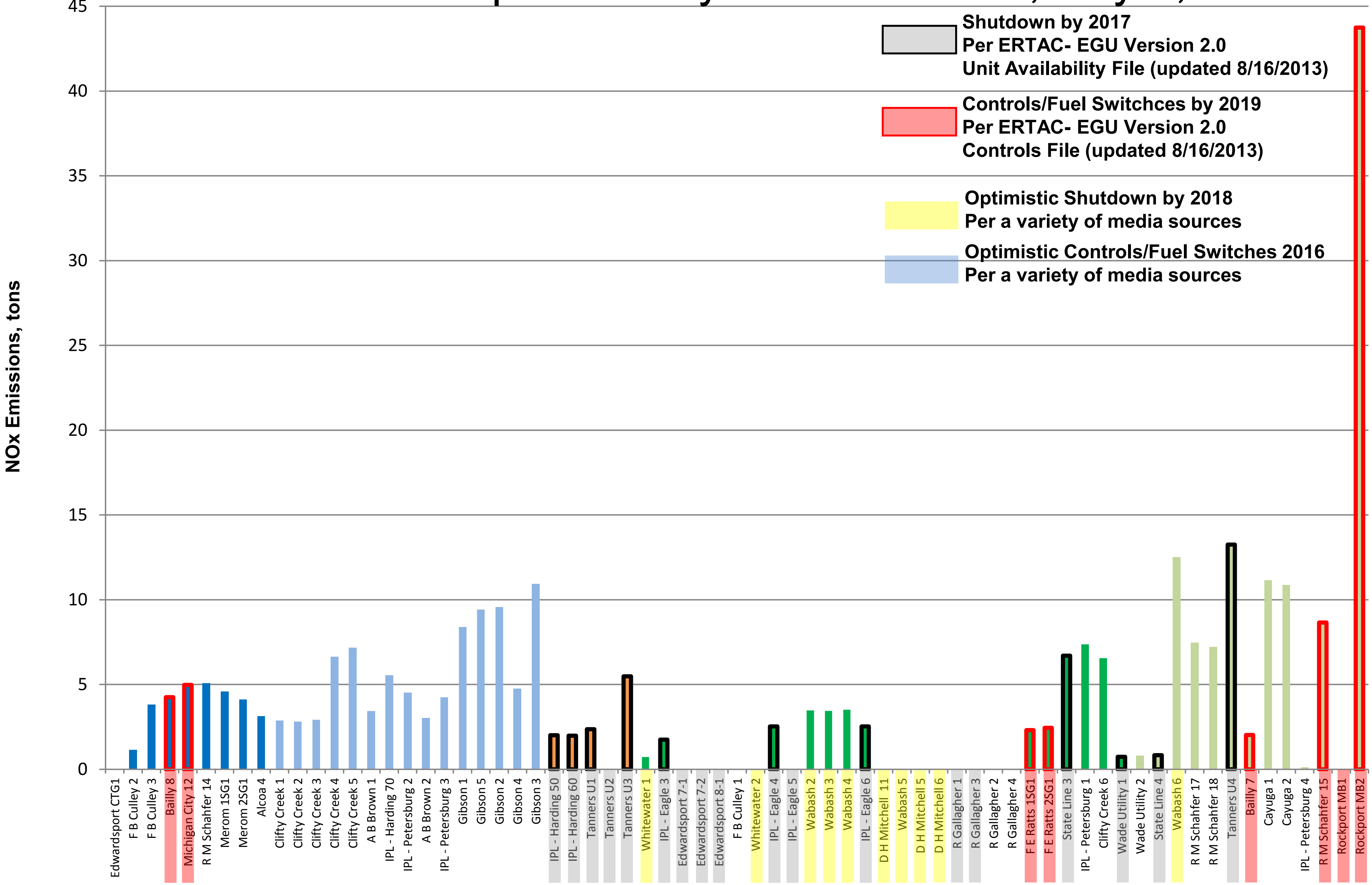
Analysis of Emissions and Controls

Tons of NOx per Day By Control Status



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

IN – Tons of NOx per Unit By Control Status, July 2, 2011



Part 5

11 State Totals

July 1 to 8, 2011 Ozone Episode:

Analysis of Emissions and Controls

11 Upwind States, 2012

- Total number of units = 1,432
- Total heat input capacity = 2,730,239 MMBtu/hr
  = 304,354 MW
- Total MW Capacity in %
  - **Total number of Coal units = 547 = 55%**
  - Total number of NG units = 672 = 25%
  - Total number of other (oil, etc.) units = 173 = 6%
  - Total number of Nuclear units = 40 = 14%
- **Total Capacity Coal = 165,910 MW**
  - 156 units with SCR = 88,783 MW = 53%
  - 114 units with SNCR = 27,561 MW = 17%
  - 277 units without SCR/SNCR = 49,566 MW = 30%

Basis – CAMD (as of 5/13/2014), NEI (for Nuclear), ERTAC (5/6/2014, 5/8/2014)

11 Upwind States, 2018

- Total number of units = 1,199
- Total heat input capacity = 2,449,194 MMBtu/hr
  = 274,300 MW
- Total MW Capacity in %
  - **Total number of Coal units = 361 = 49%**
  - Total number of NG units = 686 = 32%
  - Total number of other (oil, etc.) units = 115 = 5%
  - Total number of Nuclear units = 37 = 14%
- **Total Capacity Coal = 134,121 MW**
  - 166 units with SCR = 93,776 MW = 70%
  - 60 units with SNCR = 17,868 MW = 13%
  - 135 units without SCR/SNCR = 22,477 MW = 17%

Basis – ERTAC (5/6/2014, 5/8/2014), NEI (for Nuclear)

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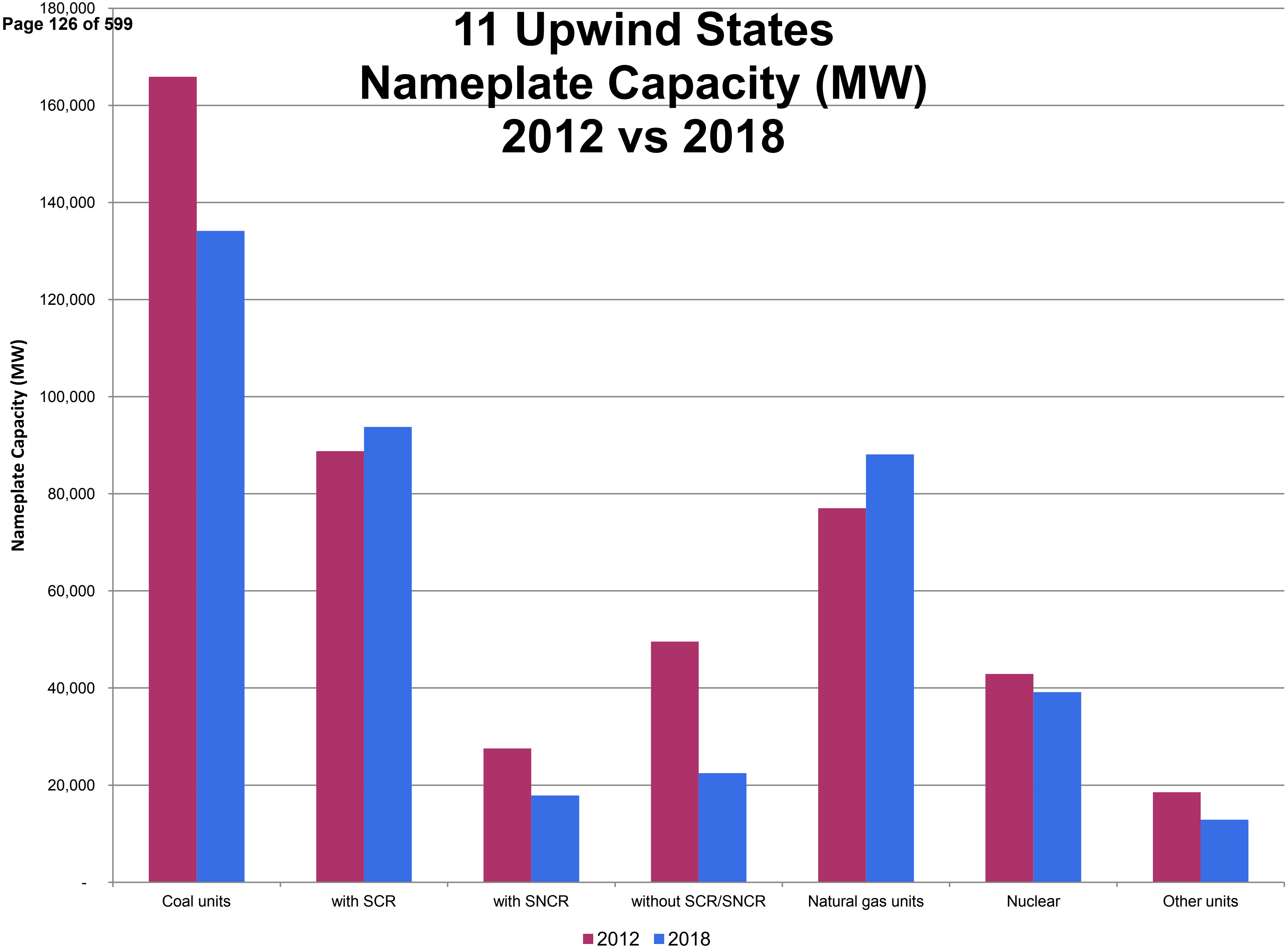
11 Upwind States Nameplate Capacity (MW) 2012 vs 2018



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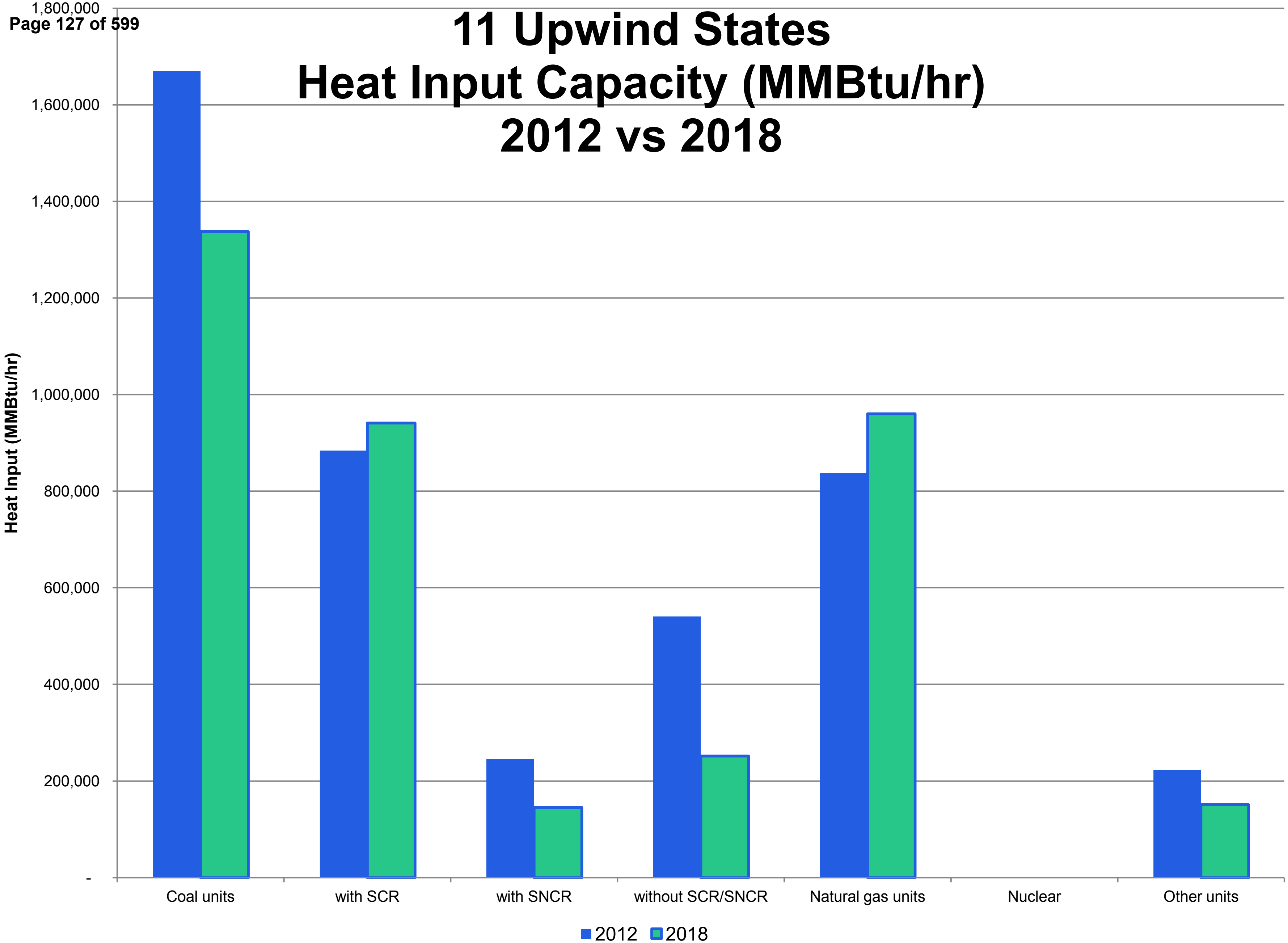
11 Upwind States Heat Input Capacity (MMBtu/hr) 2012 vs 2018



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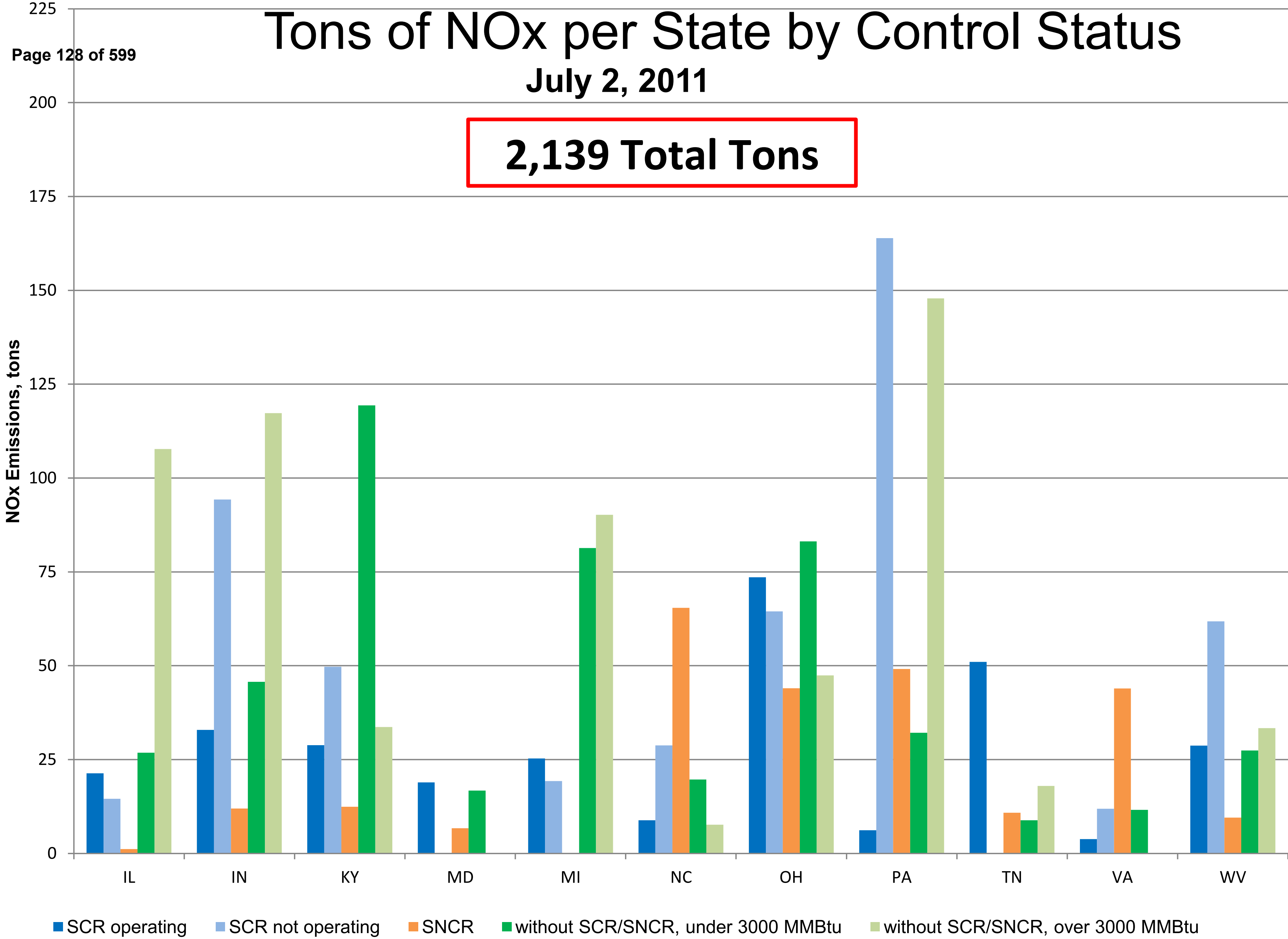
Tons of NOx per State by Control Status

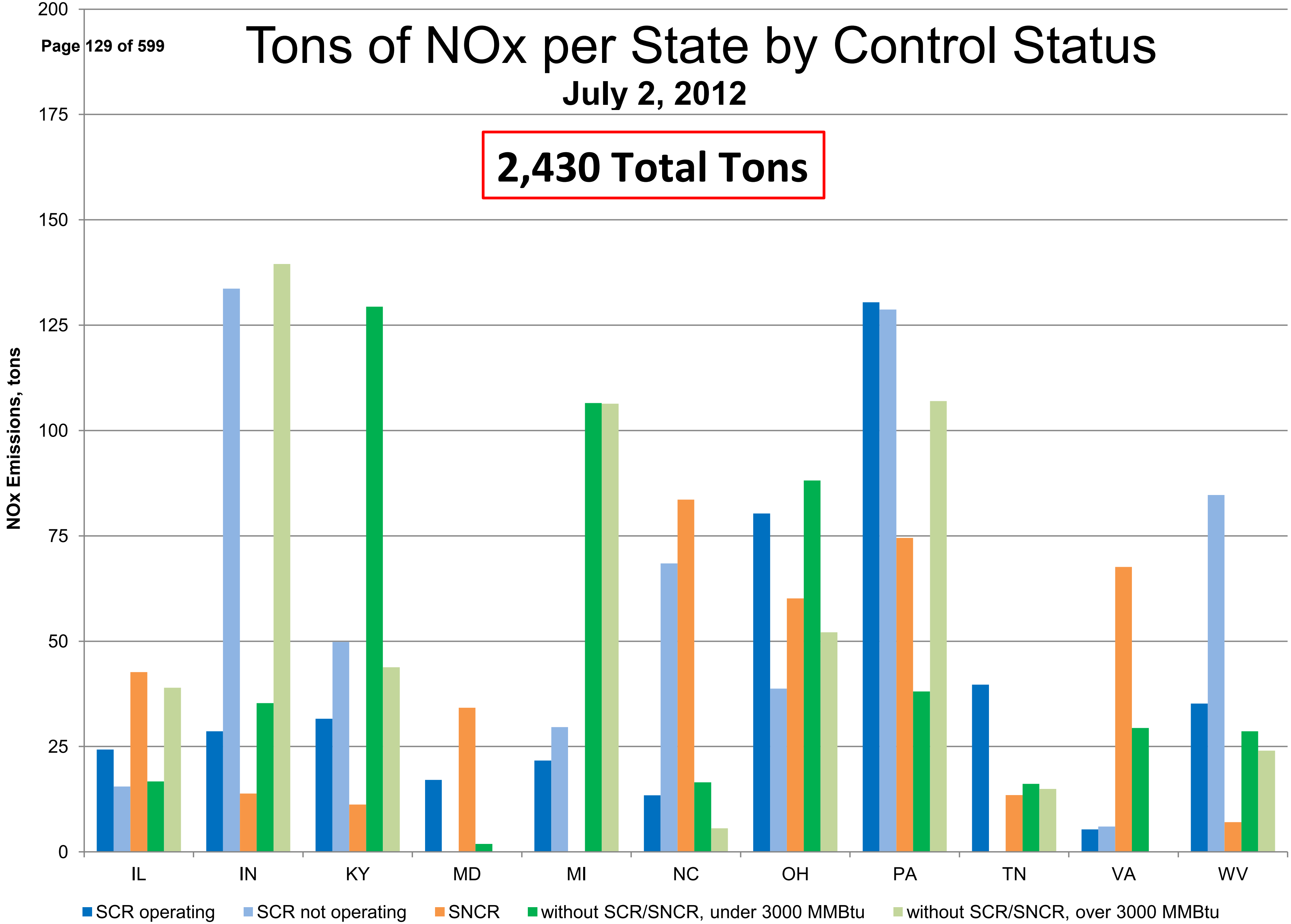
July 2, 2011

2,139 Total Tons



Tons of NOx per State by Control Status

July 2, 2012



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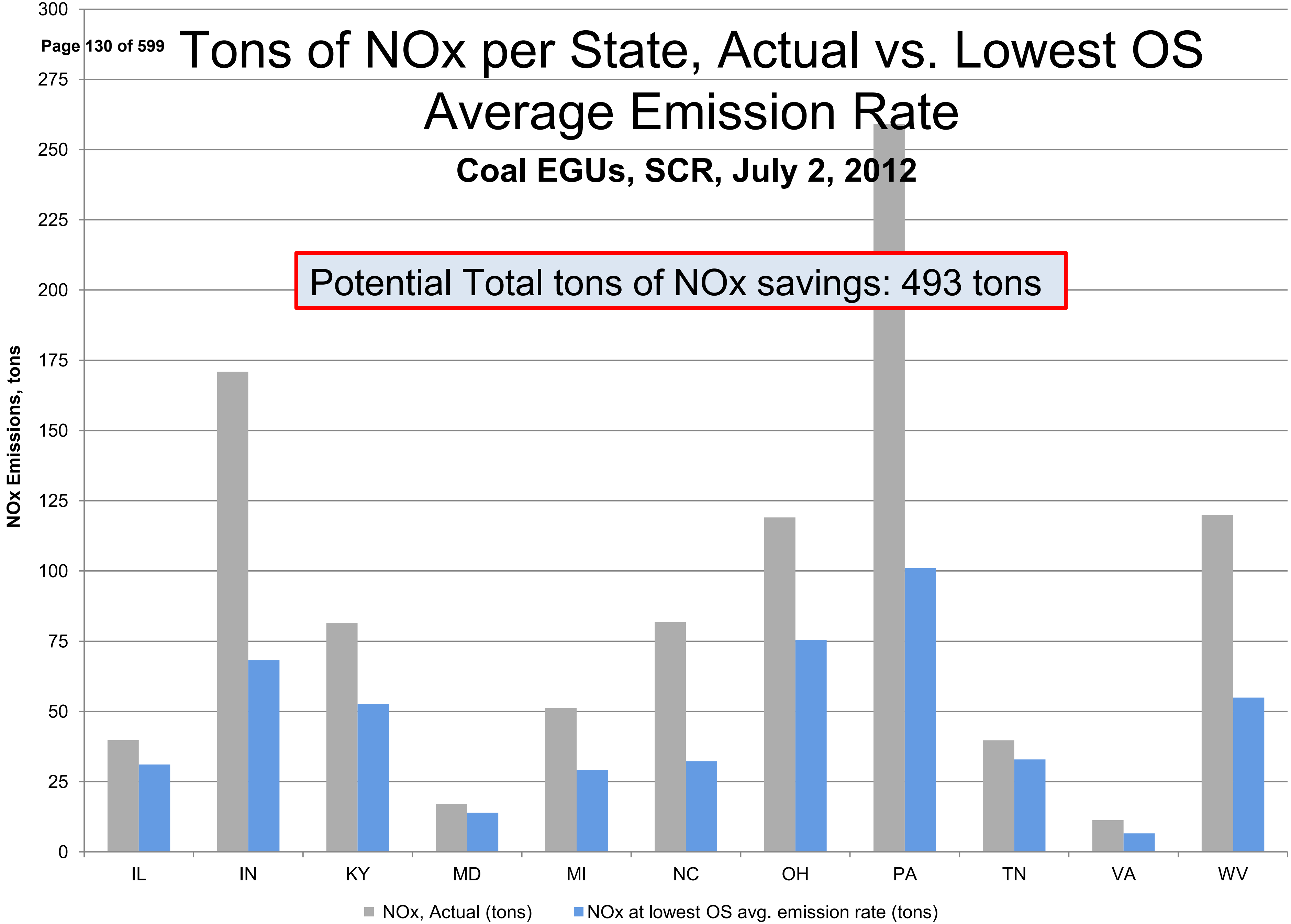
Tons of NOx per State, Actual vs. Lowest OS Average Emission Rate

Coal EGUs, SCR, July 2, 2012

Potential Total tons of NOx savings: 493 tons



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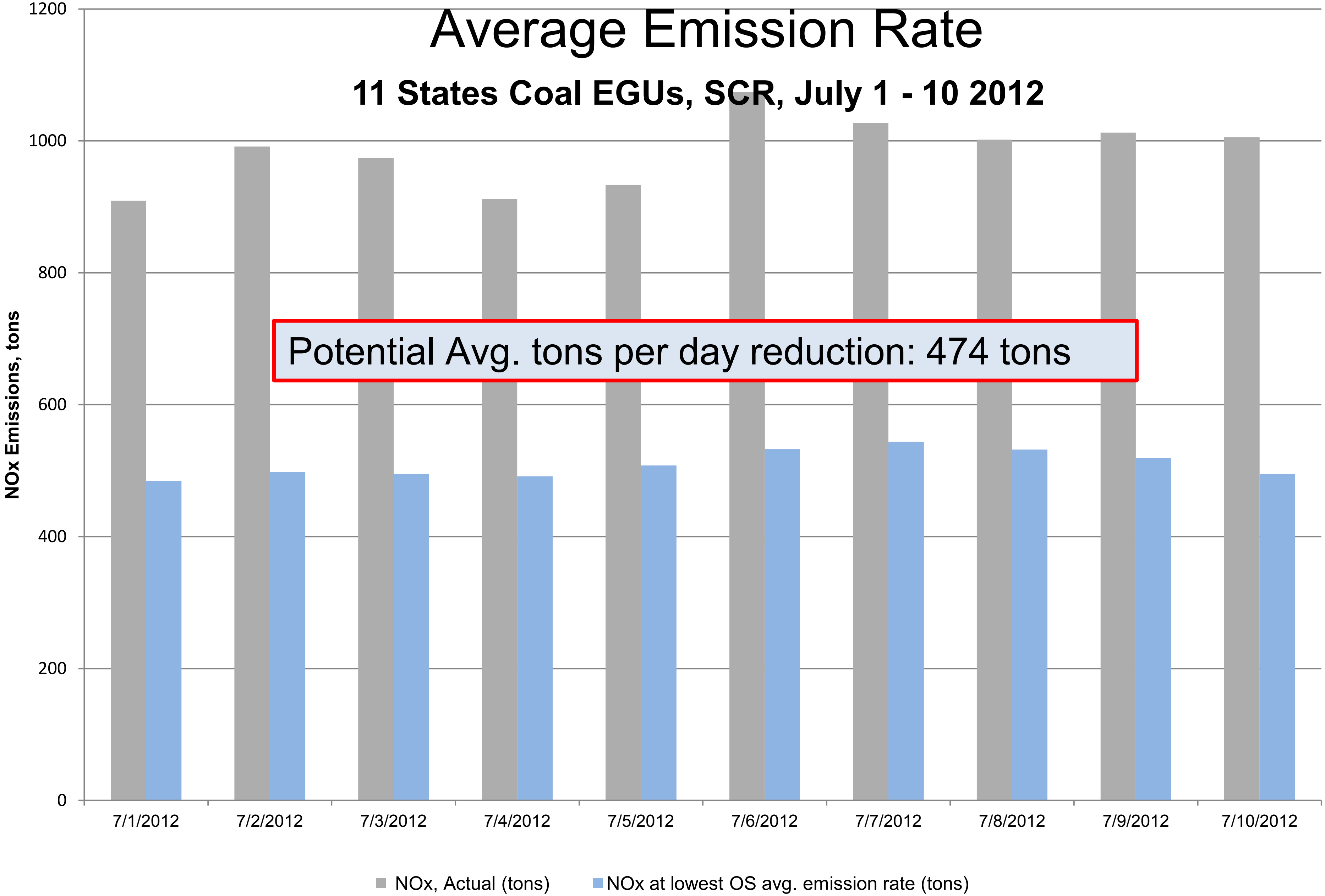
Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate



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11 State Summary

After performing similar analysis of EGUs in IL, IN, KY, MD, MI, NC, OH, PA, TN, VA and WV, the following potential total tons of lost NOx reductions was calculated:

- On July 2, 2012 actual NOx emissions in the 11 states (listed above) was 991 tons
  - If EGUs in those states were to have run their controls at the best rates observed in the data, emissions would have been 498 tons
  - This represents a single day loss of NOx reductions of 493 tons on that day
- During the 10 day episode between July 1 and 10, 2012 actual NOx emissions in the 11 states (listed above) was 9,840 tons
  - If EGUs in those states were to have run their controls at the best rates observed in the data, emissions would have been 5,099 tons
  - This represents a loss of NOx reductions of 4,741 tons over that 10-day episode

Part 6

Potential Lost Ozone Benefits from Controls Running Less Effectively in Recent Years

Preliminary Photochemical Modeling

Indiana Monitors

How Might This Affect Ozone?

- Maryland has performed several very preliminary model runs to look at how much running EGU controls inefficiently might increase ozone levels
- Three runs:
  - Scenario 2B – A worst case run
    - Assumes SCR and SNCR controls are not run at all
  - Scenario 3B – A worst data run
    - Assumes SCR and SCR units all run at worst rates seen in CAMD data - 2005 to 2012
  - Scenario 3C – Based upon CAMD data analysis for EGU performance in 2011 and 2012
    - Assumes that units that had higher ozone season emission rates were operating at the best ozone season rates observed since 2005

Lost Ozone Benefits
Potential PPB Increases

Indiana Monitors	Potential Increased Ozone in 2018 – 3 EGU Control Scenarios		
County	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Allen	2.7	0.7	0.4
Allen	2.7	0.7	0.4
Boone	6.9	1.8	0.9
Carroll	7.1	1.8	0.8
Clark	7.4	2.1	1.3
Delaware	5.7	1.7	1.0
Elkhart	3.5	0.9	0.4
Floyd	5.7	1.7	1.2
Greene	22.6	5.5	3.4
Hamilton	4.9	1.5	0.9
Hancock	5.6	1.8	1.0
Hendricks	7.8	1.4	0.8
Huntington	4.2	1.1	0.7
Jackson	12.0	4.4	2.8
Johnson	10.6	3.0	1.8
Lake	1.1	0.3	0.1
Lake	1.1	0.2	0.1
Lake	1.0	0.2	0.1
LaPorte	4.2	1.3	0.3
LaPorte	1.9	0.5	0.1
Madison	5.8	1.7	1.0

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Lost Ozone Benefits
Potential PPB Increases

Indiana Monitors	Potential Increased Ozone in 2018 – 3 EGU Control Scenarios		
County	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Marion	5.4	2.2	1.3
Marion	5.1	1.9	1.1
Marion	4.7	1.7	1.0
Marion	5.0	1.9	1.0
Morgan	9.0	2.2	1.2
Perry	7.8	2.7	1.9
Porter	0.6	0.1	0.1
Porter	0.9	0.1	0.1
Posey	10.7	3.1	2.1
Shelby	7.2	2.3	1.3
St. Joseph	4.0	1.0	0.4
St. Joseph	5.8	1.6	0.6
St. Joseph	3.5	0.9	0.3
Vanderburgh	10.9	3.2	2.1
Vanderburgh	11.7	3.5	2.4
Vigo	13.2	2.7	1.6
Vigo	13.7	2.9	1.8
Warrick	9.3	3.3	1.9
Warrick	8.7	3.1	1.7
Warrick	12.2	4.4	3.3

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Lost Ozone Benefit – 2018 Design Values

… EPA will propose a new ozone standard soon … 60 to 70 ppb range … designations to most likely be based upon 2014 to 2016 or 2015 to 2017 data

Projected to be Clean in 2018 … Potentially at Risk		Increased Ozone in 2018 – 3 EGU Control Scenarios		
Indiana Counties	**2018 – Controls Running Well (Scenario 3A)**	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Allen	61.8	64.5	62.5	62.2
Allen	61.8	64.5	62.5	62.2
Boone	66.5	73.4	68.3	67.4
Carroll	58.4	65.5	60.2	59.3
Clark	68.1	75.4	70.2	69.4
Delaware	59.2	64.8	60.8	60.1
Elkhart	61.7	65.2	62.6	62.1
Floyd	66.2	71.9	67.8	67.3
Greene	61.8	84.4	67.3	65.2
Hamilton	64.8	69.8	66.4	65.7
Hancock	61.6	67.2	63.4	62.7
Hendricks	62.5	70.3	64.0	63.3
Huntington	58.4	62.5	59.5	59.0
Jackson	59.9	71.9	64.3	62.7
Johnson	60.2	70.7	63.2	62.0
Lake	77.6	78.7	77.8	77.7
Lake	75.7	76.8	75.9	75.8
Lake	72.5	73.5	72.7	72.6
LaPorte	63.5	67.7	64.7	63.8
LaPorte	63.2	65.1	63.7	63.4
Madison	58.2	64.0	59.9	59.1

DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Lost Ozone Benefit – 2018 Design Values

… EPA will propose a new ozone standard soon … 60 to 70 ppb range … designations to most likely be based upon 2014 to 2016 or 2015 to 2017 data

Projected to be Clean in 2018 … Potentially at Risk		Increased Ozone in 2018 – 3 EGU Control Scenarios		
Indiana Counties	**2018 – Controls Running Well (Scenario 3A)**	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Marion	65.1	70.5	67.3	66.4
Marion	64.8	69.9	66.6	65.8
Marion	62.8	67.5	64.5	63.8
Marion	59.5	64.5	61.4	60.5
Morgan	61.6	70.6	63.8	62.8
Perry	63.1	70.9	65.8	65.0
Porter	75.5	76.0	75.6	75.6
Porter	75.2	76.2	75.3	75.3
Posey	58.4	69.1	61.5	60.6
Shelby	61.8	69.1	64.1	63.1
St. Joseph	62.9	66.9	64.0	63.3
St. Joseph	58.1	63.9	59.7	58.7
St. Joseph	55.7	59.2	56.6	56.0
Vanderburgh	63.2	74.1	66.4	65.2
Vanderburgh	62.3	74.0	65.8	64.7
Vigo	55.8	69.0	58.5	57.5
Vigo	52.1	65.9	55.0	53.9
Warrick	63.4	72.7	66.7	65.2
Warrick	58.3	67.0	61.4	60.0
Warrick	57.0	69.2	61.4	60.3

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EGU Data Package #3
Operation of Existing SCR, SNCR

Kentucky

Sample of draft data and analyses developed by the Maryland Department of the Environment

Contact: Tad Aburn, Air Director, MDE
(410) 537-3255

September 18, 2014

Purpose

- Maryland is the only Moderate nonattainment area in the East for the 75 ppb ozone standard.
  - This means that Maryland is the only state required to submit an attainment SIP
  - Only state required to perform attainment modeling.
- We are now beginning to build our "SIP Quality" modeling platform.
- One major issue that our data analyses have uncovered is that many EGU units appear to not be running their control equipment in recent years as efficiently as they have demonstrated they can do in earlier years. This issue is driven by recent changes in the energy market, reduced coal capacity, inexpensive allowances and a regulatory structure driven by ozone season caps not daily performance. In many states, including Maryland, this has lead to controls not always being used efficiently on the days when they are needed the most … this is perfectly legal.
- This is a critical issue that we would like to continue to discuss with you. There appears to be an interest from the private sector to discuss this issue and see if a common sense fix can be designed. Maryland believes this fix would be relatively cost-effective compared to the capital cost of the control technologies.
- MDE has focused our analyses on two of the worst large, regional scale ozone episodes from recent years: July 1-8, 2011 and July 1-10, 2012.
- The primary data used in these analyses include:
  - CEMS data from CAMD
  - Emissions and projection data from ERTAC
  - Other data we have received from individual states
- More detailed data and analyses and spreadsheets are available upon request.

How the Data Analyses Were Built

- Maryland began the data analyses in late 2012
  - Looked at EGUs in the 9 upwind states named in the 176A Petition (IL, IN, KY, MI, NC, OH, TN, VA, WV) … MD and PA
- Shared a draft package with Air Directors on April 21, 2014
  - This package focused on a bad ozone episode: July 1 – 8, 2011
- Shared a second draft package with Air Directors on May 13, 2014
  - This package focused on second bad ozone episode: July 1 – 10, 2012
  - This package also included update to specific material after receiving comments from numerous states
- The 2011 and 2012 episodes analyzed capture two of the worst regional ozone periods in 2011 and 2012
  - Other states, like Wisconsin and Delaware have done similar analyses and reached similar conclusions
- This is the third draft package, and builds on to the prior two draft packages, while incorporating input from individual states and updates to ERTAC.
- This third draft package also includes preliminary photochemical modeling performed by MDE to look at the potential loss of ozone reduction benefits.

Help Us QA the Data

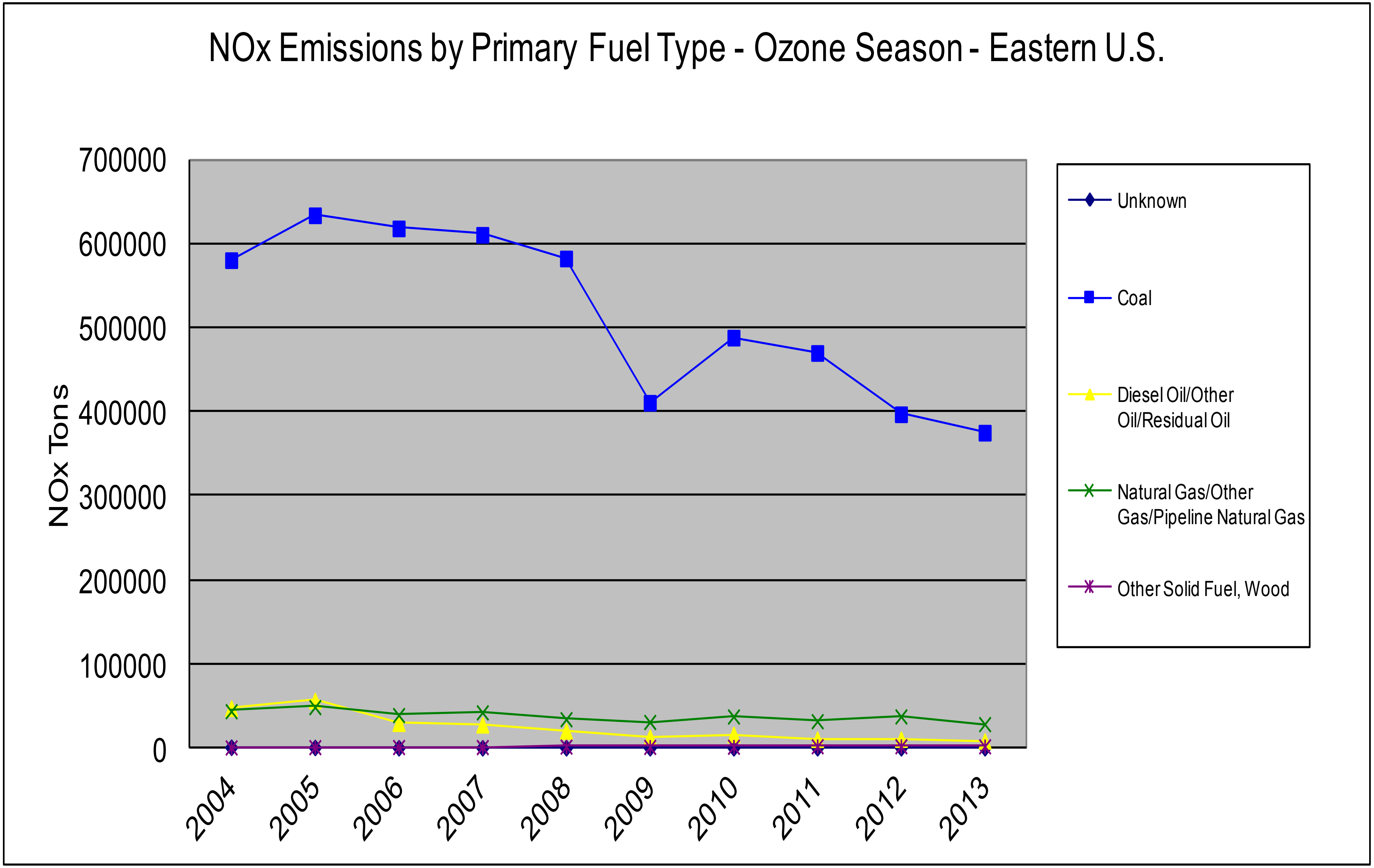
- We have used readily available data, like the CAMD and ERTAC data, but we recognize that these data sources can be out of date, or not include recent changes.
  - We hope you can help us with making sure we have the best possible data.

- This package reflects recently updated data, including but not limited to:
  - CAMD updates
  - May 8, 2014 ERTAC updates
  - PA comments to OTC, forwarded to MDE, Spreadsheets detailing "EGU Shutdowns, EGU Controls and New Natural Gas Power Projects" for the state of PA. Sent from Randy Bordner, Environmental Group Manager - Bureau of Air Quality, PA Department of Environmental Protection to Andy Bodnarik, OTC. Received as FWD from Andy Bodnarik on 4/23/2014
  - VA comments to MDE, "Electric Generation Sector Summary for Virginia" received from Thomas R. Ballou, Director - Office of Air Data Analysis and Planning, VA Department of Environmental Quality on 5/12/2014

Part 1

Background:
Generation in 2012 and 2018
Projected Changes

Why Coal?


NOx Emissions by Primary Fuel Type - Ozone Season - Eastern U.S.
NOx Tons
700000
600000
500000
400000
300000
200000
100000
0
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Unknown
Coal
Diesel Oil/Other Oil/Residual Oil
Natural Gas/Other Gas/Pipeline Natural Gas
Other Solid Fuel, Wood

Kentucky EGUs, 2012

- Total number of units = 105
- Total heat input capacity = 266,585 MMBtu/hr = 24,426 MW
- Total State MW Capacity in %
  - **Total number of Coal units = 56 = 74%**
  - Total number of NG units = 43 = 24%
  - Total number of other (oil, etc.) units = 6 = 2%
  - Total number of Nuclear units = 0 = 0%
- **Total Capacity Coal = 17,973 MW**
  - 19 units with SCR = 10,434 MW = 58%
  - 3 units with SNCR = 941 MW = 5%
  - 34 units without SCR/SNCR = 6,598 MW = 37%

Basis – CAMD (as of 5/13/2014), NEI (for Nuclear), ERTAC (5/6/2014, 5/8/2014)

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Capacity and Fuel: 2012 to 2018

A detailed review of ERTAC data for 2018 was completed, and an evaluation of the following characteristics performed.

- Total Number of units
- Heat input capacity - MMBtu/hr
- Nameplate capacity – MW
- Presence of advanced post combustion controls – SCR, SNCR
- Fuel switching
- Shutdown, retirements

Kentucky EGUs, 2018

- Total number of units = 105
- Total heat input capacity = 259,758 MMBtu/hr = 24,090 MW
- Total State MW Capacity in %
  - **Total number of Coal units = 45 = 60%**
  - Total number of NG units = 51 = 35%
  - Total number of other (oil, etc.) units = 9 = 5%
  - Total number of Nuclear units = 0 = 0%
- **Total Capacity Coal = 14,425 MW**
  - 17 units with SCR = 8,656 MW = 60%
  - 3 units with SNCR = 941 MW = 6%
  - 25 units without SCR/SNCR = 4,828 MW = 34%

Basis – ERTAC (5/6/2014, 5/8/2014), NEI (for Nuclear)

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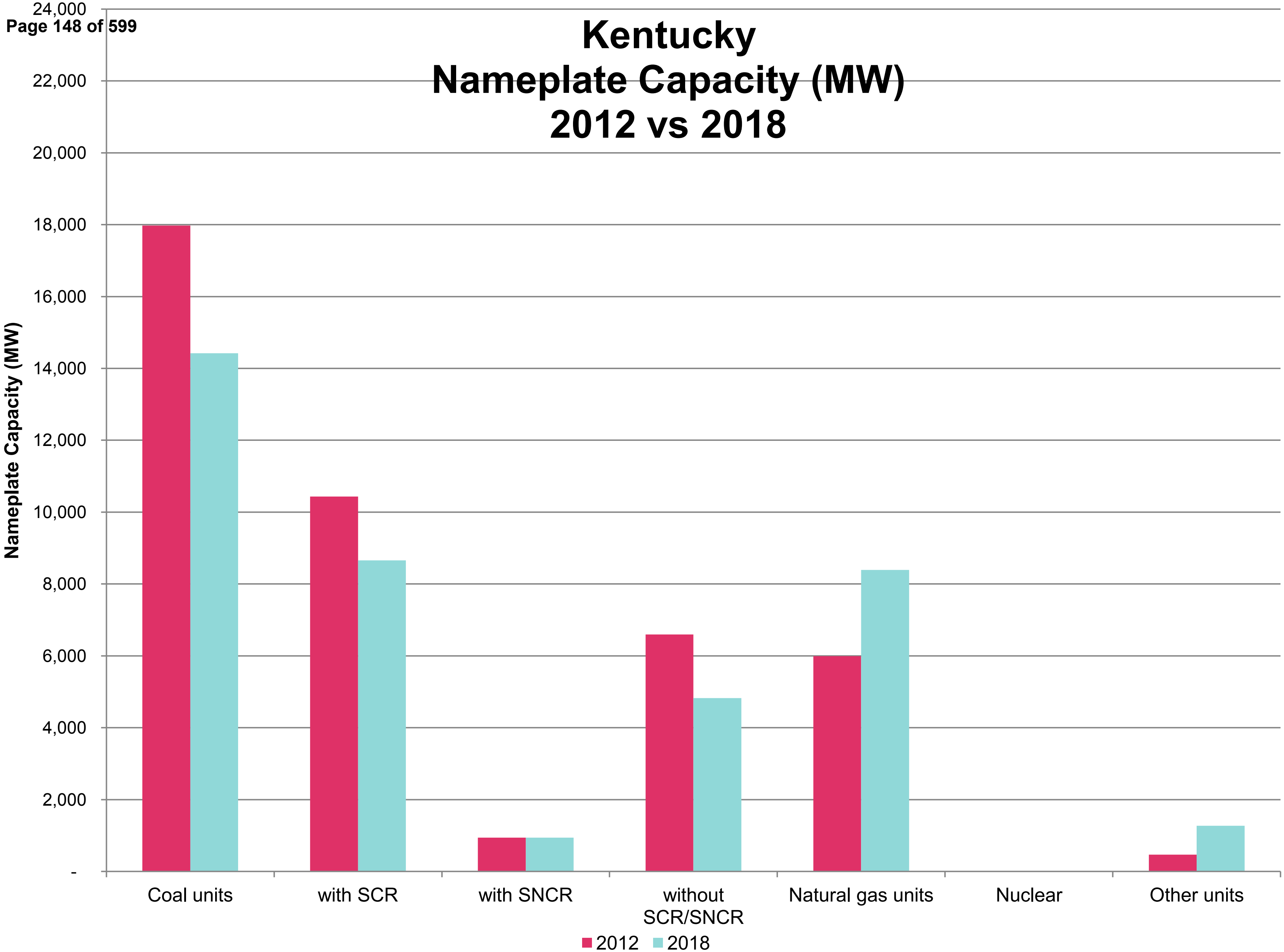
Kentucky Nameplate Capacity (MW) 2012 vs 2018



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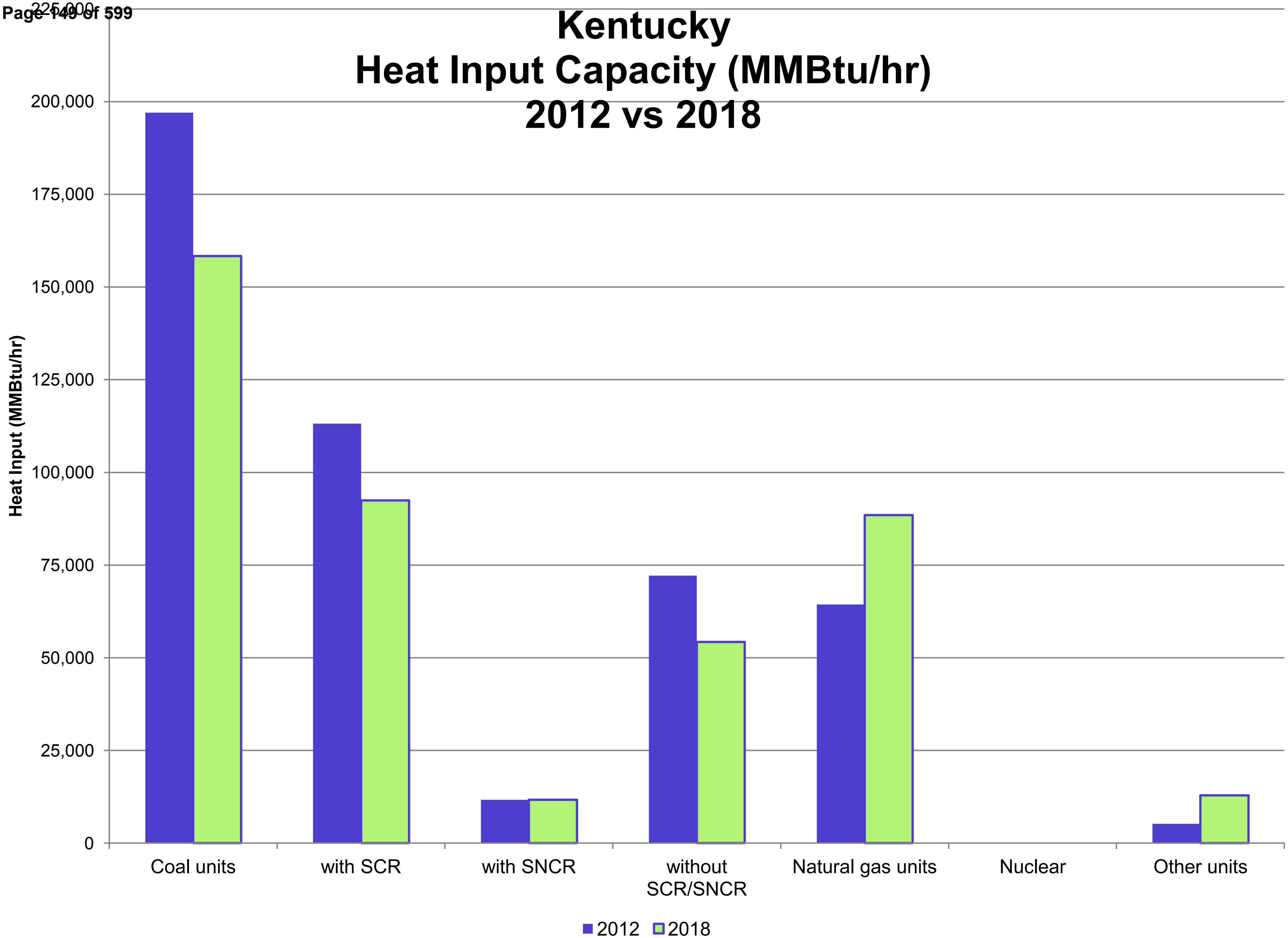
Kentucky
Heat Input Capacity (MMBtu/hr)
2012 vs 2018



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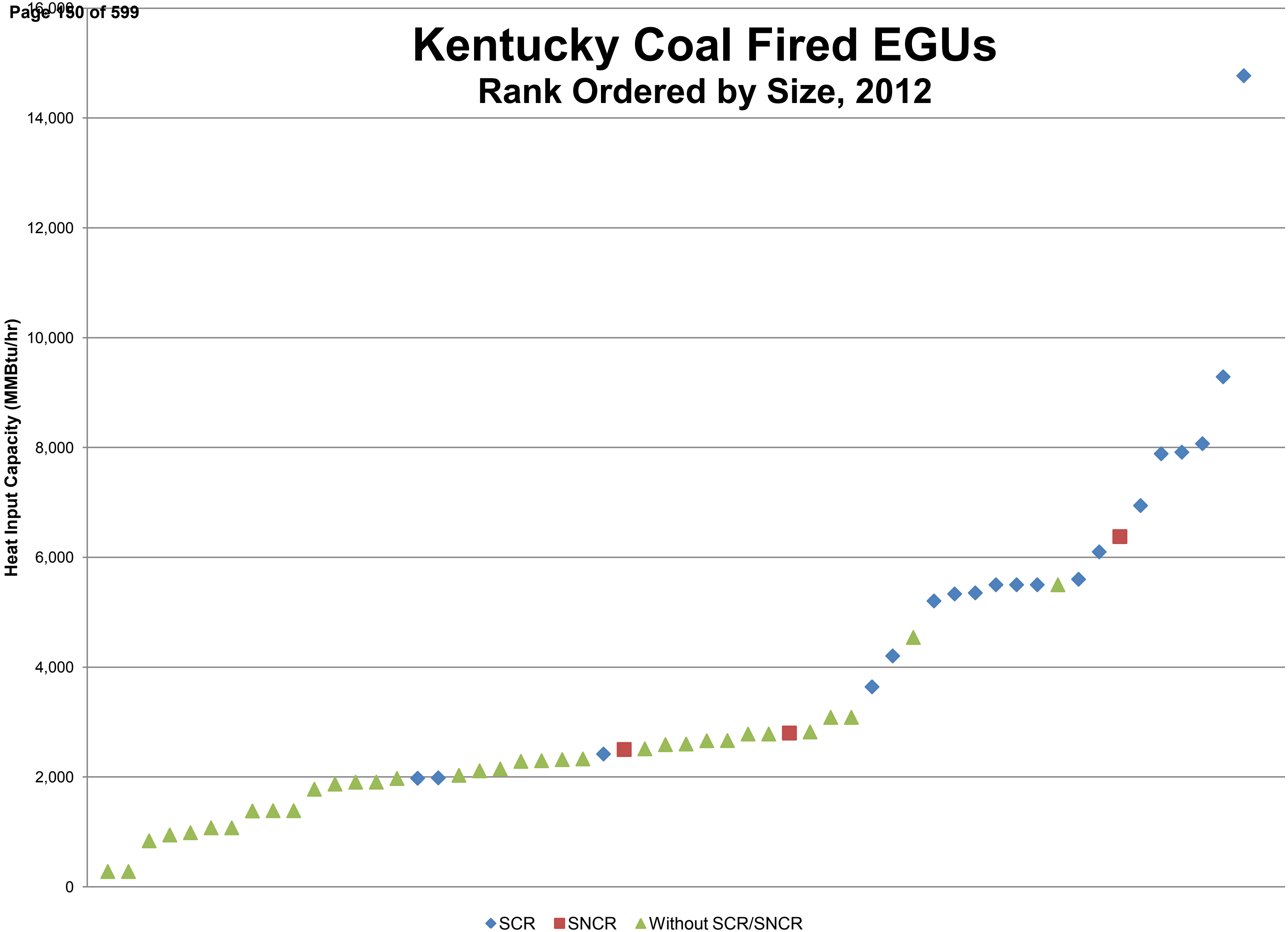
Kentucky Coal Fired EGUs

Rank Ordered by Size, 2012



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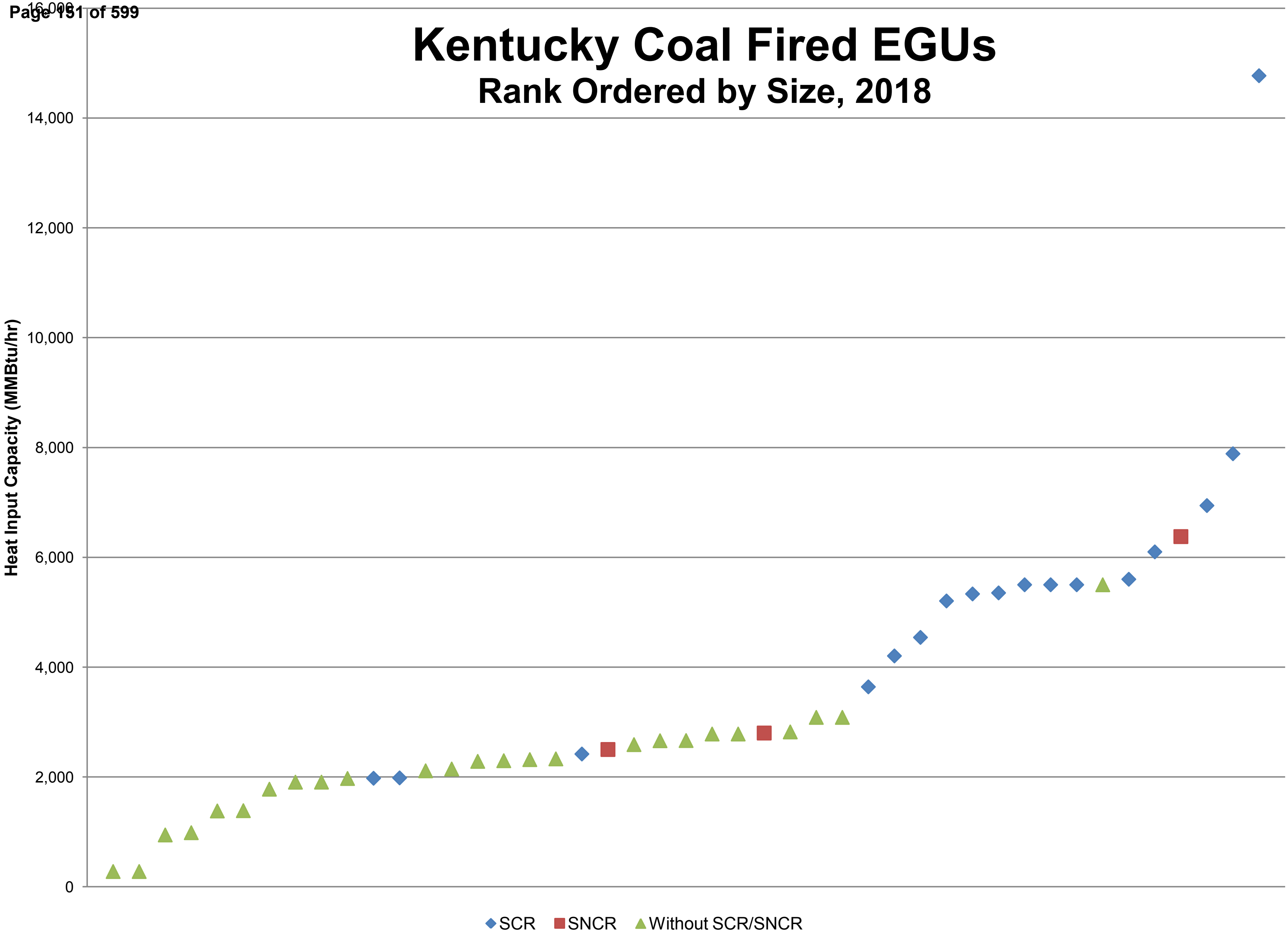
Kentucky Coal Fired EGUs
Rank Ordered by Size, 2018



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

KY : Large (> 3000 MMBtu/hr) Coal-Fired EGU NOx Emissions Rate Analysis

	Facility Name	Unit ID	Lowest OS Emission Rate Year	Lowest OS Emission Rate (lbs/MMBtu)	2007 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2007 OS ER (% Change)	2011 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2011 OS ER (% Change)	Comments/ ERTAC Closure Date
Controlled with SCR	D B Wilson	W1	2006	0.0477	0.0701	47	0.0572	20	
	East Bend	2	2006	0.0518	0.1119	116	0.1384	167	
	Elmer Smith	1	2006	0.1229	0.234	90	0.3065	149	
	Ghent	1	2005	0.0448	0.0816	82	0.0749	67	
	Ghent	3	2005	0.0272	0.087	220	0.1682	518	
	Ghent	4	2005	0.0272	0.0388	43	0.0791	191	
	H L Spurlock	1	2008	0.0829	0.1138	37	0.0889	7	
	H L Spurlock	2	2006	0.0729	0.0842	16	0.0862	18	
	Mill Creek	3	2004	0.043	0.0513	19	0.1065	148	
	Mill Creek	4	2007	0.0374	0.0374	0	0.1055	182	
	Paradise	3	2005	0.1001	0.2071	107	0.3865	286	
	Trimble County	1	2005	0.0309	0.0551	78	0.0544	76	
	Trimble County	2	2011	0.054	N/A	N/A	0.0540	0	
Controlled with SNCR	Elmer Smith	2	2004	0.2122	0.2229	5	0.2694	27	
Adding Controls or Fuel Switches by 2019	E W Brown	3	2005	0.3054	0.3481	14	0.3235	6	SCR (2013)
	Paradise	1	2006	0.0982	0.1085	10	0.1209	23	Has SCR, switch to NG (2018)
	Paradise	2	2005	0.0904	0.1265	40	0.1334	48	Has SCR, switch to NG (2018)
No Controls or Fuel Switches by 2019	Ghent	2	2010	0.1711	0.265	55	0.1804	5	
	Mill Creek	1	2003	0.27	0.3148	17	0.2832	5	
	Mill Creek	2	2004	0.2653	0.3132	18	0.2954	11	
Retiring by 2017	Big Sandy	BSU2	2005	0.0971	0.1257	29	0.1895	95	Has SCR. 2015

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KY: Small (< 3000 MMBtu/hr) Coal-Fired EGU NOx Emissions Rate Analysis

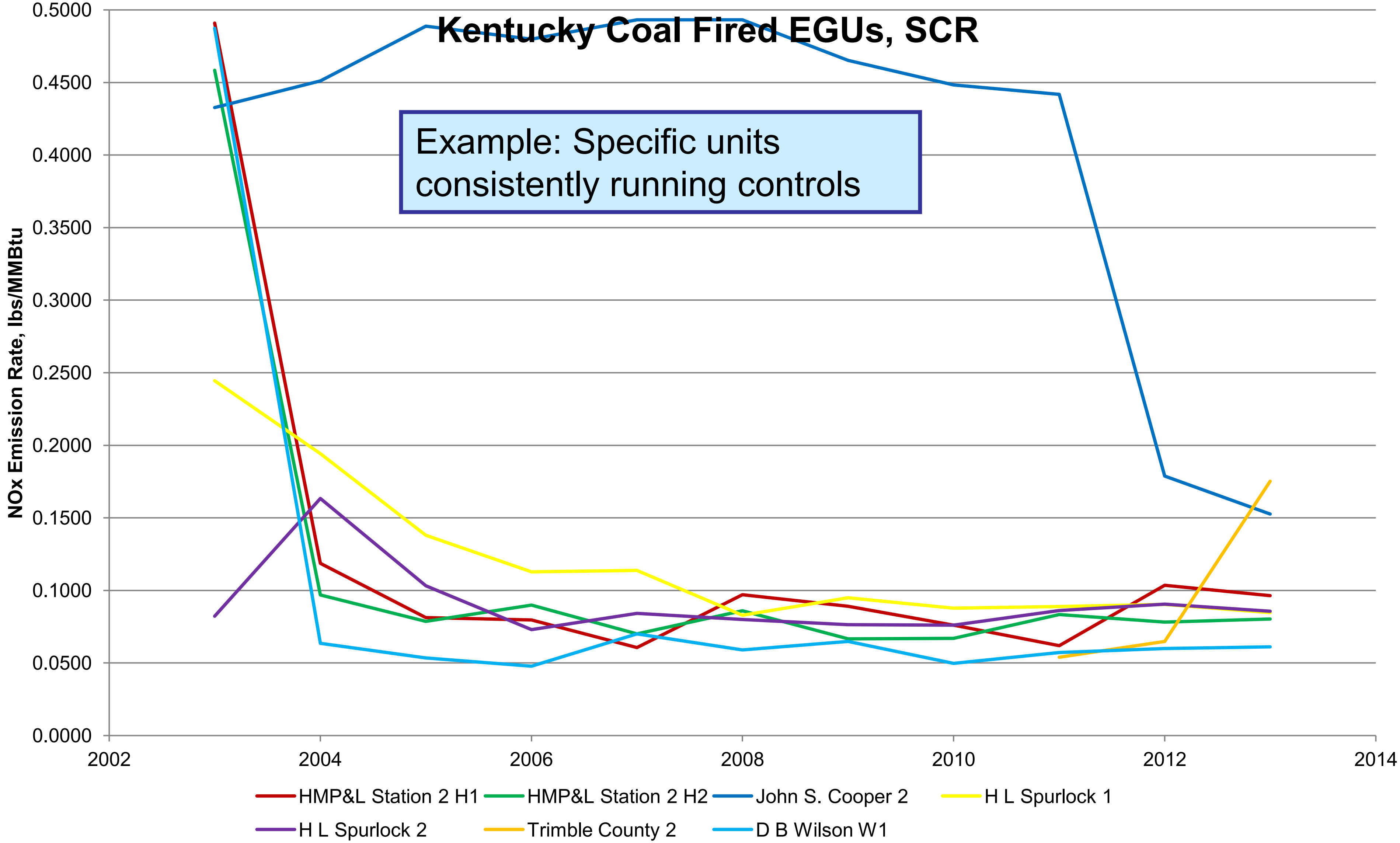
	Facility Name	Unit ID	Lowest OS Emission Rate Year	Lowest OS Emission Rate (lbs/MMBtu)	2007 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2007 OS ER (% Change)	2011 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2011 OS ER (% Change)	Comments/ ERTAC Closure Date
Controlled with SCR	HMP&L Station 2	H1	2007	0.0606	0.0606	0	0.0619	2	
	HMP&L Station 2	H2	2009	0.0666	0.0701	5	0.0834	25	
	John S. Cooper	2	2012	0.1788	0.4932	176	0.4419	147	
Controlled with SNCR	H L Spurlock	3	2011	0.0658	0.089	35	0.0658	0	
	H L Spurlock	4	2012	0.0604	N/A	N/A	0.0645	7	
Adding Controls or Fuel Switches by 2019	Big Sandy	BSU1	2005	0.1197	0.1433	20	0.2544	113	NG (2016)
	Robert Reid	R1	2004	0.364	0.4195	15	0.4181	15	NG (7/1/2014)
No Controls or Fuel Switches by 2019	Coleman	C1	2007	0.2925	0.2925	0	0.3568	22	
	Coleman	C2	2004	0.2841	0.2877	1	0.3545	25	
	Coleman	C3	2004	0.2893	0.2941	2	0.359	24	
	E W Brown	1	2011	0.3503	0.4796	37	0.3503	0	
	E W Brown	2	2005	0.2965	0.3466	17	0.3331	12	
	John S. Cooper	1	2012	0.2409	0.4892	103	0.4381	82	
	R D Green	G1	2010	0.2	0.2109	5	0.2019	1	
	R D Green	G2	2012	0.1931	0.2126	10	0.1938	0	
	Shawnee	1	2004	0.3475	0.3741	8	0.3868	11	
	Shawnee	2	2004	0.3475	0.374	8	0.3868	11	
	Shawnee	3	2004	0.3485	0.3739	7	0.3866	11	
	Shawnee	4	2004	0.3472	0.3739	8	0.386	11	
	Shawnee	5	2004	0.3476	0.3741	8	0.401	15	
	Shawnee	6	2009	0.3164	0.3683	16	0.3408	8	
	Shawnee	7	2009	0.3135	0.3636	16	0.3408	9	
	Shawnee	8	2009	0.3164	0.364	15	0.3423	8	
	Shawnee	9	2009	0.3148	0.3633	15	0.3408	8	
	Shawnee	10	2010	0.2196	0.2911	33	N/A	N/A	
	William C. Dale	1	2009	0.3493	0.6965	99	0.3748	7	Not Running 2003 - 2006
	William C. Dale	2	2009	0.3507	0.7226	106	0.3741	7	Not Running 2003 - 2006
	William C. Dale	3	2011	0.3562	0.4066	14	0.3562	0	
	William C. Dale	4	2011	0.3565	0.4035	13	0.3565	0	
Retiring by 2017	Cane Run	4	2004	0.3232	0.3466	7	0.3283	2	
	Cane Run	5	2012	0.3655	0.3879	6	0.3774	3	5/1/2015
	Cane Run	6	2011	0.2457	0.302	23	0.2457	0	5/1/2015
	Green River	4	2007	0.3594	0.3594	0	0.4261	19	4/1/2015
	Green River	5	2005	0.3693	0.3954	7	0.4017	9	1/1/2015
	Tyrone	5	2011	0.0139	0.4122	2865	0.0139	0	1/1/2013

DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Part 2

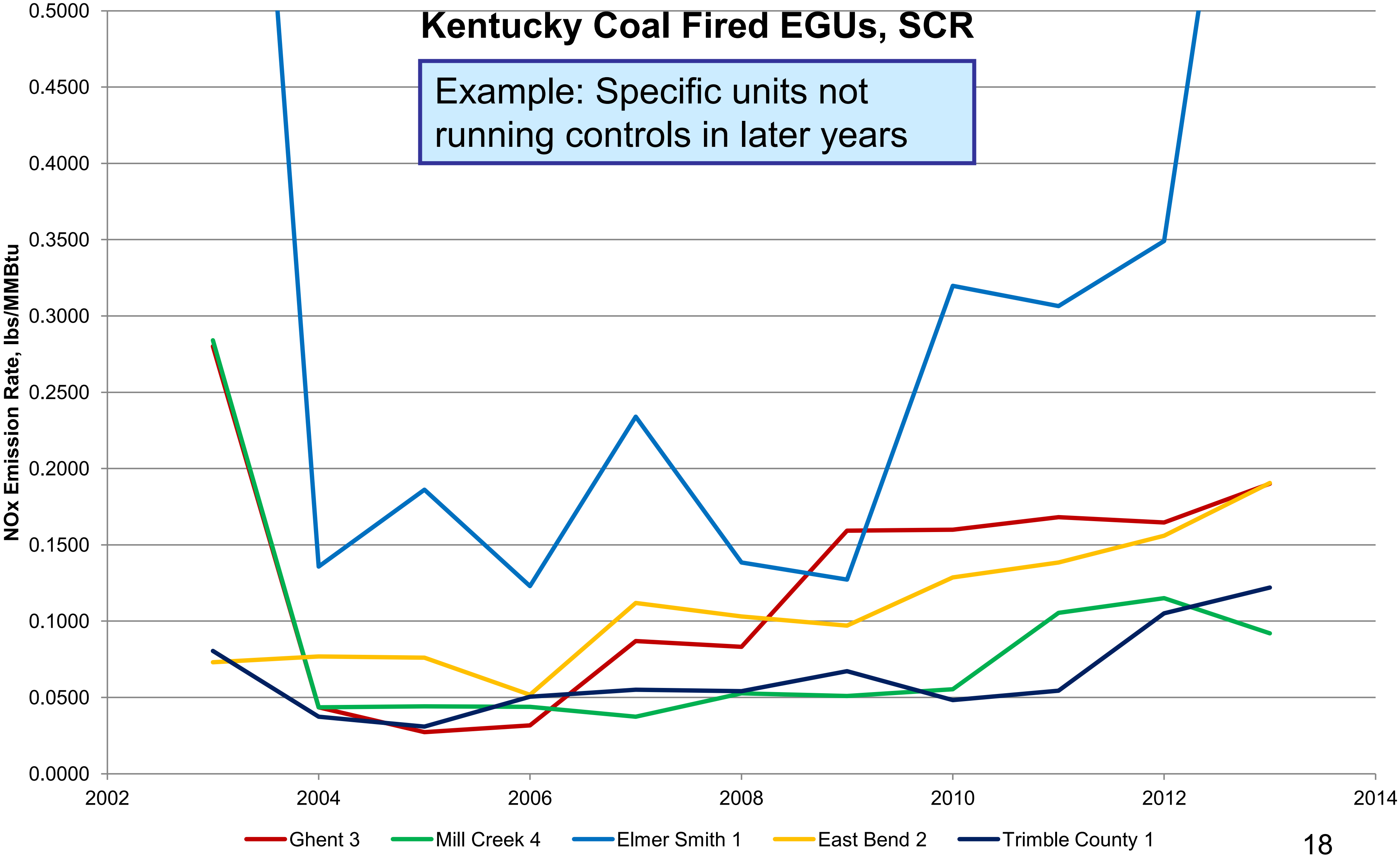
Operation of Controls: Changes in Control Efficiency 2003 to 2013

Average Ozone Season Emission Rates at Specific Units by Year



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Average Ozone Season Emission Rates at Specific Units by Year



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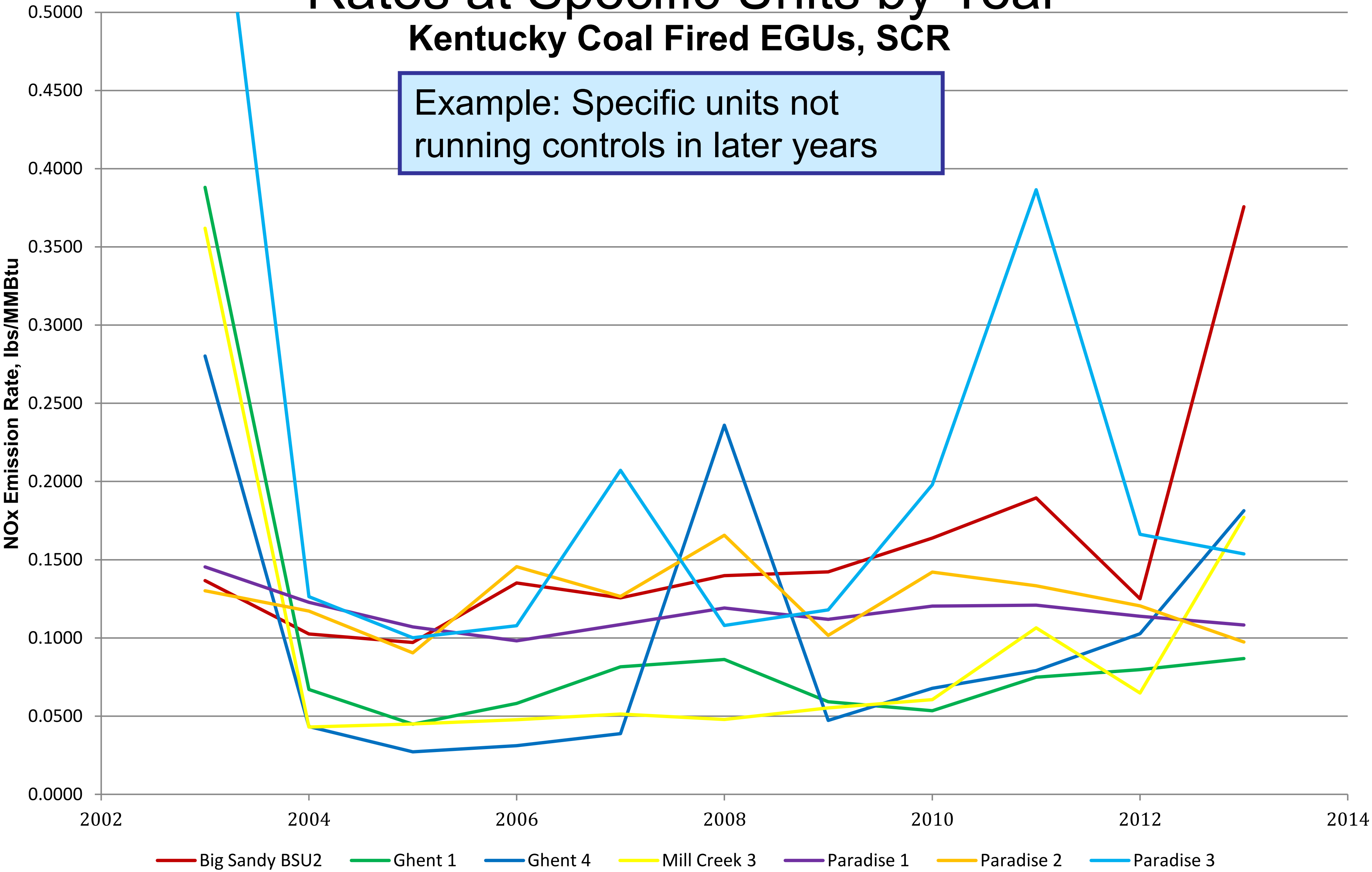
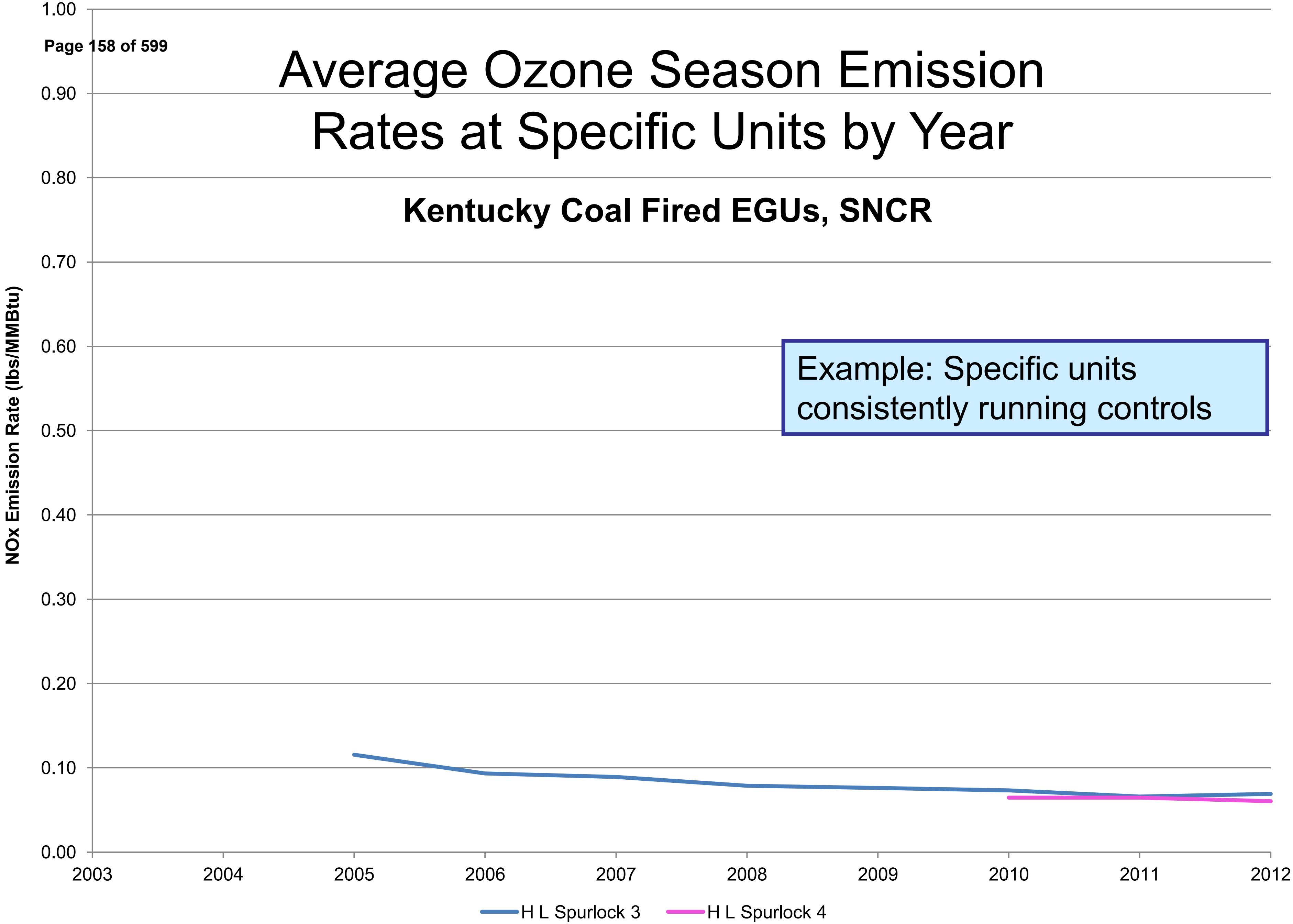
Average Ozone Season Emission Rates at Specific Units by Year



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Average Ozone Season Emission Rates at Specific Units by Year

Kentucky Coal Fired EGUs, SNCR



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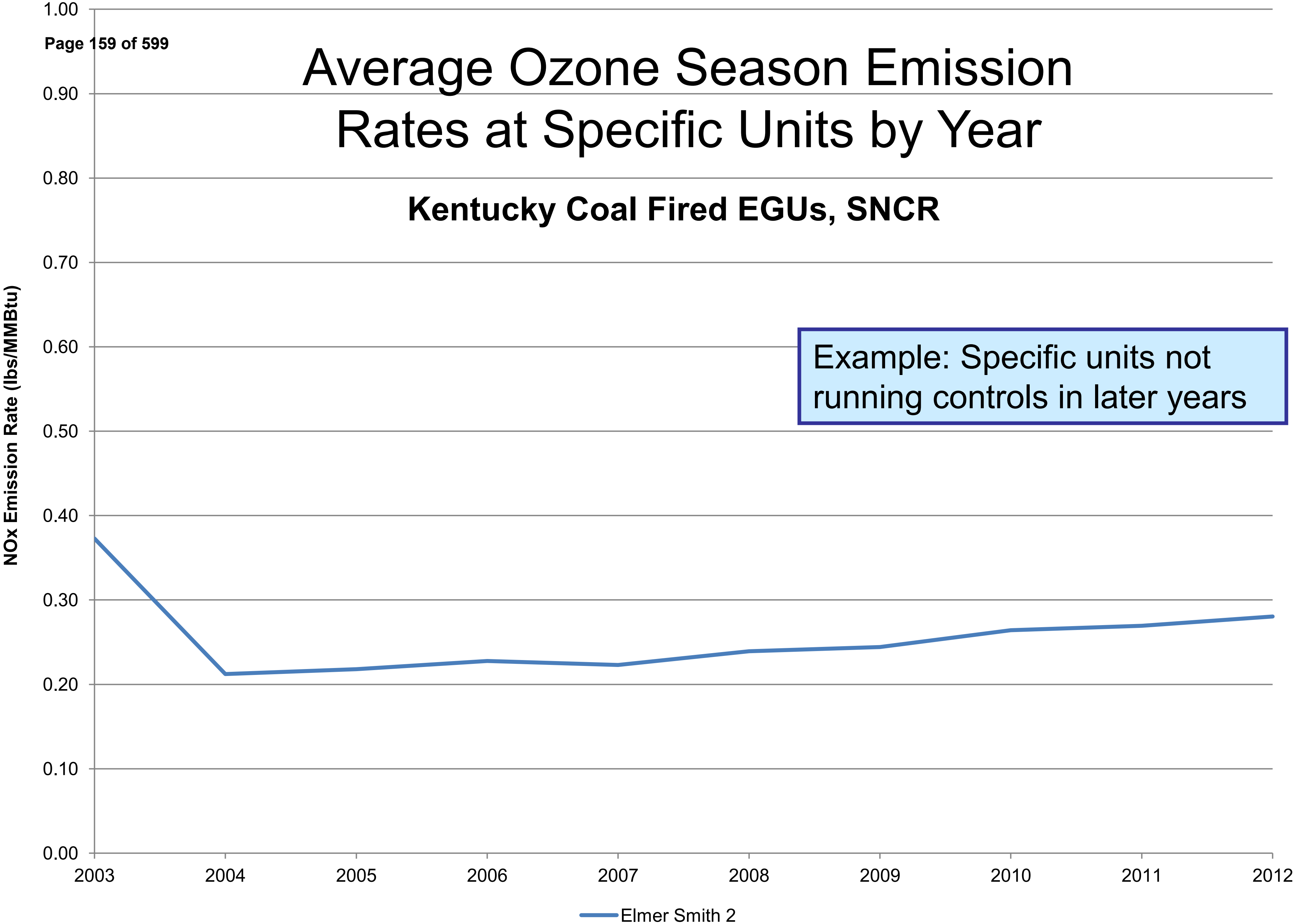
Average Ozone Season Emission Rates at Specific Units by Year

Kentucky Coal Fired EGUs, SNCR

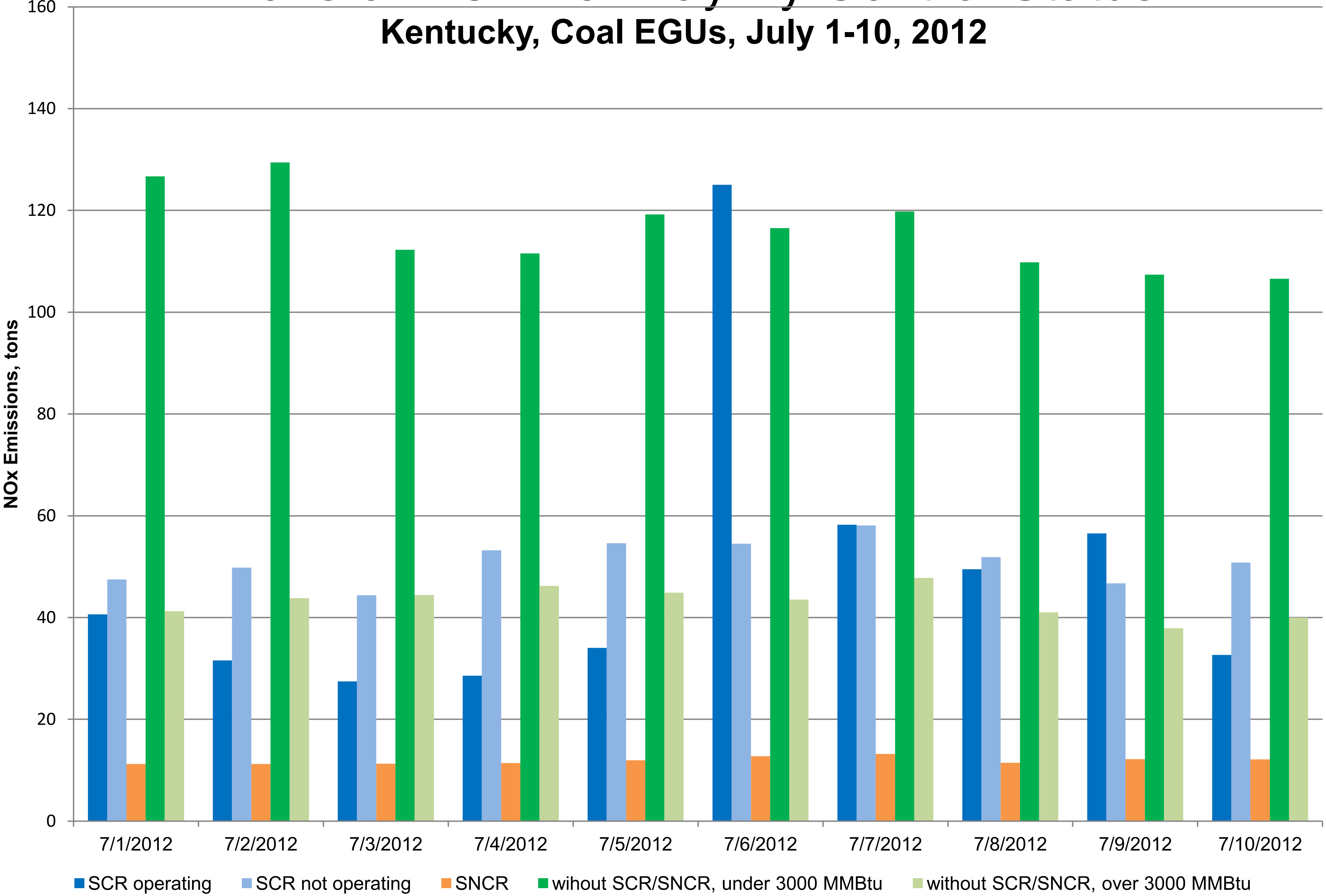


Part 3

July 1 to 10, 2012 Ozone Episode:

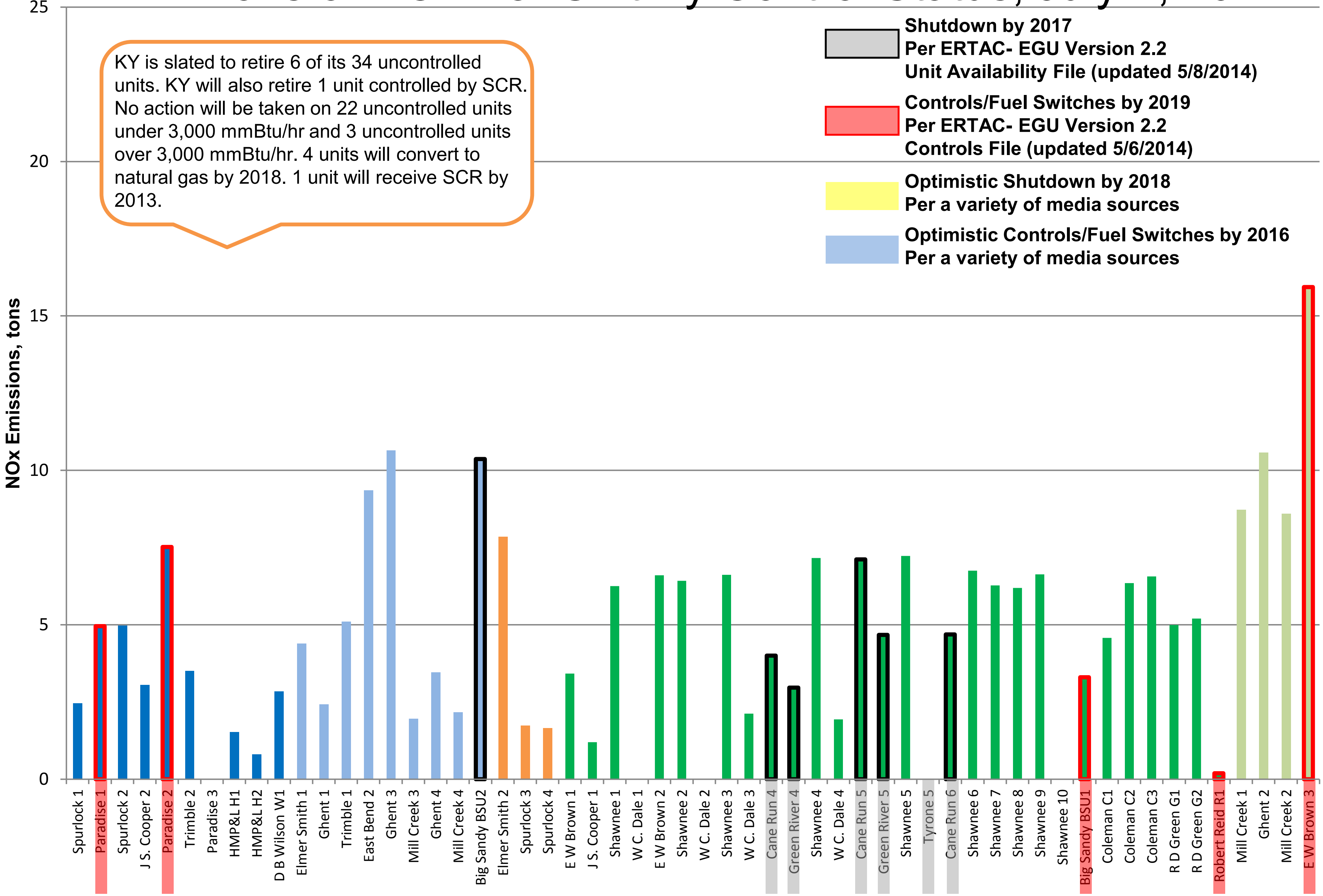
Analysis of Emissions and Controls

Tons of NOx Per Day By Control Status



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

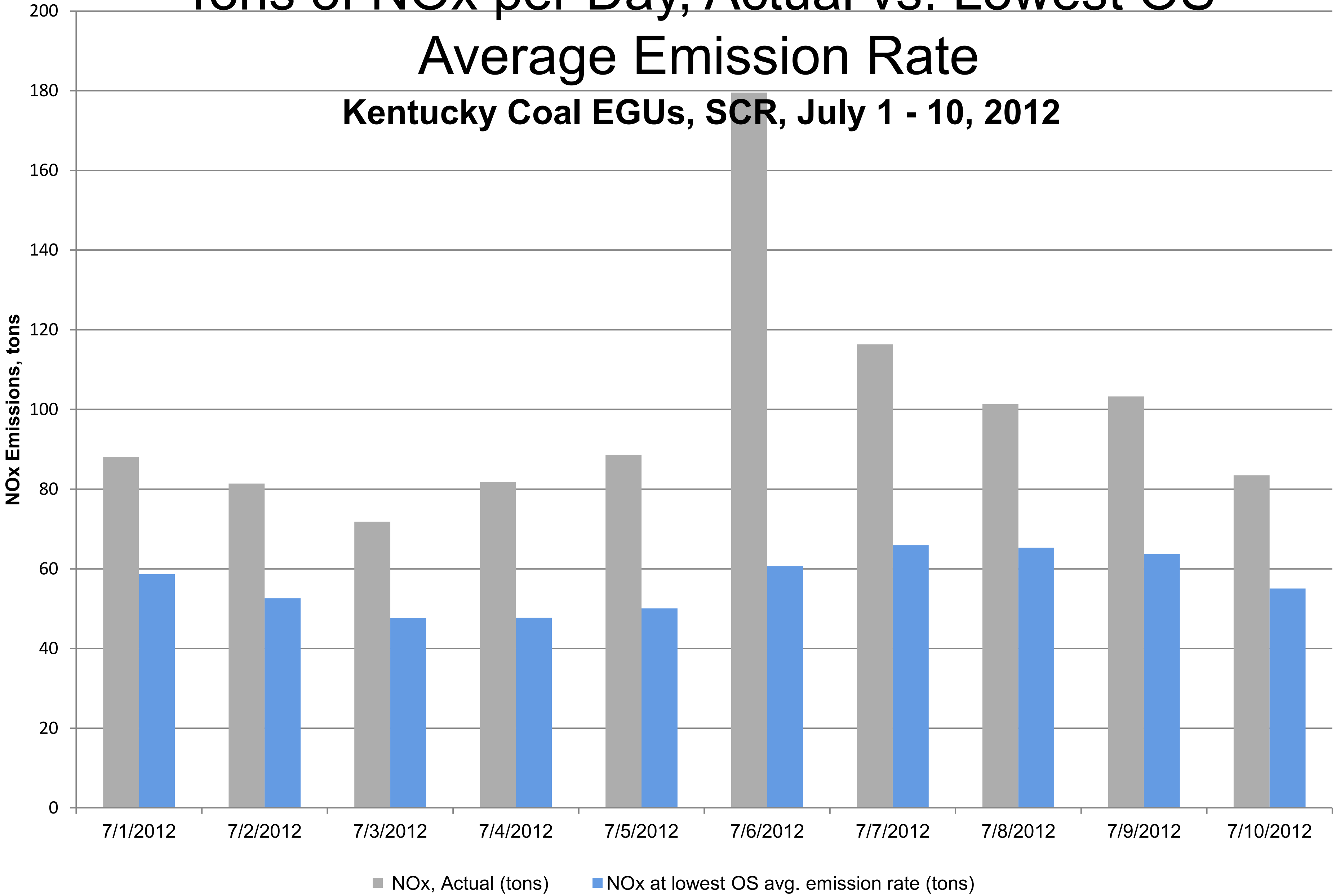
KY – Tons of NOx Per Unit By Control Status, July 2, 2012



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

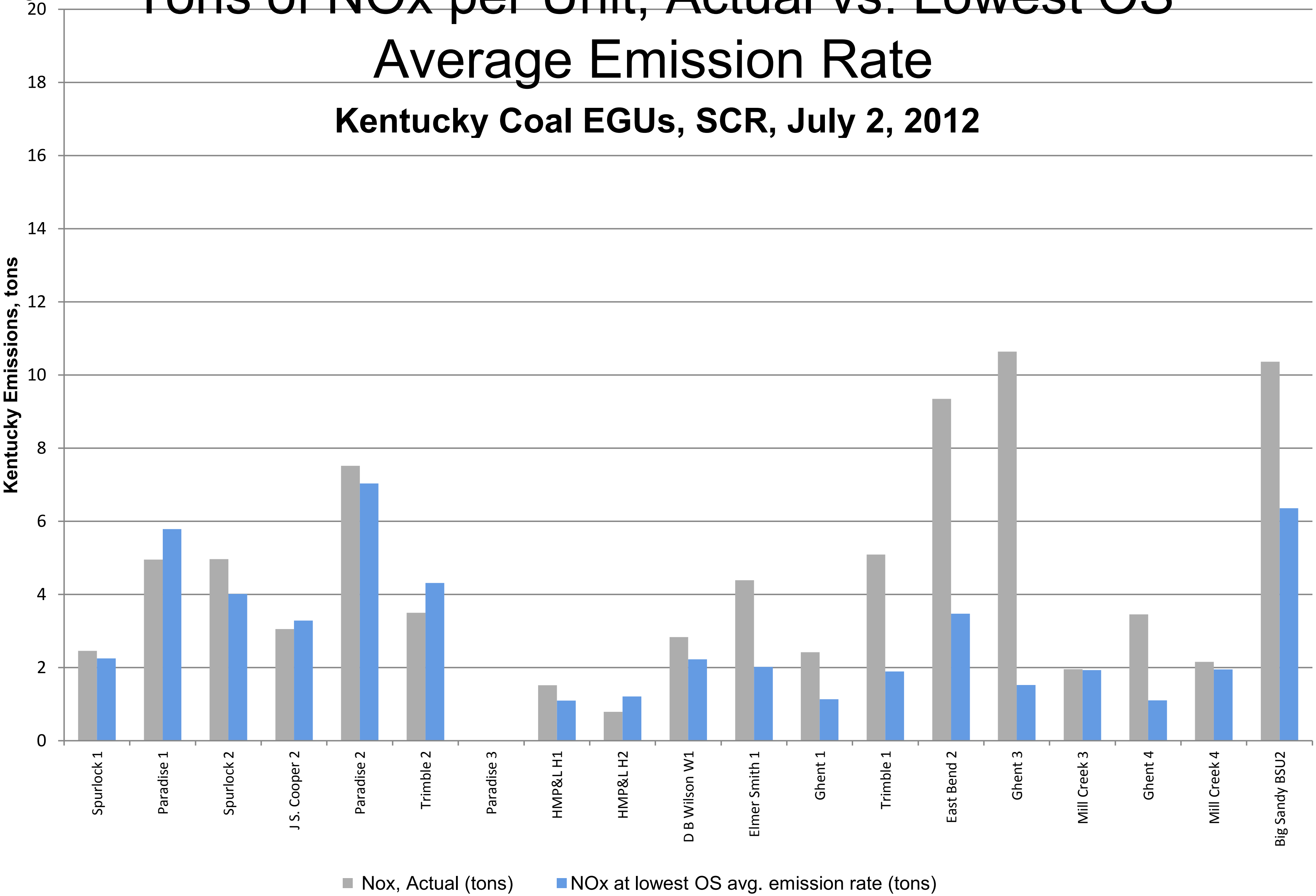
Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate

Kentucky Coal EGUs, SCR, July 1 - 10, 2012

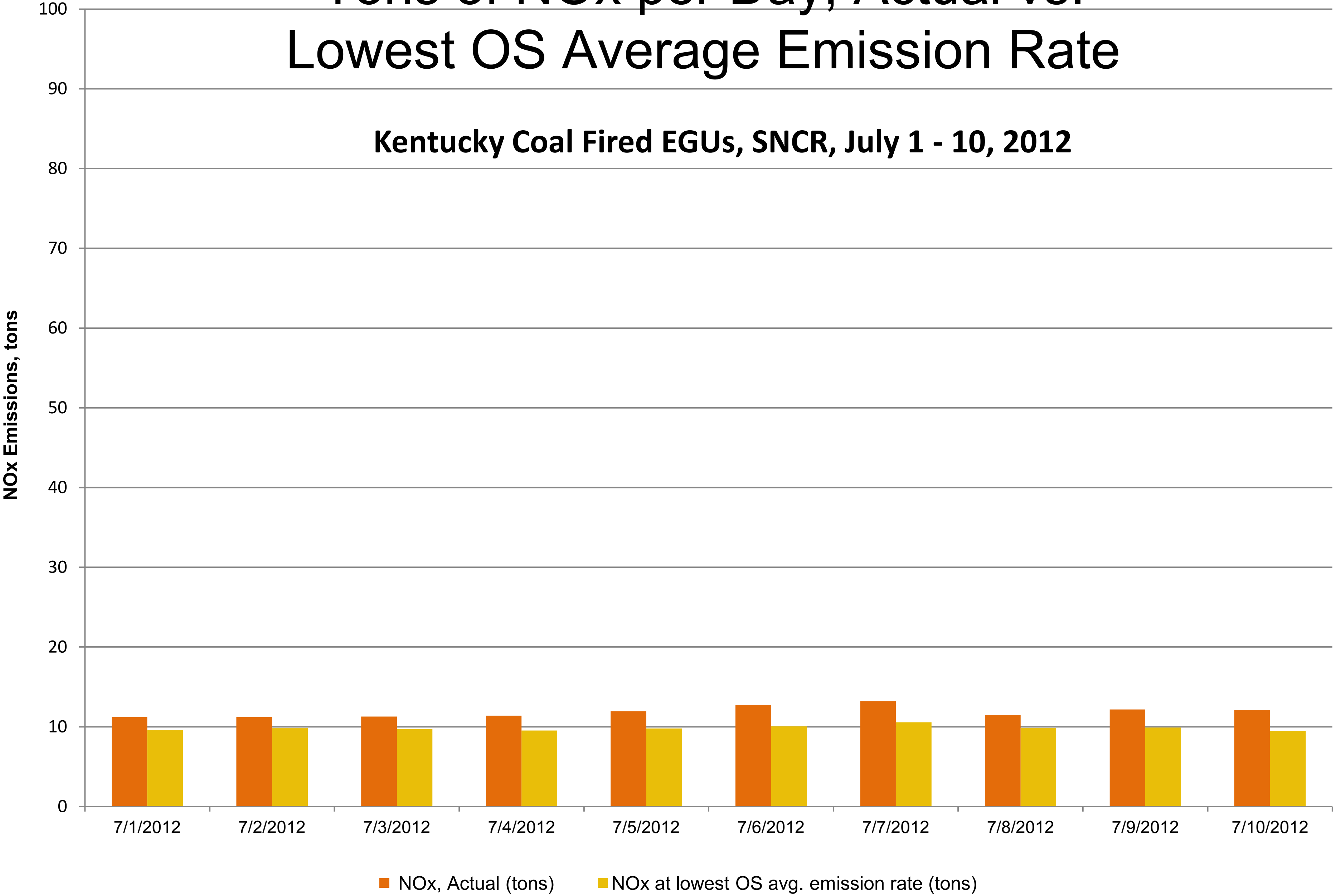


DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Tons of NOx per Unit, Actual vs. Lowest OS Average Emission Rate

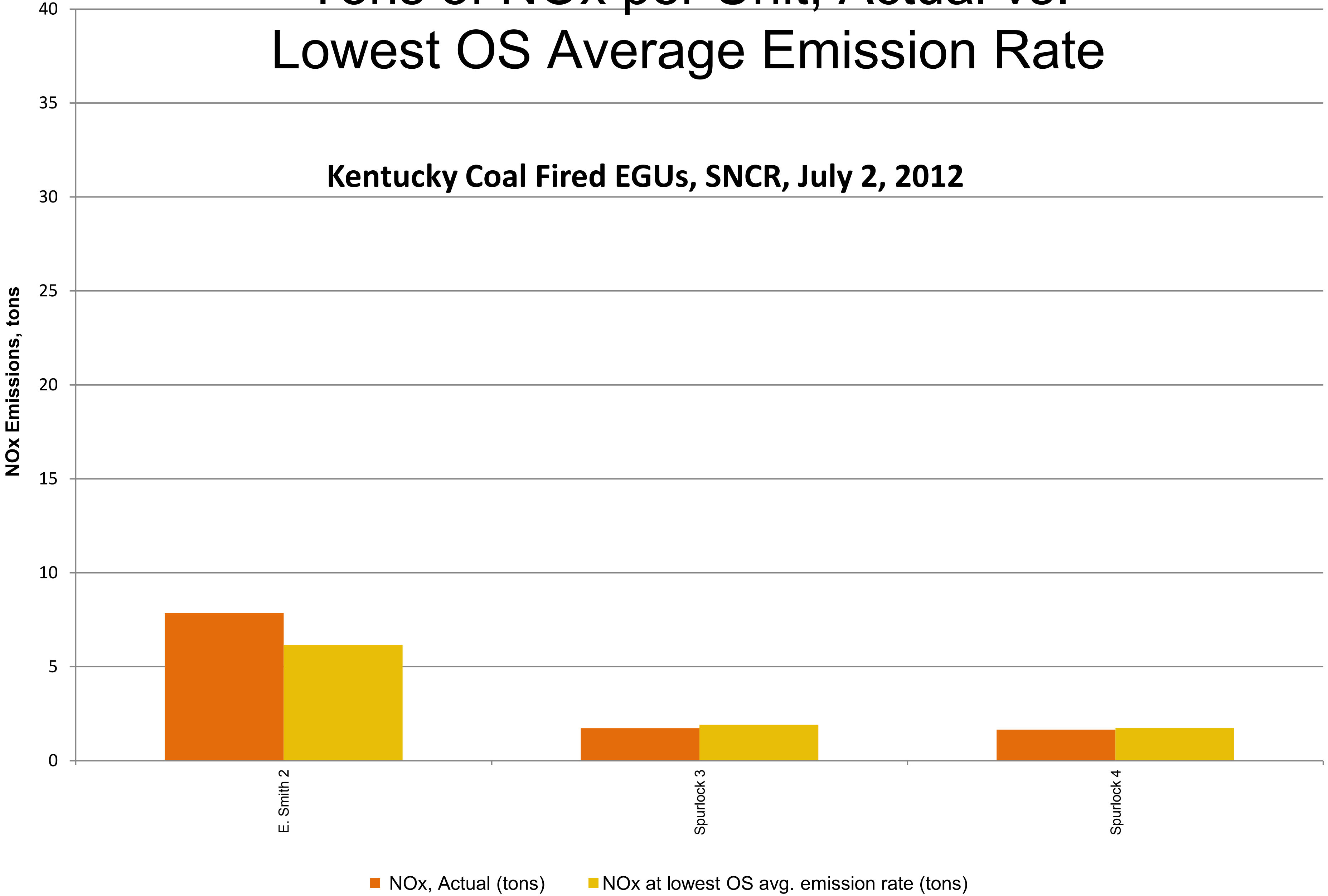


Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate



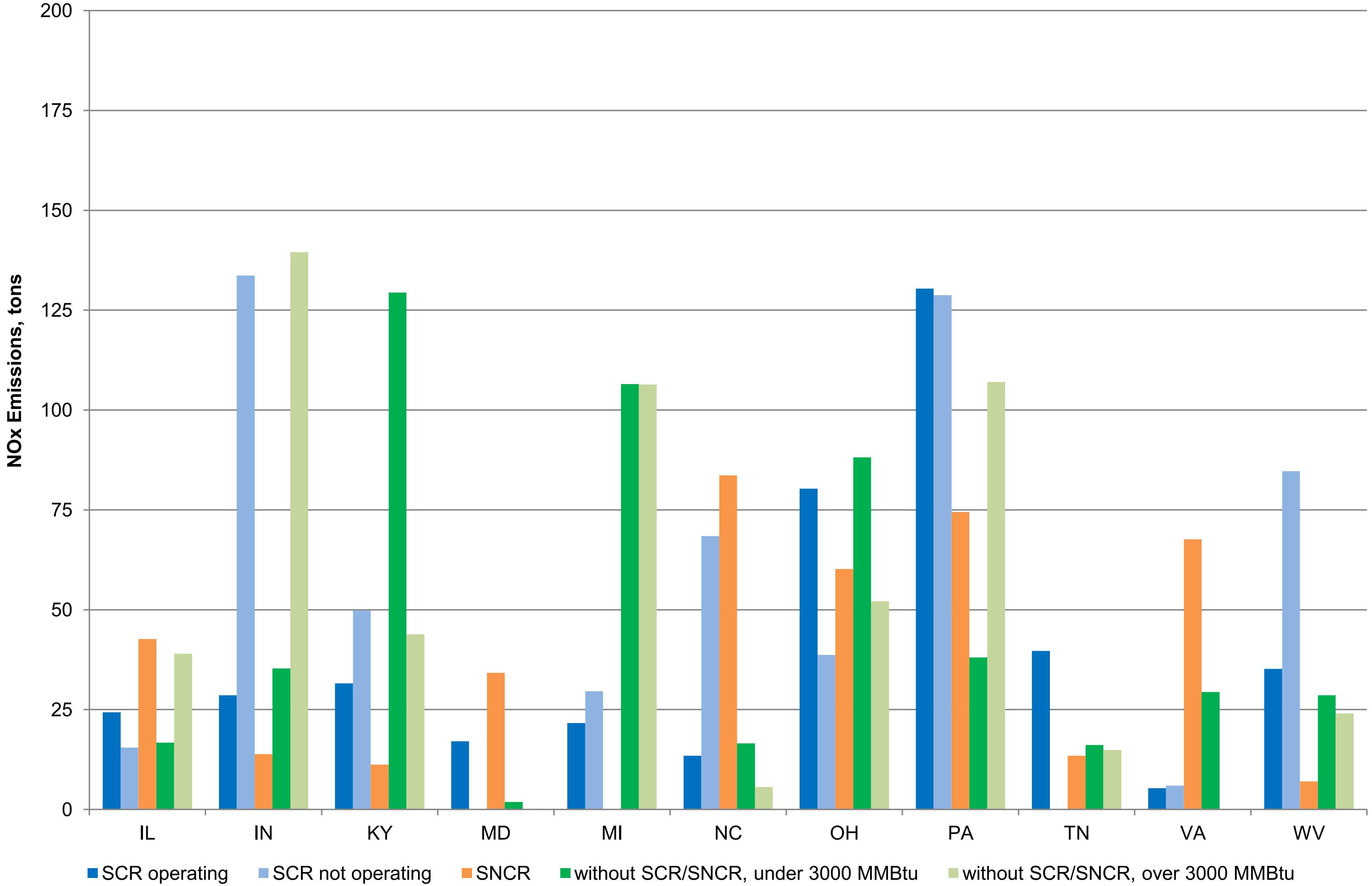
DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Tons of NOx per Unit, Actual vs. Lowest OS Average Emission Rate



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

July 2, 2012 – Tons of NOx per State by Control Status



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

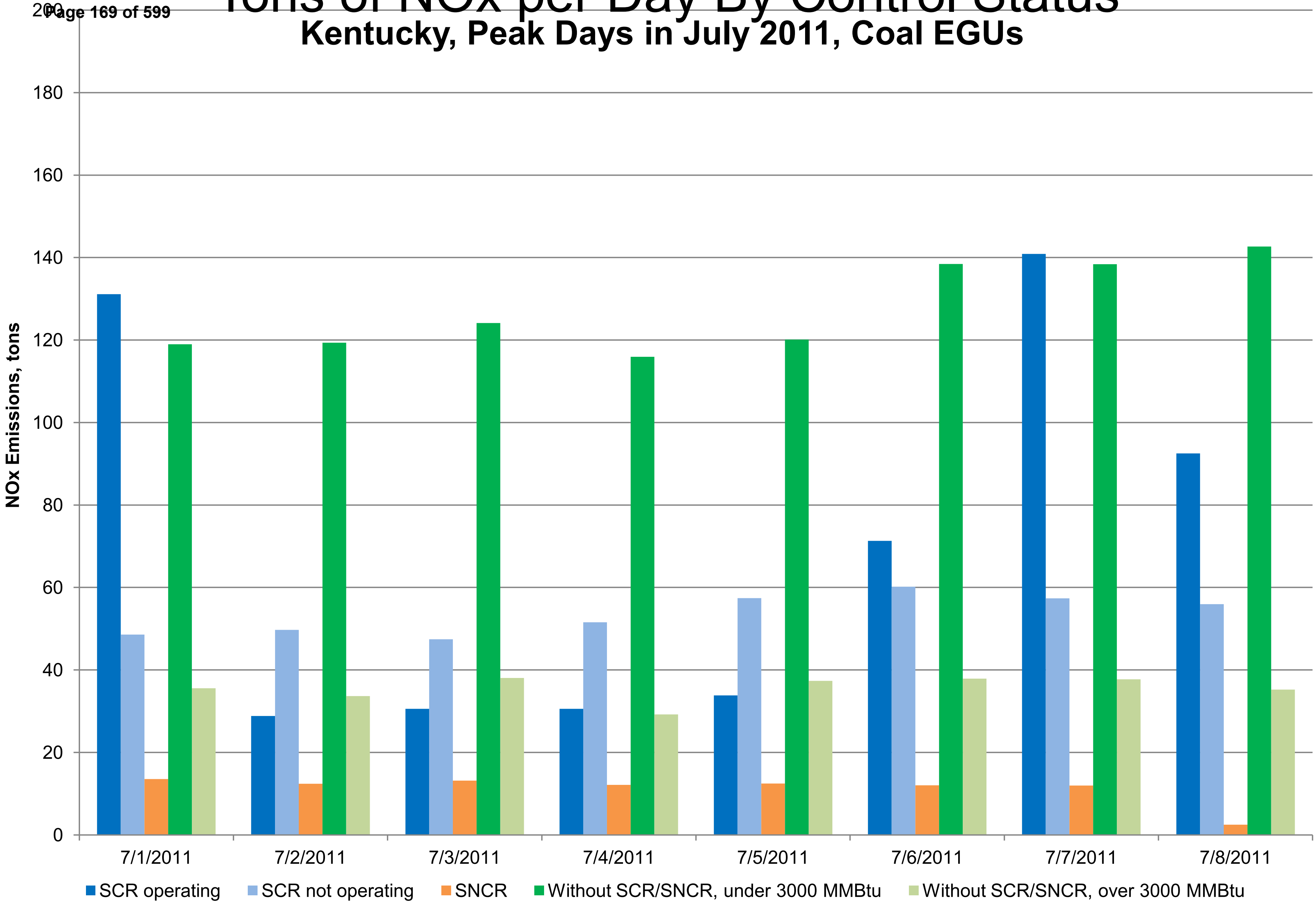
Part 4

July 1 to 8, 2011 Ozone Episode:

Analysis of Emissions and Controls

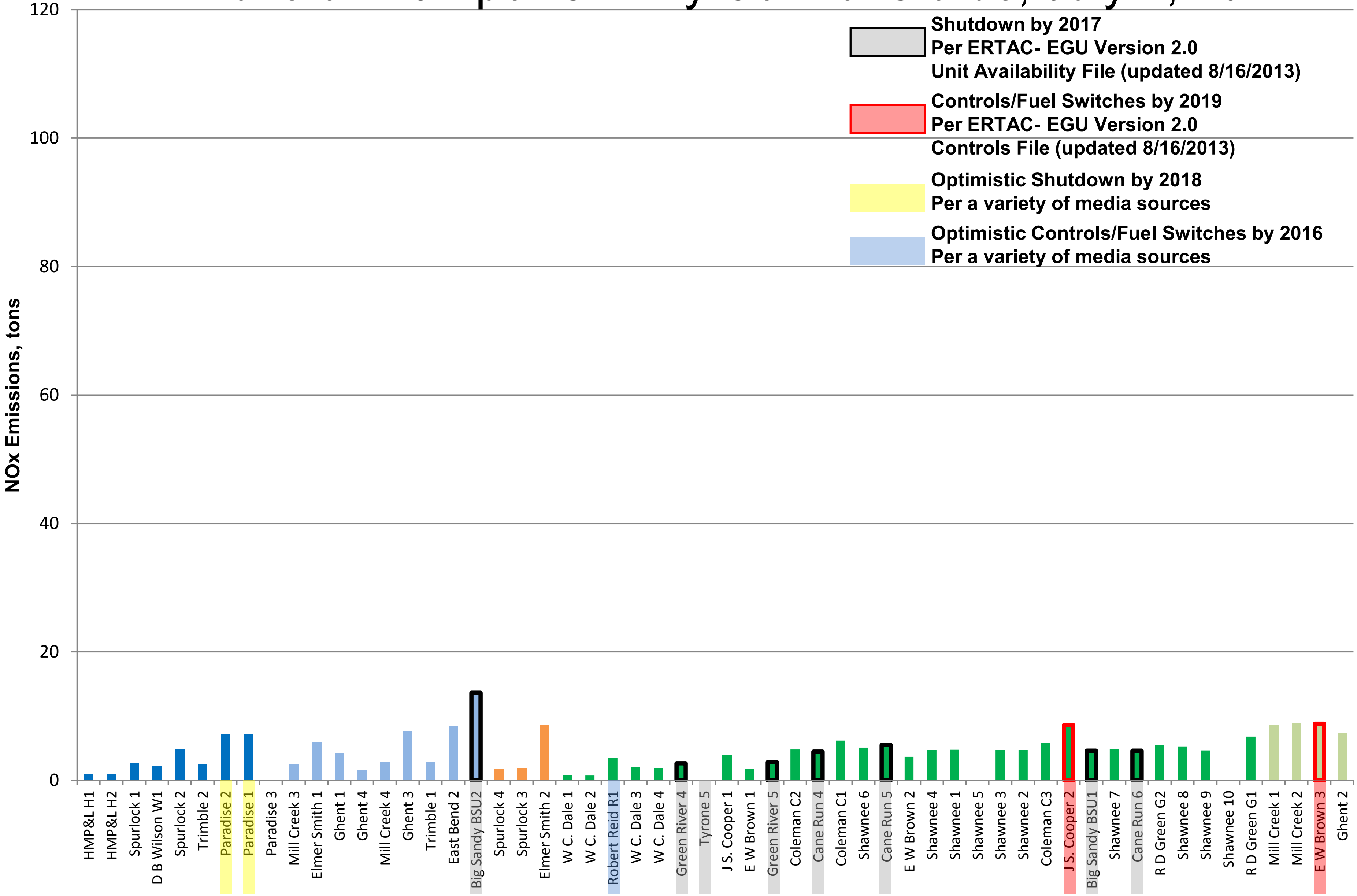
Tons of NOx per Day By Control Status

Kentucky, Peak Days in July 2011, Coal EGUs



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

KY – Tons of NOx per Unit By Control Status, July 2, 2011



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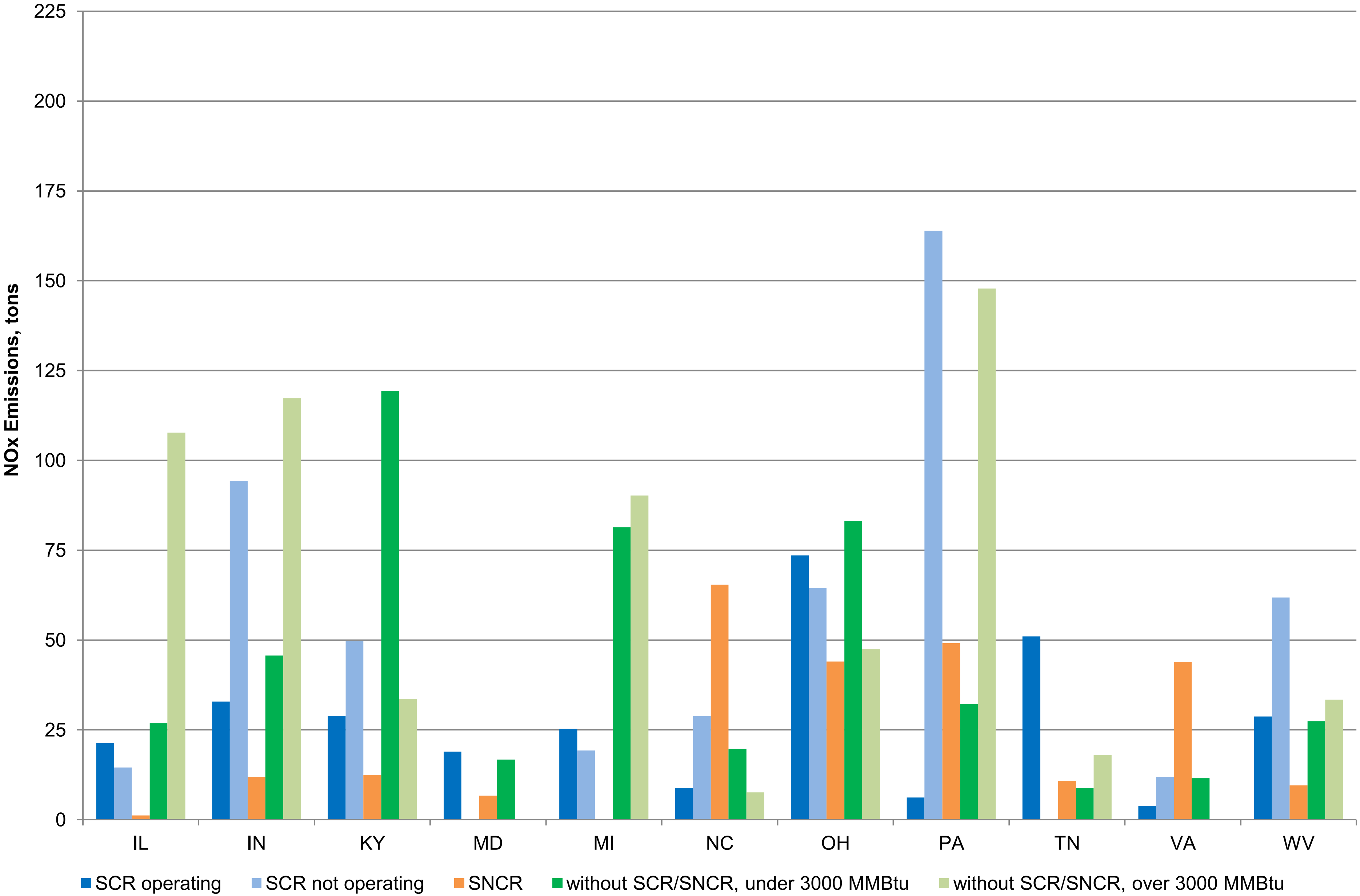
July 2, 2011 - Tons NOx per State by Control Status



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Part 5

11 State Totals

July 1 to 8, 2011 Ozone Episode:

Analysis of Emissions and Controls

11 Upwind States, 2012

- Total number of units = 1,432
- Total heat input capacity = 2,730,239 MMBtu/hr
  = 304,354 MW
- Total MW Capacity in %
  - **Total number of Coal units = 547 = 55%**
  - Total number of NG units = 672 = 25%
  - Total number of other (oil, etc.) units = 173 = 6%
  - Total number of Nuclear units = 40 = 14%
- **Total Capacity Coal = 165,910 MW**
  - 156 units with SCR = 88,783 MW = 53%
  - 114 units with SNCR = 27,561 MW = 17%
  - 277 units without SCR/SNCR = 49,566 MW = 30%

Basis – CAMD (as of 5/13/2014), NEI (for Nuclear), ERTAC (5/6/2014, 5/8/2014)

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11 Upwind States, 2018

- Total number of units = 1,199
- Total heat input capacity = 2,449,194 MMBtu/hr
  = 274,300 MW
- Total MW Capacity in %
  - **Total number of Coal units = 361 = 49%**
  - Total number of NG units = 686 = 32%
  - Total number of other (oil, etc.) units = 115 = 5%
  - Total number of Nuclear units = 37 = 14%
- **Total Capacity Coal = 134,121 MW**
  - 166 units with SCR = 93,776 MW = 70%
  - 60 units with SNCR = 17,868 MW = 13%
  - 135 units without SCR/SNCR = 22,477 MW = 17%

Basis – ERTAC (5/6/2014, 5/8/2014), NEI (for Nuclear)

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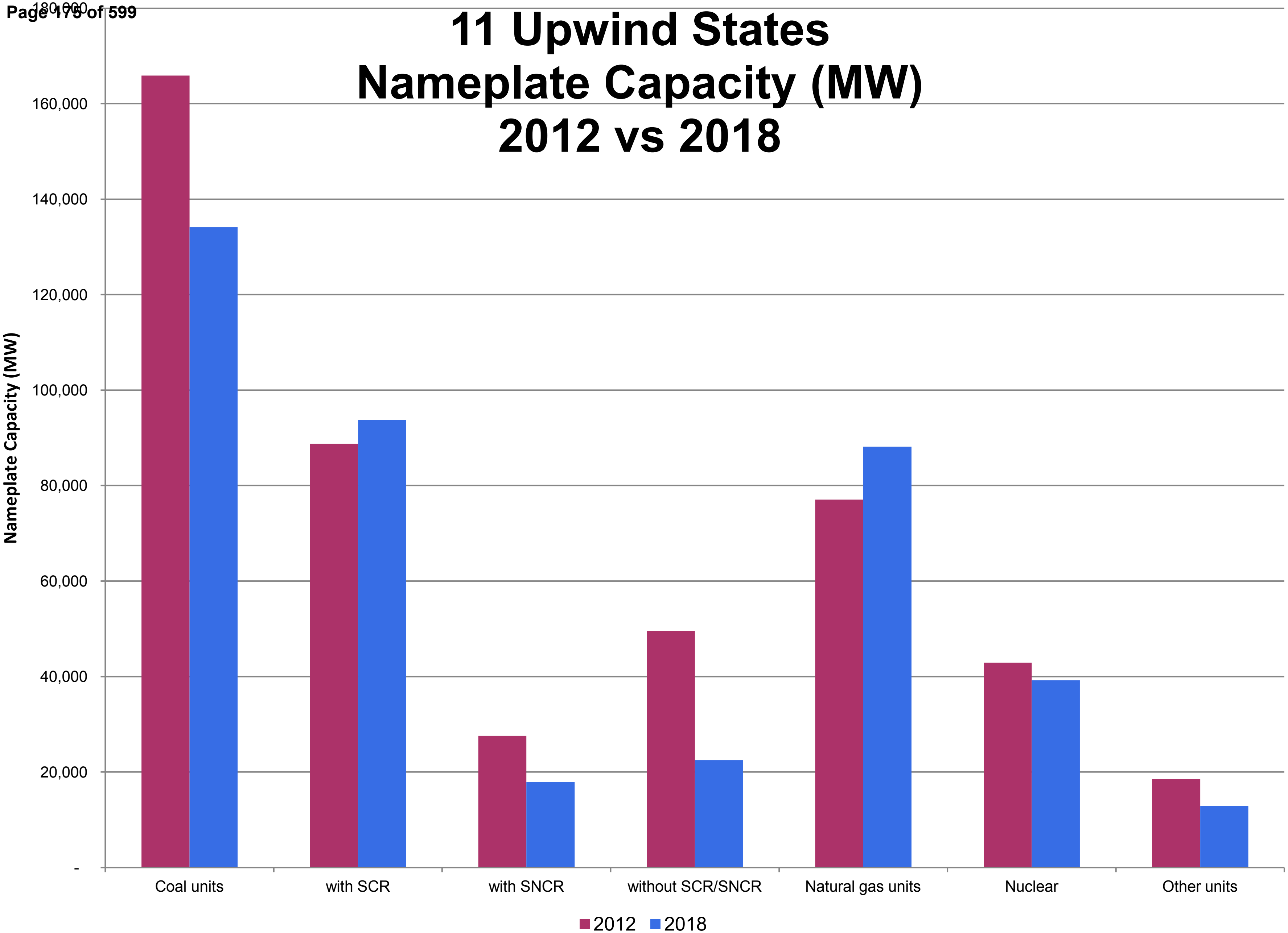
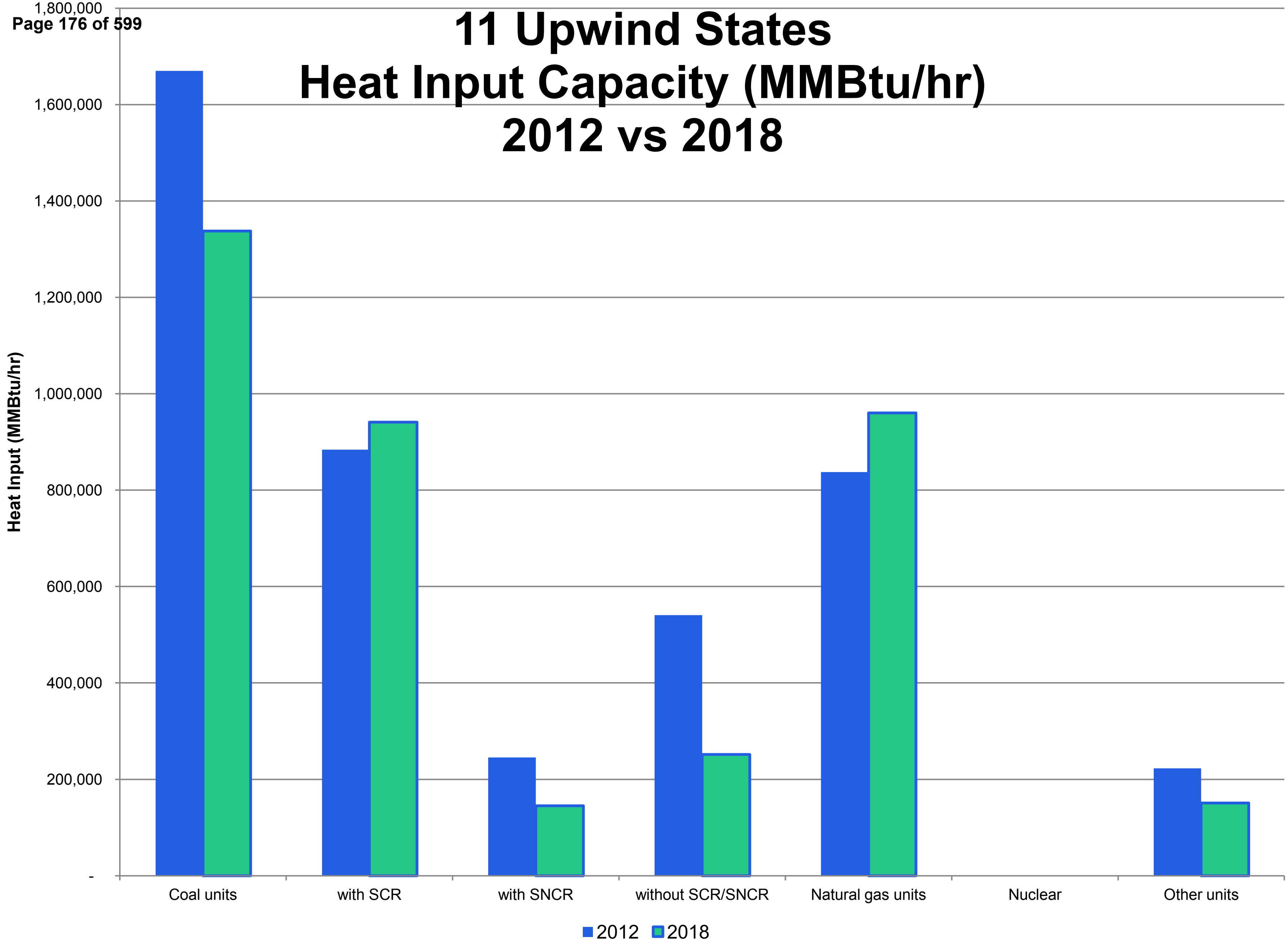
11 Upwind States Nameplate Capacity (MW) 2012 vs 2018



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

11 Upwind States Heat Input Capacity (MMBtu/hr) 2012 vs 2018

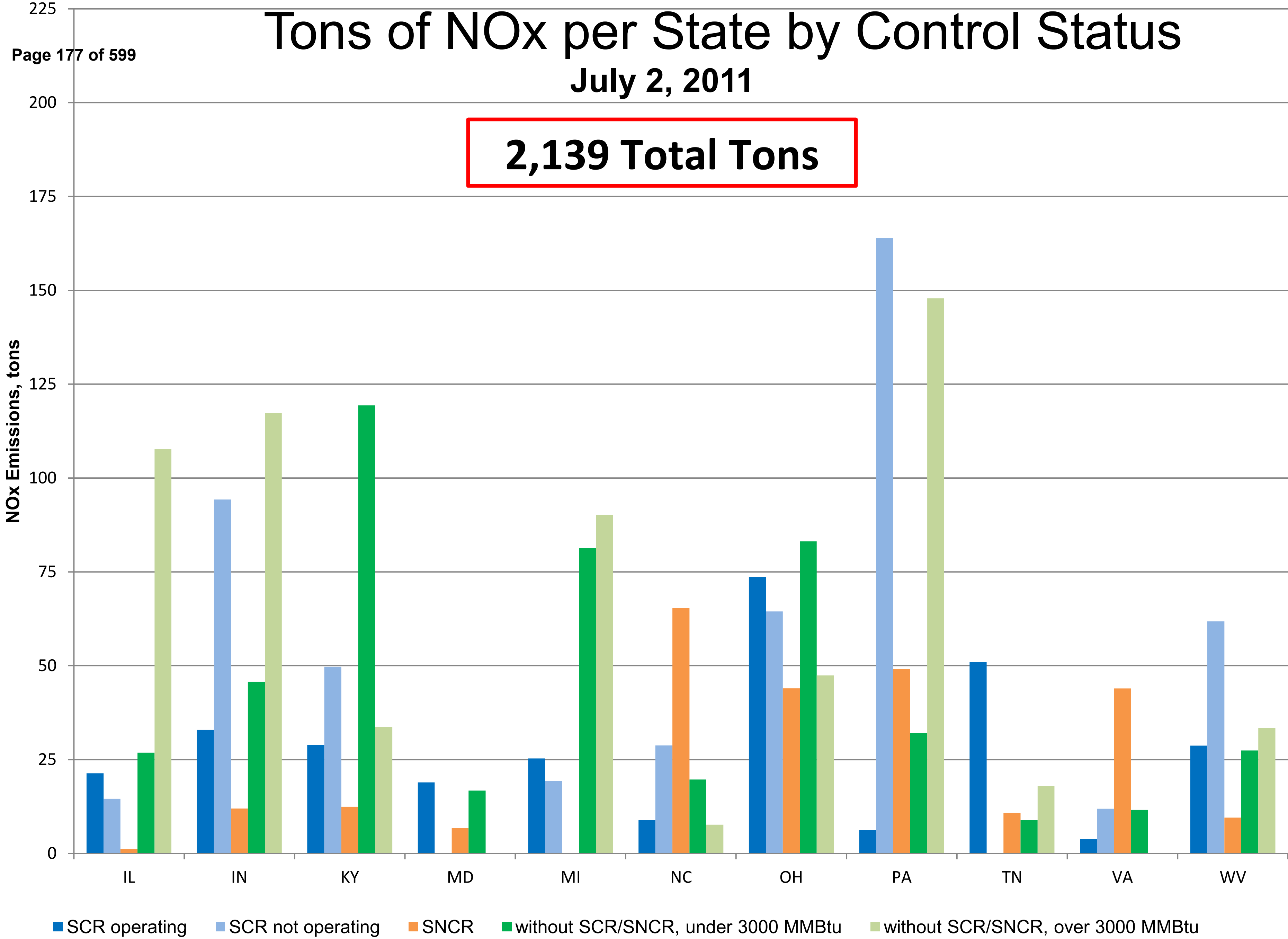


DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Tons of NOx per State by Control Status

July 2, 2011

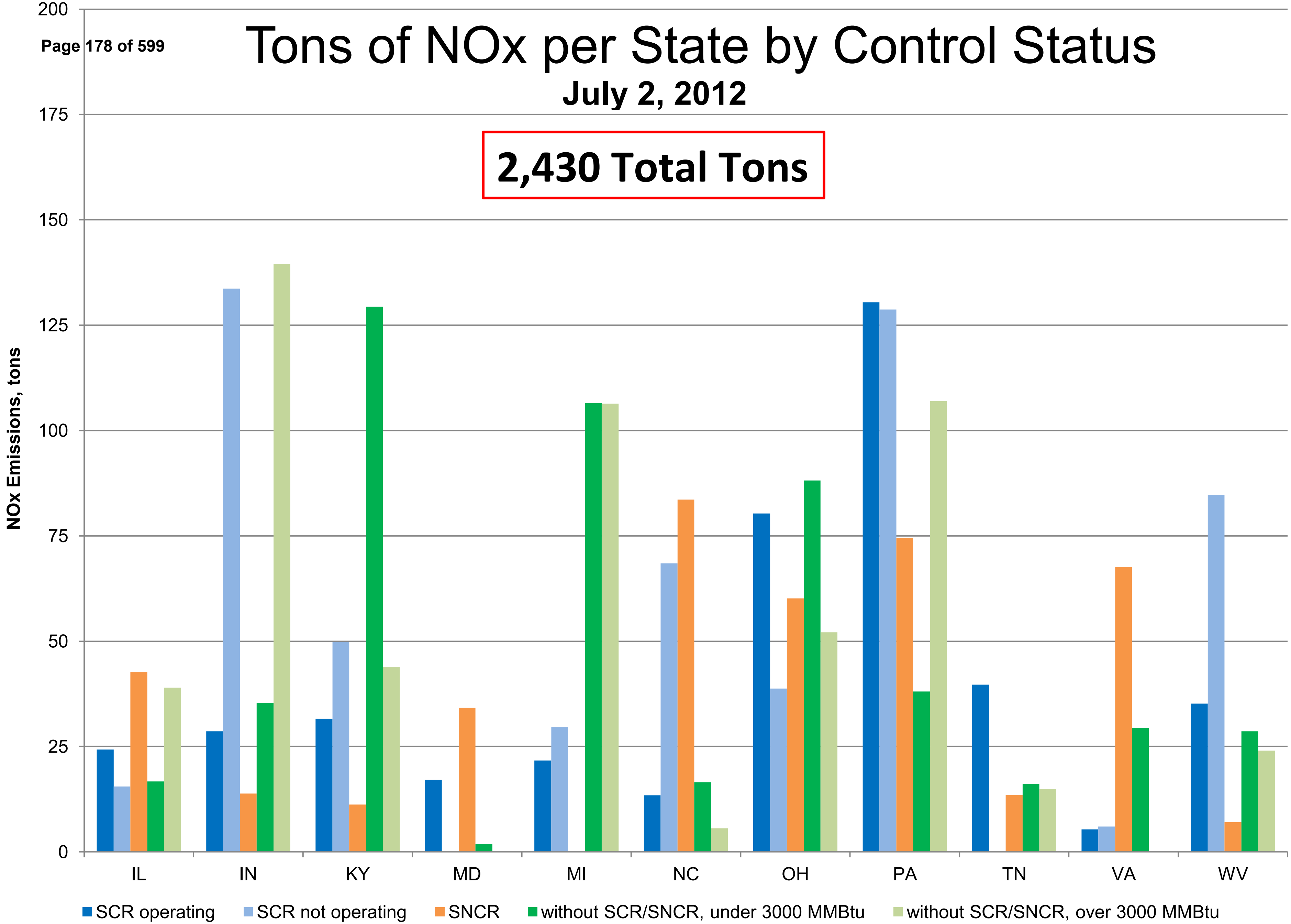
2,139 Total Tons



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Tons of NOx per State by Control Status

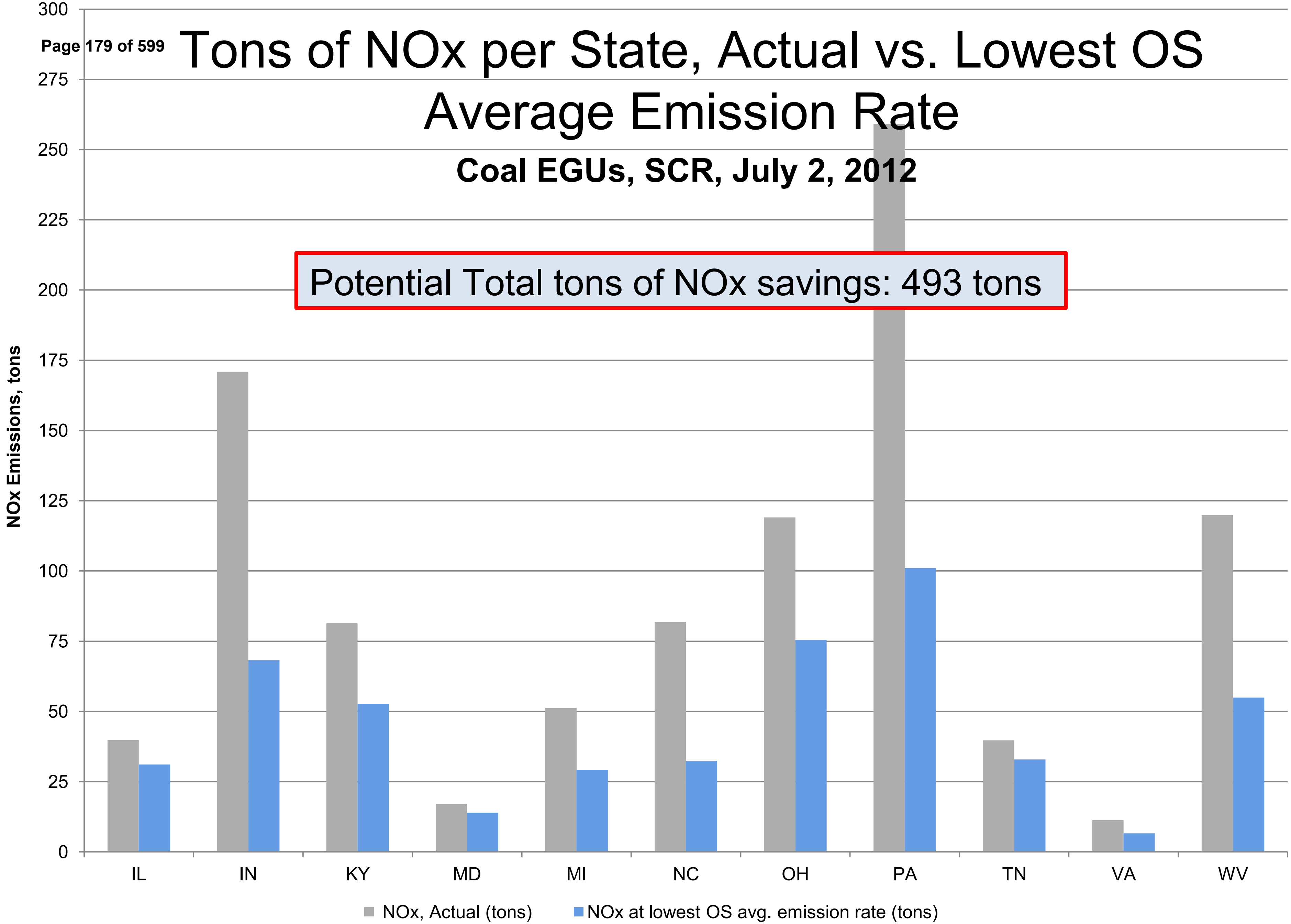
July 2, 2012



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

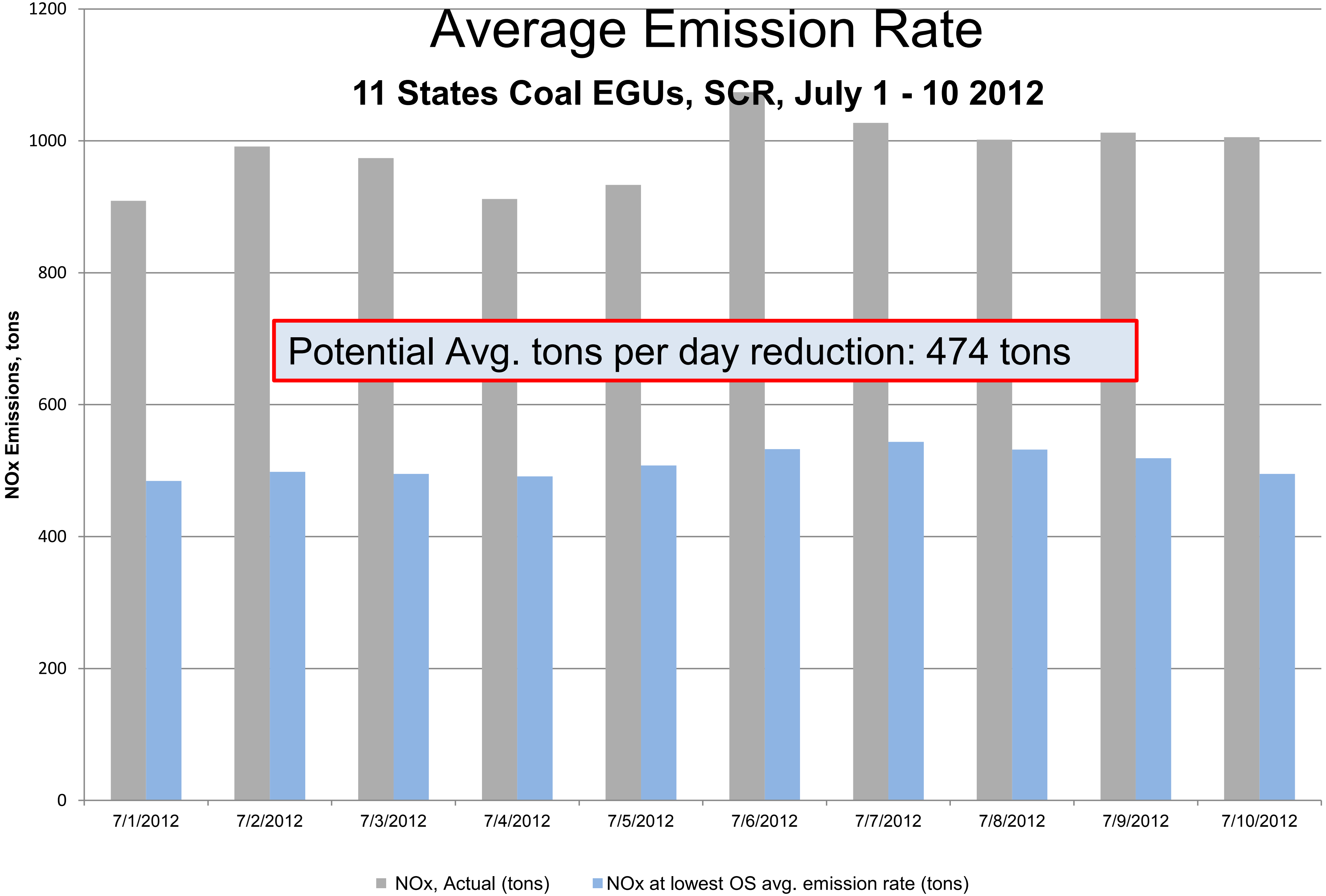
Tons of NOx per State, Actual vs. Lowest OS Average Emission Rate

Coal EGUs, SCR, July 2, 2012



Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate

11 States Coal EGUs, SCR, July 1 - 10 2012



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

11 State Summary

After performing similar analysis of EGUs in IL, IN, KY, MD, MI, NC, OH, PA, TN, VA and WV, the following potential total tons of lost NOx reductions was calculated:

- On July 2, 2012 actual NOx emissions in the 11 states (listed above) was 991 tons
  - If EGUs in those states were to have run their controls at the best rates observed in the data, emissions would have been 498 tons
  - This represents a single day loss of NOx reductions of 493 tons on that day
- During the 10 day episode between July 1 and 10, 2012 actual NOx emissions in the 11 states (listed above) was 9,840 tons
  - If EGUs in those states were to have run their controls at the best rates observed in the data, emissions would have been 5,099 tons
  - This represents a loss of NOx reductions of 4,741 tons over that 10-day episode

Part 6

Potential Lost Ozone Benefits from Controls Running Less Effectively in Recent Years

Preliminary Photochemical Modeling

Kentucky Monitors

How Might This Affect Ozone?

- Maryland has performed several very preliminary model runs to look at how much running EGU controls inefficiently might increase ozone levels
- Three runs:
  - Scenario 2B – A worst case run
    - Assumes SCR and SNCR controls are not run at all
  - Scenario 3B – A worst data run
    - Assumes SCR and SCR units all run at worst rates seen in CAMD data - 2005 to 2012
  - Scenario 3C – Based upon CAMD data analysis for EGU performance in 2011 and 2012
    - Assumes that units that had higher ozone season emission rates were operating at the best ozone season rates observed since 2005

Lost Ozone Benefits
Potential PPB Increases

Kentucky Monitors	Potential Increased Ozone in 2018 – 3 EGU Control Scenarios		
County	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Bell	7.4	1.9	0.9
Boone	19.8	7.2	4.2
Boyd	6.6	1.6	1.0
Bullitt	7.6	2.3	1.8
Campbell	9.6	2.7	1.6
Carter	9.6	2.4	1.5
Christian	13.7	4.8	3.9
Daviess	8.9	3.3	2.3
Edmonson	7.5	2.2	1.6
Fayette	7.2	2.0	1.4
Fayette	6.5	1.8	1.2
Greenup	7.3	1.7	1.0
Hancock	7.5	2.8	2.0
Hardin	6.8	1.7	1.2
Henderson	10.1	3.5	1.9

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Lost Ozone Benefits
Potential PPB Increases

Kentucky Monitors	Potential Increased Ozone in 2018 – 3 EGU Control Scenarios		
County	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Jefferson	6.7	1.9	1.4
Jefferson	5.6	1.5	1.1
Jefferson	5.1	1.5	1.0
Jessamine	8.1	2.3	1.5
Kenton	11.6	3.4	2.0
Livingston	4.7	1.5	1.0
McCracken	3.7	1.2	0.8
Oldham	9.9	2.9	1.8
Perry	10.1	2.7	1.6
Pike	N/A	N/A	N/A
Pulaski	7.2	2.1	1.1
Simpson	8.4	2.8	2.1
Trigg	6.6	1.8	1.2
Warren	5.5	1.4	1.0

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Lost Ozone Benefit – 2018 Design Values

… EPA will propose a new ozone standard soon … 60 to 70 ppb range … designations to most likely be based upon 2014 to 2016 or 2015 to 2017 data

Projected to be Clean in 2018 … Potentially at Risk		Increased Ozone in 2018 – 3 EGU Control Scenarios		
Kentucky Counties	**2018 – Controls Running Well (Scenario 3A)**	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Bell	54.9	62.3	56.9	55.8
Boone	57.5	77.2	64.7	61.6
Boyd	64.3	70.9	65.9	65.3
Bullitt	59.2	66.8	61.5	61.0
Campbell	61.6	71.3	64.3	63.3
Carter	59.1	68.7	61.5	60.6
Christian	63.0	76.7	67.7	66.8
Daviess	65.0	73.9	68.3	67.3
Edmonson	57.9	65.5	60.1	59.6
Fayette	56.4	63.7	58.5	57.8
Fayette	50.7	57.1	52.5	51.9
Greenup	65.4	72.7	67.1	66.4
Hancock	63.2	70.7	66.0	65.2
Hardin	61.7	68.5	63.4	62.9
Henderson	63.0	73.1	66.5	65.0

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Lost Ozone Benefit – 2018 Design Values

… EPA will propose a new ozone standard soon … 60 to 70 ppb range … designations to most likely be based upon 2014 to 2016 or 2015 to 2017 data

Projected to be Clean in 2018 … Potentially at Risk		Increased Ozone in 2018 – 3 EGU Control Scenarios		
Kentucky Counties	**2018 – Controls Running Well (Scenario 3A)**	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Jefferson	67.2	73.9	69.2	68.7
Jefferson	65.3	70.9	66.8	66.4
Jefferson	61.5	66.6	63.0	62.5
Jessamine	57.7	65.8	60.0	59.2
Kenton	63.7	75.3	67.1	65.7
Livingston	58.9	63.6	60.4	59.9
McCracken	62.6	66.3	63.8	63.4
Oldham	67.2	77.1	70.2	69.1
Perry	58.2	68.4	61.0	59.8
Pike	N/A	N/A	N/A	N/A
Pulaski	54.4	61.6	56.5	55.5
Simpson	59.6	68.0	62.4	61.7
Trigg	59.5	66.1	61.3	60.7
Warren	55.3	60.8	56.7	56.3

DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

EGU Data Package #3
Operation of Existing SCR, SNCR

Maryland

Sample of draft data and analyses developed by the Maryland Department of the Environment

Contact: Tad Aburn, Air Director, MDE
(410) 537-3255

September 18, 2014

Purpose

- Maryland is the only Moderate nonattainment area in the East for the 75 ppb ozone standard.
  - This means that Maryland is the only state required to submit an attainment SIP
  - Only state required to perform attainment modeling.
- We are now beginning to build our “SIP Quality” modeling platform.
- One major issue that our data analyses have uncovered is that many EGU units appear to not be running their control equipment in recent years as efficiently as they have demonstrated they can do in earlier years. This issue is driven by recent changes in the energy market, reduced coal capacity, inexpensive allowances and a regulatory structure driven by ozone season caps not daily performance. In many states, including Maryland, this has lead to controls not always being used efficiently on the days when they are needed the most … this is perfectly legal.
- This is a critical issue that we would like to continue to discuss with you. There appears to be an interest from the private sector to discuss this issue and see if a common sense fix can be designed. Maryland believes this fix would be relatively cost-effective compared to the capital cost of the control technologies.
- MDE has focused our analyses on two of the worst large, regional scale ozone episodes from recent years: July 1-8, 2011 and July 1-10, 2012.
- The primary data used in these analyses include:
  - CEMS data from CAMD
  - Emissions and projection data from ERTAC
  - Other data we have received from individual states
- More detailed data and analyses and spreadsheets are available upon request.

How the Data Analyses Were Built

- Maryland began the data analyses in late 2012
  - Looked at EGUs in the 9 upwind states named in the 176A Petition (IL, IN, KY, MI, NC, OH, TN, VA, WV) … MD and PA
- Shared a draft package with Air Directors on April 21, 2014
  - This package focused on a bad ozone episode: July 1 – 8, 2011
- Shared a second draft package with Air Directors on May 13, 2014
  - This package focused on second bad ozone episode: July 1 – 10, 2012
  - This package also included update to specific material after receiving comments from numerous states
- The 2011 and 2012 episodes analyzed capture two of the worst regional ozone periods in 2011 and 2012
  - Other states, like Wisconsin and Delaware have done similar analyses and reached similar conclusions
- This is the third draft package, and builds on to the prior two draft packages, while incorporating input from individual states and updates to ERTAC.
- This third draft package also includes preliminary photochemical modeling performed by MDE to look at the potential loss of ozone reduction benefits.

Help Us QA the Data

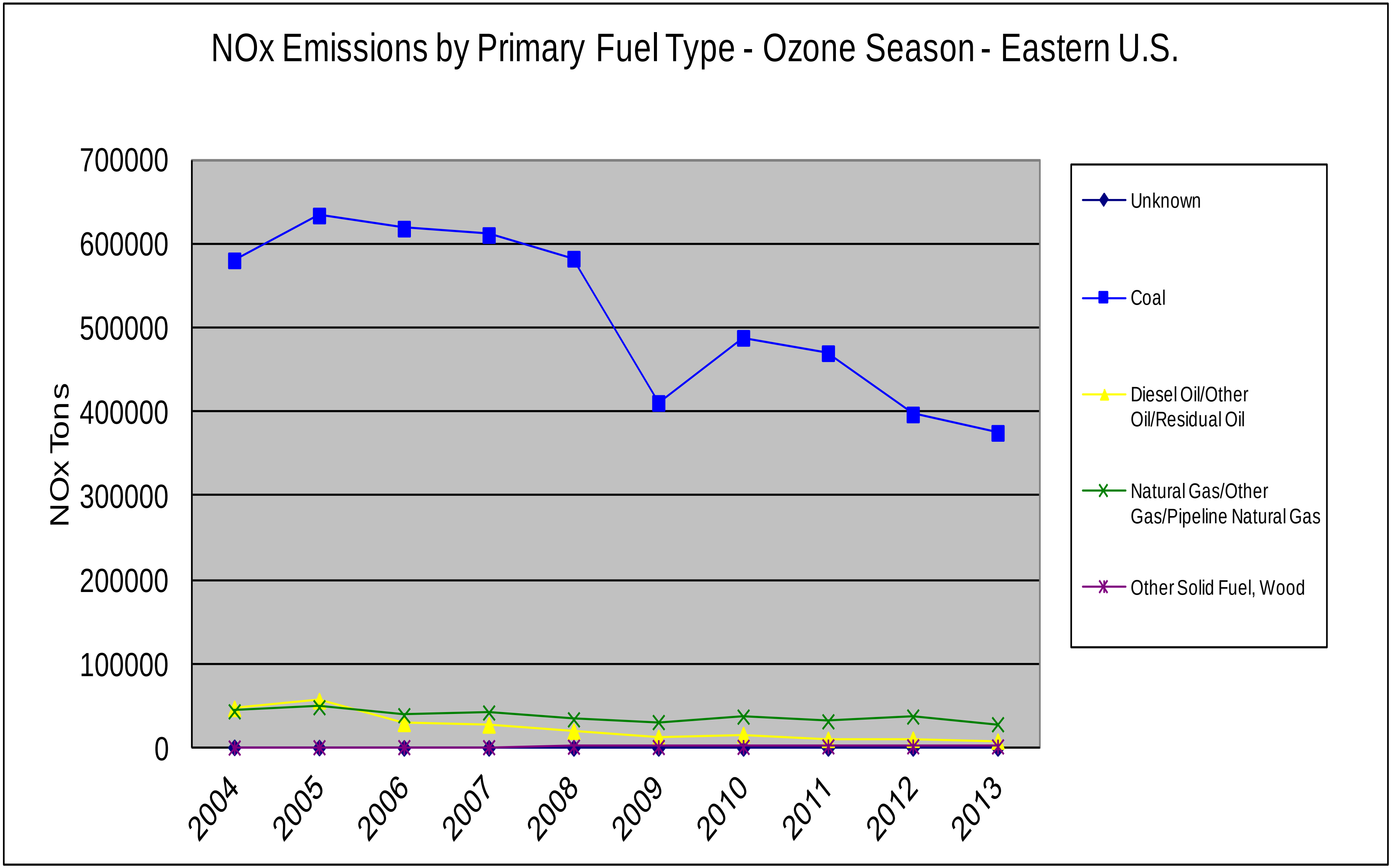
- We have used readily available data, like the CAMD and ERTAC data, but we recognize that these data sources can be out of date, or not include recent changes.
  - We hope you can help us with making sure we have the best possible data.

- This package reflects recently updated data, including but not limited to:
  - CAMD updates
  - May 8, 2014 ERTAC updates
  - PA comments to OTC, forwarded to MDE, Spreadsheets detailing "EGU Shutdowns, EGU Controls and New Natural Gas Power Projects" for the state of PA. Sent from Randy Bordner, Environmental Group Manager - Bureau of Air Quality, PA Department of Environmental Protection to Andy Bodnarik, OTC. Received as FWD from Andy Bodnarik on 4/23/2014
  - VA comments to MDE, "Electric Generation Sector Summary for Virginia" received from Thomas R. Ballou, Director - Office of Air Data Analysis and Planning, VA Department of Environmental Quality on 5/12/2014

Part 1

Background:
Generation in 2012 and 2018
Projected Changes

Why Coal?



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Maryland EGUs, 2012

- Total number of units = 48
- Total heat input capacity = 104,703 MMBtu/hr = 11,787 MW
- Total State MW Capacity in %
  - **Total number of Coal units = 16 = 44%**
  - Total number of NG units = 15 = 19%
  - Total number of other (oil, etc.) units = 15 = 22%
  - Total number of Nuclear units = 2= 15%
- **Total Capacity Coal = 5,171 MW**
  - 6 units with SCR = 3,345 MW = 65%
  - 8 units with SNCR = 1,717 MW = 33%
  - 2 units without SCR/SNCR = 110 MW = 2%

Basis – CAMD (as of 5/13/2014), NEI (for Nuclear), ERTAC (5/6/2014, 5/8/2014)

DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Capacity and Fuel: 2012 to 2018

A detailed review of ERTAC data for 2018 was completed, and an evaluation of the following characteristics performed.

- Total Number of units
- Heat input capacity - MMBtu/hr
- Nameplate capacity – MW
- Presence of advanced post combustion controls – SCR, SNCR
- Fuel switching
- Shutdown, retirements

Maryland EGUs, 2018

- Total number of units = 48
- Total heat input capacity = 103,133 MMBtu/hr = 11,772 MW
- Total State MW Capacity in %
  - **Total number of Coal units = 14 = 43%**
  - Total number of NG units = 18 = 21%
  - Total number of other (oil, etc.) units = 14 = 22%
  - Total number of Nuclear units = 2 = 14%
- **Total Capacity Coal = 5,062 MW**
  - 6 units with SCR = 3,345 MW = 66%
  - 8 units with SNCR = 1,717 MW = 34%
  - 0 units without SCR/SNCR = 0 MW = 0%

Basis – ERTAC (5/6/2014, 5/8/2014), NEI (for Nuclear)

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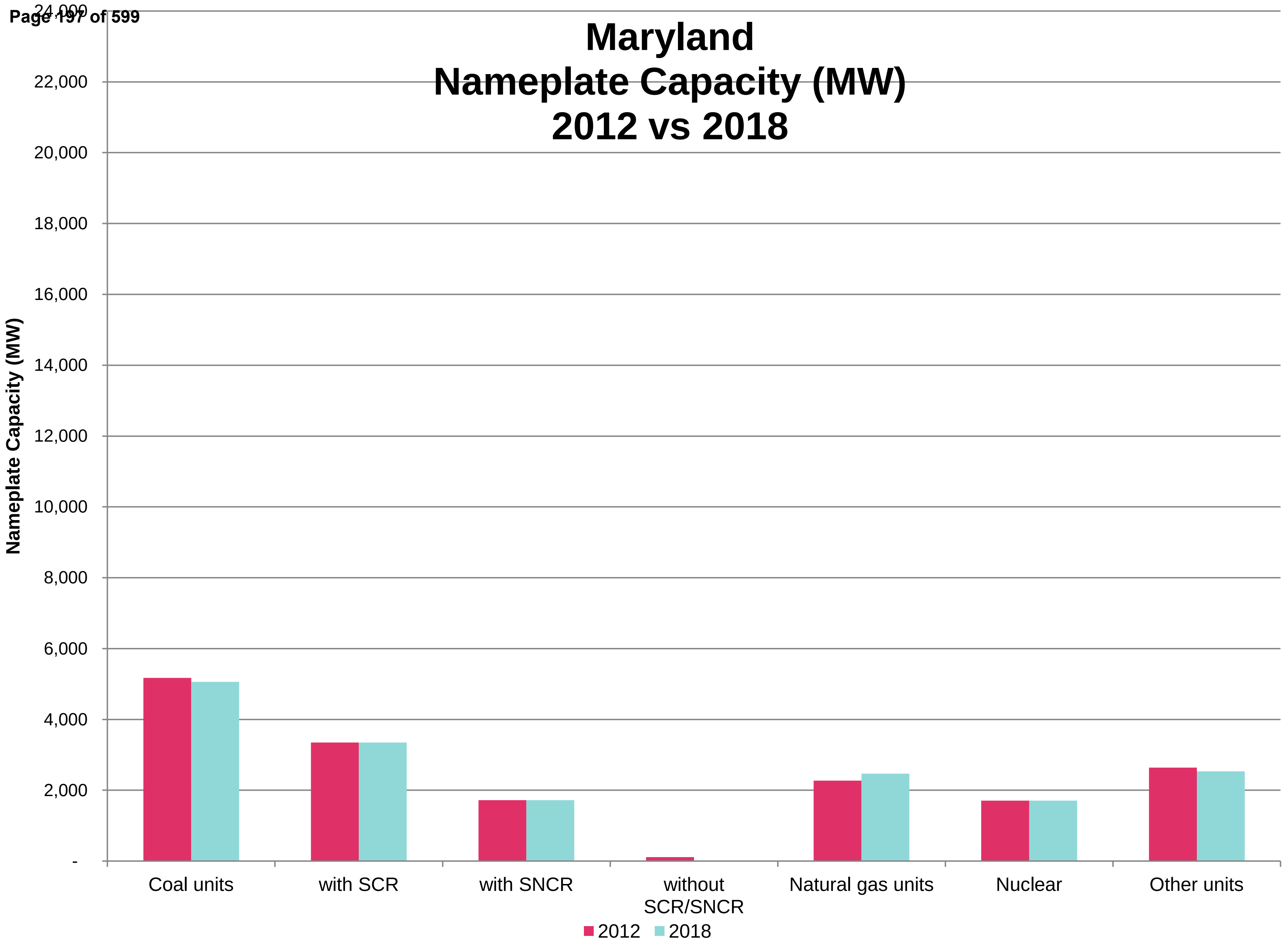

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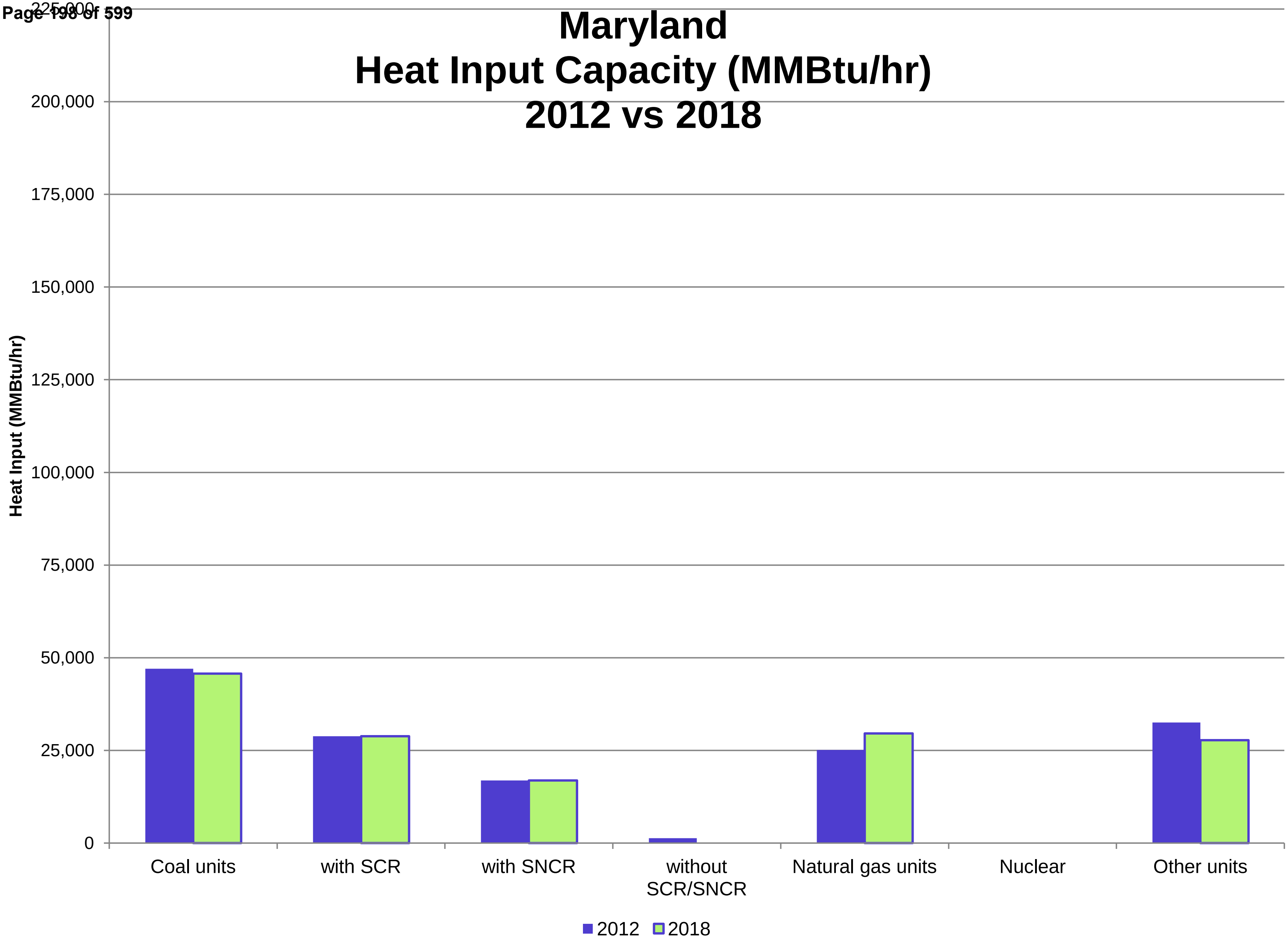
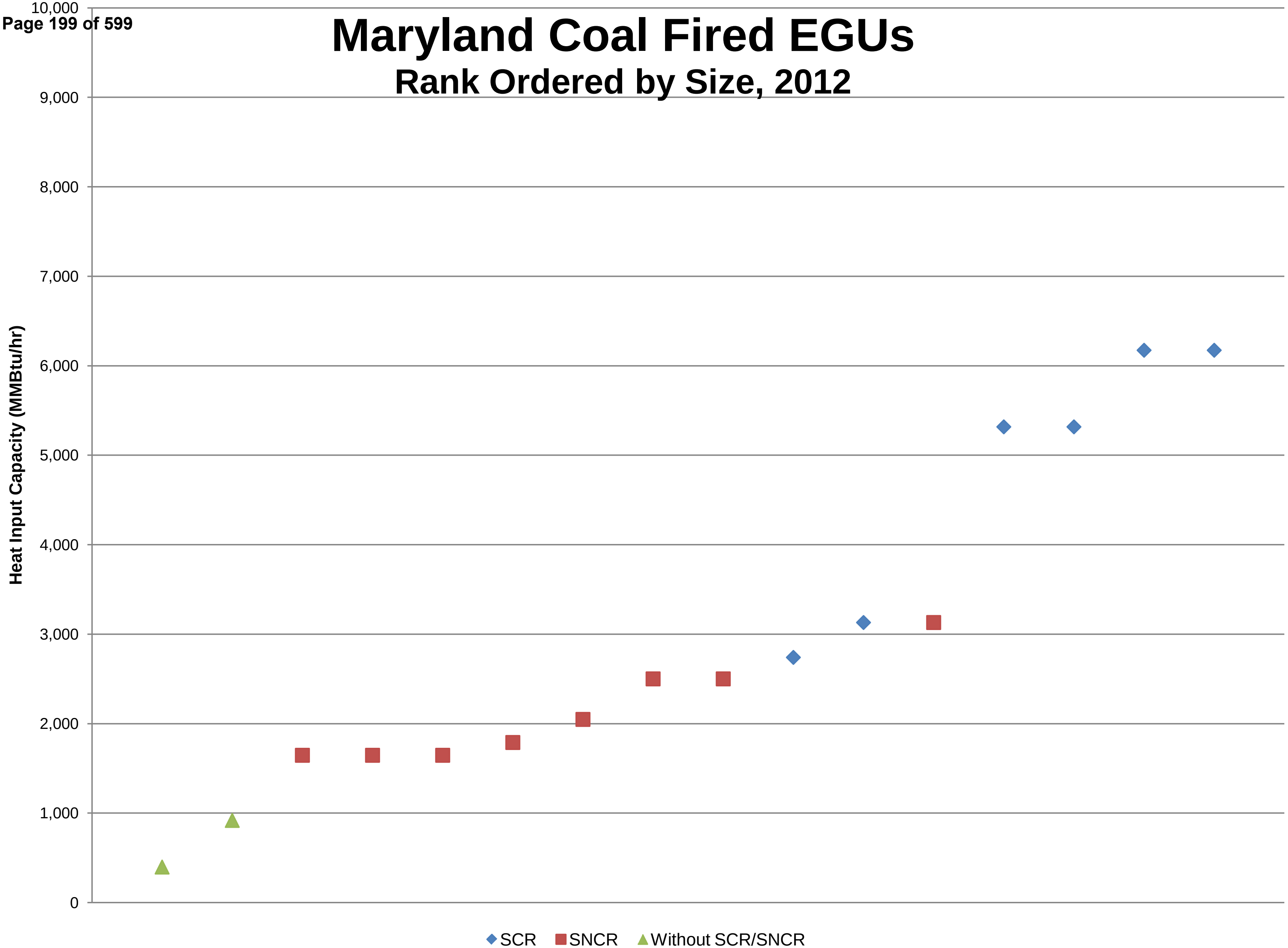
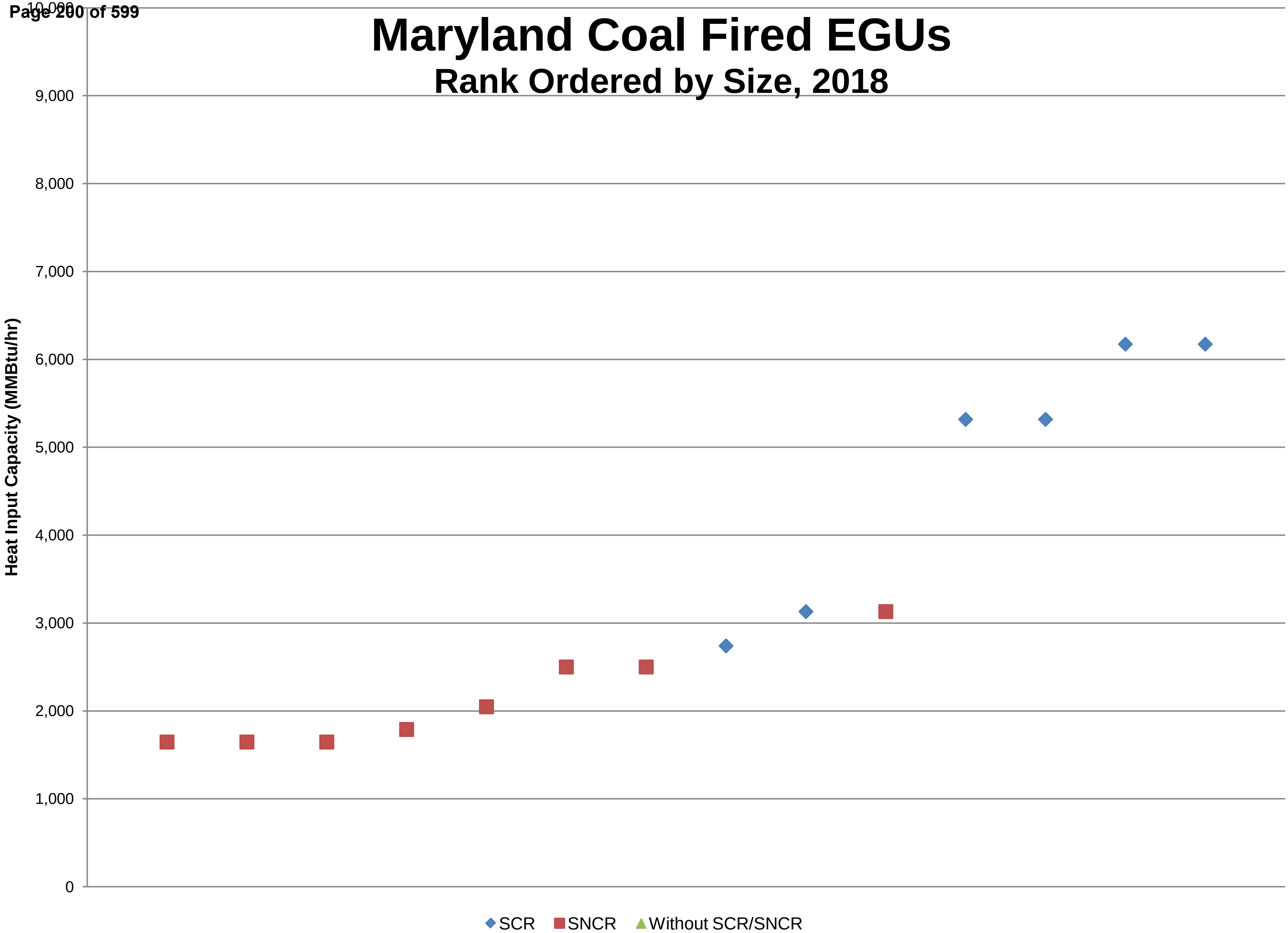

Maryland
Heat Input Capacity (MMBtu/hr)
2012 vs 2018
Heat Input (MMBtu/hr)
225,000
200,000
175,000
150,000
125,000
100,000
75,000
50,000
25,000
0
Coal units
with SCR
with SNCR
without SCR/SNCR
Natural gas units
Nuclear
Other units
2012
2018



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Maryland Coal Fired EGUs
Rank Ordered by Size, 2018



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

MD : Large (> 3000 MMBtu/hr) Coal-Fired EGU NOx Emissions Rate Analysis

	Facility Name	Unit ID	Lowest OS Emission Rate Year	Lowest OS Emission Rate (lbs/MMBtu)	2007 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2007 OS ER (% Change)	2011 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2011 OS ER (% Change)	Comments/ ERTAC Closure Date
Controlled with SCR	Brandon Shores	1	2007	0.0589	0.0589	0	0.1057	79	
	Brandon Shores	2	2005	0.0828	0.1039	25	0.1076	30	
	Mirant Chalk Point	1	2008	0.1575	0.4004	154	0.1695	8	Close 2017 (media)
	Mirant Morgantown	1	2012	0.0319	0.0652	104	0.0419	31	
	Mirant Morgantown	2	2011	0.0309	0.3219	942	0.0309	0	
Controlled with SNCR	Mirant Chalk Point	2	2009	0.1927	0.4014	208	0.2261	17	Close 2017 (media)
No Controls or Fuel Switches by 2019	N/A								
Retiring by 2017	N/A								

DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

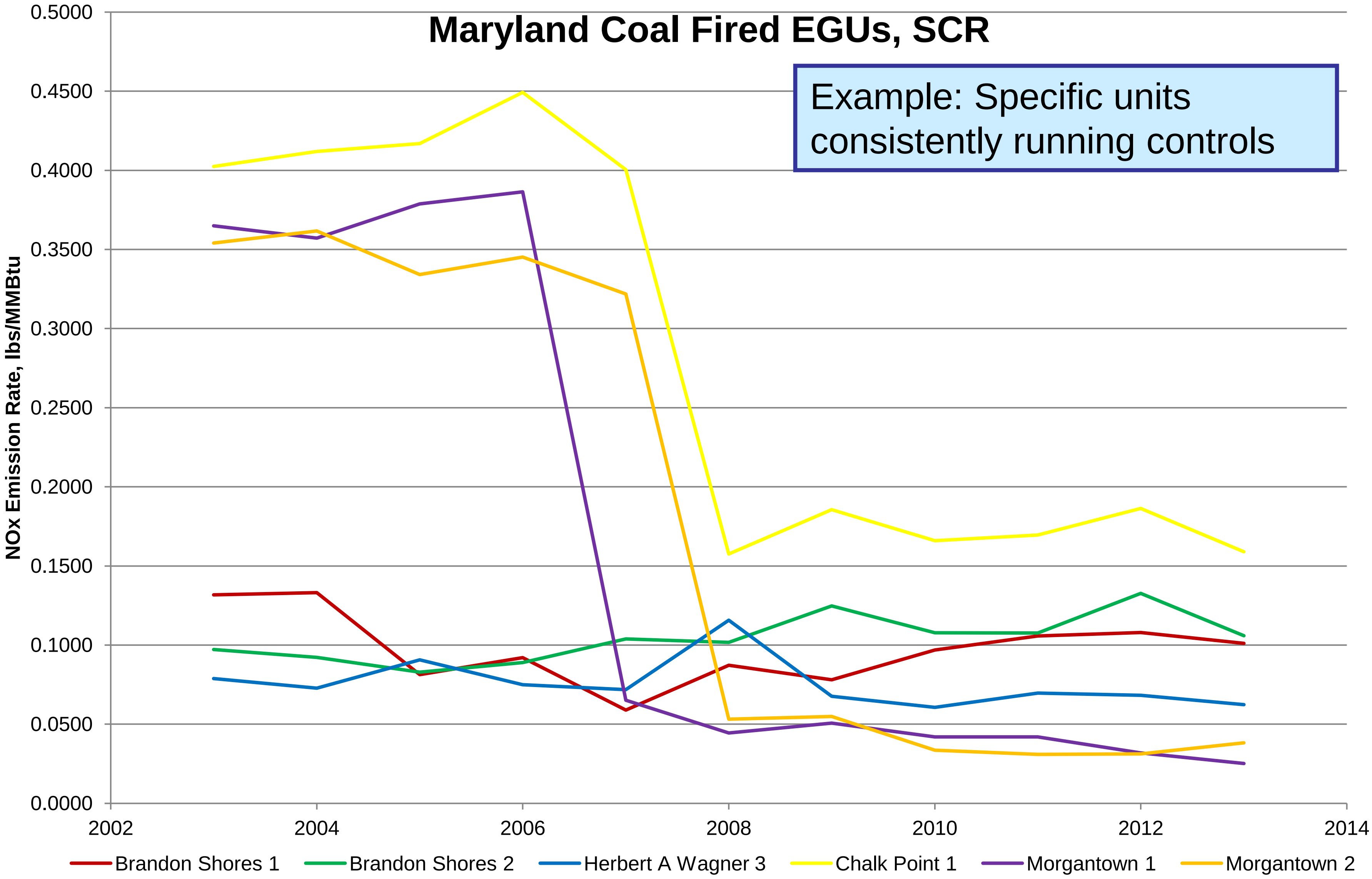
MD: Small (< 3000 MMBtu/hr) Coal-Fired EGU NOx Emissions Rate Analysis

	Facility Name	Unit ID	Lowest OS Emission Rate Year	Lowest OS Emission Rate (lbs/MMBtu)	2007 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2007 OS ER (% Change)	2011 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2011 OS ER (% Change)	Comments/ ERTAC Closure Date
Controlled with SCR	Herbert A Wagner	3	2010	0.0607	0.0718	18	0.0697	15	
Controlled with SNCR	AES Warrior Run	1	2003	0.0479	0.0548	14	0.1426	198	
	C P Crane	1	2009	0.3422	0.4318	26	0.4185	22	
	C P Crane	2	2009	0.3041	0.4145	36	0.386	27	
	Herbert A Wagner	2	2009	0.316	0.3995	26	0.3582	13	
	Mirant Dickerson	1	2010	0.2483	0.2924	18	0.2552	3	Close 2017 (media)
	Mirant Dickerson	2	2010	0.2494	0.2858	15	0.2533	2	Close 2017 (media)
	Mirant Dickerson	3	2010	0.2495	0.2849	14	0.2497	0	Close 2017 (media)
No Controls or Fuel Switches by 2019	N/A								
Retiring by 2017	R. Paul Smith	9	2003	0.3273	0.4216	29	0.3699	13	9/30/2012
	R. Paul Smith	11	2011	0.2607	0.3112	19	0.2607	0	9/30/2012

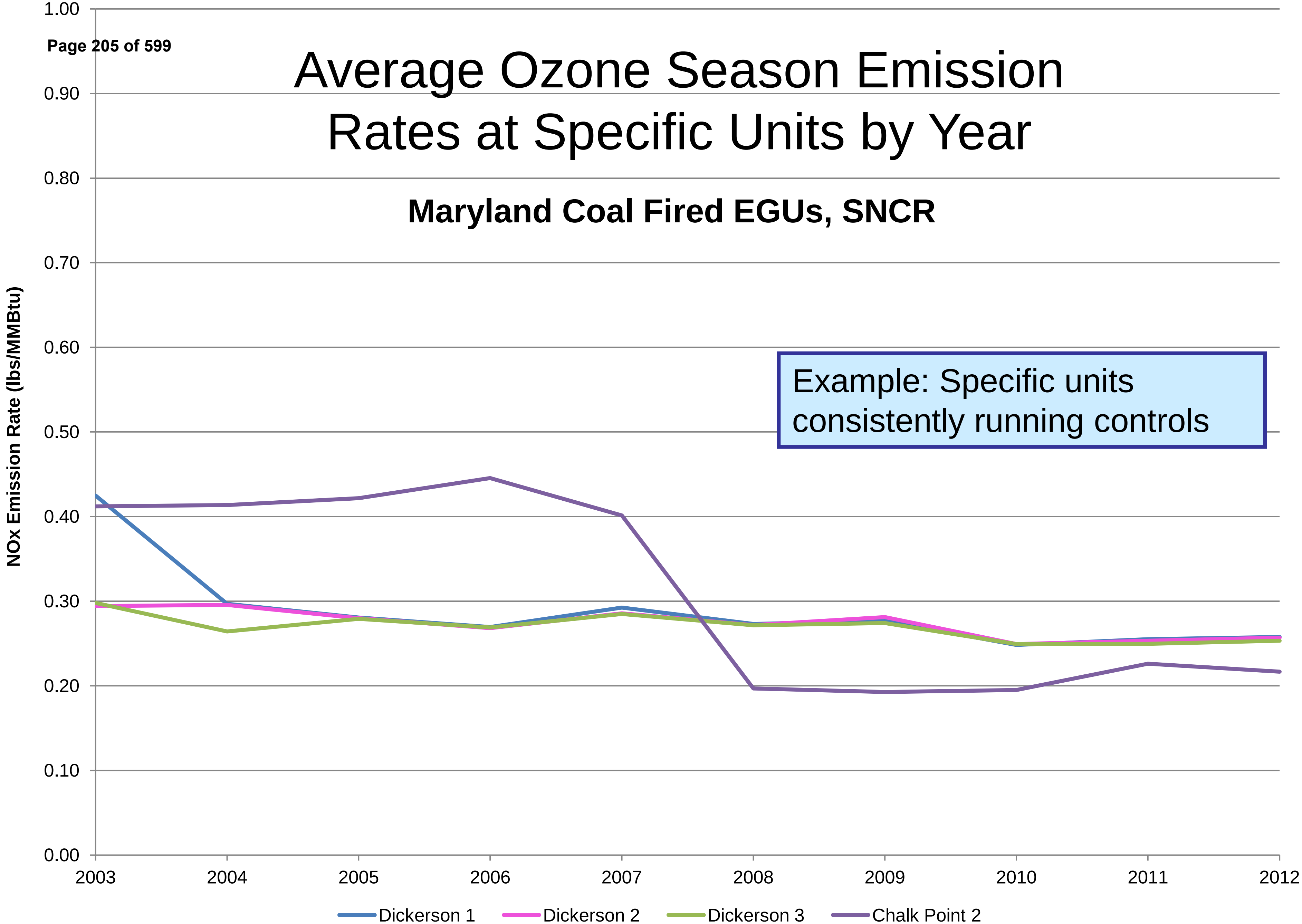
Part 2

Operation of Controls:
Changes in Control Efficiency
2003 to 2013

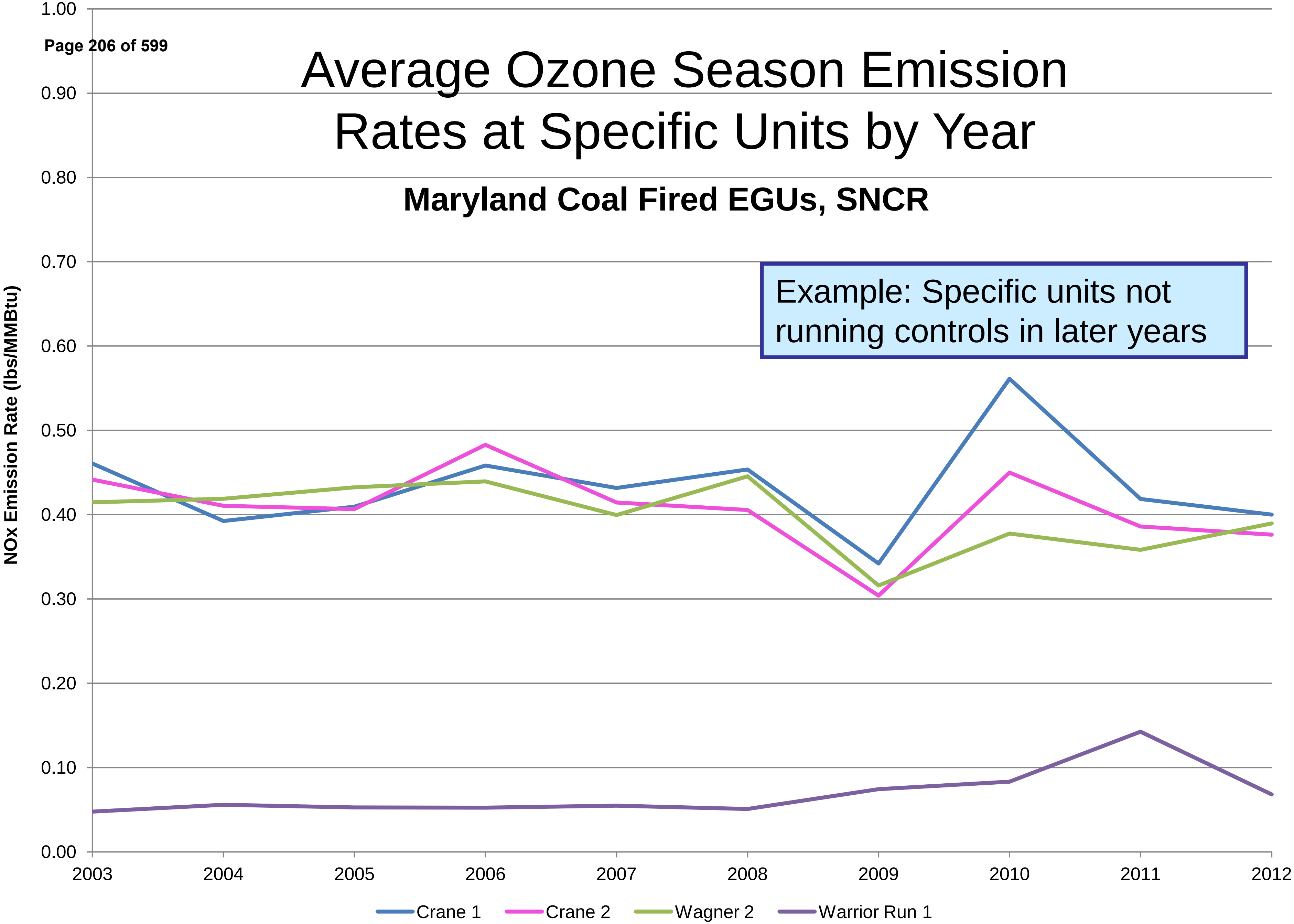
Average Ozone Season Emission Rates at Specific Units by Year



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

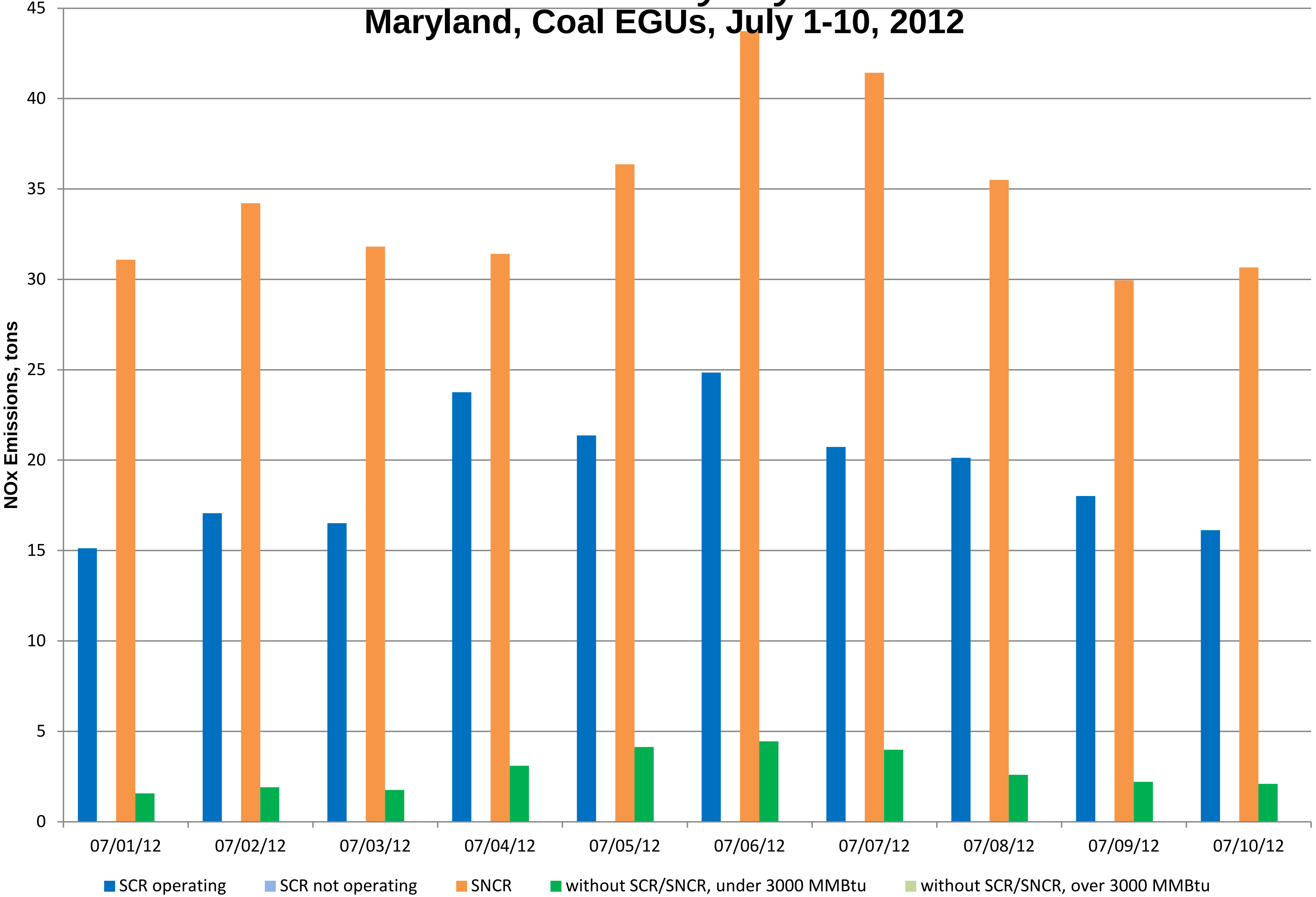
Part 3

July 1 to 10, 2012 Ozone Episode:

Analysis of Emissions and Controls

Tons of NOx Per Day By Control Status

Maryland, Coal EGUs, July 1-10, 2012



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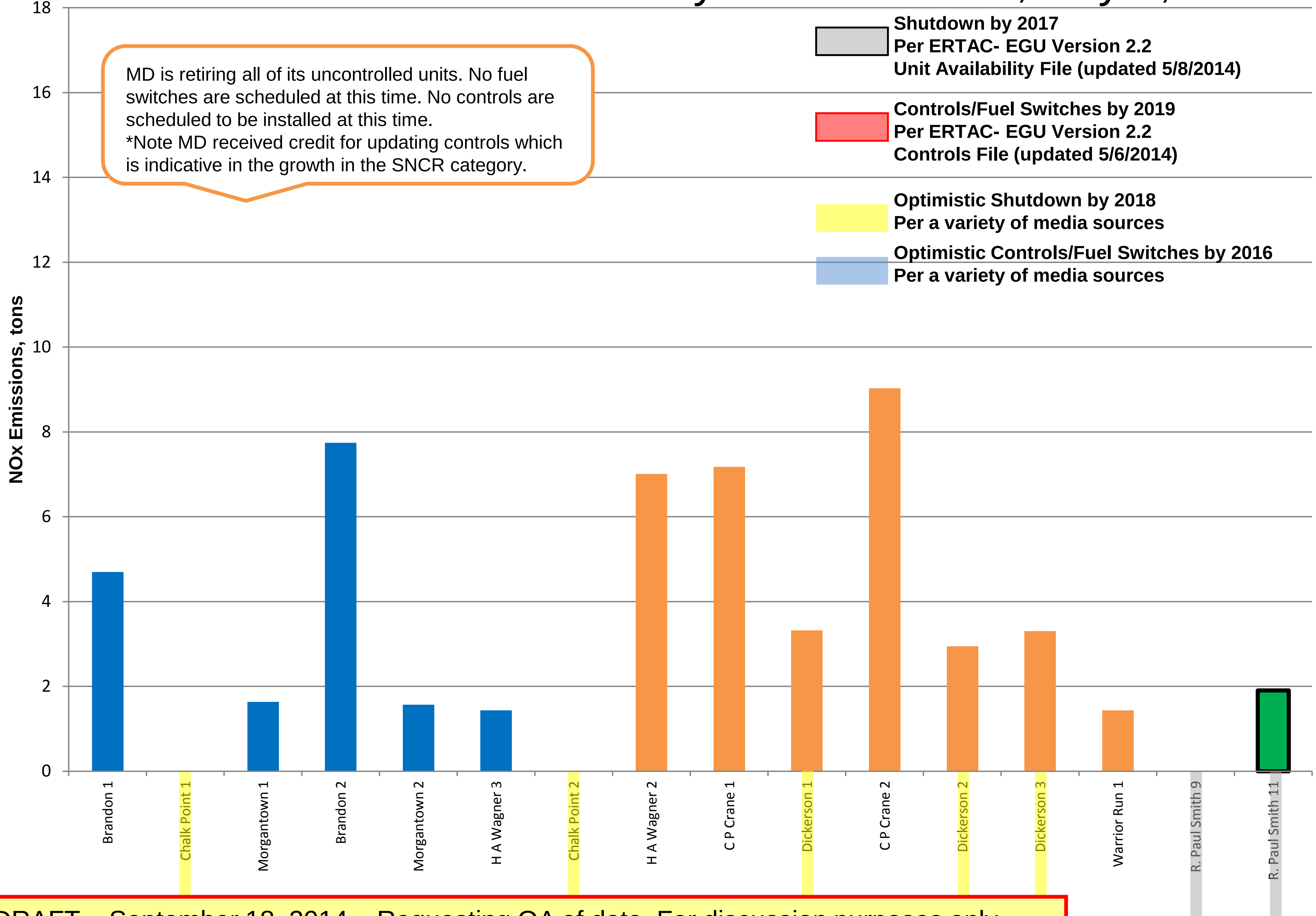
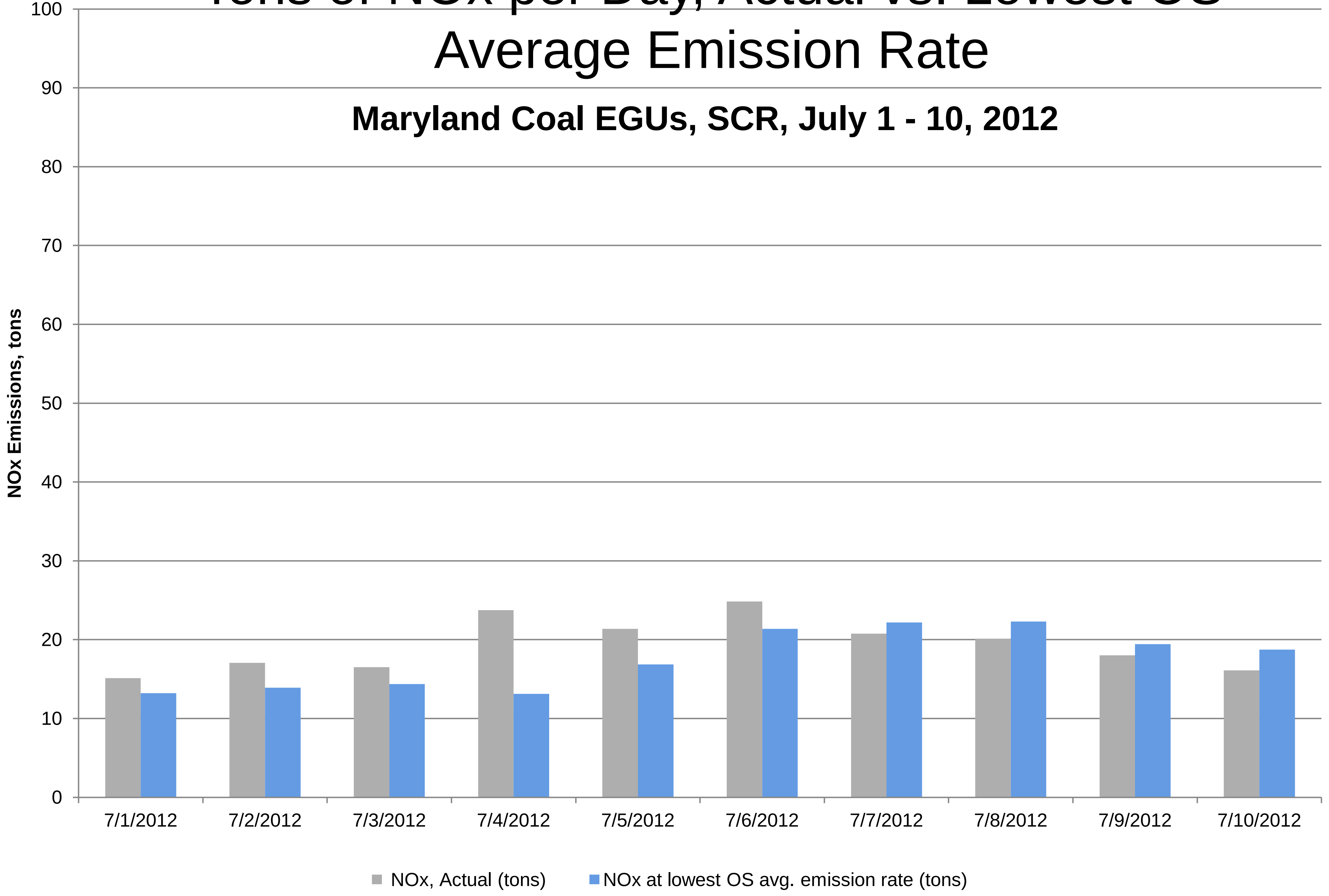
MD – Tons of NOx Per Unit By Control Status, July 2, 2012



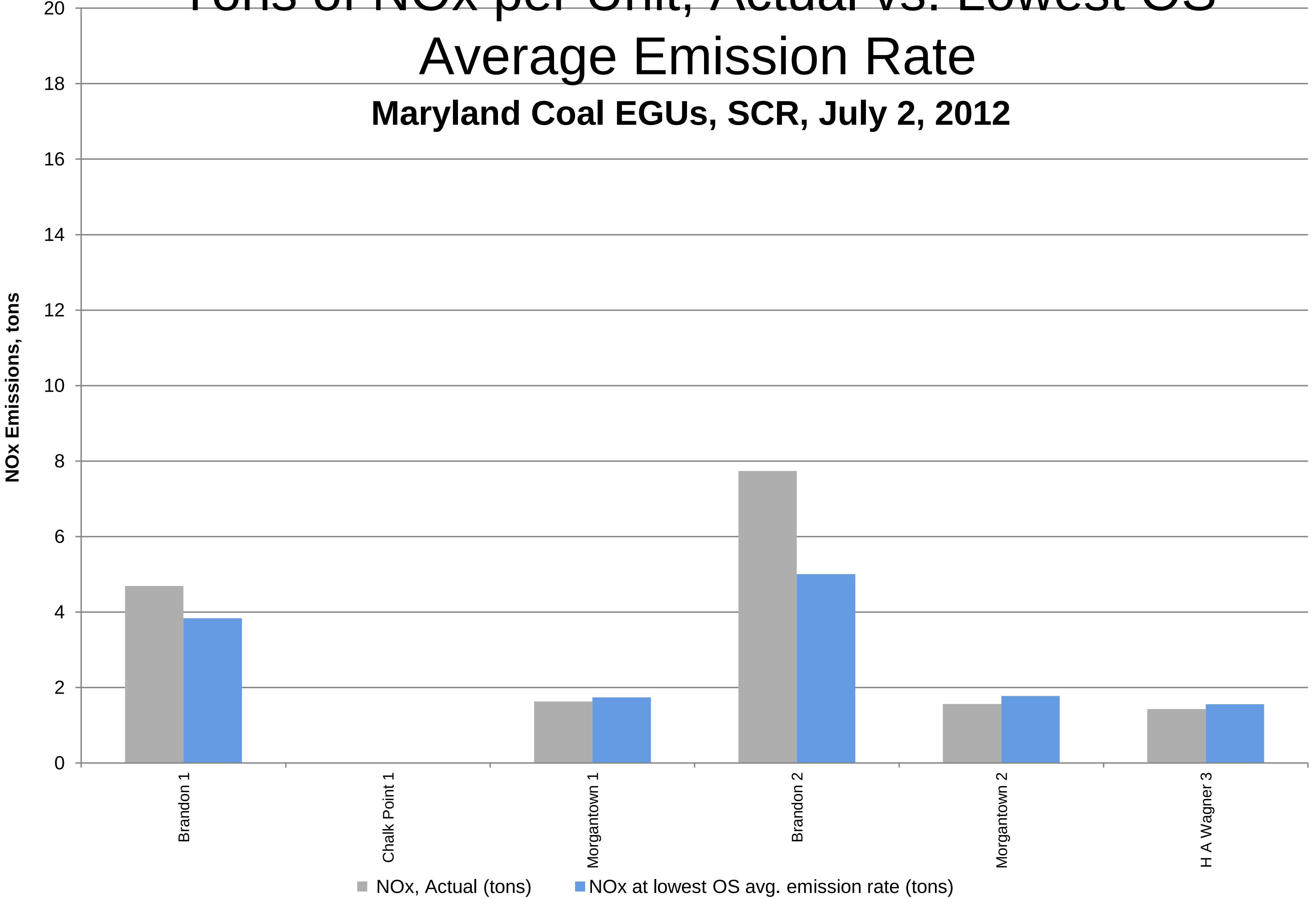
DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate



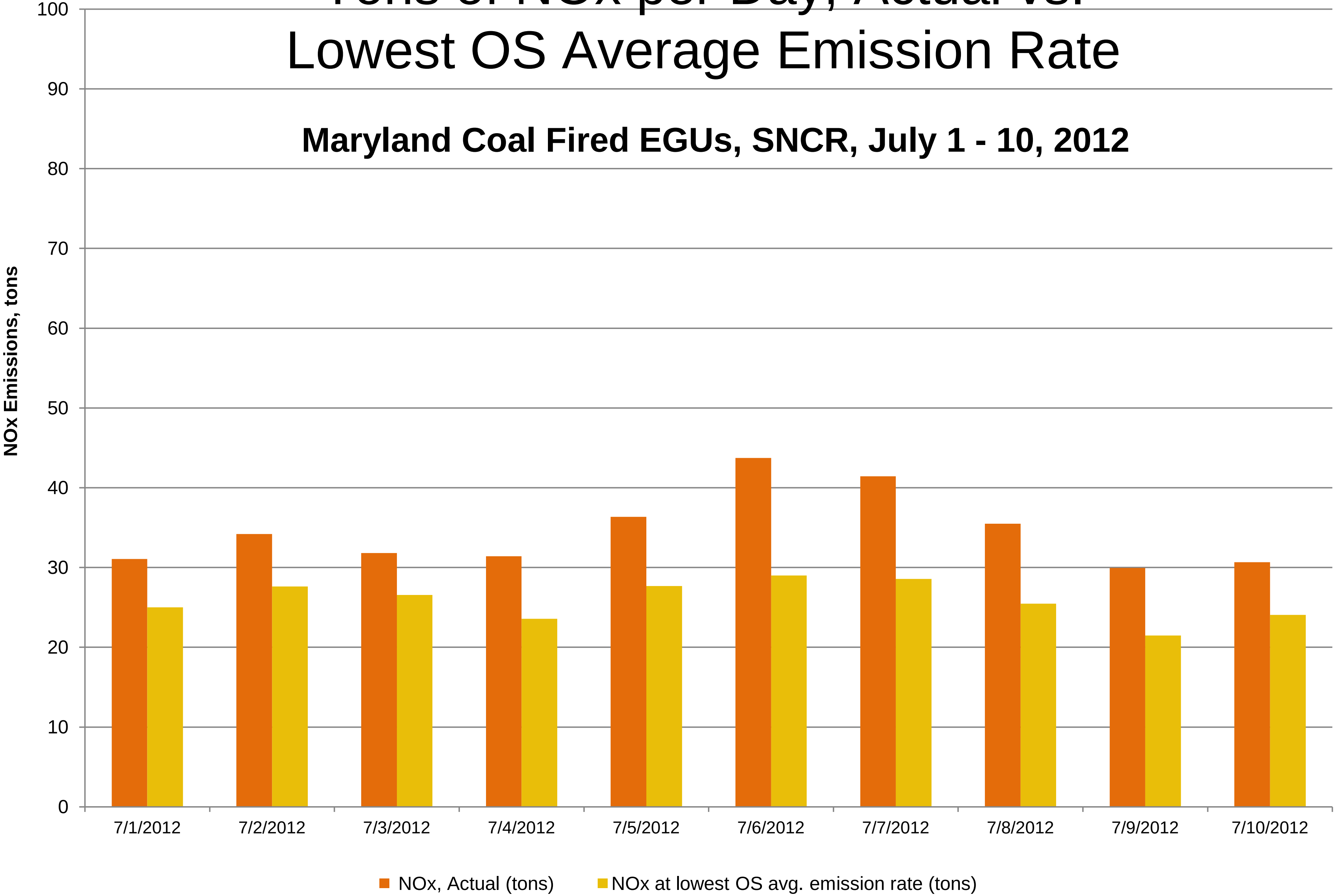
DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Tons of NOx per Unit, Actual vs. Lowest OS Average Emission Rate



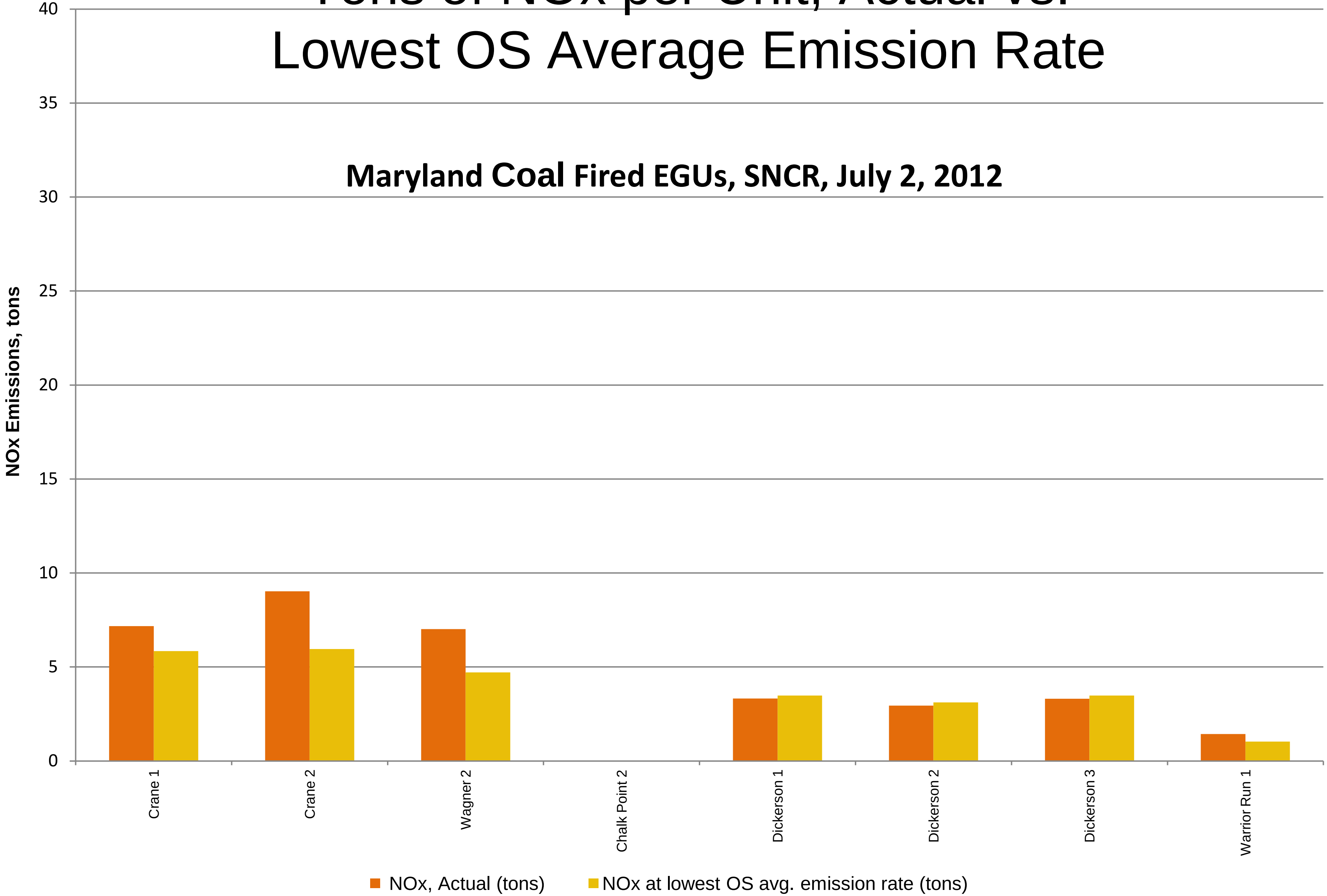
DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate



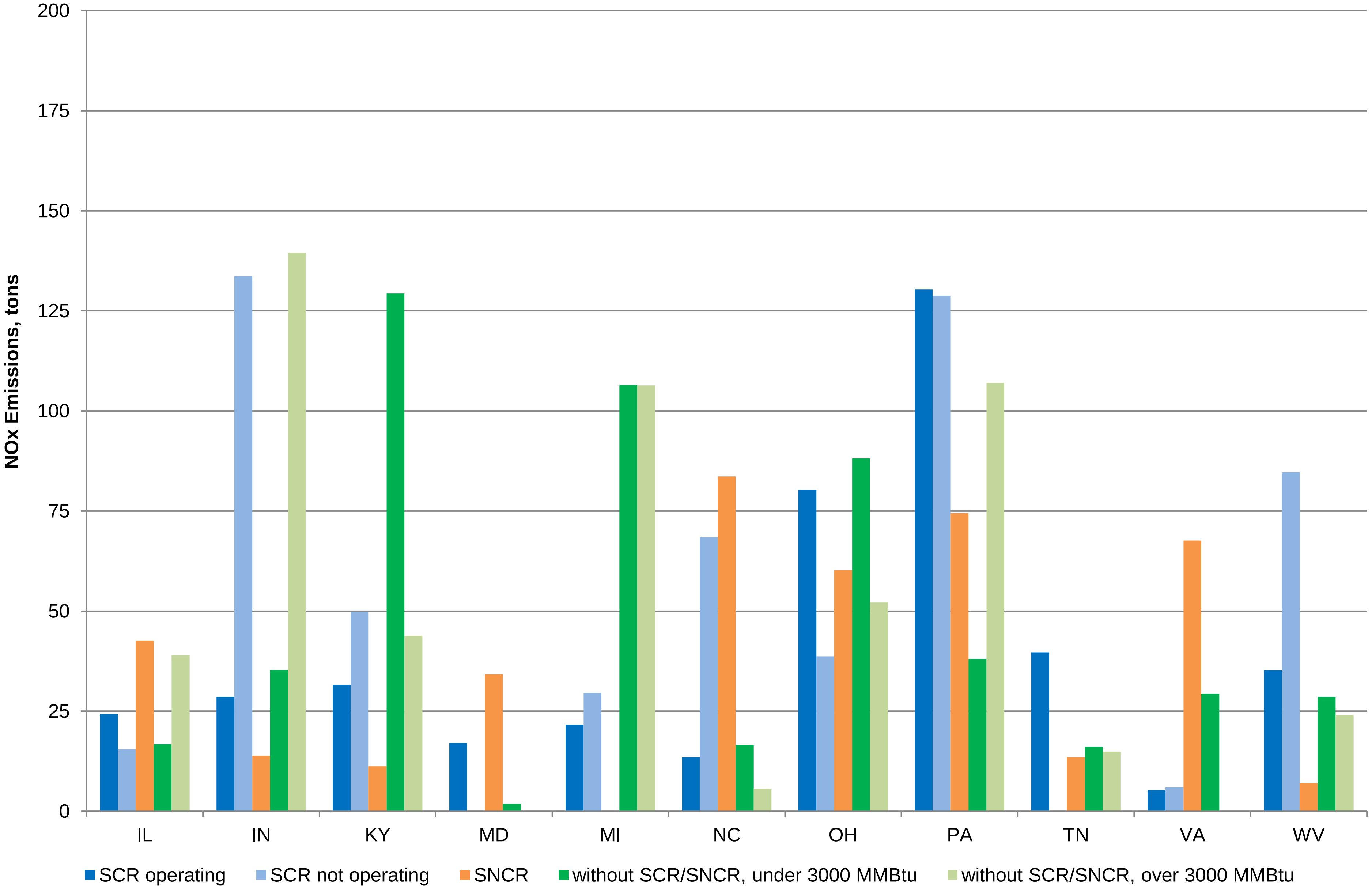
DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Tons of NOx per Unit, Actual vs. Lowest OS Average Emission Rate



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

July 2, 2012 – Tons of NOx per State by Control Status



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

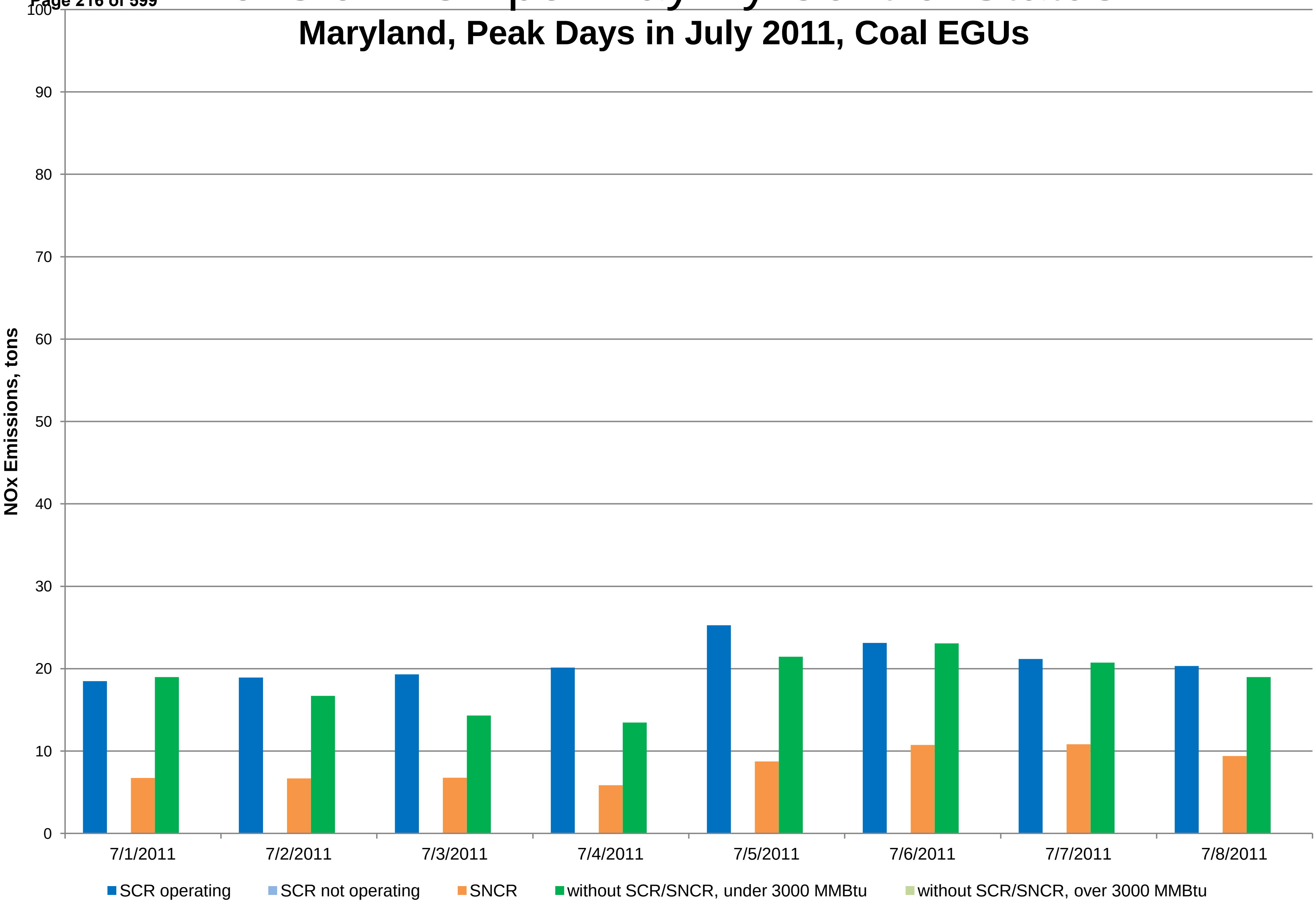
Part 4

July 1 to 8, 2011 Ozone Episode:

Analysis of Emissions and Controls

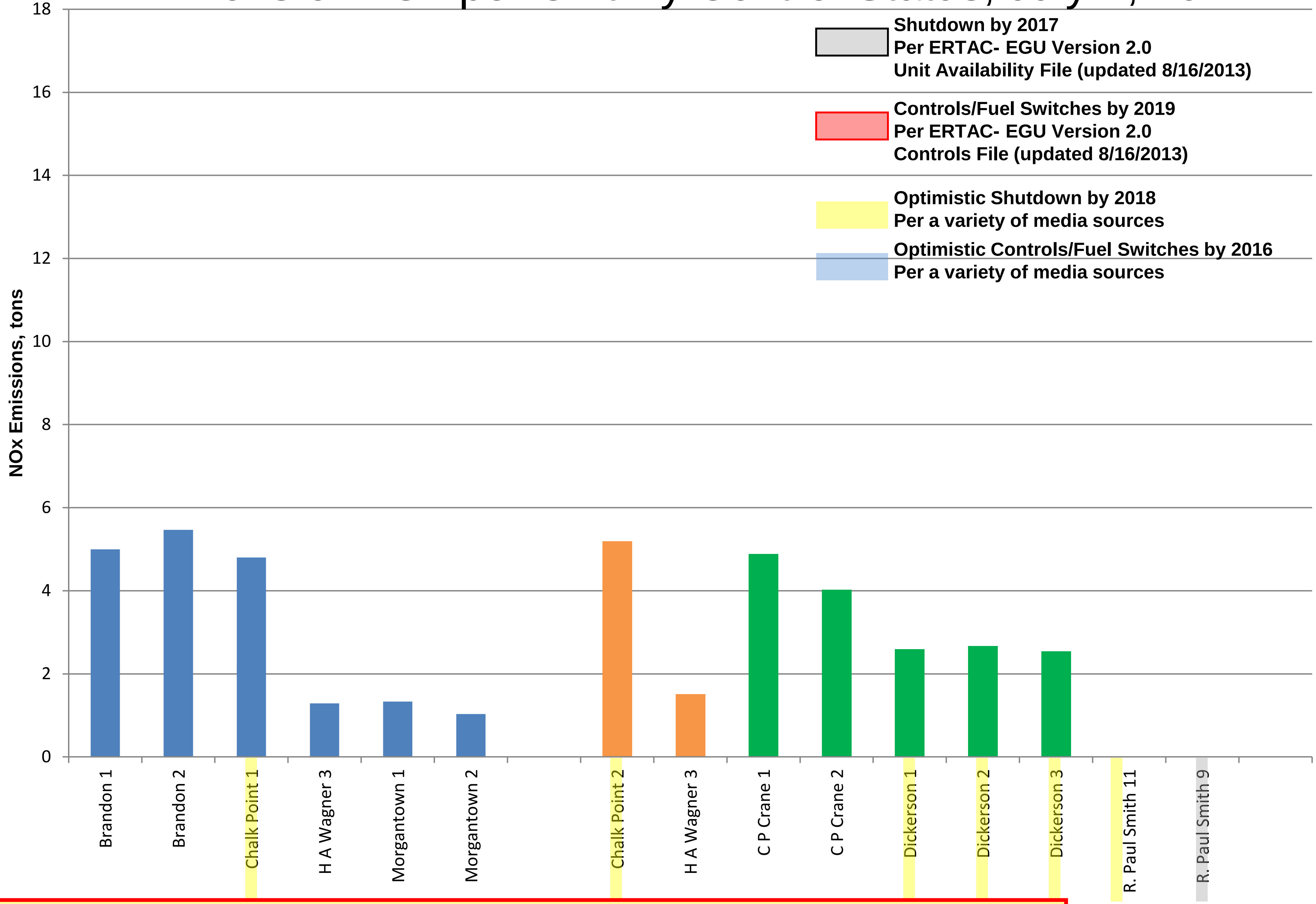
Tons of NOx per Day By Control Status

Maryland, Peak Days in July 2011, Coal EGUs



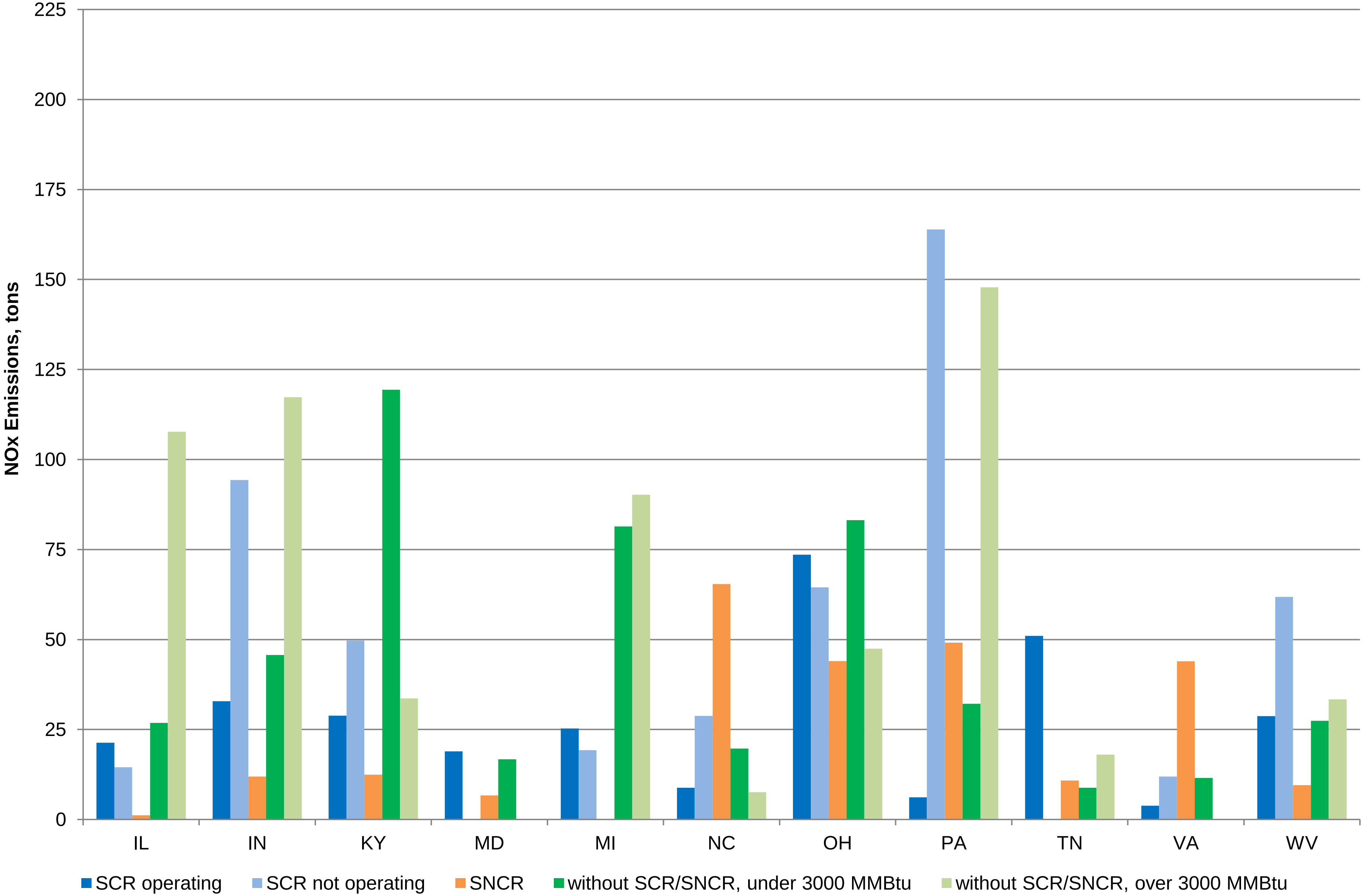
DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

MD – Tons of NOx per Unit By Control Status, July 2, 2011



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

July 2, 2011 - Tons NOx per State by Control Status



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Part 5

11 State Totals

July 1 to 8, 2011 Ozone Episode:

Analysis of Emissions and Controls

11 Upwind States, 2012

- Total number of units = 1,432
- Total heat input capacity = 2,730,239 MMBtu/hr
  = 304,354 MW
- Total MW Capacity in %
  - **Total number of Coal units = 547 = 55%**
  - Total number of NG units = 672 = 25%
  - Total number of other (oil, etc.) units = 173 = 6%
  - Total number of Nuclear units = 40 = 14%
- **Total Capacity Coal = 165,910 MW**
  - 156 units with SCR = 88,783 MW = 53%
  - 114 units with SNCR = 27,561 MW = 17%
  - 277 units without SCR/SNCR = 49,566 MW = 30%

Basis – CAMD (as of 5/13/2014), NEI (for Nuclear), ERTAC (5/6/2014, 5/8/2014)

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11 Upwind States, 2018

- Total number of units = 1,199
- Total heat input capacity = 2,449,194 MMBtu/hr
  = 274,300 MW
- Total MW Capacity in %
  - **Total number of Coal units = 361 = 49%**
  - Total number of NG units = 686 = 32%
  - Total number of other (oil, etc.) units = 115 = 5%
  - Total number of Nuclear units = 37 = 14%
- **Total Capacity Coal = 134,121 MW**
  - 166 units with SCR = 93,776 MW = 70%
  - 60 units with SNCR = 17,868 MW = 13%
  - 135 units without SCR/SNCR = 22,477 MW = 17%

Basis – ERTAC (5/6/2014, 5/8/2014), NEI (for Nuclear)

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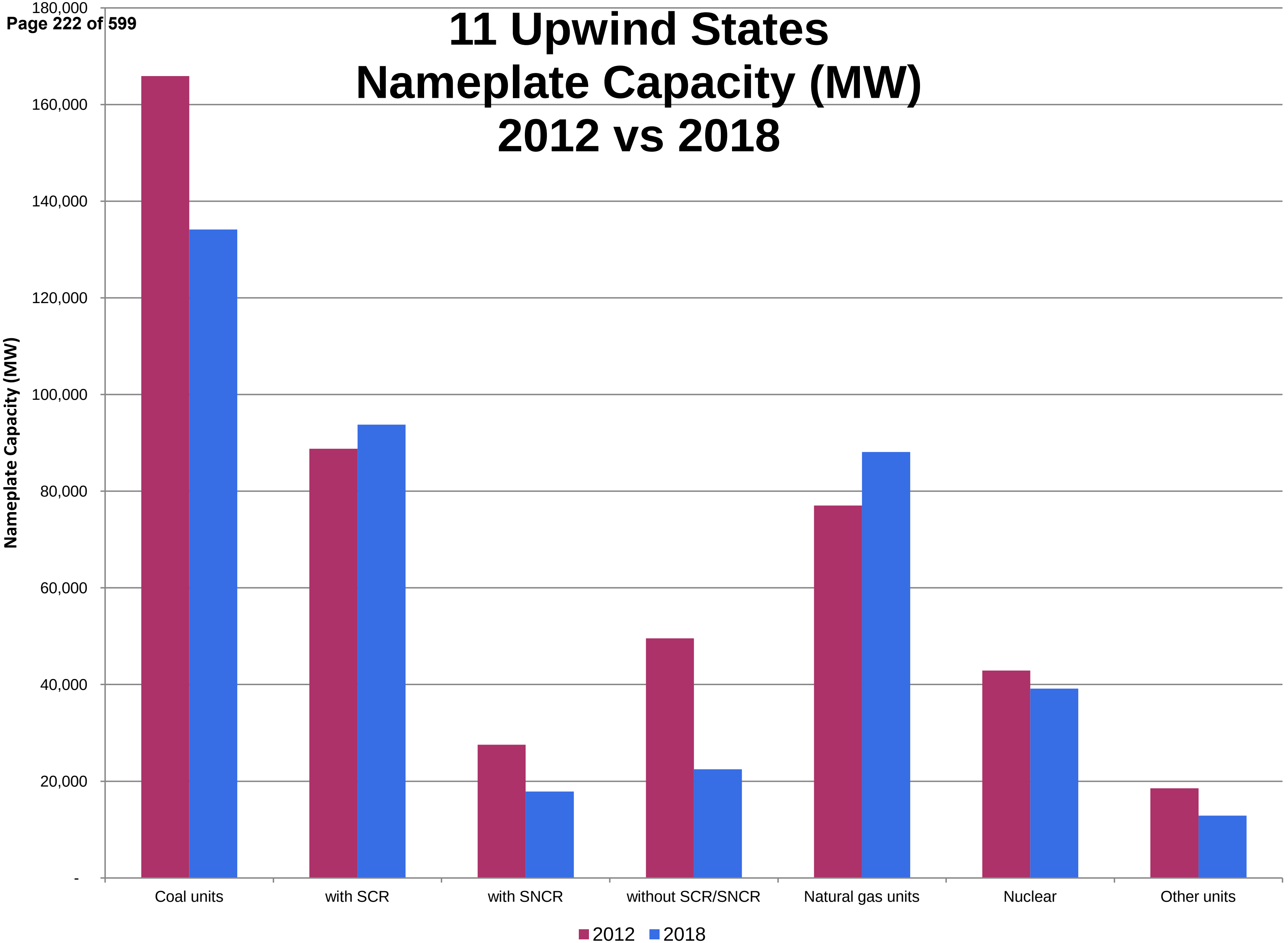
11 Upwind States Nameplate Capacity (MW) 2012 vs 2018



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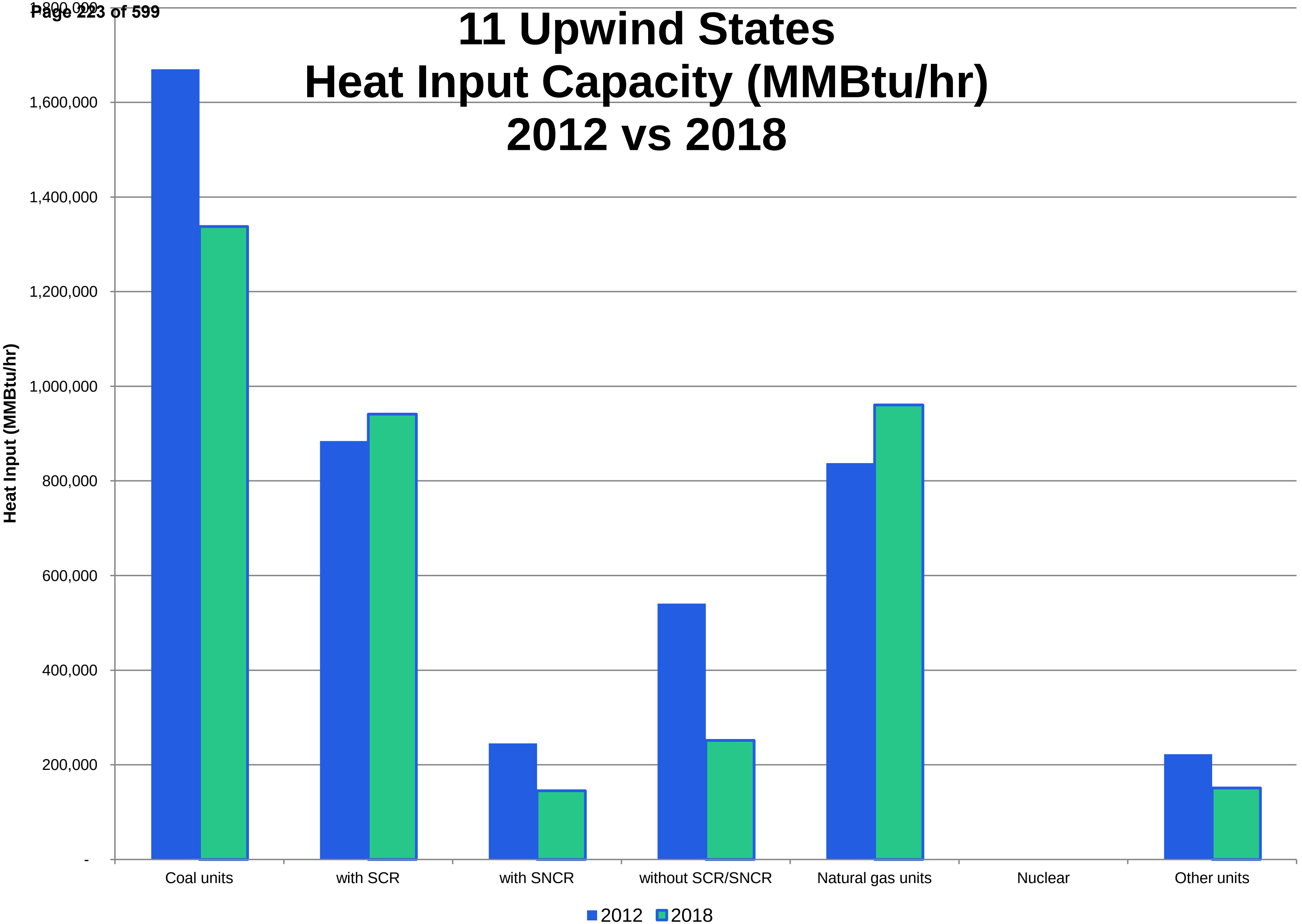
11 Upwind States
Heat Input Capacity (MMBtu/hr)
2012 vs 2018



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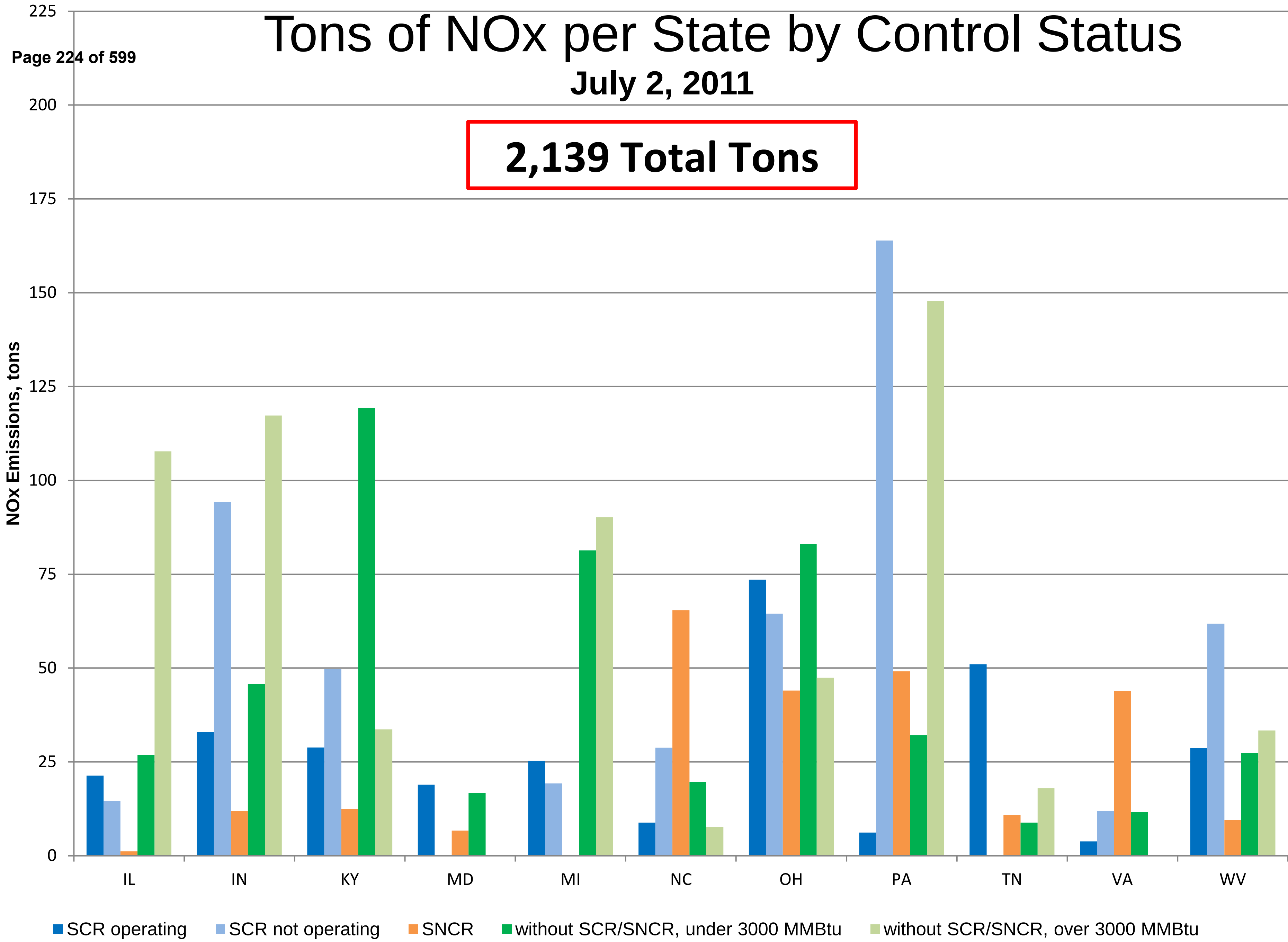
Tons of NOx per State by Control Status

July 2, 2011



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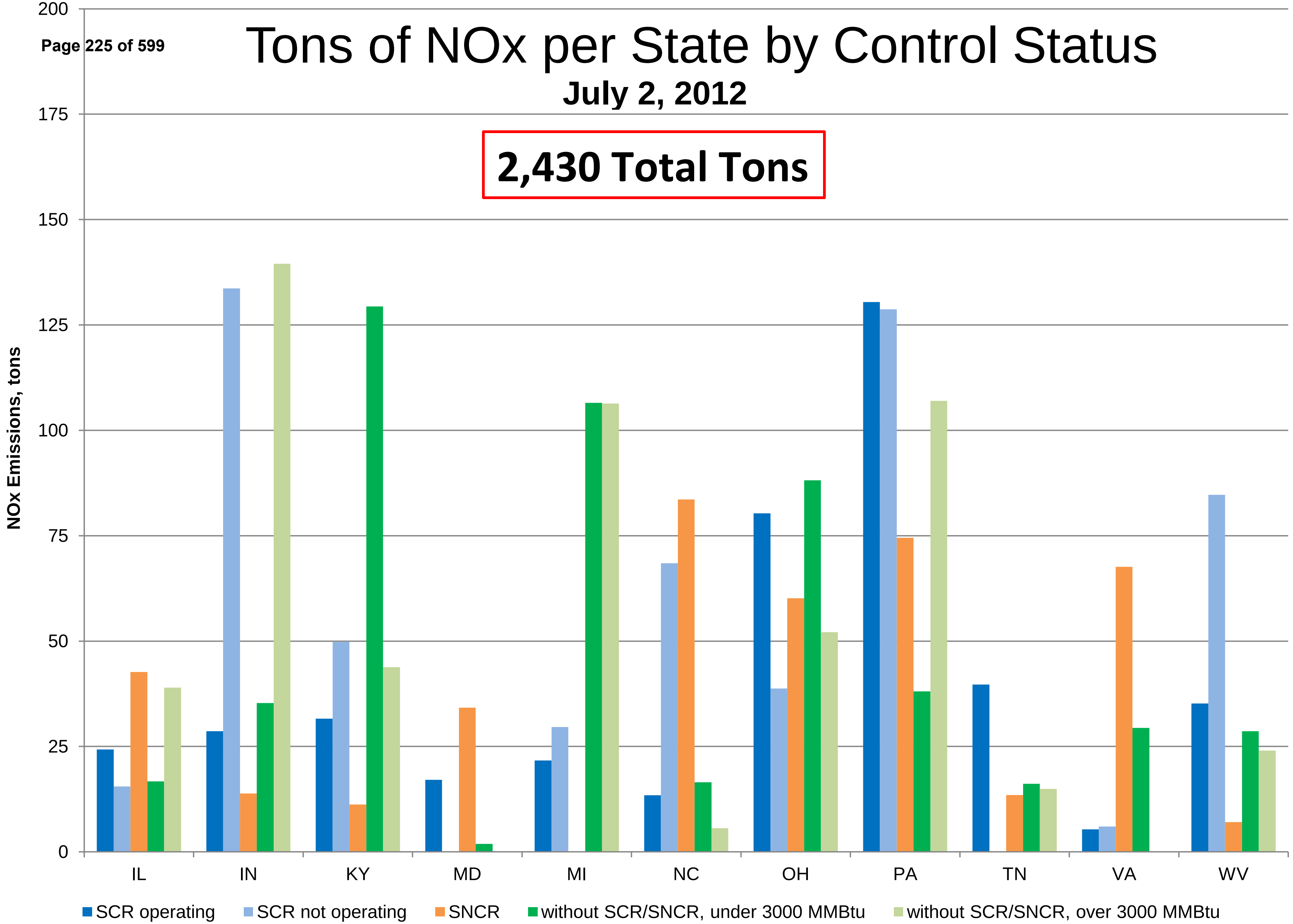

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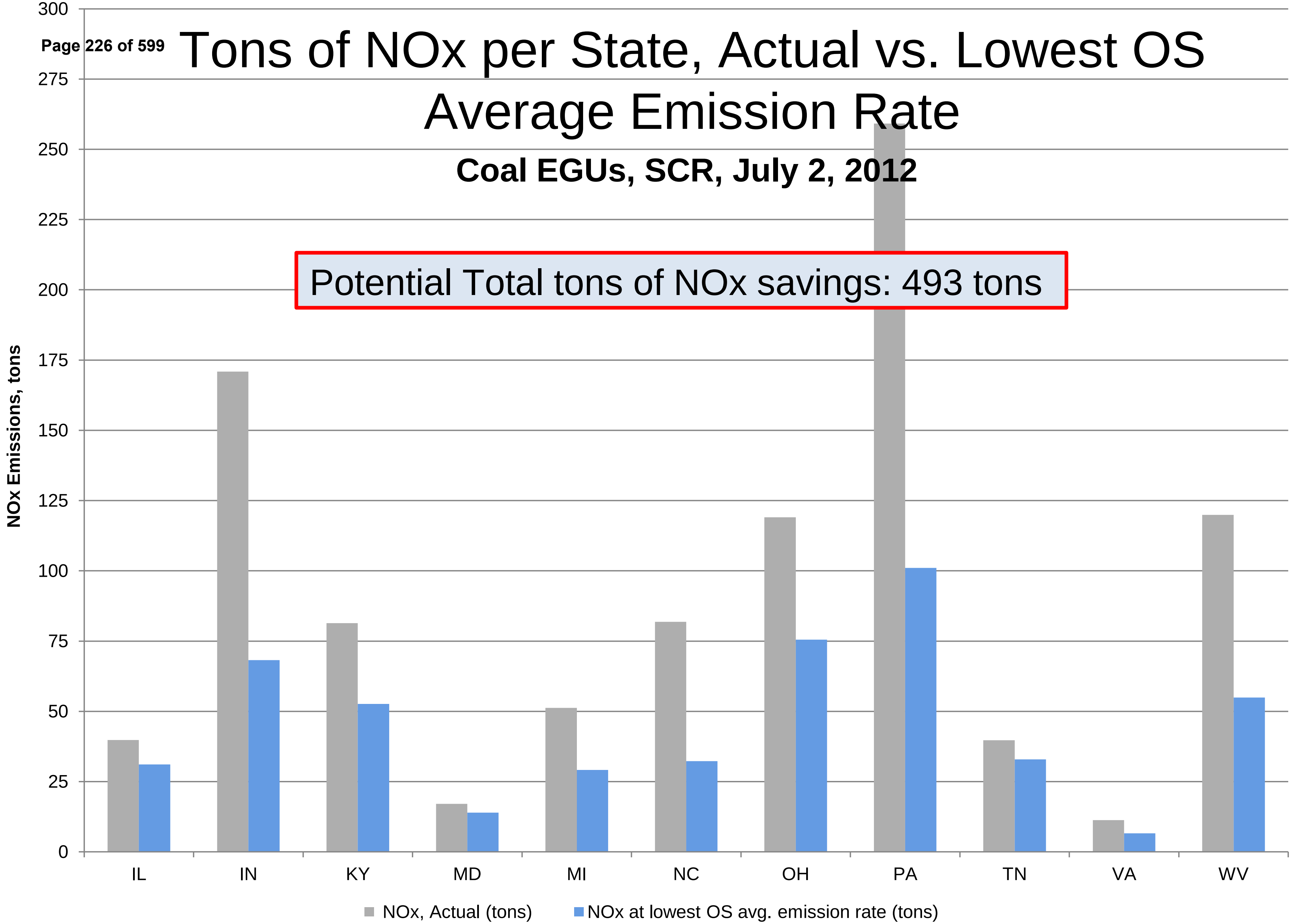
Tons of NOx per State, Actual vs. Lowest OS Average Emission Rate

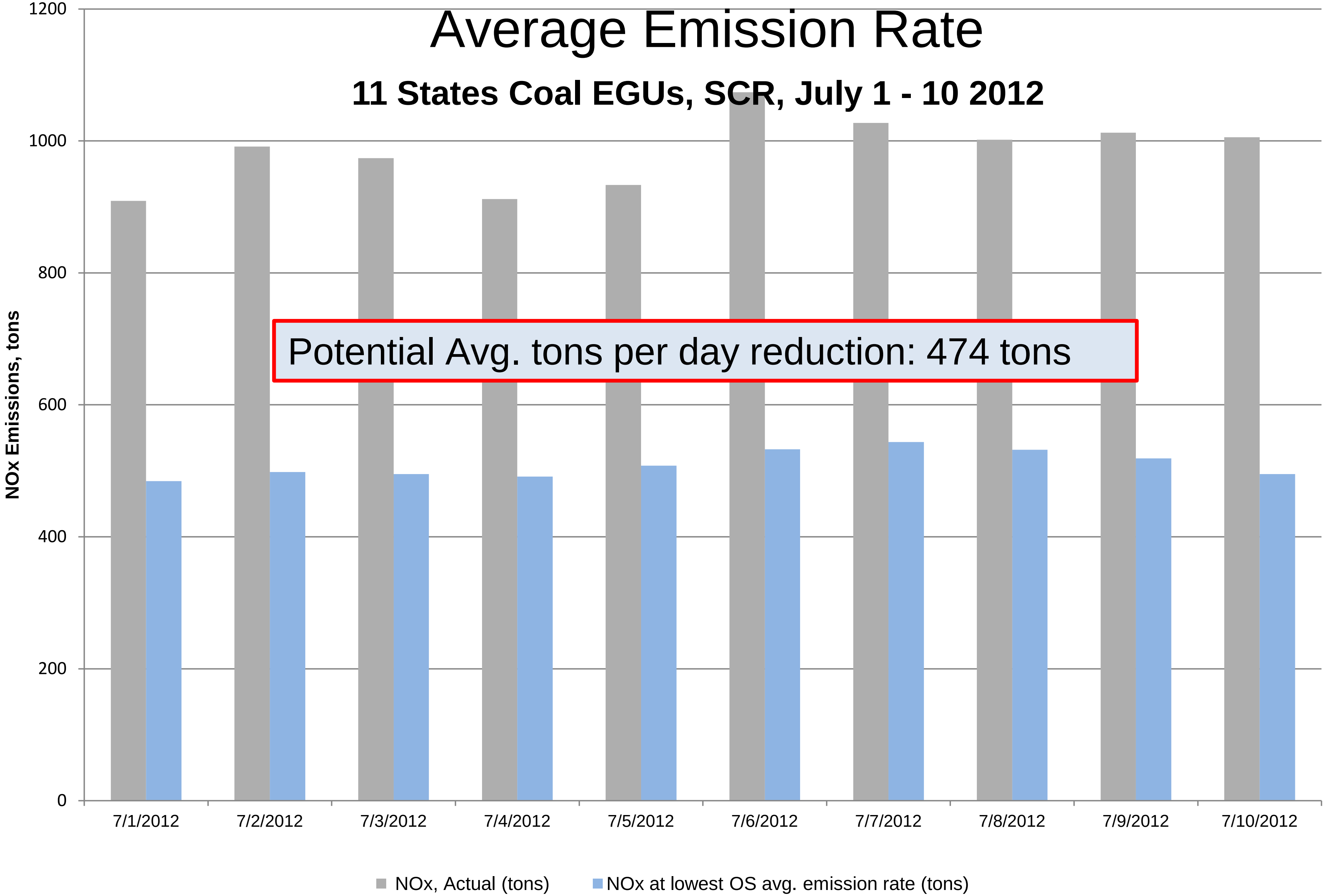
Coal EGUs, SCR, July 2, 2012



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate

11 States Coal EGUs, SCR, July 1 - 10 2012



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11 State Summary

After performing similar analysis of EGUs in IL, IN, KY, MD, MI, NC, OH, PA, TN, VA and WV, the following potential total tons of lost NOx reductions was calculated:

- On July 2, 2012 actual NOx emissions in the 11 states (listed above) was 991 tons
  - If EGUs in those states were to have run their controls at the best rates observed in the data, emissions would have been 498 tons
  - This represents a single day loss of NOx reductions of 493 tons on that day

- During the 10 day episode between July 1 and 10, 2012 actual NOx emissions in the 11 states (listed above) was 9,840 tons
  - If EGUs in those states were to have run their controls at the best rates observed in the data, emissions would have been 5,099 tons
  - This represents a loss of NOx reductions of 4,741 tons over that 10-day episode

Part 6

Potential Lost Ozone Benefits from Controls Running Less Effectively in Recent Years

Preliminary Photochemical Modeling

Maryland Monitors

How Might This Affect Ozone?

- Maryland has performed several very preliminary model runs to look at how much running EGU controls inefficiently might increase ozone levels
- Three runs:
  - Scenario 2B – A worst case run
    - Assumes SCR and SNCR controls are not run at all
  - Scenario 3B – A worst data run
    - Assumes SCR and SCR units all run at worst rates seen in CAMD data - 2005 to 2012
  - Scenario 3C – Based upon CAMD data analysis for EGU performance in 2011 and 2012
    - Assumes that units that had higher ozone season emission rates were operating at the best ozone season rates observed since 2005

Lost Ozone Benefits
Potential PPB Increases

Maryland Monitors	Potential Increased Ozone in 2018 – 3 EGU Control Scenarios		
County	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Anne Arundel	4.5	1.0	0.5
Baltimore	4.2	1.1	0.5
Baltimore	5.1	1.2	0.6
Baltimore (City)	4.3	1.2	0.5
Calvert	5.3	1.0	0.5
Carroll	4.6	0.9	0.5
Cecil	5.3	1.3	0.6
Charles	7.4	1.4	0.7
Frederick	4.2	0.9	0.5
Garrett	17.2	3.8	2.4
Harford	4.3	1.2	0.5
Harford	3.9	1.1	0.4
Kent	4.0	0.9	0.4
Montgomery	4.7	0.9	0.5
Prince George's	4.5	1.0	0.5
Prince George's	4.5	0.9	0.5
Washington	6.9	1.3	0.7

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Lost Ozone Benefit – 2018 Design Values

… EPA will propose a new ozone standard soon … 60 to 70 ppb range … designations to most likely be based upon 2014 to 2016 or 2015 to 2017 data

Projected to be Clean in 2018 … Potentially at Risk		Increased Ozone in 2018 – 3 EGU Control Scenarios		
Maryland Counties	**2018 – Controls Running Well (Scenario 3A)**	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Anne Arundel	67.5	72.1	68.5	68.0
Baltimore	71.1	75.3	72.2	71.6
Baltimore	63.7	68.7	64.9	64.2
Baltimore (City)	56.7	61.0	57.9	57.2
Calvert	60.2	65.4	61.2	60.7
Carroll	65.6	70.2	66.5	66.1
Cecil	72.3	77.6	73.6	72.9
Charles	61.0	68.4	62.4	61.7
Frederick	64.1	68.2	65.0	64.6
Garrett	58.7	75.9	62.6	61.1
Harford	77.3	81.6	78.5	77.8
Harford	75.2	79.1	76.3	75.6
Kent	65.0	69.0	66.0	65.5
Montgomery	67.6	72.3	68.6	68.2
Prince George's	67.2	71.8	68.2	67.7
Prince George's	66.6	71.1	67.5	67.1
Washington	61.8	68.7	63.1	62.5

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EGU Data Package #3

Operation of Existing SCR, SNCR

Michigan

Sample of draft data and analyses developed by the Maryland Department of the Environment

Contact: Tad Aburn, Air Director, MDE
(410) 537-3255

September 18, 2014

Purpose

- Maryland is the only Moderate nonattainment area in the East for the 75 ppb ozone standard.
  - This means that Maryland is the only state required to submit an attainment SIP
  - Only state required to perform attainment modeling.
- We are now beginning to build our “SIP Quality” modeling platform.
- One major issue that our data analyses have uncovered is that many EGU units appear to not be running their control equipment in recent years as efficiently as they have demonstrated they can do in earlier years. This issue is driven by recent changes in the energy market, reduced coal capacity, inexpensive allowances and a regulatory structure driven by ozone season caps not daily performance. In many states, including Maryland, this has lead to controls not always being used efficiently on the days when they are needed the most … this is perfectly legal.
- This is a critical issue that we would like to continue to discuss with you. There appears to be an interest from the private sector to discuss this issue and see if a common sense fix can be designed. Maryland believes this fix would be relatively cost-effective compared to the capital cost of the control technologies.
- MDE has focused our analyses on two of the worst large, regional scale ozone episodes from recent years: July 1-8, 2011 and July 1-10, 2012.
- The primary data used in these analyses include:
  - CEMS data from CAMD
  - Emissions and projection data from ERTAC
  - Other data we have received from individual states
- More detailed data and analyses and spreadsheets are available upon request.

How the Data Analyses Were Built

- Maryland began the data analyses in late 2012
  - Looked at EGUs in the 9 upwind states named in the 176A Petition (IL, IN, KY, MI, NC, OH, TN, VA, WV) … MD and PA
- Shared a draft package with Air Directors on April 21, 2014
  - This package focused on a bad ozone episode: July 1 – 8, 2011
- Shared a second draft package with Air Directors on May 13, 2014
  - This package focused on second bad ozone episode: July 1 – 10, 2012
  - This package also included update to specific material after receiving comments from numerous states
- The 2011 and 2012 episodes analyzed capture two of the worst regional ozone periods in 2011 and 2012
  - Other states, like Wisconsin and Delaware have done similar analyses and reached similar conclusions
- This is the third draft package, and builds on to the prior two draft packages, while incorporating input from individual states and updates to ERTAC.
- This third draft package also includes preliminary photochemical modeling performed by MDE to look at the potential loss of ozone reduction benefits.

Help Us QA the Data

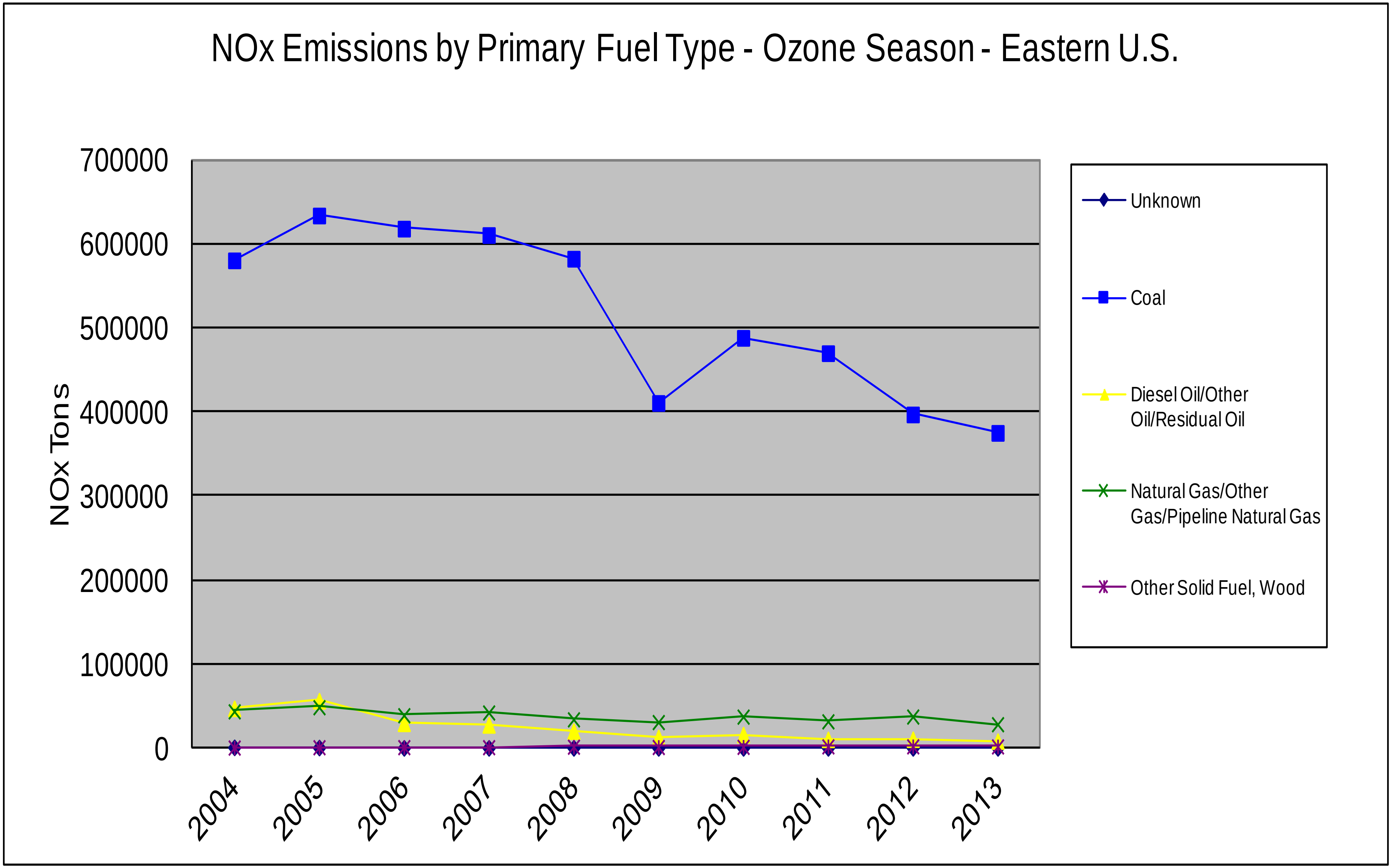
- We have used readily available data, like the CAMD and ERTAC data, but we recognize that these data sources can be out of date, or not include recent changes.
  - We hope you can help us with making sure we have the best possible data.

- This package reflects recently updated data, including but not limited to:
  - CAMD updates
  - May 8, 2014 ERTAC updates
  - PA comments to OTC, forwarded to MDE, Spreadsheets detailing "EGU Shutdowns, EGU Controls and New Natural Gas Power Projects" for the state of PA. Sent from Randy Bordner, Environmental Group Manager - Bureau of Air Quality, PA Department of Environmental Protection to Andy Bodnarik, OTC. Received as FWD from Andy Bodnarik on 4/23/2014
  - VA comments to MDE, "Electric Generation Sector Summary for Virginia" received from Thomas R. Ballou, Director - Office of Air Data Analysis and Planning, VA Department of Environmental Quality on 5/12/2014

Part 1

Background:
Generation in 2012 and 2018
Projected Changes

Why Coal?



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Michigan EGUs, 2012

- Total number of units = 128
- Total heat input capacity = 236,470 MMBtu/hr = 25,603 MW
- Total State MW Capacity in %
  - **Total number of Coal units = 52 = 43%**
  - Total number of NG units = 67 = 34%
  - Total number of other (oil, etc.) units = 5 = 6%
  - Total number of Nuclear units = 4= 17%
- **Total Capacity Coal = 10,931 MW**
  - 6 units with SCR = 3,646 MW = 33%
  - 0 units with SNCR = 0 MW = 0%
  - 46 units without SCR/SNCR = 7,285 MW = 67%

Basis – CAMD (as of 5/13/2014), NEI (for Nuclear), ERTAC (5/6/2014, 5/8/2014)

DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Capacity and Fuel: 2012 to 2018

A detailed review of ERTAC data for 2018 was completed, and an evaluation of the following characteristics performed.

- Total Number of units
- Heat input capacity - MMBtu/hr
- Nameplate capacity – MW
- Presence of advanced post combustion controls – SCR, SNCR
- Fuel switching
- Shutdown, retirements

Michigan EGUs, 2018

- Total number of units = 144
- Total heat input capacity = 278,147 MMBtu/hr = 30,035 MW
- Total State MW Capacity in %
  - **Total number of Coal units = 40 = 32%**
  - Total number of NG units = 100 = 54%
  - Total number of other (oil, etc.) units = 0 = 0%
  - Total number of Nuclear units = 4 = 14%
- **Total Capacity Coal = 9,675 MW**
  - 8 units with SCR = 4,872 MW = 50%
  - 0 units with SNCR = 0 MW = 0%
  - 32 units without SCR/SNCR = 4,803 MW = 50%

Basis – ERTAC (5/6/2014, 5/8/2014), NEI (for Nuclear)

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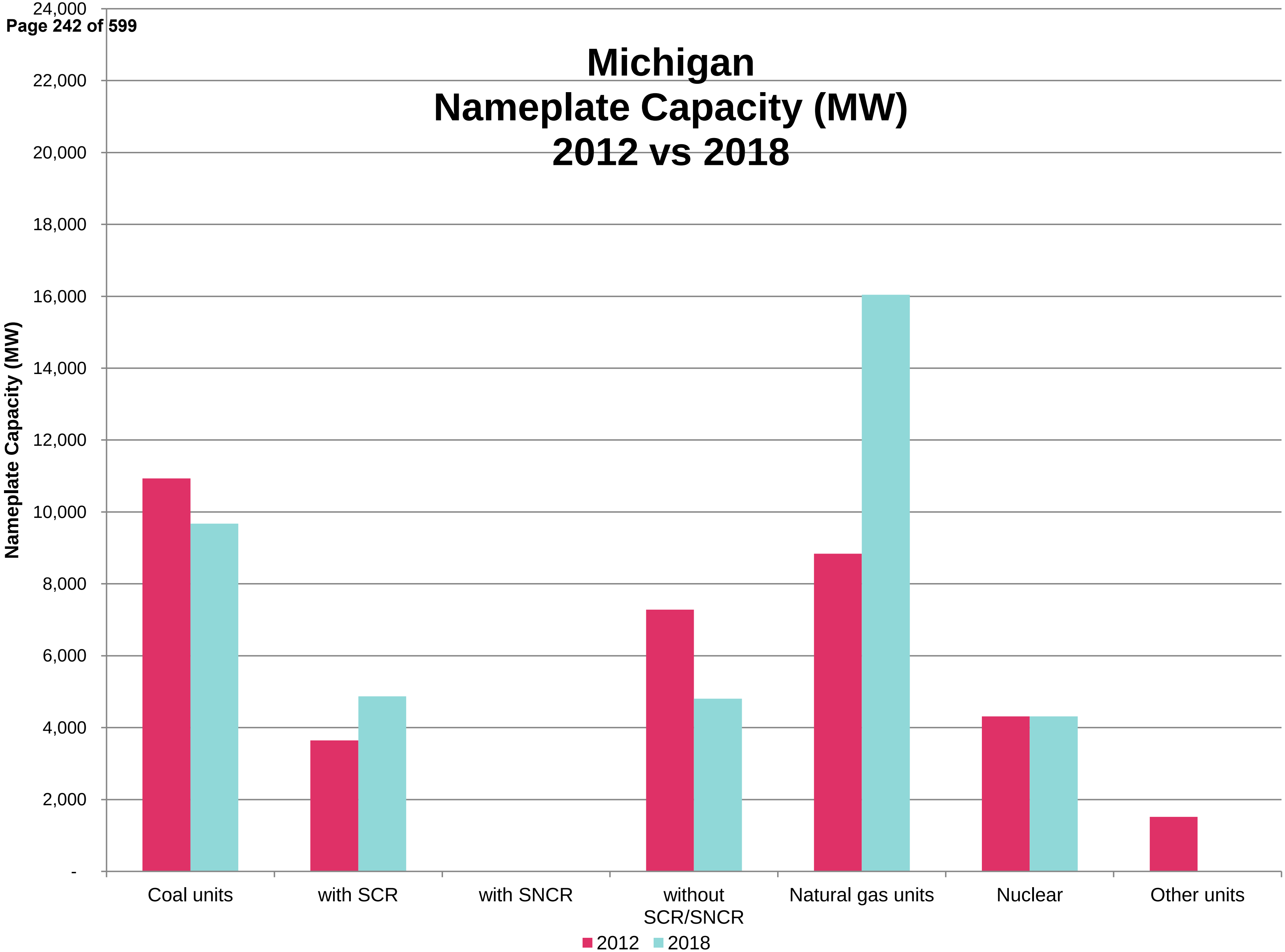

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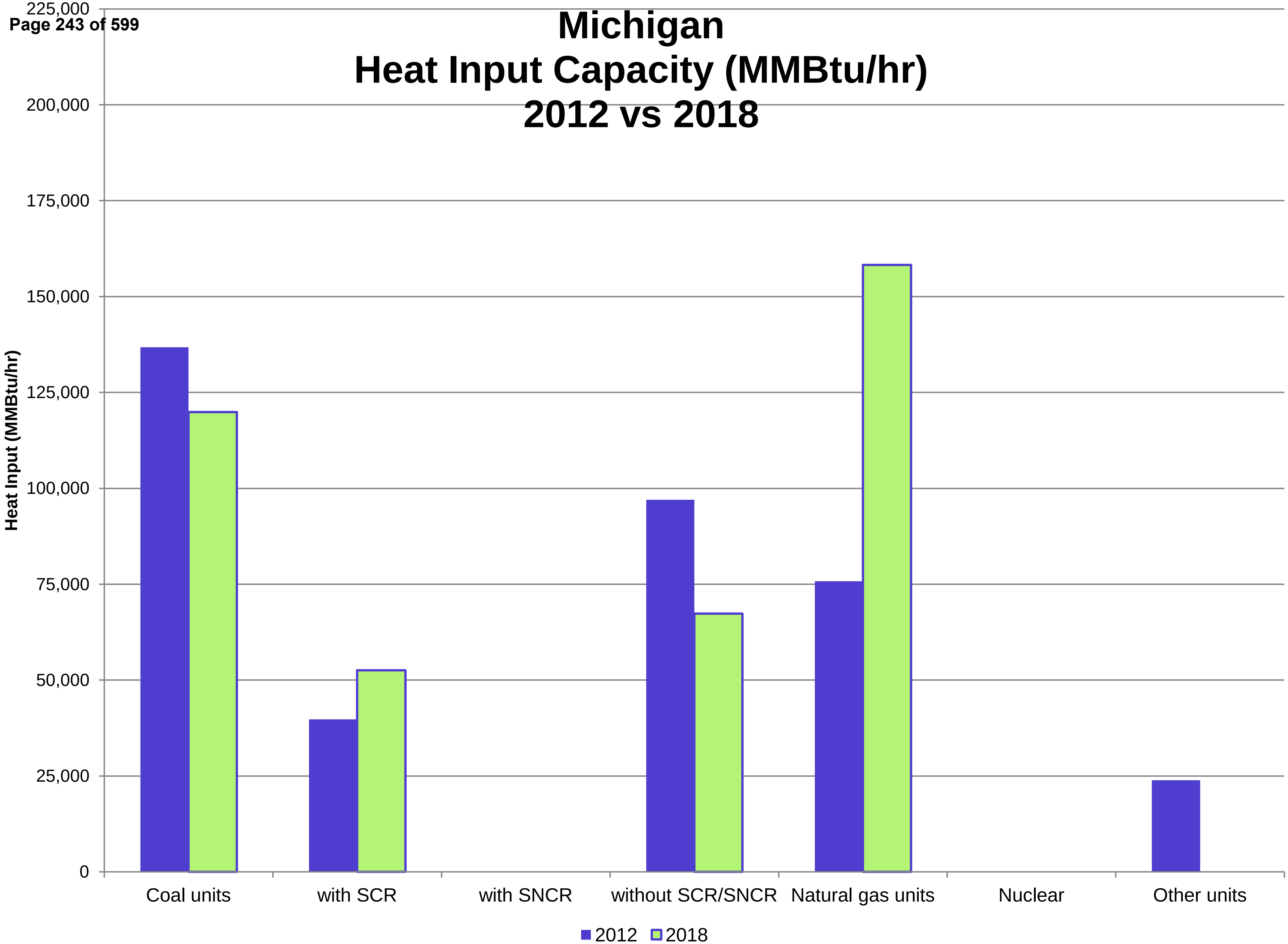

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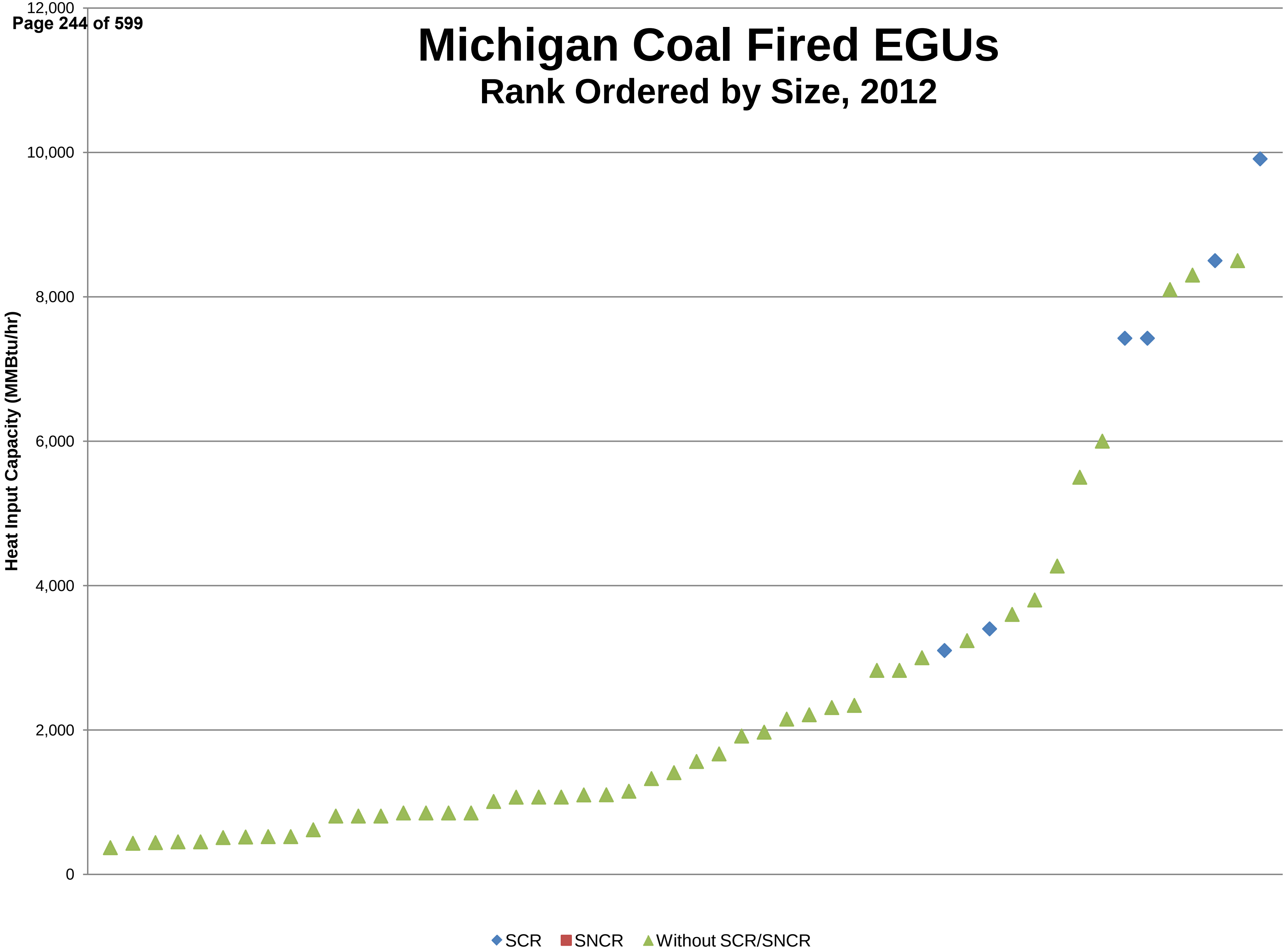

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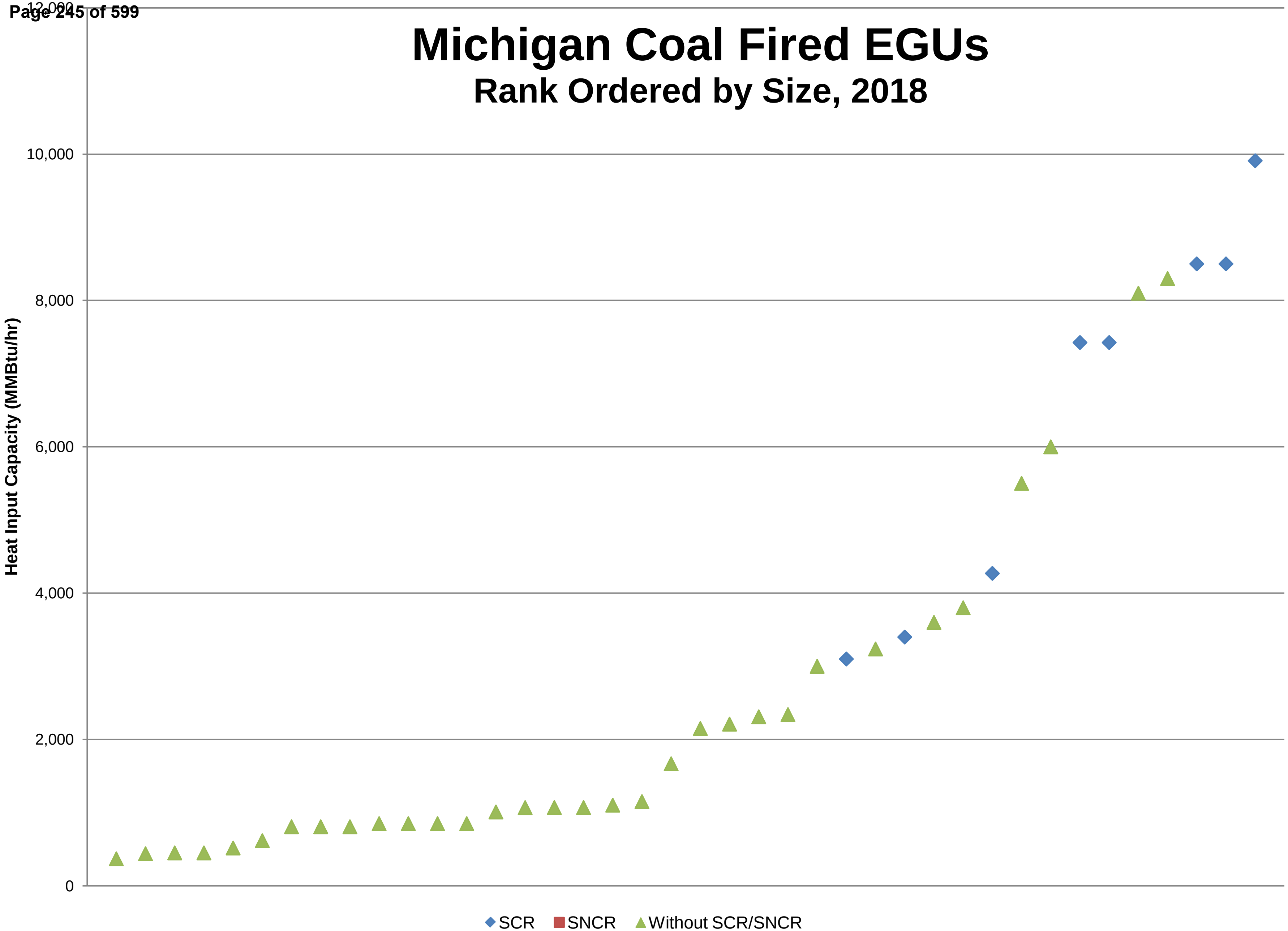


DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

MI : Large (> 3000 MMBtu/hr) Coal-Fired EGU NOx Emissions Rate Analysis

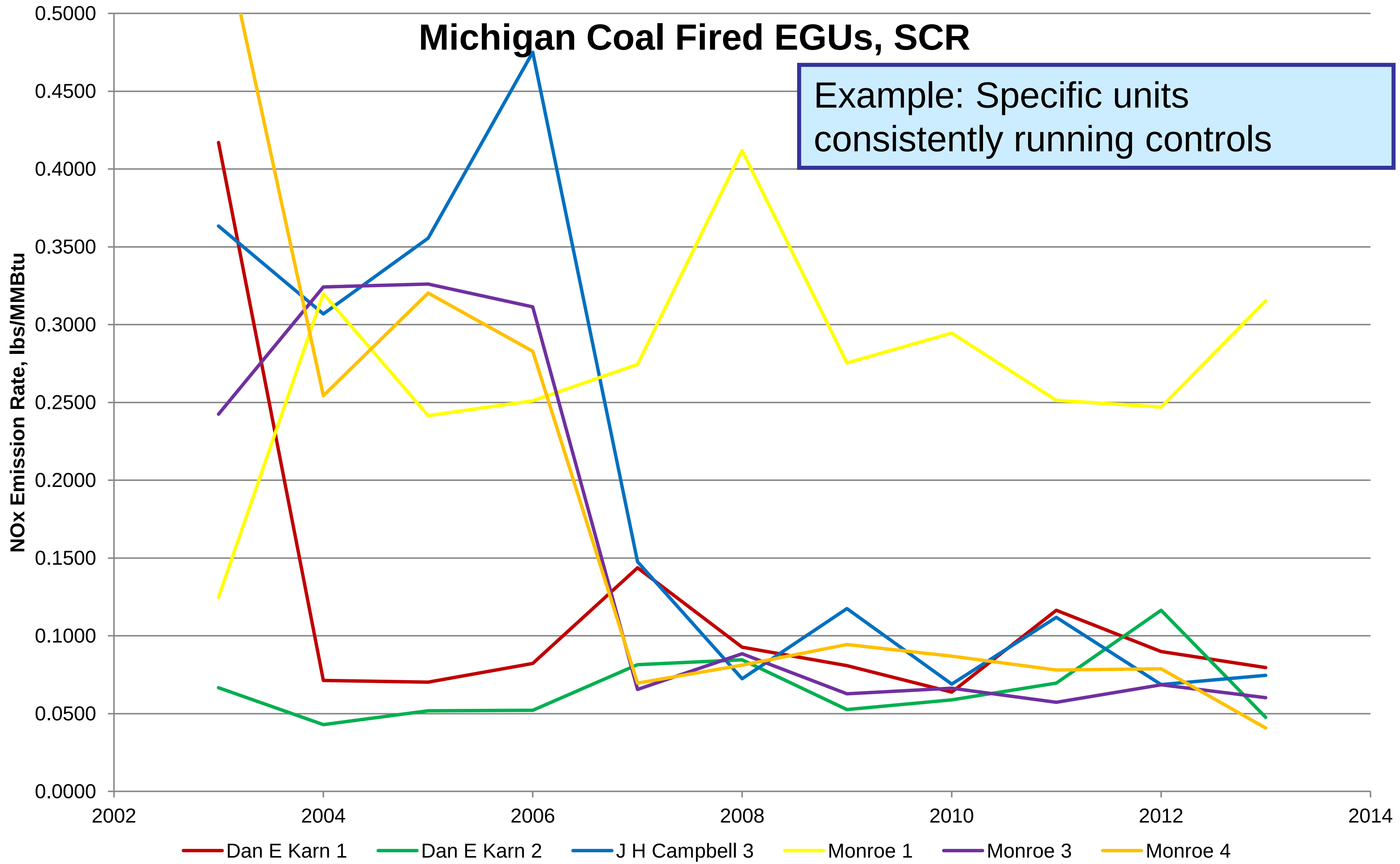
	Facility Name	Unit ID	Lowest OS Emission Rate Year	Lowest OS Emission Rate (lbs/MMBtu)	2007 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2007 OS ER (% Change)	2011 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2011 OS ER (% Change)	Comments/ ERTAC Closure Date
Controlled with SCR	Dan E Karn	1	2010	0.0639	0.1437	125	0.1165	82	Close 2015 (media)
	Dan E Karn	2	2004	0.0429	0.0815	90	0.0696	62	Close 2015 (media)
	J H Campbell	3	2012	0.0687	0.1477	115	0.1119	63	
	Monroe	1	2003	0.1249	0.2744	120	0.2514	101	
	Monroe	3	2011	0.0573	0.0655	14	0.0573	0	
	Monroe	4	2007	0.0696	0.0696	0	0.0781	12	
Controlled with SNCR	N/A								
Adding Controls or Fuel Switches by 2019	J H Campbell	2	2012	0.2572	0.3058	19	0.2926	14	SCR (2014)
	Monroe	2	2012	0.2589	0.3068	19	0.2851	10	SCR (2014)
No Controls or Fuel Switches by 2019	Belle River	1	2006	0.1806	0.2223	23	0.209	16	
	Belle River	2	2003	0.1634	0.1723	5	0.1976	21	
	J H Campbell	1	2004	0.1566	0.16	2	0.2229	42	
	River Rouge	2	2010	0.1647	0.1726	5	0.2688	63	
	River Rouge	3	2012	0.2595	0.3368	30	0.332	28	
	St. Clair	6	2005	0.1363	0.1445	6	0.1617	19	
	St. Clair	7	2006	0.1633	0.1871	15	0.1888	16	
	Trenton Channel	9A	2007	0.1726	0.1726	0	0.1838	6	
Retiring by 2017	N/A								

	Facility Name	Unit ID	Lowest OS Emission Rate Year	Lowest OS Emission Rate (lbs/MMBtu)	2007 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2007 OS ER (% Change)	2011 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2011 OS ER (% Change)	Comments/ ERTAC Closure Date
Controlled with SCR	N/A								
Controlled with SNCR	N/A								
No Controls or Fuel Switches by 2019	Eckert Station	4	2005	0.2008	0.2086	4	0.2312	15	
	Eckert Station	5	2007	0.1972	0.1972	0	0.2215	12	
	Eckert Station	6	2009	0.1973	0.2162	10	0.2262	15	
	Endicott Generating	1	2007	0.1592	0.1592	0	0.1888	19	
	Erickson	1	2009	0.1852	0.1954	6	0.2241	21	
	J B Sims	3	2009	0.1939	0.217	12	0.2335	20	
	Presque Isle	5	2012	0.2932	0.3797	30	0.3511	20	
	Presque Isle	6	2012	0.3039	0.368	21	0.3523	16	
	Presque Isle	7	2012	0.327	0.4032	23	0.3912	20	
	Presque Isle	8	2012	0.3218	0.4064	26	0.3897	21	
	Presque Isle	9	2012	0.3248	0.4045	25	0.3884	20	
	Shiras	3	2003	0.1304	0.1453	11	0.1562	20	
	St. Clair	1	2010	0.3012	0.3729	24	0.3078	2	
	St. Clair	2	2006	0.306	0.3302	8	0.4116	35	
	St. Clair	3	2004	0.2733	0.3908	43	0.428	57	
	St. Clair	4	2009	0.3199	0.3282	3	0.3391	6	
	TES Filer City Station	1	2008	0.3767	Not Operating	N/A	0.424	13	
	TES Filer City Station	2	2008	0.3566	Not Operating	N/A	0.3809	7	
	Trenton Channel	16	2012	0.3991	0.4441	11	0.622	56	
	Trenton Channel	17	2005	0.4304	0.4434	3	0.631	47	
	Trenton Channel	18	2005	0.4282	0.4389	2	0.6296	47	
	Trenton Channel	19	2003	0.4272	0.4459	4	0.6306	48	
	Wyandotte	7	2012	0.071	0.373	425	0.1768	149	NG 2012 (media)
	Wyandotte	8	2007	0.0729	0.0729	0	0.1936	166	NG 2012 (media)
Retiring by 2017	B C Cobb	4	2006	0.3389	0.4203	24	0.3651	8	2015
	B C Cobb	5	2005	0.1581	0.1707	8	0.1694	7	2015
	Eckert Station	1	2006	0.1972	0.2096	6	0.2555	30	2016
	Eckert Station	2	2005	0.2316	0.2381	3	0.2696	16	2016
	Eckert Station	3	2010	0.1448	0.1602	11	0.1638	13	2016
	Harbor Beach	1	2007	0.2812	0.2812	0	0.6254	122	2015
	J C Weadock	7	2004	0.2671	0.337	26	0.2886	8	2015
	J C Weadock	8	2006	0.2948	0.3329	13	0.3164	7	2015
	J R Whiting	1	2004	0.2185	0.2443	12	0.2614	20	2015
	J R Whiting	2	2004	0.236	0.2425	3	0.2576	9	2015
	J R Whiting	3	2005	0.2214	0.2358	7	0.2618	18	2015
	James De Young	5	2006	0.3778	0.4854	28	0.3921	4	2016

Part 2

Operation of Controls:
Changes in Control Efficiency
2003 to 2013

Average Ozone Season Emission Rates at Specific Units by Year



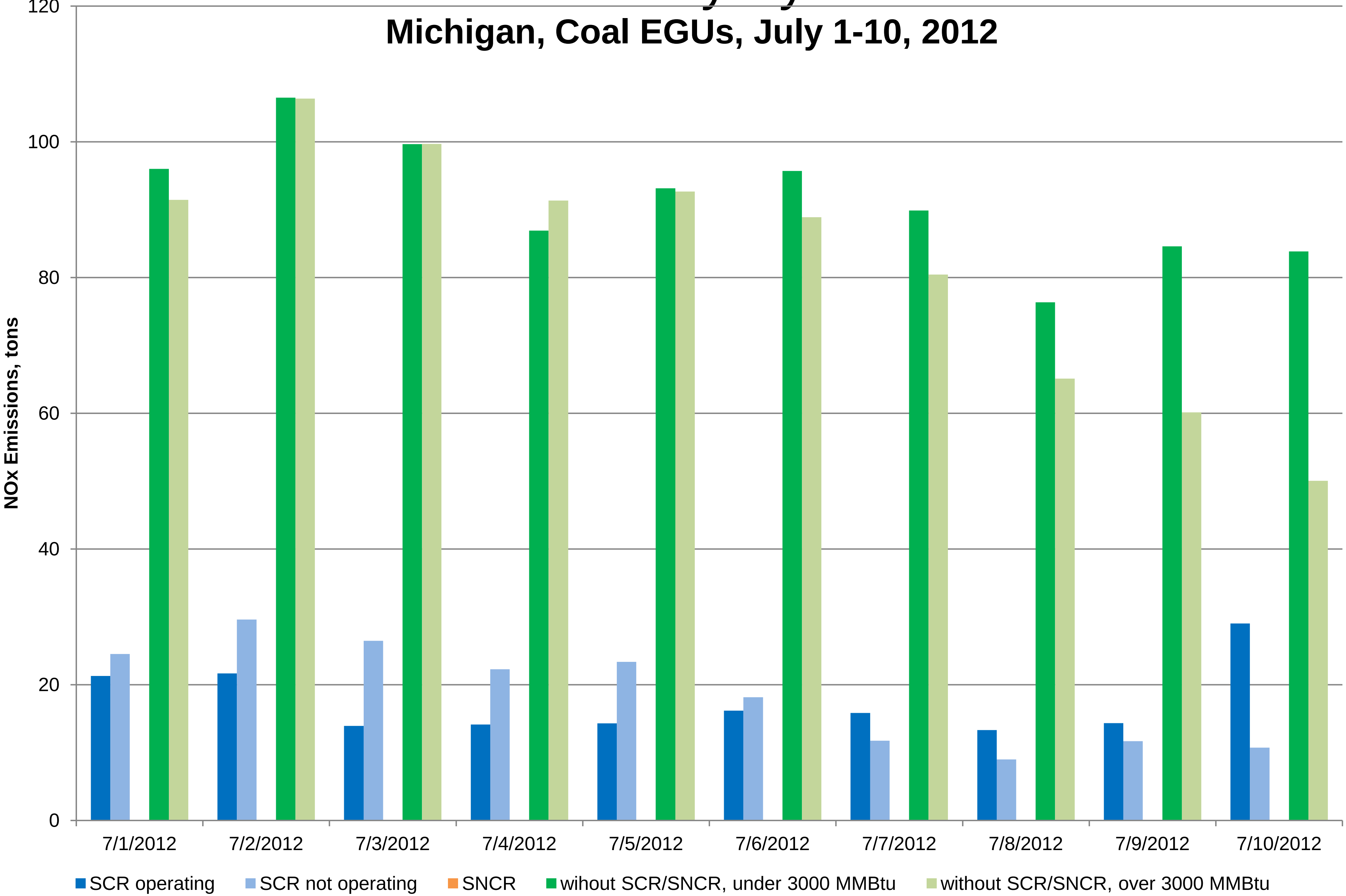
DRAFT – May 13, 2014– Requesting QA of data. For discussion purposes only.

Part 3

July 1 to 10, 2012 Ozone Episode:

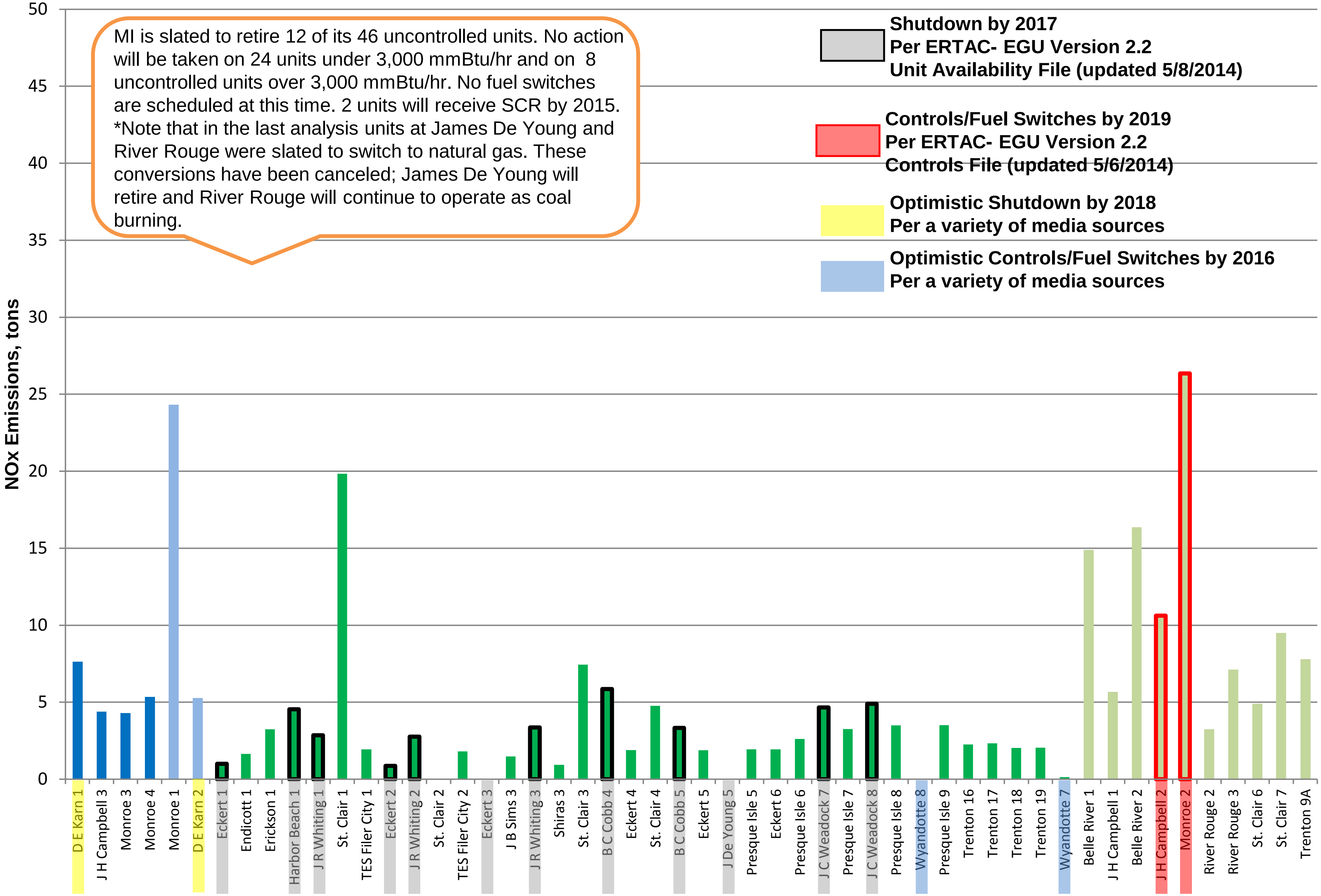
Analysis of Emissions and Controls

Tons of NOx Per Day By Control Status



DRAFT – May 13, 2014 – Requesting QA of data. For discussion purposes only.

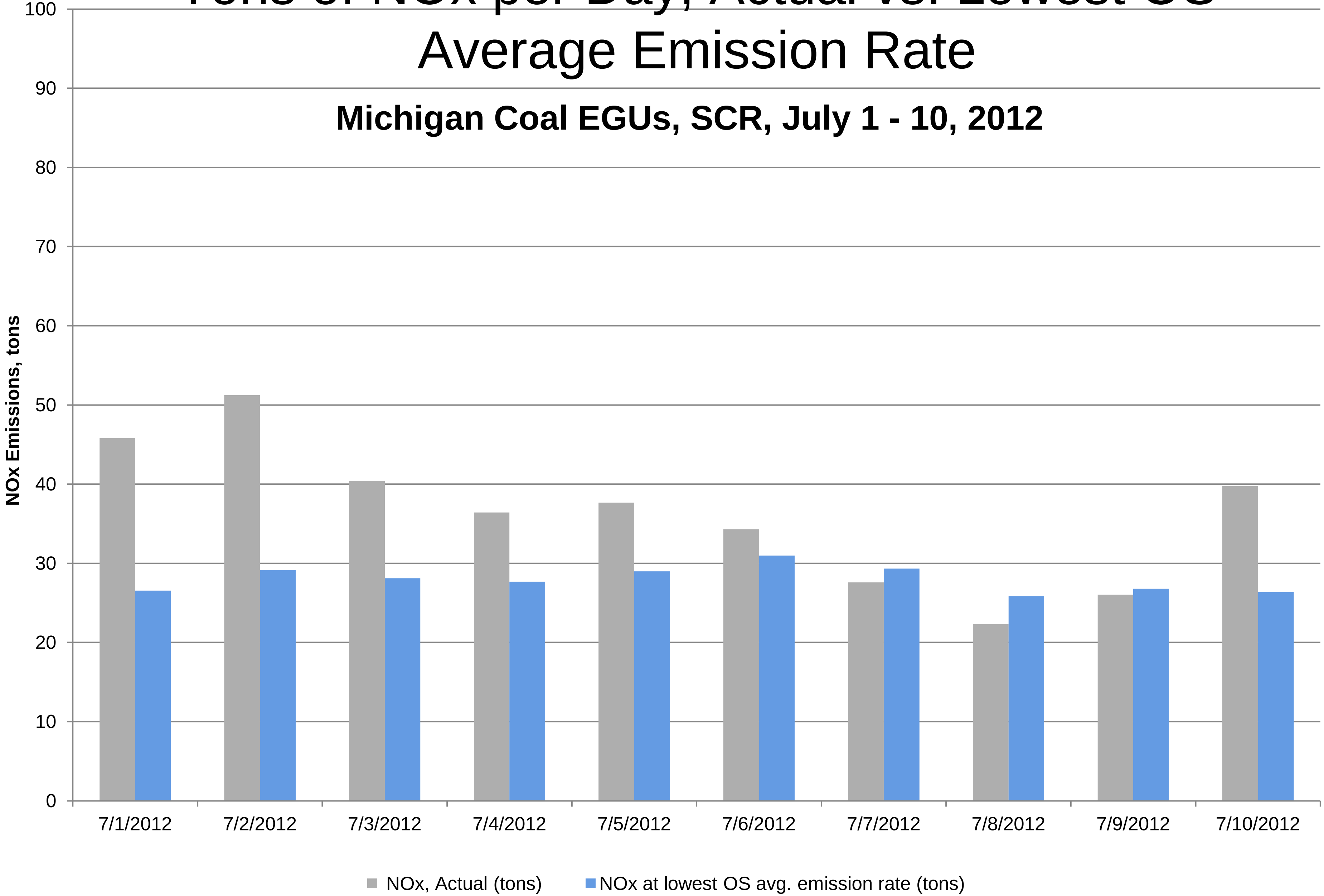
MI – Tons of NOx Per Unit By Control Status, July 2, 2012



DRAFT – May 13, 2014 – Requesting QA of data. For discussion purposes only.

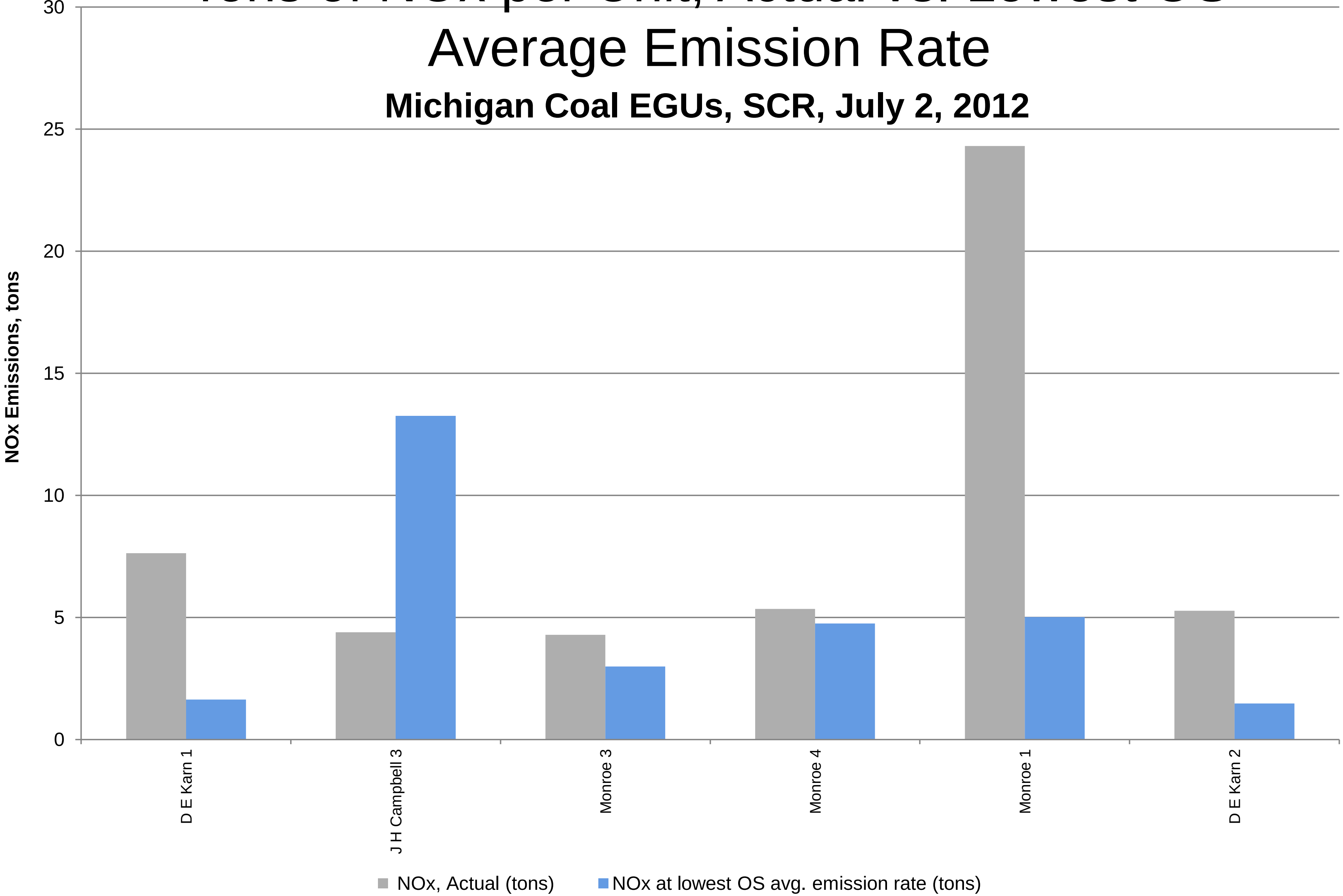
Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate

Michigan Coal EGUs, SCR, July 1 - 10, 2012



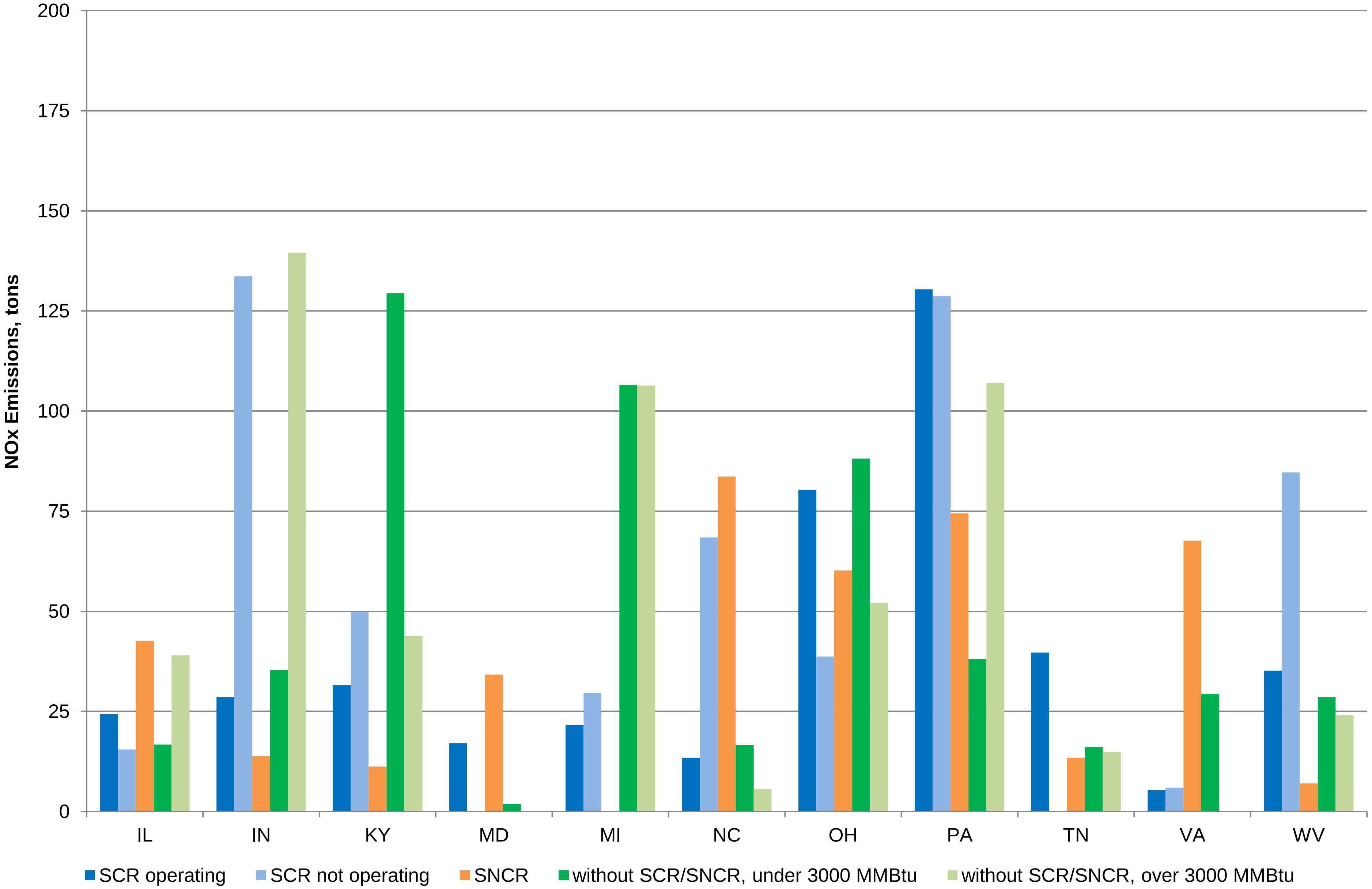
DRAFT – May 13, 2014 – Requesting QA of data. For discussion purposes only.

Tons of NOx per Unit, Actual vs. Lowest OS Average Emission Rate



DRAFT – May 13, 2014 – Requesting QA of data. For discussion purposes only.

July 2, 2012 – Tons of NOx per State by Control Status



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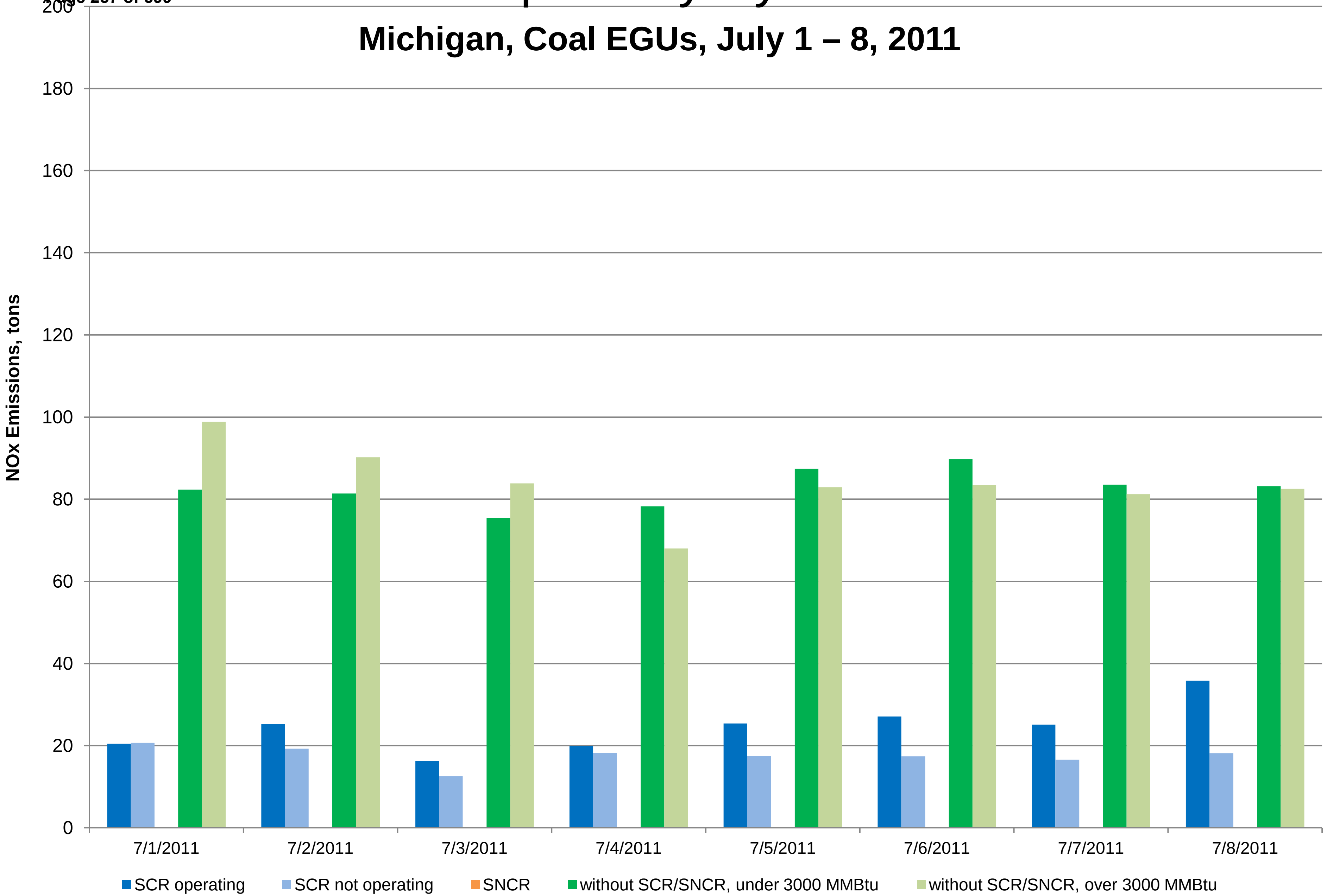
Part 4

July 1 to 8, 2011 Ozone Episode:

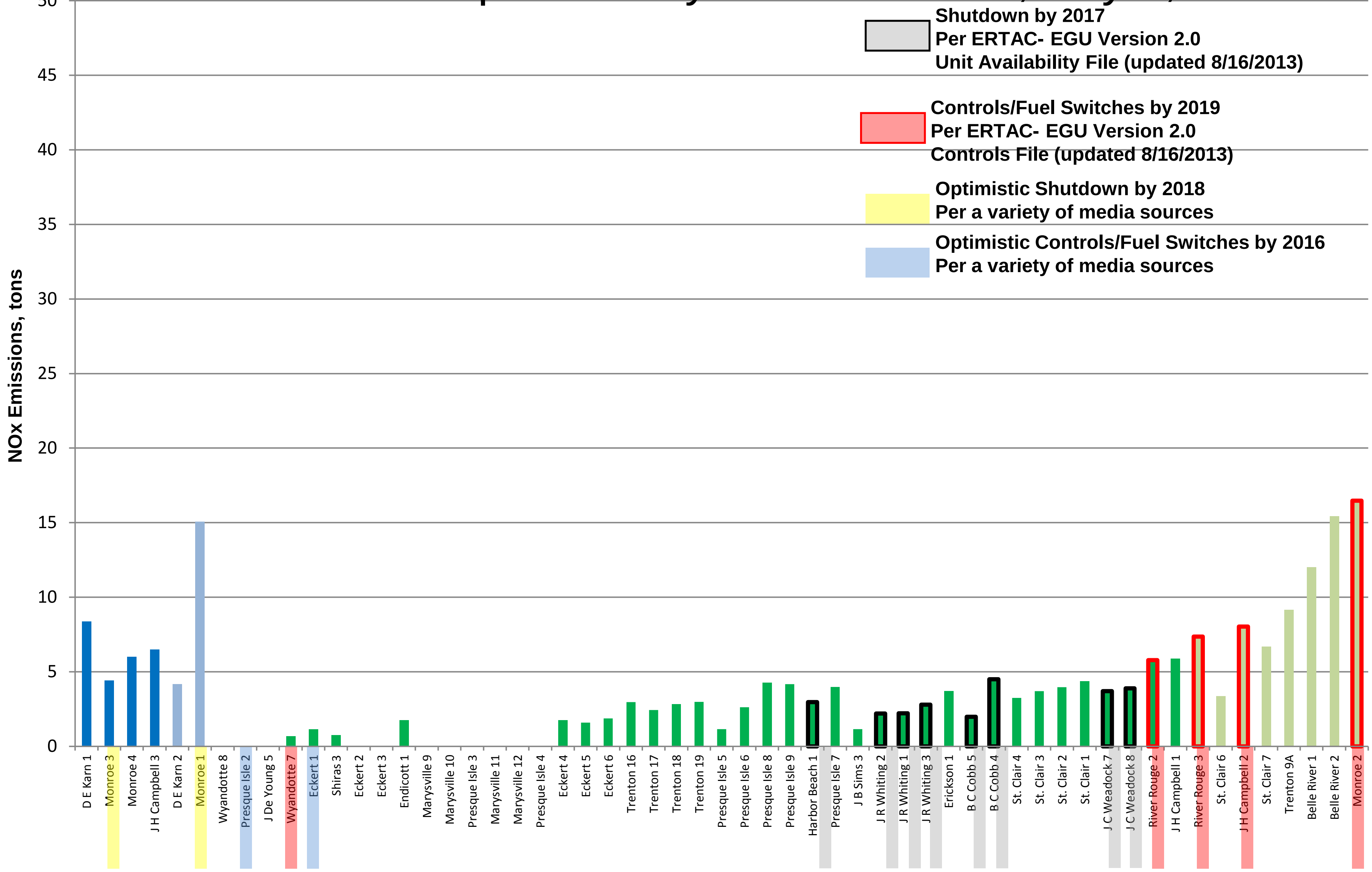
Analysis of Emissions and Controls

Tons of NOx per Day By Control Status



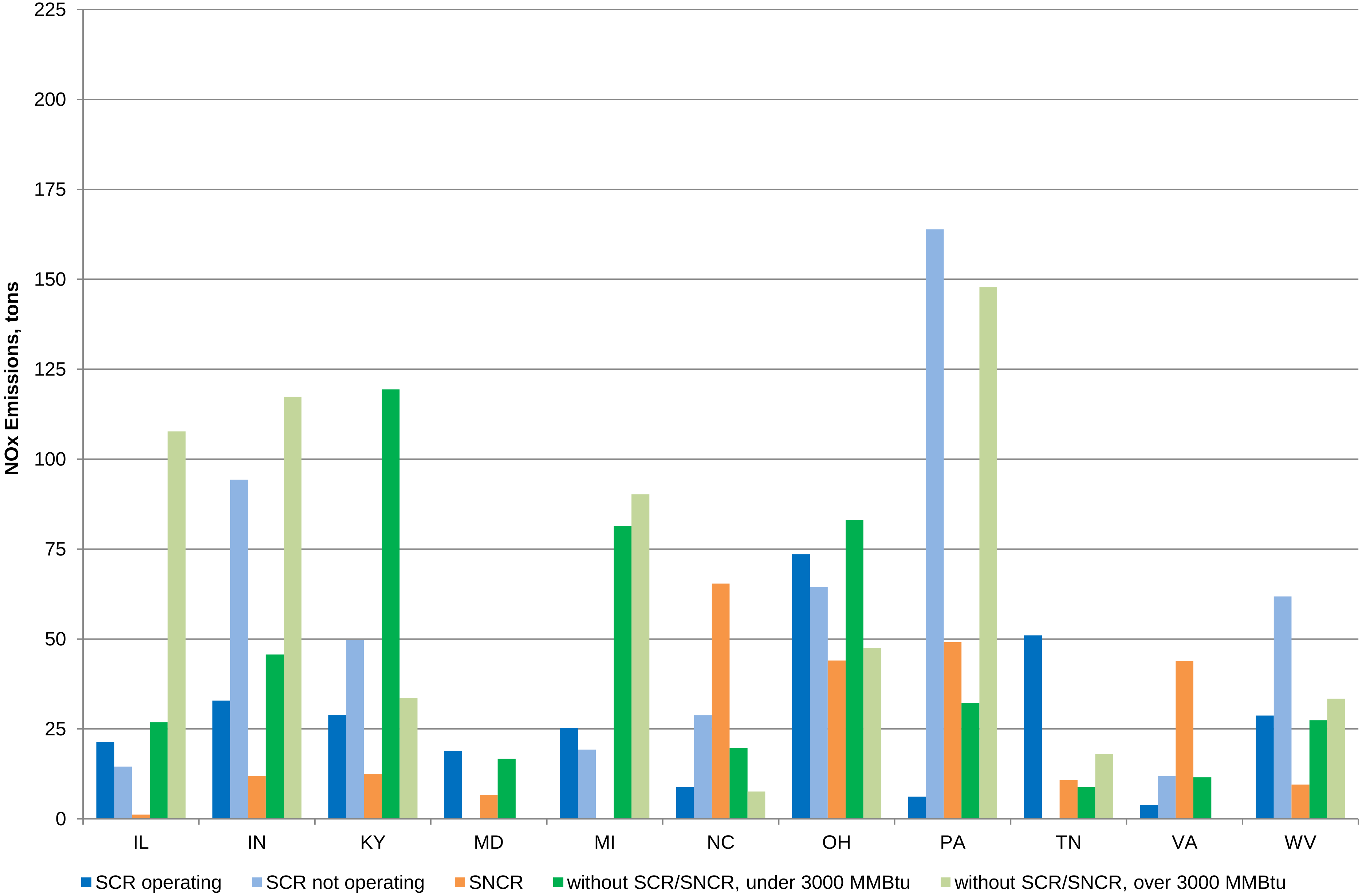
DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

MI – Tons of NOx per Unit By Control Status, July 2, 2011



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

July 2, 2011 - Tons NOx per State by Control Status



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Part 5

11 State Totals

July 1 to 8, 2011 Ozone Episode:

Analysis of Emissions and Controls

11 Upwind States, 2012

- Total number of units = **1,432**
- Total heat input capacity = 2,730,239 MMBtu/hr
  = 304,354 MW
- Total MW Capacity in %
  - **Total number of Coal units = 547 = 55%**
  - Total number of NG units = 672 = 25%
  - Total number of other (oil, etc.) units = **173** = 6%
  - Total number of Nuclear units = **40** = **14**%
- **Total Capacity Coal = 165,910 MW**
  - **156** units with SCR = 88,783 MW = 53%
  - **114** units with SNCR = 27,561 MW = 17%
  - **277** units without SCR/SNCR = 49,566 MW = 30%

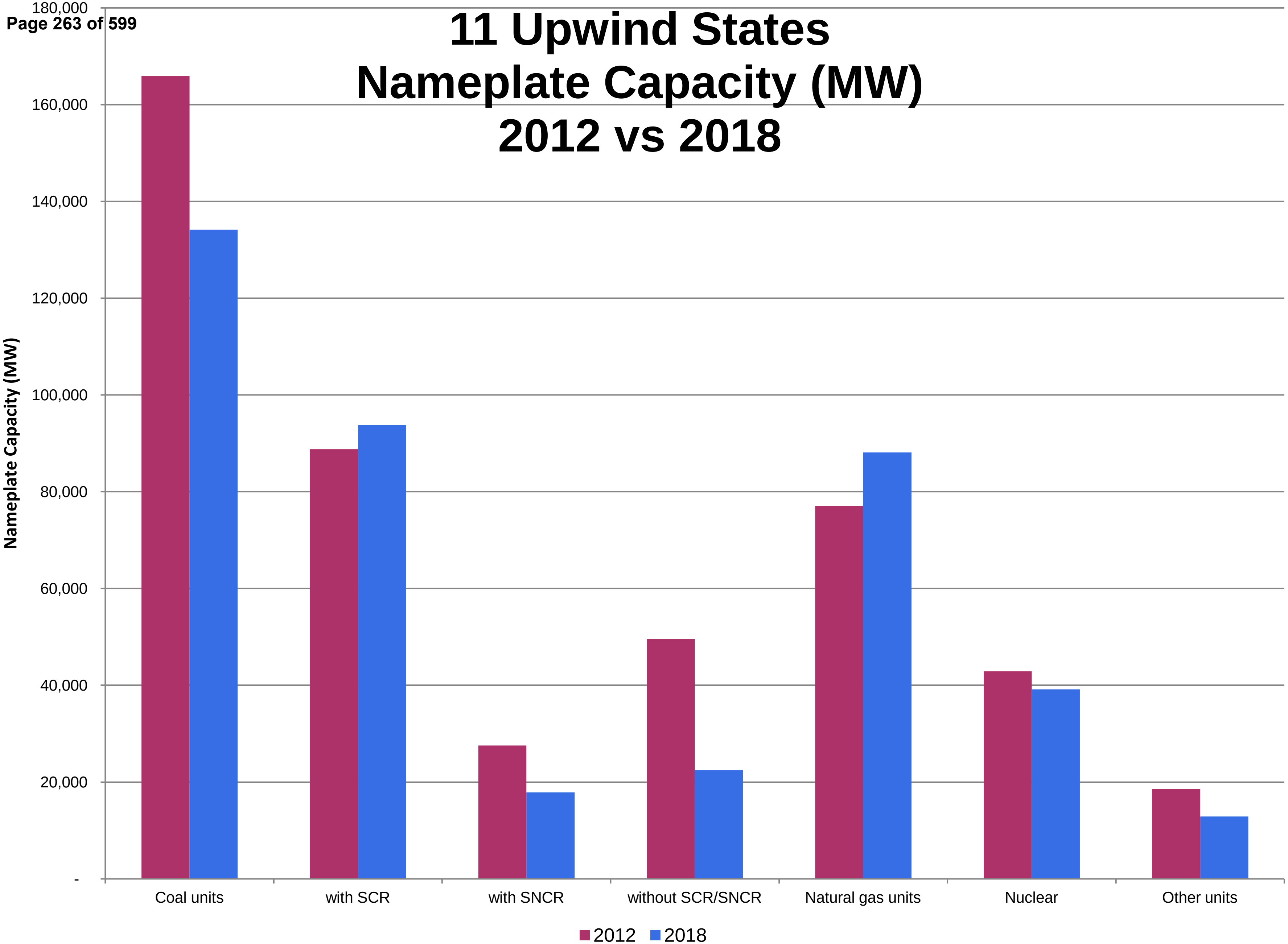
Basis – CAMD (as of 5/13/2014), NEI (for Nuclear), ERTAC (5/6/2014, 5/8/2014)

11 Upwind States, 2018

- Total number of units = 1,199
- Total heat input capacity = 2,449,194 MMBtu/hr
  = 274,300 MW
- Total MW Capacity in %
  - **Total number of Coal units = 361 = 49%**
  - Total number of NG units = 686 = 32%
  - Total number of other (oil, etc.) units = 115 = 5%
  - Total number of Nuclear units = 37 = 14%
- **Total Capacity Coal = 134,121 MW**
  - 166 units with SCR = 93,776 MW = 70%
  - 60 units with SNCR = 17,868 MW = 13%
  - 135 units without SCR/SNCR = 22,477 MW = 17%

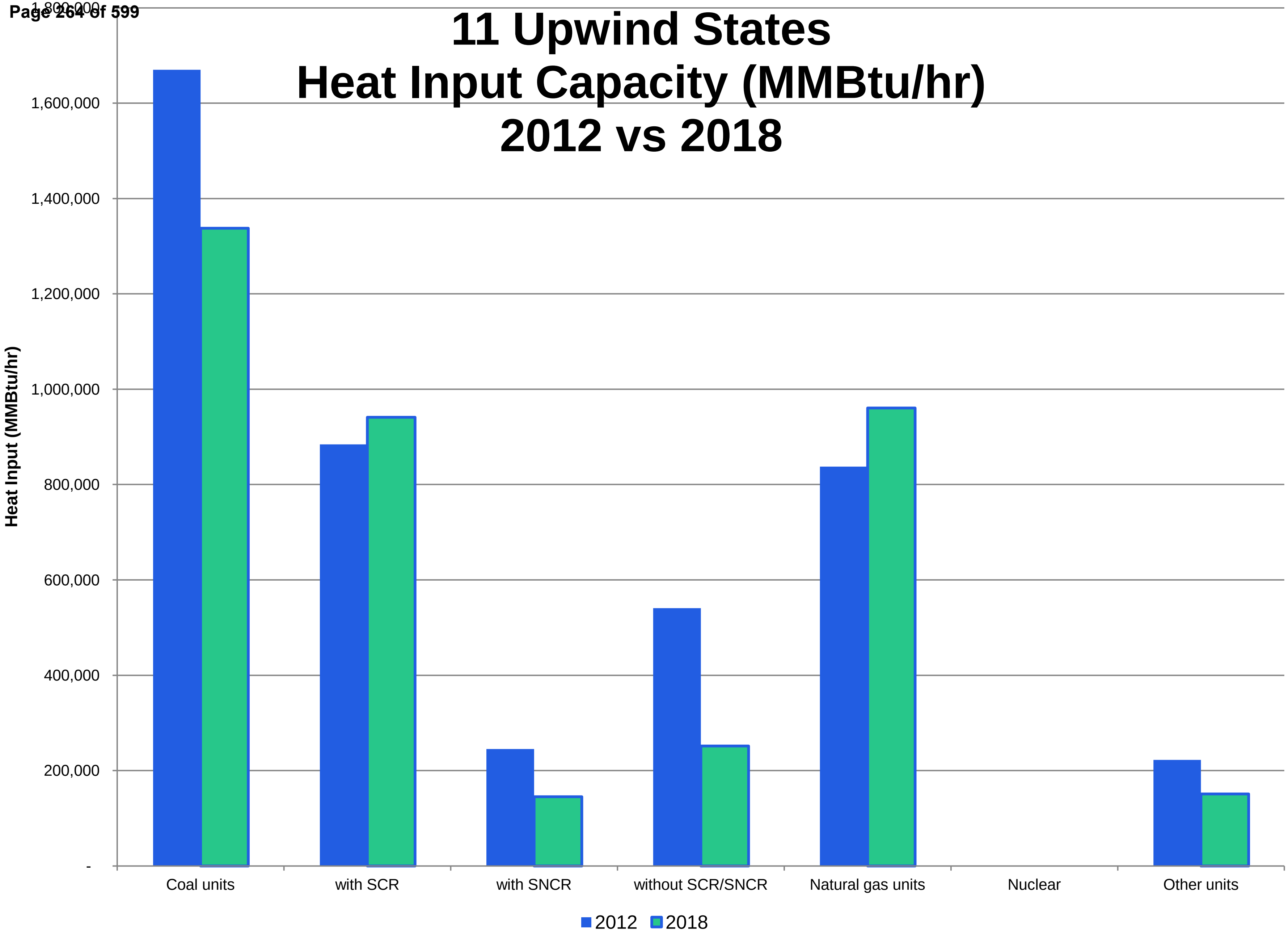
Basis – ERTAC (5/6/2014, 5/8/2014), NEI (for Nuclear)

11 Upwind States Nameplate Capacity (MW) 2012 vs 2018



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

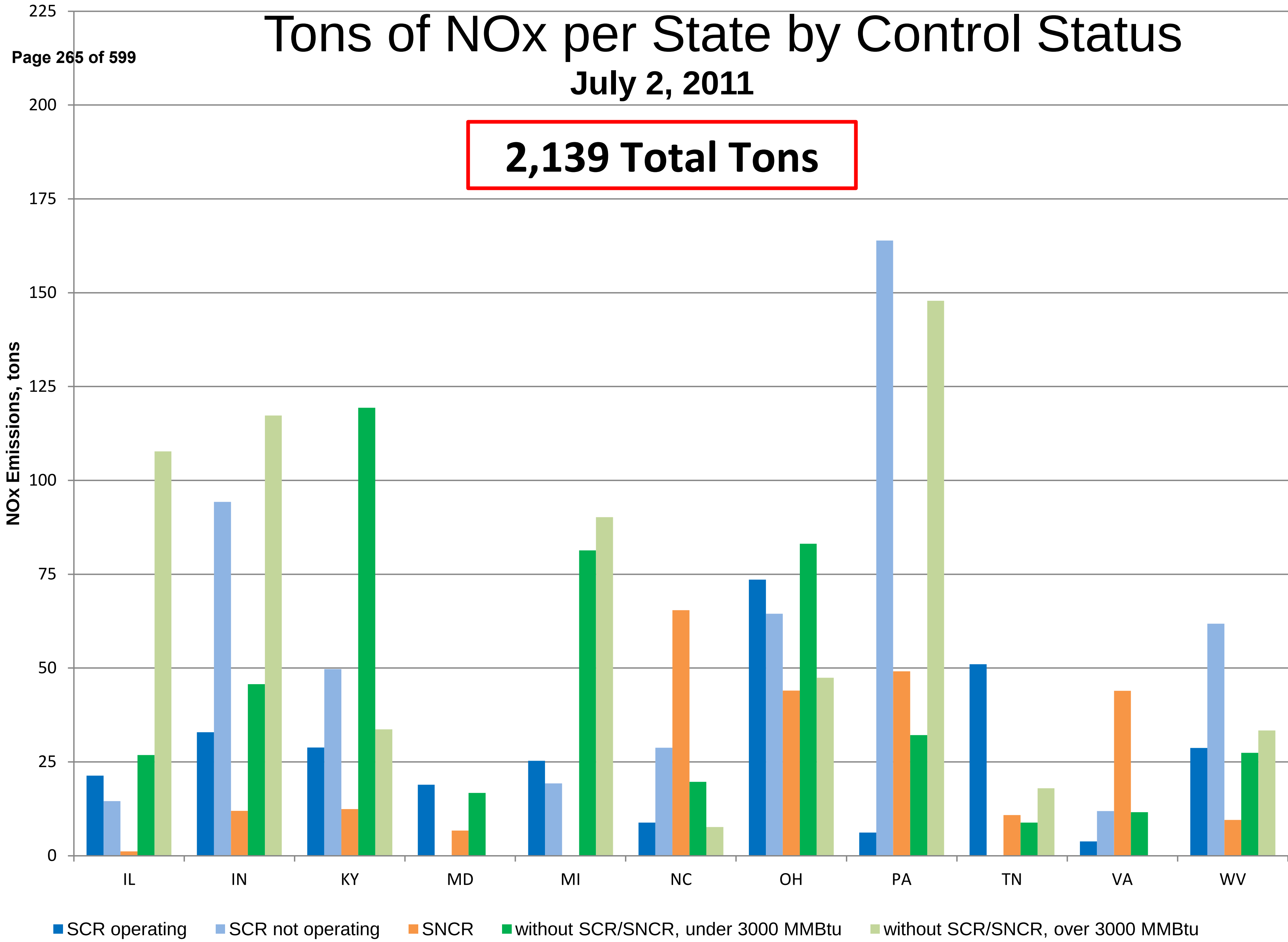
11 Upwind States
Heat Input Capacity (MMBtu/hr)
2012 vs 2018



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Tons of NOx per State by Control Status

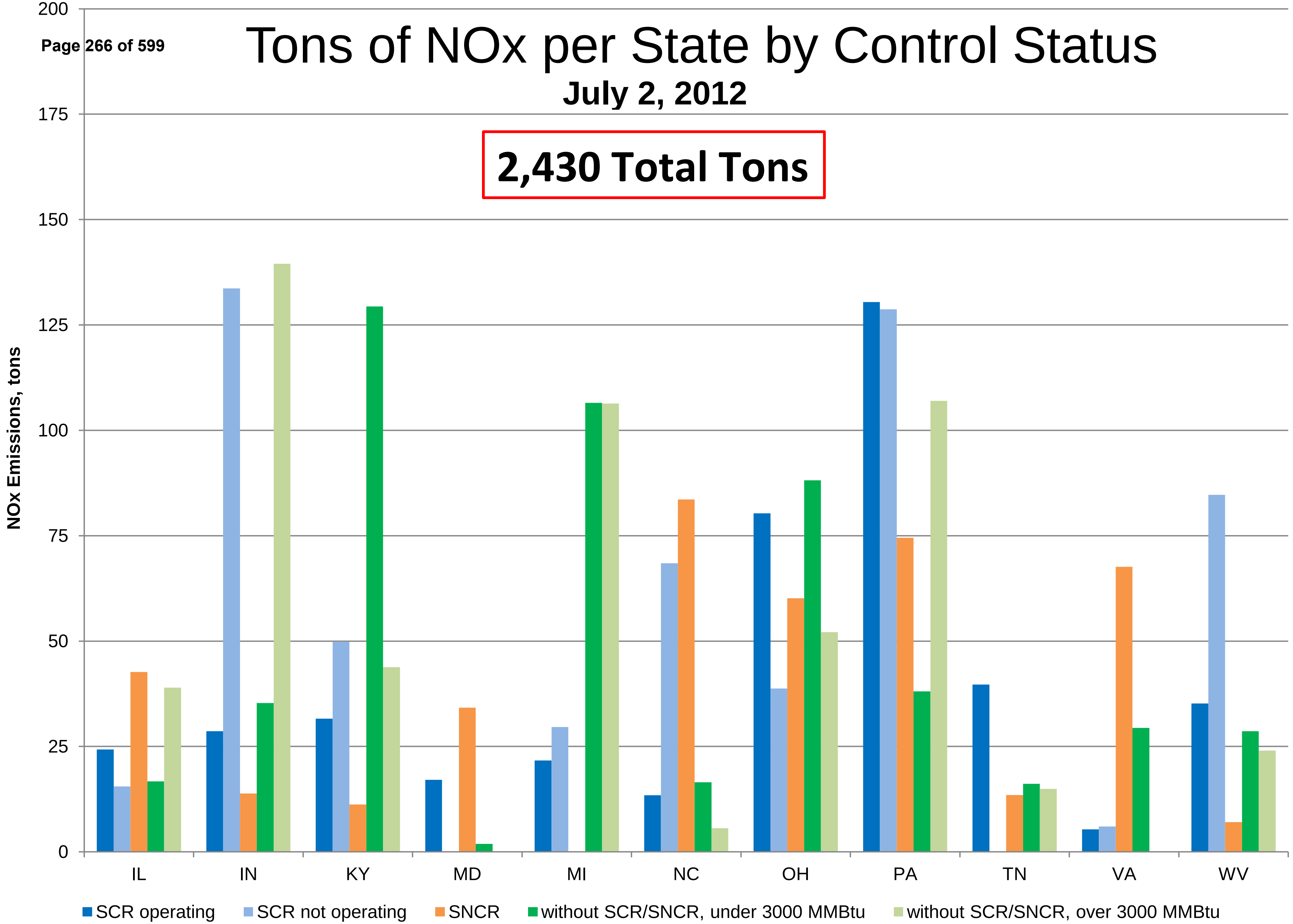
July 2, 2011



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Tons of NOx per State by Control Status

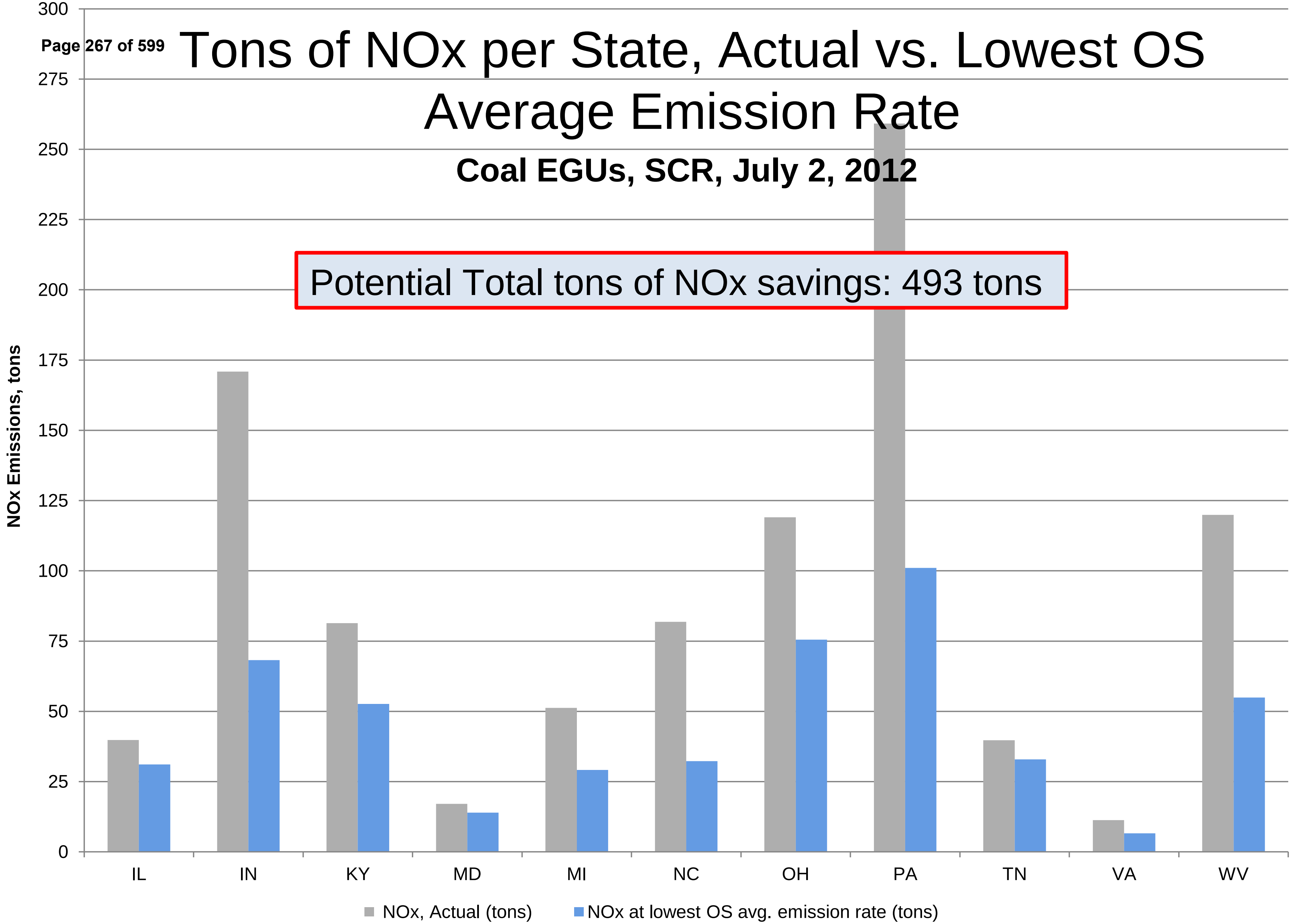
July 2, 2012



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

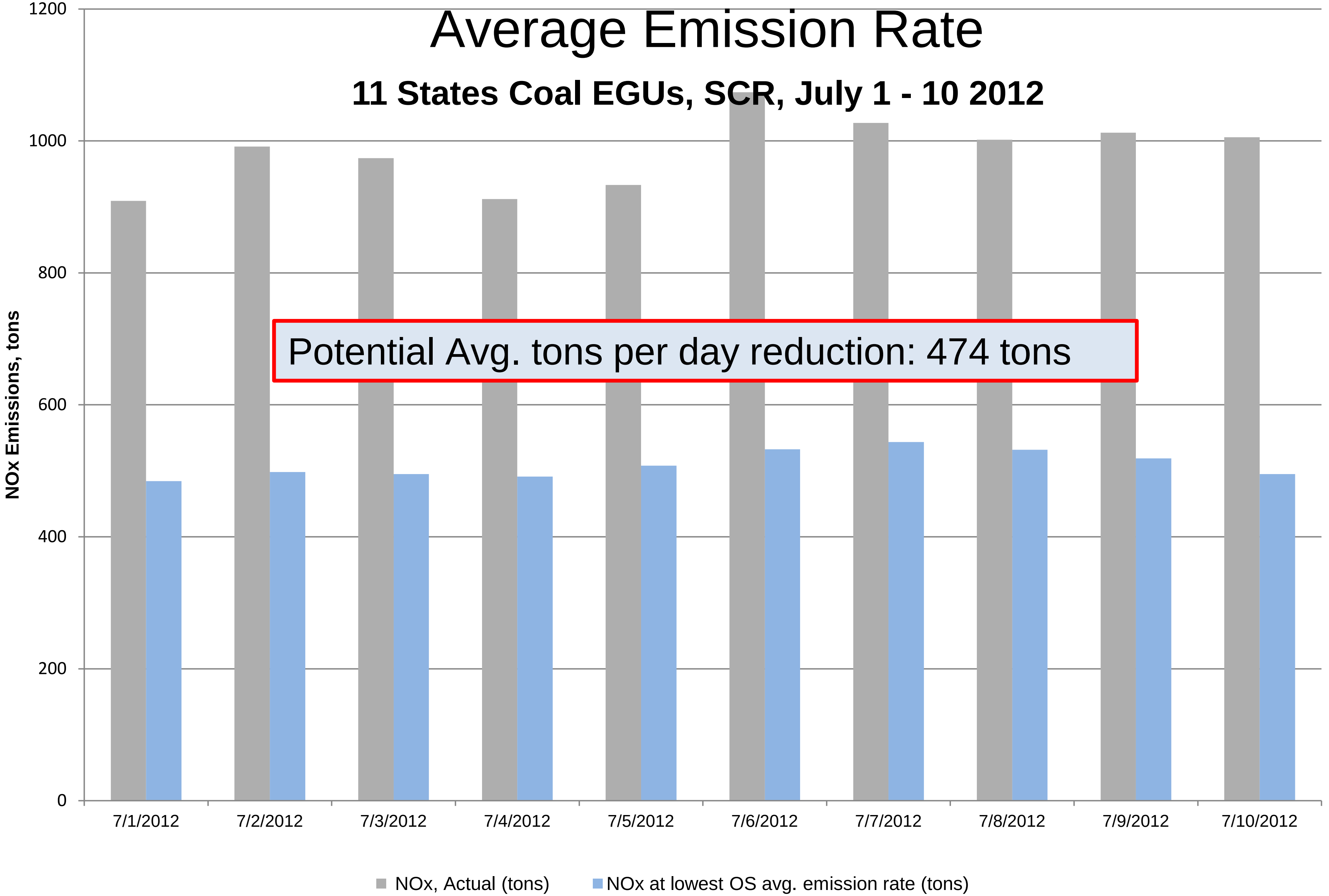
Tons of NOx per State, Actual vs. Lowest OS Average Emission Rate

Coal EGUs, SCR, July 2, 2012



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

11 State Summary

After performing similar analysis of EGUs in IL, IN, KY, MD, MI, NC, OH, PA, TN, VA and WV, the following potential total tons of lost NOx reductions was calculated:

- On July 2, 2012 actual NOx emissions in the 11 states (listed above) was 991 tons
  - If EGUs in those states were to have run their controls at the best rates observed in the data, emissions would have been 498 tons
  - This represents a single day loss of NOx reductions of 493 tons on that day
- During the 10 day episode between July 1 and 10, 2012 actual NOx emissions in the 11 states (listed above) was 9,840 tons
  - If EGUs in those states were to have run their controls at the best rates observed in the data, emissions would have been 5,099 tons
  - This represents a loss of NOx reductions of 4,741 tons over that 10-day episode

Part 6

Potential Lost Ozone Benefits from Controls Running Less Effectively in Recent Years

Preliminary Photochemical Modeling

Michigan Monitors

How Might This Affect Ozone?

- Maryland has performed several very preliminary model runs to look at how much running EGU controls inefficiently might increase ozone levels
- Three runs:
  - Scenario 2B – A worst case run
    - Assumes SCR and SNCR controls are not run at all
  - Scenario 3B – A worst data run
    - Assumes SCR and SCR units all run at worst rates seen in CAMD data - 2005 to 2012
  - Scenario 3C – Based upon CAMD data analysis for EGU performance in 2011 and 2012
    - Assumes that units that had higher ozone season emission rates were operating at the best ozone season rates observed since 2005

Lost Ozone Benefits
Potential PPB Increases

Michigan Monitors	Potential Increased Ozone in 2018 – 3 EGU Control Scenarios		
County	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Allegan	3.5	1.4	0.3
Benzie	1.8	0.4	0.1
Berrien	3.4	1.3	0.3
Cass	4.1	1.1	0.4
Clinton	1.8	0.4	0.2
Genesee	1.7	0.3	0.2
Genesee	1.7	0.3	0.1
Huron	1.6	0.3	0.1
Ingham	2.0	0.5	0.2
Kalamazoo	3.1	0.8	0.3
Kent	2.8	0.8	0.3
Kent	3.3	1.1	0.5
Leelanau	1.7	0.3	0.1
Lenawee	2.4	0.7	0.3

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Lost Ozone Benefits
Potential PPB Increases

Michigan Monitors	Potential Increased Ozone in 2018 – 3 EGU Control Scenarios		
County	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Macomb	1.6	0.4	0.2
Macomb	2.3	0.7	0.2
Manistee	2.0	0.5	0.2
Mason	2.5	0.7	0.2
Missaukee	-999.0	-999.0	-999.0
Muskegon	3.4	1.1	0.3
Oakland	1.4	0.4	0.2
Ottawa	3.8	1.4	0.6
Schoolcraft	-999.0	-999.0	-999.0
St. Clair	1.8	0.4	0.2
Washtenaw	2.1	0.4	0.2
Wayne	1.6	0.5	0.2
Wayne	1.6	0.4	0.2

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Lost Ozone Benefit – 2018 Design Values

… EPA will propose a new ozone standard soon … 60 to 70 ppb range … designations to most likely be based upon 2014 to 2016 or 2015 to 2017 data

Projected to be Clean in 2018 … Potentially at Risk		Increased Ozone in 2018 – 3 EGU Control Scenarios		
Michigan Counties	**2018 – Controls Running Well (Scenario 3A)**	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Allegan	75.7	79.2	77.1	76.0
Benzie	67.4	69.2	67.7	67.5
Berrien	70.5	73.8	71.8	70.8
Cass	65.2	69.3	66.3	65.5
Clinton	63.0	64.8	63.5	63.2
Genesee	66.9	68.6	67.2	67.0
Genesee	65.1	66.8	65.4	65.3
Huron	67.1	68.8	67.4	67.2
Ingham	63.9	65.9	64.4	64.1
Kalamazoo	62.3	65.3	63.1	62.6
Kent	67.5	70.3	68.3	67.8
Kent	66.1	69.4	67.2	66.5
Leelanau	62.8	64.5	63.1	62.9
Lenawee	64.8	67.2	65.5	65.1

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Lost Ozone Benefit – 2018 Design Values

… EPA will propose a new ozone standard soon … 60 to 70 ppb range … designations to most likely be based upon 2014 to 2016 or 2015 to 2017 data

Projected to be Clean in 2018 … Potentially at Risk		Increased Ozone in 2018 – 3 EGU Control Scenarios		
Michigan Counties	**2018 – Controls Running Well (Scenario 3A)**	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Macomb	74.9	76.5	75.2	75.0
Macomb	72.6	74.8	73.3	72.8
Manistee	65.0	67.1	65.5	65.2
Mason	66.6	69.1	67.3	66.8
Missaukee	-999.0	-999.0	-999.0	-999.0
Muskegon	71.6	75.1	72.8	72.0
Oakland	73.6	75.0	74.0	73.8
Ottawa	68.4	72.2	69.7	69.0
Schoolcraft	-999.0	-999.0	-999.0	-999.0
St. Clair	72.2	73.9	72.5	72.3
Washtenaw	65.6	67.6	66.0	65.8
Wayne	76.5	78.1	77.0	76.7
Wayne	66.6	68.2	67.1	66.8

DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

EGU Data Package #3
Operation of Existing SCR, SNCR

North Carolina

Sample of draft data and analyses developed by the Maryland Department of the Environment

Contact: Tad Aburn, Air Director, MDE
(410) 537-3255

September 18, 2014

Purpose

- Maryland is the only Moderate nonattainment area in the East for the 75 ppb ozone standard.
  - This means that Maryland is the only state required to submit an attainment SIP
  - Only state required to perform attainment modeling.
- We are now beginning to build our "SIP Quality" modeling platform.
- One major issue that our data analyses have uncovered is that many EGU units appear to not be running their control equipment in recent years as efficiently as they have demonstrated they can do in earlier years. This issue is driven by recent changes in the energy market, reduced coal capacity, inexpensive allowances and a regulatory structure driven by ozone season caps not daily performance. In many states, including Maryland, this has lead to controls not always being used efficiently on the days when they are needed the most … this is perfectly legal.
- This is a critical issue that we would like to continue to discuss with you. There appears to be an interest from the private sector to discuss this issue and see if a common sense fix can be designed. Maryland believes this fix would be relatively cost-effective compared to the capital cost of the control technologies.
- MDE has focused our analyses on two of the worst large, regional scale ozone episodes from recent years: July 1-8, 2011 and July 1-10, 2012.
- The primary data used in these analyses include:
  - CEMS data from CAMD
  - Emissions and projection data from ERTAC
  - Other data we have received from individual states
- More detailed data and analyses and spreadsheets are available upon request.

How the Data Analyses Were Built

- Maryland began the data analyses in late 2012
  - Looked at EGUs in the 9 upwind states named in the 176A Petition (IL, IN, KY, MI, NC, OH, TN, VA, WV) … MD and PA
- Shared a draft package with Air Directors on April 21, 2014
  - This package focused on a bad ozone episode: July 1 – 8, 2011
- Shared a second draft package with Air Directors on May 13, 2014
  - This package focused on second bad ozone episode: July 1 – 10, 2012
  - This package also included update to specific material after receiving comments from numerous states
- The 2011 and 2012 episodes analyzed capture two of the worst regional ozone periods in 2011 and 2012
  - Other states, like Wisconsin and Delaware have done similar analyses and reached similar conclusions
- This is the third draft package, and builds on to the prior two draft packages, while incorporating input from individual states and updates to ERTAC.
- This third draft package also includes preliminary photochemical modeling performed by MDE to look at the potential loss of ozone reduction benefits.

Help Us QA the Data

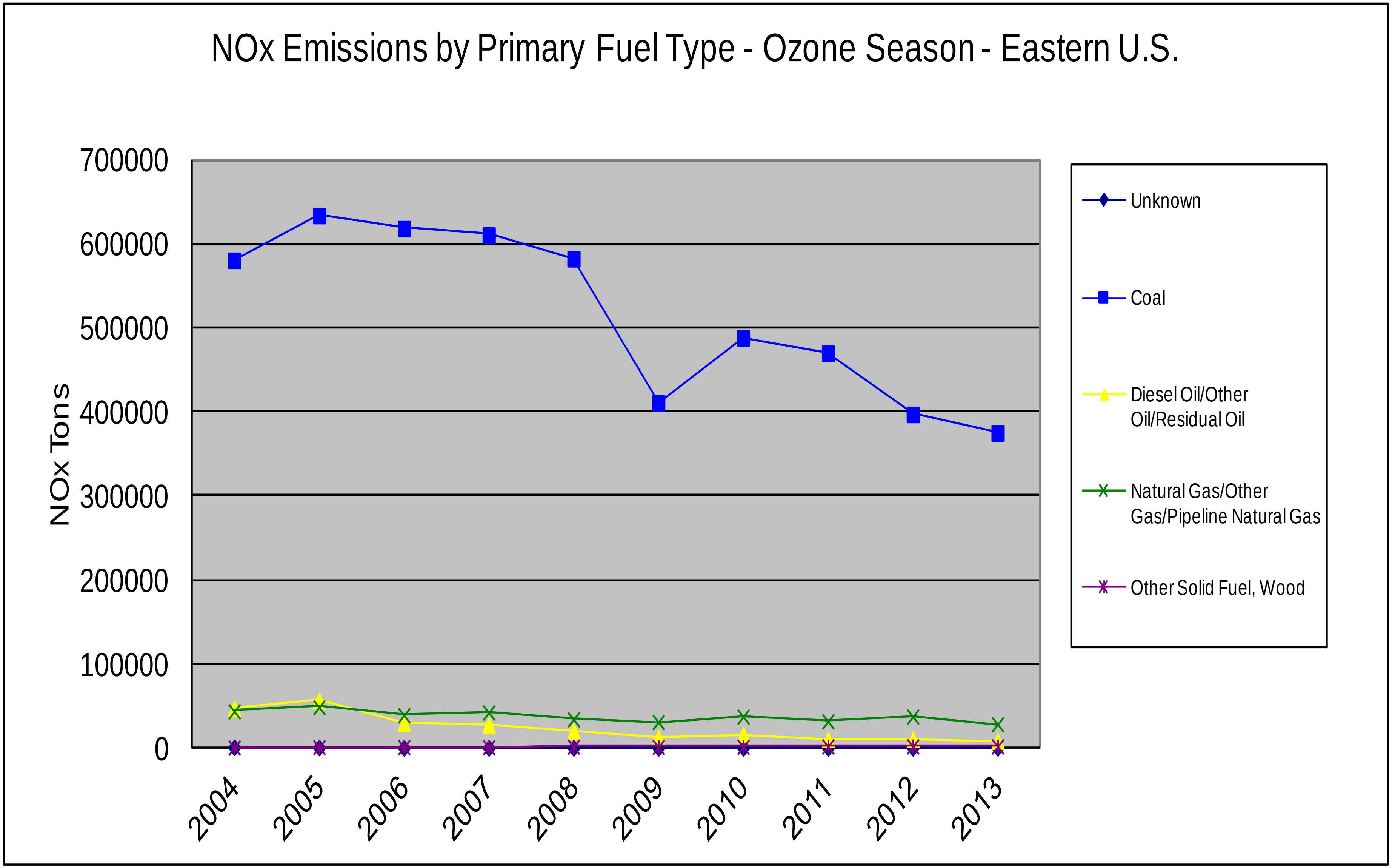
- We have used readily available data, like the CAMD and ERTAC data, but we recognize that these data sources can be out of date, or not include recent changes.
  - We hope you can help us with making sure we have the best possible data.

- This package reflects recently updated data, including but not limited to:
  - CAMD updates
  - May 8, 2014 ERTAC updates
  - PA comments to OTC, forwarded to MDE, Spreadsheets detailing "EGU Shutdowns, EGU Controls and New Natural Gas Power Projects" for the state of PA. Sent from Randy Bordner, Environmental Group Manager - Bureau of Air Quality, PA Department of Environmental Protection to Andy Bodnarik, OTC. Received as FWD from Andy Bodnarik on 4/23/2014
  - VA comments to MDE, "Electric Generation Sector Summary for Virginia" received from Thomas R. Ballou, Director - Office of Air Data Analysis and Planning, VA Department of Environmental Quality on 5/12/2014

Part 1

Background:
Generation in 2012 and 2018
Projected Changes

Why Coal?



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

North Carolina EGUs, 2012

- Total number of units = 163
- Total heat input capacity = 271,936 MMBtu/hr = 30,799 MW
- Total State MW Capacity in %
  - **Total number of Coal units = 51 = 48%**
  - Total number of NG units = 71 = 26%
  - Total number of other (oil, etc.) units = 36 = 9%
  - Total number of Nuclear units = 5 = 17%
- **Total Capacity Coal = 14,651 MW**
  - 14 units with SCR = 8,872 MW = 61%
  - 17 units with SNCR = 3,995 MW = 27%
  - 20 units without SCR/SNCR = 1,784 MW = 12%

Basis – CAMD (as of 5/13/2014), NEI (for Nuclear), ERTAC (5/6/2014, 5/8/2014)

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Capacity and Fuel: 2012 to 2018

A detailed review of ERTAC data for 2018 was completed, and an evaluation of the following characteristics performed.

- ❖ Total Number of units
- ❖ Heat input capacity - MMBtu/hr
- ❖ Nameplate capacity – MW
- ❖ Presence of advanced post combustion controls – SCR, SNCR
- ❖ Fuel switching
- ❖ Shutdown, retirements

North Carolina EGUs, 2018

- Total number of units = 84
- Total heat input capacity = 193,288 MMBtu/hr = 25,066 MW
- Total State MW Capacity in %
  - **Total number of Coal units = 31 = 49%**
  - Total number of NG units = 29 = 26%
  - Total number of other (oil, etc.) units = 19 = 4%
  - Total number of Nuclear units = 5 = 21%
- **Total Capacity Coal = 12,173 MW**
  - 15 units with SCR = 9,067 MW = 75%
  - 8 units with SNCR = 2,581 MW = 21%
  - 8 units without SCR/SNCR = 525 MW = 4%

Basis – ERTAC (5/6/2014, 5/8/2014), NEI (for Nuclear)

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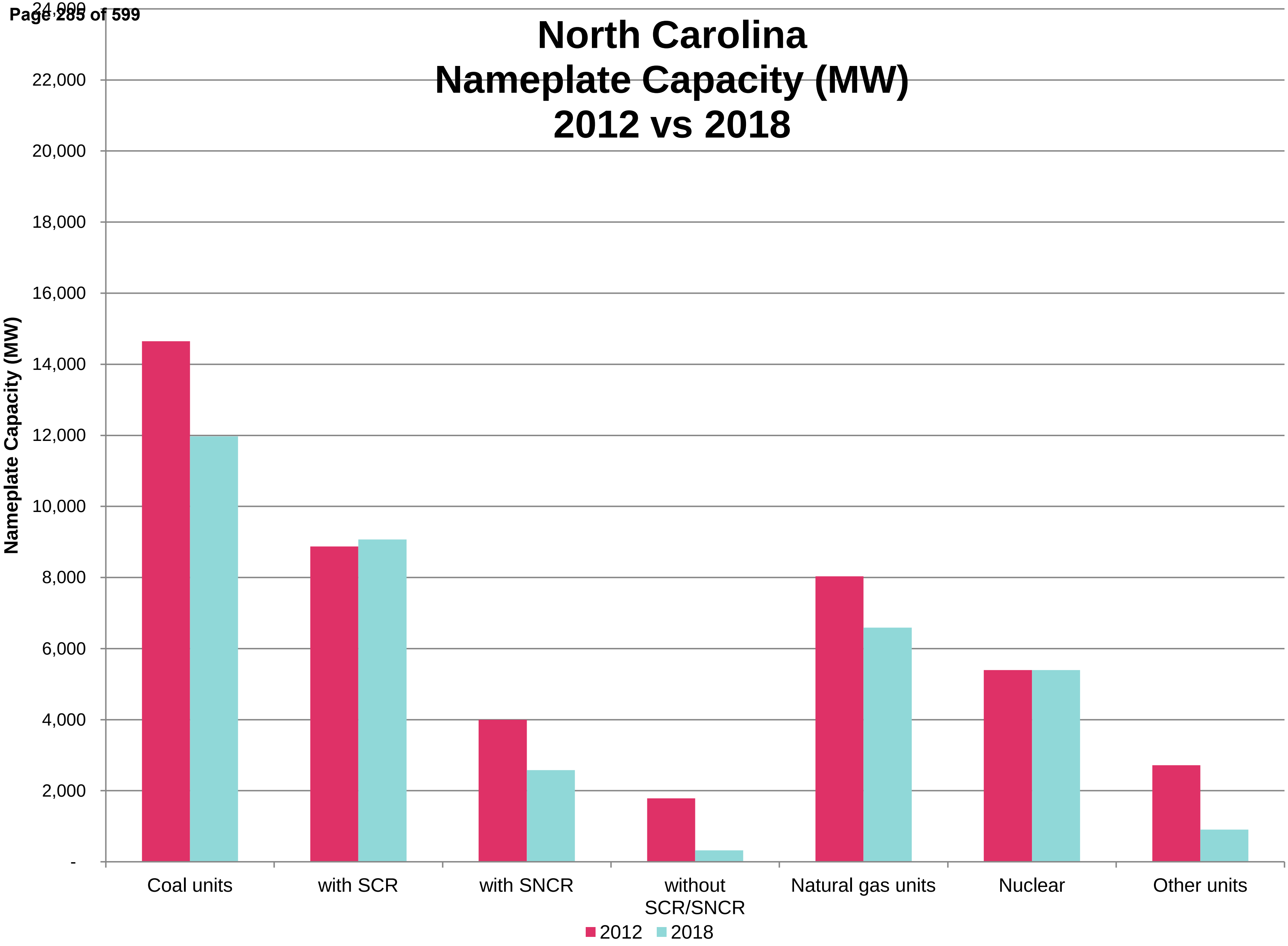
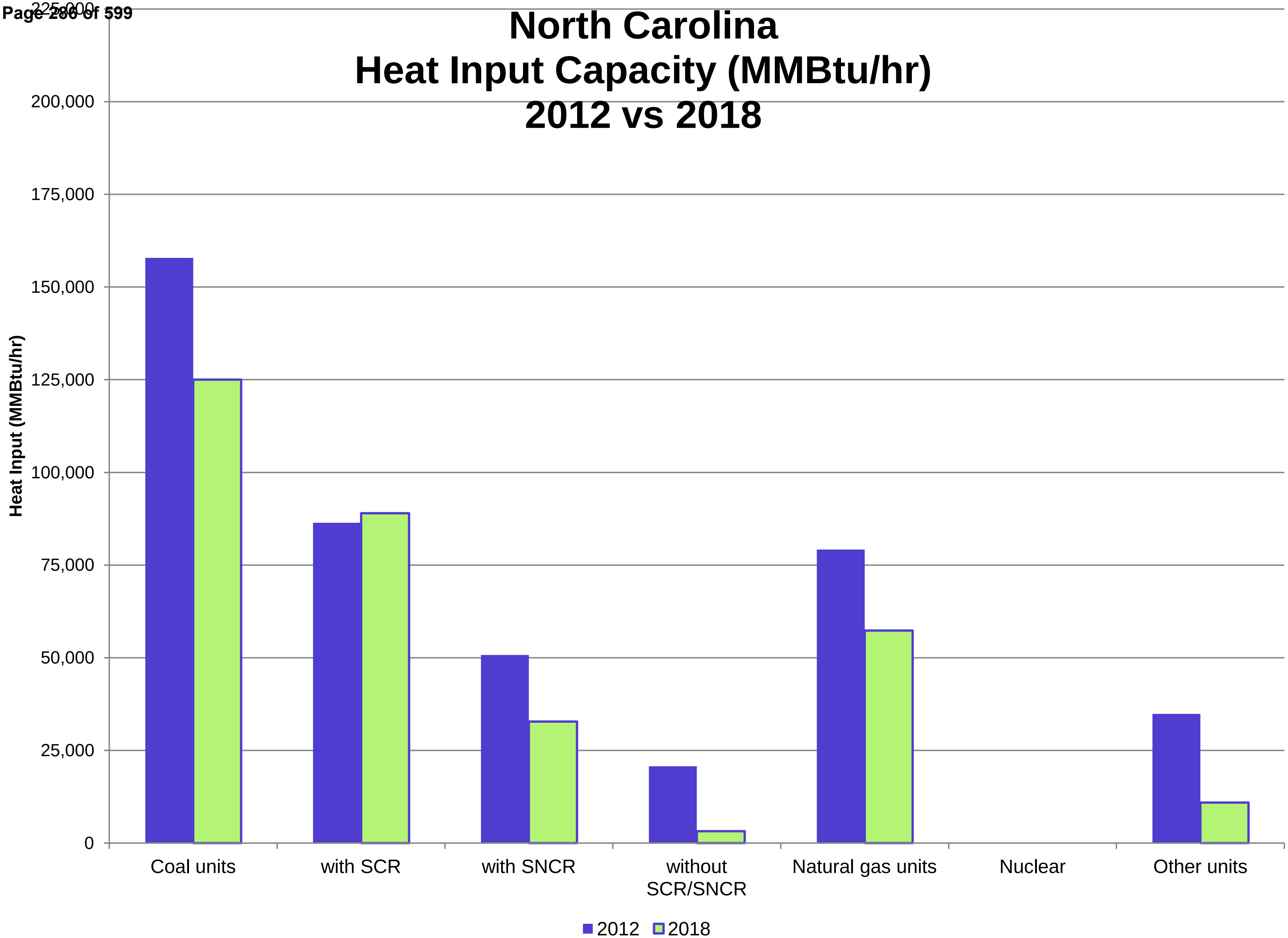
North Carolina
Nameplate Capacity (MW)
2012 vs 2018





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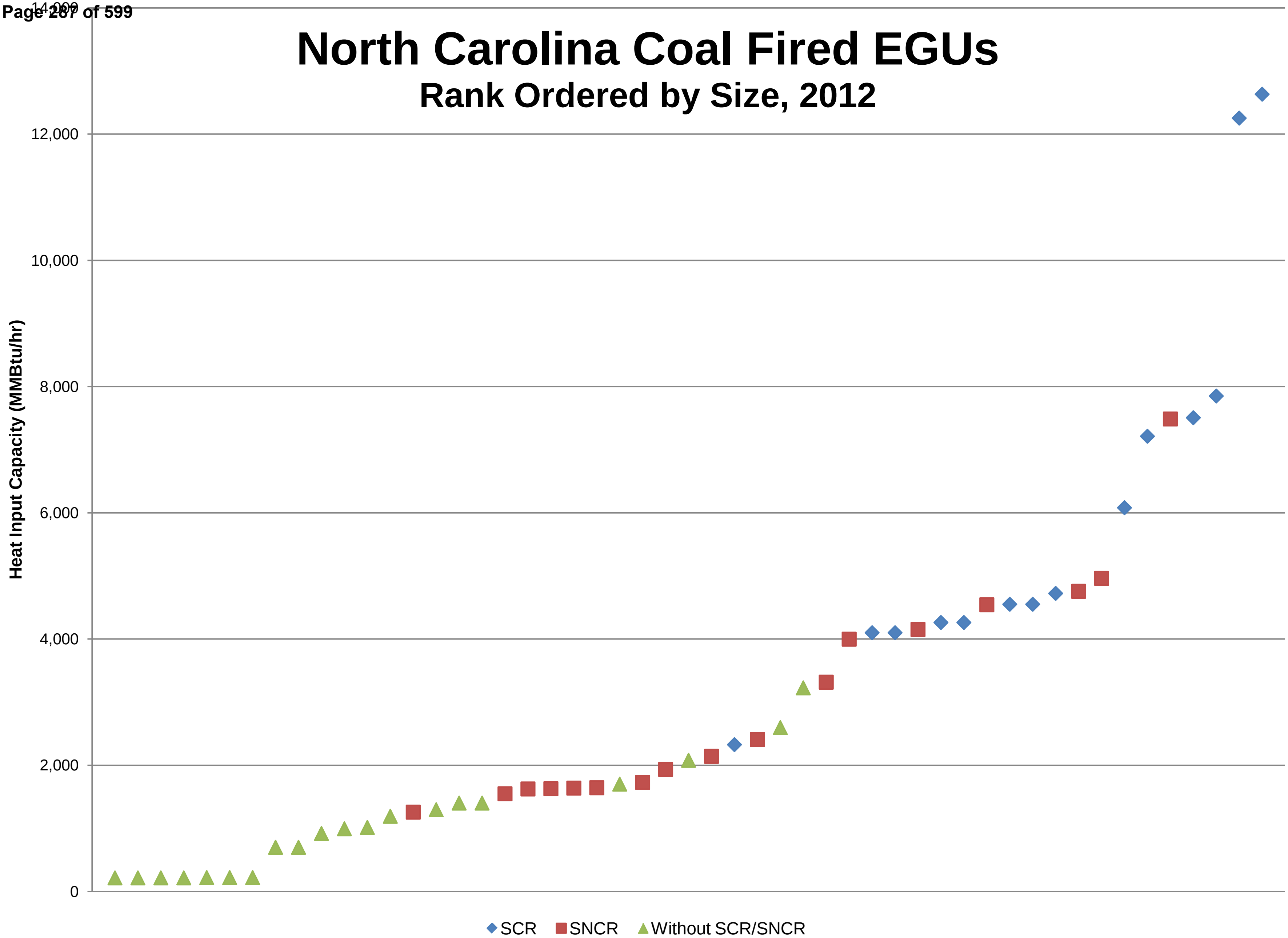
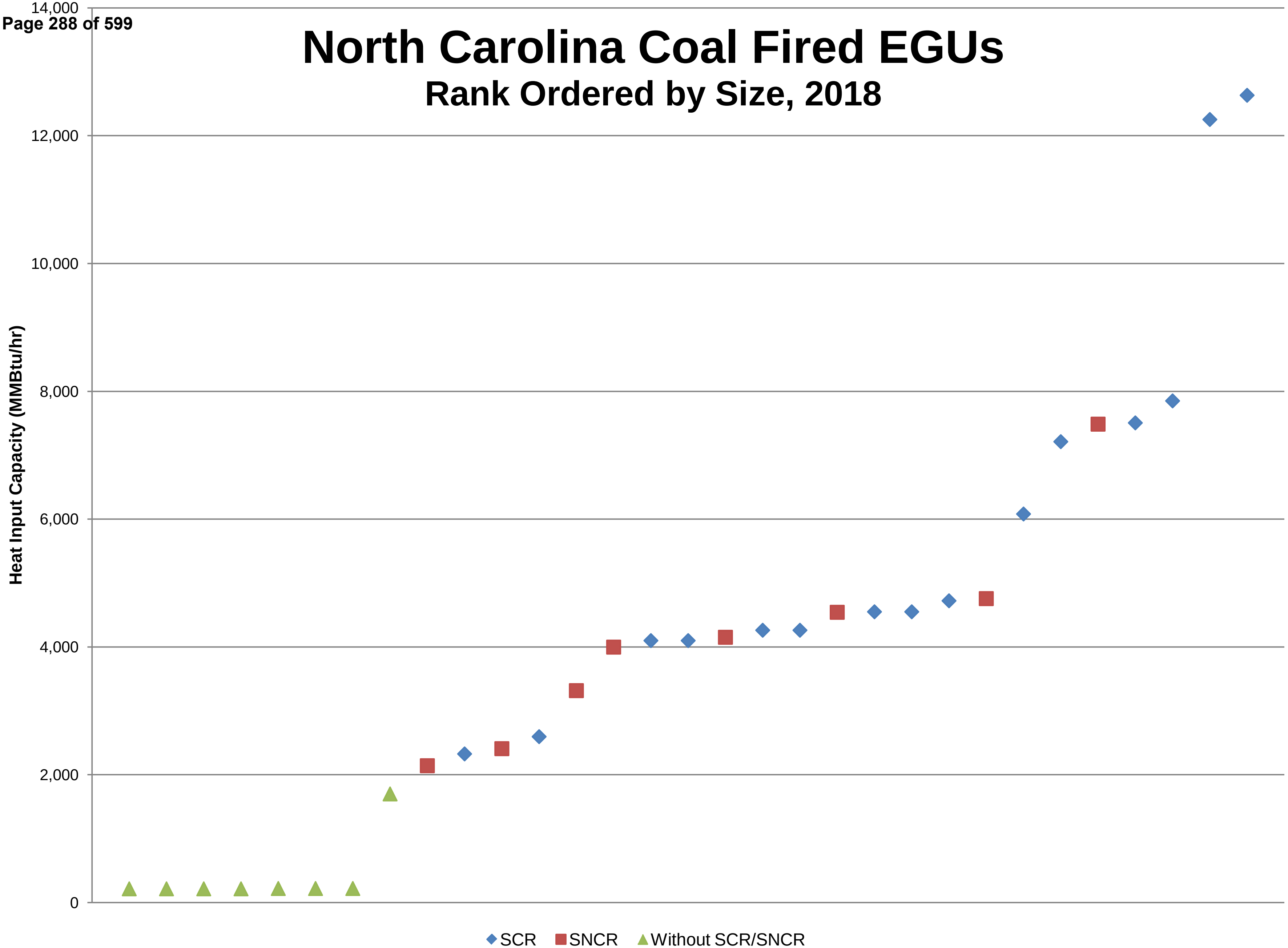


DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.



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NC : Large (> 3000 MMBtu/hr) Coal-Fired EGU NOx Emissions Rate Analysis

	Facility Name	Unit ID	Lowest OS Emission Rate Year	Lowest OS Emission Rate (lbs/MMBtu)	2007 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2007 OS ER (% Change)	2011 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2011 OS ER (% Change)	Comments/ ERTAC Closure Date
Controlled with SCR	Belews Creek	1	2007	0.028	0.028	0	0.0524	87	
	Belews Creek	2	2009	0.0382	0.0550	44	0.0533	40	
	Cliffside	5	2011	0.056	0.0602	7	0.056	0	
	Cliffside	6	--	--	--	N/A	--	N/A	New 2012
	Marshall	3	2011	0.0431	0.2009	366	0.0431	0	
	Mayo	1A	2005	0.0537	0.061	14	0.0740	38	
	Mayo	1B	2005	0.0537	0.0614	14	0.0714	33	
	Roxboro	1	2005	0.084	0.0873	4	0.1566	86	
	Roxboro	2	2011	0.0575	0.0589	2	0.0575	0	
	Roxboro	3A	2004	0.0697	0.0990	42	0.1161	67	
	Roxboro	3B	2004	0.0688	0.0987	43	0.1155	68	
	Roxboro	4A	2004	0.0728	0.0926	27	0.1002	38	
	Roxboro	4B	2004	0.0733	0.0926	26	0.1	36	
Controlled with SNCR	G G Allen	3	2007	0.1712	0.1712	0	0.2383	39	
	G G Allen	4	2008	0.1778	0.1819	2	0.2413	36	
	G G Allen	5	2008	0.1878	0.2206	17	0.2478	32	
	Marshall	1	2006	0.1707	0.2053	20	0.2109	24	
	Marshall	2	2010	0.1956	0.2096	7	0.2081	6	
	Marshall	4	2007	0.1967	0.1967	0	0.2297	17	
No Controls of Fuel Switches by 2019	N/A								
Retiring by 2017	HF Lee 3	3	2008	0.259	0.3023	17	0.3504	35	2012
	L V Sutton	3	2007	0.3037	0.3037	0	0.4335	43	Has SNCR. 2013

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Page 290 of 599	Facility Name	Unit ID	Lowest OS Emission Rate Year	Lowest OS Emission Rate (lbs/MMBtu)	2007 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2007 OS ER (% Change)	2011 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2011 OS ER (% Change)	Comments/ ERTAC Closure Date
Controlled with SCR	Asheville	2	2008	0.0612	0.0657	7	0.1425	133	
Controlled with SNCR	G G Allen	1	2005	0.1643	0.1778	8	0.2521	53	
	G G Allen	2	2007	0.1601	0.1601	0	0.255	59	
Adding Controls or Fuel Switches by 2019	Asheville	1	2009	0.0455	0.1293	184	0.0795	75	SCR (2013)
No Controls or Fuel Switches by 2019	Elizabethtown	UNIT1	2003	0.3863	0.9655	150	N/A	N/A	No emissions reported after 2008
	Elizabethtown	UNIT2	2004	0.3977	1.0944	175	N/A	N/A	
	Lumberton	UNIT1	2003	0.4039	0.7506	86	N/A	N/A	
	Lumberton	UNIT2	2004	0.4366	0.782	79	N/A	N/A	
	PE Roxboro BLR01A	BLR01A	2012	0.2284	0.2906	27	0.2513	10	Fuel switch to biomass (media)
	PE Roxboro BLR01B	BLR01B	2012	0.2203	0.2978	35	0.2359	7	
	PE Roxboro BLR01C	BLR01C	2012	0.2288	0.2939	28	0.2592	13	
	Westmoreland	1	2012	0.2985	0.3007	1	0.3072	3	
Retiring by 2017	Buck	8	2007	0.1521	0.1521	0	0.1799	18	Has SNCR. 2013
	Buck	9	2007	0.1546	0.1546	0	0.1951	26	Has SNCR. 2013
	Cape Fear	5	2006	0.1748	0.2164	24	0.3234	85	Has SNCR. 2012
	Cape Fear	6	2004	0.2021	0.2091	3	0.2616	29	Has SNCR. 2012
	Dan River	1	2008	0.261	0.3705	42	0.4281	64	2012
	Dan River	2	2007	0.228	0.228	0	0.4383	92	2012
	Dan River	3	2008	0.1937	0.213	10	0.4009	107	2012
	HF Lee1	1	2009	0.4623	0.5046	9	0.5206	13	2012
	HF Lee 2	2	2011	0.2923	0.3235	11	0.2923	0	2012
	LV Sutton	1	2007	0.3461	0.3461	0	0.3907	13	2013
	LV Sutton	2	2007	0.3481	0.3481	0	0.3966	14	2013
	Riverbend	7	2007	0.1842	0.1842	0	0.2776	51	Has SNCR. 2013
	Riverbend	8	2008	0.1771	0.2277	29	0.3293	86	Has SNCR. 2013
	Riverbend	9	2007	0.1667	0.1667	0	0.2620	57	Has SNCR. 2013
	Riverbend	10	2007	0.1754	0.1754	0	0.2878	64	Has SNCR. 2013
	WH Weatherspoon	1	2011	0.4373	0.8312	90	0.4373	0	2012
	WH Weatherspoon	2	2009	0.7407	0.8293	12	0.8601	16	2012
	WH Weatherspoon	3	2009	0.3766	0.4062	8	0.4280	14	2012

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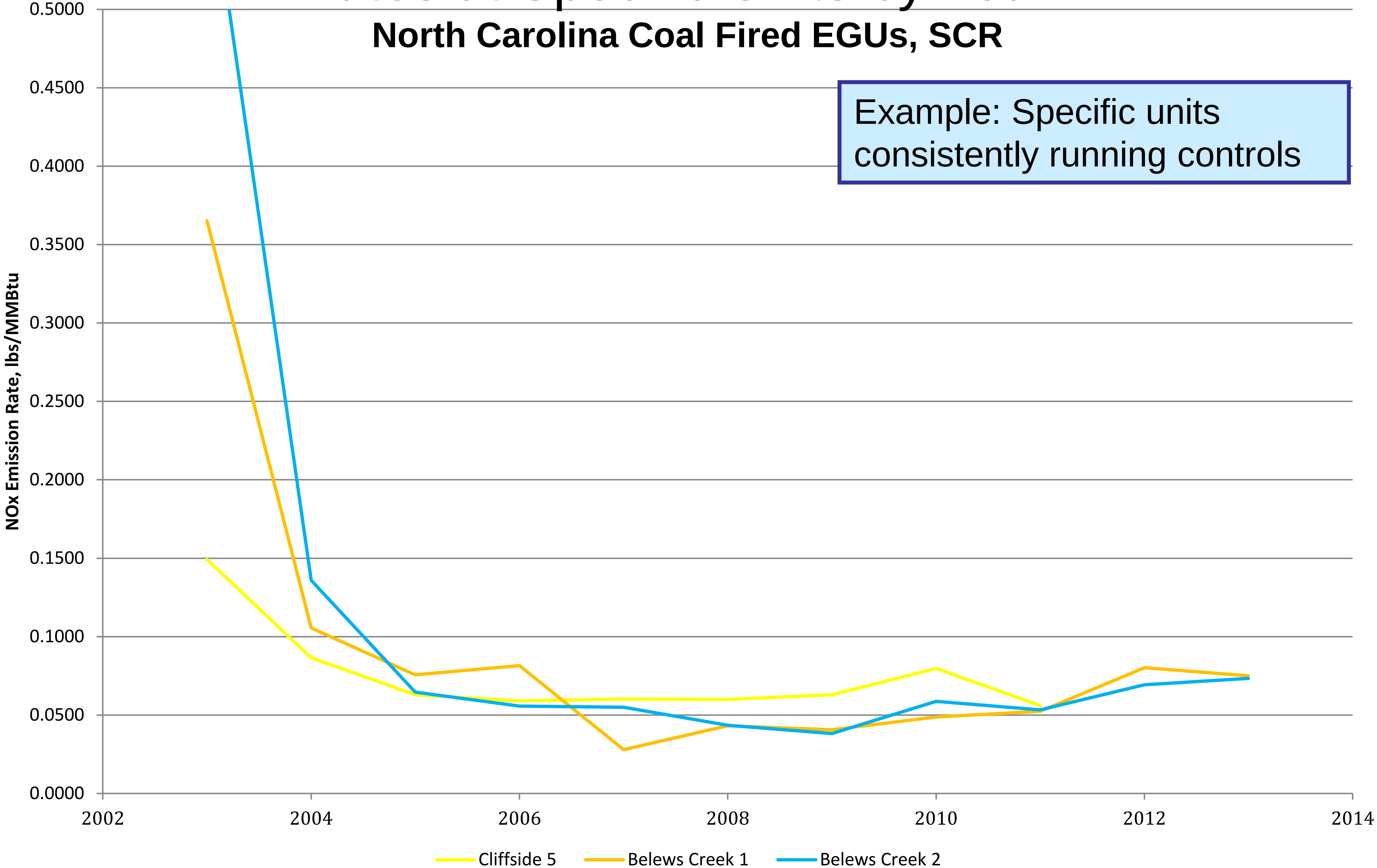
Part 2

Operation of Controls:
Changes in Control Efficiency
2003 to 2013

Average Ozone Season Emission Rates at Specific Units by Year



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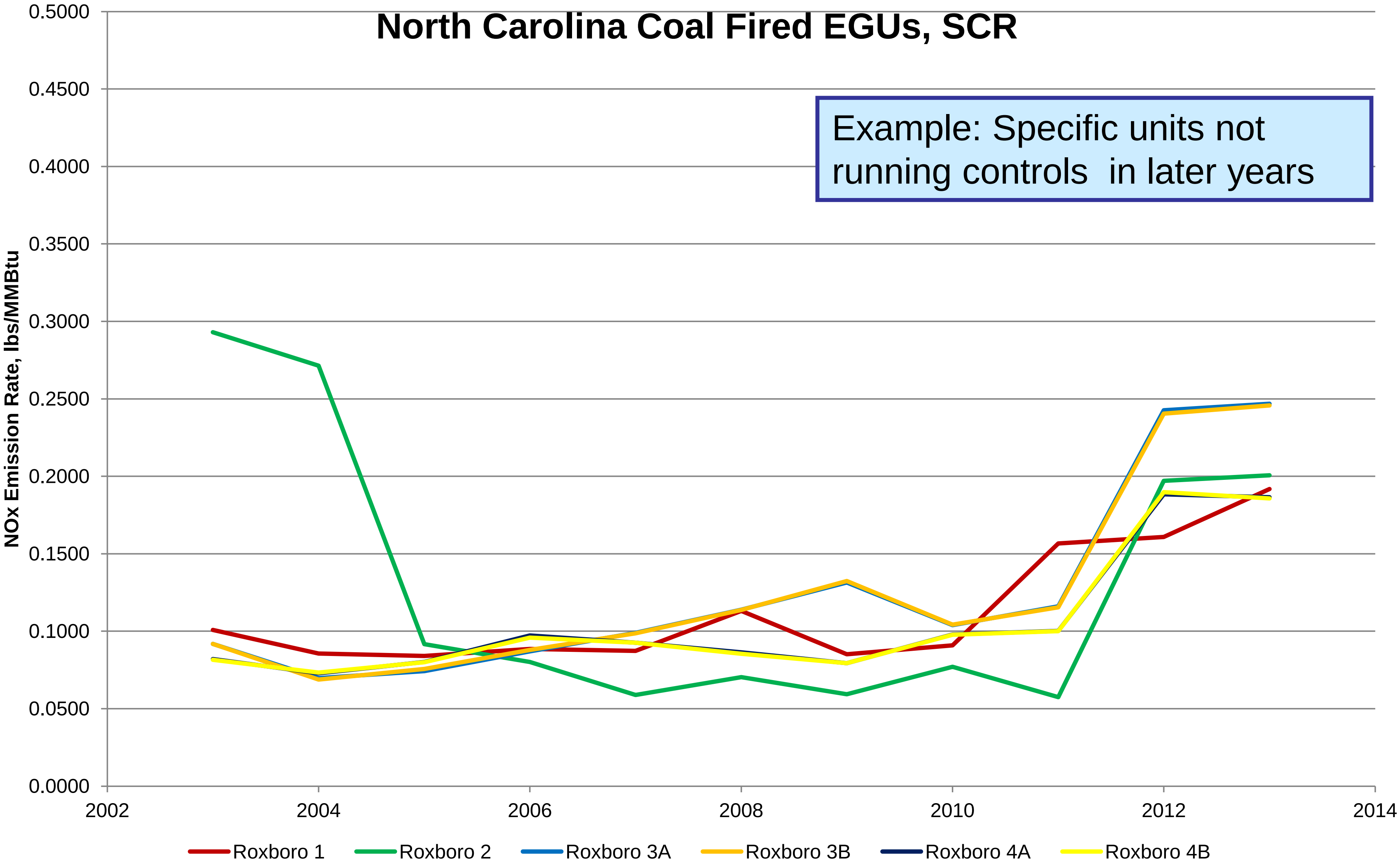
Average Ozone Season Emission Rates at Specific Units by Year



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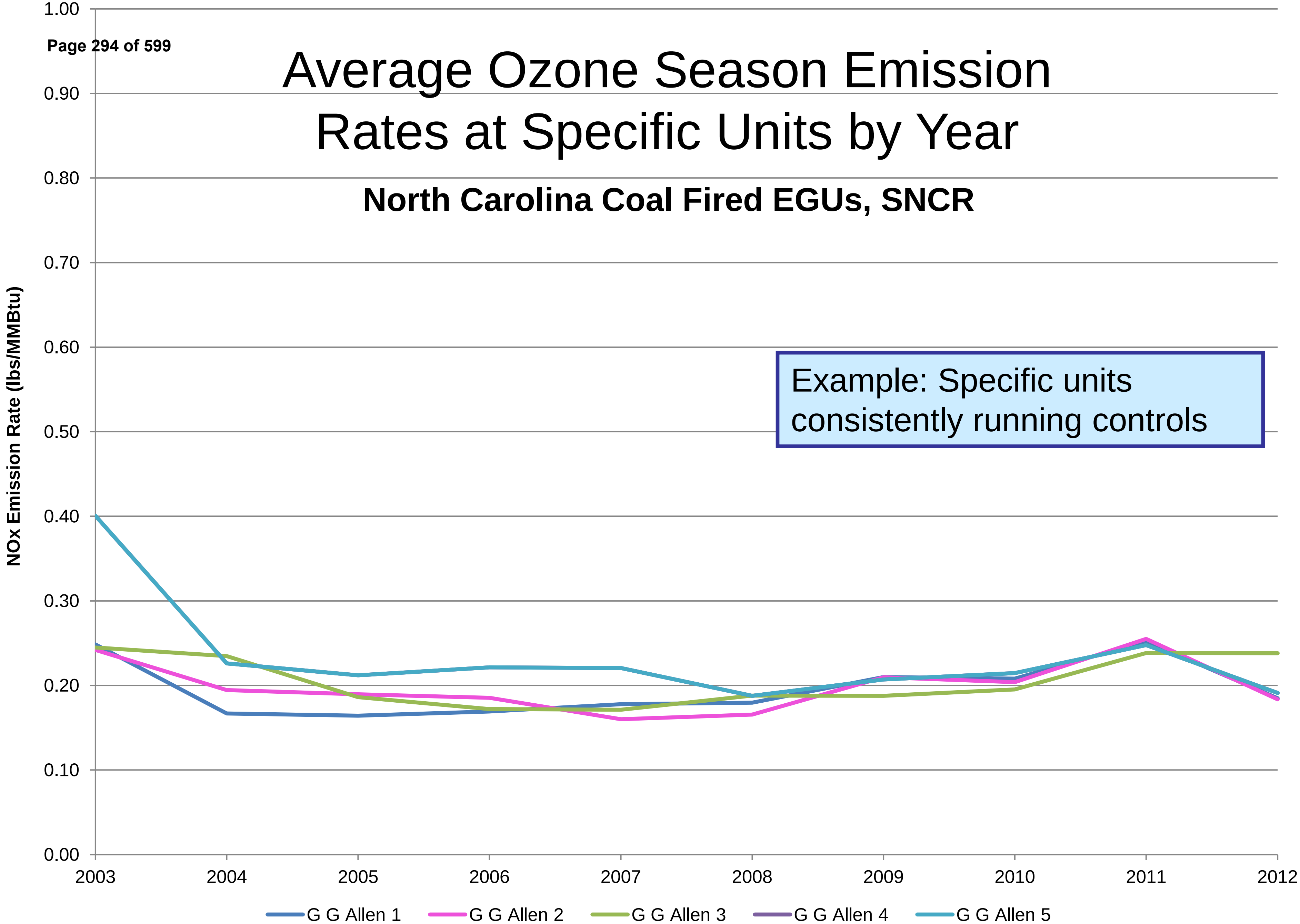
Average Ozone Season Emission Rates at Specific Units by Year



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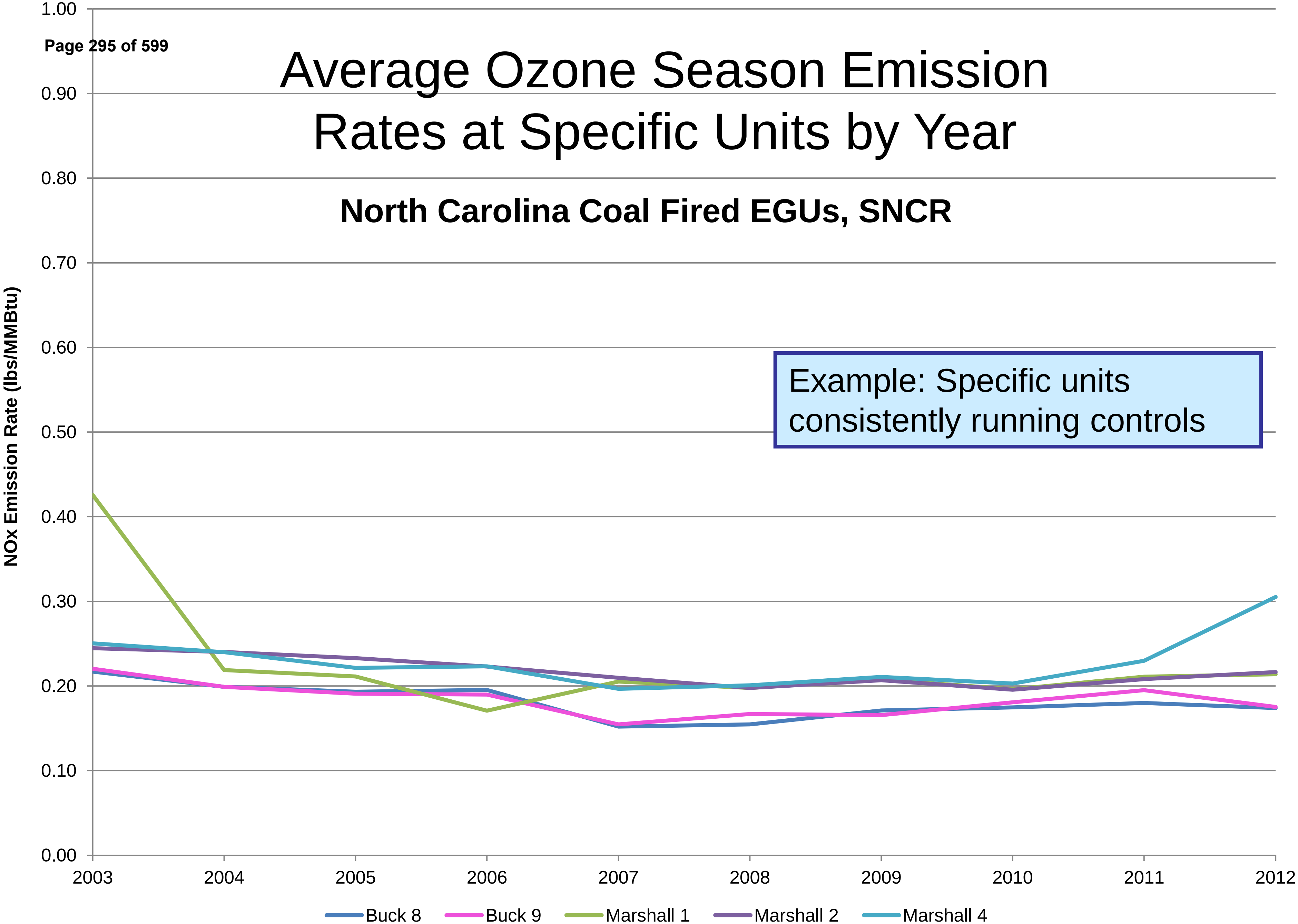
Average Ozone Season Emission Rates at Specific Units by Year

North Carolina Coal Fired EGUs, SNCR



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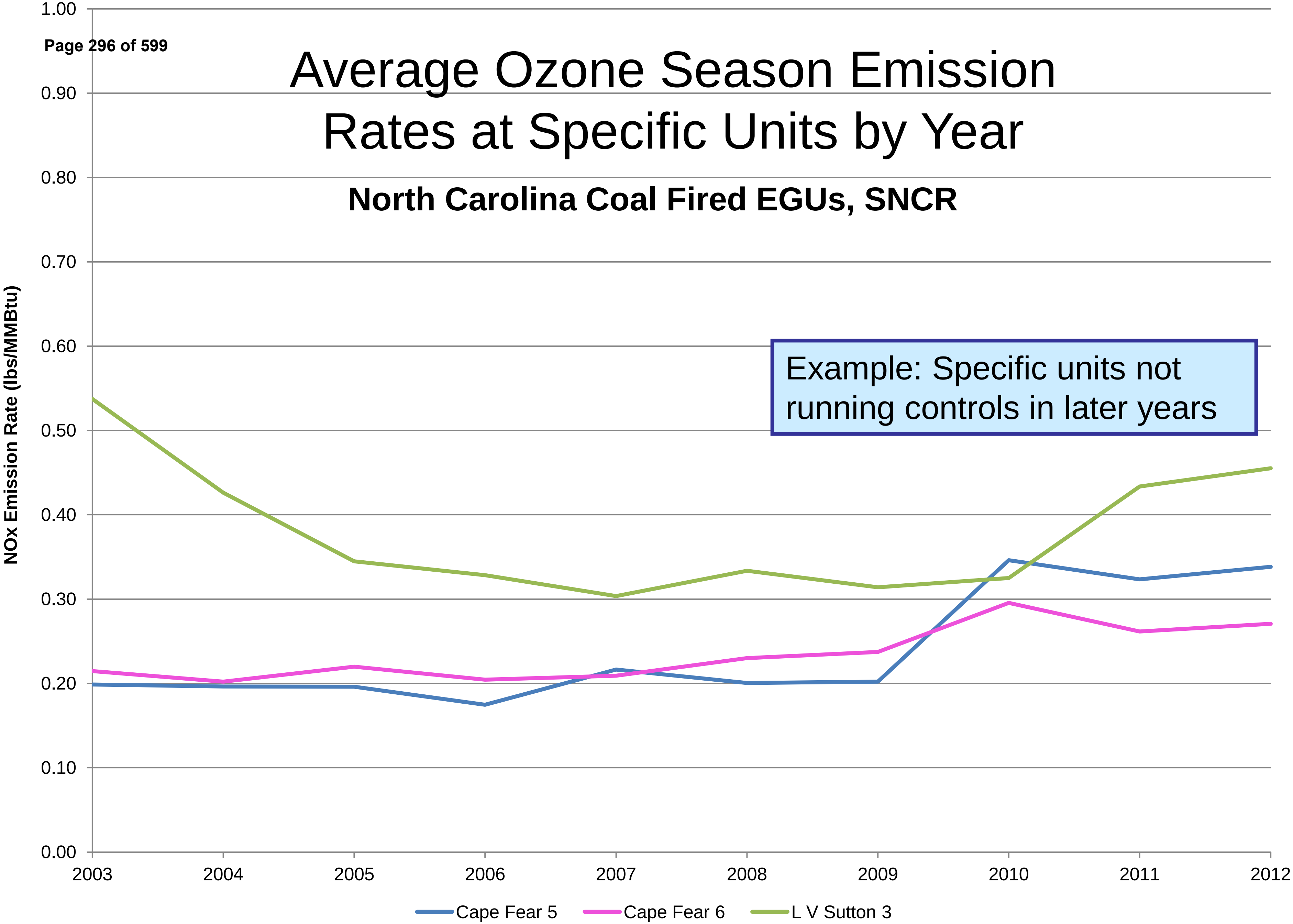
Average Ozone Season Emission Rates at Specific Units by Year



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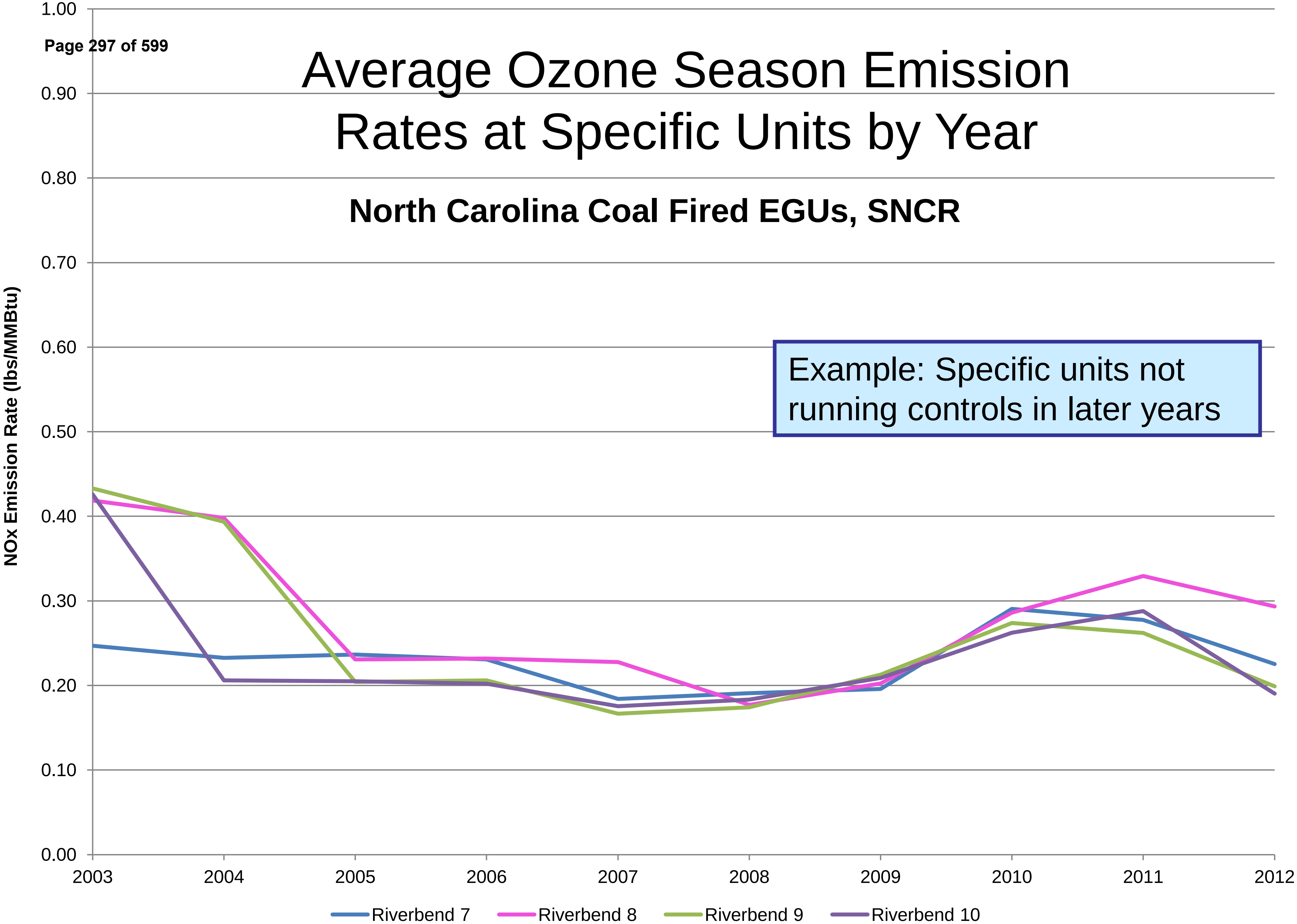
Average Ozone Season Emission Rates at Specific Units by Year

North Carolina Coal Fired EGUs, SNCR



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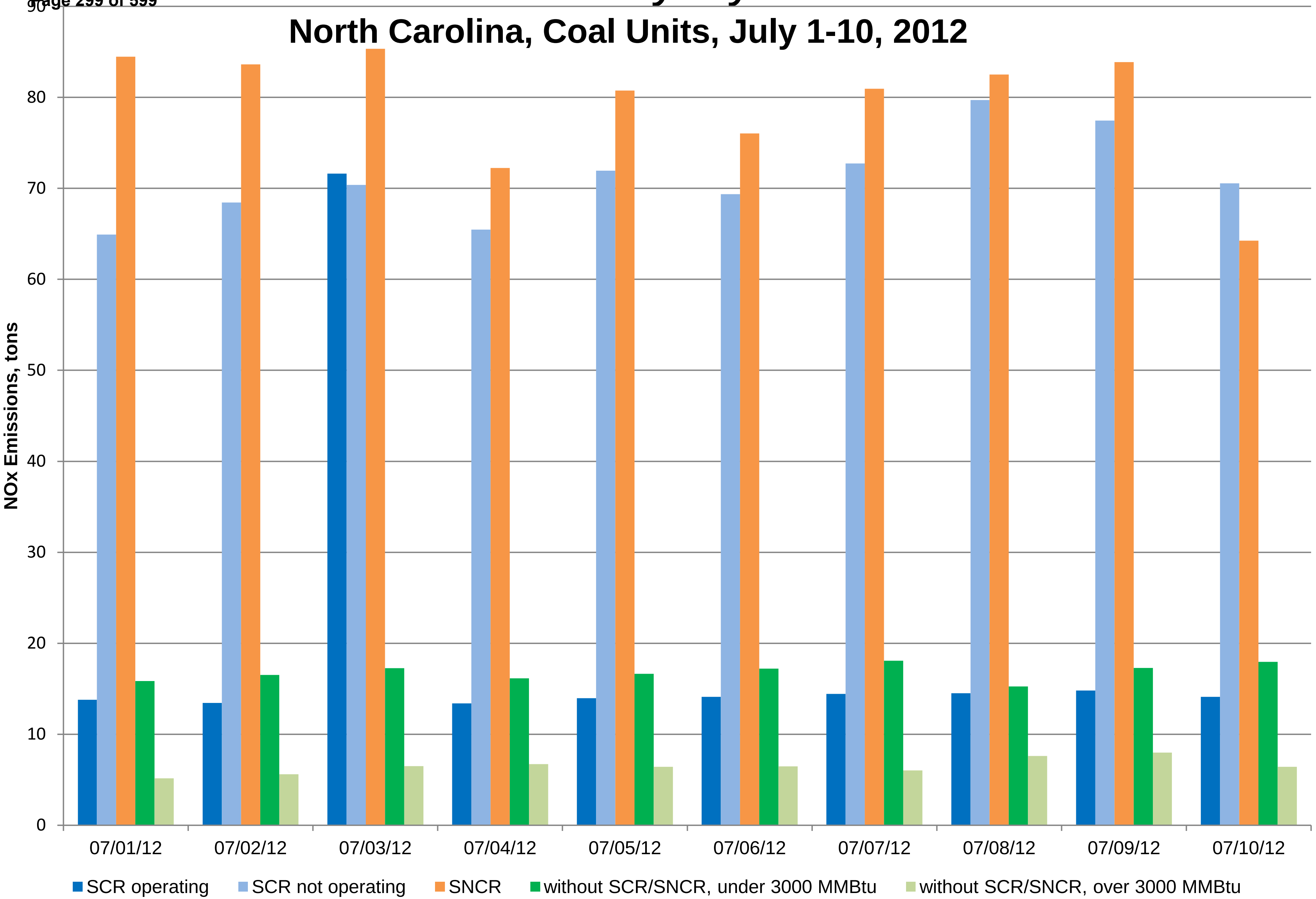
Part 3

July 1 to 10, 2012 Ozone Episode:

Analysis of Emissions and Controls

Tons of NOx Per Day By Control Status



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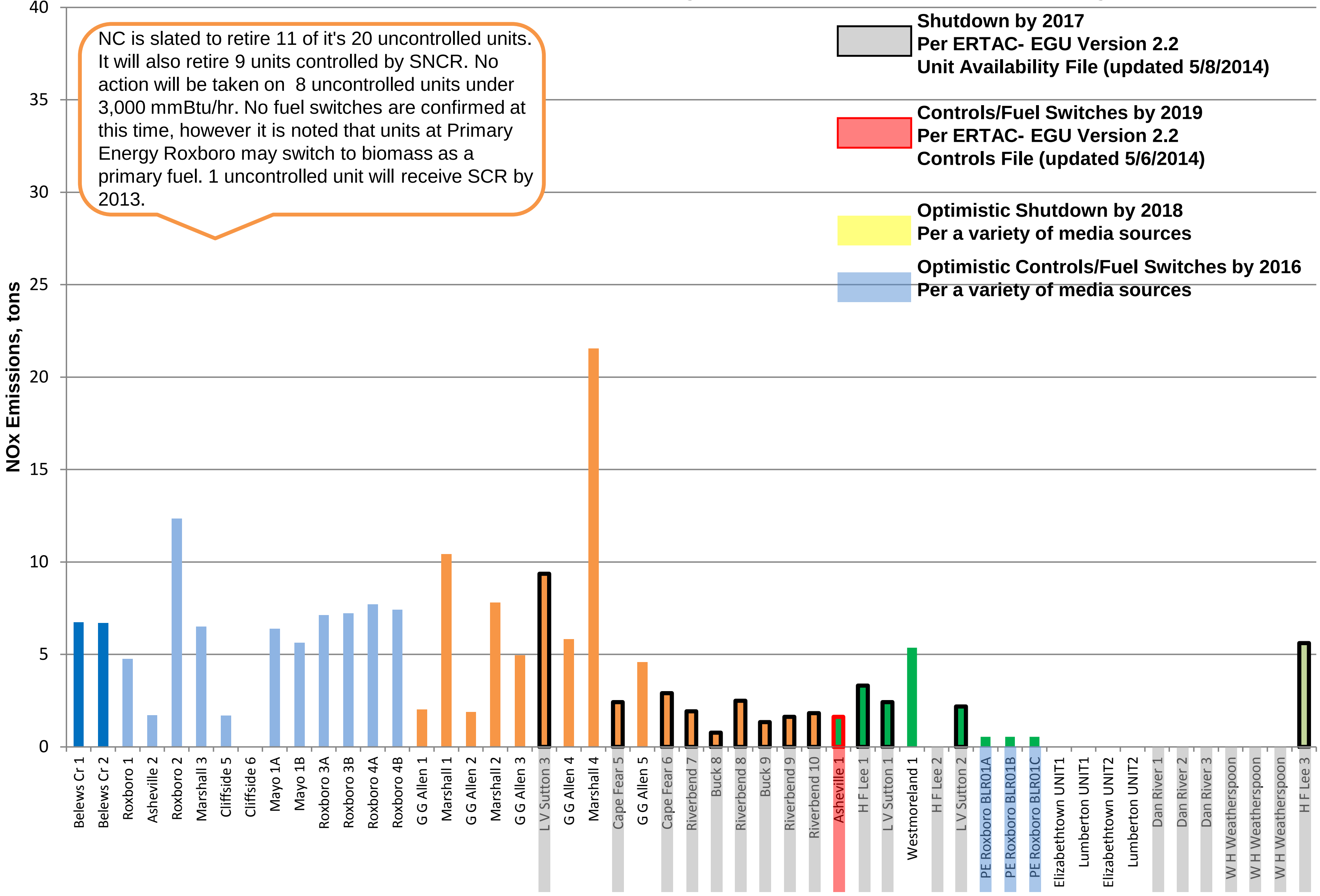
NC – Tons of NOx Per Unit By Control Status, July 2, 2012



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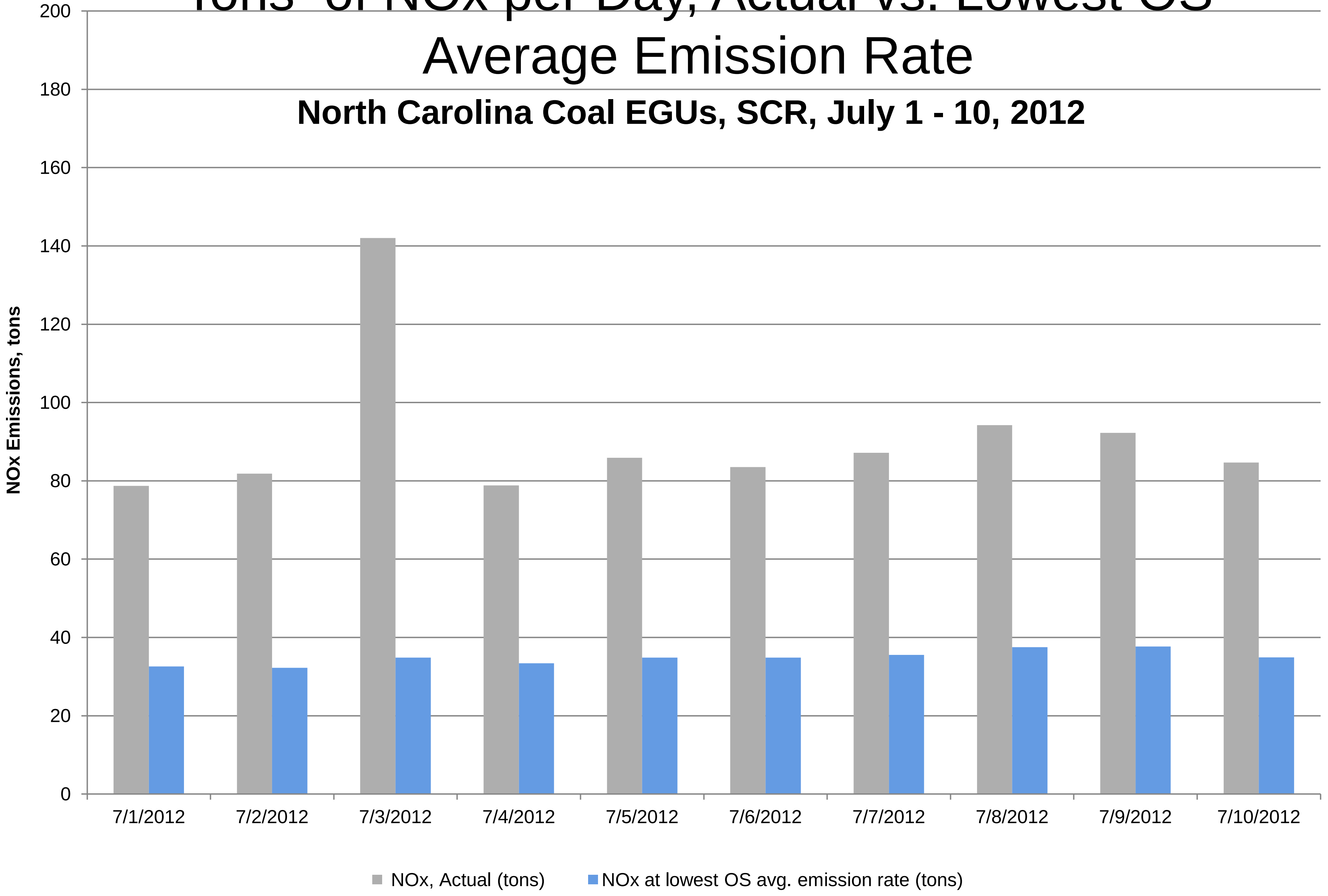
Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate

North Carolina Coal EGUs, SCR, July 1 - 10, 2012



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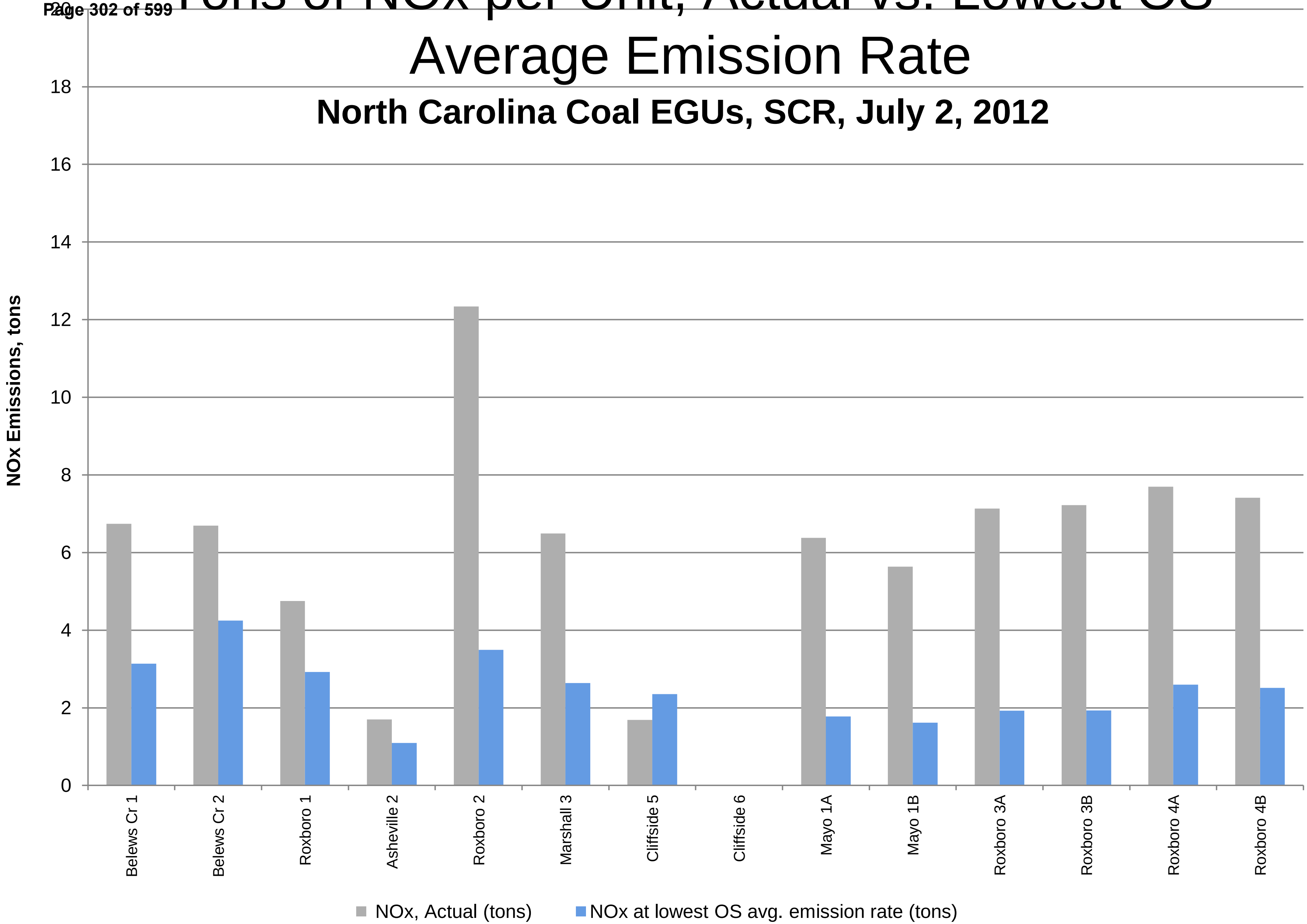
Tons of NOx per Unit, Actual vs. Lowest OS Average Emission Rate

North Carolina Coal EGUs, SCR, July 2, 2012



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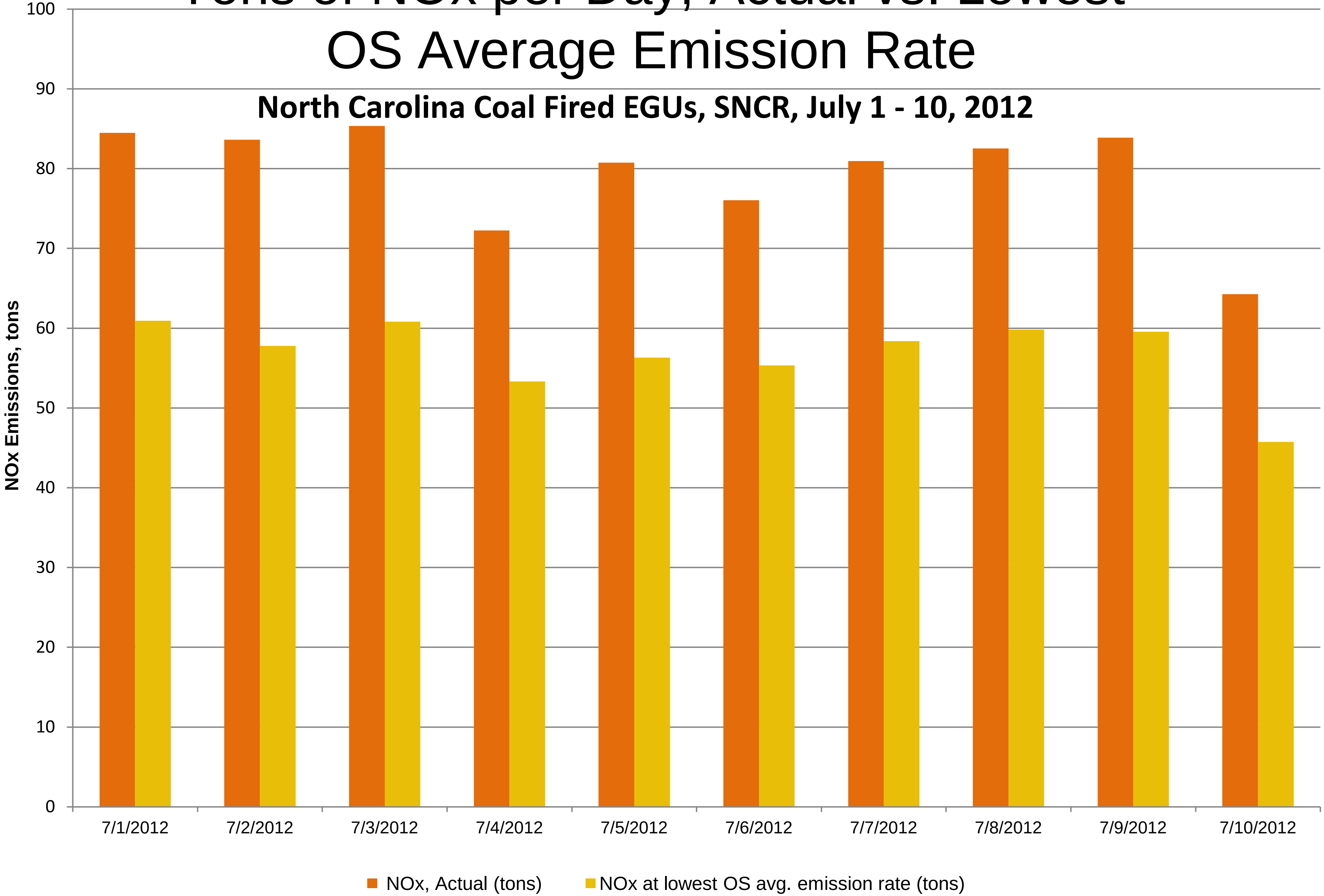
Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate



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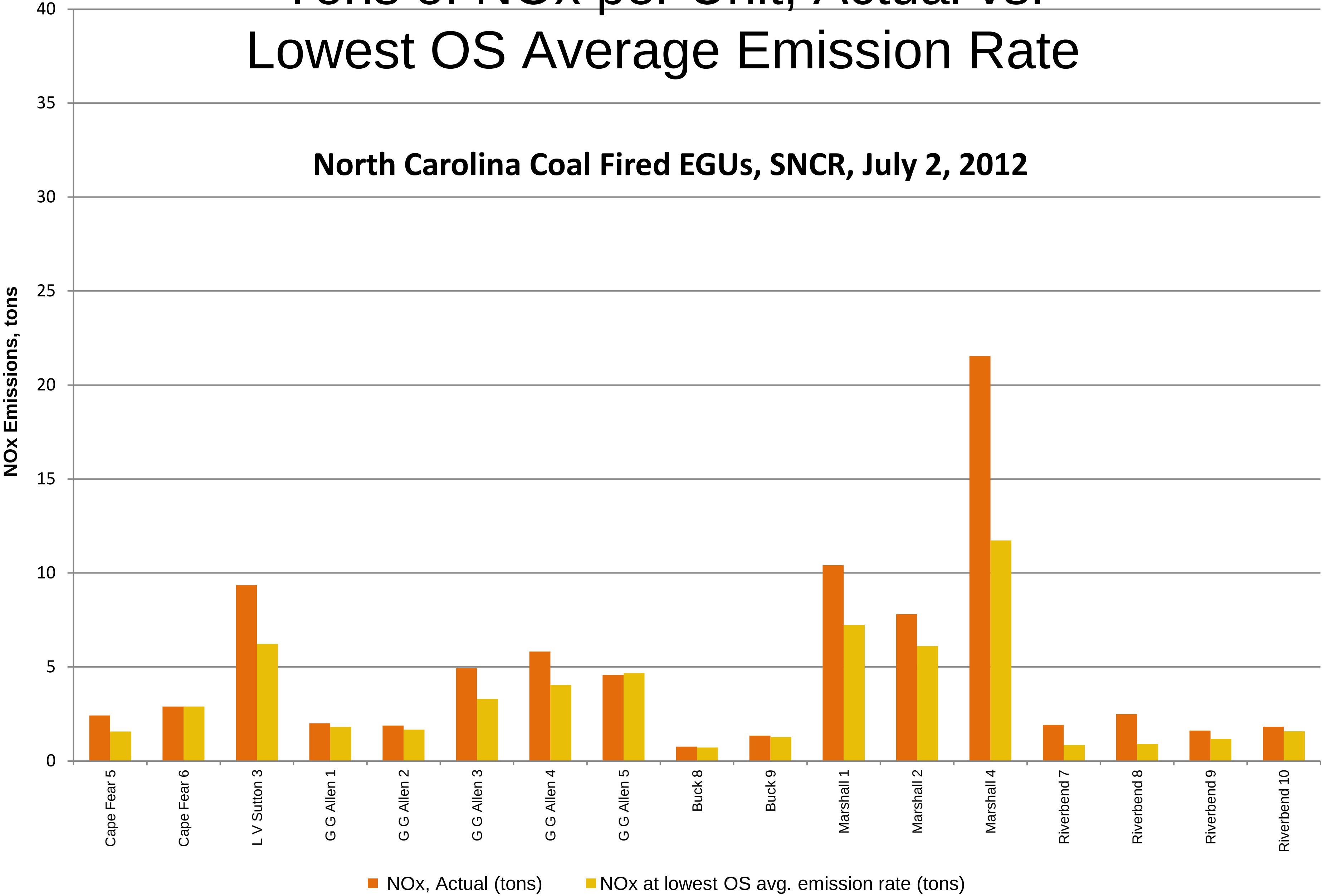
Tons of NOx per Unit, Actual vs. Lowest OS Average Emission Rate



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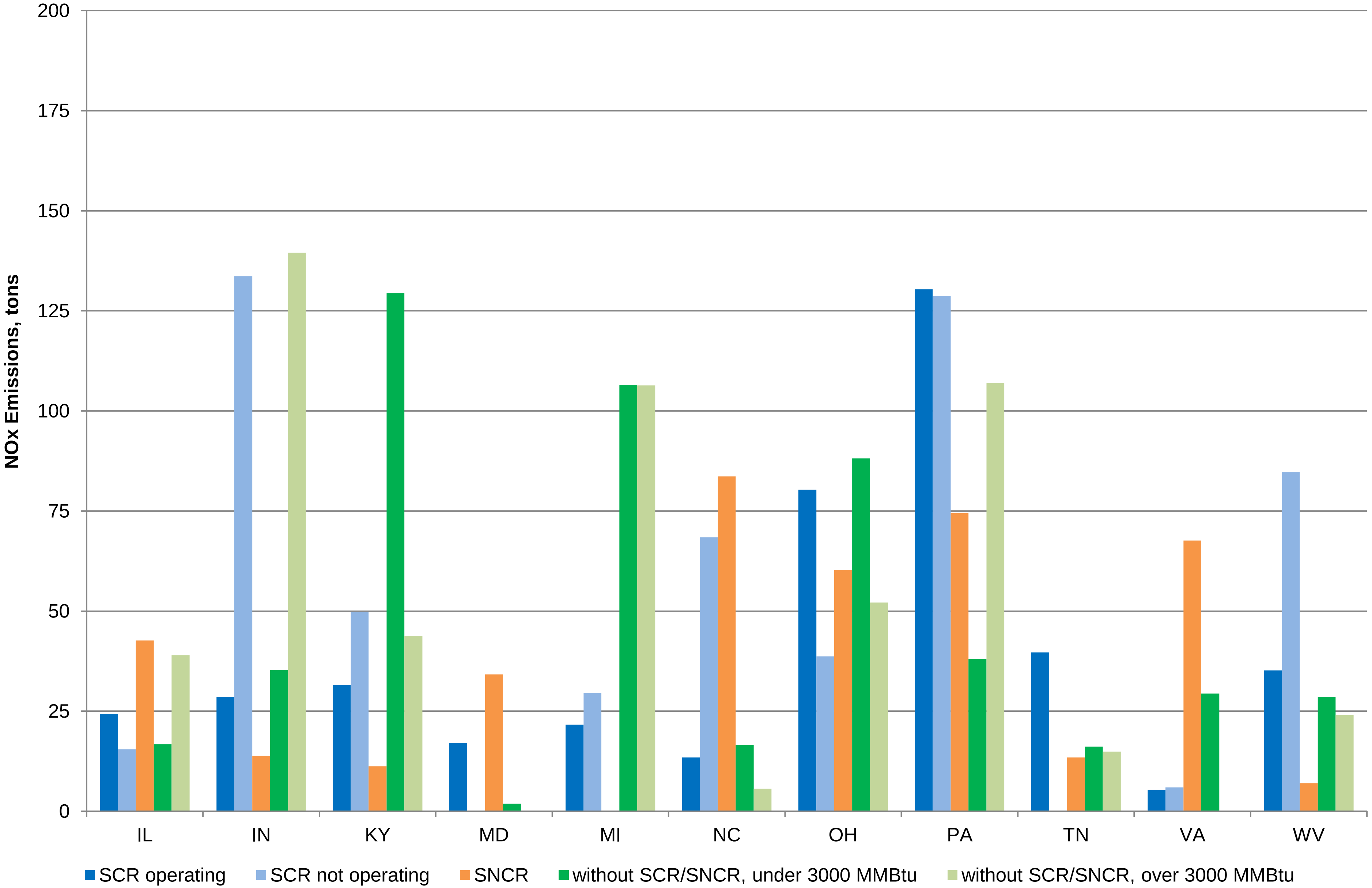
July 2, 2012 – Tons of NOx per State by Control Status



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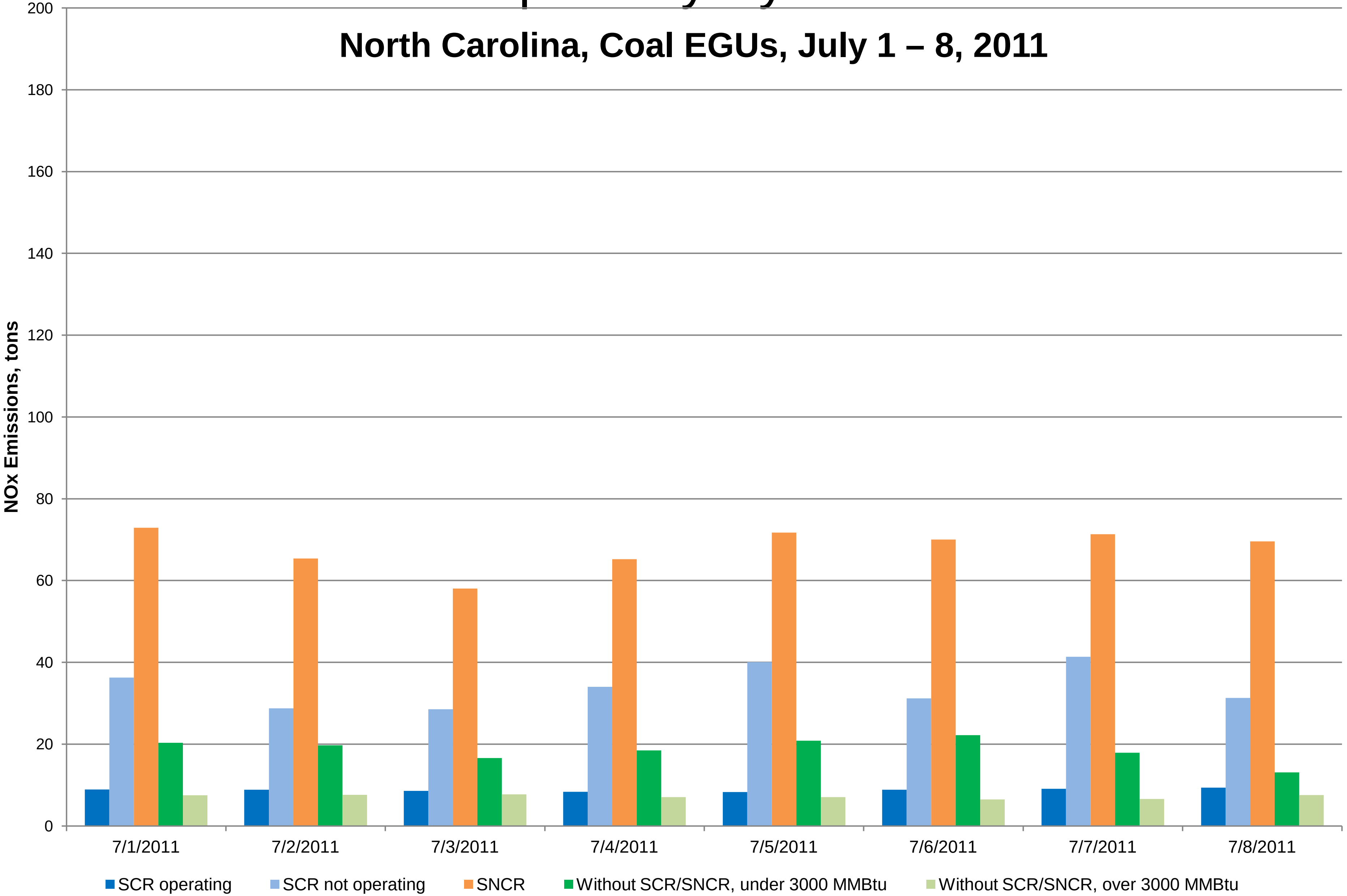
Part 4

July 1 to 8, 2011 Ozone Episode:

Analysis of Emissions and Controls

Tons of NOx per Day By Control Status



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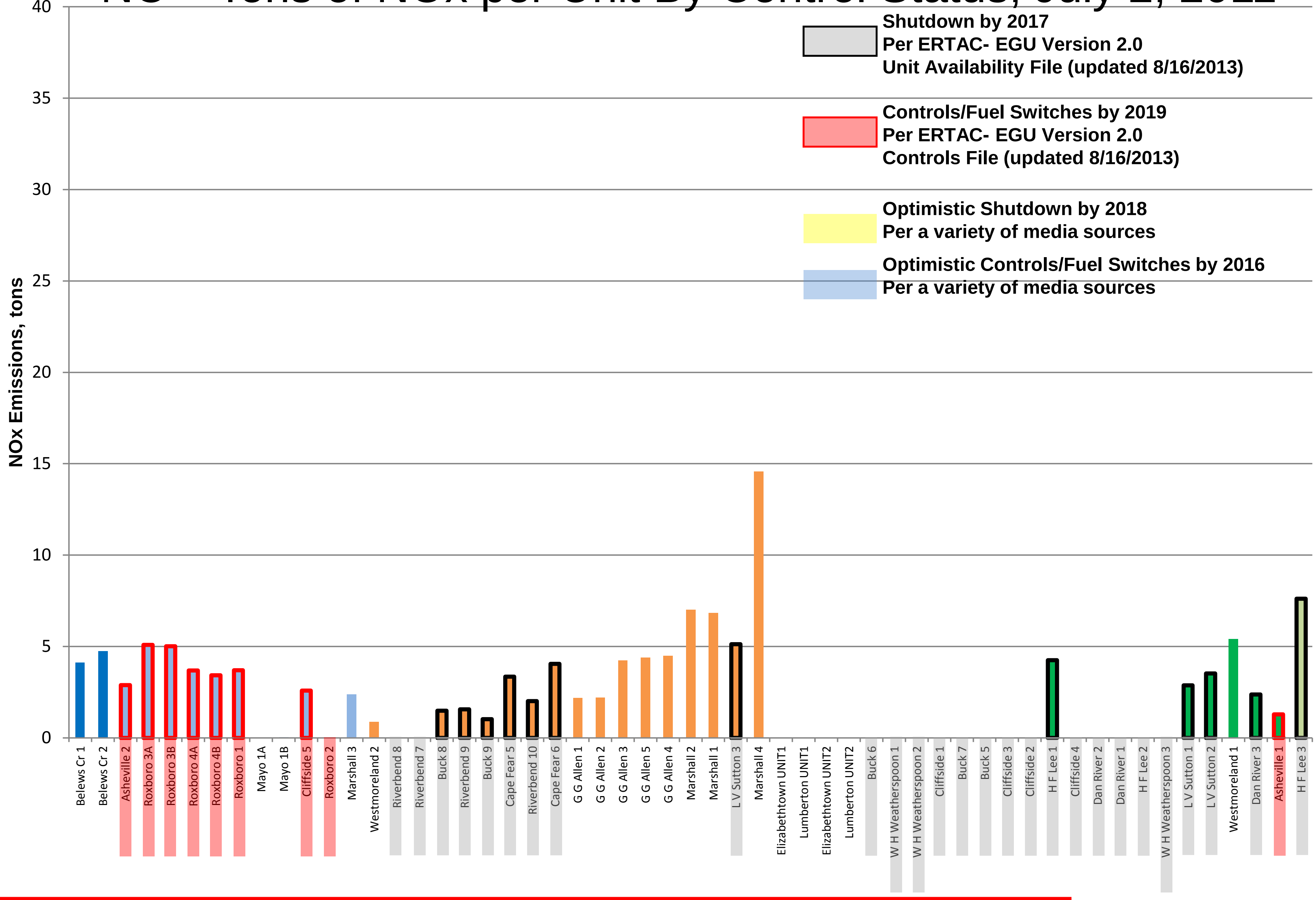
NC – Tons of NOx per Unit By Control Status, July 2, 2011



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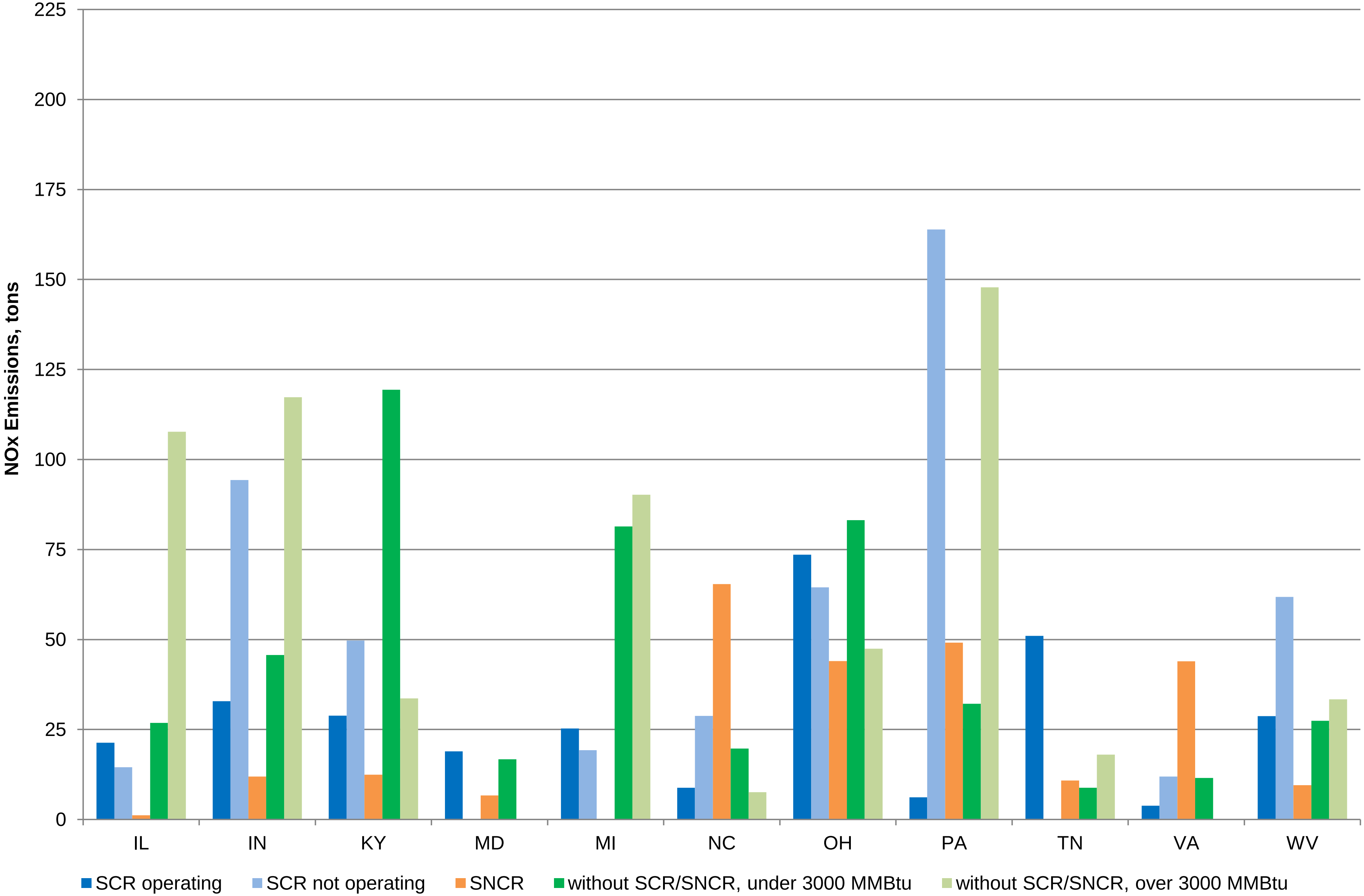
July 2, 2011 - Tons NOx per State by Control Status



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Part 5

11 State Totals

July 1 to 8, 2011 Ozone Episode:

Analysis of Emissions and Controls

11 Upwind States, 2012

- Total number of units = 1,432
- Total heat input capacity = 2,730,239 MMBtu/hr
  = 304,354 MW
- Total MW Capacity in %
  - **Total number of Coal units = 547 = 55%**
  - Total number of NG units = 672 = 25%
  - Total number of other (oil, etc.) units = 173 = 6%
  - Total number of Nuclear units = 40 = 14%
- **Total Capacity Coal = 165,910 MW**
  - 156 units with SCR = 88,783 MW = 53%
  - 114 units with SNCR = 27,561 MW = 17%
  - 277 units without SCR/SNCR = 49,566 MW = 30%

Basis – CAMD (as of 5/13/2014), NEI (for Nuclear), ERTAC (5/6/2014, 5/8/2014)

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11 Upwind States, 2018

- Total number of units = 1,199
- Total heat input capacity = 2,449,194 MMBtu/hr
  = 274,300 MW
- Total MW Capacity in %
  - **Total number of Coal units = 361 = 49%**
  - Total number of NG units = 686 = 32%
  - Total number of other (oil, etc.) units = 115 = 5%
  - Total number of Nuclear units = 37 = 14%
- **Total Capacity Coal = 134,121 MW**
  - 166 units with SCR = 93,776 MW = 70%
  - 60 units with SNCR = 17,868 MW = 13%
  - 135 units without SCR/SNCR = 22,477 MW = 17%

Basis – ERTAC (5/6/2014, 5/8/2014), NEI (for Nuclear)

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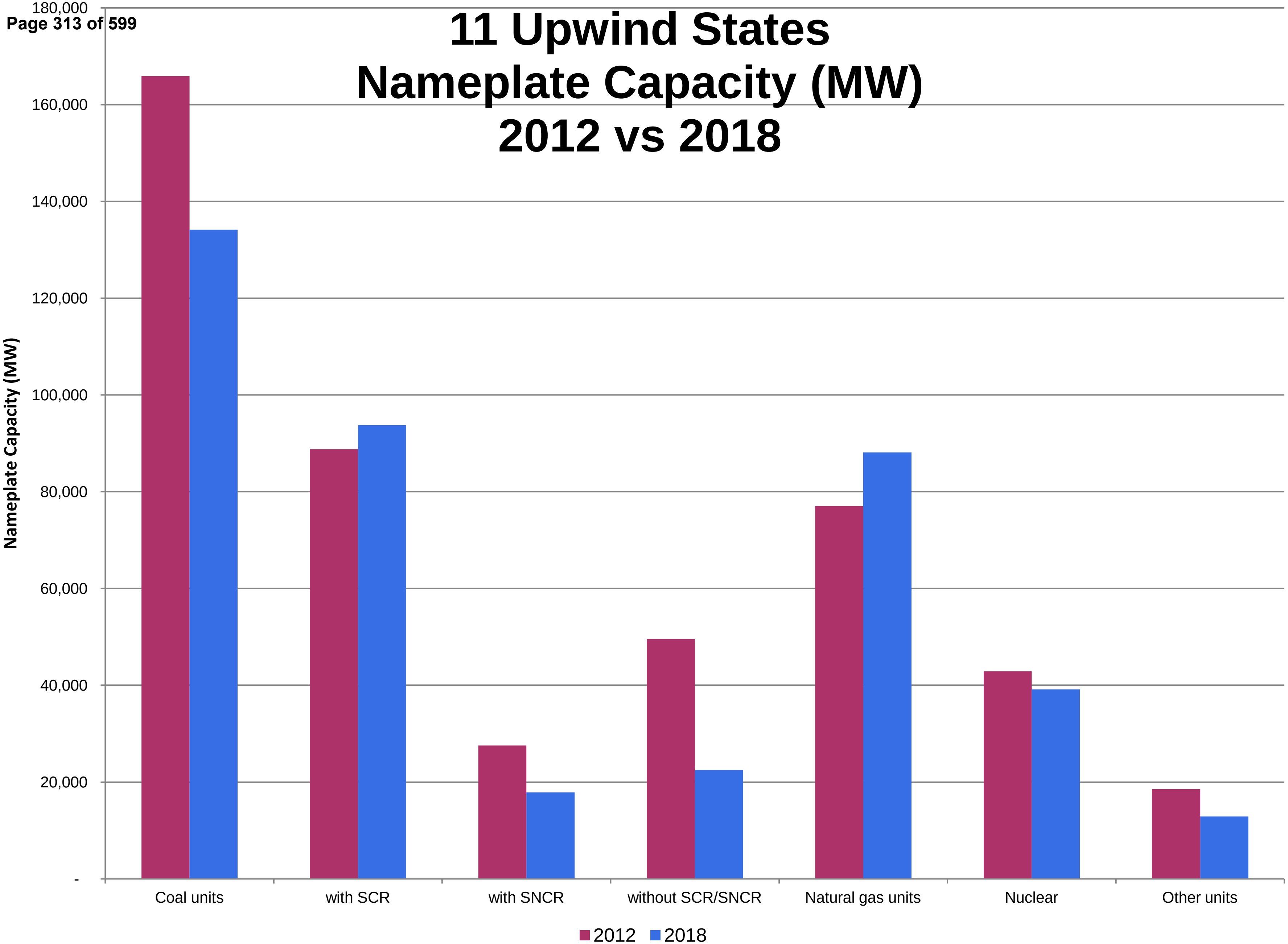

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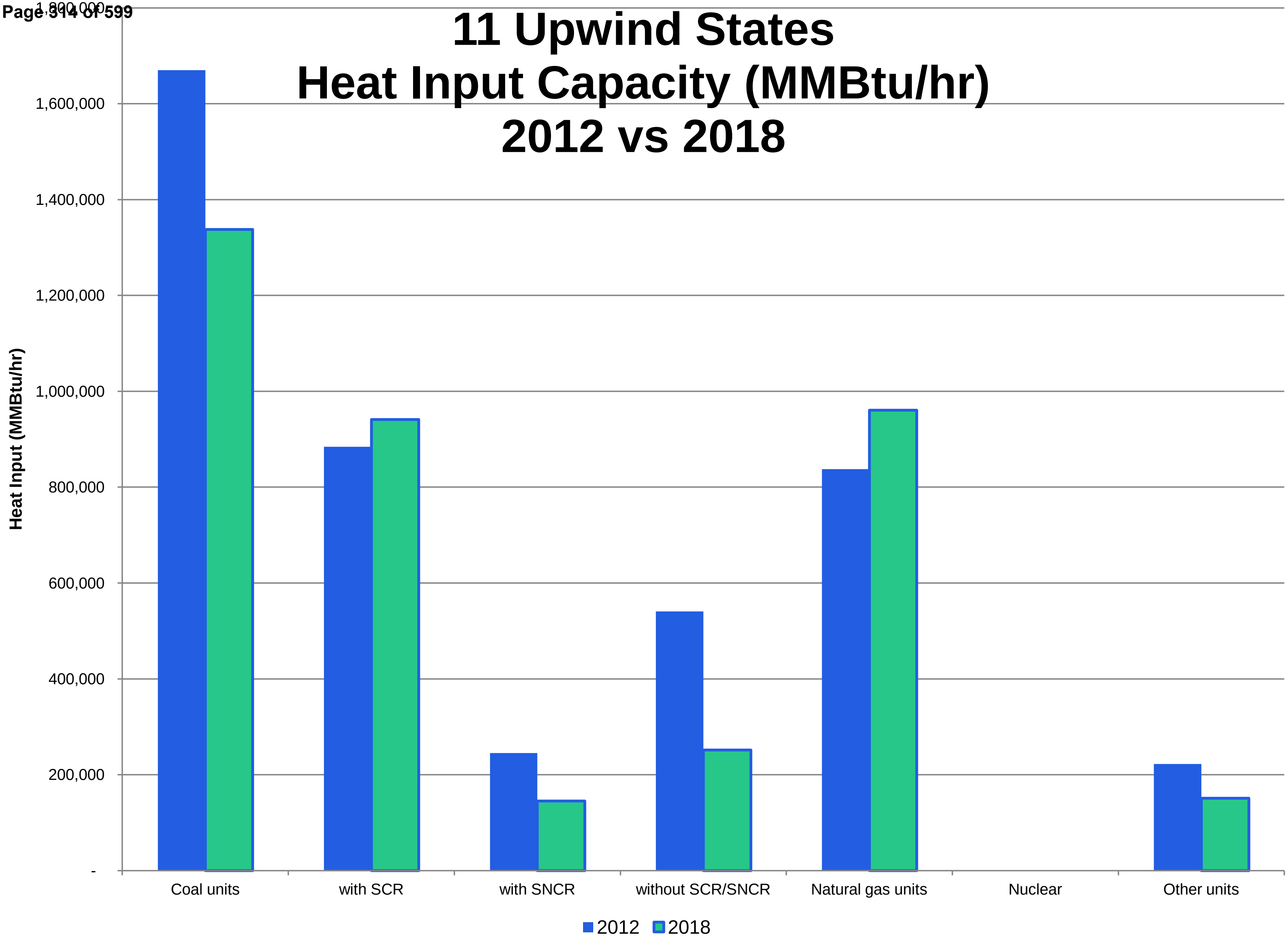

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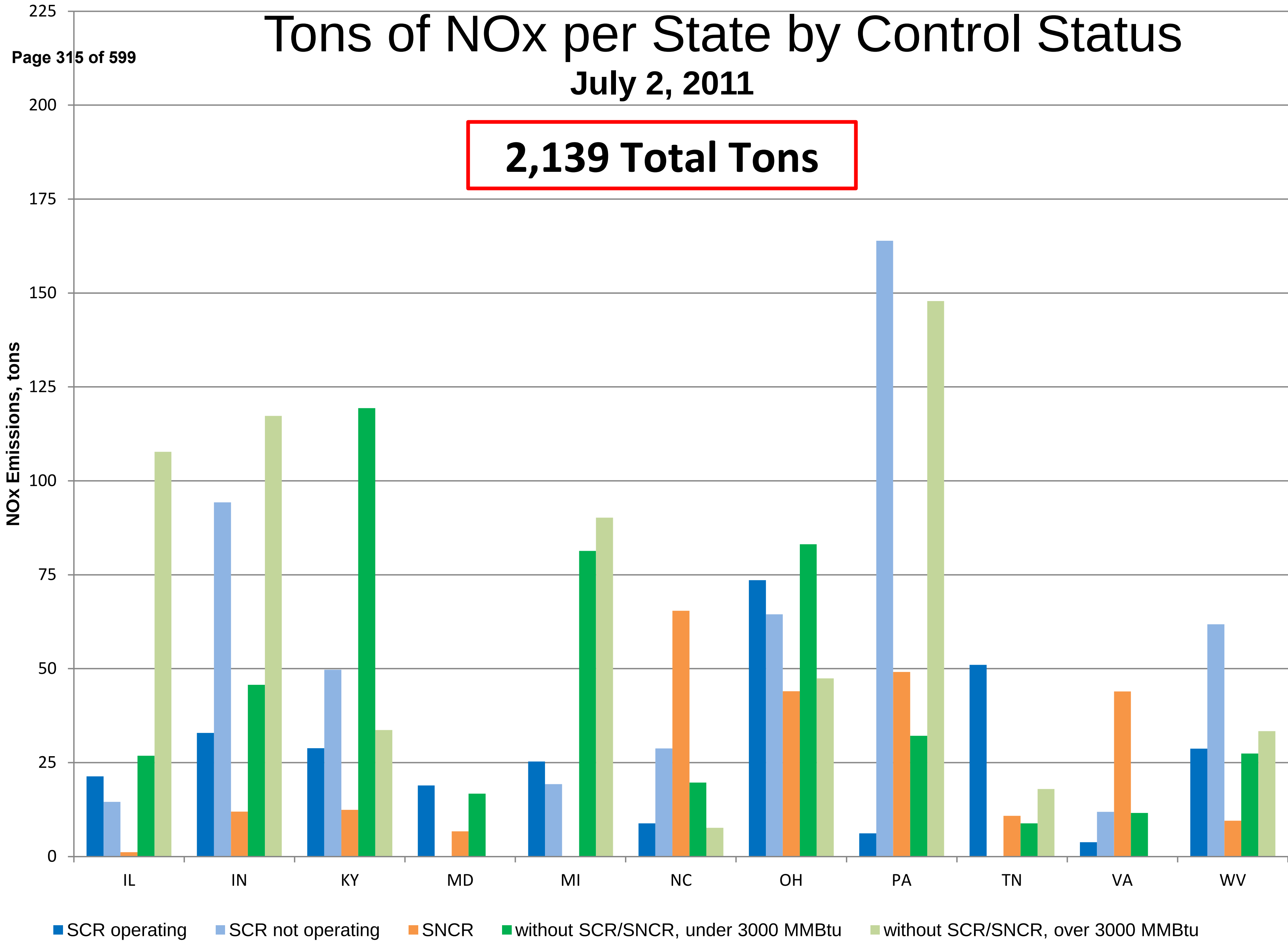
Tons of NOx per State by Control Status

July 2, 2011



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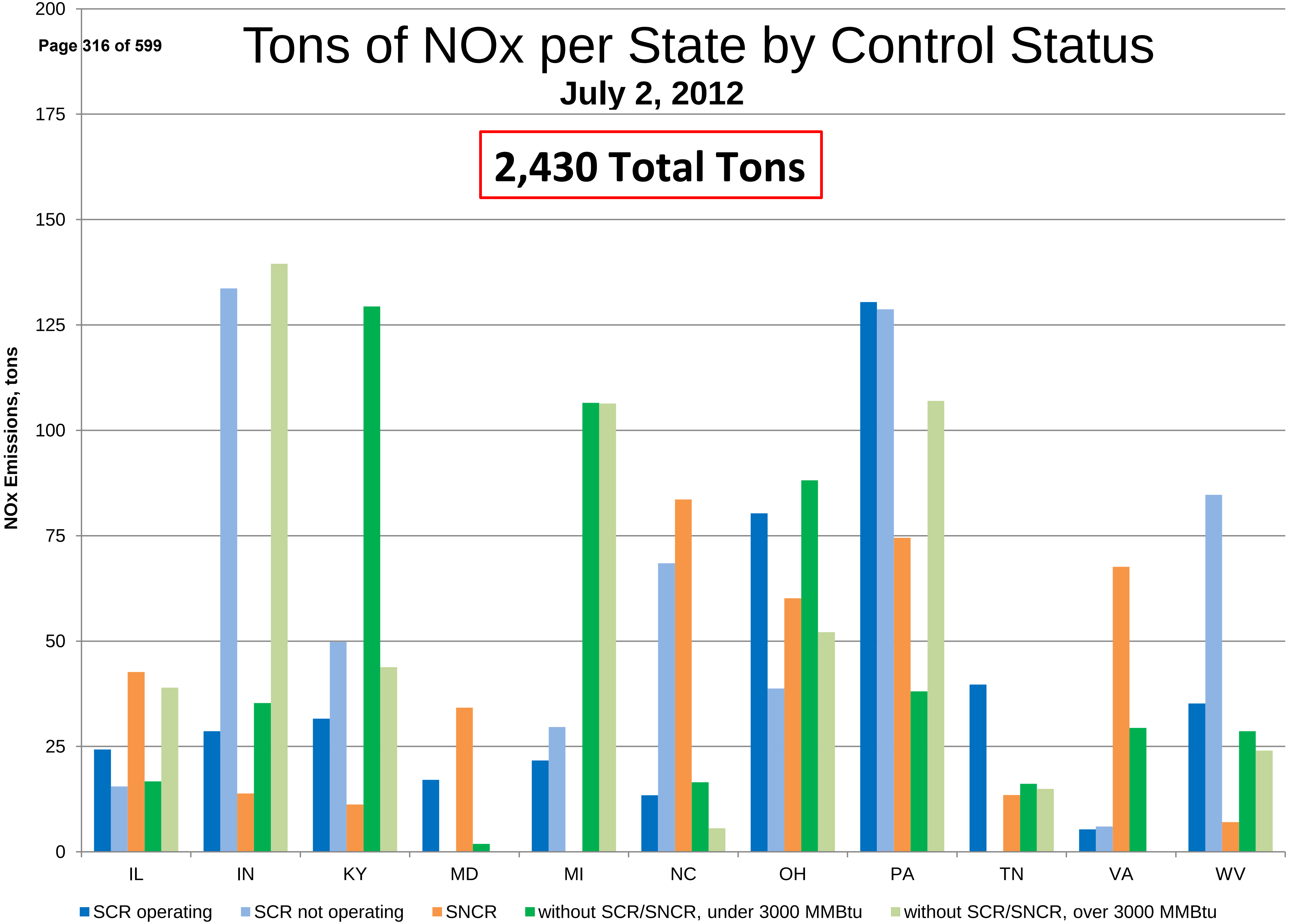
Tons of NOx per State by Control Status

July 2, 2012



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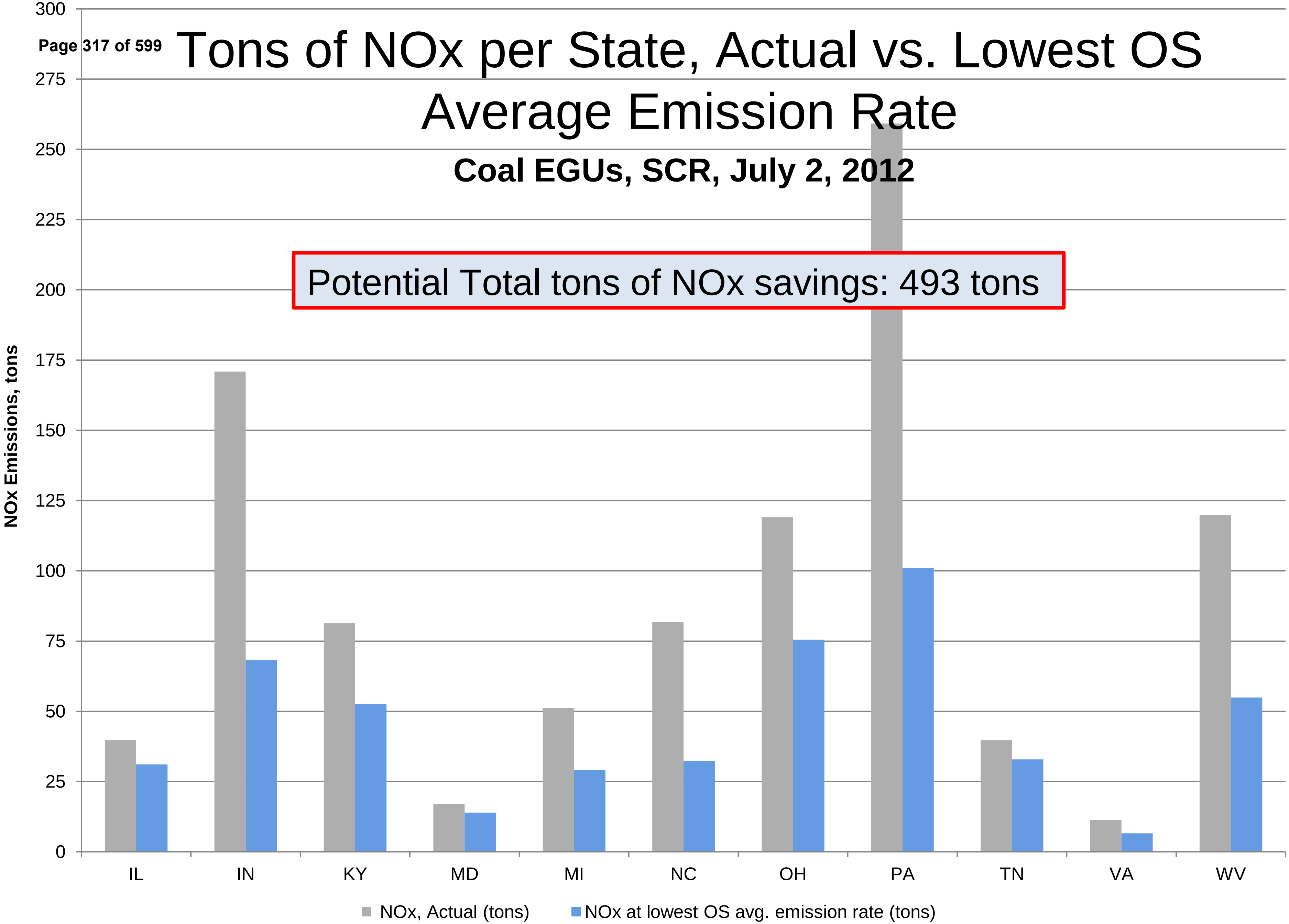
Tons of NOx per State, Actual vs. Lowest OS Average Emission Rate

Coal EGUs, SCR, July 2, 2012



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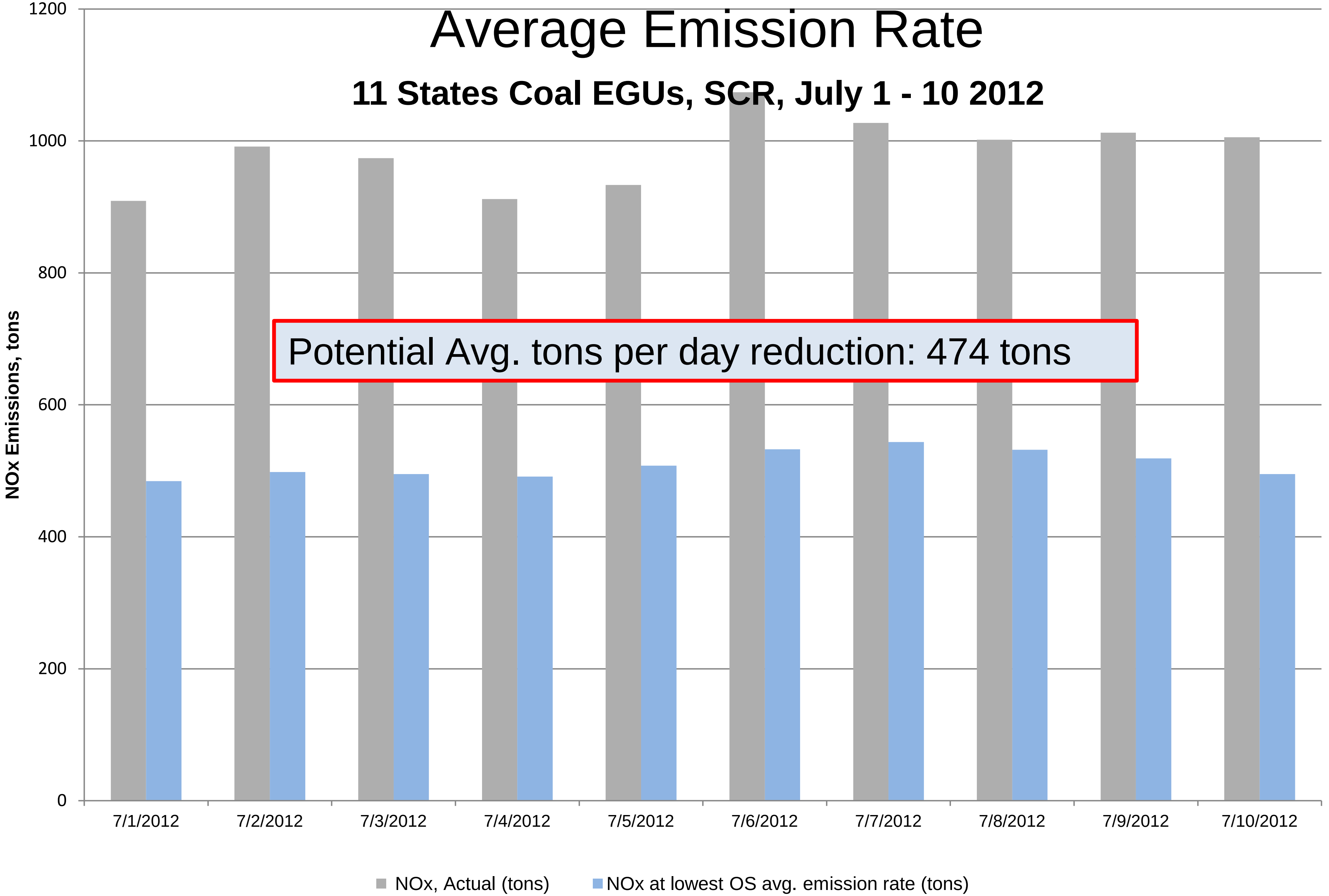
Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate



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11 State Summary

After performing similar analysis of EGUs in IL, IN, KY, MD, MI, NC, OH, PA, TN, VA and WV, the following potential total tons of lost NOx reductions was calculated:

- On July 2, 2012 actual NOx emissions in the 11 states (listed above) was 991 tons
  - If EGUs in those states were to have run their controls at the best rates observed in the data, emissions would have been 498 tons
  - This represents a single day loss of NOx reductions of 493 tons on that day
- During the 10 day episode between July 1 and 10, 2012 actual NOx emissions in the 11 states (listed above) was 9,840 tons
  - If EGUs in those states were to have run their controls at the best rates observed in the data, emissions would have been 5,099 tons
  - This represents a loss of NOx reductions of 4,741 tons over that 10-day episode

Part 6

Potential Lost Ozone Benefits from Controls Running Less Effectively in Recent Years

Preliminary Photochemical Modeling

North Carolina Monitors

How Might This Affect Ozone?

- Maryland has performed several very preliminary model runs to look at how much running EGU controls inefficiently might increase ozone levels
- Three runs:
  - Scenario 2B – A worst case run
    - Assumes SCR and SNCR controls are not run at all
  - Scenario 3B – A worst data run
    - Assumes SCR and SCR units all run at worst rates seen in CAMD data - 2005 to 2012
  - Scenario 3C – Based upon CAMD data analysis for EGU performance in 2011 and 2012
    - Assumes that units that had higher ozone season emission rates were operating at the best ozone season rates observed since 2005

Lost Ozone Benefits
Potential PPB Increases

North Carolina Monitors	Potential Increased Ozone in 2018 – 3 EGU Control Scenarios		
County	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Alexander	4.2	1.3	0.6
Avery	5.0	1.2	0.6
Buncombe	4.6	1.8	1.4
Caldwell	4.3	1.0	0.5
Caswell	5.3	1.4	0.6
Chatham	5.4	1.8	0.7
Cumberland	4.1	1.0	0.5
Cumberland	4.8	1.2	0.6
Davie	5.2	1.6	0.8
Durham	5.3	1.7	0.6
Edgecombe	4.1	1.0	0.6
Forsyth	5.6	1.4	0.6
Forsyth	6.5	1.7	0.8
Forsyth	4.6	1.4	0.7
Forsyth	12.0	2.8	0.9
Franklin	3.7	0.8	0.4
Graham	5.2	1.2	0.6
Granville	6.2	2.1	0.6
Guilford	5.1	1.2	0.6
Haywood	5.1	1.5	1.0
Haywood	4.5	1.1	0.6

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Lost Ozone Benefits
Potential PPB Increases

North Carolina Monitors	Potential Increased Ozone in 2018 – 3 EGU Control Scenarios		
County	Worst Case – No SCRs or SNCRs (Scenario 2B)	Using worst rate CAMD Data (Scenario 3B)	Using actual 2011/2012 Data (Scenario 3C)
Haywood	3.8	1.0	0.6
Jackson	5.7	1.5	0.8
Johnston	5.3	1.5	0.6
Lenoir	3.5	0.8	0.4
Lincoln	7.0	2.9	1.2
Martin	3.3	0.8	0.4
Mecklenburg	4.6	1.7	1.0
Mecklenburg	4.1	1.8	1.2
Mecklenburg	4.0	1.9	1.4
New Hanover	2.4	0.5	0.3
Person	17.9	11.5	3.4
Pitt	4.5	1.2	0.6
Rockingham	11.8	2.7	1.0
Rowan	4.9	1.9	1.0
Rowan	5.5	1.9	0.9
Swain	4.9	1.3	0.6
Union	4.5	1.3	0.7
Wake	4.1	1.1	0.4
Wake	5.0	1.5	0.6
Yancey	4.8	1.3	0.8

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Lost Ozone Benefit – 2018 Design Values

… EPA will propose a new ozone standard soon … 60 to 70 ppb range … designations to most likely be based upon 2014 to 2016 or 2015 to 2017 data

Projected to be Clean in 2018 … Potentially at Risk		Increased Ozone in 2018 – 3 EGU Control Scenarios		
North Carolina Counties	**2018 – Controls Running Well (Scenario 3A)**	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Alexander	58.6	62.8	59.9	59.2
Avery	53.6	58.6	54.8	54.2
Buncombe	57.2	61.8	59.0	58.6
Caldwell	55.8	60.2	56.8	56.3
Caswell	58.7	64.0	60.1	59.2
Chatham	54.7	60.1	56.4	55.4
Cumberland	59.8	63.9	60.8	60.3
Cumberland	57.8	62.5	59.0	58.3
Davie	63.1	68.3	64.8	63.9
Durham	56.7	61.9	58.4	57.3
Edgecombe	59.9	64.0	60.9	60.4
Forsyth	60.6	66.3	62.0	61.3
Forsyth	60.5	67.0	62.2	61.3
Forsyth	58.6	63.3	60.0	59.3
Forsyth	55.8	67.8	58.6	56.7
Franklin	56.5	60.1	57.2	56.8
Graham	60.9	66.1	62.1	61.5
Granville	58.8	64.9	60.9	59.4
Guilford	63.4	68.6	64.6	64.0
Haywood	62.8	67.9	64.3	63.8
Haywood	62.1	66.6	63.2	62.7

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Lost Ozone Benefit – 2018 Design Values

… EPA will propose a new ozone standard soon … 60 to 70 ppb range … designations to most likely be based upon 2014 to 2016 or 2015 to 2017 data

Projected to be Clean in 2018 … Potentially at Risk		Increased Ozone in 2018 – 3 EGU Control Scenarios		
North Carolina Counties	**2018 – Controls Running Well (Scenario 3A)**	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Haywood	58.7	62.5	59.7	59.3
Jackson	60.9	66.6	62.4	61.6
Johnston	56.2	61.6	57.7	56.9
Lenoir	59.1	62.6	59.9	59.5
Lincoln	62.8	69.8	65.7	64.0
Martin	59.7	63.0	60.5	60.1
Mecklenburg	70.1	74.8	71.8	71.2
Mecklenburg	68.1	72.2	69.9	69.3
Mecklenburg	62.5	66.6	64.5	63.9
New Hanover	56.4	58.9	57.0	56.7
Person	60.2	78.1	71.7	63.6
Pitt	60.4	65.0	61.6	61.0
Rockingham	60.5	72.3	63.3	61.5
Rowan	66.3	71.2	68.2	67.2
Rowan	65.9	71.3	67.8	66.8
Swain	52.3	57.2	53.6	53.0
Union	60.4	64.8	61.6	61.1
Wake	60.7	64.8	61.8	61.1
Wake	59.9	64.8	61.3	60.4
Yancey	62.5	67.3	63.8	63.3

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EGU Data Package #3

Operation of Existing SCR, SNCR

Ohio

Sample of draft data and analyses developed by the Maryland Department of the Environment

Contact: Tad Aburn, Air Director, MDE
(410) 537-3255

September 18, 2014

Purpose

- Maryland is the only Moderate nonattainment area in the East for the 75 ppb ozone standard.
  - This means that Maryland is the only state required to submit an attainment SIP
  - Only state required to perform attainment modeling.
- We are now beginning to build our "SIP Quality" modeling platform.
- One major issue that our data analyses have uncovered is that many EGU units appear to not be running their control equipment in recent years as efficiently as they have demonstrated they can do in earlier years. This issue is driven by recent changes in the energy market, reduced coal capacity, inexpensive allowances and a regulatory structure driven by ozone season caps not daily performance. In many states, including Maryland, this has lead to controls not always being used efficiently on the days when they are needed the most … this is perfectly legal.
- This is a critical issue that we would like to continue to discuss with you. There appears to be an interest from the private sector to discuss this issue and see if a common sense fix can be designed. Maryland believes this fix would be relatively cost-effective compared to the capital cost of the control technologies.
- MDE has focused our analyses on two of the worst large, regional scale ozone episodes from recent years: July 1-8, 2011 and July 1-10, 2012.
- The primary data used in these analyses include:
  - CEMS data from CAMD
  - Emissions and projection data from ERTAC
  - Other data we have received from individual states
- More detailed data and analyses and spreadsheets are available upon request.

How the Data Analyses Were Built

- Maryland began the data analyses in late 2012
  - Looked at EGUs in the 9 upwind states named in the 176A Petition (IL, IN, KY, MI, NC, OH, TN, VA, WV) … MD and PA
- Shared a draft package with Air Directors on April 21, 2014
  - This package focused on a bad ozone episode: July 1 – 8, 2011
- Shared a second draft package with Air Directors on May 13, 2014
  - This package focused on second bad ozone episode: July 1 – 10, 2012
  - This package also included update to specific material after receiving comments from numerous states
- The 2011 and 2012 episodes analyzed capture two of the worst regional ozone periods in 2011 and 2012
  - Other states, like Wisconsin and Delaware have done similar analyses and reached similar conclusions
- This is the third draft package, and builds on to the prior two draft packages, while incorporating input from individual states and updates to ERTAC.
- This third draft package also includes preliminary photochemical modeling performed by MDE to look at the potential loss of ozone reduction benefits.

Help Us QA the Data

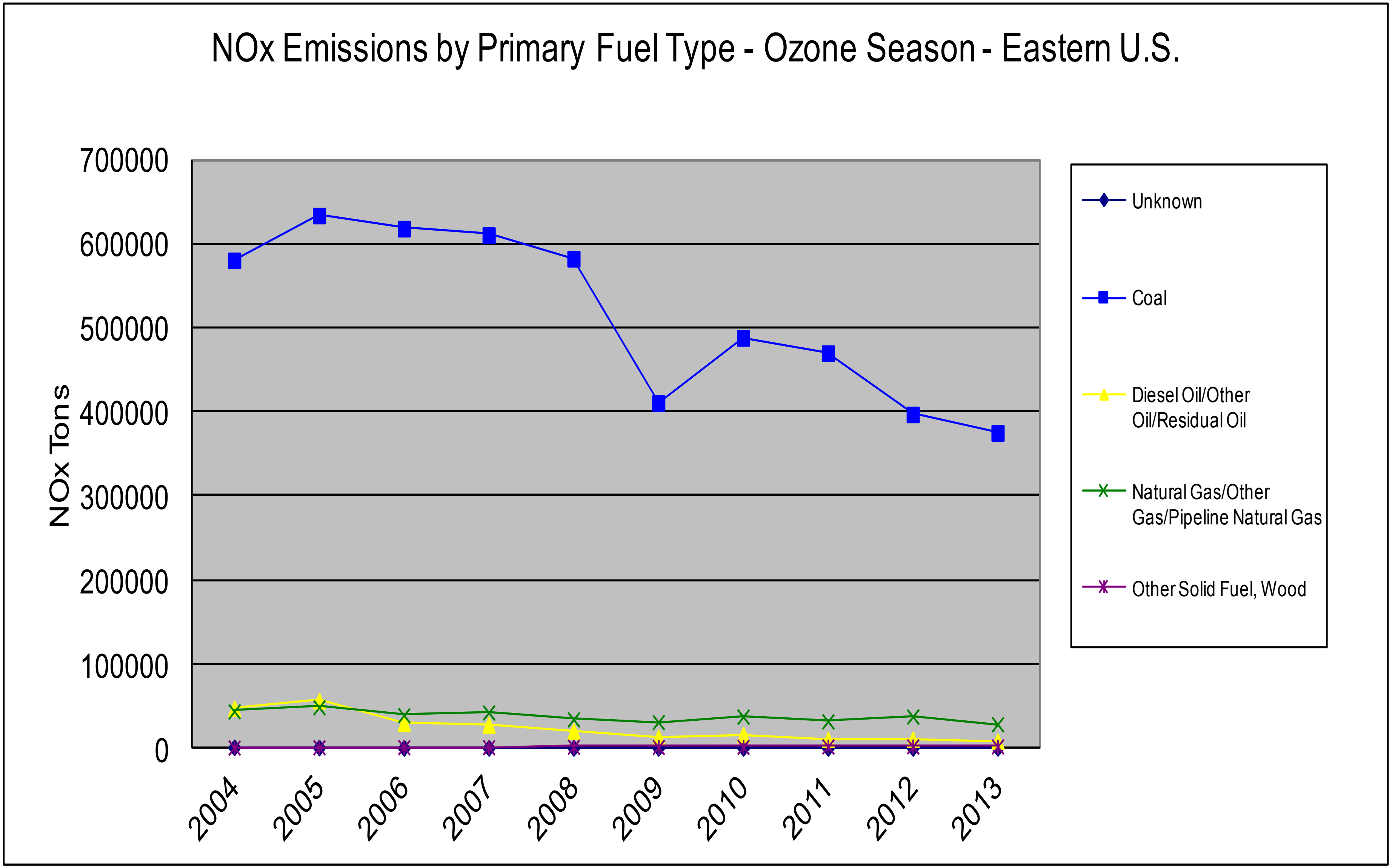
- We have used readily available data, like the CAMD and ERTAC data, but we recognize that these data sources can be out of date, or not include recent changes.
  - We hope you can help us with making sure we have the best possible data.

- This package reflects recently updated data, including but not limited to:
  - CAMD updates
  - May 8, 2014 ERTAC updates
  - PA comments to OTC, forwarded to MDE, Spreadsheets detailing "EGU Shutdowns, EGU Controls and New Natural Gas Power Projects" for the state of PA. Sent from Randy Bordner, Environmental Group Manager - Bureau of Air Quality, PA Department of Environmental Protection to Andy Bodnarik, OTC. Received as FWD from Andy Bodnarik on 4/23/2014
  - VA comments to MDE, "Electric Generation Sector Summary for Virginia" received from Thomas R. Ballou, Director - Office of Air Data Analysis and Planning, VA Department of Environmental Quality on 5/12/2014

Part 1

Background:
Generation in 2012 and 2018
Projected Changes

Why Coal?



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Ohio EGUs, 2012

- Total number of units = 157
- Total heat input capacity = 324,655 MMBtu/hr = 34,071 MW
- Total State MW Capacity in %
  - **Total number of Coal units = 65 = 66%**
  - Total number of NG units = 75 = 25%
  - Total number of other (oil, etc.) units = 15 = 3%
  - Total number of Nuclear units = 2 = 6%
- **Total Capacity Coal = 22,345 MW**
  - 22 units with SCR = 14,025 MW = 63%
  - 6 units with SNCR = 2,043 MW = 9%
  - 37 units without SCR/SNCR = 6,277 MW = 28%

Basis – CAMD (as of 5/13/2014), NEI (for Nuclear), ERTAC (5/6/2014, 5/8/2014)

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Capacity and Fuel: 2012 to 2018

A detailed review of ERTAC data for 2018 was completed, and an evaluation of the following characteristics performed.

- Total Number of units
- Heat input capacity - MMBtu/hr
- Nameplate capacity – MW
- Presence of advanced post combustion controls – SCR, SNCR
- Fuel switching
- Shutdown, retirements

Ohio EGUs, 2018

- Total number of units = 122
- Total heat input capacity = 265,085 MMBtu/hr = 27,644 MW
- Total State MW Capacity in %
  - **Total number of Coal units = 40 = 61%**
  - Total number of NG units = 73 = 30%
  - Total number of other (oil, etc.) units = 7 = 1%
  - Total number of Nuclear units = 2 = 8%
- **Total Capacity Coal = 17,013 MW**
  - 21 units with SCR = 13,410 MW = 79%
  - 4 units with SNCR = 1,240 MW = 7%
  - 15 units without SCR/SNCR = 2,363 MW = 14%

Basis – ERTAC (5/6/2014, 5/8/2014), NEI (for Nuclear)

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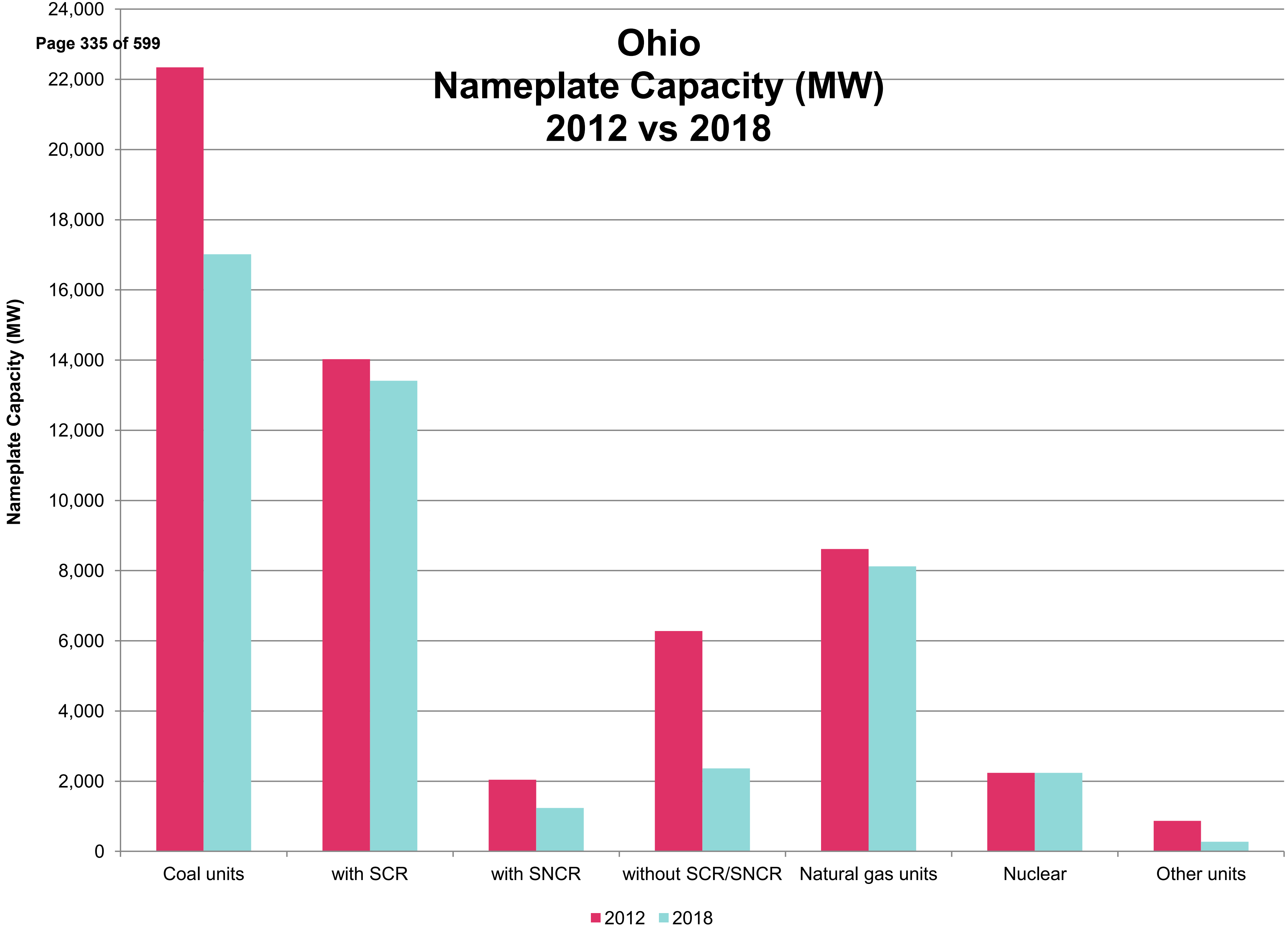
Ohio Nameplate Capacity (MW) 2012 vs 2018



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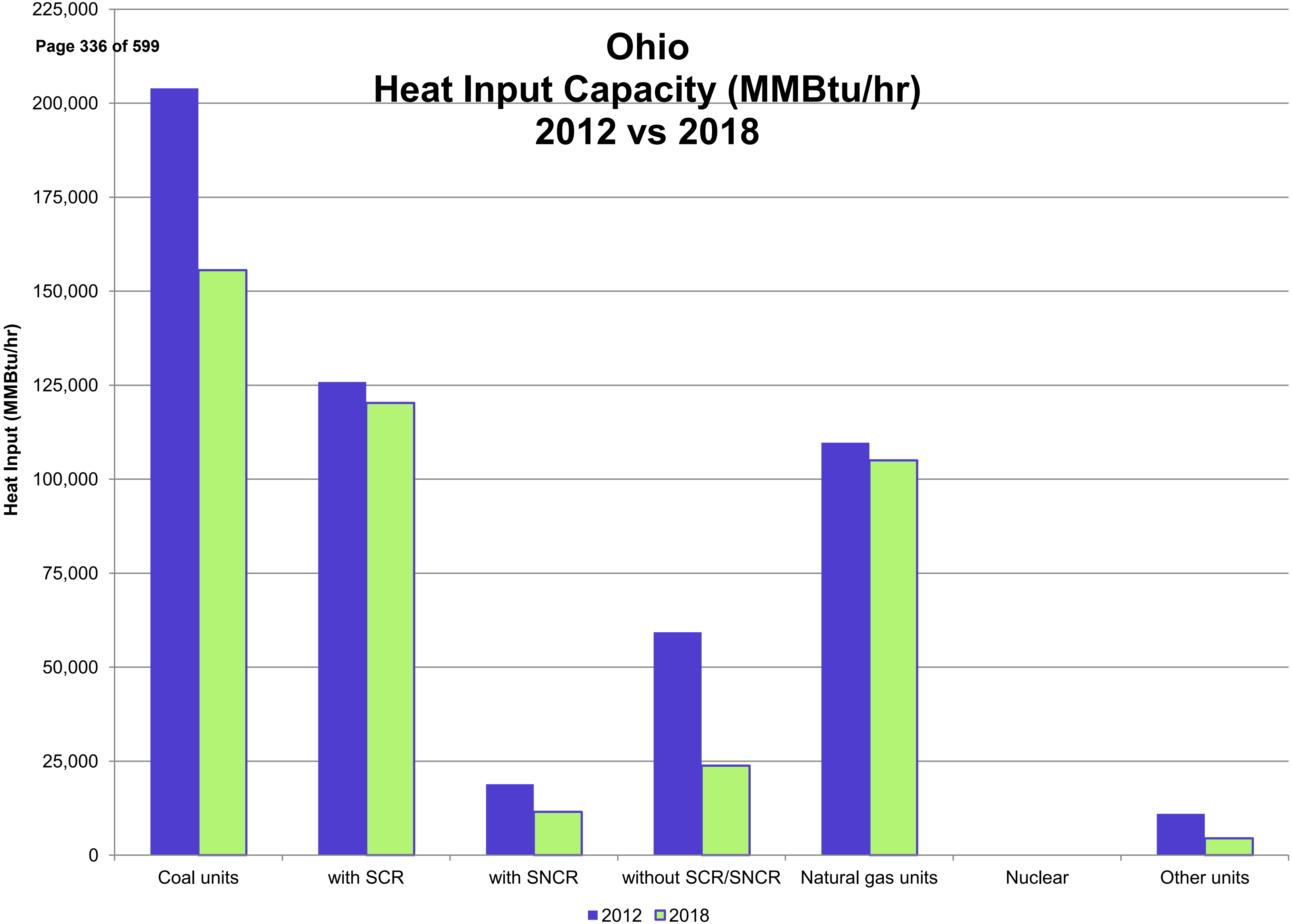

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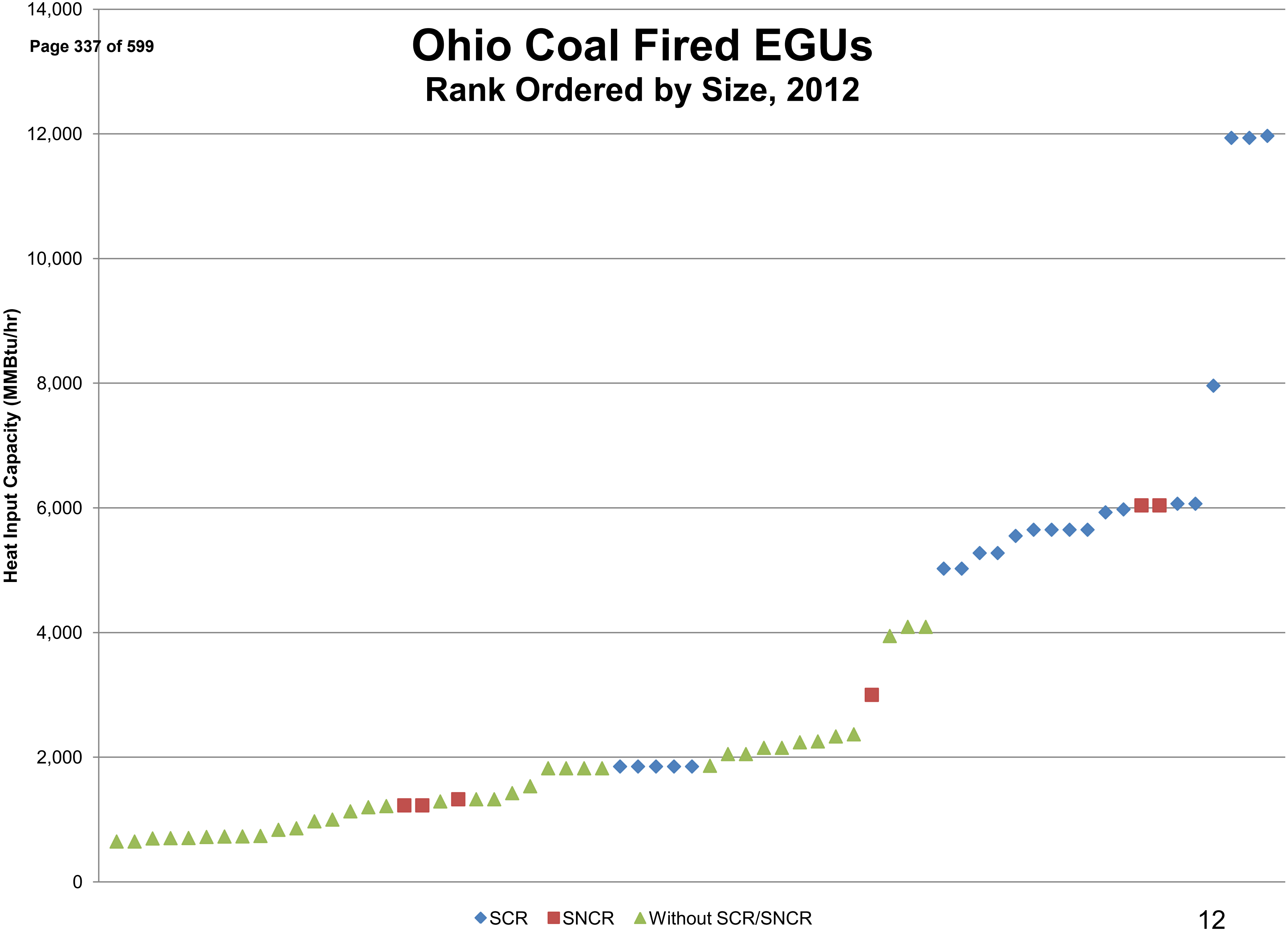
Ohio Coal Fired EGUs
Rank Ordered by Size, 2012



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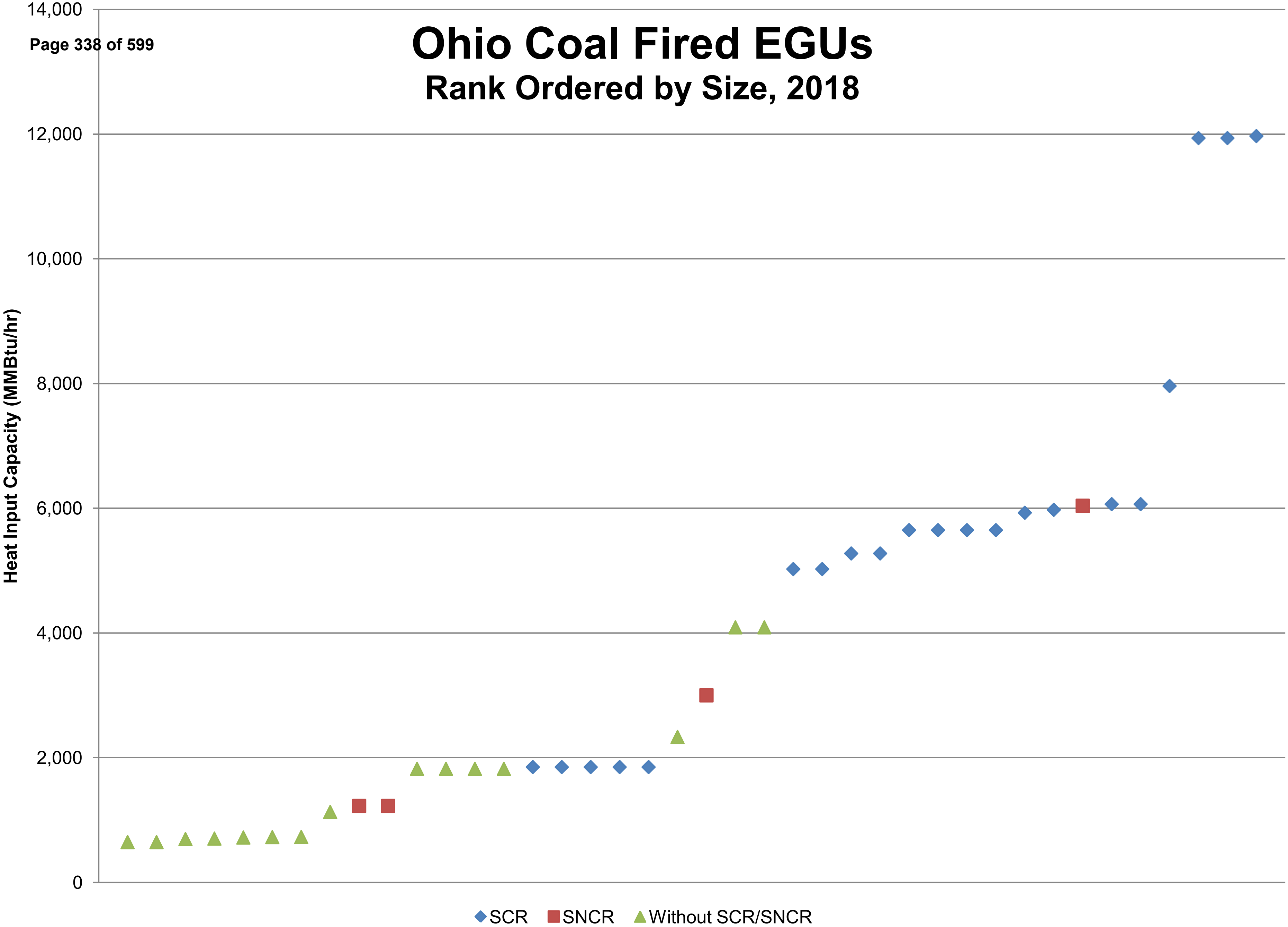

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OH : Large (> 3000 MMBtu/hr) Coal-Fired EGU NOx Emissions Rate Analysis

	Facility Name	Unit ID	Lowest OS Emission Rate Year	Lowest OS Emission Rate (lbs/MMBtu)	2007 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2007 OS ER (% Change)	2011 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2011 OS ER (% Change)	Comments/ ERTAC Closure Date
Controlled with SCR	Cardinal	1	2009	0.0348	0.0682	96	0.0585	68	
	Cardinal	2	2009	0.0426	0.051	20	0.0618	45	
	Cardinal	3	2007	0.0226	0.0226	0	0.0613	171	
	Conesville	4	2010	0.0546	0.2689	392	0.0743	36	
	Gen J M Gavin	1	2004	0.0685	0.0686	0	0.0785	15	
	Gen J M Gavin	2	2005	0.0553	0.072	30	0.0824	49	
	J M Stuart	1	2009	0.0939	0.107	14	0.11	17	
	J M Stuart	2	2009	0.1076	0.134	25	0.1225	14	
	J M Stuart	3	2006	0.0961	0.1128	17	0.1154	20	
	J M Stuart	4	2007	0.1106	0.1106	0	0.1218	10	
	Killen Station	2	2005	0.0885	0.2025	129	0.1724	95	
	Miami Fort	7	2007	0.0536	0.0536	0	0.1504	181	
	Miami Fort	8	2007	0.054	0.054	0	0.1191	121	
	W H Sammis	6	2011	0.0959	0.2851	197	0.0959	0	
	W H Sammis	7	2012	0.1035	0.2849	175	0.1116	8	
	W H Zimmer	1	2006	0.0562	0.0745	33	0.2189	290	
Controlled with SNCR	Avon Lake Power Plant	12	2009	0.2992	0.3829	28	0.4	34	Close 2015 (media)
	W H Sammis	5	2012	0.1058	0.2531	139	0.1525	44	
No Controls or Fuel Switches by 2019	Conesville	5	2005	0.2752	0.3085	12	0.2998	9	
	Conesville	6	2006	0.2763	0.3098	12	0.3	9	
Retiring by 2017	Muskingum River	5	2007	0.0481	0.0481	0	0.0601	25	Has SCR. Retire 2015
	Walter C Beckjord	6	2006	0.2331	0.2476	6	0.3478	49	2015

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OH: Small (< 3000 MMBtu/hr) Coal-Fired EGU NOx Emissions Rate Analysis

	Facility Name	Unit ID	Lowest OS Emission Rate Year	Lowest OS Emission Rate (lbs/MMBtu)	2007 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2007 OS ER (% Change)	2011 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2011 OS ER (% Change)	Comments/ ERTAC Closure Date
Controlled with SCR	Kyger Creek	1	2005	0.0788	0.093	18	0.1637	108	
	Kyger Creek	2	2005	0.0792	0.0939	19	0.1656	109	
	Kyger Creek	3	2005	0.0787	0.0926	18	0.1679	113	
	Kyger Creek	4	2005	0.0786	0.095	21	0.1593	103	
	Kyger Creek	5	2005	0.0785	0.0927	18	0.1621	106	
Controlled with SNCR	Niles	1	2009	0.4796	0.6785	41	0.705	47	Close 2012 (media)
	Niles	2	2011	0.2559	0.6738	163	0.2559	0	
No Controls or Fuel Switches by 2019	Ashtabula	7	2006	0.1694	0.2478	46	0.1968	16	Close 2015 (media)
	Avon Lake Power Plant	10	2009	0.2991	0.3669	23	0.3212	7	
	Hamilton Municipal	9	2011	0.2615	0.3343	28	0.2615	0	
	O H Hutchings	H-3	2009	0.2663	0.3751	41	0.3582	35	Close 2015 (media)
	O H Hutchings	H-4	2009	0.2657	0.3609	36	N/A		
	O H Hutchings	H-5	2009	0.2842	0.3471	22	0.3414	20	
	O H Hutchings	H-6	2009	0.2895	0.3565	23	0.3539	22	
	R E Burger	5	2010	0.3013	0.3352	11	N/A	N/A	Close 2015 (media)
	R E Burger	6	2010	0.3056	0.3386	11	N/A	N/A	Close 2011 (media)
	W H Sammis	1	2008	0.1901	0.2082	10	0.2183	15	
	W H Sammis	2	2008	0.1904	0.2082	9	0.2193	15	
	W H Sammis	3	2008	0.1981	0.2091	6	0.2195	11	
	W H Sammis	4	2009	0.1966	0.2089	6	0.2135	9	
Retiring by 2017	Bay Shore	2	2004	0.3068	0.4012	31	0.4644	51	2012
	Bay Shore	3	2004	0.2977	0.3957	33	0.4587	54	2012
	Bay Shore	4	2004	0.2982	0.3977	33	0.449	51	2012
	Conesville	3	2012	0.3164	0.4628	46	0.3434	9	2012
	Eastlake	1	2008	0.22	0.2441	11	0.2371	8	2016
	Eastlake	2	2010	0.2113	0.2327	10	0.2383	13	2016
	Eastlake	3	2004	0.2096	0.2236	7	0.2428	16	Has SNCR, retire 2016
	Eastlake	4	2006	0.2036	0.2054	1	0.2142	5	2016
	Eastlake	5	2011	0.2621	0.2813	7	0.2621	0	Has SNCR, retire 2016
	Lake Shore	18	2010	0.2767	0.2787	1	0.3042	10	2016
	Miami Fort	6	2008	0.2212	0.2220	0	0.2972	34	2015
	Muskingum River	1	2005	0.3432	0.429	25	0.5223	52	2015
	Muskingum River	2	2005	0.3409	0.4267	25	0.5263	54	2015
	Muskingum River	3	2005	0.3327	0.4205	26	0.5213	57	2015
	Muskingum River	4	2005	0.3377	0.4195	24	0.5214	54	2015
	O H Hutchings	H-1	2010	0.3064	0.542	77	0.459	50	2016
	O H Hutchings	H-2	2010	0.3425	0.5736	67	0.4654	36	2016
	Picway	9	2012	0.3575	0.428	20	0.4106	15	2016
	Walter C Beckjord	1	2006	0.5307	0.5539	4	N/A	N/A	2015
	Walter C Beckjord	2	2003	0.5537	0.5963	8	N/A	N/A	2015
	Walter C Beckjord	3	2004	0.3709	0.4743	28	N/A	N/A	2015
	Walter C Beckjord	4	2007	0.3438	0.3438	0	0.4406	28	2015
	Walter C Beckjord	5	2005	0.343	0.3814	11	0.3828	12	2015

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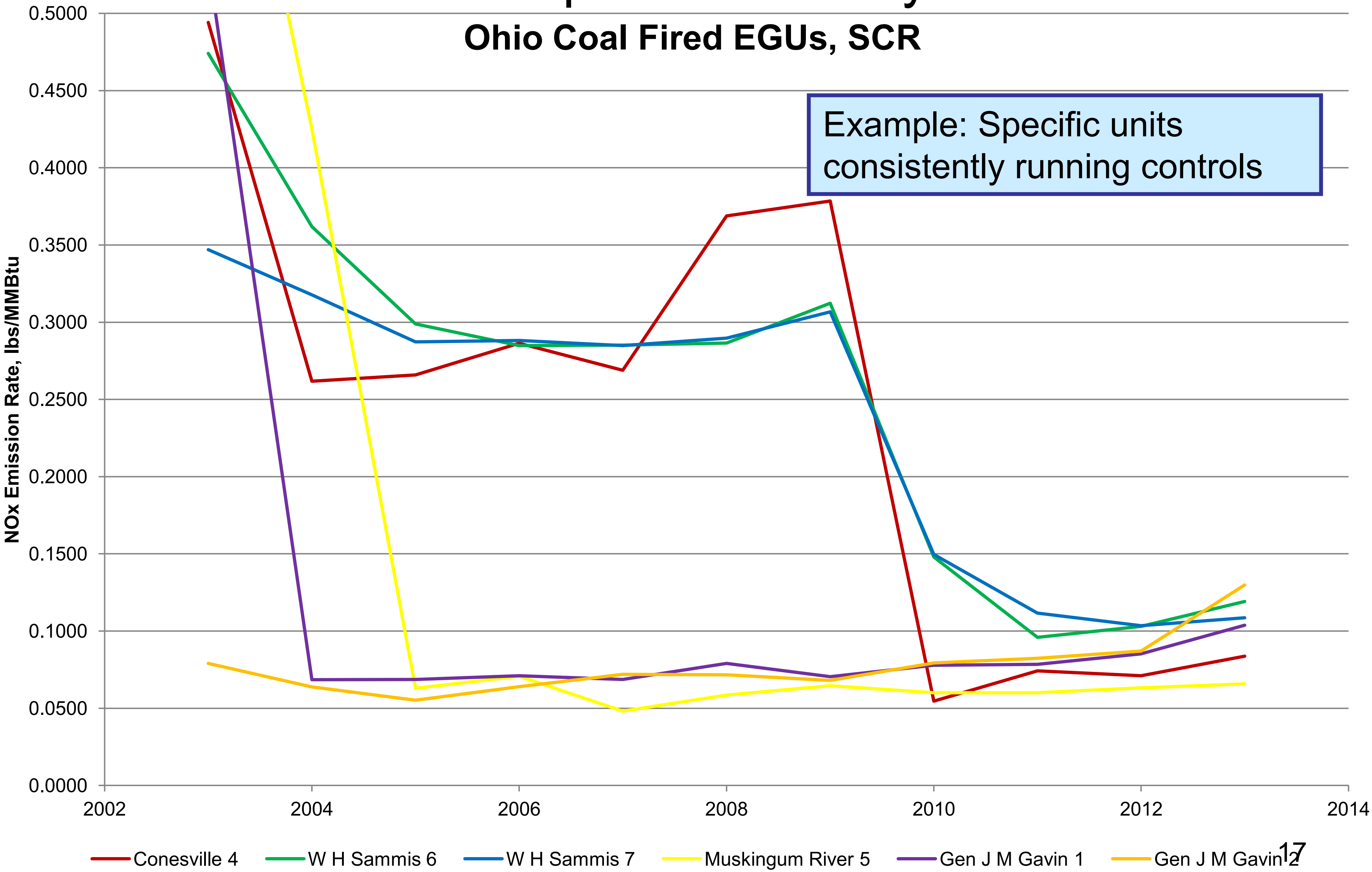
Part 2

Operation of Controls: Changes in Control Efficiency 2003 to 2013

Average Ozone Season Emission Rates at Specific Units by Year



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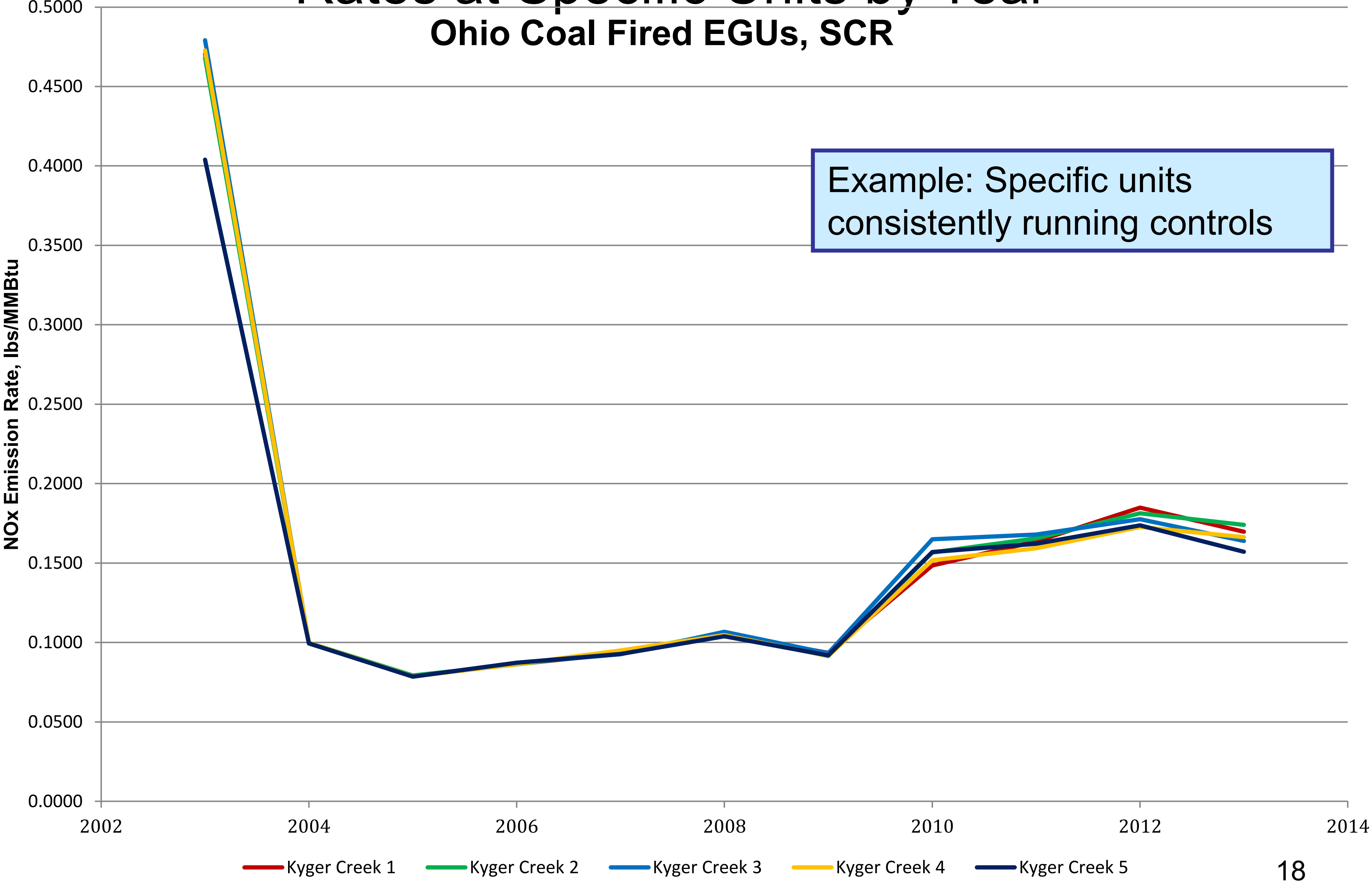
Average Ozone Season Emission Rates at Specific Units by Year



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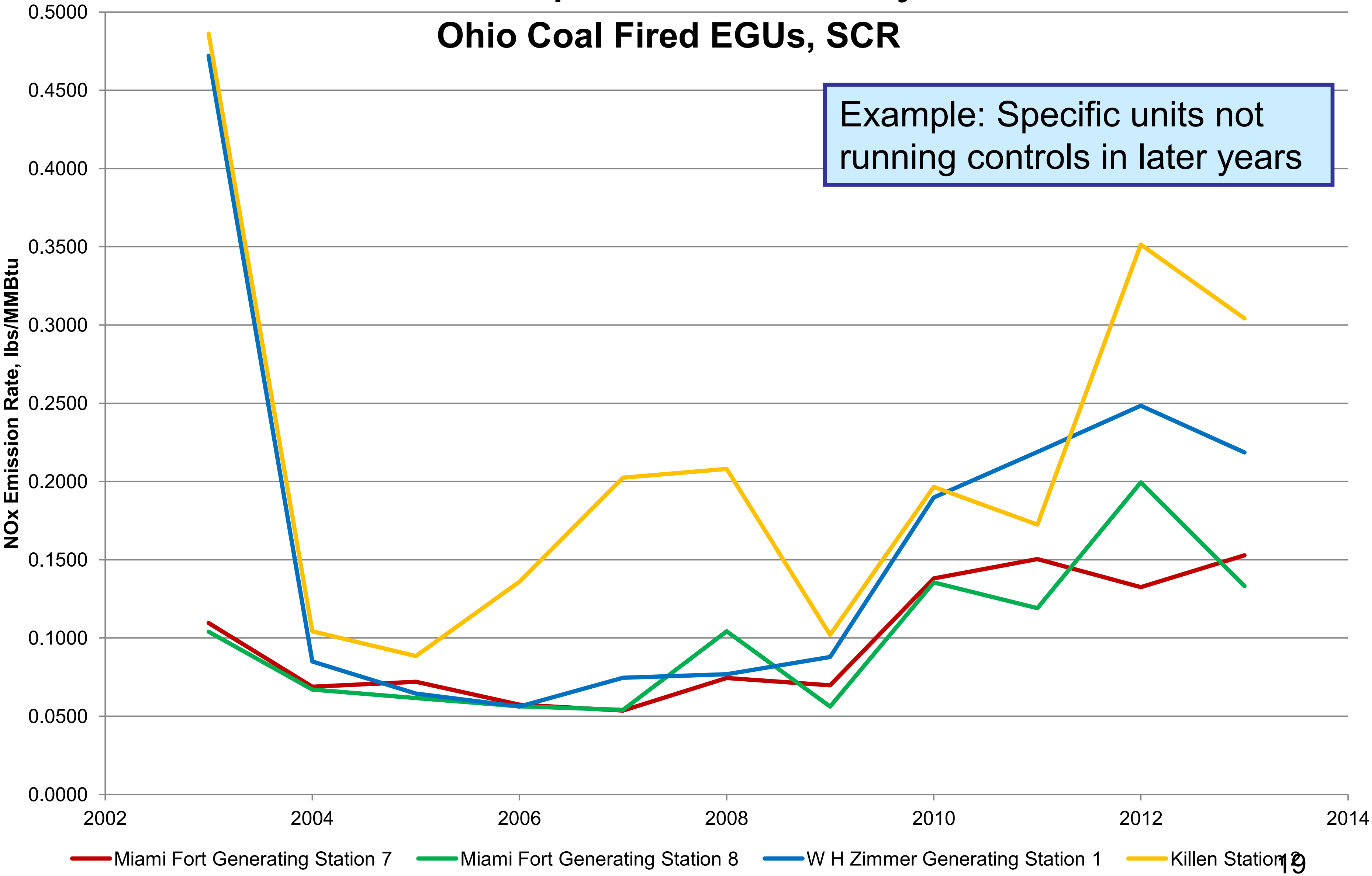
Average Ozone Season Emission Rates at Specific Units by Year



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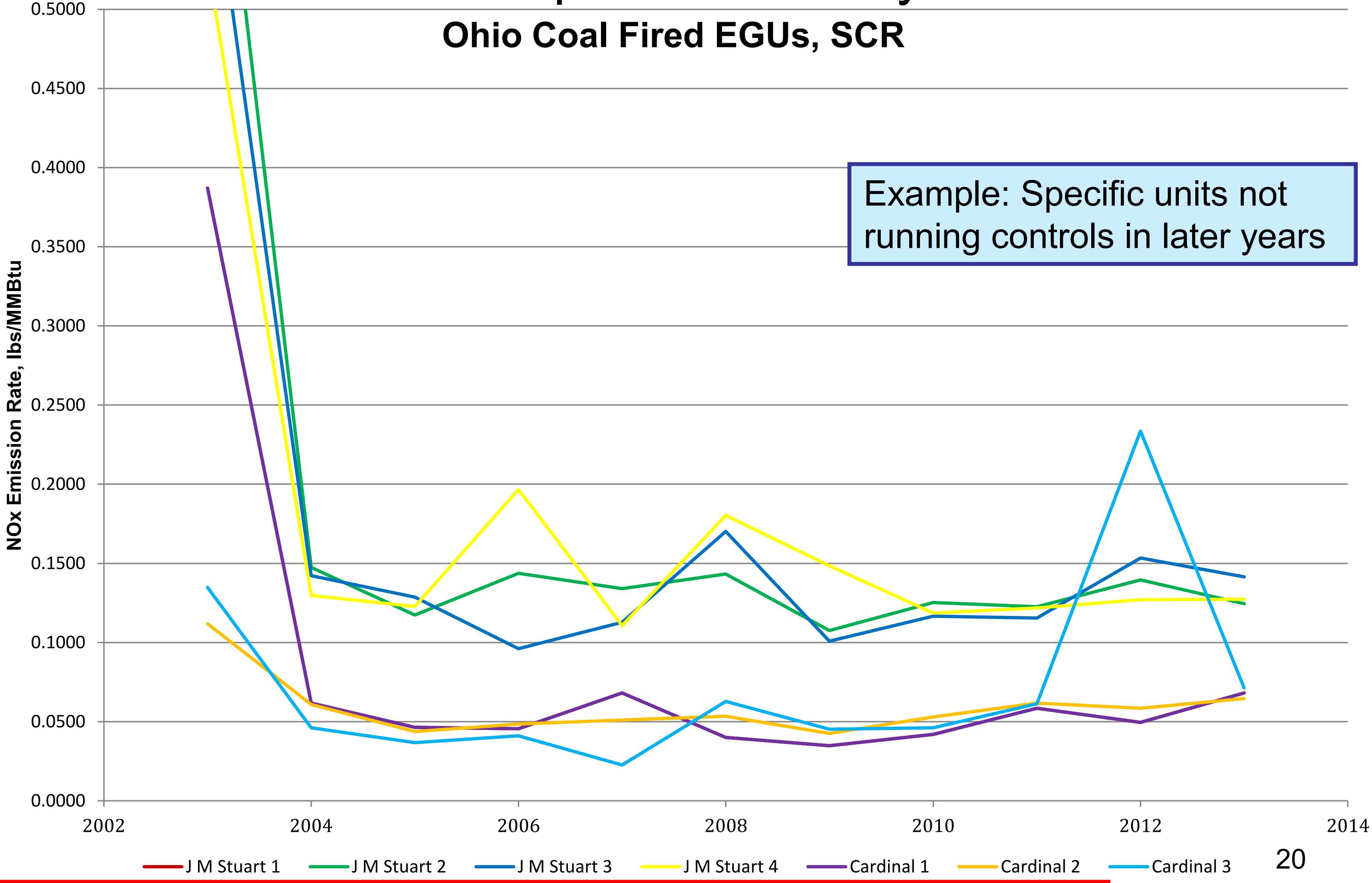
Average Ozone Season Emission Rates at Specific Units by Year



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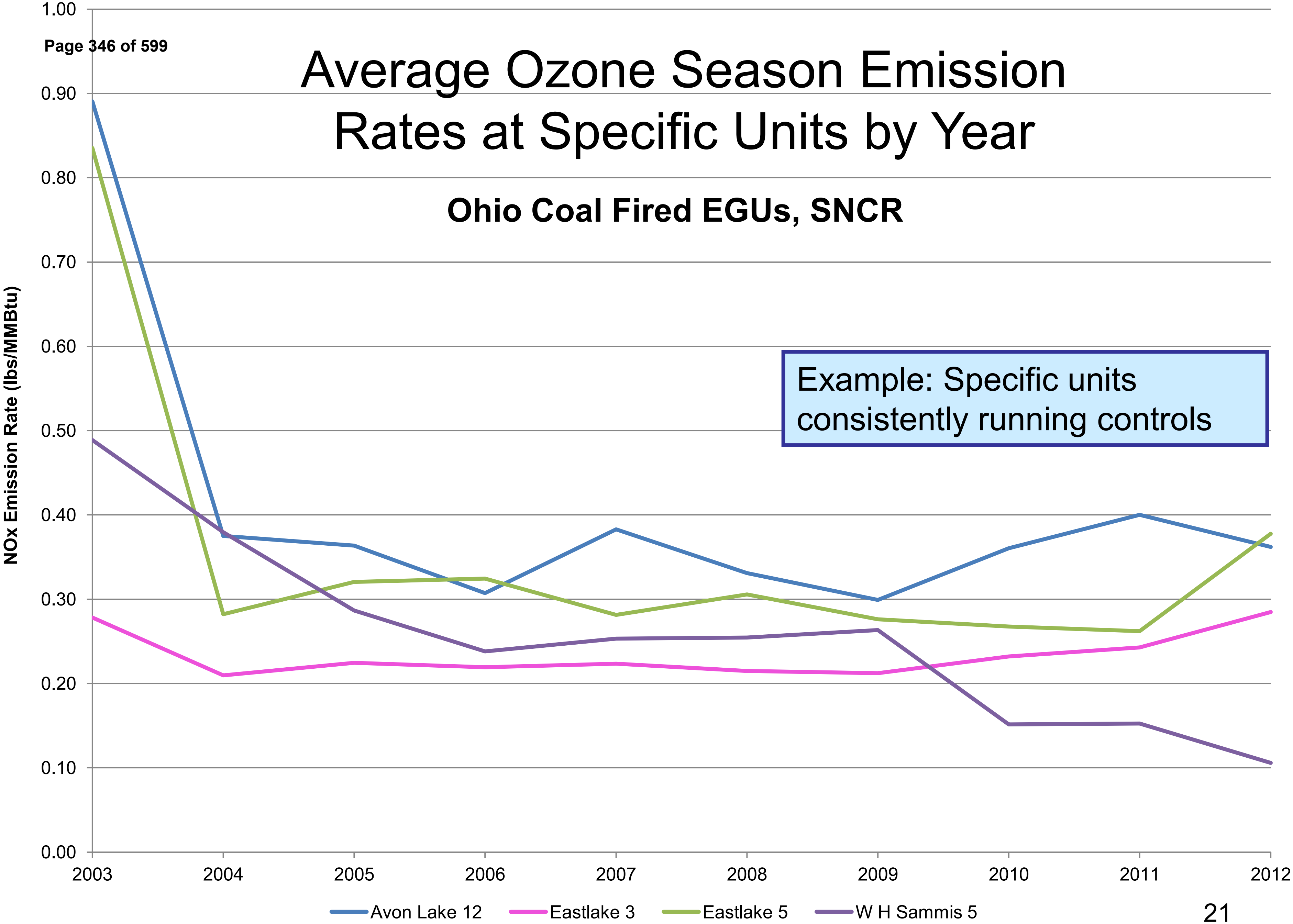
Average Ozone Season Emission Rates at Specific Units by Year



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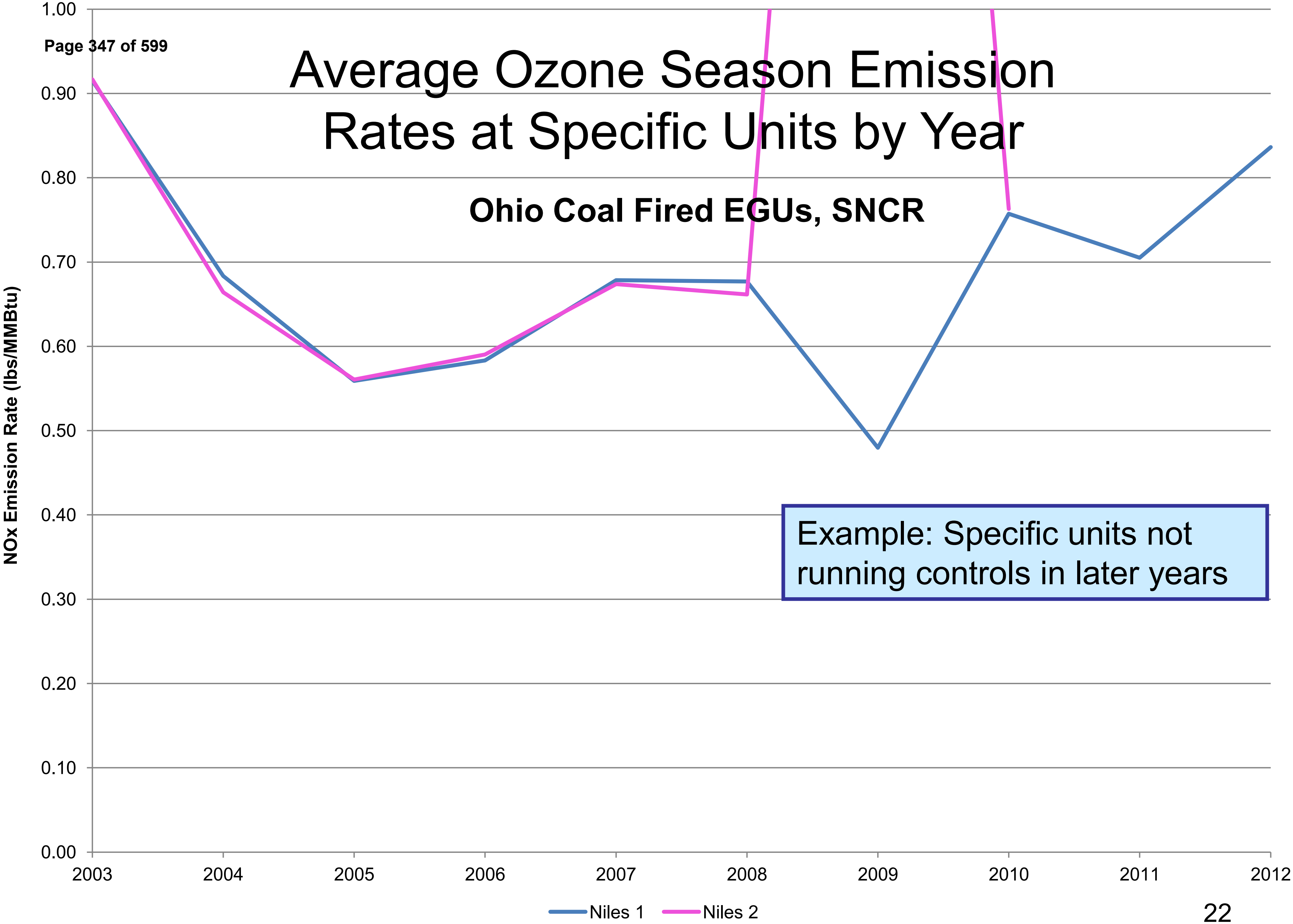
Average Ozone Season Emission Rates at Specific Units by Year

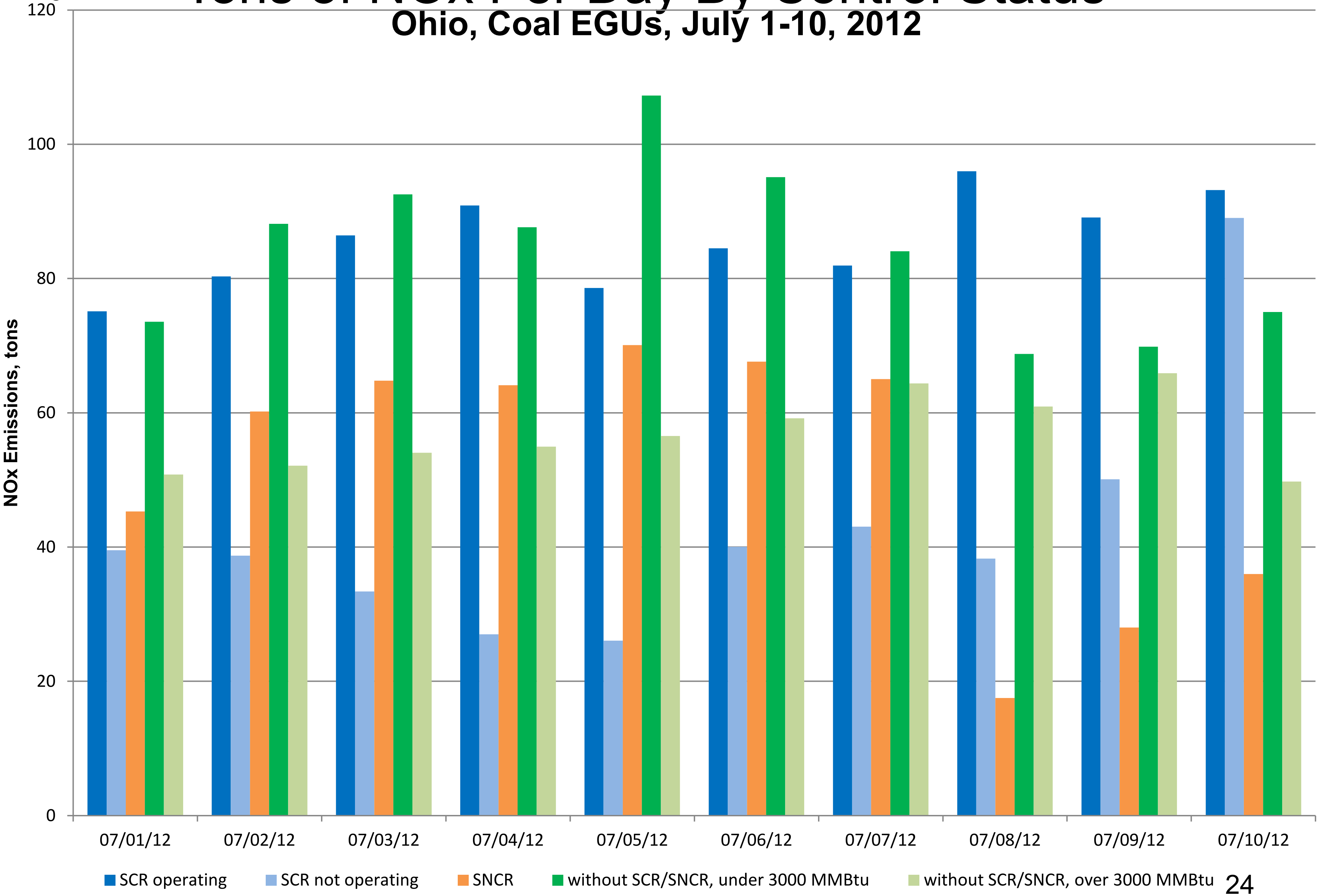


Part 3

July 1 to 10, 2012 Ozone Episode:

Analysis of Emissions and Controls

Tons of NOx Per Day By Control Status



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OH – Tons of NOx Per Unit By Control Status, July 2, 2012

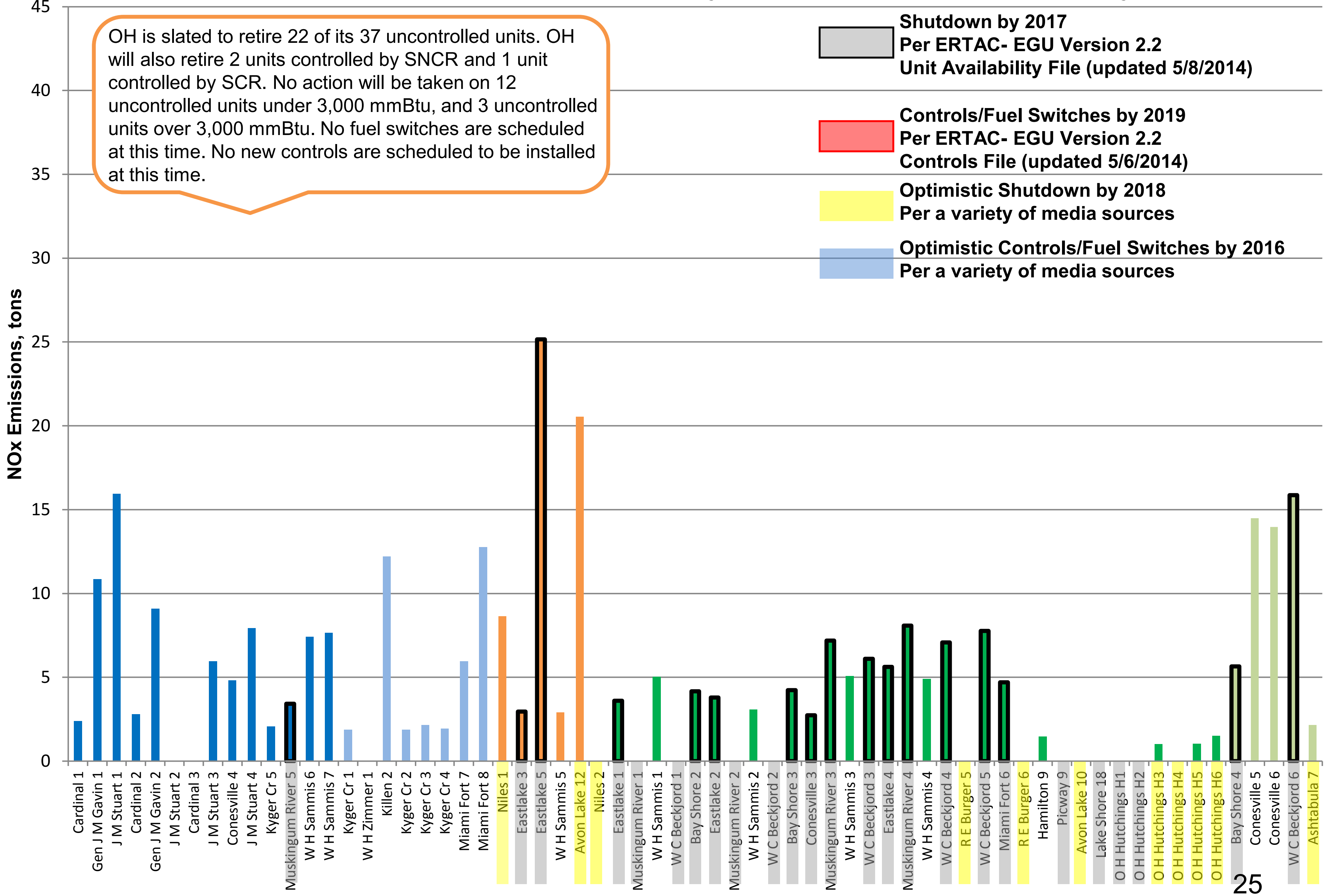
OH is slated to retire 22 of its 37 uncontrolled units. OH will also retire 2 units controlled by SNCR and 1 unit controlled by SCR. No action will be taken on 12 uncontrolled units under 3,000 mmBtu, and 3 uncontrolled units over 3,000 mmBtu. No fuel switches are scheduled at this time. No new controls are scheduled to be installed at this time.

Shutdown by 2017 Per ERTAC- EGU Version 2.2 Unit Availability File (updated 5/8/2014)

Controls/Fuel Switches by 2019 Per ERTAC- EGU Version 2.2 Controls File (updated 5/6/2014)

Optimistic Shutdown by 2018 Per a variety of media sources

Optimistic Controls/Fuel Switches by 2016 Per a variety of media sources



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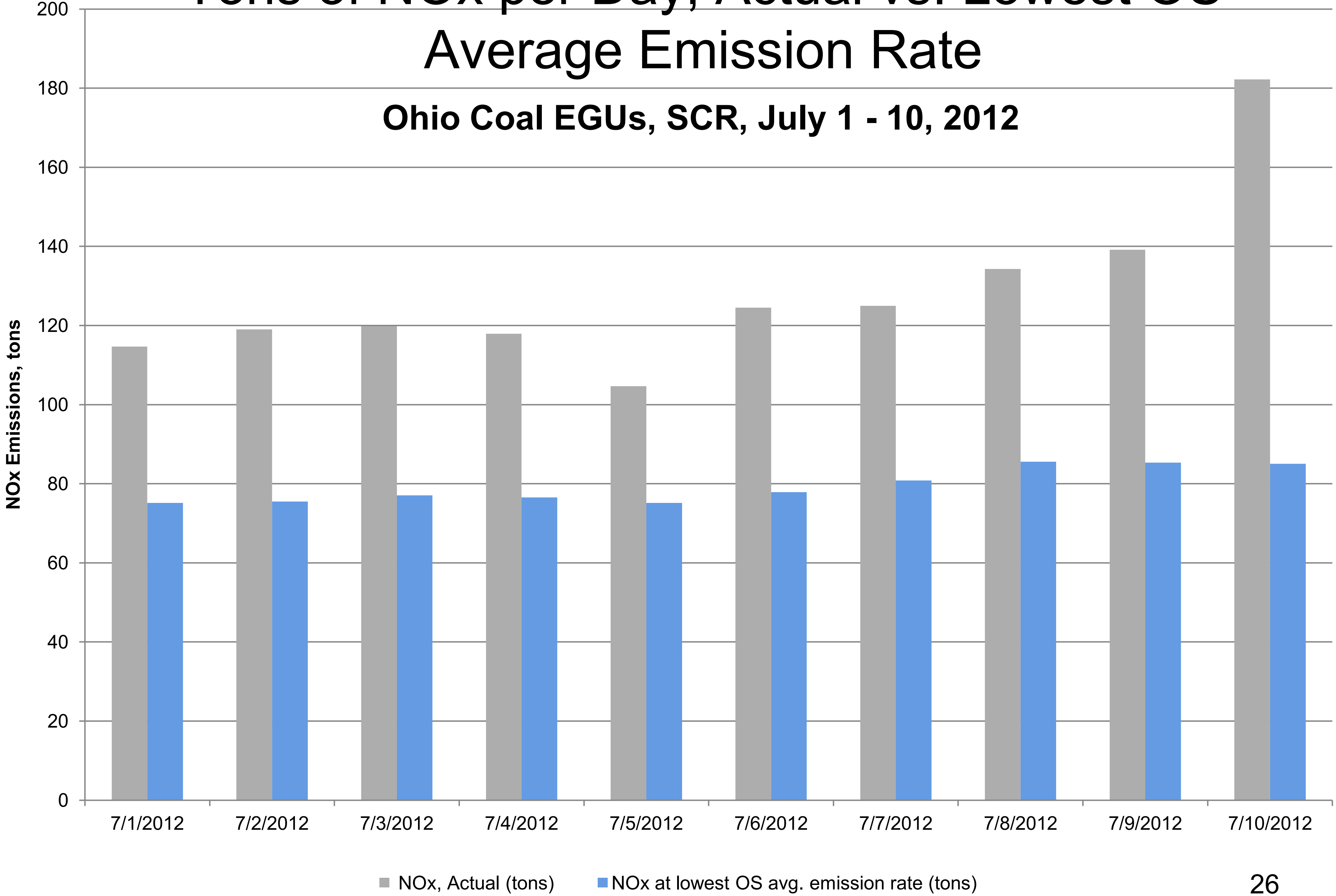
Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate



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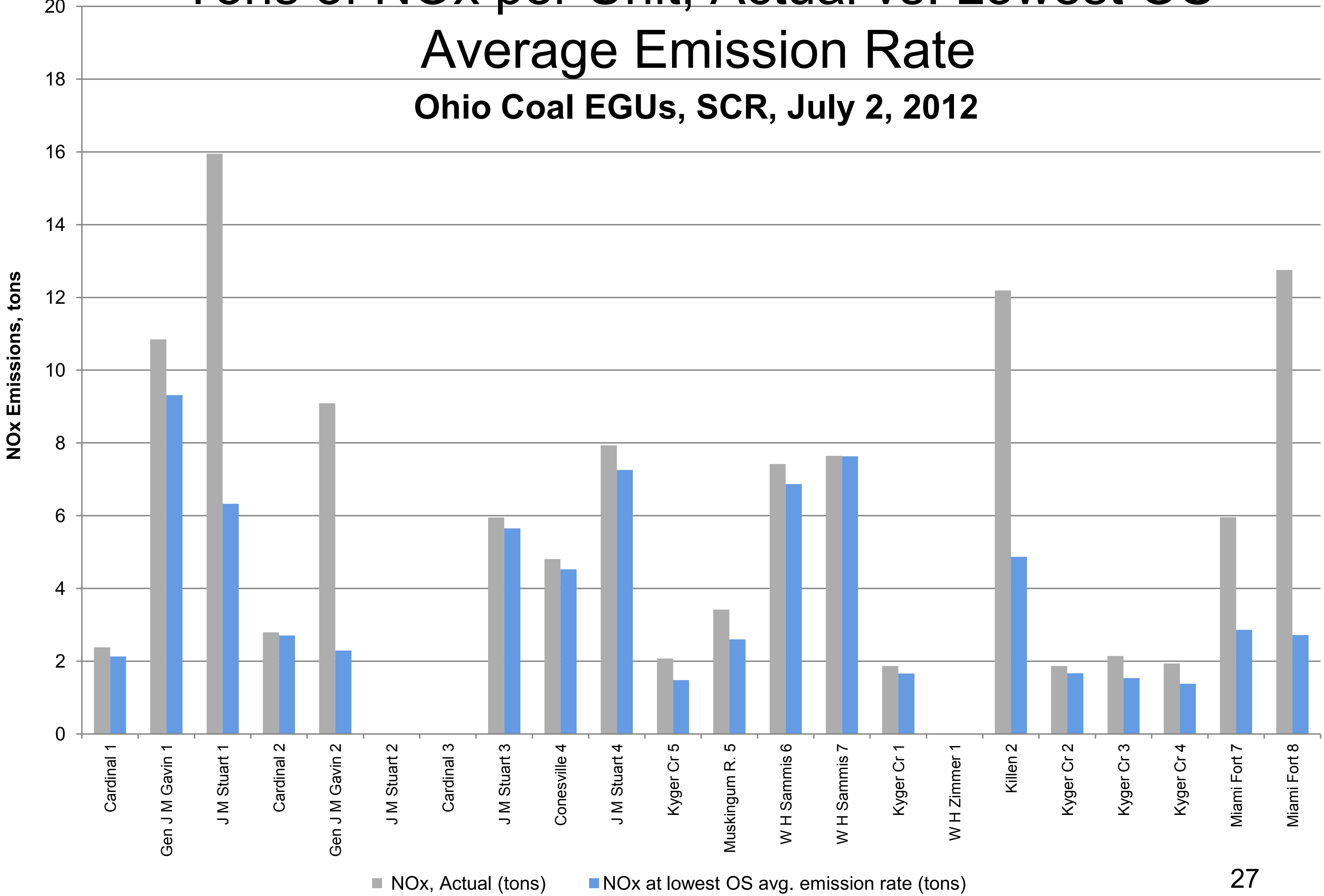
Tons of NOx per Unit, Actual vs. Lowest OS Average Emission Rate

Ohio Coal EGUs, SCR, July 2, 2012



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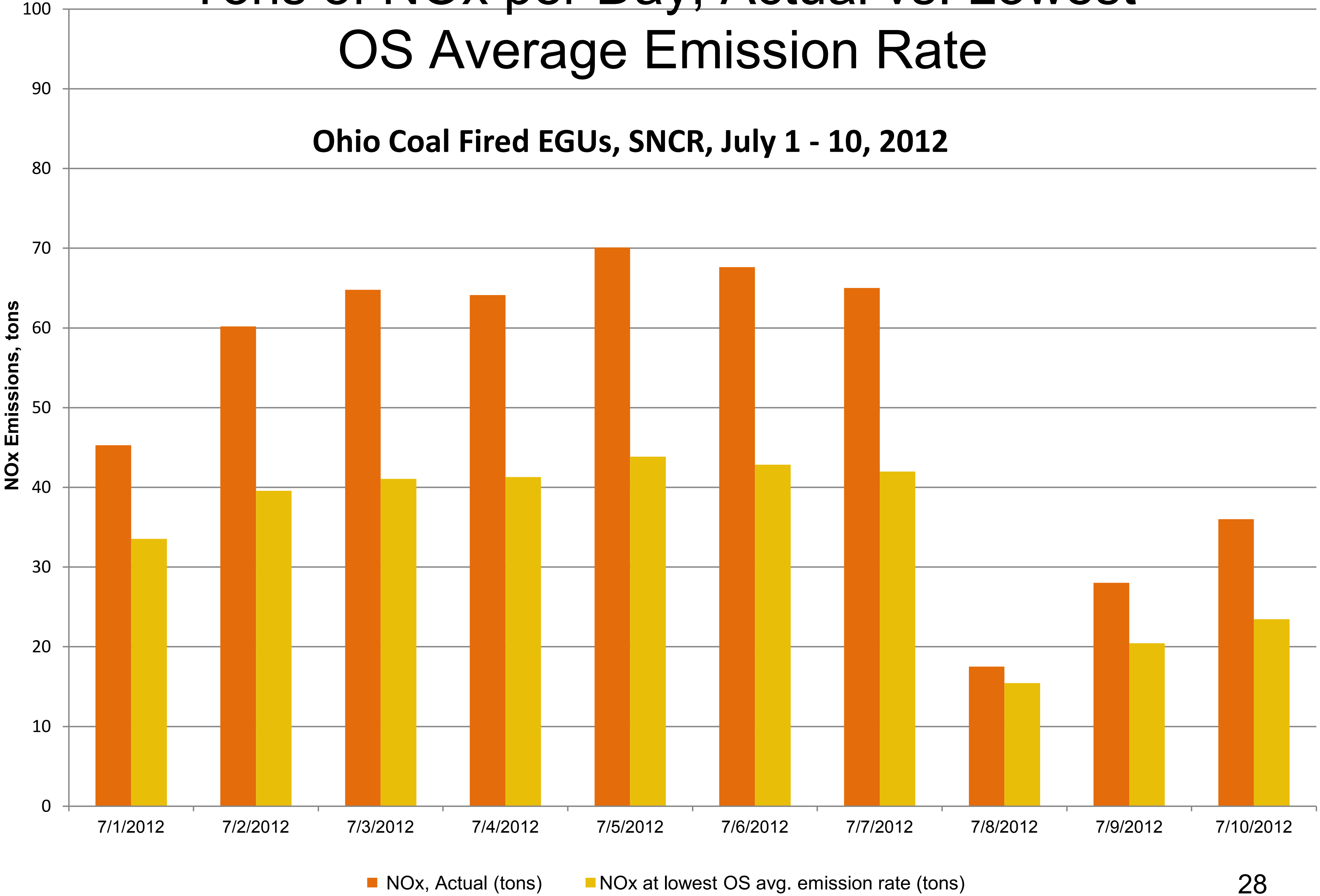
Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate



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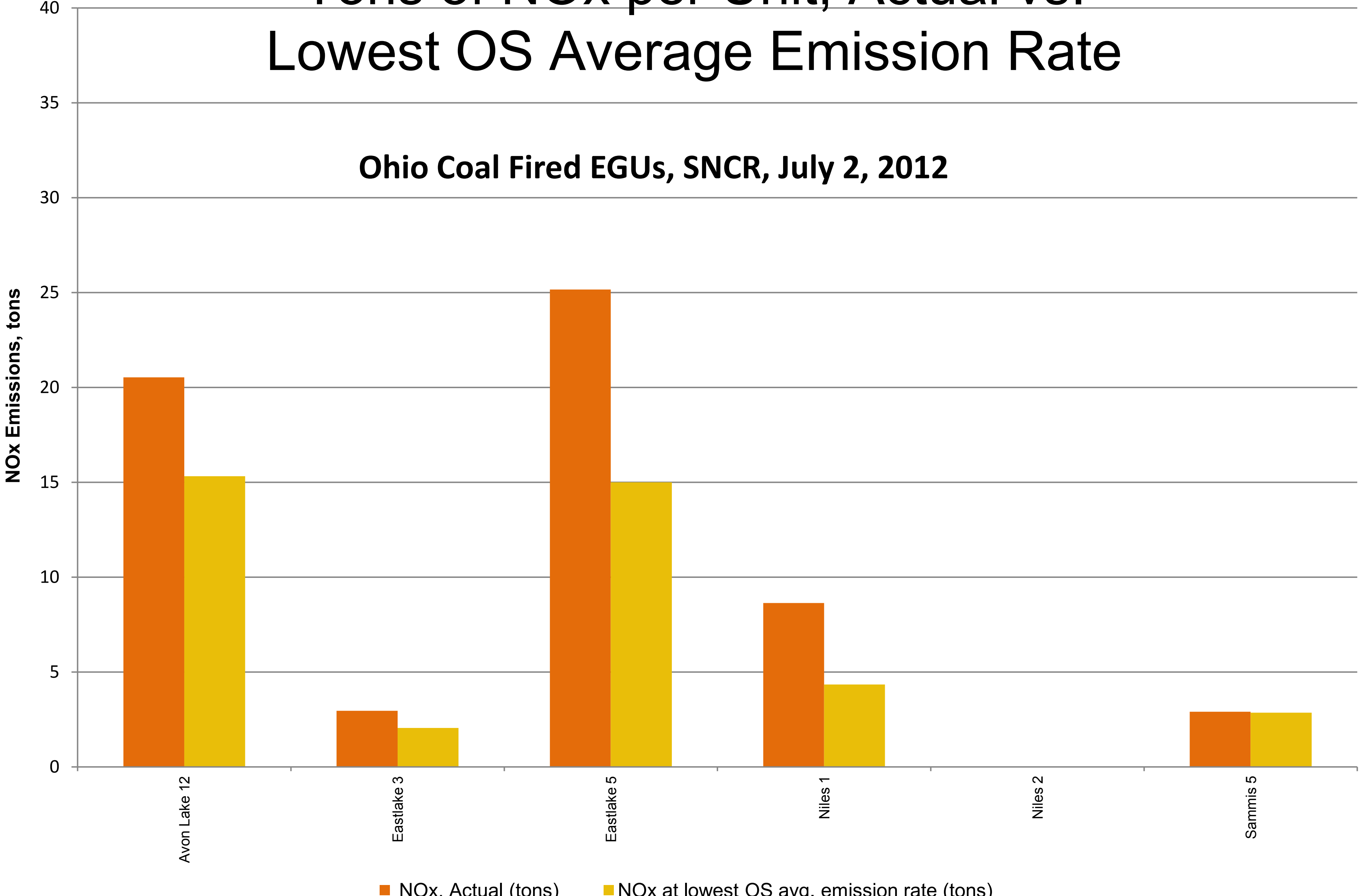
Tons of NOx per Unit, Actual vs. Lowest OS Average Emission Rate



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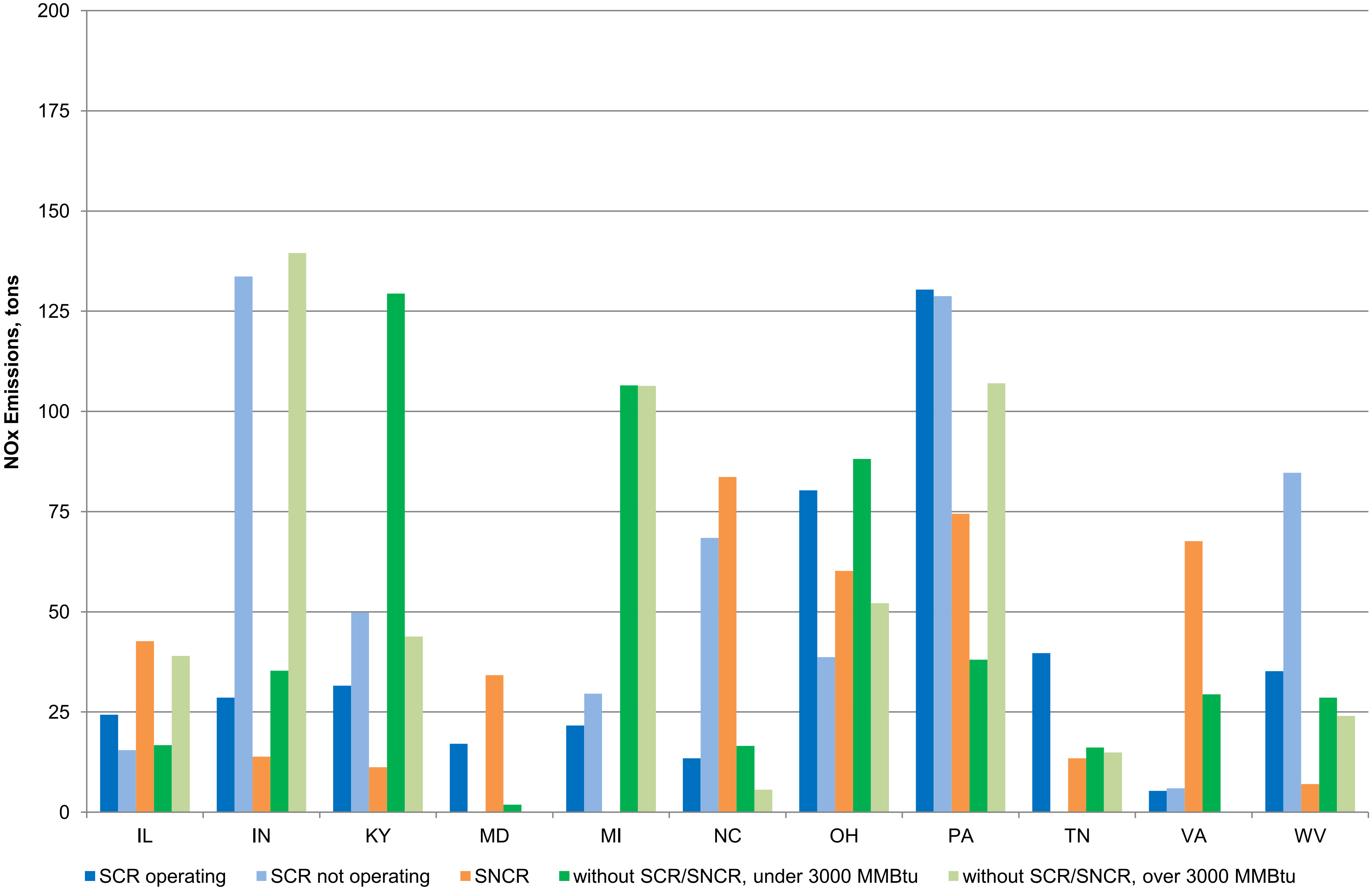
July 2, 2012 – Tons of NOx per State by Control Status



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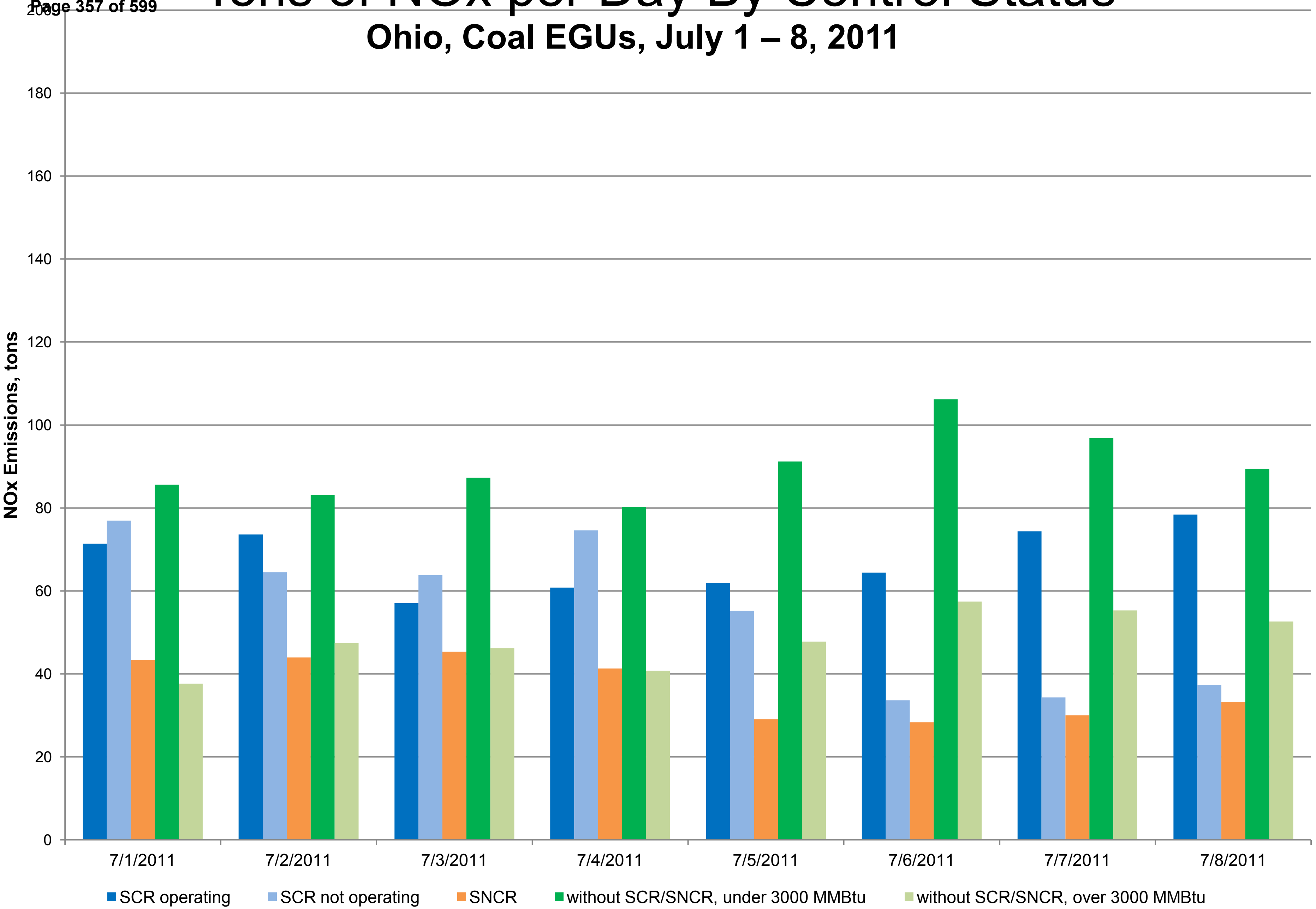
Part 4

July 1 to 8, 2011 Ozone Episode:

Analysis of Emissions and Controls

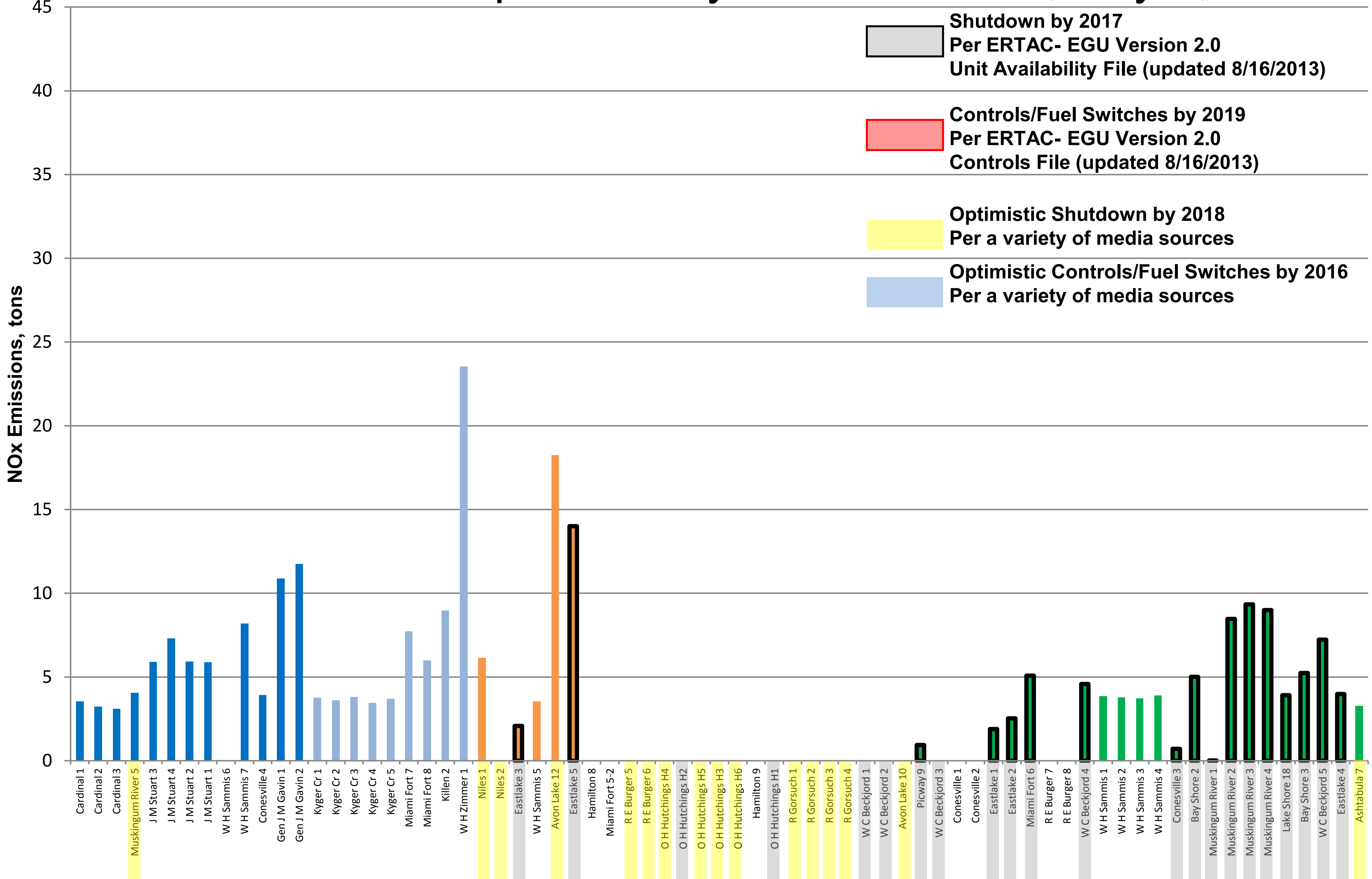
Tons of NOx per Day By Control Status

Ohio, Coal EGUs, July 1 – 8, 2011



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

OH – Tons of NOx per Unit By Control Status, July 2, 2011



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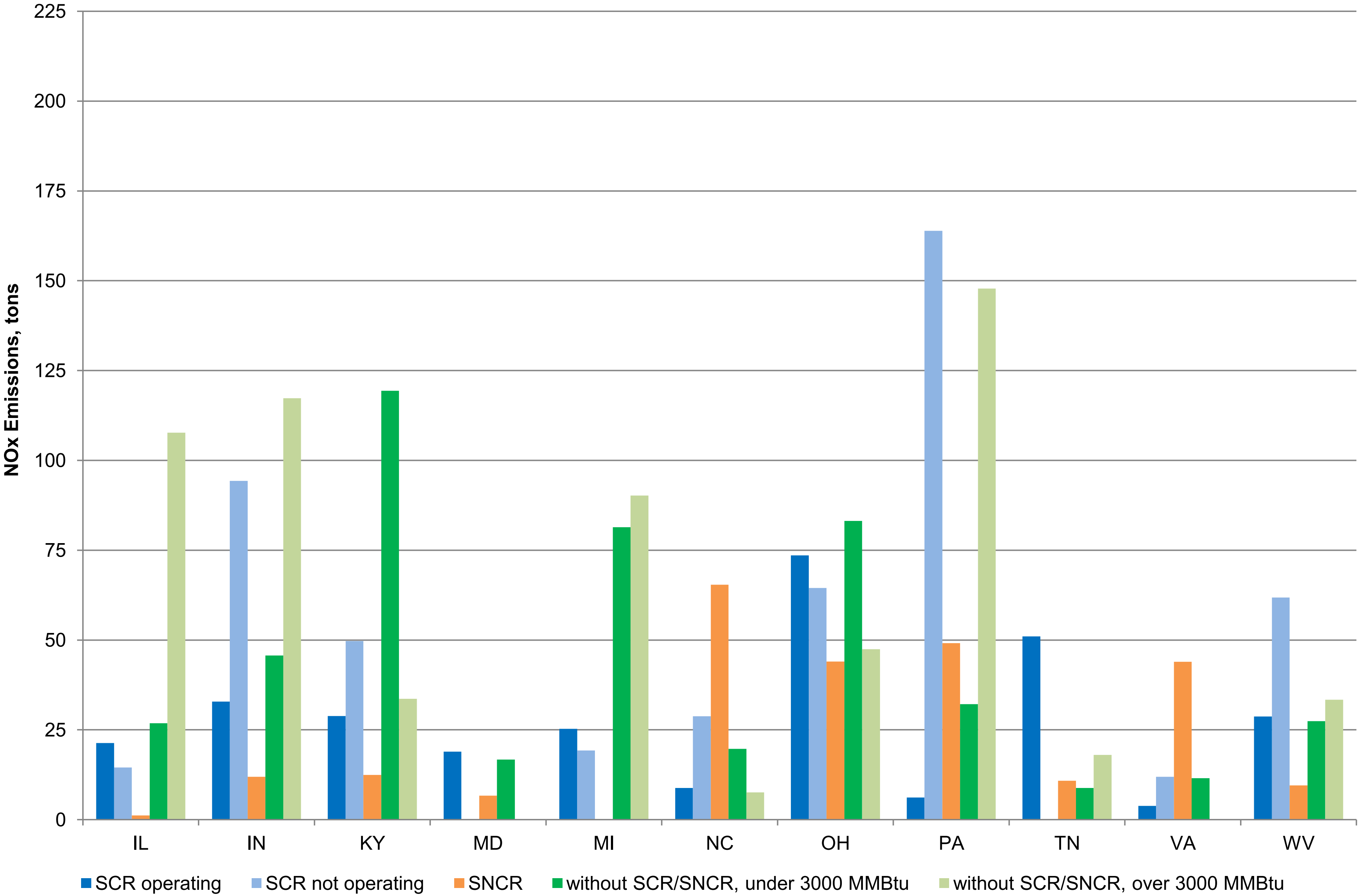
July 2, 2011 - Tons NOx per State by Control Status



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Part 5

11 State Totals

July 1 to 8, 2011 Ozone Episode:

Analysis of Emissions and Controls

11 Upwind States, 2012

- Total number of units = 1,432
- Total heat input capacity = 2,730,239 MMBtu/hr
  = 304,354 MW
- Total MW Capacity in %
  - **Total number of Coal units = 547 = 55%**
  - Total number of NG units = 672 = 25%
  - Total number of other (oil, etc.) units = 173 = 6%
  - Total number of Nuclear units = 40 = 14%
- **Total Capacity Coal = 165,910 MW**
  - 156 units with SCR = 88,783 MW = 53%
  - 114 units with SNCR = 27,561 MW = 17%
  - 277 units without SCR/SNCR = 49,566 MW = 30%

Basis – CAMD (as of 5/13/2014), NEI (for Nuclear), ERTAC (5/6/2014, 5/8/2014)

DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

11 Upwind States, 2018

- Total number of units = 1,199
- Total heat input capacity = 2,449,194 MMBtu/hr
  = 274,300 MW
- Total MW Capacity in %
  - **Total number of Coal units = 361 = 49%**
  - Total number of NG units = 686 = 32%
  - Total number of other (oil, etc.) units = 115 = 5%
  - Total number of Nuclear units = 37 = 14%
- **Total Capacity Coal = 134,121 MW**
  - 166 units with SCR = 93,776 MW = 70%
  - 60 units with SNCR = 17,868 MW = 13%
  - 135 units without SCR/SNCR = 22,477 MW = 17%

Basis – ERTAC (5/6/2014, 5/8/2014), NEI (for Nuclear)

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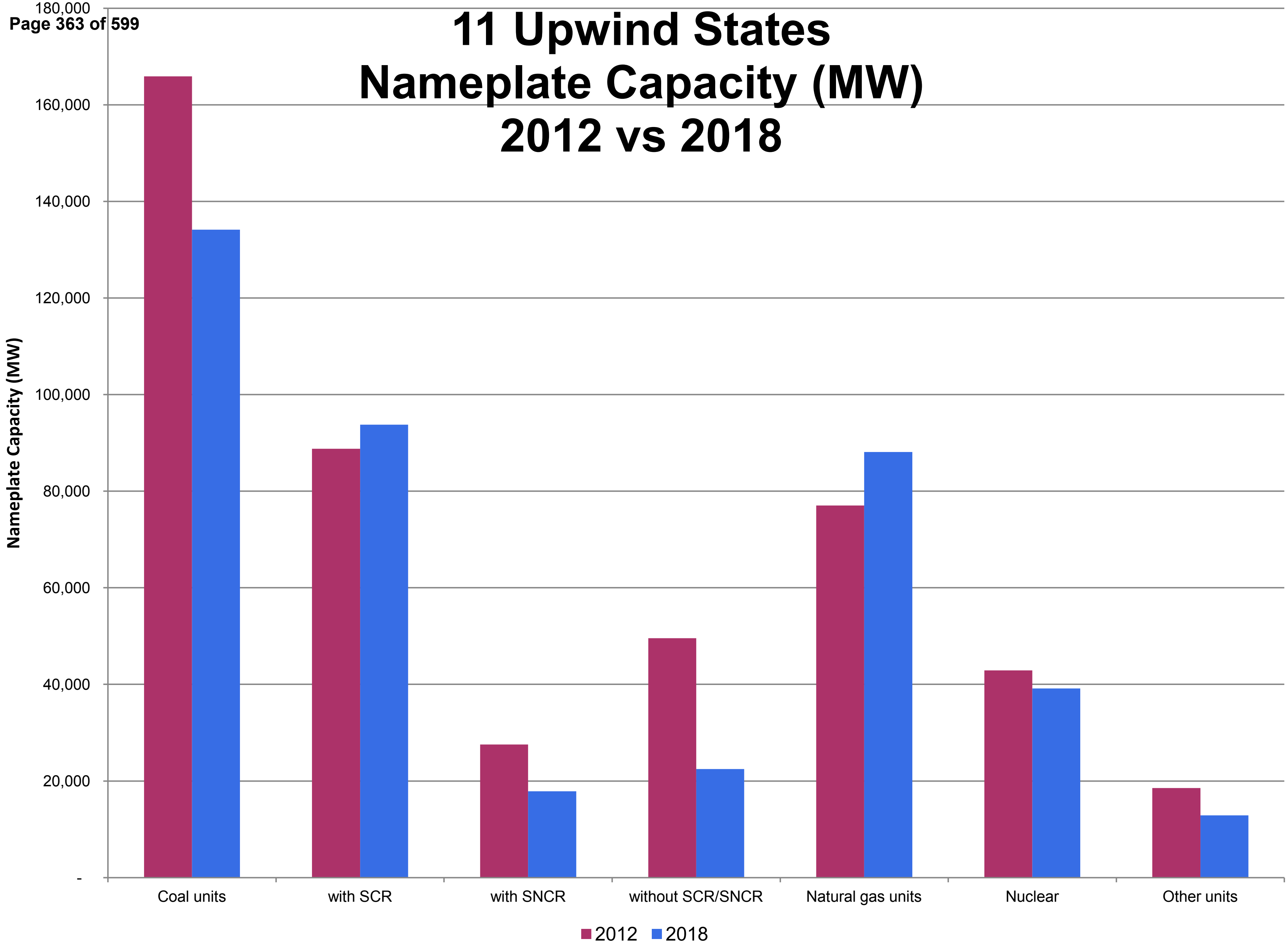
11 Upwind States Nameplate Capacity (MW) 2012 vs 2018



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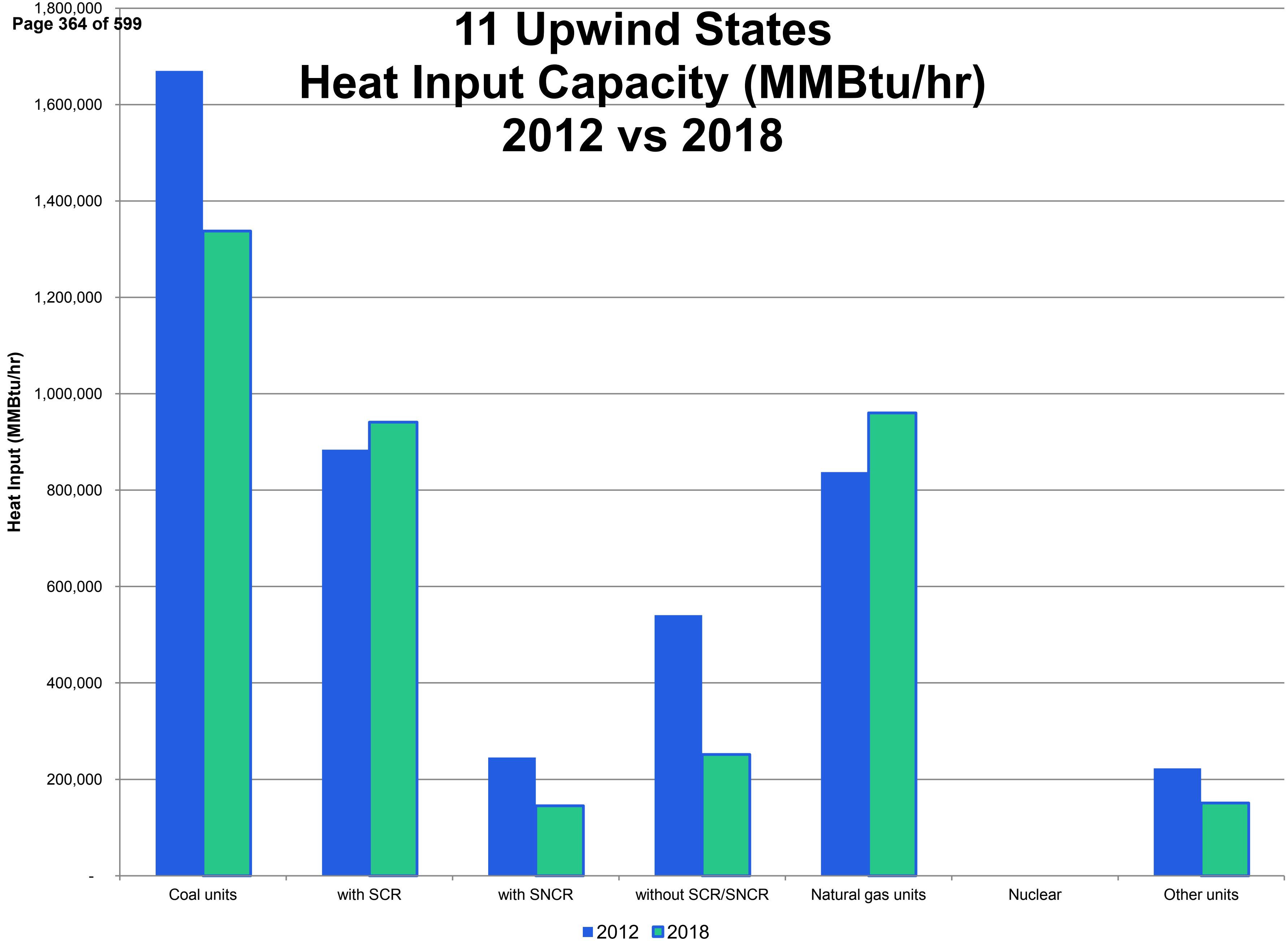
11 Upwind States
Heat Input Capacity (MMBtu/hr)
2012 vs 2018

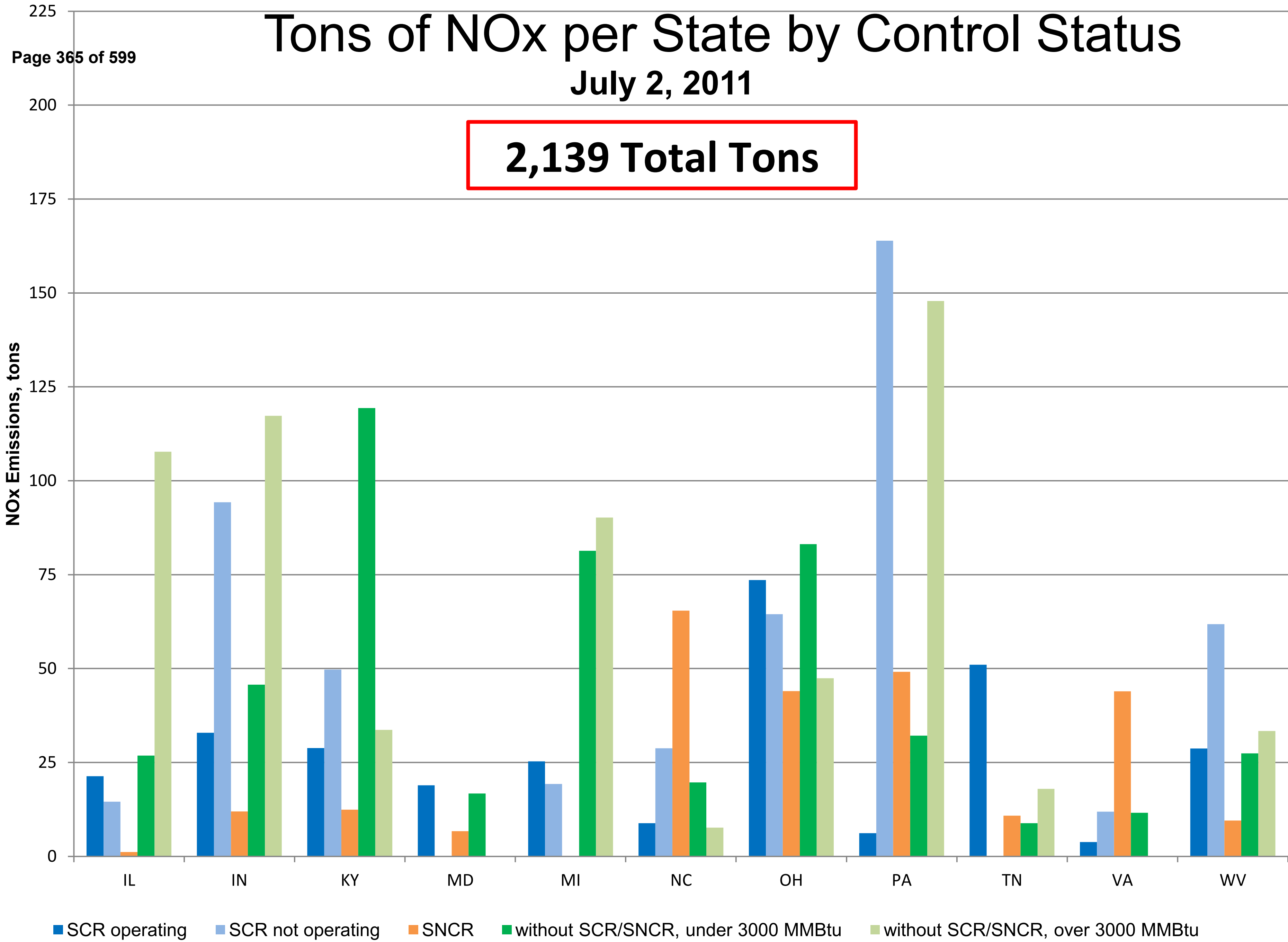


DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Tons of NOx per State by Control Status

July 2, 2011

2,139 Total Tons



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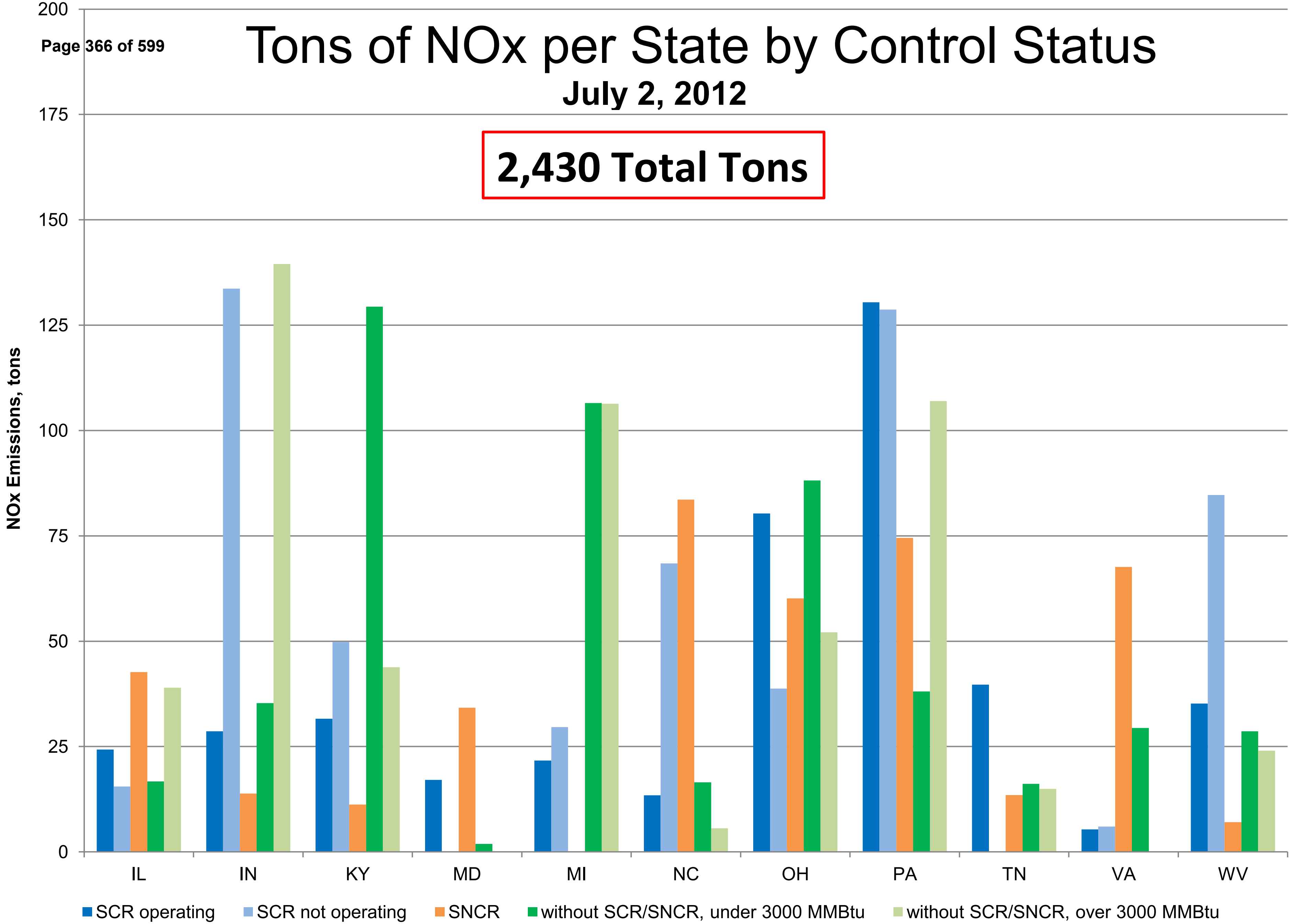
Tons of NOx per State by Control Status

July 2, 2012

2,430 Total Tons



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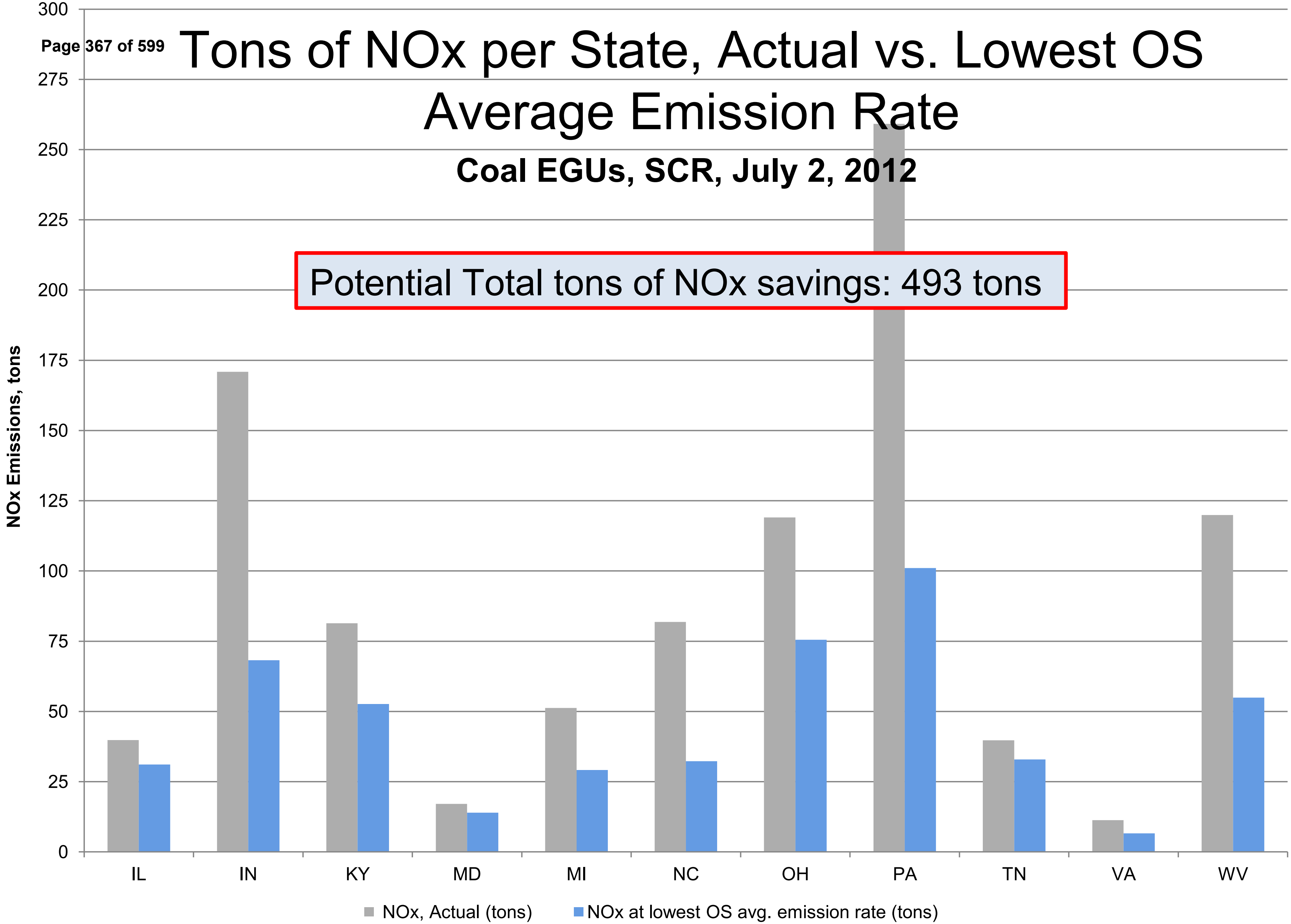
Tons of NOx per State, Actual vs. Lowest OS Average Emission Rate

Coal EGUs, SCR, July 2, 2012



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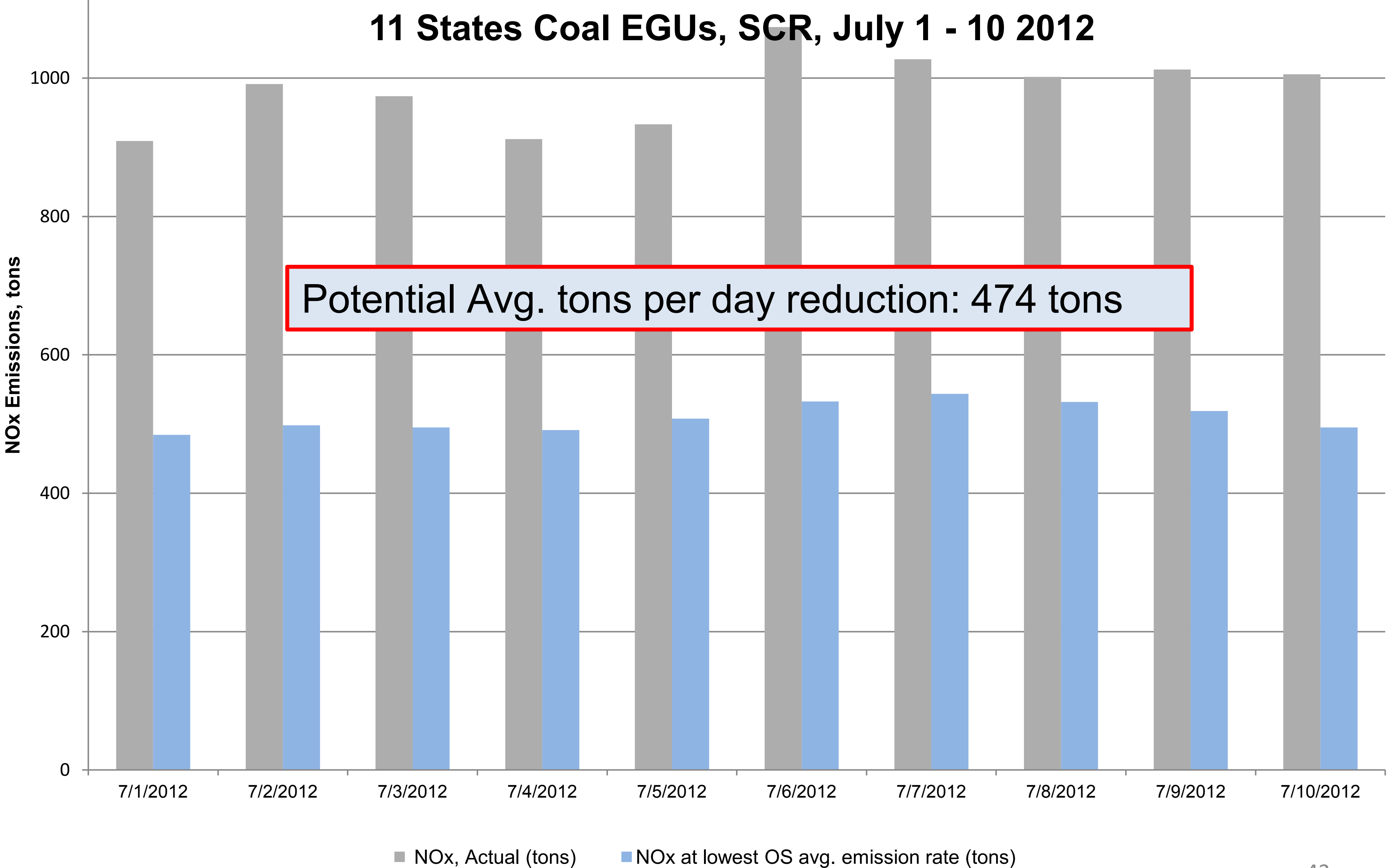
Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate



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11 State Summary

After performing similar analysis of EGUs in IL, IN, KY, MD, MI, NC, OH, PA, TN, VA and WV, the following potential total tons of lost NOx reductions was calculated:

- On July 2, 2012 actual NOx emissions in the 11 states (listed above) was 991 tons
  - If EGUs in those states were to have run their controls at the best rates observed in the data, emissions would have been 498 tons
  - This represents a single day loss of NOx reductions of 493 tons on that day
- During the 10 day episode between July 1 and 10, 2012 actual NOx emissions in the 11 states (listed above) was 9,840 tons
  - If EGUs in those states were to have run their controls at the best rates observed in the data, emissions would have been 5,099 tons
  - This represents a loss of NOx reductions of 4,741 tons over that 10-day episode

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Part 6

Potential Lost Ozone Benefits from Controls Running Less Effectively in Recent Years

Preliminary Photochemical Modeling

Ohio Monitors

How Might This Affect Ozone?

- Maryland has performed several very preliminary model runs to look at how much running EGU controls inefficiently might increase ozone levels
- Three runs:
  - Scenario 2B – A worst case run
    - Assumes SCR and SNCR controls are not run at all
  - Scenario 3B – A worst data run
    - Assumes SCR and SCR units all run at worst rates seen in CAMD data - 2005 to 2012
  - Scenario 3C – Based upon CAMD data analysis for EGU performance in 2011 and 2012
    - Assumes that units that had higher ozone season emission rates were operating at the best ozone season rates observed since 2005

Lost Ozone Benefits
Potential PPB Increases

Ohio Monitors	Potential Increased Ozone in 2018 – 3 EGU Control Scenarios		
County	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Allen	3.7	0.9	0.5
Ashtabula	3.5	1.0	0.6
Athens	16.6	4.3	2.7
Butler	9.2	3.0	2.0
Butler	8.4	2.8	1.8
Clark	6.5	1.8	1.1
Clark	6.4	1.6	1.0
Clermont	10.7	4.1	2.8
Clinton	11.7	3.3	2.2
Cuyahoga	3.0	1.1	0.6
Cuyahoga	2.8	1.0	0.5
Cuyahoga	3.5	1.2	0.5
Delaware	5.9	1.7	1.0
Franklin	5.8	1.6	1.0
Franklin	6.1	1.8	1.1
Franklin	4.7	1.3	0.8
Franklin	5.6	1.7	1.1
Geauga	3.6	1.2	0.7
Greene	8.9	2.6	1.7

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Lost Ozone Benefits
Potential PPB Increases

Ohio Monitors	Potential Increased Ozone in 2018 – 3 EGU Control Scenarios		
County	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Hamilton	9.0	2.9	1.9
Hamilton	9.4	2.9	1.9
Hamilton	11.5	4.5	2.9
Jefferson	11.8	4.8	1.7
Knox	6.2	1.7	1.1
Lake	2.8	1.0	0.6
Lake	2.8	0.9	0.6
Lawrence	7.2	1.7	1.0
Lawrence	10.5	3.0	1.9
Licking	6.3	1.3	0.8
Lorain	3.0	0.9	0.4
Lucas	1.6	0.4	0.2
Lucas	1.5	0.3	0.2
Lucas	1.5	0.4	0.2
Lucas	2.5	0.6	0.2
Madison	7.3	2.0	1.3
Mahoning	5.5	1.2	0.5
Medina	4.2	1.1	0.6
Miami	5.1	1.3	0.8

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Lost Ozone Benefits
Potential PPB Increases

Ohio Monitors	Potential Increased Ozone in 2018 – 3 EGU Control Scenarios		
County	Worst Case – No SCRs or SNCRs (Scenario 2B)	Using worst rate CAMD Data (Scenario 3B)	Using actual 2011/2012 Data (Scenario 3C)
Montgomery	6.3	1.8	1.1
Portage	4.3	1.1	0.5
Preble	7.3	2.2	1.4
Stark	5.8	1.3	0.8
Stark	5.7	1.1	0.6
Stark	5.1	1.3	0.7
Summit	4.5	1.1	0.5
Trumbull	5.9	1.3	0.6
Trumbull	6.5	1.4	0.6
Warren	11.0	3.3	2.1
Washington	20.3	8.8	6.1
Wood	3.7	0.7	0.4

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Lost Ozone Benefit – 2018 Design Values

… EPA will propose a new ozone standard soon … 60 to 70 ppb range … designations to most likely be based upon 2014 to 2016 or 2015 to 2017 data

Projected to be Clean in 2018 … Potentially at Risk		Increased Ozone in 2018 – 3 EGU Control Scenarios		
Ohio Counties	**2018 – Controls Running Well (Scenario 3A)**	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Allen	62.8	66.5	63.7	63.3
Ashtabula	70.3	73.8	71.3	70.9
Athens	57.8	74.4	62.1	60.5
Butler	68.9	78.1	71.9	70.9
Butler	68.1	76.5	70.9	69.9
Clark	64.4	70.9	66.2	65.5
Clark	62.5	68.9	64.1	63.5
Clermont	60.6	71.4	64.7	63.4
Clinton	62.4	74.2	65.7	64.6
Cuyahoga	74.1	77.2	75.2	74.8
Cuyahoga	71.4	74.2	72.4	72.0
Cuyahoga	67.1	70.6	68.3	67.6
Delaware	63.3	69.2	65.0	64.3
Franklin	72.9	78.7	74.6	73.9
Franklin	69.0	75.1	70.7	70.1
Franklin	66.7	71.4	68.0	67.5
Franklin	65.0	70.6	66.7	66.0
Geauga	62.7	66.3	63.9	63.4
Greene	62.0	70.9	64.6	63.7

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Lost Ozone Benefit – 2018 Design Values

… EPA will propose a new ozone standard soon … 60 to 70 ppb range … designations to most likely be based upon 2014 to 2016 or 2015 to 2017 data

Projected to be Clean in 2018 … Potentially at Risk		Increased Ozone in 2018 – 3 EGU Control Scenarios		
Ohio Counties	**2018 – Controls Running Well (Scenario 3A)**	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Hamilton	70.6	79.6	73.5	72.5
Hamilton	67.0	76.4	69.9	68.9
Hamilton	65.4	76.9	69.9	68.3
Jefferson	63.9	75.6	68.6	65.5
Knox	61.4	67.6	63.1	62.5
Lake	71.9	74.7	72.8	72.5
Lake	69.1	71.9	70.1	69.7
Lawrence	64.2	71.4	65.9	65.3
Lawrence	59.7	70.2	62.7	61.7
Licking	60.8	67.1	62.1	61.6
Lorain	64.6	67.6	65.5	64.9
Lucas	68.8	70.4	69.2	69.0
Lucas	66.2	67.6	66.5	66.3
Lucas	65.4	66.9	65.7	65.5
Lucas	63.9	66.4	64.5	64.1
Madison	61.8	69.1	63.8	63.0
Mahoning	62.2	67.7	63.4	62.7
Medina	60.7	64.8	61.7	61.2
Miami	61.3	66.5	62.6	62.1

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Lost Ozone Benefit – 2018 Design Values

… EPA will propose a new ozone standard soon … 60 to 70 ppb range … designations to most likely be based upon 2014 to 2016 or 2015 to 2017 data

Projected to be Clean in 2018 … Potentially at Risk		Increased Ozone in 2018 – 3 EGU Control Scenarios		
Ohio Counties	**2018 – Controls Running Well (Scenario 3A)**	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Montgomery	63.0	69.3	64.8	64.1
Portage	63.4	67.7	64.5	63.9
Preble	58.3	65.6	60.5	59.7
Stark	68.1	73.9	69.4	68.9
Stark	65.2	70.9	66.3	65.8
Stark	65.0	70.1	66.3	65.7
Summit	69.2	73.7	70.3	69.7
Trumbull	66.5	72.4	67.8	67.1
Trumbull	62.1	68.6	63.5	62.8
Warren	68.8	79.8	72.1	70.9
Washington	60.1	80.5	68.9	66.2
Wood	64.4	68.1	65.1	64.7

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EGU Data Package #3

Operation of Existing SCR, SNCR

Pennsylvania

Sample of draft data and analyses developed by the Maryland Department of the Environment

Contact: Tad Aburn, Air Director, MDE
(410) 537-3255

September 18, 2014

Purpose

- Maryland is the only Moderate nonattainment area in the East for the 75 ppb ozone standard.
  - This means that Maryland is the only state required to submit an attainment SIP
  - Only state required to perform attainment modeling.
- We are now beginning to build our “SIP Quality” modeling platform.
- One major issue that our data analyses have uncovered is that many EGU units appear to not be running their control equipment in recent years as efficiently as they have demonstrated they can do in earlier years. This issue is driven by recent changes in the energy market, reduced coal capacity, inexpensive allowances and a regulatory structure driven by ozone season caps not daily performance. In many states, including Maryland, this has lead to controls not always being used efficiently on the days when they are needed the most … this is perfectly legal.
- This is a critical issue that we would like to continue to discuss with you. There appears to be an interest from the private sector to discuss this issue and see if a common sense fix can be designed. Maryland believes this fix would be relatively cost-effective compared to the capital cost of the control technologies.
- MDE has focused our analyses on two of the worst large, regional scale ozone episodes from recent years: July 1-8, 2011 and July 1-10, 2012.
- The primary data used in these analyses include:
  - CEMS data from CAMD
  - Emissions and projection data from ERTAC
  - Other data we have received from individual states
- More detailed data and analyses and spreadsheets are available upon request.

How the Data Analyses Were Built

- Maryland began the data analyses in late 2012
  - Looked at EGUs in the 9 upwind states named in the 176A Petition (IL, IN, KY, MI, NC, OH, TN, VA, WV) … MD and PA
- Shared a draft package with Air Directors on April 21, 2014
  - This package focused on a bad ozone episode: July 1 – 8, 2011
- Shared a second draft package with Air Directors on May 13, 2014
  - This package focused on second bad ozone episode: July 1 – 10, 2012
  - This package also included update to specific material after receiving comments from numerous states
- The 2011 and 2012 episodes analyzed capture two of the worst regional ozone periods in 2011 and 2012
  - Other states, like Wisconsin and Delaware have done similar analyses and reached similar conclusions
- This is the third draft package, and builds on to the prior two draft packages, while incorporating input from individual states and updates to ERTAC.
- This third draft package also includes preliminary photochemical modeling performed by MDE to look at the potential loss of ozone reduction benefits.

Help Us QA the Data

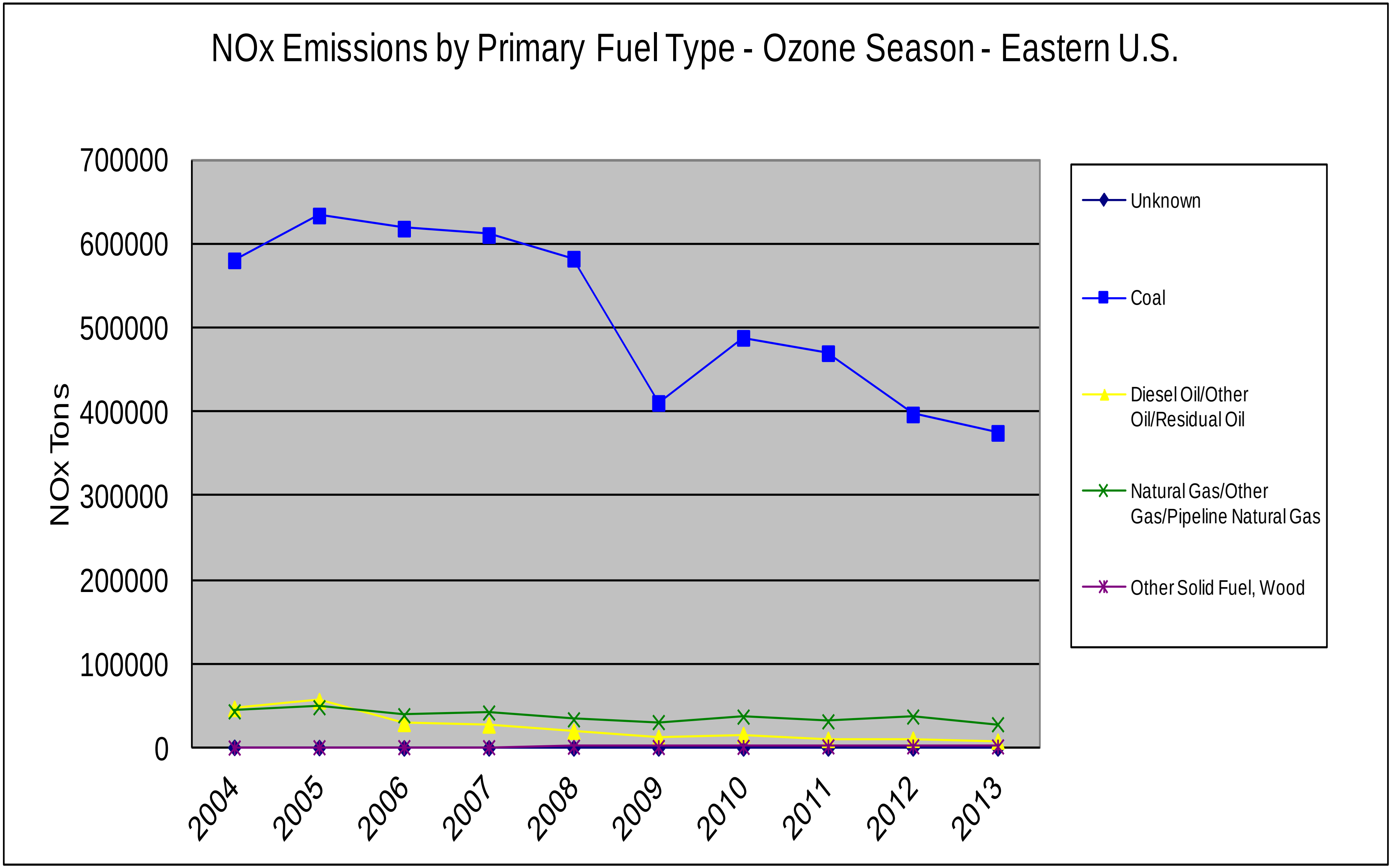
- We have used readily available data, like the CAMD and ERTAC data, but we recognize that these data sources can be out of date, or not include recent changes.
  - We hope you can help us with making sure we have the best possible data.

- This package reflects recently updated data, including but not limited to:
  - CAMD updates
  - May 8, 2014 ERTAC updates
  - PA comments to OTC, forwarded to MDE, Spreadsheets detailing "EGU Shutdowns, EGU Controls and New Natural Gas Power Projects" for the state of PA. Sent from Randy Bordner, Environmental Group Manager - Bureau of Air Quality, PA Department of Environmental Protection to Andy Bodnarik, OTC. Received as FWD from Andy Bodnarik on 4/23/2014
  - VA comments to MDE, "Electric Generation Sector Summary for Virginia" received from Thomas R. Ballou, Director - Office of Air Data Analysis and Planning, VA Department of Environmental Quality on 5/12/2014

Part 1

Background:
Generation in 2012 and 2018
Projected Changes

Why Coal?



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Pennsylvania EGUs, 2012

- Total number of units = 169
- Total heat input capacity = 325,477 MMBtu/hr = 42,142 MW
- Total State MW Capacity in %
  - **Total number of Coal units = 70 = 50%**
  - Total number of NG units = 62 = 18%
  - Total number of other (oil, etc.) units = 28 = 10%
  - Total number of Nuclear units = 9 = 22%
- **Total Capacity Coal = 20,958 MW**
  - 13 units with SCR = 10,759 MW = 51%
  - 28 units with SNCR = 4,859 MW = 23%
  - 29 units without SCR/SNCR = 5,340 MW = 26%

Basis – CAMD (as of 5/13/2014), NEI (for Nuclear), ERTAC (5/6/2014, 5/8/2014)

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Capacity and Fuel: 2012 to 2018

A detailed review of ERTAC data for 2018 was completed, and an evaluation of the following characteristics performed.

- ❖ Total Number of units
- ❖ Heat input capacity - MMBtu/hr
- ❖ Nameplate capacity – MW
- ❖ Presence of advanced post combustion controls – SCR, SNCR
- ❖ Fuel switching
- ❖ Shutdown, retirements

Pennsylvania EGUs, 2018

- Total number of units = 132
- Total heat input capacity = 273,378 MMBtu/hr = 35,914 MW
- Total State MW Capacity in %
  - **Total number of Coal units = 37 = 41%**
  - Total number of NG units = 69 = 24%
  - Total number of other (oil, etc.) units = 17 = 9%
  - Total number of Nuclear units = 9 = 26%
- **Total Capacity Coal = 14,738 MW**
  - 16 units with SCR = 12,317 MW = 84%
  - 11 units with SNCR = 1,662 MW = 11%
  - 10 units without SCR/SNCR = 758 MW = 5%

Basis – ERTAC (5/6/2014, 5/8/2014), NEI (for Nuclear)

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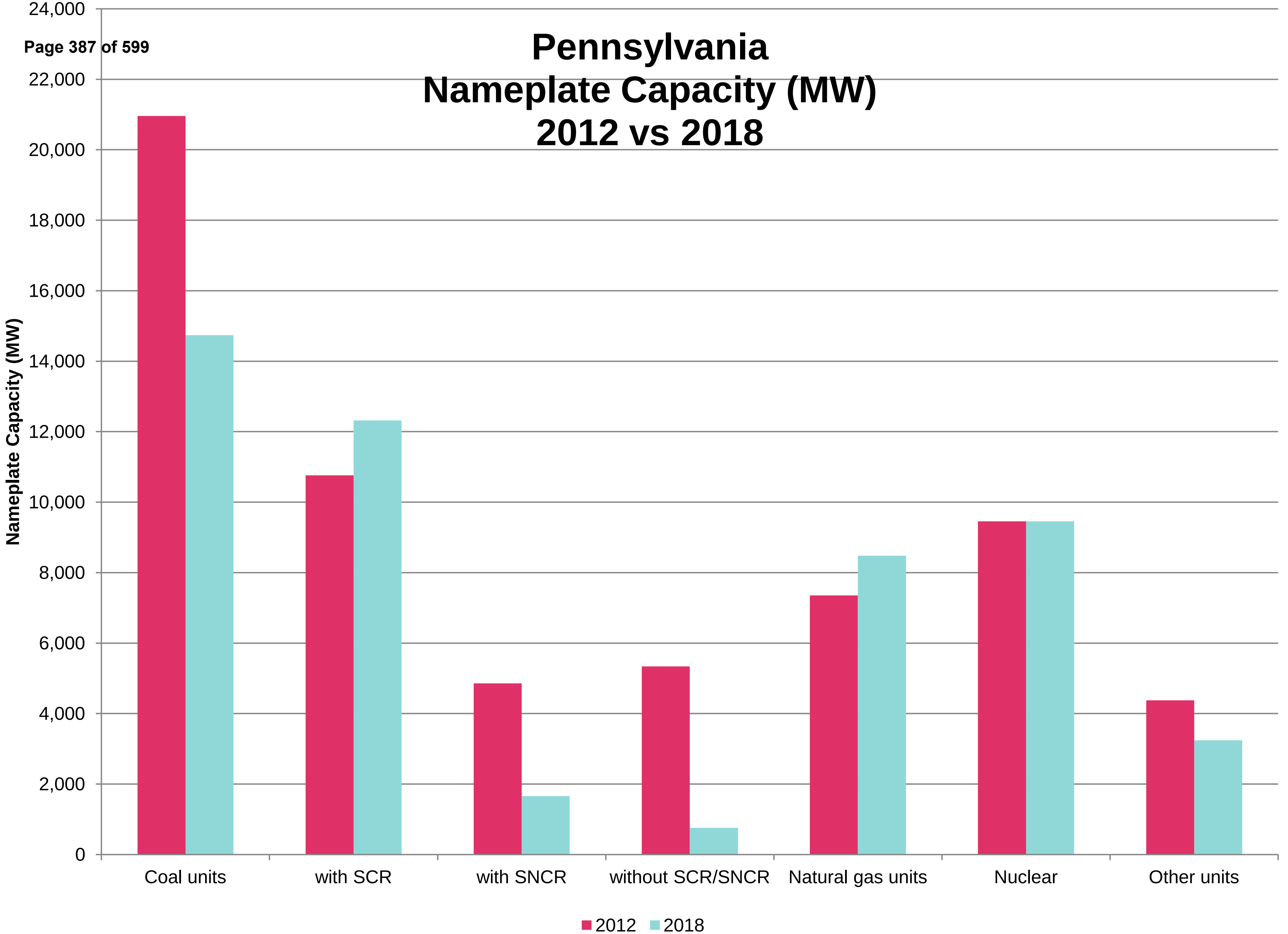

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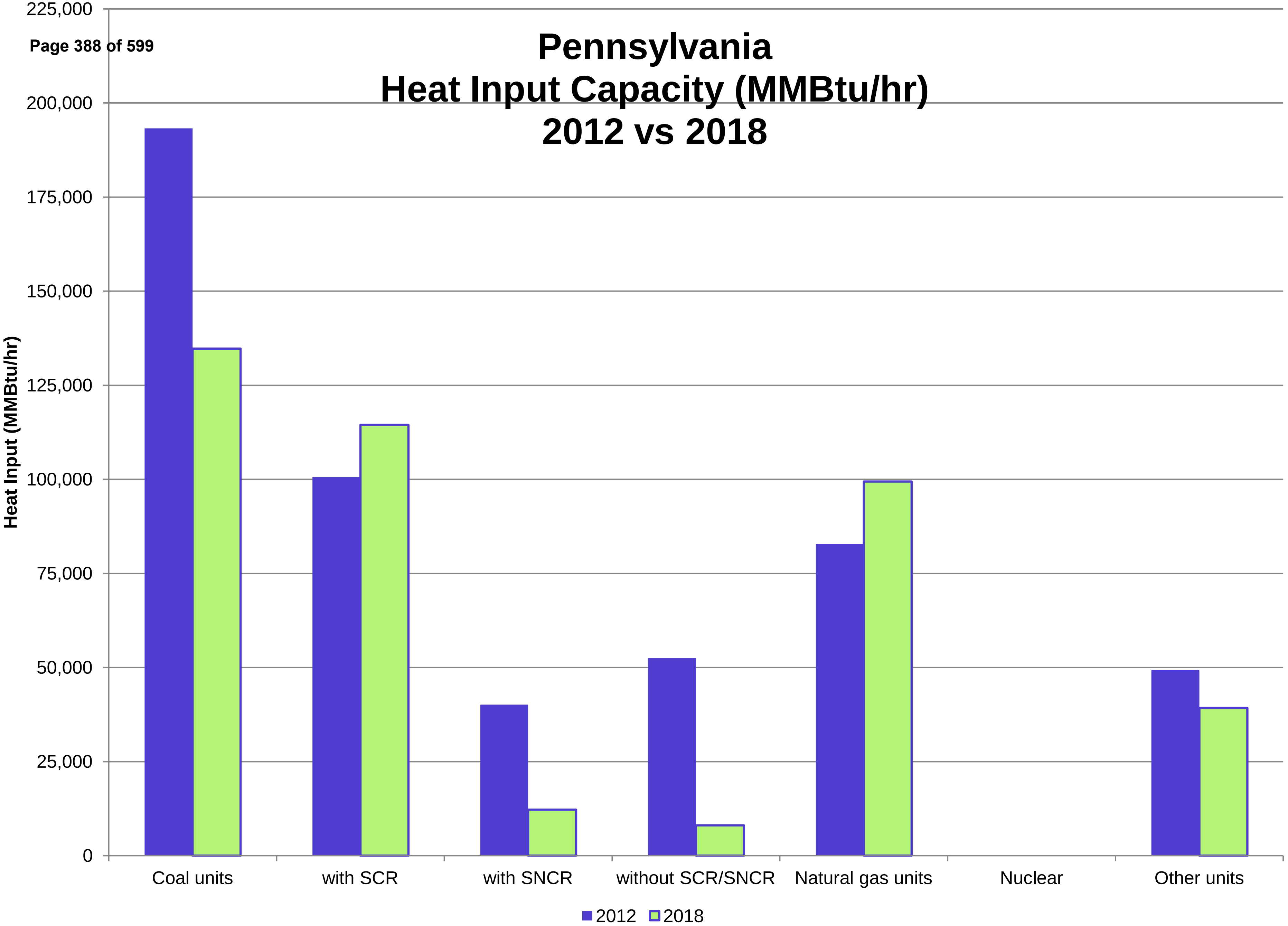

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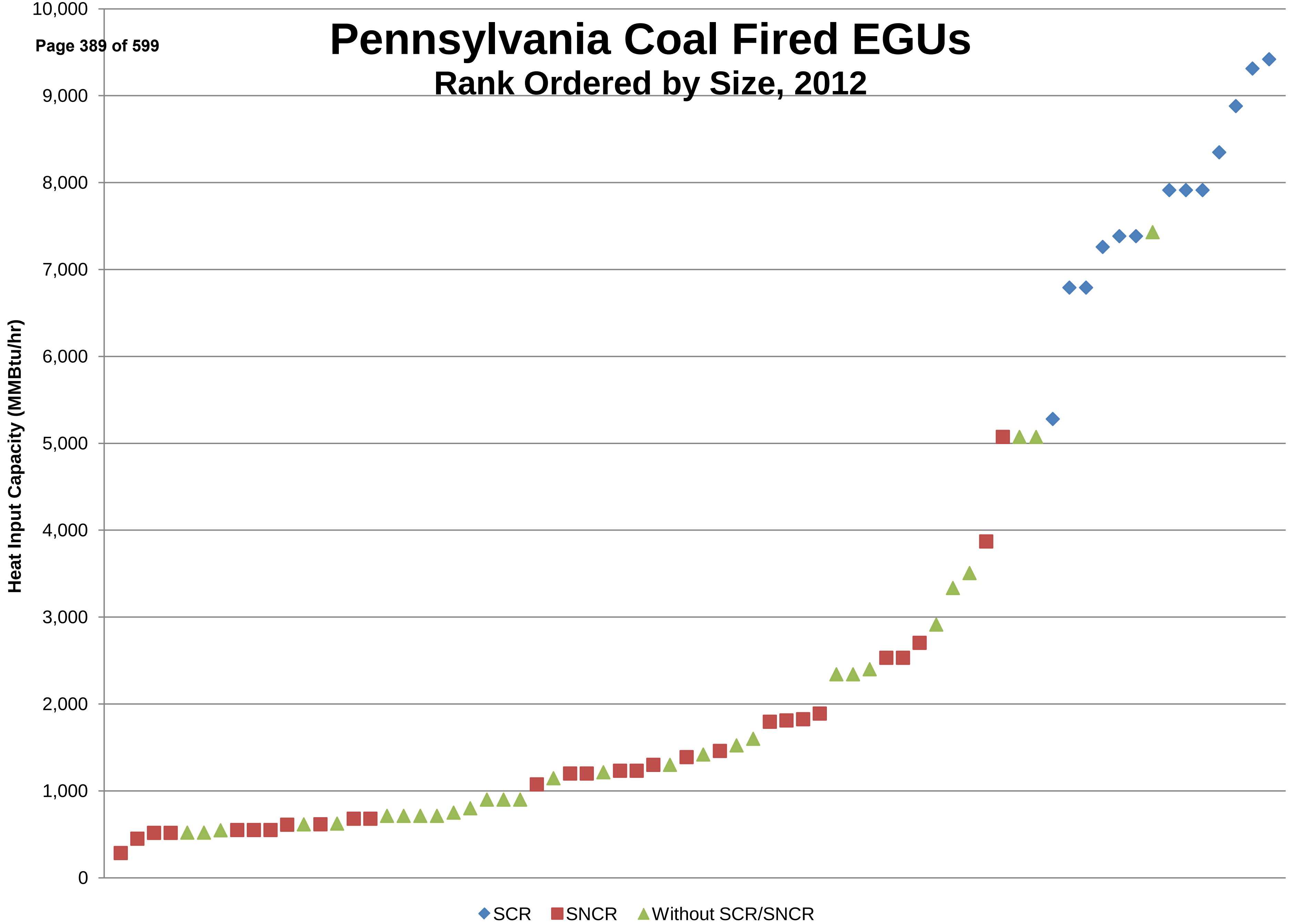
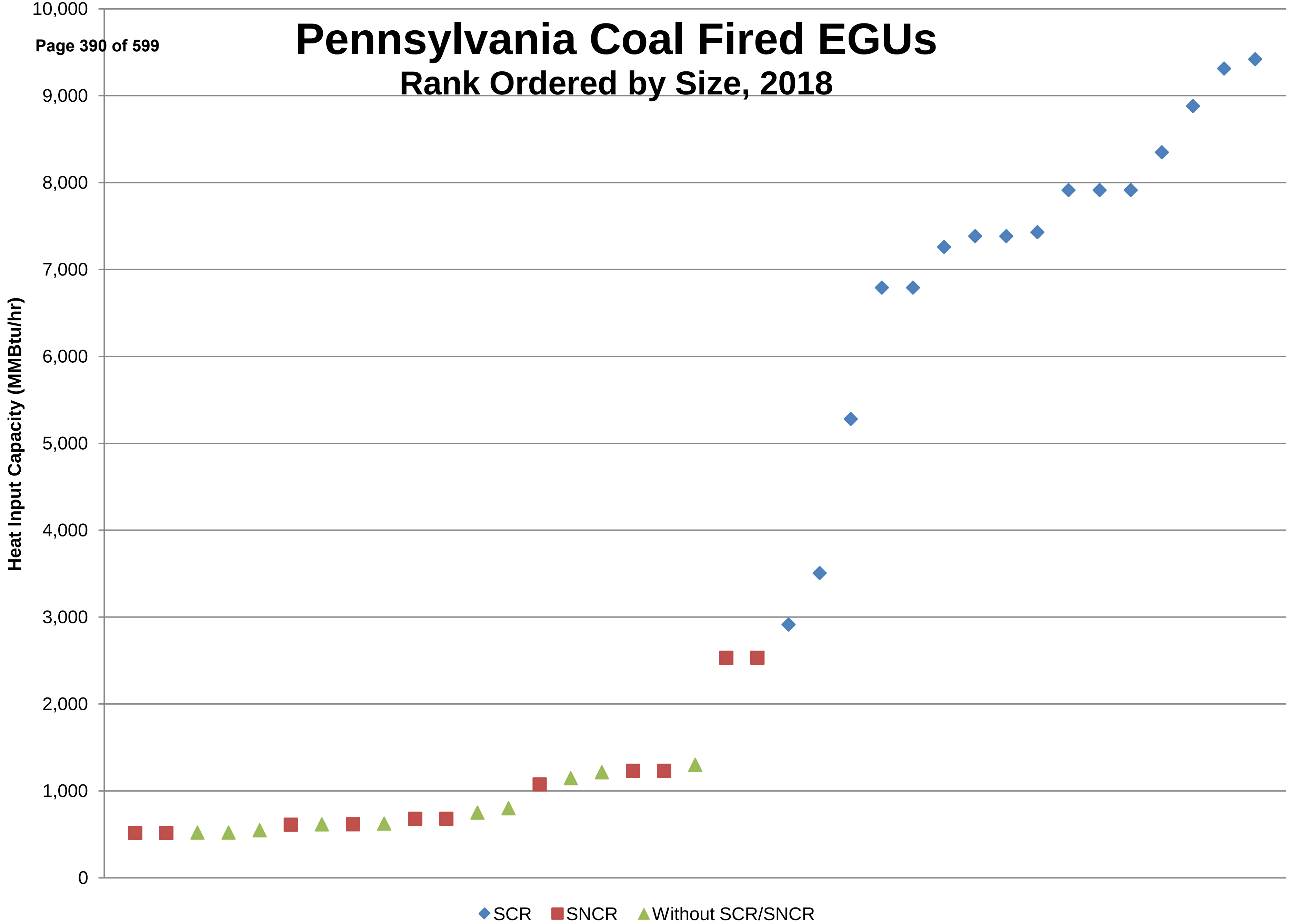


DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Pennsylvania Coal Fired EGUs
Rank Ordered by Size, 2018



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

PA : Large (> 3000 MMBtu/hr) Coal-Fired EGU NOx Emissions Rate Analysis									
	Facility Name	Unit ID	Lowest OS Emission Rate Year	Lowest OS Emission Rate (lbs/MMBtu)	2007 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2007 OS ER (% Change)	2011 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2011 OS ER (% Change)	Comments/ ERTAC Closure Date
Controlled with SCR	Bruce Mansfield	1	2004	0.0759	0.0841	11	0.1337	76	
	Bruce Mansfield	2	2004	0.0796	0.0801	1	0.1065	34	
	Bruce Mansfield	3	2005	0.0744	0.1191	60	0.0788	6	
	Cheswick	1	2003	0.0595	0.1898	219	0.2386	301	
	Conemaugh	1	2005	0.2982	0.3263	9	0.3411	14	
	Conemaugh	2	2009	0.2864	0.2951	3	0.317	11	
	Homer City	1	2006	0.0667	0.1134	70	0.1876	181	
	Homer City	2	2006	0.0826	0.0895	8	0.2239	171	
	Homer City	3	2005	0.0872	0.1868	114	0.1986	128	
	Keystone	1	2003	0.0423	0.0649	53	0.3717	779	
	Keystone	2	2008	0.0433	0.0448	3	0.363	738	
	Montour	1	2003	0.0444	0.0645	45	0.3323	648	
	Montour	2	2003	0.0472	0.1056	124	0.3159	569	
Controlled with SNCR	N/A								
Adding Controls or Fuel Switches by 2019	Brunner Island	2	2005	0.2886	0.3246	12	0.3575	24	SCR (2017)
	Brunner Island	3	2005	0.2537	0.3242	28	0.376	48	SCR (2017)
No Controls or Fuel Switches by 2019	N/A								
Retiring by 2017	Eddystone	2	2003	0.1646	0.261	59	Not Operating	N/A	Has SNCR. 2012
	Hatfields Ferry	1	2004	0.2677	0.4264	59	0.4923	84	10/9/2013
	Hatfields Ferry	2	2005	0.2897	0.4129	43	0.4746	64	10/9/2013
	Hatfields Ferry	3	2005	0.2699	0.4013	49	0.432	60	Has SNCR. 10/9/2013
	Mitchell Power Station	33	2005	0.2025	0.2688	33	0.3134	55	10/9/2013

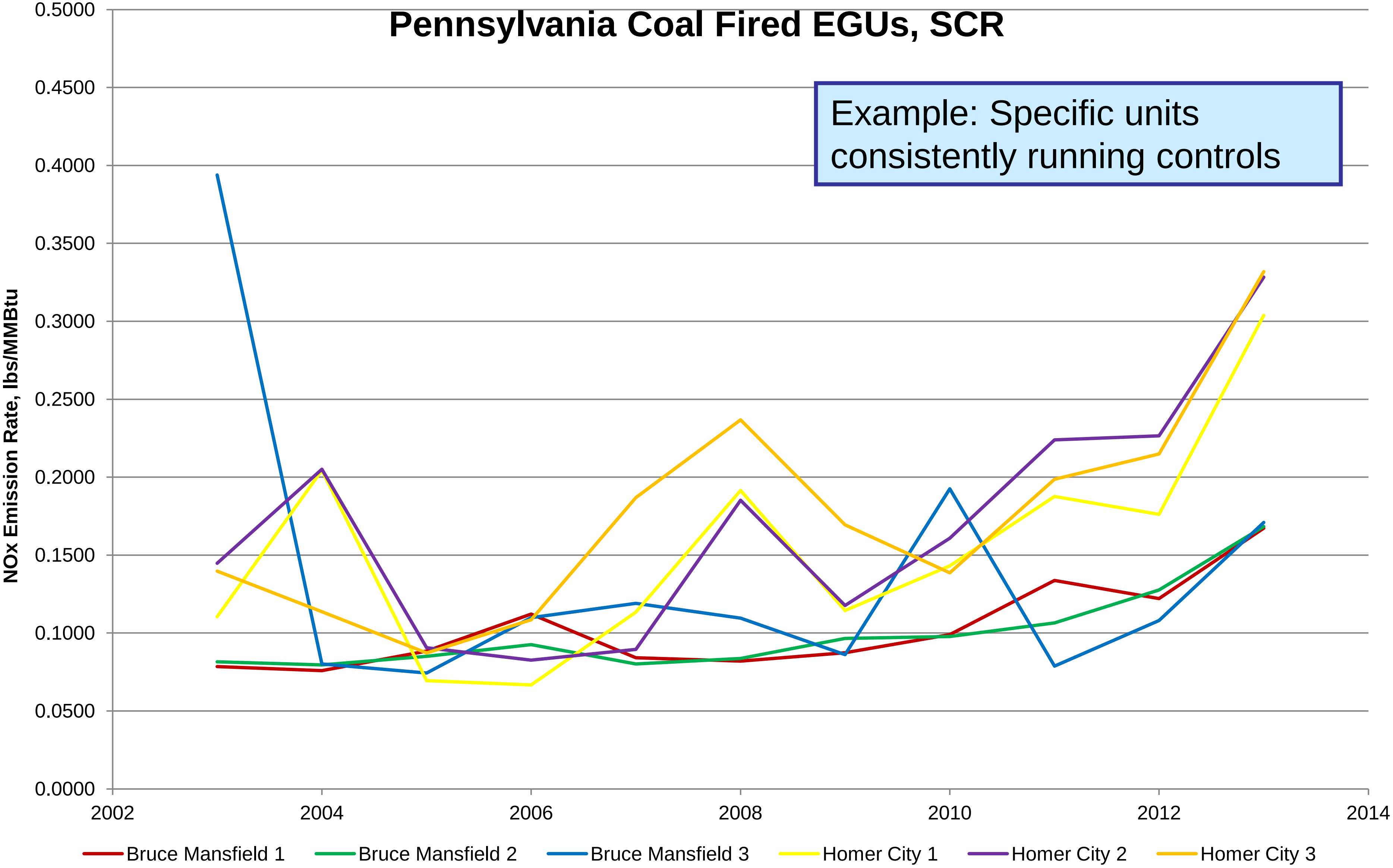
PA: Small (< 3000 MMBtu/hr) Coal-Fired EGU NOx Emissions Rate Analysis

	Facility Name	Unit ID	Lowest OS Emission Rate Year	Lowest OS Emission Rate (lbs/MMBtu)	2007 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2007 OS ER (% Change)	2011 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2011 OS ER (% Change)	Comments/ ERTAC Closure Date
Controlled with SCR	N/A								
Controlled with SNCR	Cambria Cogen	1	2005	0.0945	0.1036	10	0.1269	34	
	Cambria Cogen	2	2006	0.0949	0.1056	11	0.1295	36	
	New Castle	3	2005	0.2612	0.3259	25	0.3405	30	Close 2014 (media)
	New Castle	4	2006	0.2799	0.3383	21	0.327	17	Close 2015 (media)
	New Castle	5	2005	0.3242	0.3842	19	0.406	25	Close 2015 (media)
	Panther Creek	1	2005	0.1051	0.1214	16	0.13	24	
	Panther Creek	2	2005	0.1093	0.1261	15	0.1207	10	
	Scrubgrass	1	2003	0.0548	0.0969	77	0.1189	117	
	Scrubgrass	2	2004	0.0681	0.1385	103	0.1282	88	
	Seward	1	2004	0.0695	0.0844	21	0.0898	29	
	Seward	2	2012	0.0745	0.0847	14	0.0887	19	
Adding Controls or Fuel Switches by 2019	Brunner Island	1	2005	0.2848	0.31	9	0.3696	30	SCR (2017)
No Controls or Fuel Switches by 2019	Colver Power Project	AAB01	2006	0.1087	0.1295	19	0.1209	11	
	Ebensburg	31	2003	0.0717	0.0844	18	0.0802	12	
	Gilberton Power	31	2007	0.0409	0.0409	0	0.0581	42	
	Gilberton Power	32	2010	0.0402	0.0411	2	0.0577	44	
	Mt. Carmel Cogeneration	SG-101	2003	0.0942	0.1215	29	0.1375	46	
	Northampton	NGC01	2003	0.0564	0.0852	51	0.0812	44	
	Northeastern	31	2009	0.0299	0.0484	62	0.0373	25	
	St. Nicholas	1	2009	0.0379	0.046	21	0.0526	39	
	Wheelabrator - Frackville	GEN1	2004	0.1009	0.1254	24	0.1641	63	
	WPS Westwood	31	2011	0.1061	0.1419	34	0.1061	0	
Retiring by 2017	AES Beaver Valley LLC	32	2004	0.3715	0.4257	15	0.4149	12	Has SNCR. Retire 6/1/2017.
	AES Beaver Valley LLC	33	2009	0.2808	0.3716	32	0.4508	61	
	AES Beaver Valley LLC	34	2003	0.3992	0.411	3	0.4452	12	
	AES Beaver Valley LLC	35	2005	0.3181	0.4502	42	0.4679	47	
	Armstrong Power Station	1	2009	0.2736	0.312	14	0.3454	26	9/30/2012
	Armstrong Power Station	2	2012	0.2048	0.319	56	0.365	78	9/30/2012
	Cromby	1	2003	0.2371	0.3737	58	0.349	47	Has SNCR. 2012
	Eddystone	1	2003	0.1917	0.3222	68	Not Operating	N/A	Has SNCR. 2012.
	Elrama	1	2003	0.3812	0.5314	39	0.4975	31	Has SNCR. 10/12/2012
	Elrama	2	2003	0.3757	0.5225	39	0.4551	21	
	Elrama	3	2004	0.378	0.5242	39	0.5212	38	
	Elrama	4	2004	0.3518	0.5198	48	0.4545	29	
	Piney Creek Power Plant	31	2004	0.0747	0.1098	47	0.1287	72	Has SNCR. 4/12/2013
	Portland	1	2006	0.2048	0.2083	2	0.2407	18	Has SNCR. 6/1/2014
	Portland	2	2004	0.2437	0.2867	18	0.4062	67	6/1/2014
	Shawville	1	2011	0.3706	0.4322	17	0.3706	0	Has SNCR. 4/16/2015
	Shawville	2	2005	0.3963	0.4378	10	0.3989	1	
	Shawville	3	2008	0.3437	0.359	4	0.3826	11	
	Shawville	4	2008	0.3453	0.3605	4	0.363	5	
	Sunbury	3	2009	0.259	0.2836	9	0.2723	5	2/1/2012
	Sunbury	4	2012	0.2125	0.2609	23	0.2546	20	2/1/2012
	Sunbury	1A	2012	0.033	0.2858	766	0.2481	652	2/1/2012
	Sunbury	1B	2012	0.033	0.2892	776	0.2487	654	2/1/2012
	Sunbury	2A	2012	0.1454	0.2719	87	0.2842	95	2/1/2012
	Sunbury	2B	2012	0.025	0.271	984	0.028	12	2/1/2012
	Titus	1	2003	0.2369	0.2849	20	0.3648	54	9/1/2013
	Titus	2	2003	0.2583	0.2852	10	0.366	42	9/1/2013
	Titus	3	2003	0.2554	0.2853	12	0.3622	42	9/1/2013

Part 2

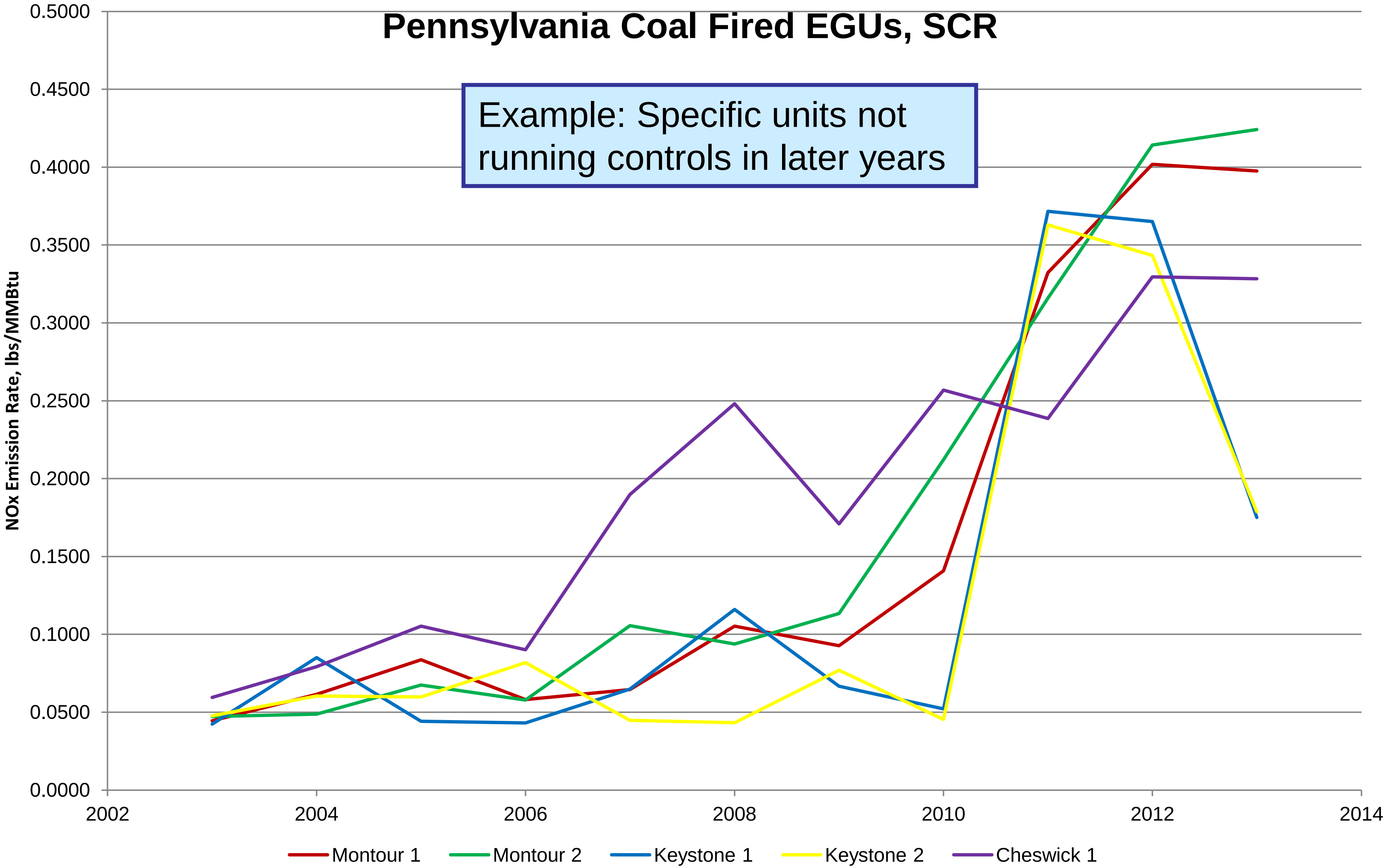
Operation of Controls: Changes in Control Efficiency 2003 to 2013

Average Ozone Season Emission Rates at Specific Units by Year



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Average Ozone Season Emission Rates at Specific Units by Year



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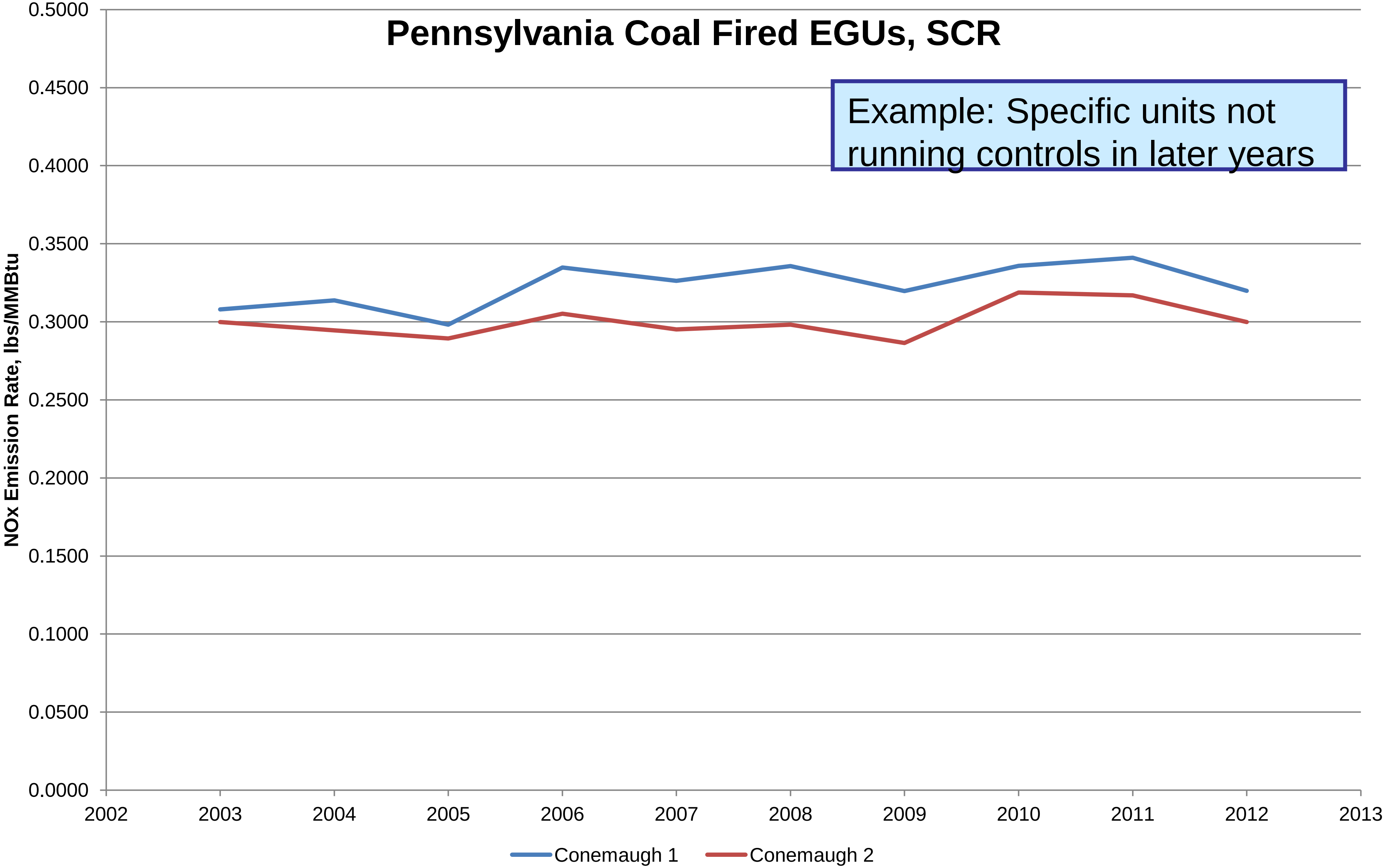
Average Ozone Season Emission Rates at Specific Units by Year



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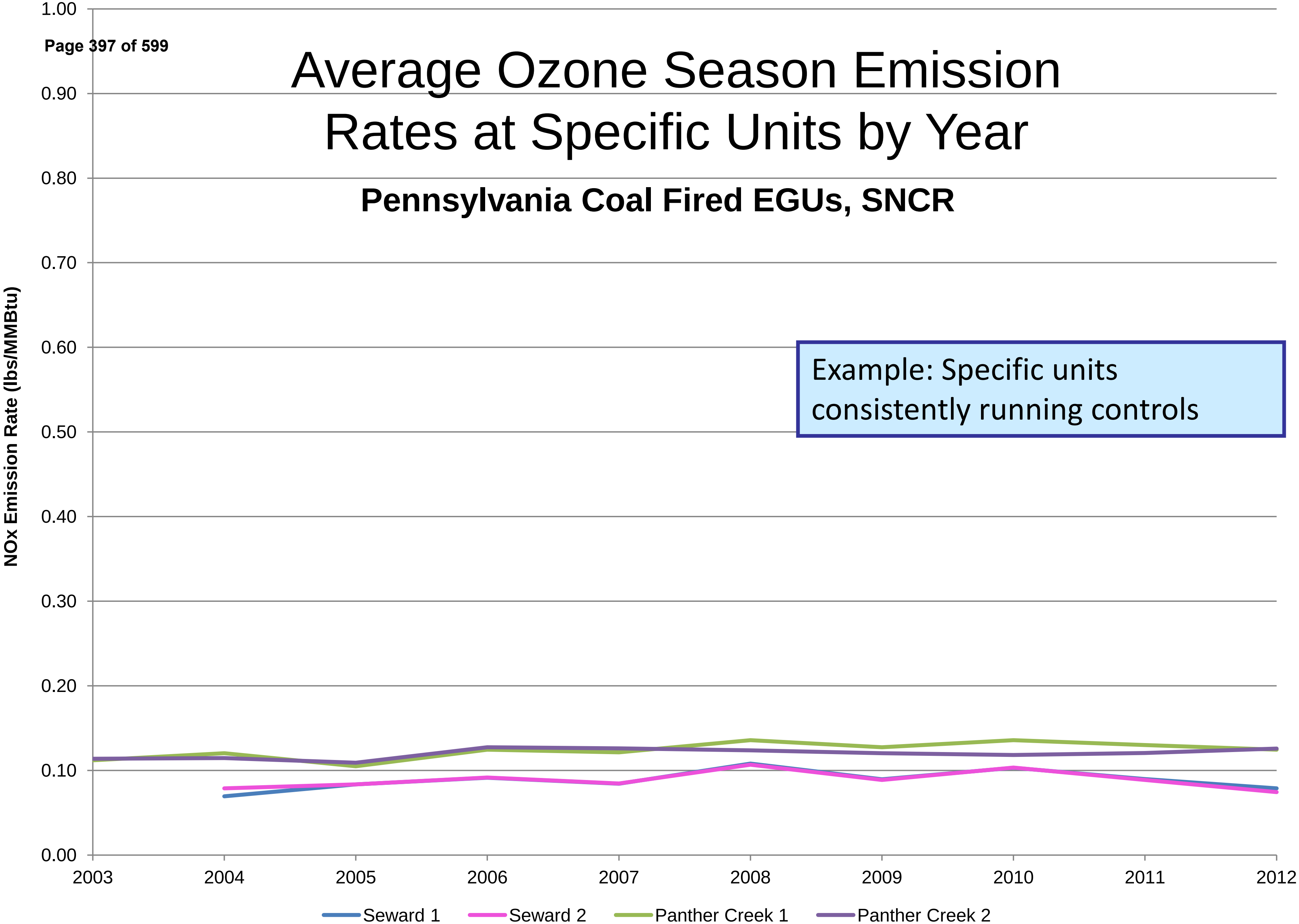
Average Ozone Season Emission Rates at Specific Units by Year

Pennsylvania Coal Fired EGUs, SNCR



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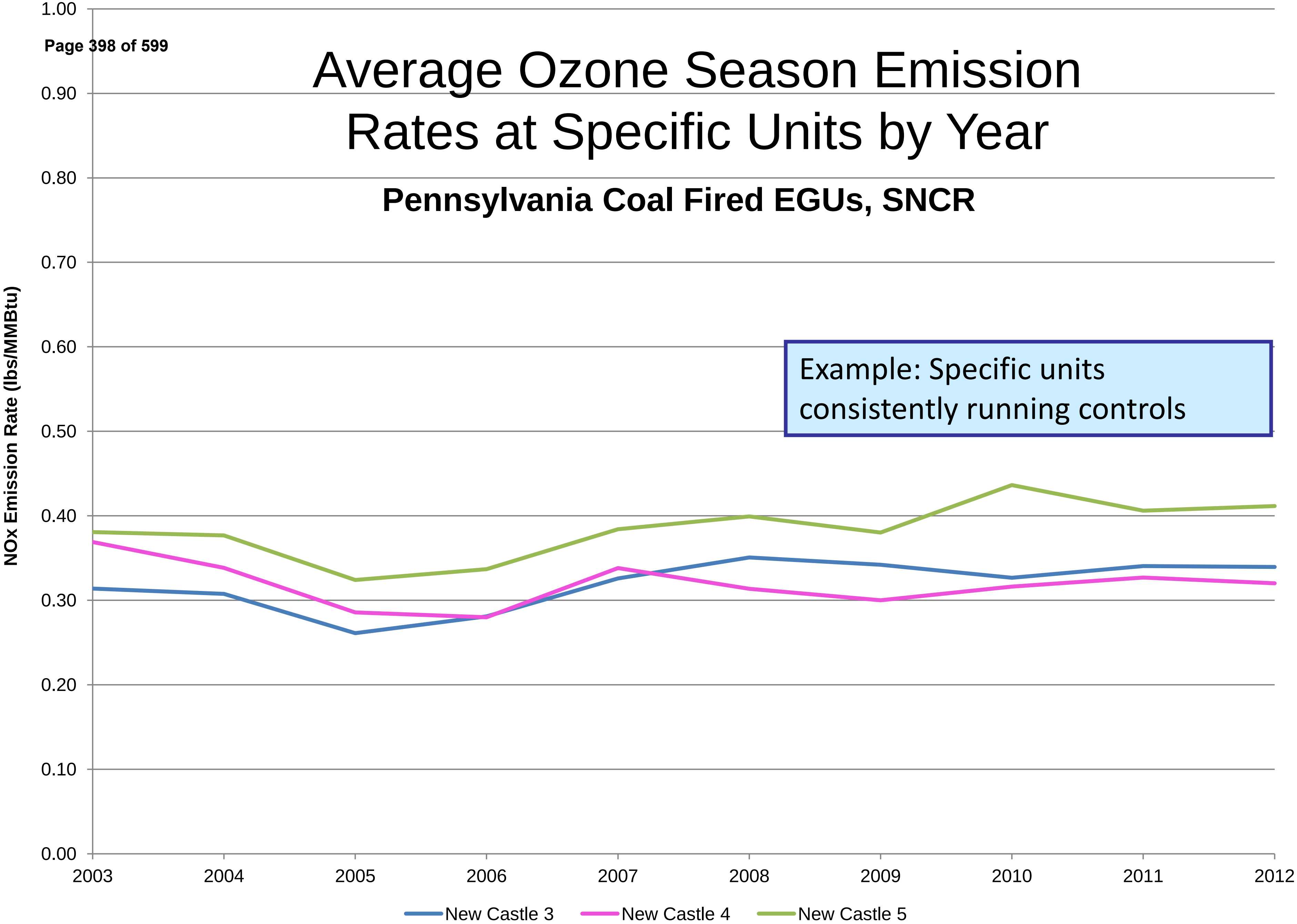
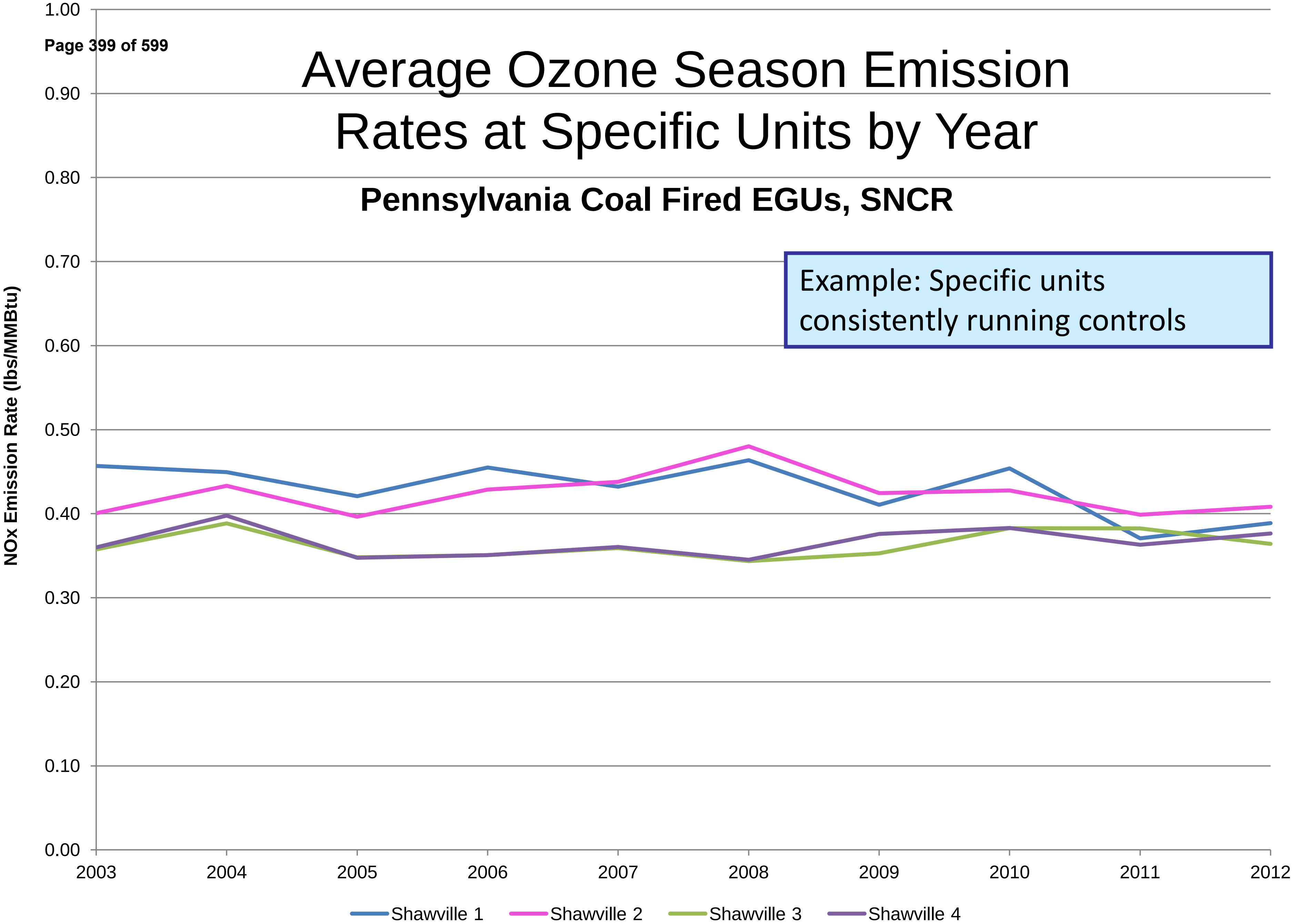
Average Ozone Season Emission Rates at Specific Units by Year

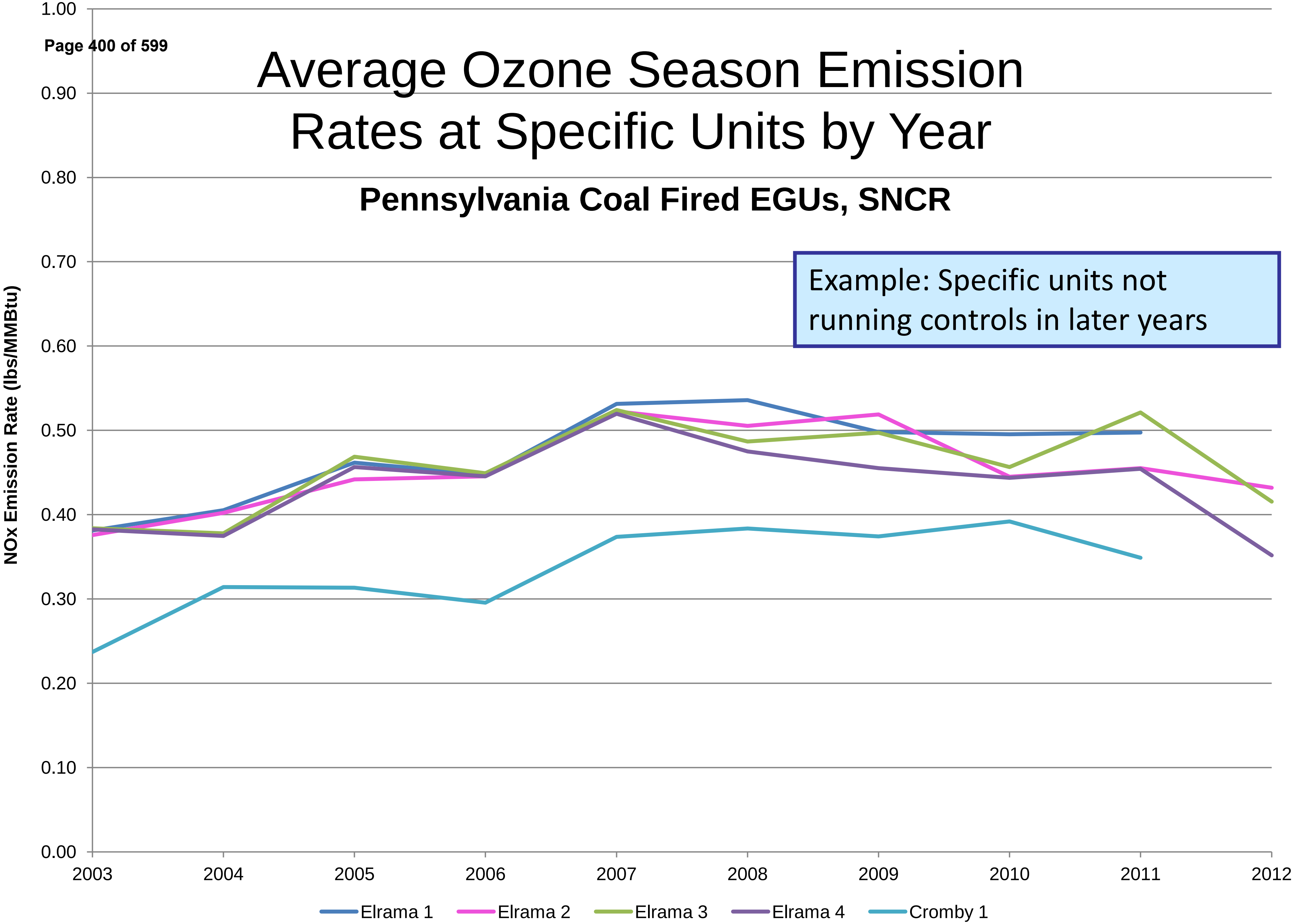


DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Average Ozone Season Emission Rates at Specific Units by Year



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.



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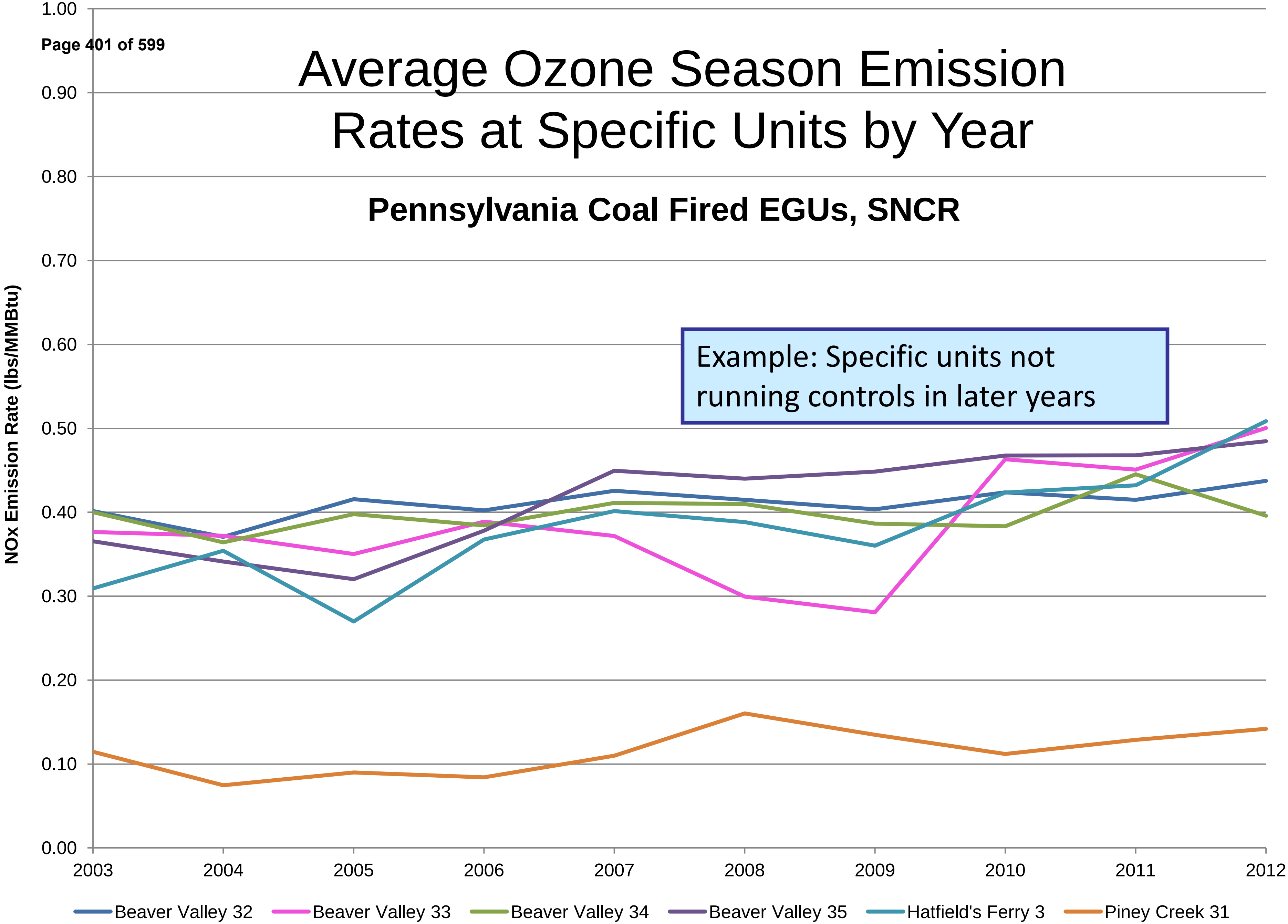
Average Ozone Season Emission Rates at Specific Units by Year

Pennsylvania Coal Fired EGUs, SNCR



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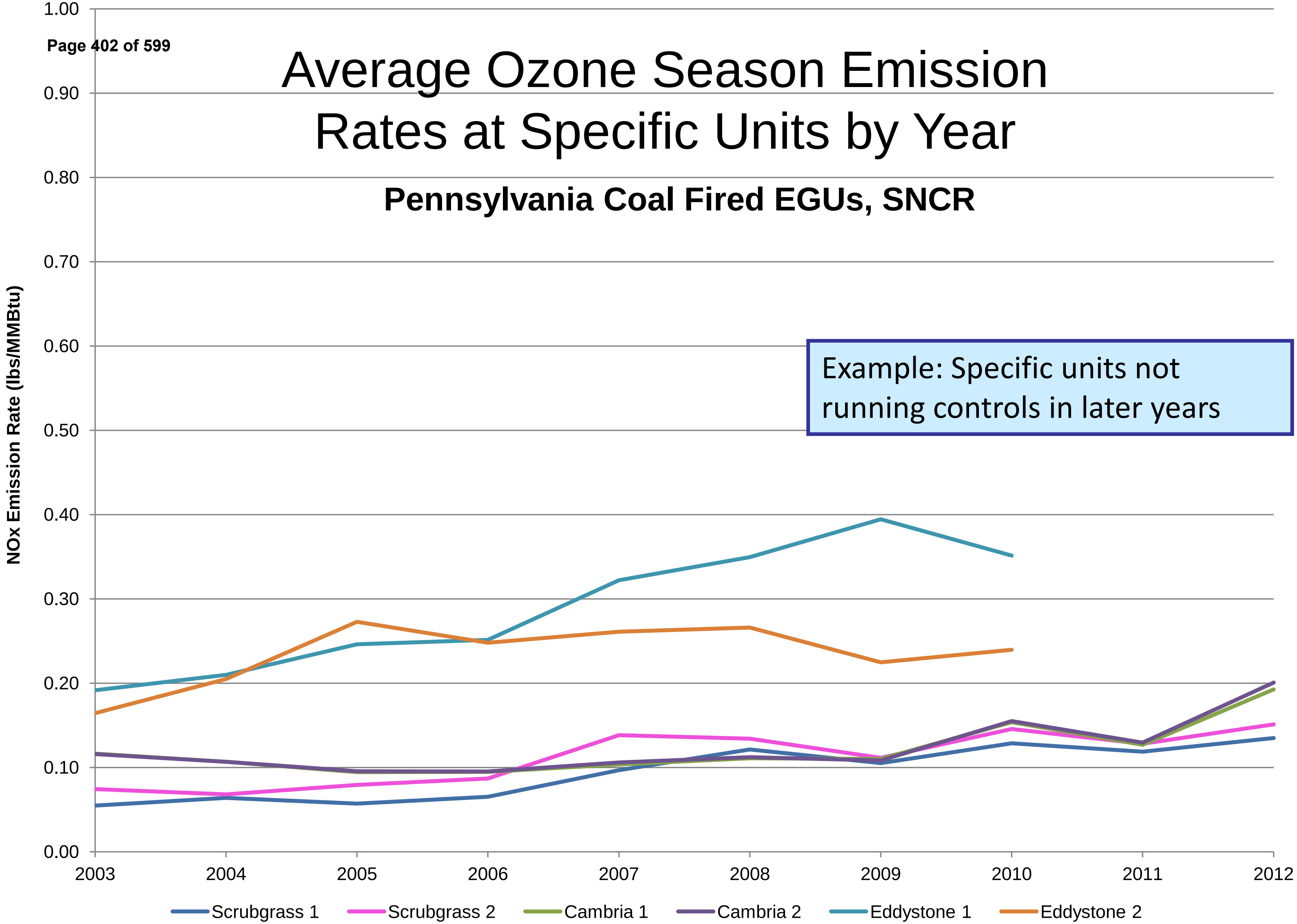
Average Ozone Season Emission Rates at Specific Units by Year

Pennsylvania Coal Fired EGUs, SNCR

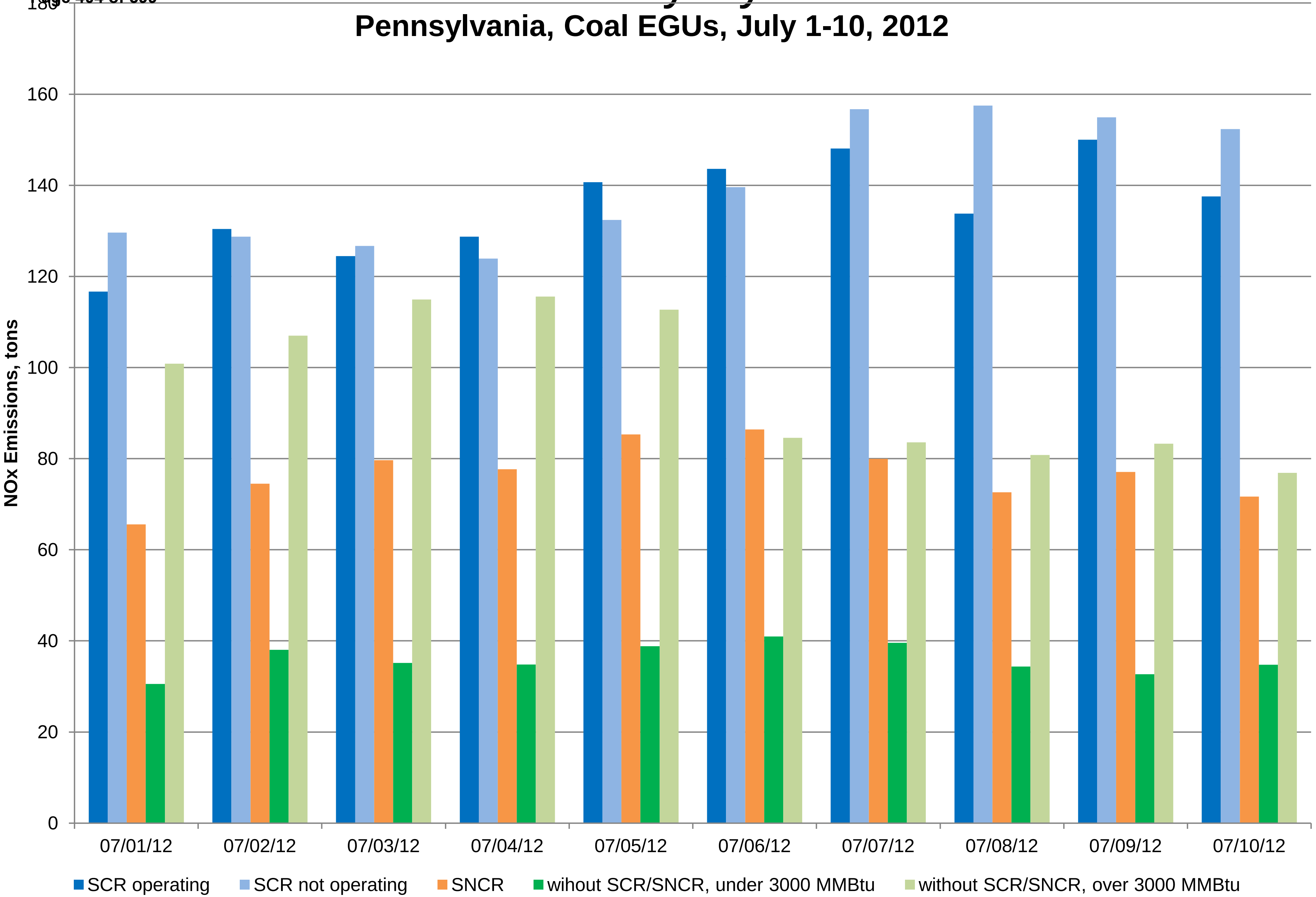


Part 3

July 1 to 10, 2012 Ozone Episode:

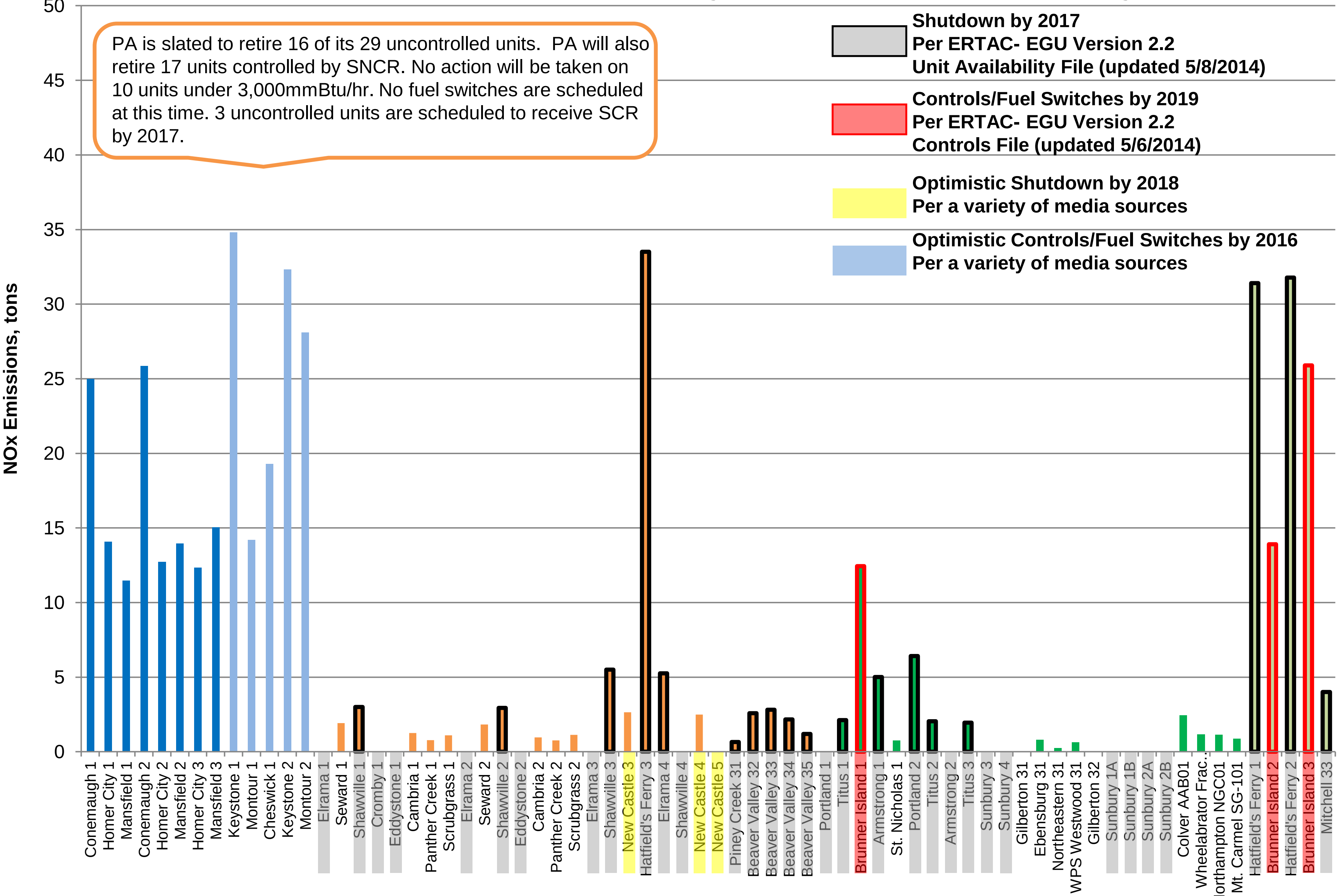
Analysis of Emissions and Controls

Tons of NOx Per Day By Control Status



DRAFT – May 13, 2014 – Requesting QA of data. For discussion purposes only.

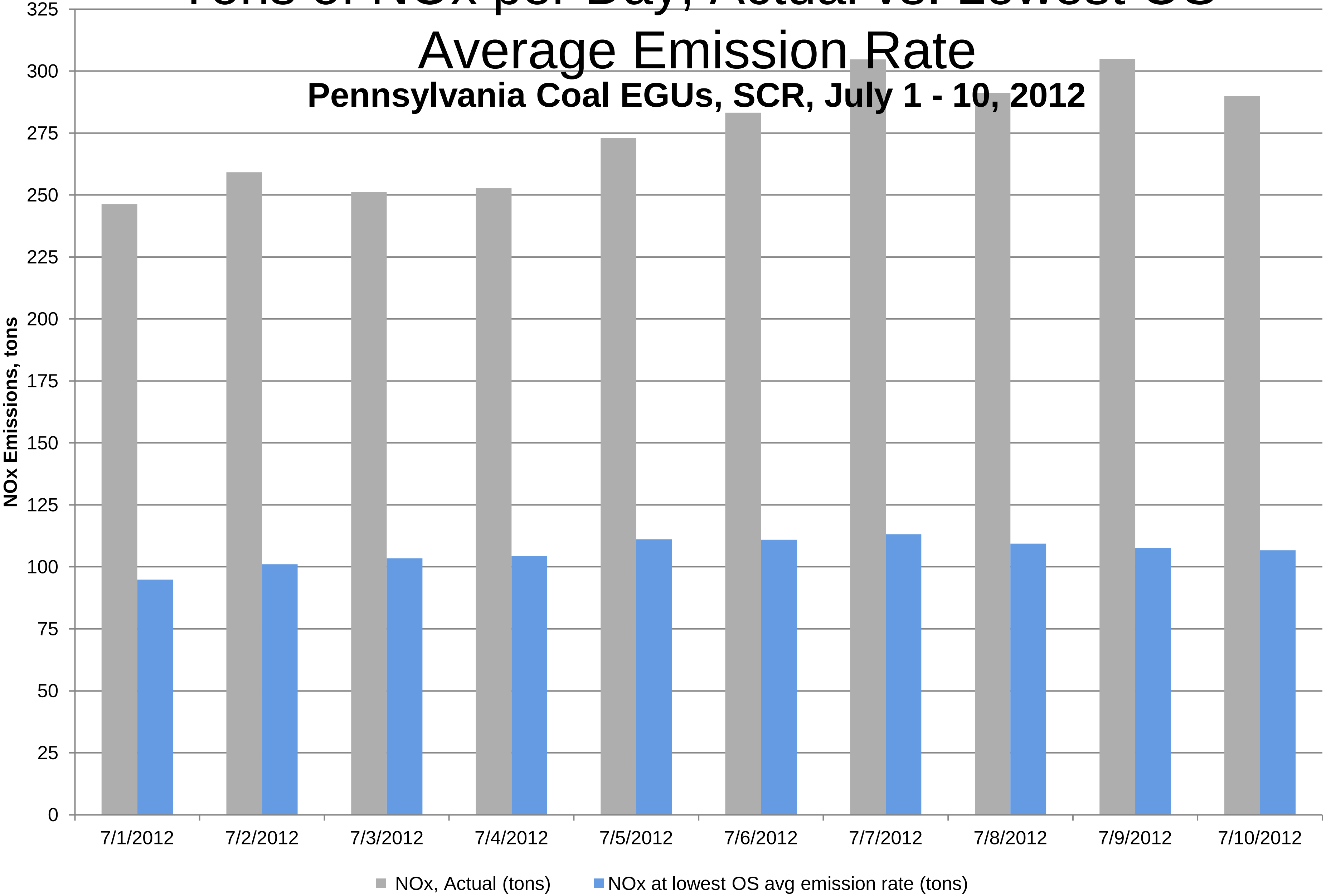
PA – Tons of NOx Per Unit By Control Status, July 2, 2012



DRAFT – May 13, 2014 – Requesting QA of data. For discussion purposes only.

Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate

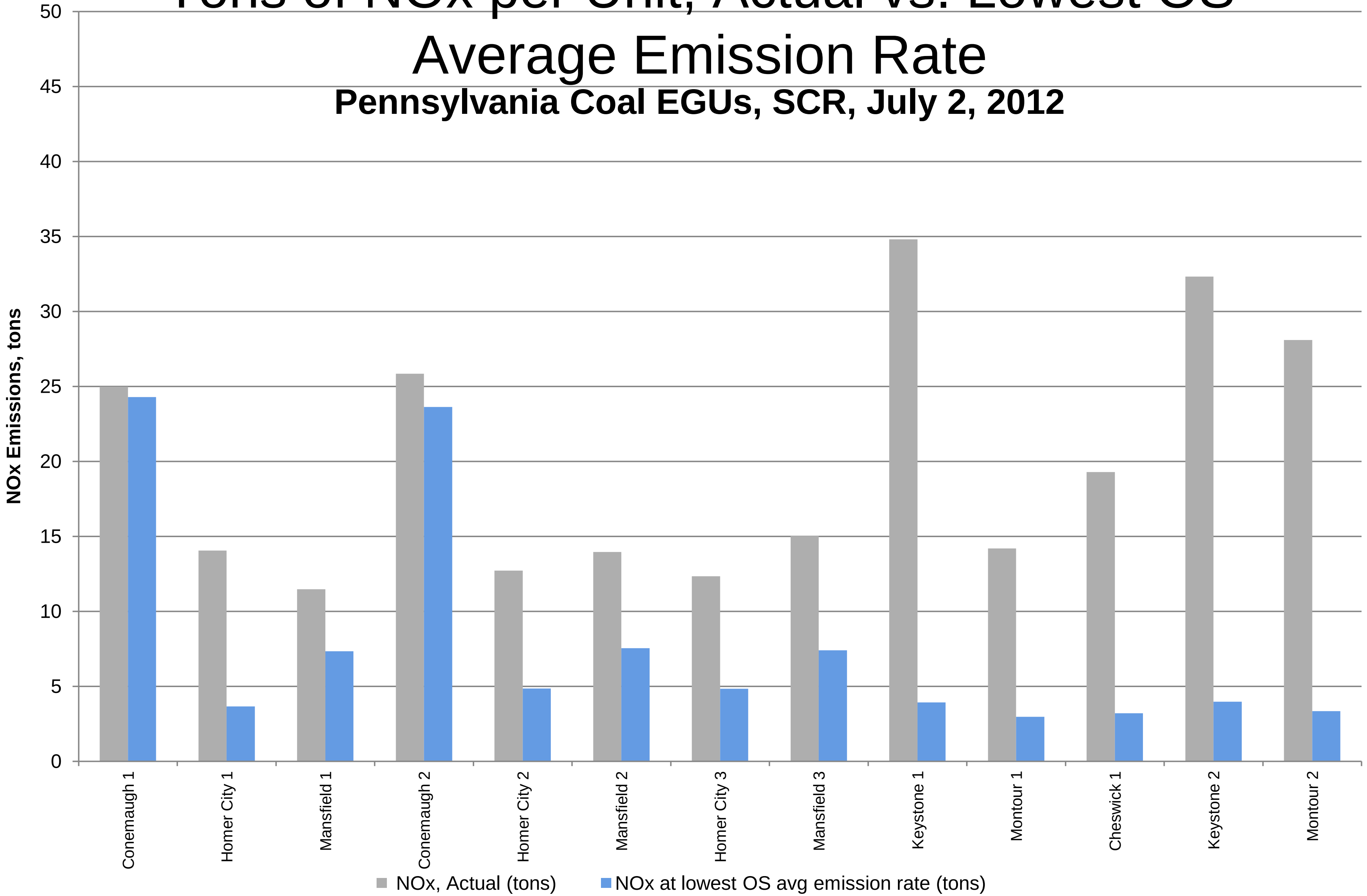
Pennsylvania Coal EGUs, SCR, July 1 - 10, 2012



DRAFT – May 13, 2014 – Requesting QA of data. For discussion purposes only.

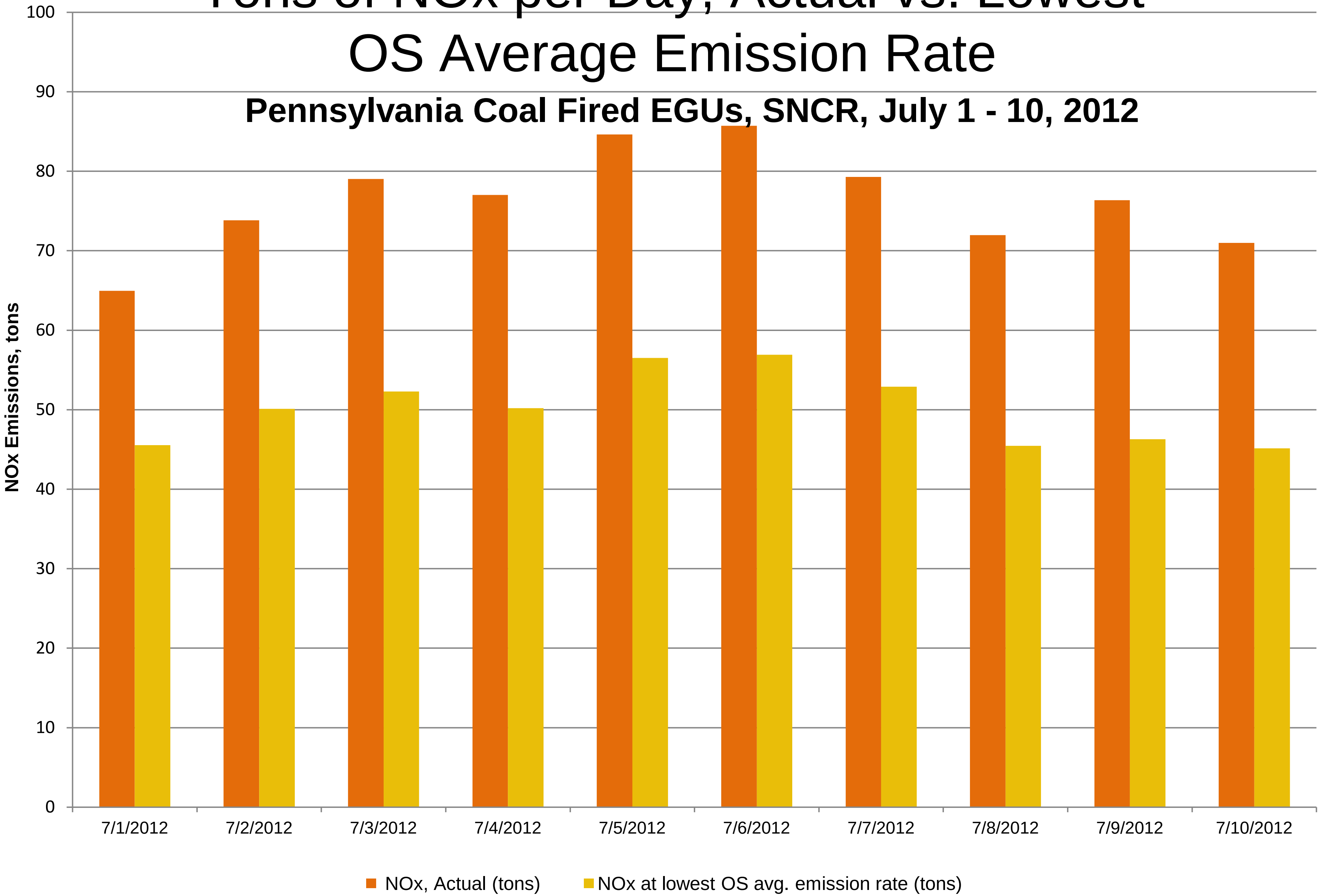
Tons of NOx per Unit, Actual vs. Lowest OS Average Emission Rate

Pennsylvania Coal EGUs, SCR, July 2, 2012



DRAFT – May 13, 2014 – Requesting QA of data. For discussion purposes only.

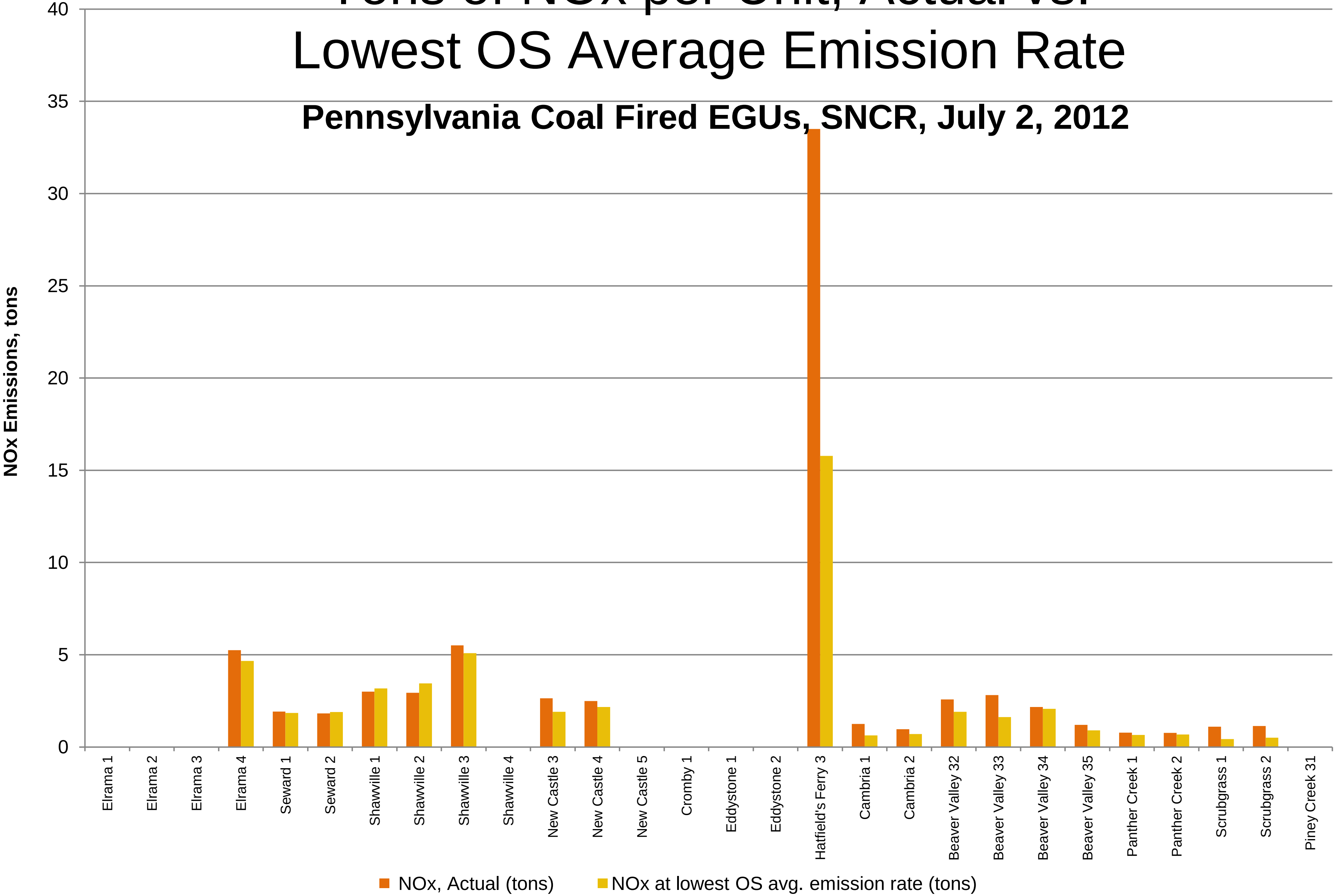
Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate



DRAFT – August 15, 2014 – Requesting QA of data. For discussion purposes only.

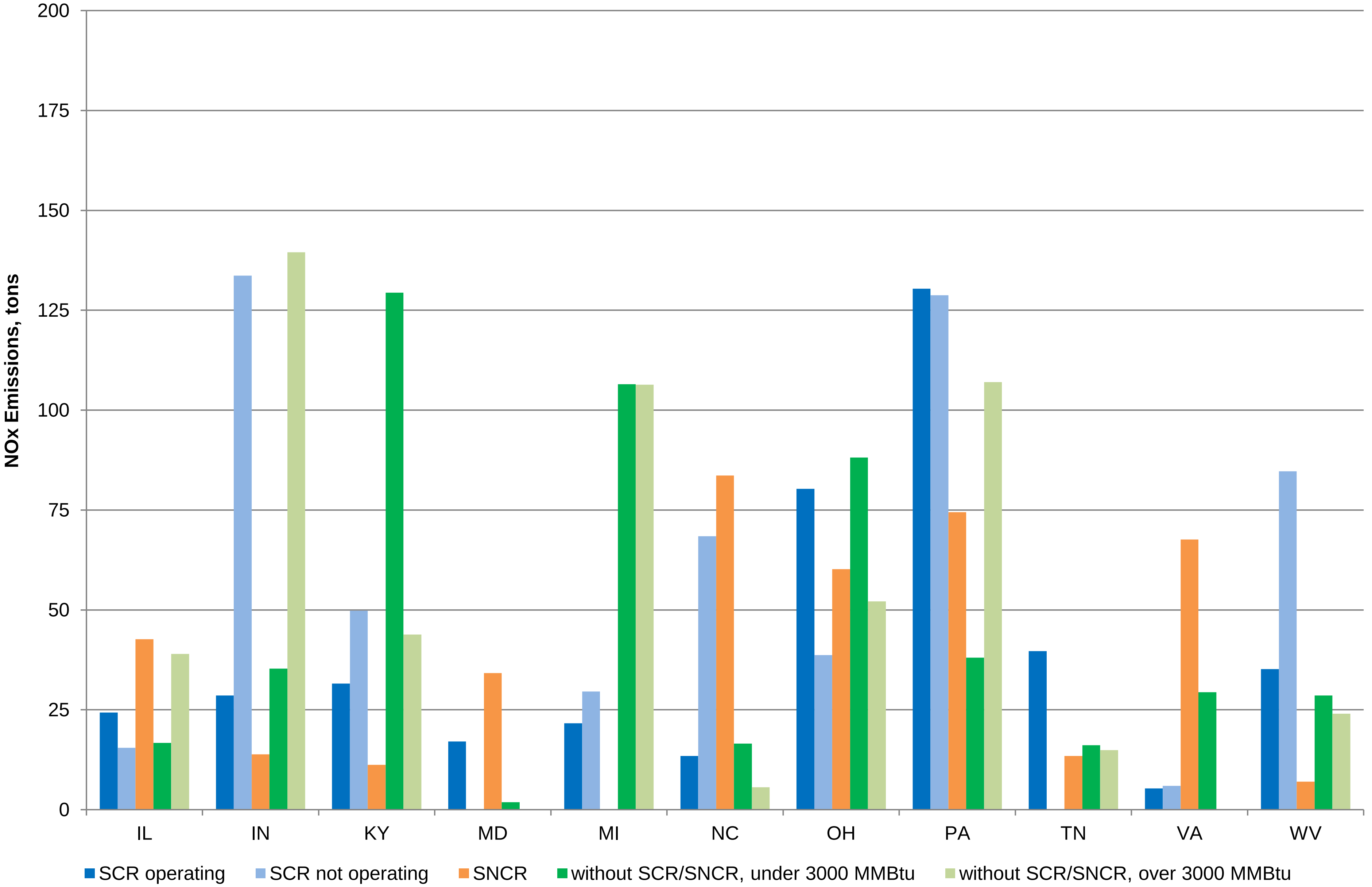
Tons of NOx per Unit, Actual vs. Lowest OS Average Emission Rate

Pennsylvania Coal Fired EGUs, SNCR, July 2, 2012



DRAFT – August 15, 2014 – Requesting QA of data. For discussion purposes only.

July 2, 2012 – Tons of NOx per State by Control Status



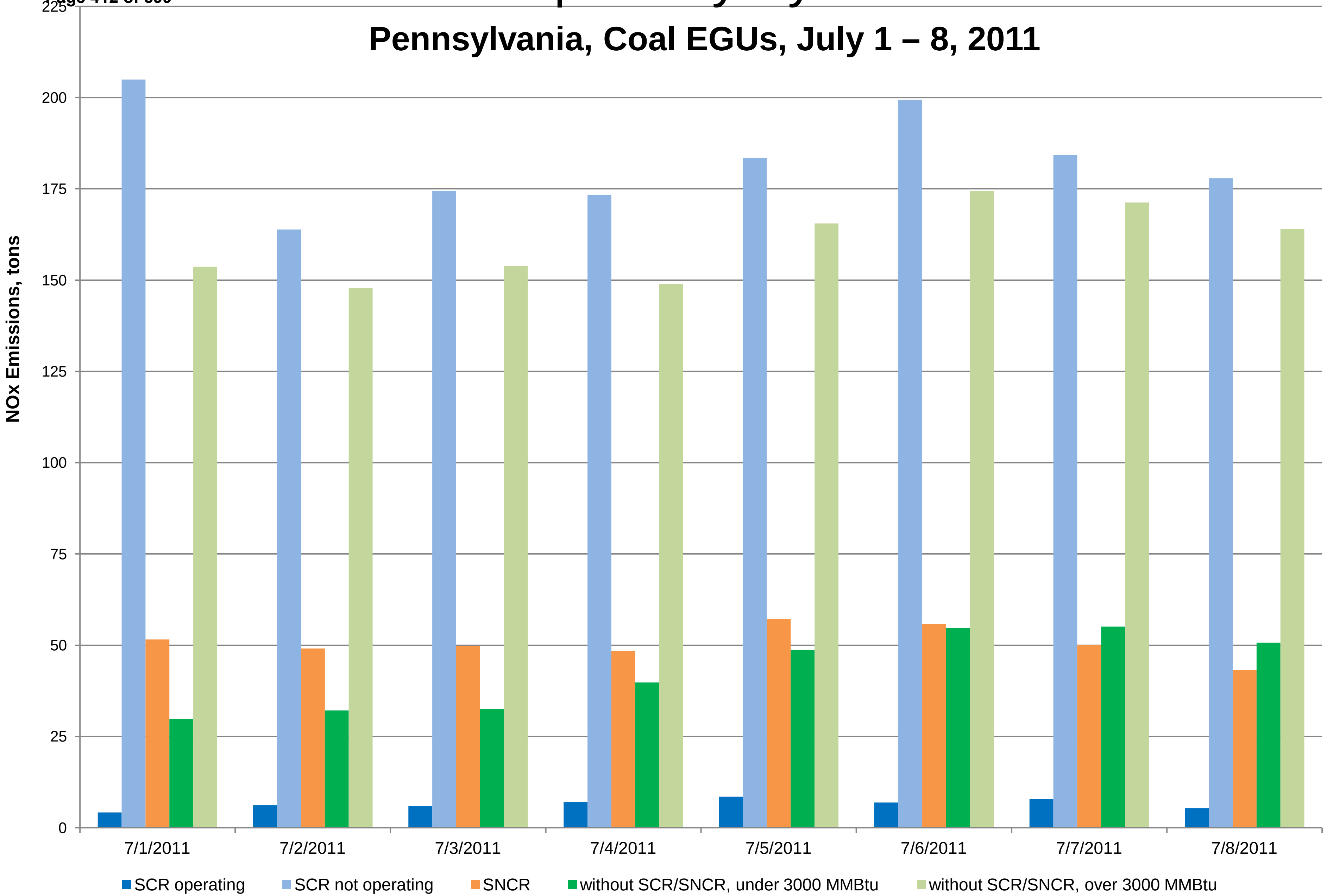
DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Part 4

July 1 to 8, 2011 Ozone Episode:

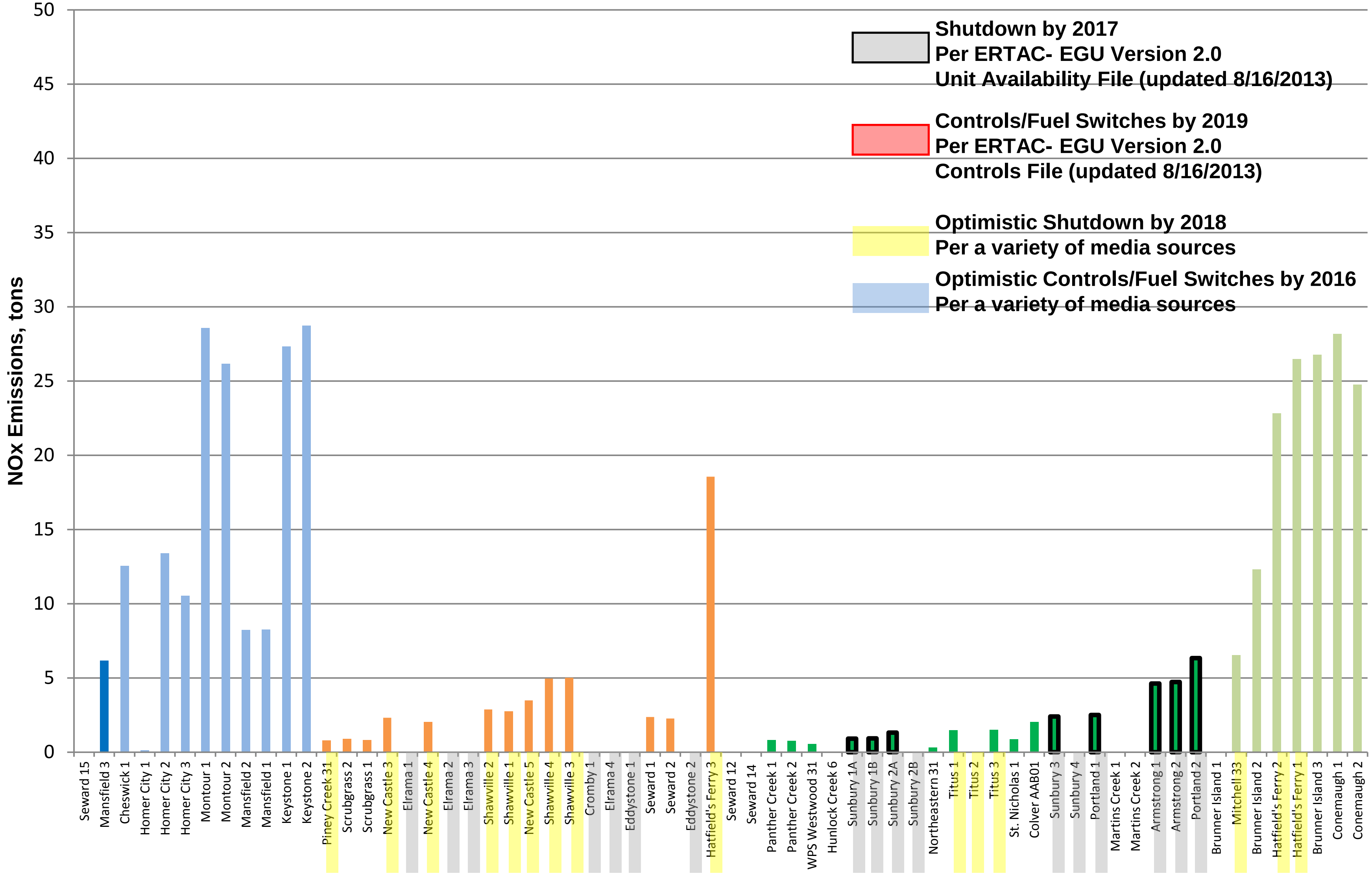
Analysis of Emissions and Controls

Tons of NOx per Day By Control Status



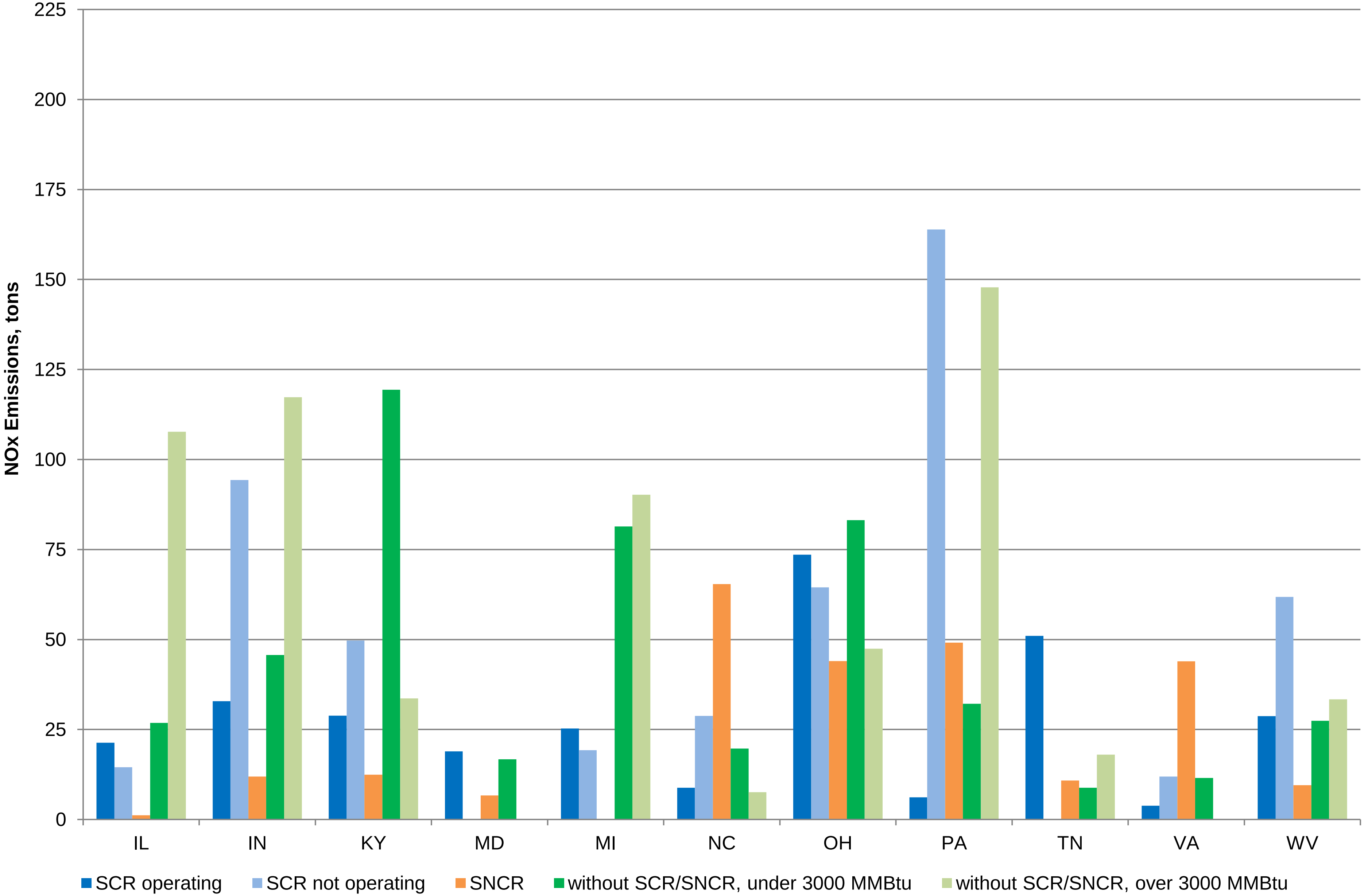
DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

PA – Tons of NOx per Unit By Control Status, July 2, 2011



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

July 2, 2011 - Tons NOx per State by Control Status



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Part 5

11 State Totals

July 1 to 8, 2011 Ozone Episode:

Analysis of Emissions and Controls

11 Upwind States, 2012

- Total number of units = 1,432
- Total heat input capacity = 2,730,239 MMBtu/hr
  = 304,354 MW
- Total MW Capacity in %
  - **Total number of Coal units = 547 = 55%**
  - Total number of NG units = 672 = 25%
  - Total number of other (oil, etc.) units = 173 = 6%
  - Total number of Nuclear units = 40 = 14%
- **Total Capacity Coal = 165,910 MW**
  - 156 units with SCR = 88,783 MW = 53%
  - 114 units with SNCR = 27,561 MW = 17%
  - 277 units without SCR/SNCR = 49,566 MW = 30%

Basis – CAMD (as of 5/13/2014), NEI (for Nuclear), ERTAC (5/6/2014, 5/8/2014)

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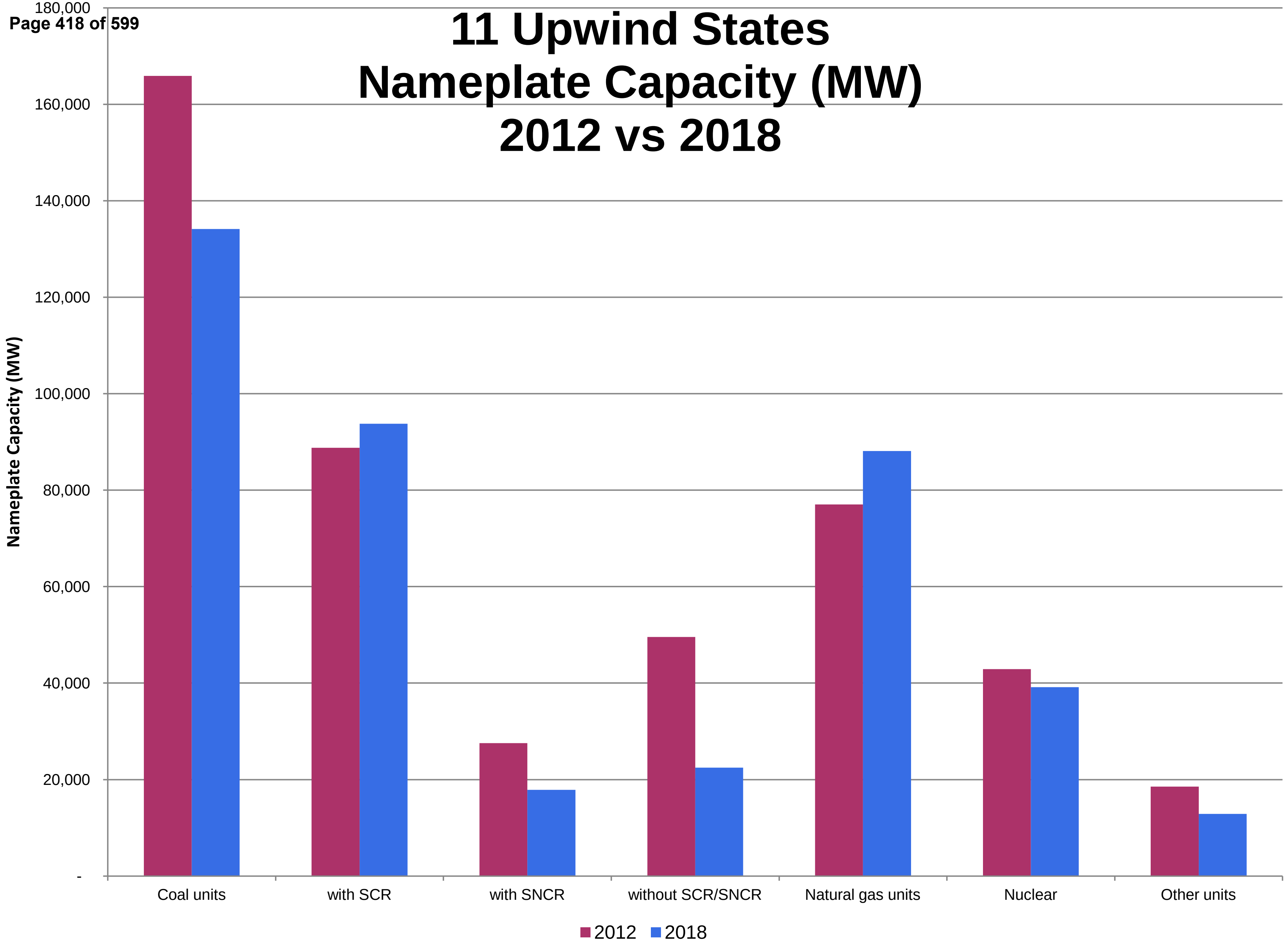
11 Upwind States, 2018

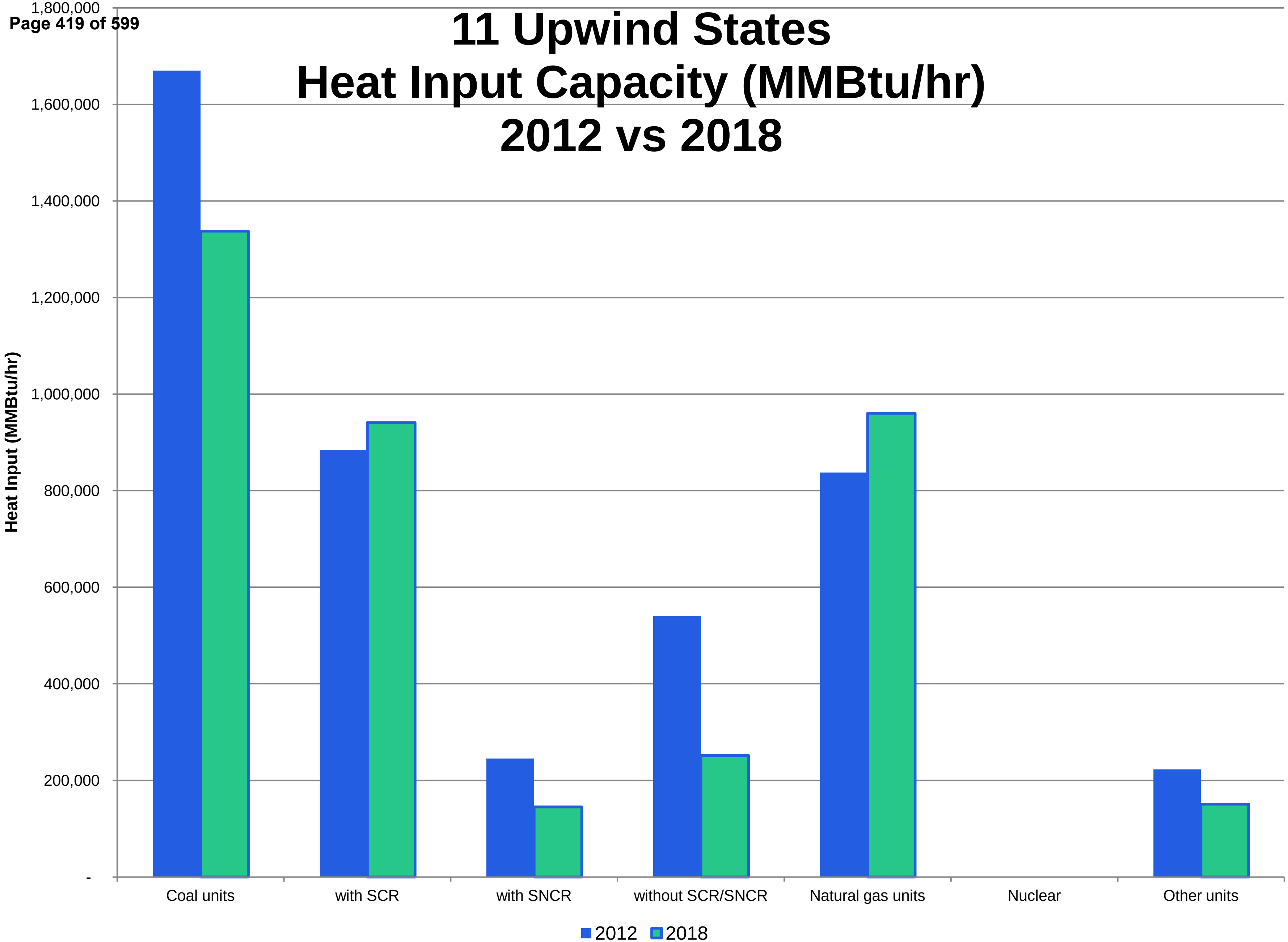
- Total number of units = 1,199
- Total heat input capacity = 2,449,194 MMBtu/hr
  = 274,300 MW
- Total MW Capacity in %
  - **Total number of Coal units = 361 = 49%**
  - Total number of NG units = 686 = 32%
  - Total number of other (oil, etc.) units = 115 = 5%
  - Total number of Nuclear units = 37 = 14%
- **Total Capacity Coal = 134,121 MW**
  - 166 units with SCR = 93,776 MW = 70%
  - 60 units with SNCR = 17,868 MW = 13%
  - 135 units without SCR/SNCR = 22,477 MW = 17%

Basis – ERTAC (5/6/2014, 5/8/2014), NEI (for Nuclear)

DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.



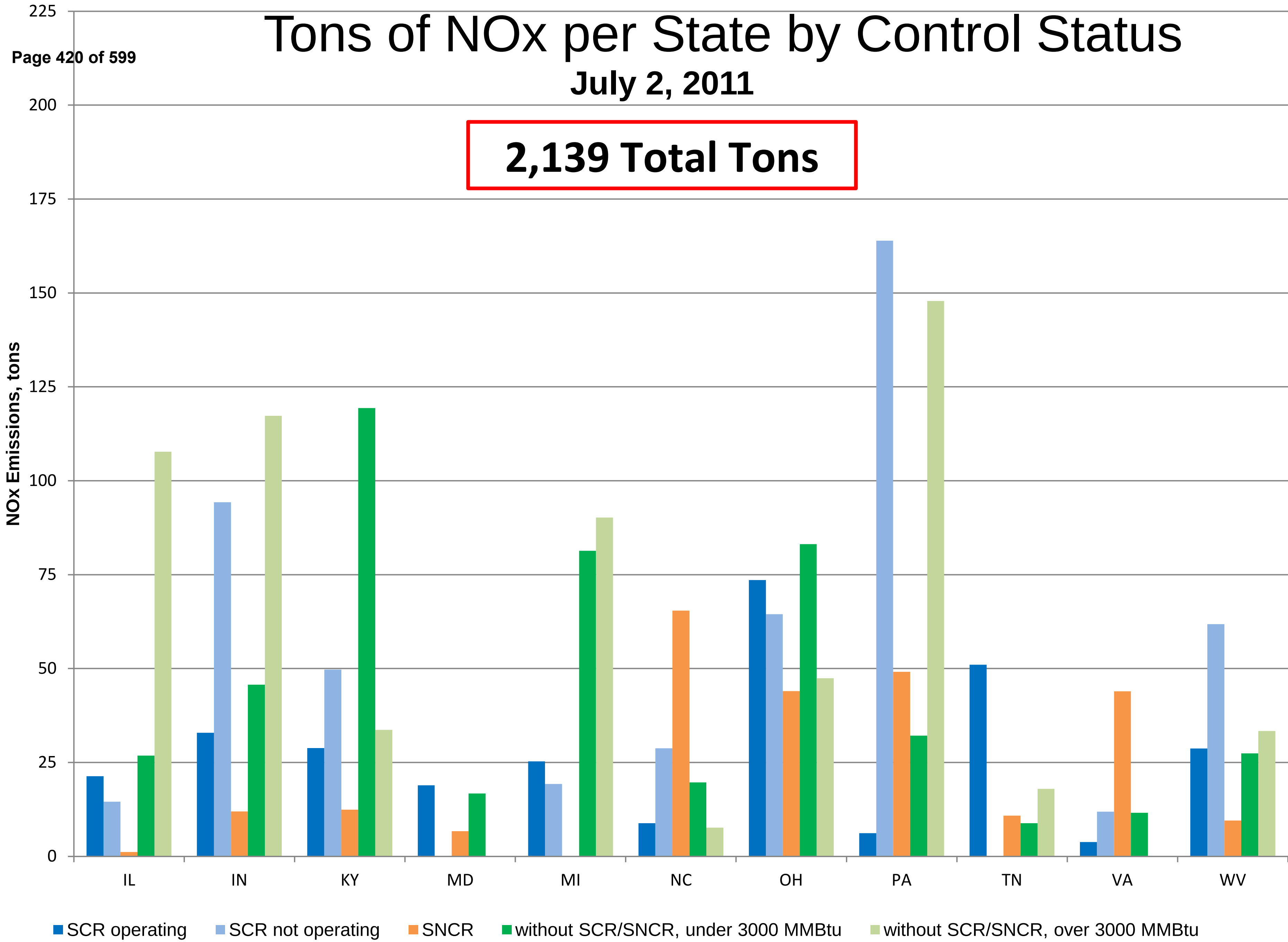
DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.



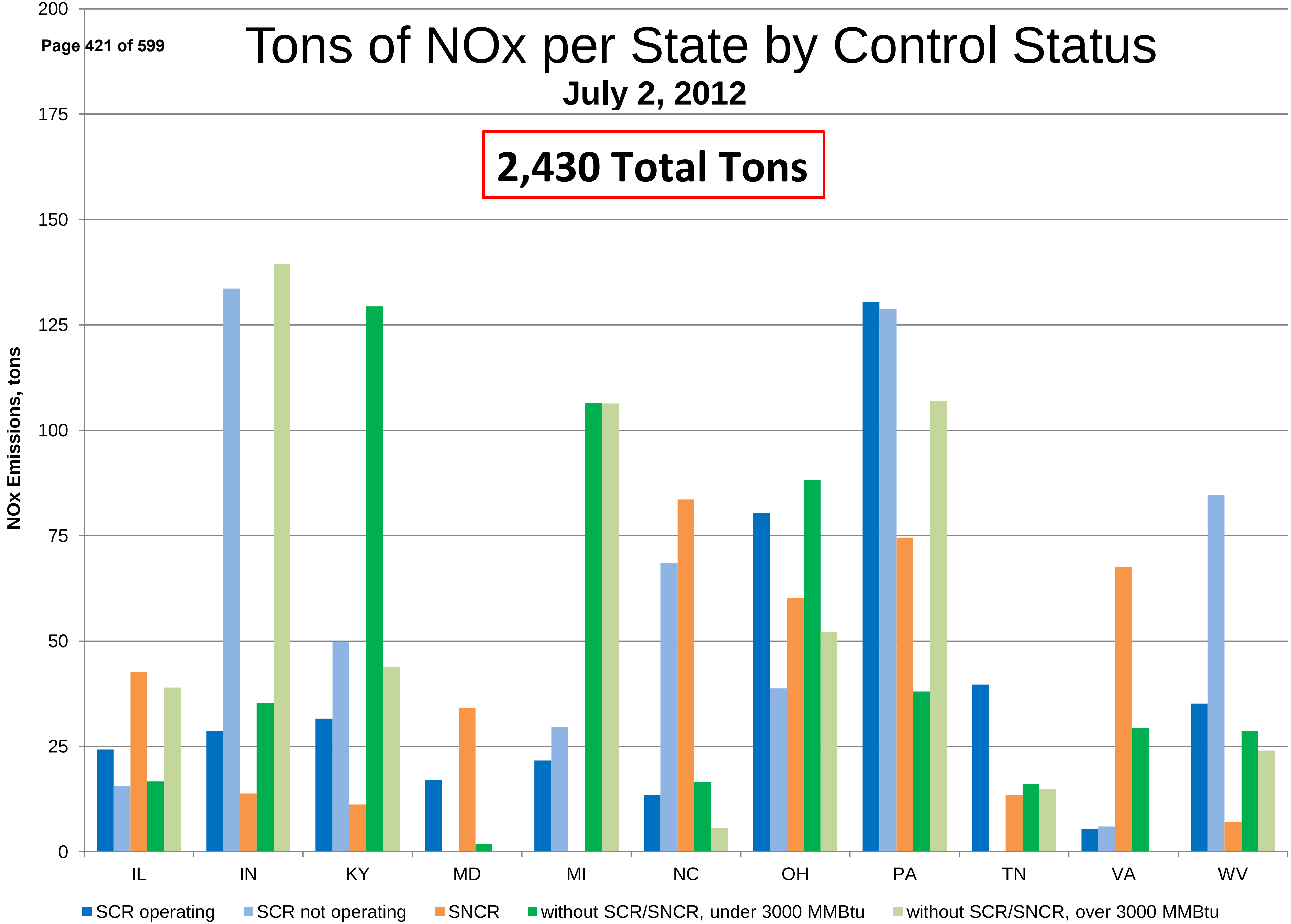
DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Tons of NOx per State by Control Status

July 2, 2011



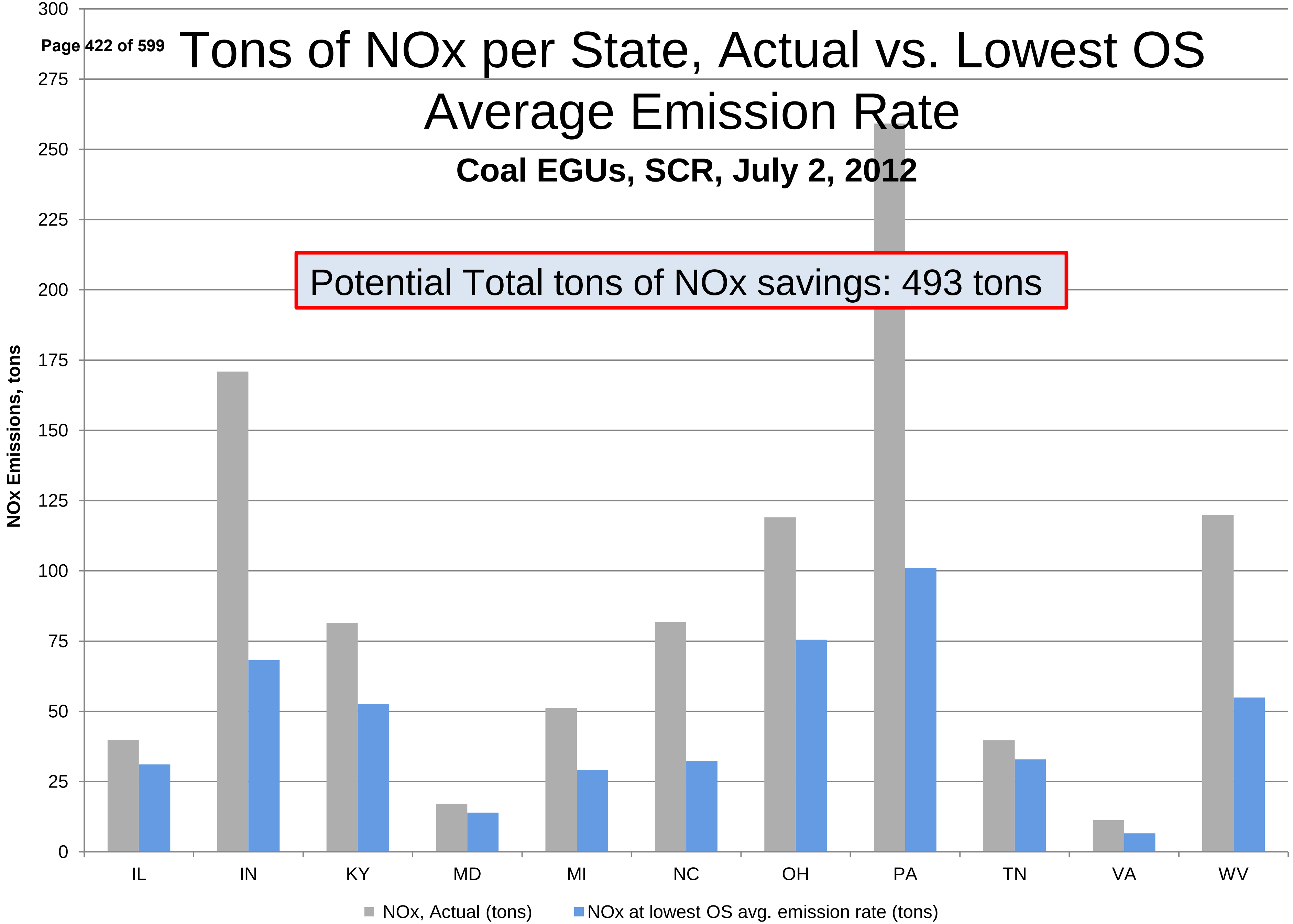
DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

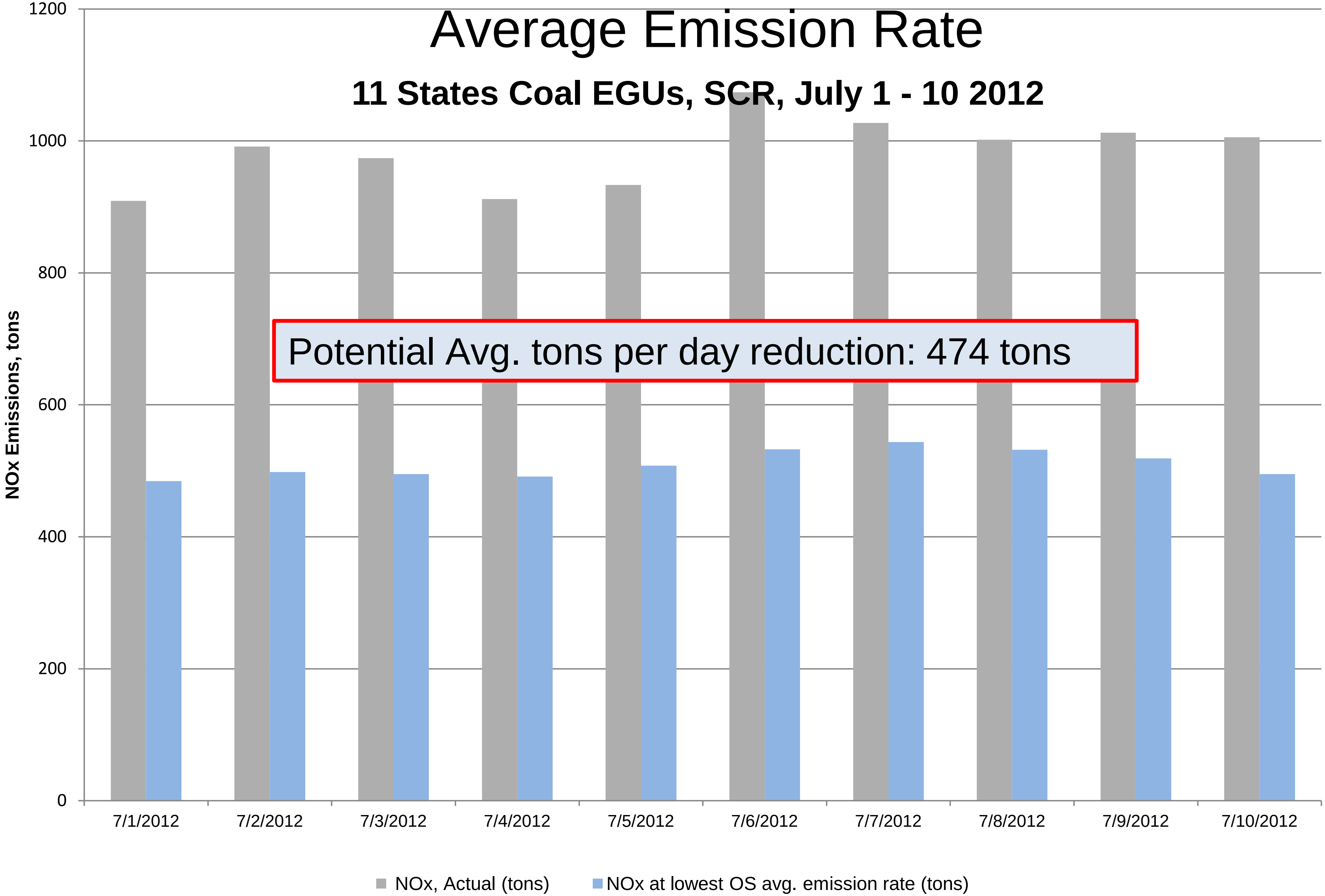
Tons of NOx per State, Actual vs. Lowest OS Average Emission Rate

Coal EGUs, SCR, July 2, 2012



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

11 State Summary

After performing similar analysis of EGUs in IL, IN, KY, MD, MI, NC, OH, PA, TN, VA and WV, the following potential total tons of lost NOx reductions was calculated:

- On July 2, 2012 actual NOx emissions in the 11 states (listed above) was 991 tons
    - If EGUs in those states were to have run their controls at the best rates observed in the data, emissions would have been 498 tons
    - This represents a single day loss of NOx reductions of 493 tons on that day
- During the 10 day episode between July 1 and 10, 2012 actual NOx emissions in the 11 states (listed above) was 9,840 tons
    - If EGUs in those states were to have run their controls at the best rates observed in the data, emissions would have been 5,099 tons
    - This represents a loss of NOx reductions of 4,741 tons over that 10-day episode

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Part 6

Potential Lost Ozone Benefits from Controls Running Less Effectively in Recent Years

Preliminary Photochemical Modeling

Pennsylvania Monitors

How Might This Affect Ozone?

- Maryland has performed several very preliminary model runs to look at how much running EGU controls inefficiently might increase ozone levels
- Three runs:
  - Scenario 2B – A worst case run
    - Assumes SCR and SNCR controls are not run at all
  - Scenario 3B – A worst data run
    - Assumes SCR and SCR units all run at worst rates seen in CAMD data - 2005 to 2012
  - Scenario 3C – Based upon CAMD data analysis for EGU performance in 2011 and 2012
    - Assumes that units that had higher ozone season emission rates were operating at the best ozone season rates observed since 2005

Lost Ozone Benefits
Potential PPB Increases

Pennsylvania Monitors	Potential Increased Ozone in 2018 – 3 EGU Control Scenarios		
County	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Adams	6.0	1.3	0.7
Allegheny	8.2	2.8	1.4
Allegheny	8.1	2.8	1.3
Allegheny	13.0	5.3	3.1
Allegheny	8.2	2.9	1.4
Armstrong	13.4	4.4	2.4
Beaver	1.3	2.9	0.6
Beaver	5.5	4.4	1.7
Beaver	5.2	4.0	1.6
Berks	4.4	1.3	0.7
Blair	17.8	5.3	4.0
Bucks	3.1	0.5	0.3
Cambria	12.2	5.5	4.4
Centre	12.3	3.2	2.4
Chester	4.8	1.2	0.7
Clearfield	18.3	5.6	4.2
Dauphin	5.2	1.8	0.9
Dauphin	4.7	1.4	0.8
Delaware	3.1	0.7	0.3

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Lost Ozone Benefits
Potential PPB Increases

Pennsylvania Monitors	Potential Increased Ozone in 2018 – 3 EGU Control Scenarios		
County	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Erie	3.4	0.8	0.5
Franklin	7.9	1.5	1.0
Greene	15.8	3.8	2.0
Indiana	21.0	8.2	6.8
Lackawanna	5.4	2.1	1.5
Lackawanna	5.3	2.1	1.5
Lancaster	6.7	2.4	1.1
Lawrence	10.3	3.1	1.2
Lehigh	3.4	0.8	0.5
Luzerne	6.4	3.1	2.3
Luzerne	5.5	3.0	2.1
Lycoming	5.7	1.4	0.9
Mercer	6.0	1.3	0.6
Monroe	3.2	0.7	0.4
Montgomery	3.5	0.7	0.4
Northampton	3.5	0.8	0.5
Northampton	3.4	0.8	0.5
Perry	7.0	2.0	1.4
Philadelphia	2.9	0.5	0.3

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Lost Ozone Benefits
Potential PPB Increases

Pennsylvania Monitors	Potential Increased Ozone in 2018 – 3 EGU Control Scenarios		
County	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Philadelphia	2.6	0.5	0.3
Philadelphia	2.4	0.5	0.3
Philadelphia	2.1	0.4	0.2
Tioga	-999.0	-999.0	-999.0
Washington	7.8	5.1	1.7
Washington	11.0	3.0	1.8
Washington	10.3	3.7	1.7
Westmoreland	8.2	2.5	1.3
Westmoreland	8.3	2.7	1.7
York	5.6	1.7	0.9

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Lost Ozone Benefit – 2018 Design Values

… EPA will propose a new ozone standard soon … 60 to 70 ppb range … designations to most likely be based upon 2014 to 2016 or 2015 to 2017 data

Projected to be Clean in 2018 … Potentially at Risk		Increased Ozone in 2018 – 3 EGU Control Scenarios		
Pennsylvania Counties	**2018 – Controls Running Well (Scenario 3A)**	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Adams	60.9	66.9	62.2	61.7
Allegheny	70.9	79.1	73.7	72.2
Allegheny	70.0	78.1	72.7	71.3
Allegheny	70.2	83.2	75.5	73.3
Allegheny	68.0	76.2	71.0	69.4
Armstrong	66.4	79.8	70.7	68.8
Beaver	68.3	69.6	71.1	68.9
Beaver	63.8	69.3	68.2	65.6
Beaver	63.5	68.7	67.5	65.1
Berks	62.6	67.0	63.9	63.3
Blair	58.7	76.5	64.0	62.7
Bucks	78.35	81.4	78.89	78.7
Cambria	58.7	70.9	64.2	63.2
Centre	61.7	74.0	64.9	64.0
Chester	65.2	70.0	66.5	65.9
Clearfield	59.5	77.8	65.1	63.7
Dauphin	62.2	67.4	64.0	63.2
Dauphin	61.1	65.8	62.6	62.0
Delaware	70.6	73.8	71.3	71.0

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Lost Ozone Benefit – 2018 Design Values

… EPA will propose a new ozone standard soon … 60 to 70 ppb range … designations to most likely be based upon 2014 to 2016 or 2015 to 2017 data

Projected to be Clean in 2018 … Potentially at Risk		Increased Ozone in 2018 – 3 EGU Control Scenarios		
Pennsylvania Counties	**2018 – Controls Running Well (Scenario 3A)**	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Erie	65.5	68.9	66.2	65.9
Franklin	57.0	65.0	58.6	58.0
Greene	61.8	77.5	65.6	63.8
Indiana	63.4	84.4	71.7	70.2
Lackawanna	59.1	64.5	61.2	60.5
Lackawanna	57.9	63.2	60.0	59.4
Lancaster	67.0	73.6	69.4	68.1
Lawrence	58.8	69.1	61.9	60.0
Lehigh	64.7	68.1	65.5	65.1
Luzerne	58.8	65.2	61.9	61.1
Luzerne	52.8	58.3	55.8	54.9
Lycoming	57.8	63.4	59.1	58.7
Mercer	66.2	72.2	67.5	66.8
Monroe	56.7	59.9	57.4	57.1
Montgomery	71.0	74.4	71.7	71.4
Northampton	63.4	66.9	64.2	63.9
Northampton	61.6	65.1	62.5	62.2
Perry	59.7	66.6	61.6	61.1
Philadelphia	76.0	78.9	76.5	76.3

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Lost Ozone Benefit – 2018 Design Values

… EPA will propose a new ozone standard soon … 60 to 70 ppb range … designations to most likely be based upon 2014 to 2016 or 2015 to 2017 data

Projected to be Clean in 2018 … Potentially at Risk		**Increased Ozone in 2018 – 3 EGU Control Scenarios**		
Pennsylvania Counties	**2018 – Controls Running Well (Scenario 3A)**	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Philadelphia	71.2	73.8	71.7	71.5
Philadelphia	68.6	71.0	69.1	68.9
Philadelphia	57.6	59.7	58.0	57.8
Tioga	-999.0	-999.0	-999.0	-999.0
Washington	63.2	71.0	68.3	64.9
Washington	60.2	71.2	63.2	62.0
Washington	60.2	70.5	63.9	61.9
Westmoreland	66.0	74.2	68.5	67.3
Westmoreland	61.2	69.5	64.0	62.9
York	65.4	71.1	67.1	66.3

DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

EGU Data Package #3
Operation of Existing SCR, SNCR

Tennessee

Sample of draft data and analyses developed by the Maryland Department of the Environment

Contact: Tad Aburn, Air Director, MDE
(410) 537-3255

September 18, 2014

Purpose

- Maryland is the only Moderate nonattainment area in the East for the 75 ppb ozone standard.
  - This means that Maryland is the only state required to submit an attainment SIP
  - Only state required to perform attainment modeling.
- We are now beginning to build our “SIP Quality” modeling platform.
- One major issue that our data analyses have uncovered is that many EGU units appear to not be running their control equipment in recent years as efficiently as they have demonstrated they can do in earlier years. This issue is driven by recent changes in the energy market, reduced coal capacity, inexpensive allowances and a regulatory structure driven by ozone season caps not daily performance. In many states, including Maryland, this has lead to controls not always being used efficiently on the days when they are needed the most … this is perfectly legal.
- This is a critical issue that we would like to continue to discuss with you. There appears to be an interest from the private sector to discuss this issue and see if a common sense fix can be designed. Maryland believes this fix would be relatively cost-effective compared to the capital cost of the control technologies.
- MDE has focused our analyses on two of the worst large, regional scale ozone episodes from recent years: July 1-8, 2011 and July 1-10, 2012.
- The primary data used in these analyses include:
  - CEMS data from CAMD
  - Emissions and projection data from ERTAC
  - Other data we have received from individual states
- More detailed data and analyses and spreadsheets are available upon request.

How the Data Analyses Were Built

- Maryland began the data analyses in late 2012
  - Looked at EGUs in the 9 upwind states named in the 176A Petition (IL, IN, KY, MI, NC, OH, TN, VA, WV) … MD and PA
- Shared a draft package with Air Directors on April 21, 2014
  - This package focused on a bad ozone episode: July 1 – 8, 2011
- Shared a second draft package with Air Directors on May 13, 2014
  - This package focused on second bad ozone episode: July 1 – 10, 2012
  - This package also included update to specific material after receiving comments from numerous states
- The 2011 and 2012 episodes analyzed capture two of the worst regional ozone periods in 2011 and 2012
  - Other states, like Wisconsin and Delaware have done similar analyses and reached similar conclusions
- This is the third draft package, and builds on to the prior two draft packages, while incorporating input from individual states and updates to ERTAC.
- This third draft package also includes preliminary photochemical modeling performed by MDE to look at the potential loss of ozone reduction benefits.

Help Us QA the Data

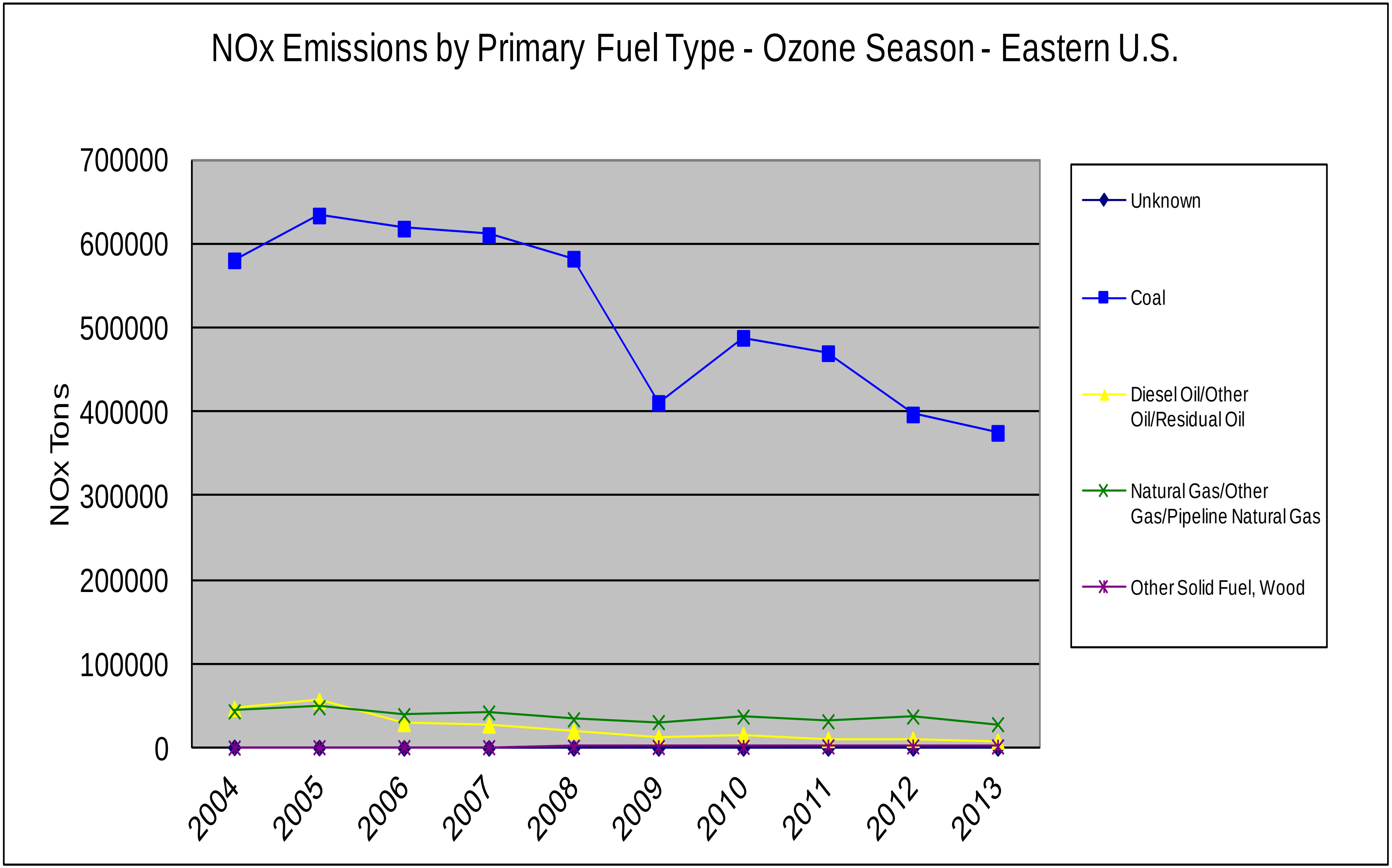
- We have used readily available data, like the CAMD and ERTAC data, but we recognize that these data sources can be out of date, or not include recent changes.
  - We hope you can help us with making sure we have the best possible data.

- This package reflects recently updated data, including but not limited to:
  - CAMD updates
  - May 8, 2014 ERTAC updates
  - PA comments to OTC, forwarded to MDE, Spreadsheets detailing "EGU Shutdowns, EGU Controls and New Natural Gas Power Projects" for the state of PA. Sent from Randy Bordner, Environmental Group Manager - Bureau of Air Quality, PA Department of Environmental Protection to Andy Bodnarik, OTC. Received as FWD from Andy Bodnarik on 4/23/2014
  - VA comments to MDE, "Electric Generation Sector Summary for Virginia" received from Thomas R. Ballou, Director - Office of Air Data Analysis and Planning, VA Department of Environmental Quality on 5/12/2014

Part 1

Background:
Generation in 2012 and 2018
Projected Changes

Why Coal?



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Tennessee EGUs, 2012

- Total number of units = 92
- Total heat input capacity = 198,143 MMBtu/hr = 18,788 MW
- Total State MW Capacity in %
  - **Total number of Coal units = 33 = 52%**
  - Total number of NG units = 36 = 19%
  - Total number of other (oil, etc.) units = 20 = 9%
  - Total number of Nuclear units = 3 = 20%
- **Total Capacity Coal = 9,780 MW**
  - 15 units with SCR = 6,240 MW = 64%
  - 6 units with SNCR = 1,050 MW = 11%
  - 12 units without SCR/SNCR = 2,490 MW = 25%

Basis – CAMD (as of 5/13/2014), NEI (for Nuclear), ERTAC (5/6/2014, 5/8/2014)

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Capacity and Fuel: 2012 to 2018

A detailed review of ERTAC data for 2018 was completed, and an evaluation of the following characteristics performed.

- Total Number of units
- Heat input capacity - MMBtu/hr
- Nameplate capacity – MW
- Presence of advanced post combustion controls – SCR, SNCR
- Fuel switching
- Shutdown, retirements

Tennessee EGUs, 2018

- Total number of units = 58
- Total heat input capacity = 146,554 MMBtu/hr = 11,304 MW
- Total State MW Capacity in %
  - **Total number of Coal units = 19 = 66%**
  - Total number of NG units = 17 = 17%
  - Total number of other (oil, etc.) units = 22 = 17%
  - Total number of Nuclear units = 0 = 0%
- **Total Capacity Coal = 7,495 MW**
  - 19 units with SCR = 7,495 MW = 100%
  - 0 units with SNCR = 0 MW = 0%
  - 0 units without SCR/SNCR = 0 MW = 0%

Basis – ERTAC (5/6/2014, 5/8/2014), NEI (for Nuclear)

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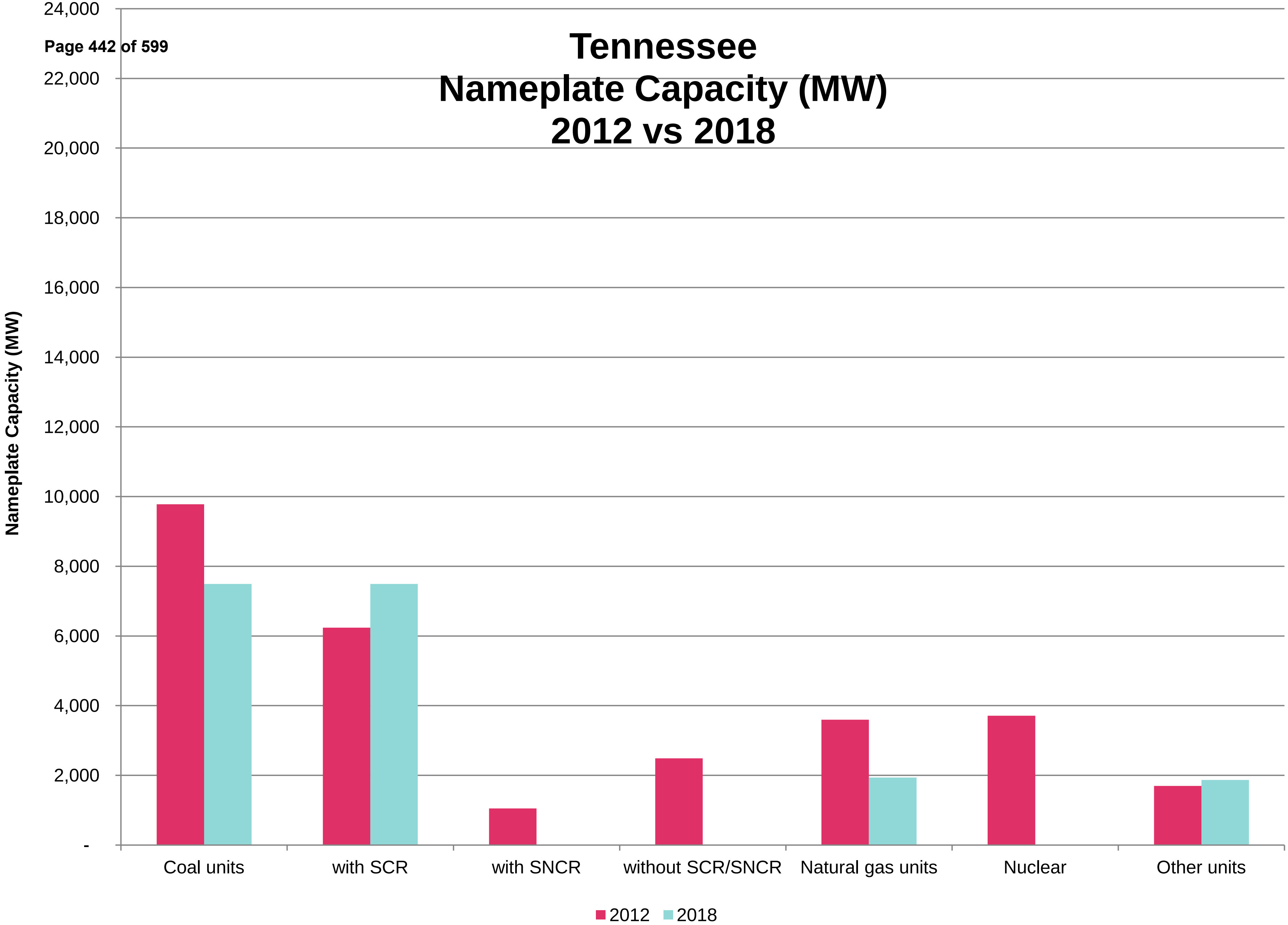

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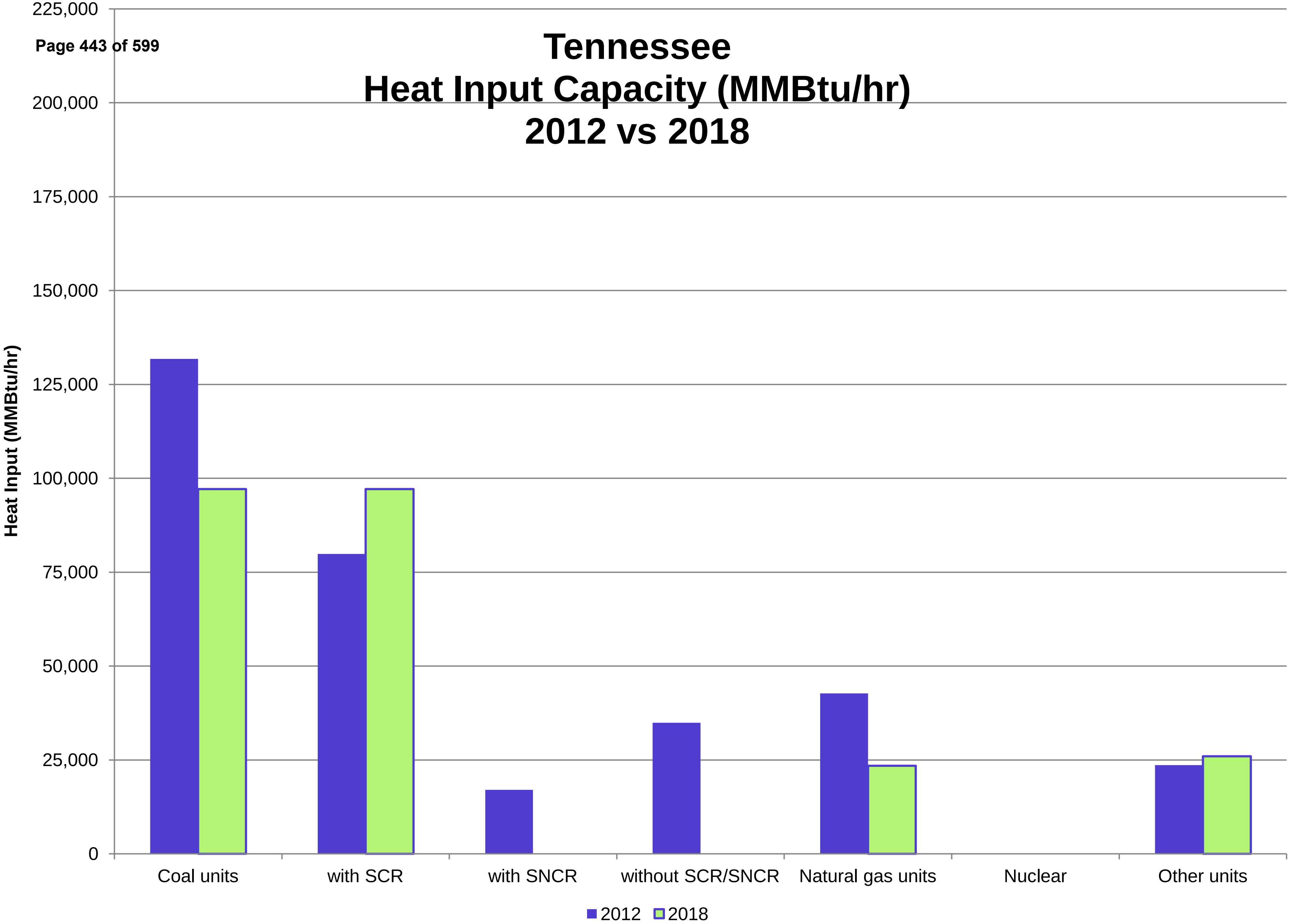

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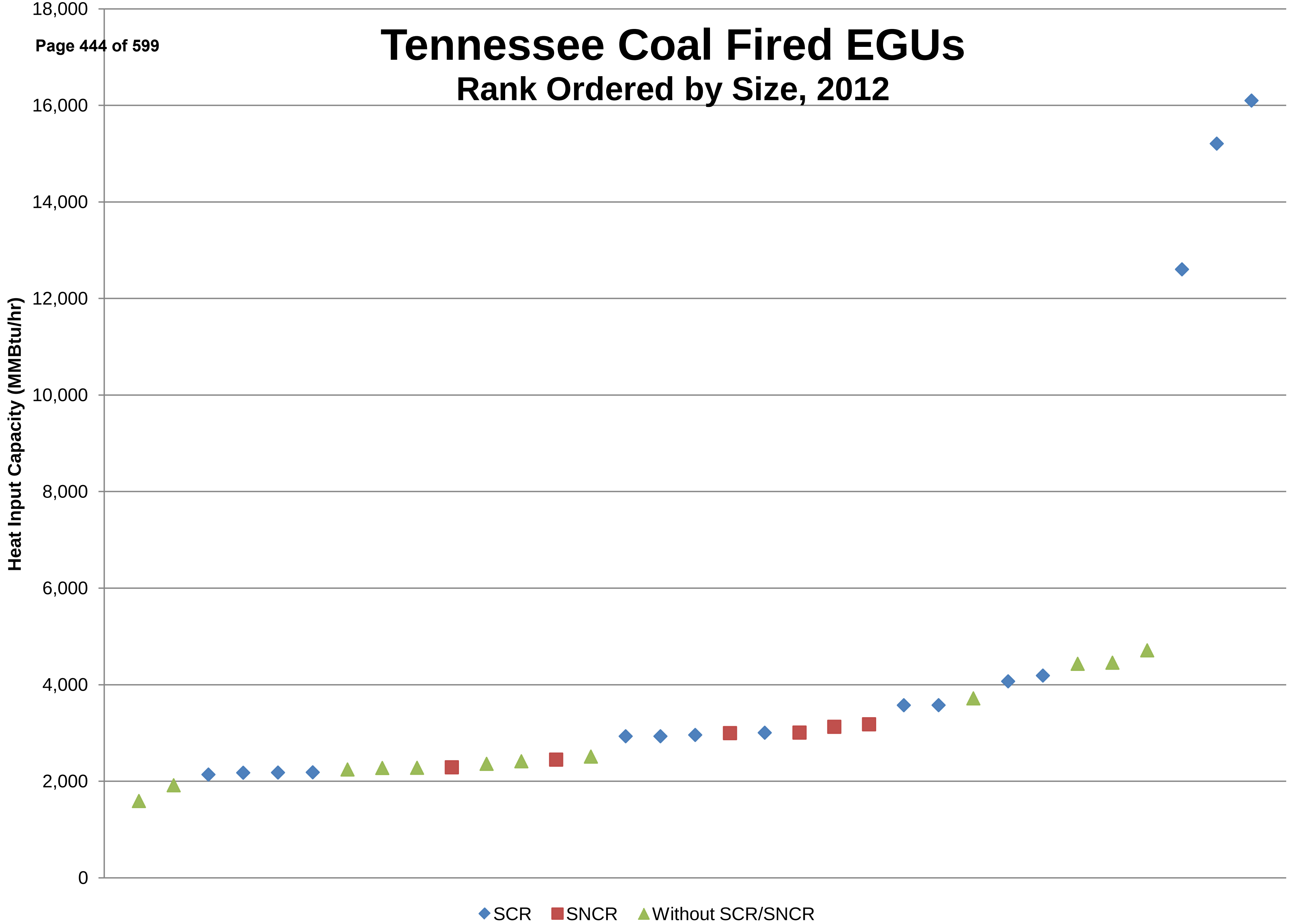

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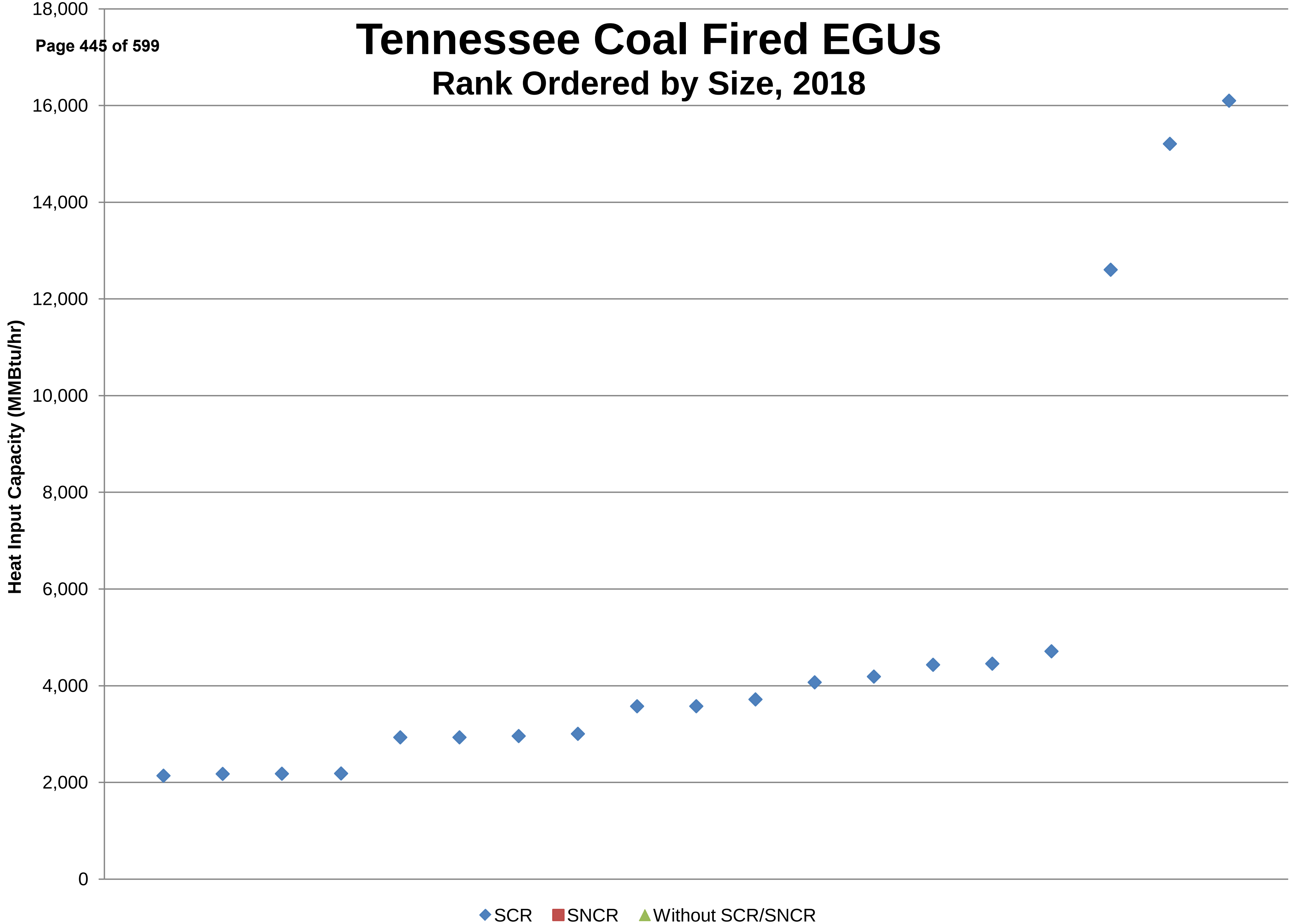
Tennessee Coal Fired EGUs

Rank Ordered by Size, 2018



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TN : Large (> 3000 MMBtu/hr) Coal-Fired EGU NOx Emissions Rate Analysis

	Facility Name	Unit ID	Lowest OS Emission Rate Year	Lowest OS Emission Rate (lbs/MMBtu)	2007 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2007 OS ER (% Change)	2011 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2011 OS ER (% Change)	Comments/ ERTAC Closure Date
Controlled with SCR	Allen	1	2006	0.0568	0.0643	13	0.0799	41	
	Allen	2	2006	0.0711	0.0791	11	0.0869	22	
	Allen	3	2005	0.0664	0.0749	13	0.0885	33	
	Bull Run	1	2009	0.0618	0.0715	16	0.0692	12	
	Cumberland	1	2009	0.0588	0.0734	25	0.0697	19	
	Cumberland	2	2006	0.0748	0.0873	17	0.0835	12	
	Kingston	7	2006	0.0447	0.0515	15	0.0545	22	
	Kingston	8	2006	0.0448	0.0515	15	0.0549	23	
Controlled with SNCR	John Sevier	1	2009	0.2319	0.3046	31	0.2397	3	Close 2012 (media)
	John Sevier	2	2009	0.2345	0.3066	31	0.2396	2	
	John Sevier	3	2009	0.2452	0.3747	53	0.2531	3	Close 2015 (media)
No Controls or Fuel Switches by 2019	Gallatin	1	2010	0.1508	0.1604	6	0.1601	6	
	Gallatin	2	2010	0.1505	0.1564	4	0.1601	6	
	Gallatin	3	2009	0.1474	0.149	1	0.1611	9	
	Gallatin	4	2009	0.1479	0.1487	1	0.1596	8	
Retiring by 2017	N/A								

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TN: Small (< 3000 MMBtu/hr) Coal-Fired EGU NOx Emissions Rate Analysis

	Facility Name	Unit ID	Lowest OS Emission Rate Year	Lowest OS Emission Rate (lbs/MMBtu)	2007 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2007 OS ER (% Change)	2011 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2011 OS ER (% Change)	Comments/ ERTAC Closure Date
Controlled with SCR	Kingston	1	2009	0.0498	0.0501	1	0.0562	13	
	Kingston	2	2007	0.0501	0.0501	0	0.0562	12	
	Kingston	3	2007	0.0504	0.0504	0	0.0564	12	
	Kingston	4	2007	0.0501	0.0501	0	0.0565	13	
	Kingston	5	2007	0.0486	0.0486	0	0.0569	17	
	Kingston	6	2006	0.0448	0.0511	14	0.0559	25	
	Kingston	9	2006	0.0449	0.0517	15	0.0549	22	
Controlled with SNCR	John Sevier	4	2009	0.2525	0.3769	49	0.254	1	Close 2015 (media)
	Johnsonville	1	2012	0.2378	0.3592	51	0.2819	19	Close 2017 (media)
	Johnsonville	4	2012	0.2386	0.3581	50	0.2728	14	
No Controls or Fuel Switches by 2019	Johnsonville	2	2012	0.2347	0.3592	53	0.2748	17	Close 2017 (media)
	Johnsonville	3	2012	0.2465	0.3593	46	0.274	11	
	Johnsonville	5	2012	0.2507	0.3603	44	0.2865	14	Close 2015 (media)
	Johnsonville	6	2012	0.2487	0.3593	44	0.2739	10	
	Johnsonville	7	2011	0.2898	0.3631	25	0.2898	0	
	Johnsonville	8	2011	0.287	0.3595	25	0.287	0	
	Johnsonville	9	2012	0.2702	0.3593	33	0.2878	7	
	Johnsonville	10	2012	0.2766	0.36	30	0.2859	3	
Retiring by 2017	N/A								

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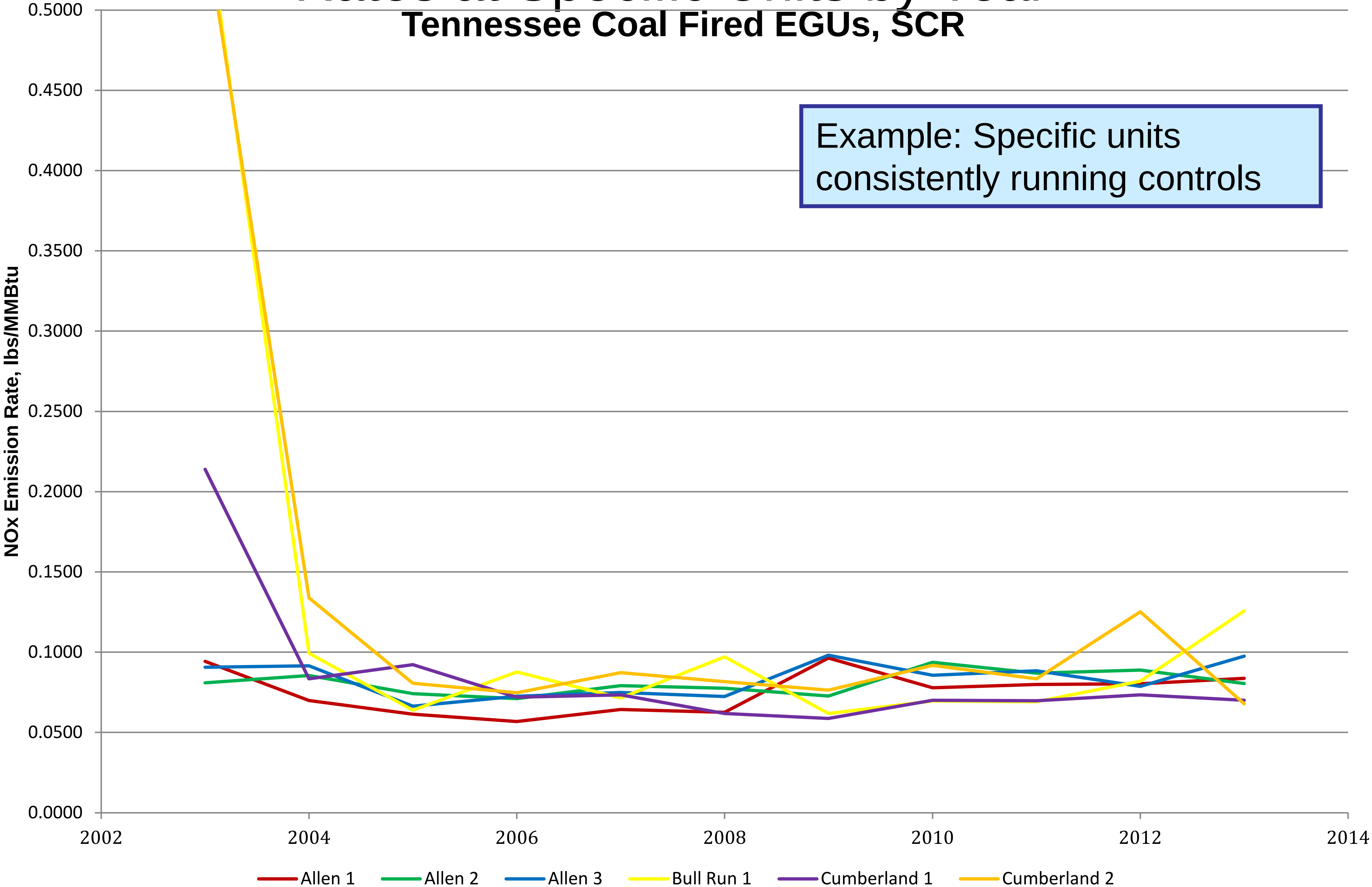
Part 2

Operation of Controls:
Changes in Control Efficiency
2003 to 2013

Average Ozone Season Emission Rates at Specific Units by Year



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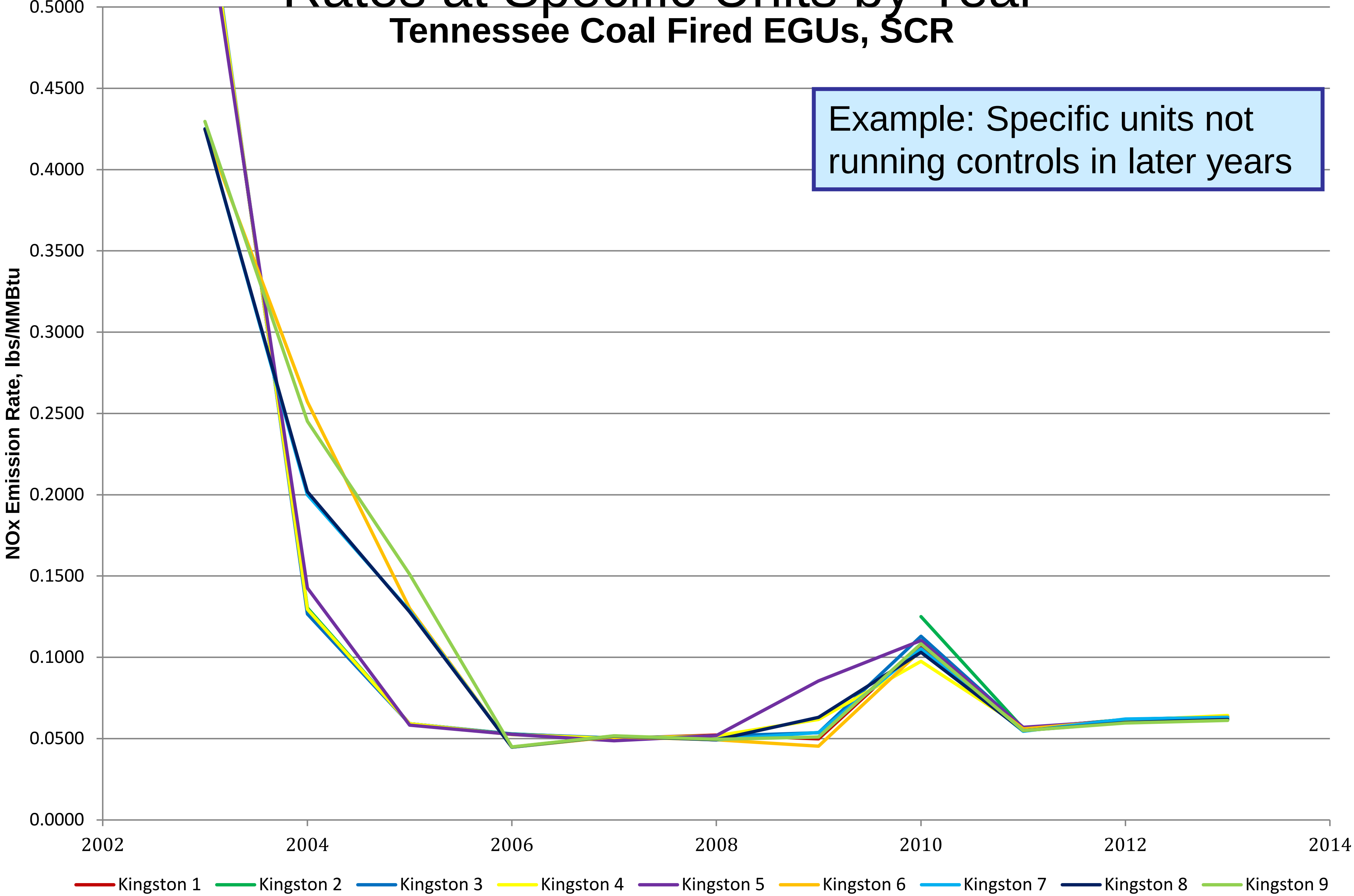
Average Ozone Season Emission Rates at Specific Units by Year



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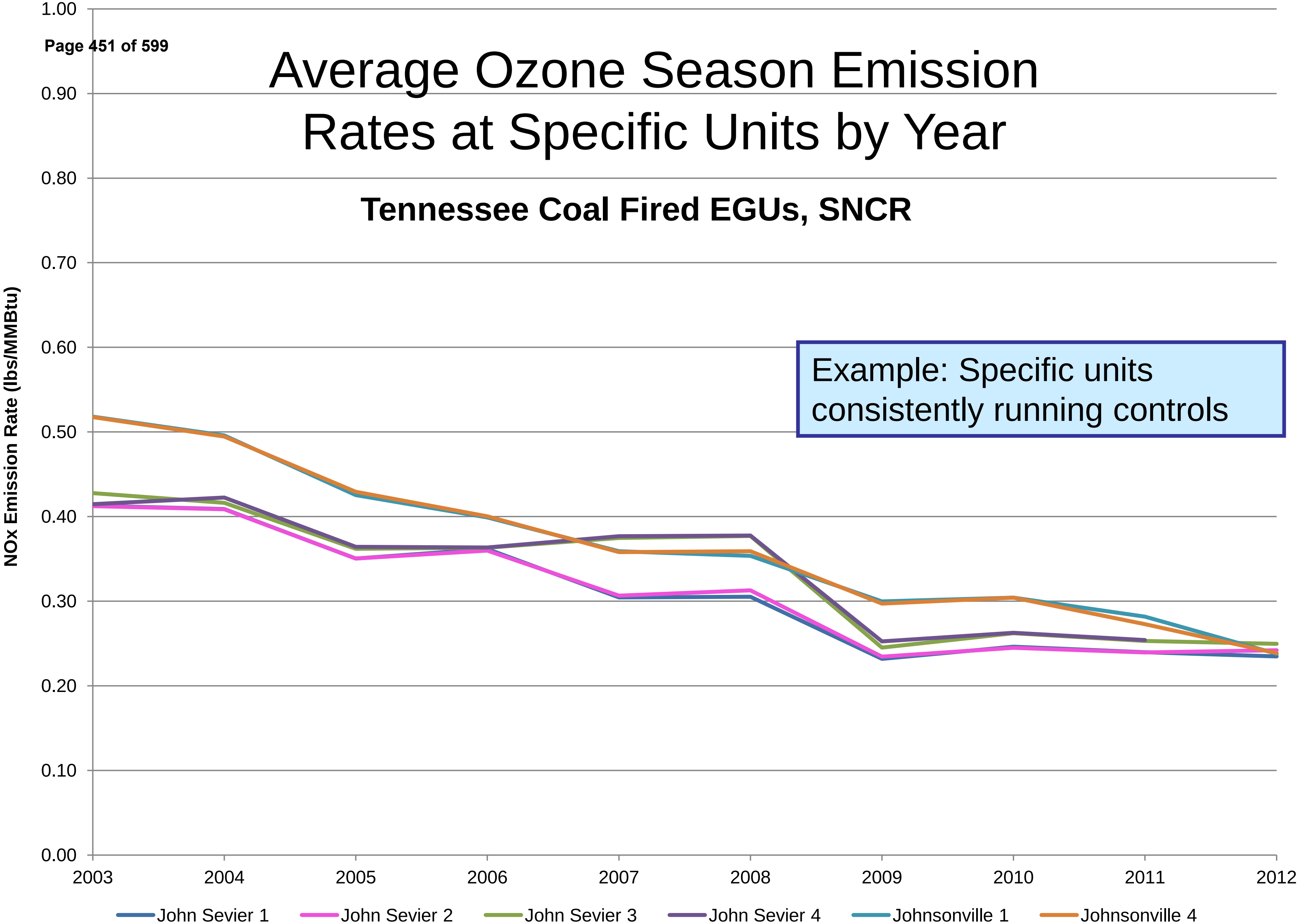
Average Ozone Season Emission Rates at Specific Units by Year



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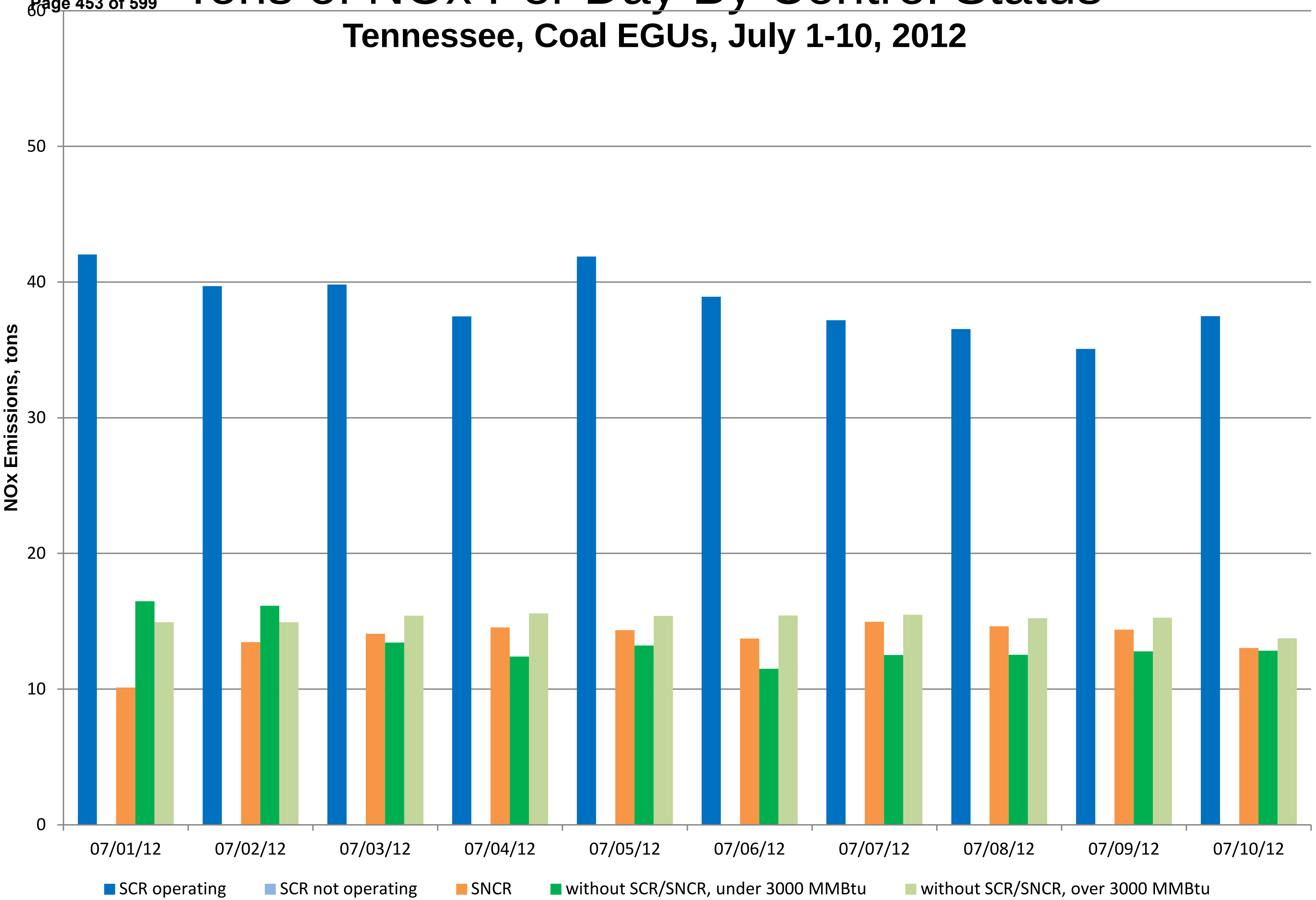
Part 3

July 1 to 10, 2012 Ozone Episode:

Analysis of Emissions and Controls

Tons of NOx Per Day By Control Status

Tennessee, Coal EGUs, July 1-10, 2012



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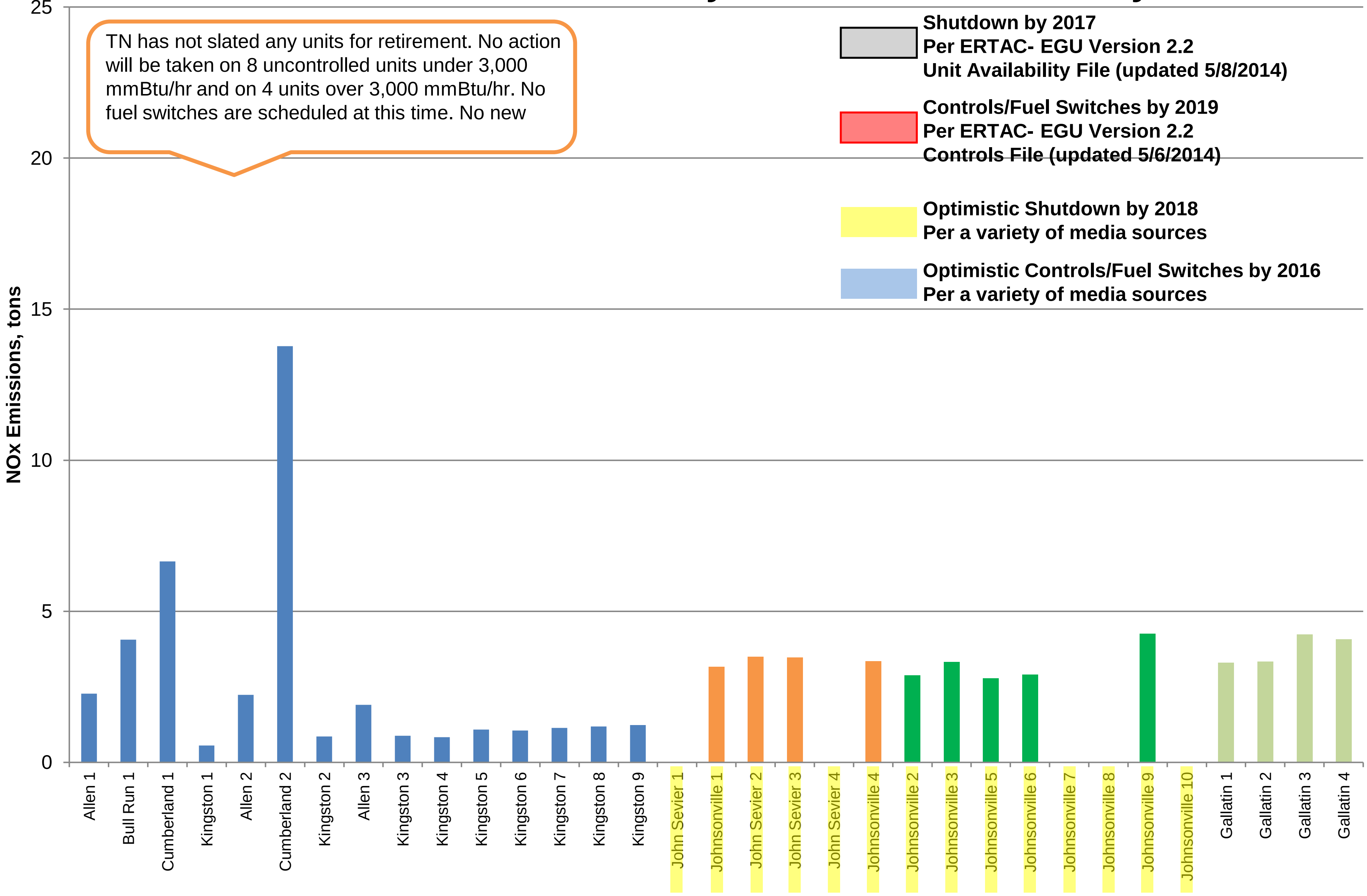
TN – Tons of NOx Per Unit By Control Status, July 2, 2012



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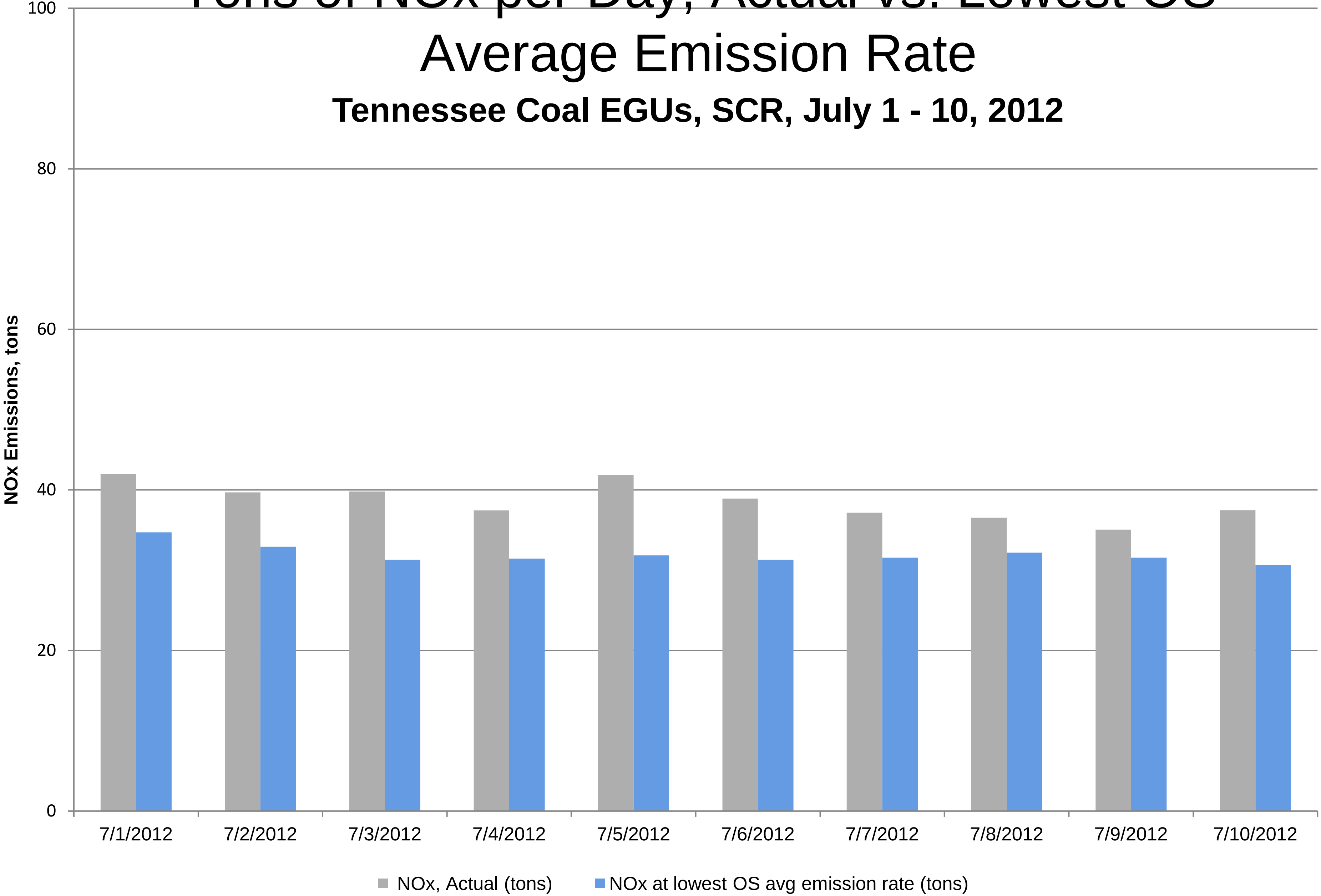
Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate

Tennessee Coal EGUs, SCR, July 1 - 10, 2012



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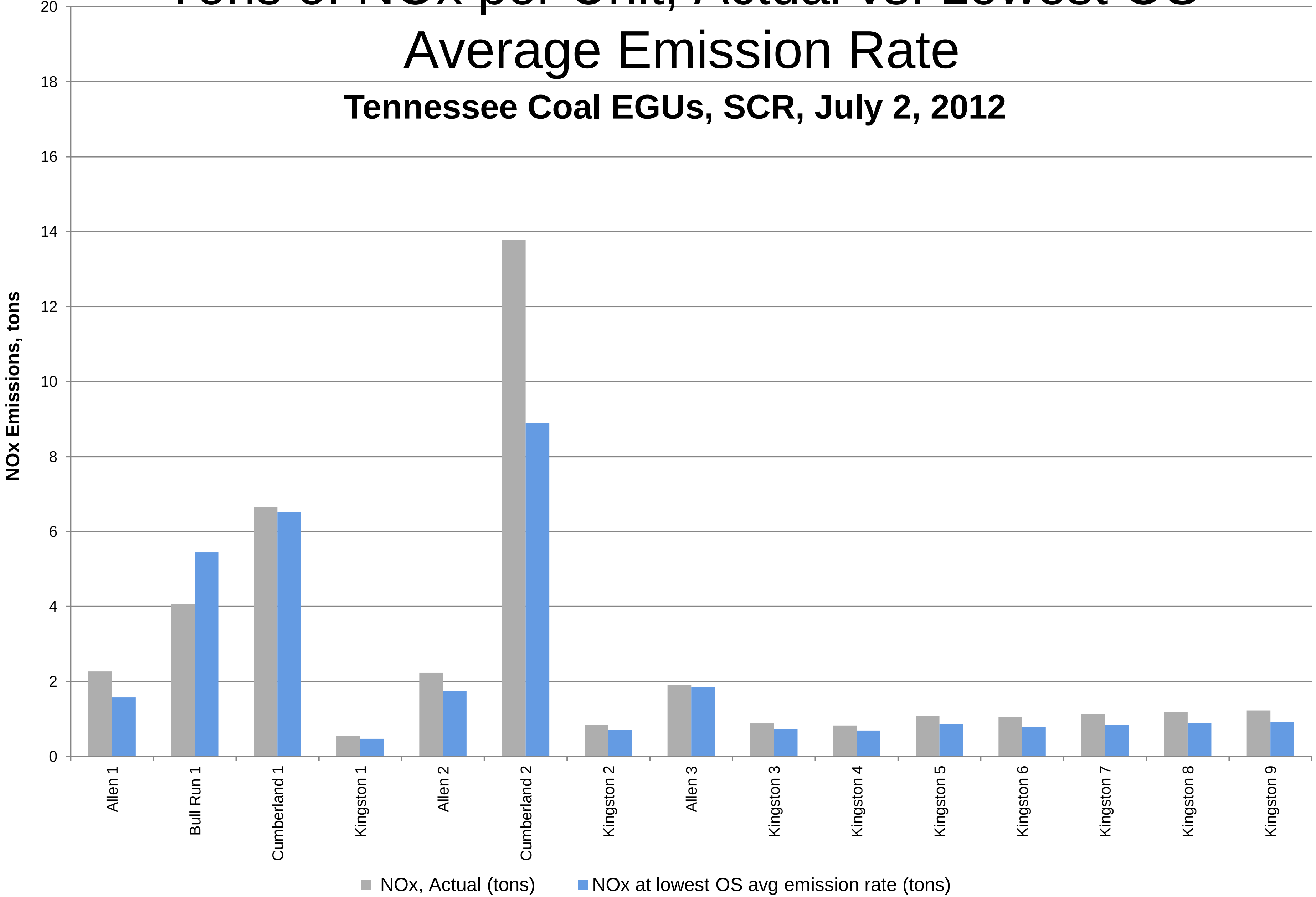
Tons of NOx per Unit, Actual vs. Lowest OS Average Emission Rate



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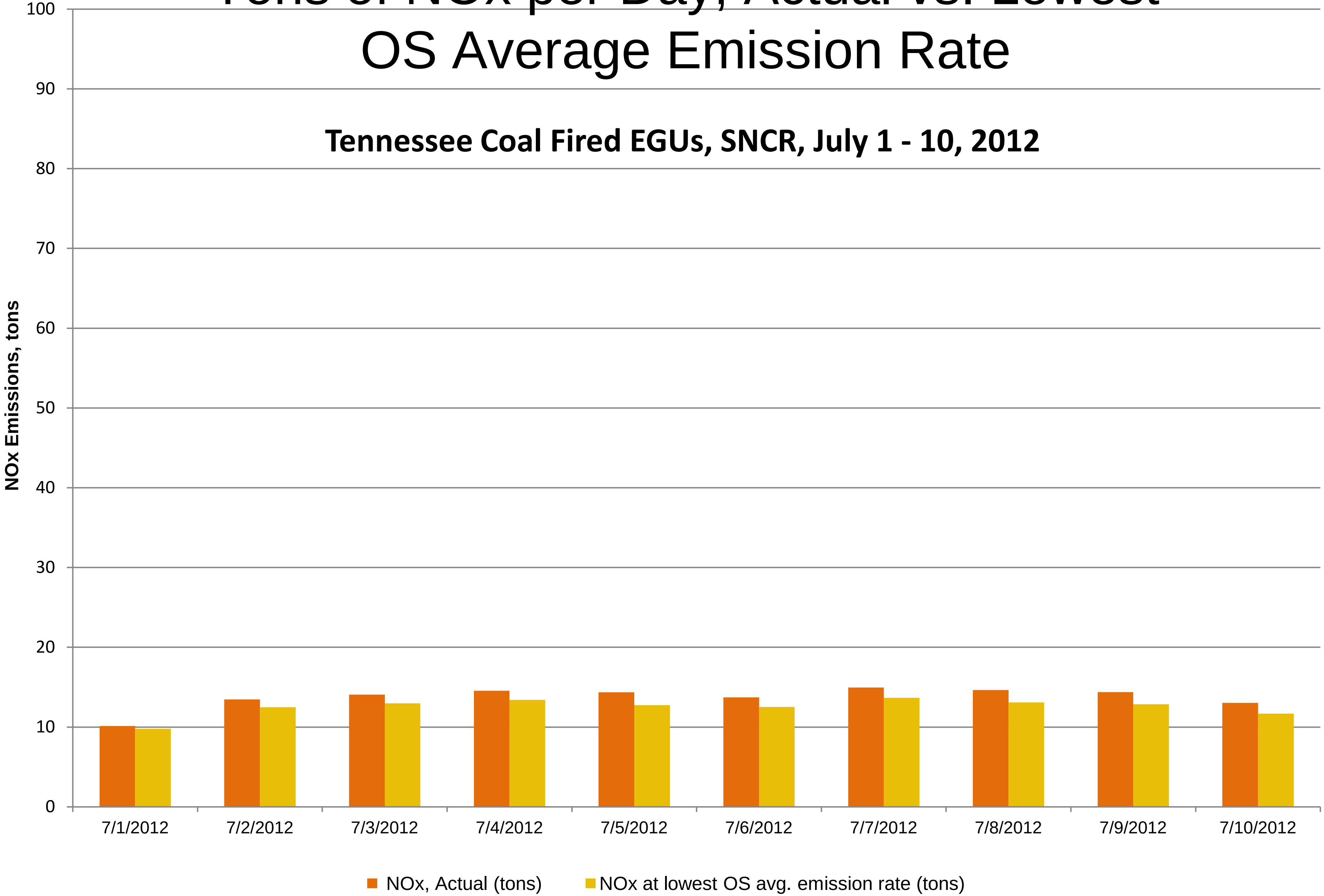
Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate



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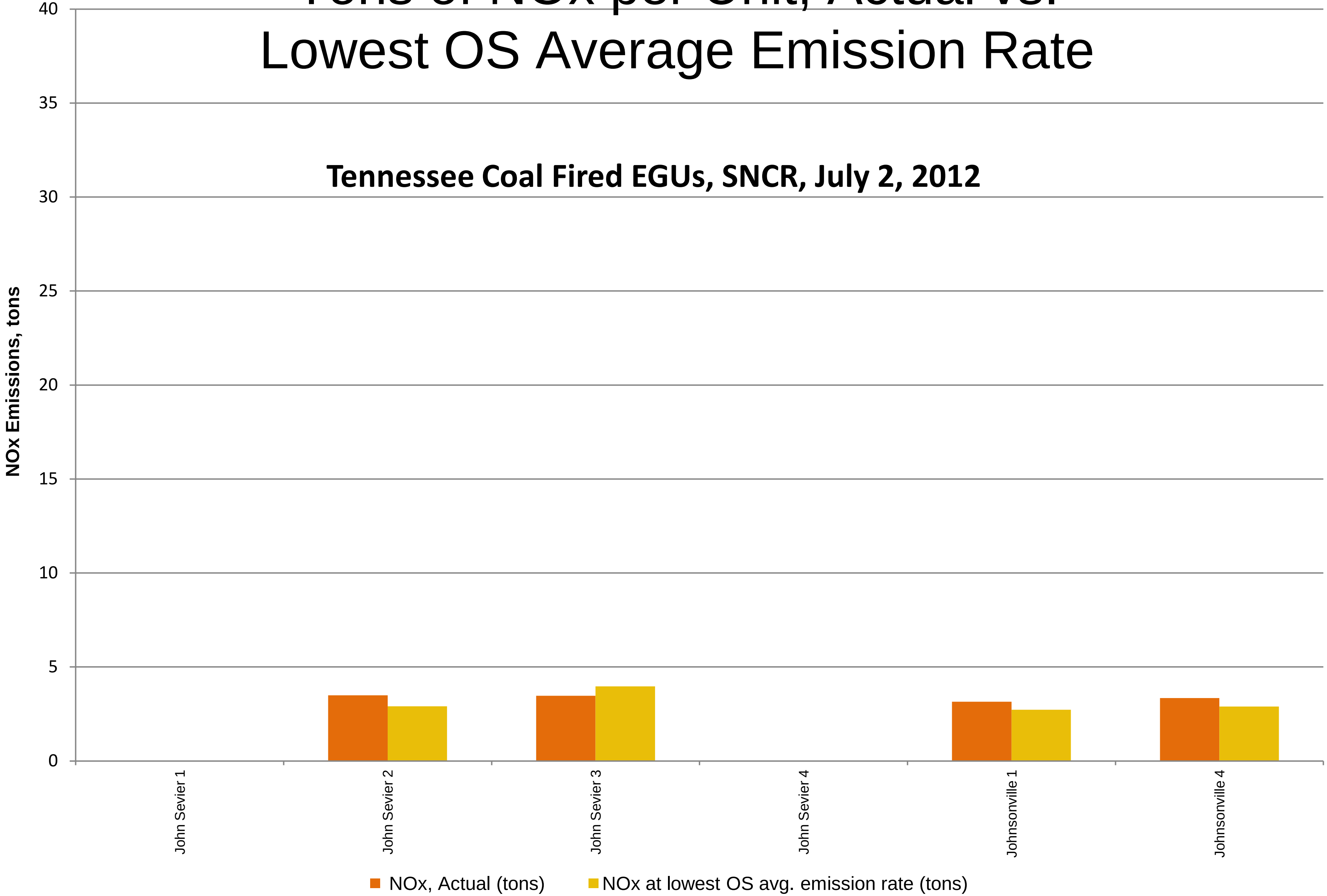
Tons of NOx per Unit, Actual vs. Lowest OS Average Emission Rate



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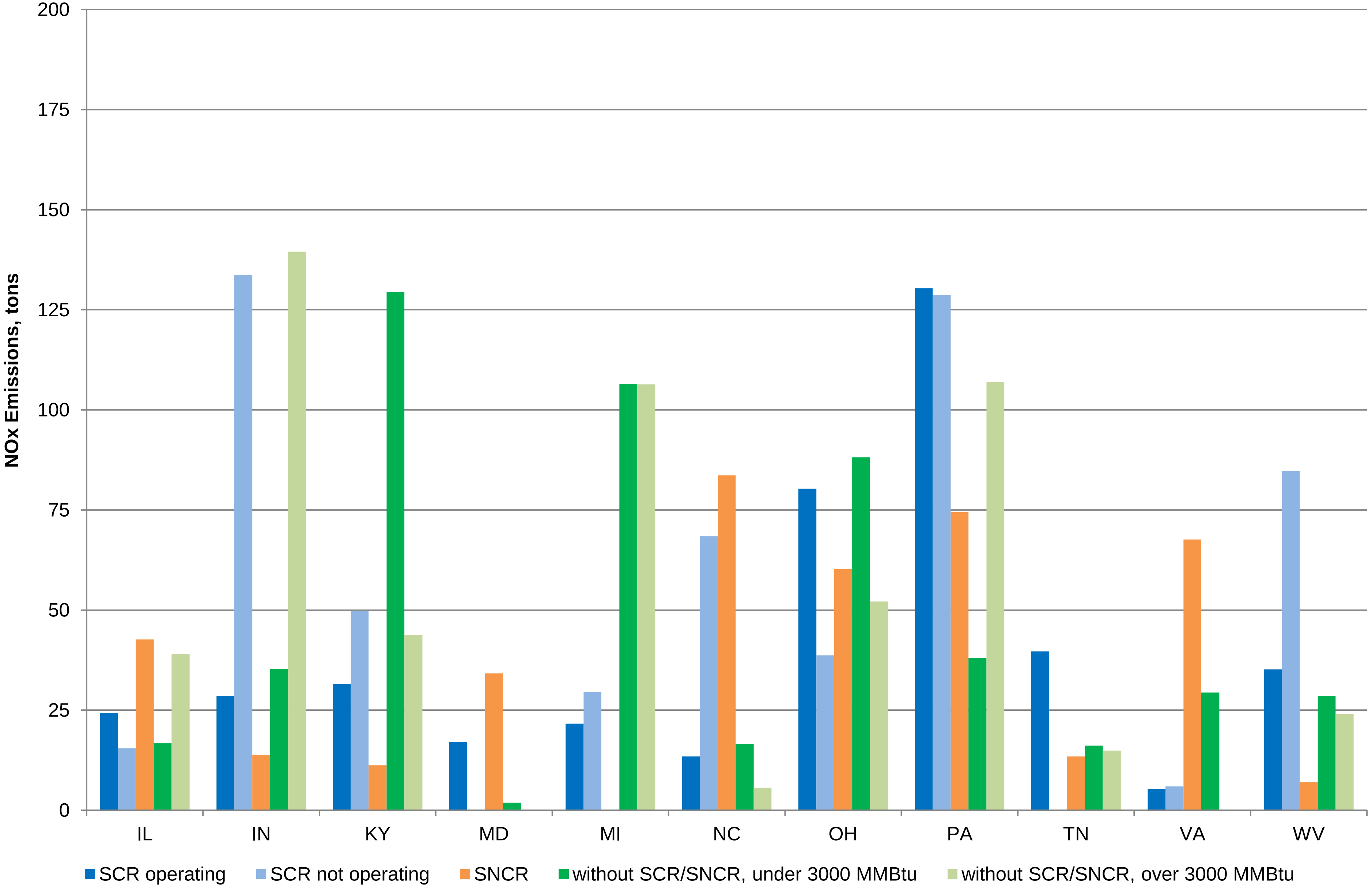
July 2, 2012 – Tons of NOx per State by Control Status



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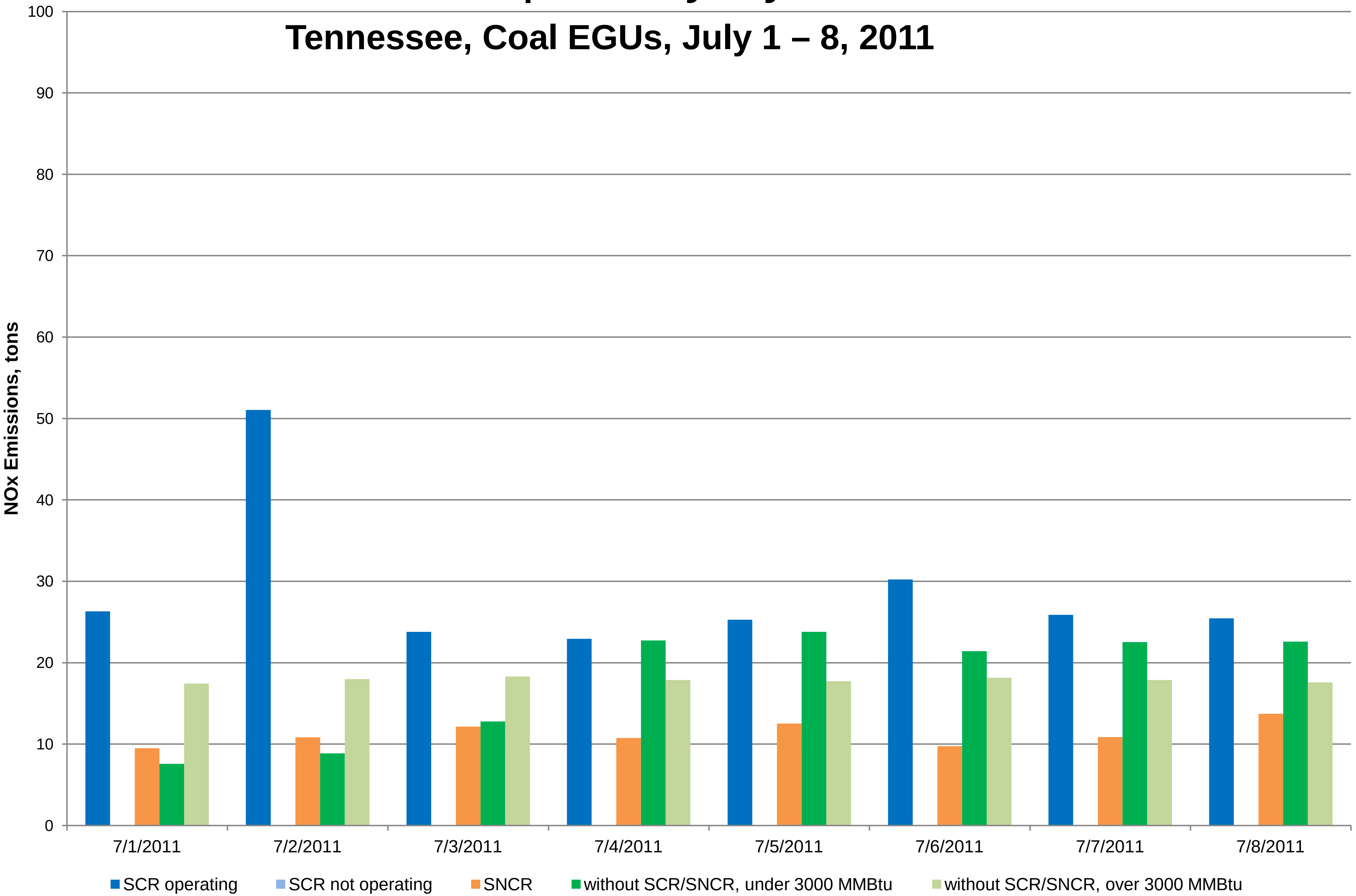
Part 4

July 1 to 8, 2011 Ozone Episode:

Analysis of Emissions and Controls

Tons of NOx per Day By Control Status



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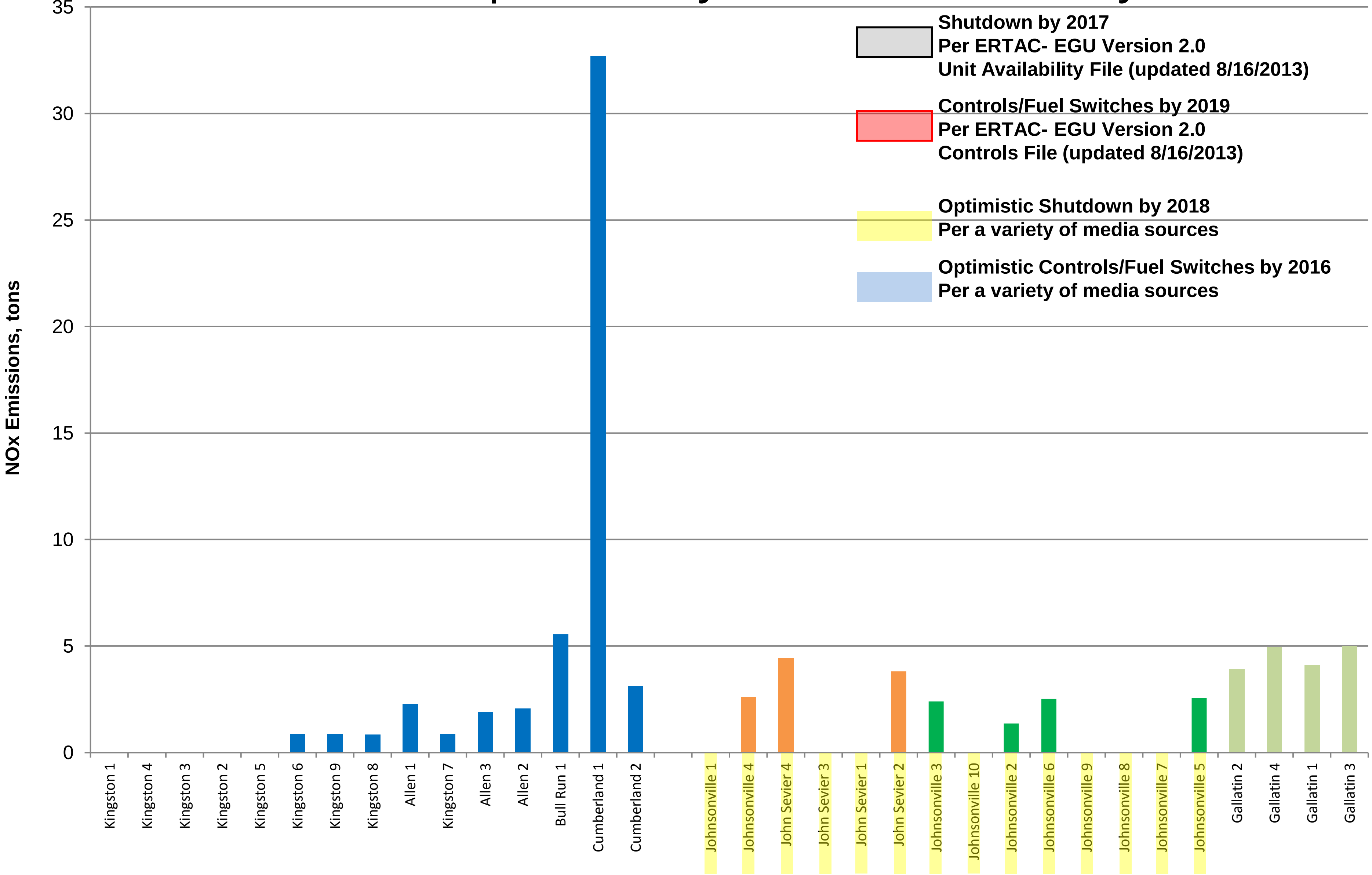
TN – Tons of NOx per Unit By Control Status, July 2, 2011



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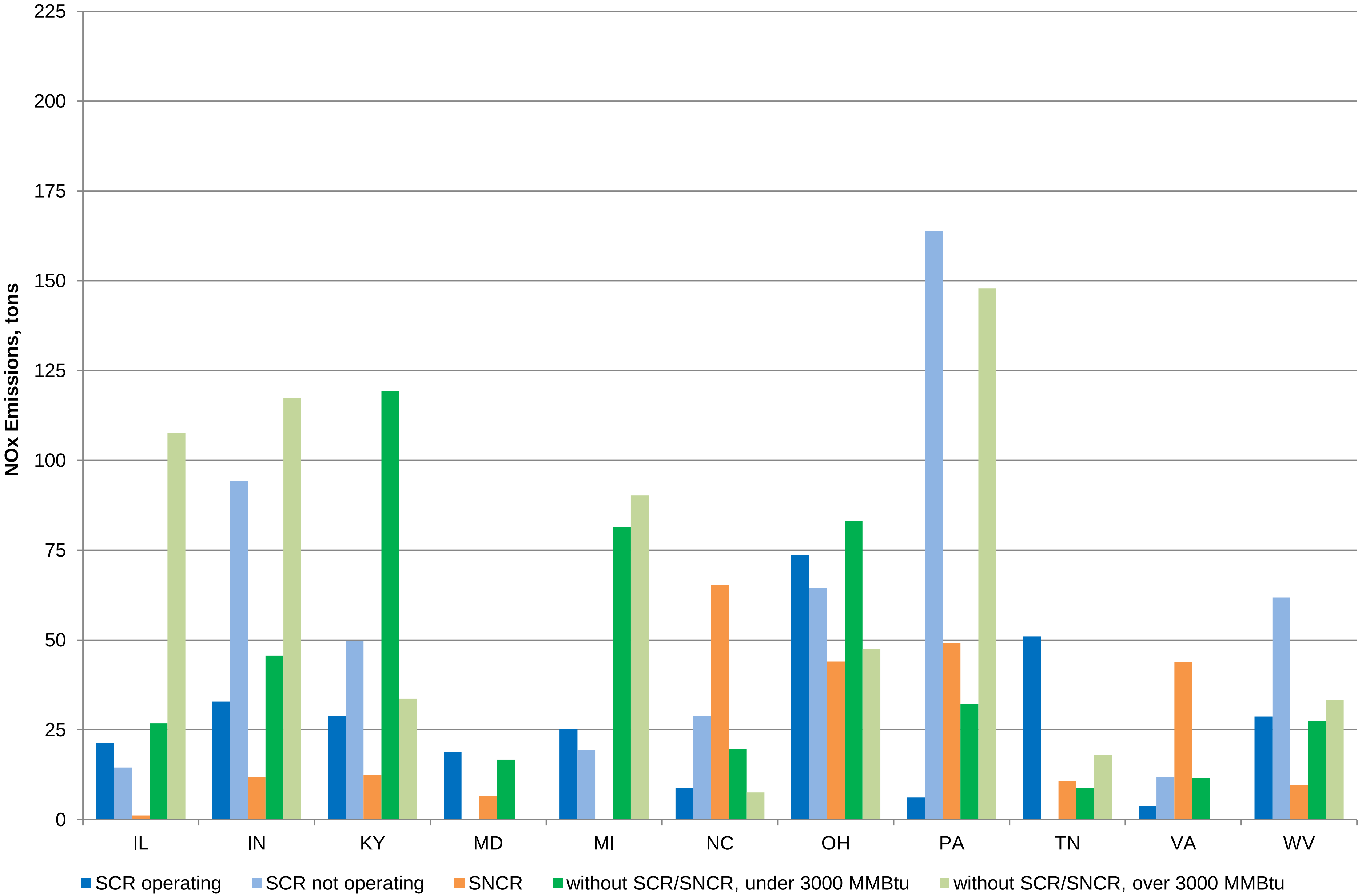
July 2, 2011 - Tons NOx per State by Control Status



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Part 5

11 State Totals

July 1 to 8, 2011 Ozone Episode:

Analysis of Emissions and Controls

11 Upwind States, 2012

- Total number of units = 1,432
- Total heat input capacity = 2,730,239 MMBtu/hr
  = 304,354 MW
- Total MW Capacity in %
  - **Total number of Coal units = 547 = 55%**
  - Total number of NG units = 672 = 25%
  - Total number of other (oil, etc.) units = 173 = 6%
  - Total number of Nuclear units = 40 = 14%
- **Total Capacity Coal = 165,910 MW**
  - 156 units with SCR = 88,783 MW = 53%
  - 114 units with SNCR = 27,561 MW = 17%
  - 277 units without SCR/SNCR = 49,566 MW = 30%

Basis – CAMD (as of 5/13/2014), NEI (for Nuclear), ERTAC (5/6/2014, 5/8/2014)

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11 Upwind States, 2018

- Total number of units = 1,199
- Total heat input capacity = 2,449,194 MMBtu/hr
  = 274,300 MW
- Total MW Capacity in %
  - **Total number of Coal units = 361 = 49%**
  - Total number of NG units = 686 = 32%
  - Total number of other (oil, etc.) units = 115 = 5%
  - Total number of Nuclear units = 37 = 14%
- **Total Capacity Coal = 134,121 MW**
  - 166 units with SCR = 93,776 MW = 70%
  - 60 units with SNCR = 17,868 MW = 13%
  - 135 units without SCR/SNCR = 22,477 MW = 17%

Basis – ERTAC (5/6/2014, 5/8/2014), NEI (for Nuclear)

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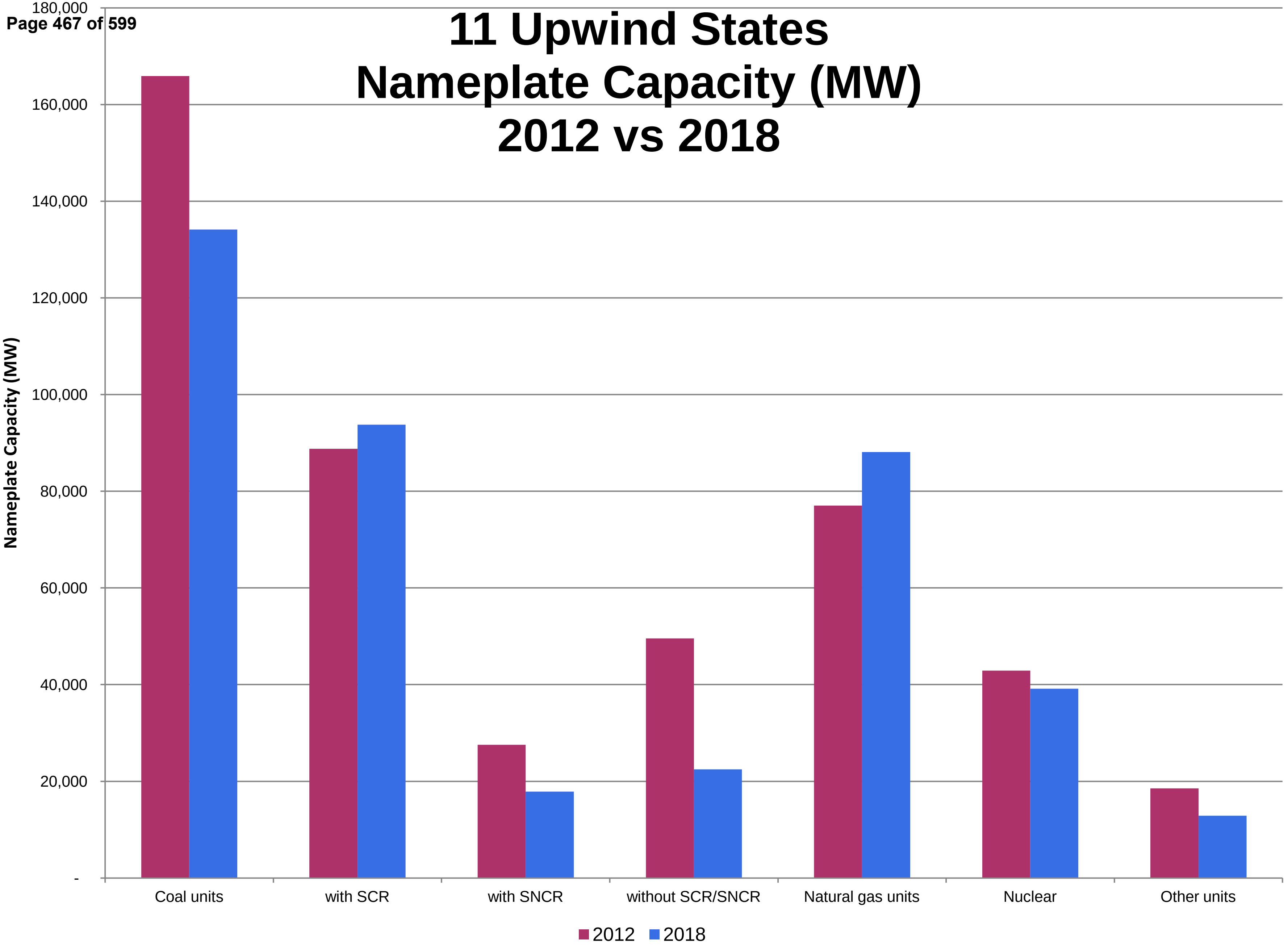
11 Upwind States Nameplate Capacity (MW) 2012 vs 2018



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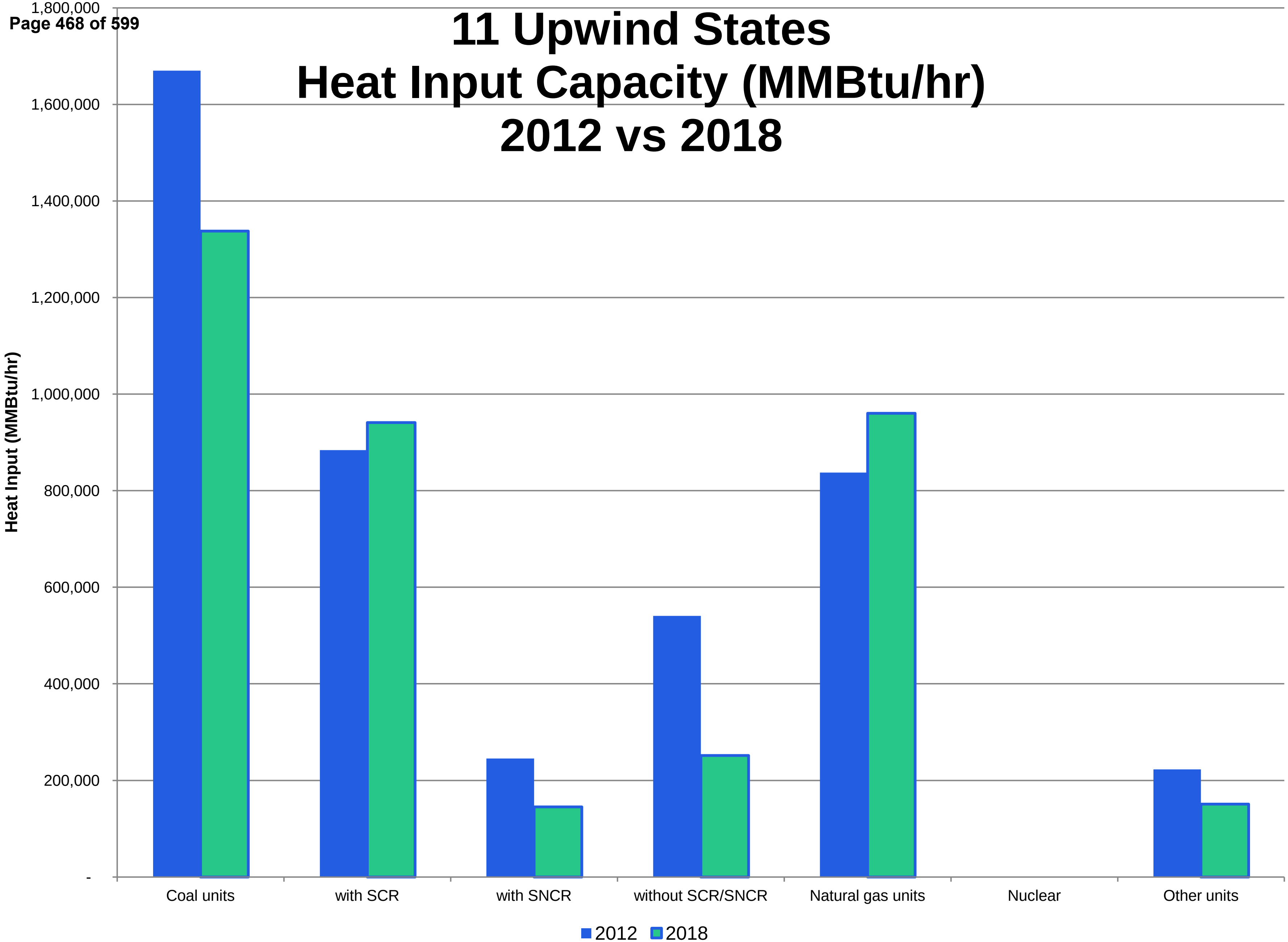

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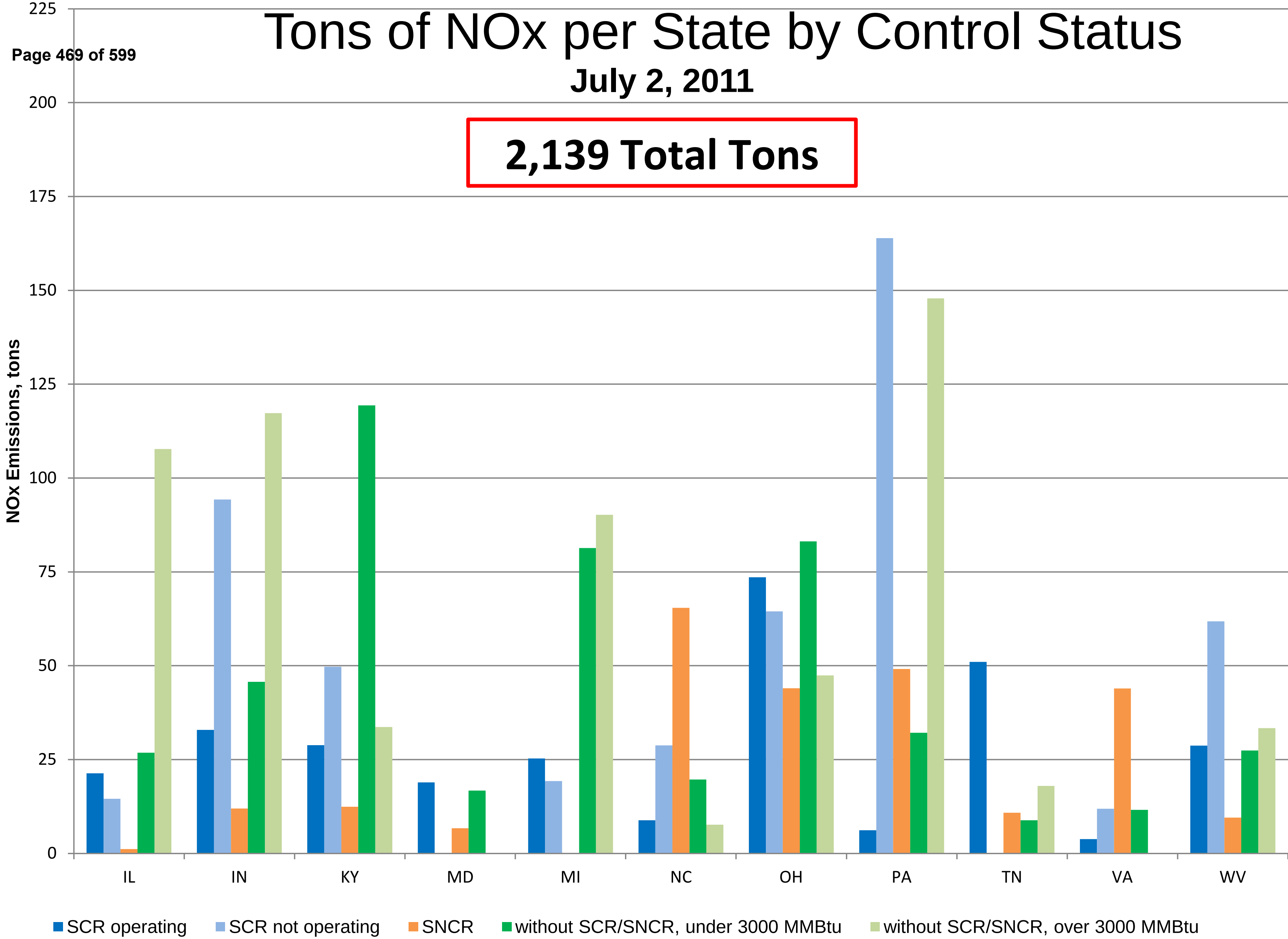
Tons of NOx per State by Control Status

July 2, 2011



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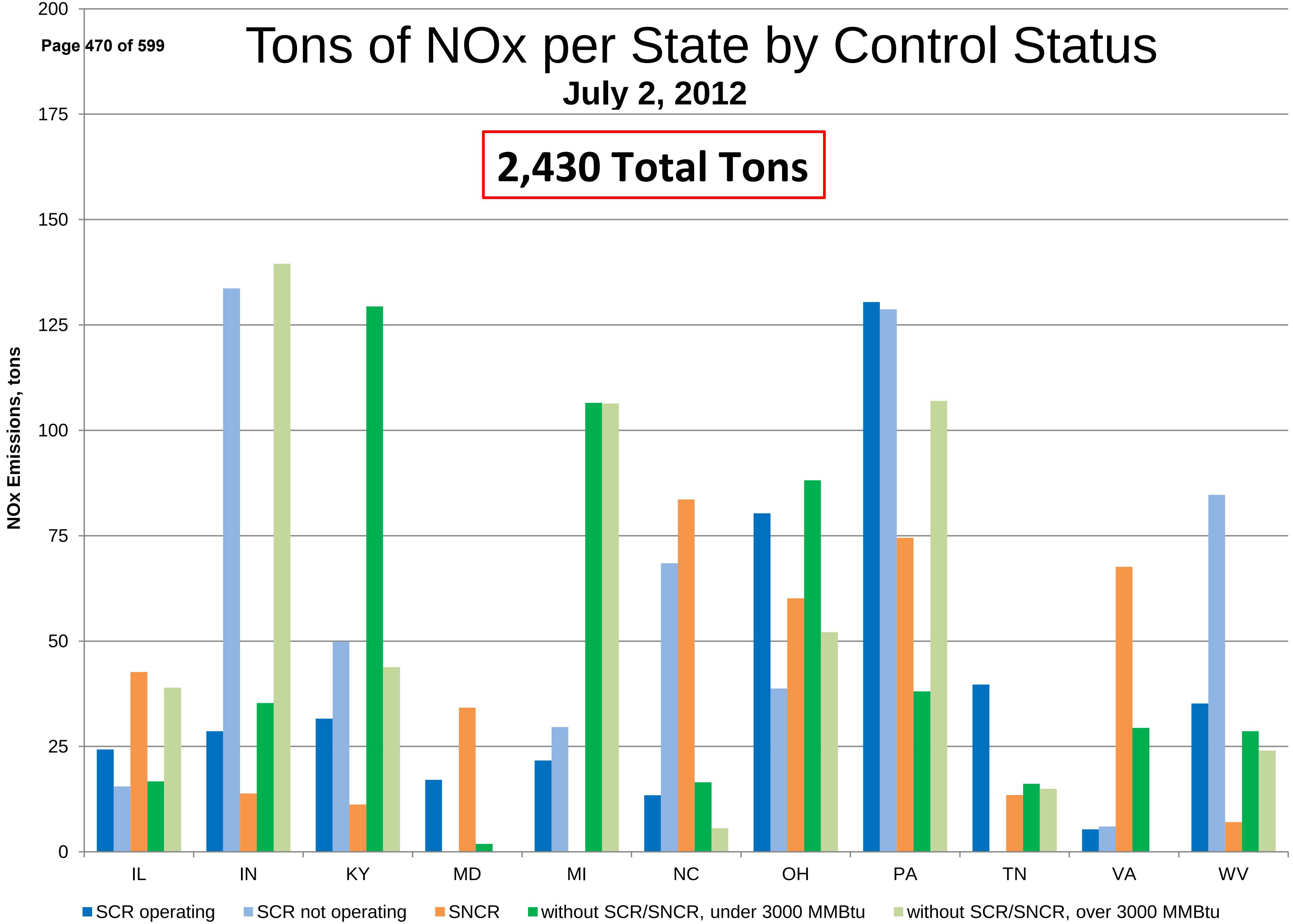

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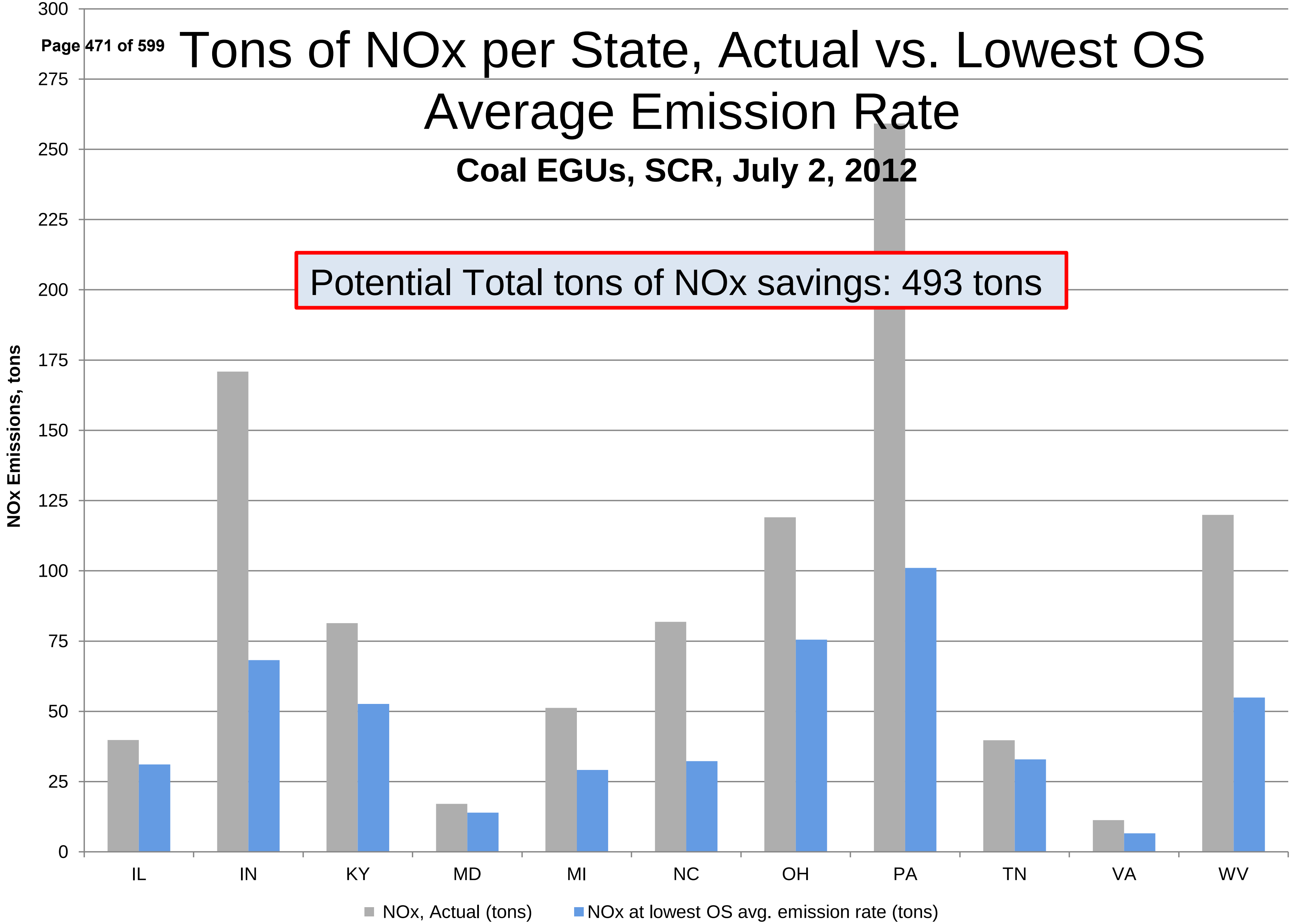
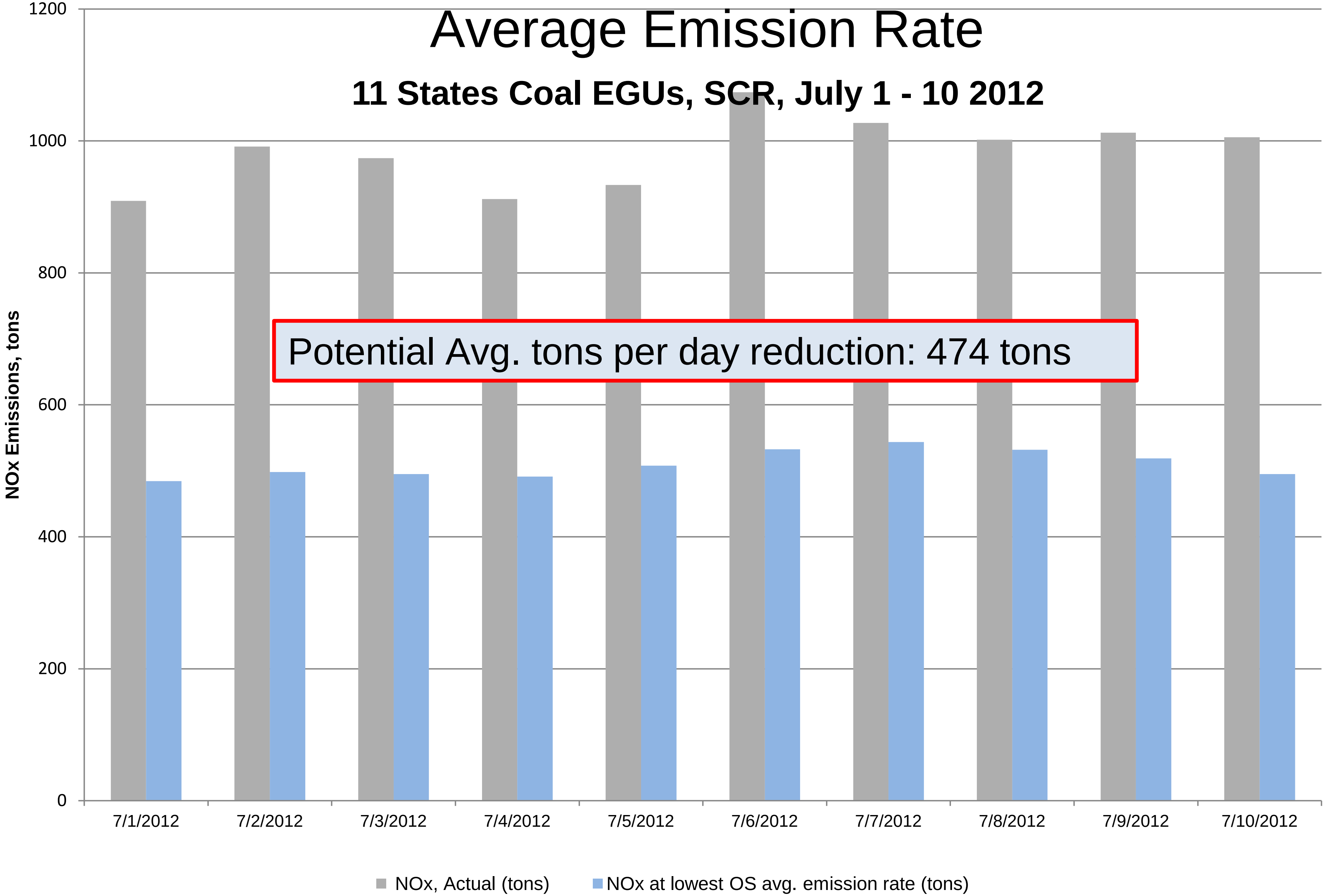
Tons of NOx per State, Actual vs. Lowest OS Average Emission Rate

Coal EGUs, SCR, July 2, 2012



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate



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11 State Summary

After performing similar analysis of EGUs in IL, IN, KY, MD, MI, NC, OH, PA, TN, VA and WV, the following potential total tons of lost NOx reductions was calculated:

- On July 2, 2012 actual NOx emissions in the 11 states (listed above) was 991 tons
  - If EGUs in those states were to have run their controls at the best rates observed in the data, emissions would have been 498 tons
  - This represents a single day loss of NOx reductions of 493 tons on that day
- During the 10 day episode between July 1 and 10, 2012 actual NOx emissions in the 11 states (listed above) was 9,840 tons
  - If EGUs in those states were to have run their controls at the best rates observed in the data, emissions would have been 5,099 tons
  - This represents a loss of NOx reductions of 4,741 tons over that 10-day episode

Part 6

Potential Lost Ozone Benefits from Controls Running Less Effectively in Recent Years

Preliminary Photochemical Modeling

Tennessee Monitors

How Might This Affect Ozone?

- Maryland has performed several very preliminary model runs to look at how much running EGU controls inefficiently might increase ozone levels
- Three runs:
  - Scenario 2B – A worst case run
    - Assumes SCR and SNCR controls are not run at all
  - Scenario 3B – A worst data run
    - Assumes SCR and SCR units all run at worst rates seen in CAMD data - 2005 to 2012
  - Scenario 3C – Based upon CAMD data analysis for EGU performance in 2011 and 2012
    - Assumes that units that had higher ozone season emission rates were operating at the best ozone season rates observed since 2005

Lost Ozone Benefits
Potential PPB Increases

Tennessee Monitors	**Potential Increased Ozone in 2018 – 3 EGU Control Scenarios**		
County	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Anderson	8.0	1.9	0.5
Blount	6.5	1.6	0.7
Blount	5.2	1.3	0.6
Davidson	3.5	0.6	0.4
Davidson	3.2	0.6	0.4
Hamilton	3.1	0.4	0.2
Hamilton	2.8	0.4	0.2
Jefferson	6.5	1.4	0.5
Knox	6.2	1.2	0.4
Knox	6.6	1.4	0.5
Loudon	11.8	3.6	0.7
Meigs	3.5	0.6	0.3

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Lost Ozone Benefits
Potential PPB Increases

Tennessee Monitors	Potential Increased Ozone in 2018 – 3 EGU Control Scenarios		
County	Worst Case – No SCRs or SNCRs (Scenario 2B)	Using worst rate CAMD Data (Scenario 3B)	Using actual 2011/2012 Data (Scenario 3C)
Rutherford	5.1	1.2	0.8
Sevier	6.4	1.6	0.8
Sevier	6.3	1.6	0.8
Shelby	4.0	0.8	0.5
Shelby	3.8	0.7	0.4
Sullivan	3.1	0.6	0.3
Sullivan	3.1	0.6	0.3
Sumner	4.9	1.1	0.7
Sumner	4.3	1.0	0.7
Williamson	6.2	1.4	0.9
Wilson	4.6	0.9	0.6

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Lost Ozone Benefit – 2018 Design Values

… EPA will propose a new ozone standard soon … 60 to 70 ppb range … designations to most likely be based upon 2014 to 2016 or 2015 to 2017 data

Projected to be Clean in 2018 … Potentially at Risk		Increased Ozone in 2018 – 3 EGU Control Scenarios		
Tennessee Counties	**2018 – Controls Running Well (Scenario 3A)**	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Anderson	58.8	66.8	60.7	59.3
Blount	64.2	70.7	65.8	64.9
Blount	54.5	59.8	55.9	55.1
Davidson	59.5	62.9	60.1	59.9
Davidson	55.8	59.0	56.3	56.1
Hamilton	63.2	66.4	63.7	63.5
Hamilton	61.6	64.4	62.0	61.8
Jefferson	61.9	68.4	63.3	62.3
Knox	68.1	74.3	69.3	68.5
Knox	62.7	69.3	64.1	63.2
Loudon	61.9	73.8	65.5	62.6
Meigs	57.8	61.3	58.4	58.0

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Lost Ozone Benefit – 2018 Design Values

… EPA will propose a new ozone standard soon … 60 to 70 ppb range … designations to most likely be based upon 2014 to 2016 or 2015 to 2017 data

Projected to be Clean in 2018 … Potentially at Risk		Increased Ozone in 2018 – 3 EGU Control Scenarios		
Tennessee Counties	**2018 – Controls Running Well (Scenario 3A)**	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Rutherford	60.3	65.4	61.5	61.1
Sevier	64.3	70.6	65.9	65.0
Sevier	62.3	68.6	63.8	63.1
Shelby	70.7	74.7	71.4	71.2
Shelby	64.4	68.2	65.0	64.8
Sullivan	69.5	72.6	70.1	69.8
Sullivan	69.2	72.4	69.8	69.5
Sumner	64.3	69.1	65.4	65.0
Sumner	62.1	66.4	63.1	62.8
Williamson	56.8	63.0	58.2	57.7
Wilson	62.6	67.1	63.5	63.2

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EGU Data Package #3
Operation of Existing SCR, SNCR

Virginia

Sample of draft data and analyses developed by the Maryland Department of the Environment

Contact: Tad Aburn, Air Director, MDE
(410) 537-3255

September 18, 2014

Purpose

- Maryland is the only Moderate nonattainment area in the East for the 75 ppb ozone standard.
  - This means that Maryland is the only state required to submit an attainment SIP
  - Only state required to perform attainment modeling.
- We are now beginning to build our “SIP Quality” modeling platform.
- One major issue that our data analyses have uncovered is that many EGU units appear to not be running their control equipment in recent years as efficiently as they have demonstrated they can do in earlier years. This issue is driven by recent changes in the energy market, reduced coal capacity, inexpensive allowances and a regulatory structure driven by ozone season caps not daily performance. In many states, including Maryland, this has lead to controls not always being used efficiently on the days when they are needed the most … this is perfectly legal.
- This is a critical issue that we would like to continue to discuss with you. There appears to be an interest from the private sector to discuss this issue and see if a common sense fix can be designed. Maryland believes this fix would be relatively cost-effective compared to the capital cost of the control technologies.
- MDE has focused our analyses on two of the worst large, regional scale ozone episodes from recent years: July 1-8, 2011 and July 1-10, 2012.
- The primary data used in these analyses include:
  - CEMS data from CAMD
  - Emissions and projection data from ERTAC
  - Other data we have received from individual states
- More detailed data and analyses and spreadsheets are available upon request.

How the Data Analyses Were Built

- Maryland began the data analyses in late 2012
  - Looked at EGUs in the 9 upwind states named in the 176A Petition (IL, IN, KY, MI, NC, OH, TN, VA, WV) … MD and PA
- Shared a draft package with Air Directors on April 21, 2014
  - This package focused on a bad ozone episode: July 1 – 8, 2011
- Shared a second draft package with Air Directors on May 13, 2014
  - This package focused on second bad ozone episode: July 1 – 10, 2012
  - This package also included update to specific material after receiving comments from numerous states
- The 2011 and 2012 episodes analyzed capture two of the worst regional ozone periods in 2011 and 2012
  - Other states, like Wisconsin and Delaware have done similar analyses and reached similar conclusions
- This is the third draft package, and builds on to the prior two draft packages, while incorporating input from individual states and updates to ERTAC.
- This third draft package also includes preliminary photochemical modeling performed by MDE to look at the potential loss of ozone reduction benefits.

Help Us QA the Data

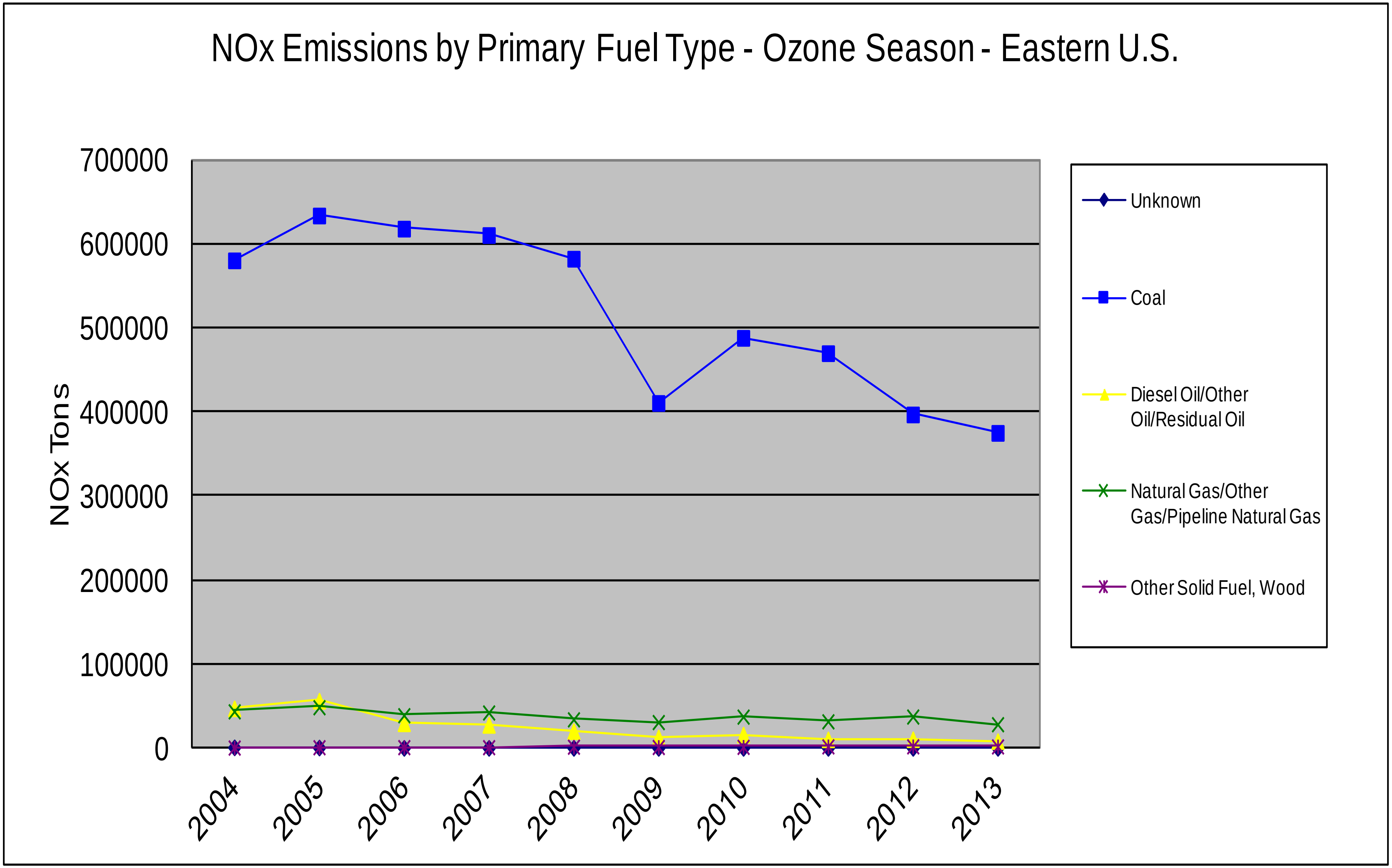
- We have used readily available data, like the CAMD and ERTAC data, but we recognize that these data sources can be out of date, or not include recent changes.
  - We hope you can help us with making sure we have the best possible data.

- This package reflects recently updated data, including but not limited to:
  - CAMD updates
  - May 8, 2014 ERTAC updates
  - PA comments to OTC, forwarded to MDE, Spreadsheets detailing "EGU Shutdowns, EGU Controls and New Natural Gas Power Projects" for the state of PA. Sent from Randy Bordner, Environmental Group Manager - Bureau of Air Quality, PA Department of Environmental Protection to Andy Bodnarik, OTC. Received as FWD from Andy Bodnarik on 4/23/2014
  - VA comments to MDE, "Electric Generation Sector Summary for Virginia" received from Thomas R. Ballou, Director - Office of Air Data Analysis and Planning, VA Department of Environmental Quality on 5/12/2014

Part 1

Background:
Generation in 2012 and 2018
Projected Changes

Why Coal?



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Virginia EGUs, 2012

- Total number of units = 130
- Total heat input capacity = 178,451 MMBtu/hr = 20,645 MW
- Total State MW Capacity in %
  - **Total number of Coal units = 56 = 36%**
  - Total number of NG units = 60 = 35%
  - Total number of other (oil, etc.) units = 10 = 11%
  - Total number of Nuclear units = 4 = 18%
- **Total Capacity Coal = 7,463 MW**
  - 6 units with SCR = 1,885 MW = 25%
  - 23 units with SNCR = 3,547 MW = 48%
  - 27 units without SCR/SNCR = 2,031 MW = 27%

Basis – CAMD (as of 5/13/2014), NEI (for Nuclear), ERTAC (5/6/2014, 5/8/2014)

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Capacity and Fuel: 2012 to 2018

A detailed review of ERTAC data for 2018 was completed, and an evaluation of the following characteristics performed.

- Total Number of units
- Heat input capacity - MMBtu/hr
- Nameplate capacity – MW
- Presence of advanced post combustion controls – SCR, SNCR
- Fuel switching
- Shutdown, retirements

Virginia EGUs, 2018

- Total number of units = 126
- Total heat input capacity = 197,846 MMBtu/hr = 21,603 MW
- Total State MW Capacity in %
  - **Total number of Coal units = 31 = 19%**
  - Total number of NG units = 81 = 54%
  - Total number of other (oil, etc.) units = 10 = 10%
  - Total number of Nuclear units = 4 = 17%
- **Total Capacity Coal = 4,116 MW**
  - 4 units with SCR = 1,461 MW = 35%
  - 12 units with SNCR = 1,968 MW = 48%
  - 15 units without SCR/SNCR = 687 MW = 17%

Basis – ERTAC (5/6/2014, 5/8/2014), NEI (for Nuclear)

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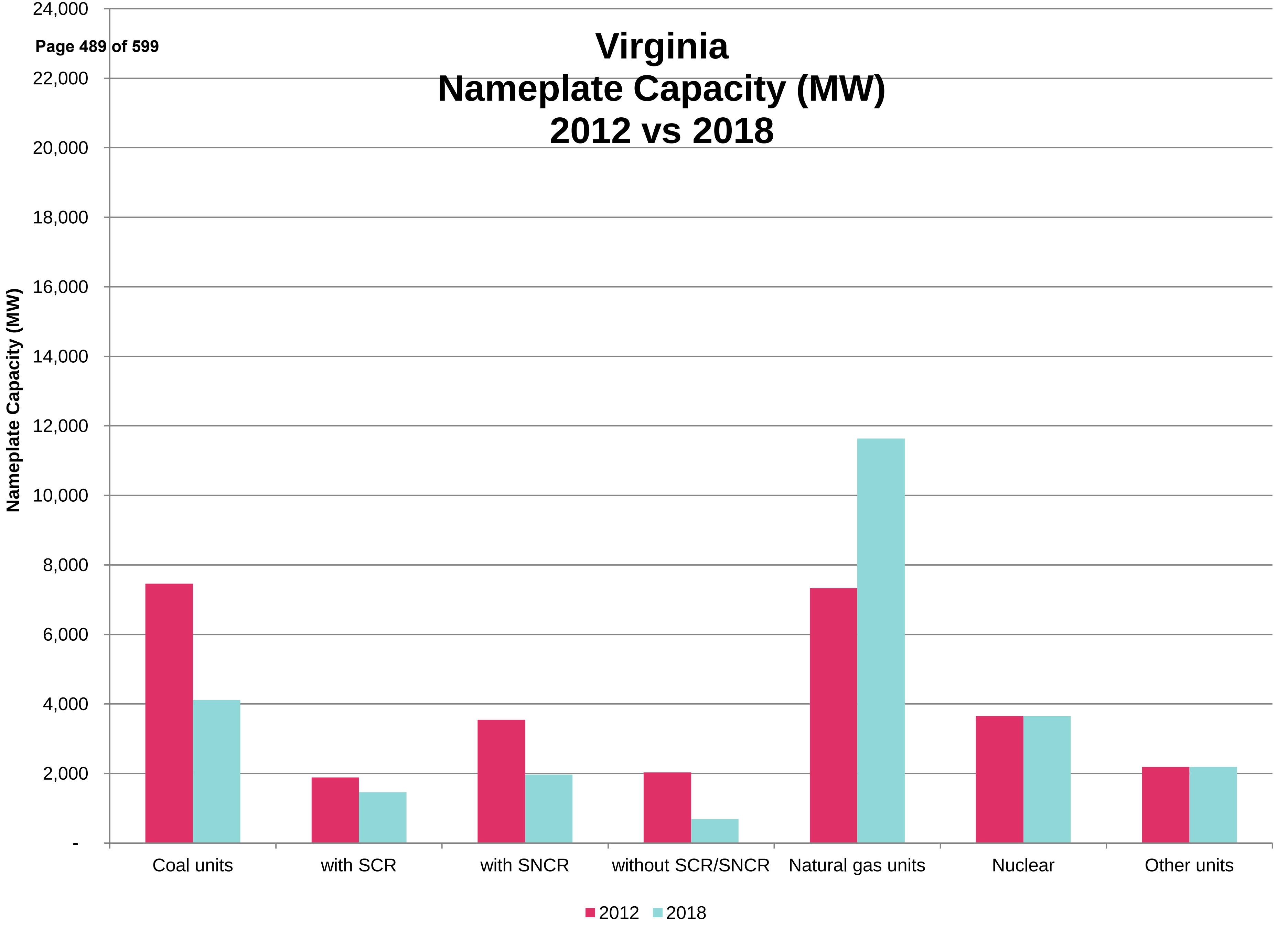

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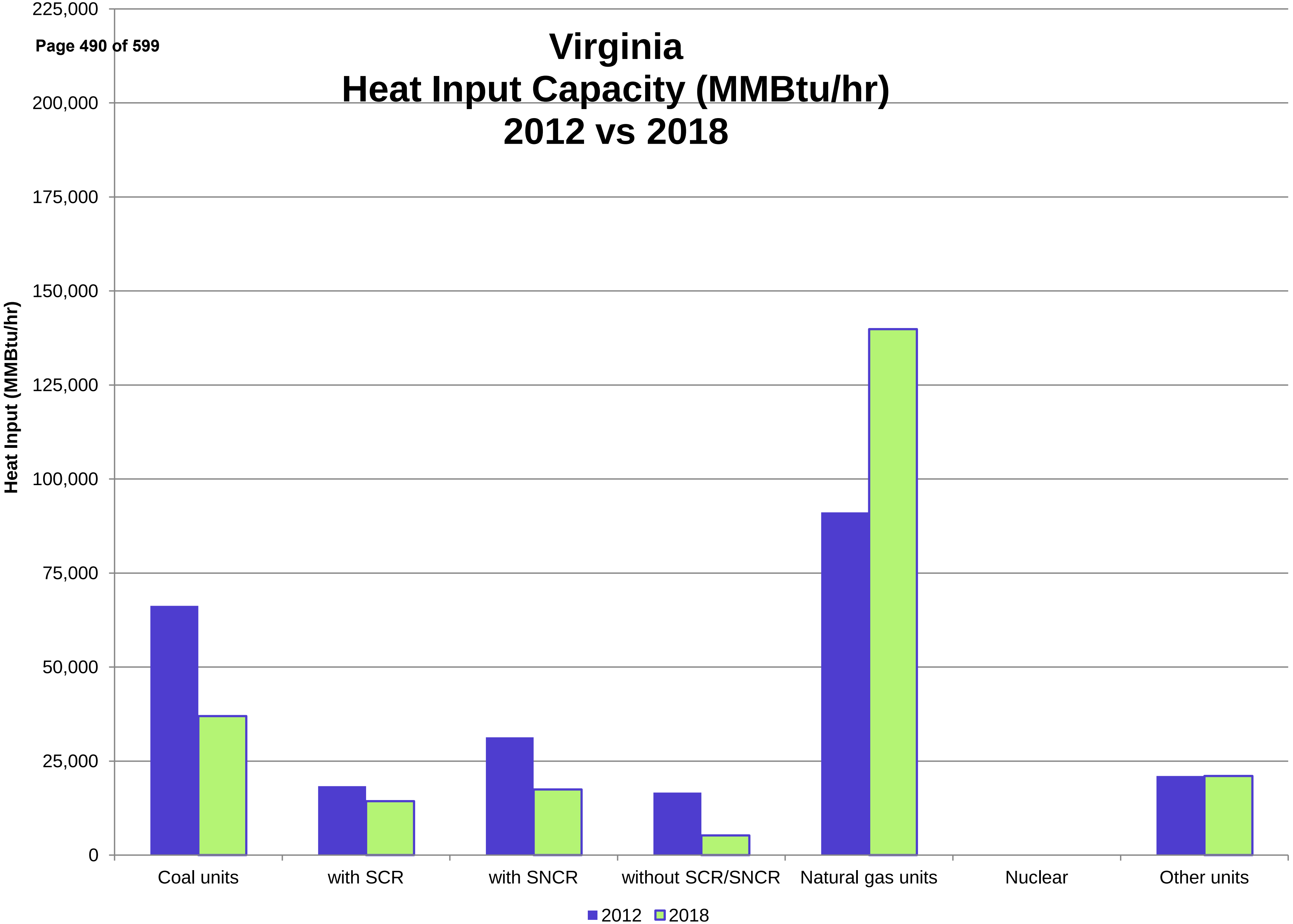
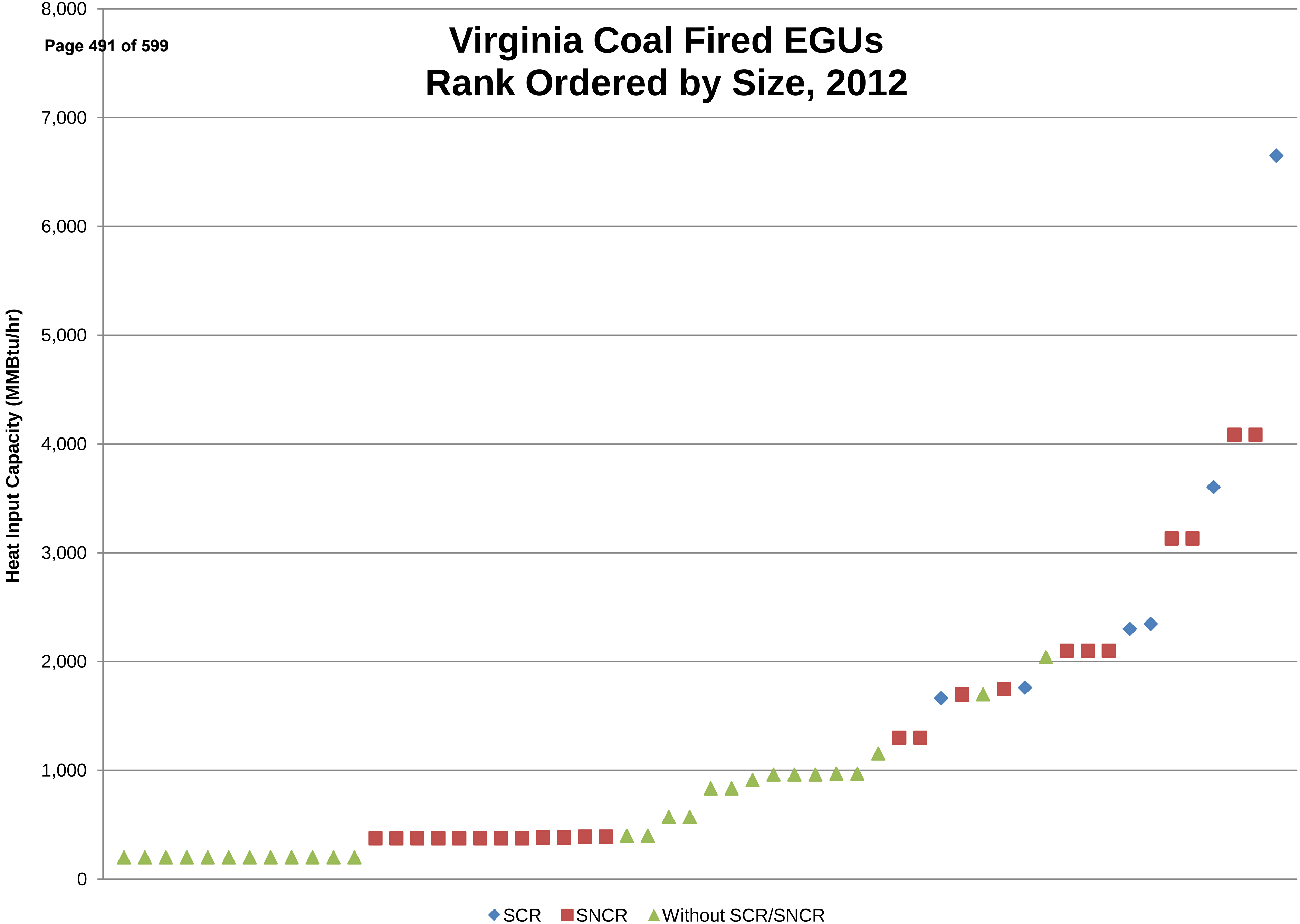

Virginia
Heat Input Capacity (MMBtu/hr)
2012 vs 2018
Heat Input (MMBtu/hr)
225,000
200,000
175,000
150,000
125,000
100,000
75,000
50,000
25,000
0
Coal units
with SCR
with SNCR
without SCR/SNCR
Natural gas units
Nuclear
Other units
2012
2018



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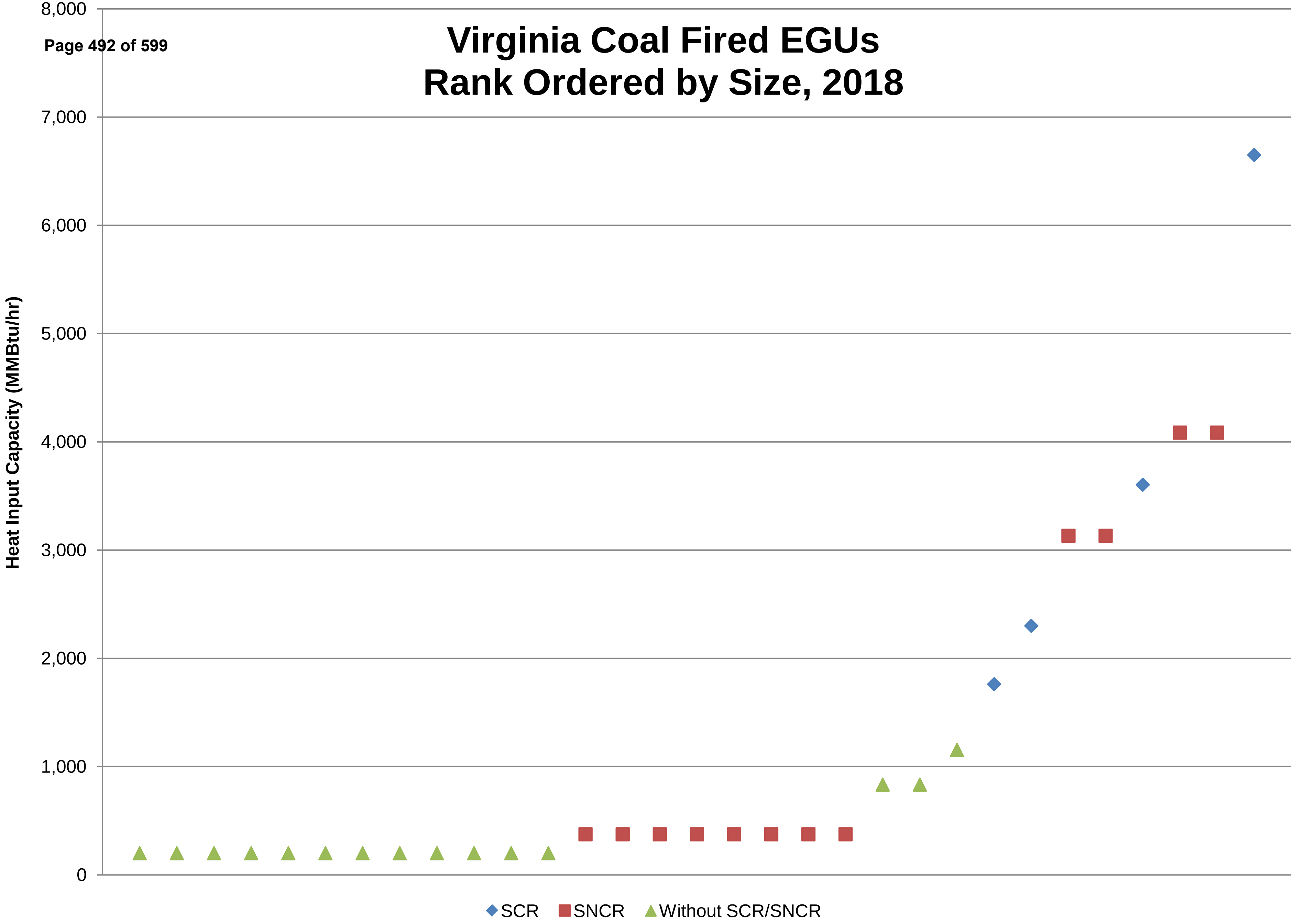

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VA : Large (> 3000 MMBtu/hr) Coal-Fired EGU NOx Emissions Rate Analysis

	Facility Name	Unit ID	Lowest OS Emission Rate Year	Lowest OS Emission Rate (lbs/MMBtu)	2007 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2007 OS ER (% Change)	2011 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2011 OS ER (% Change)	Comments/ ERTAC Closure Date
Controlled with SCR	Chesterfield Power Station	5	2008	0.0309	0.0460	49	0.2487	705	
	Chesterfield Power Station	6	2006	0.0326	0.0330	1	0.0518	59	
Controlled with SNCR	Clover Power Station	1	2003	0.2315	0.2473	7	0.2474	7	
	Clover Power Station	2	2003	0.2287	0.2428	6	0.2746	20	
	Virginia City Hybrid	1	2012	0.056	N/A		N/A		New 2012
	Virginia City Hybrid	2	2012	0.0577	N/A		N/A		New 2012
No Controls or Fuel Switches by 2019	N/A								
Retiring by 2017	N/A								

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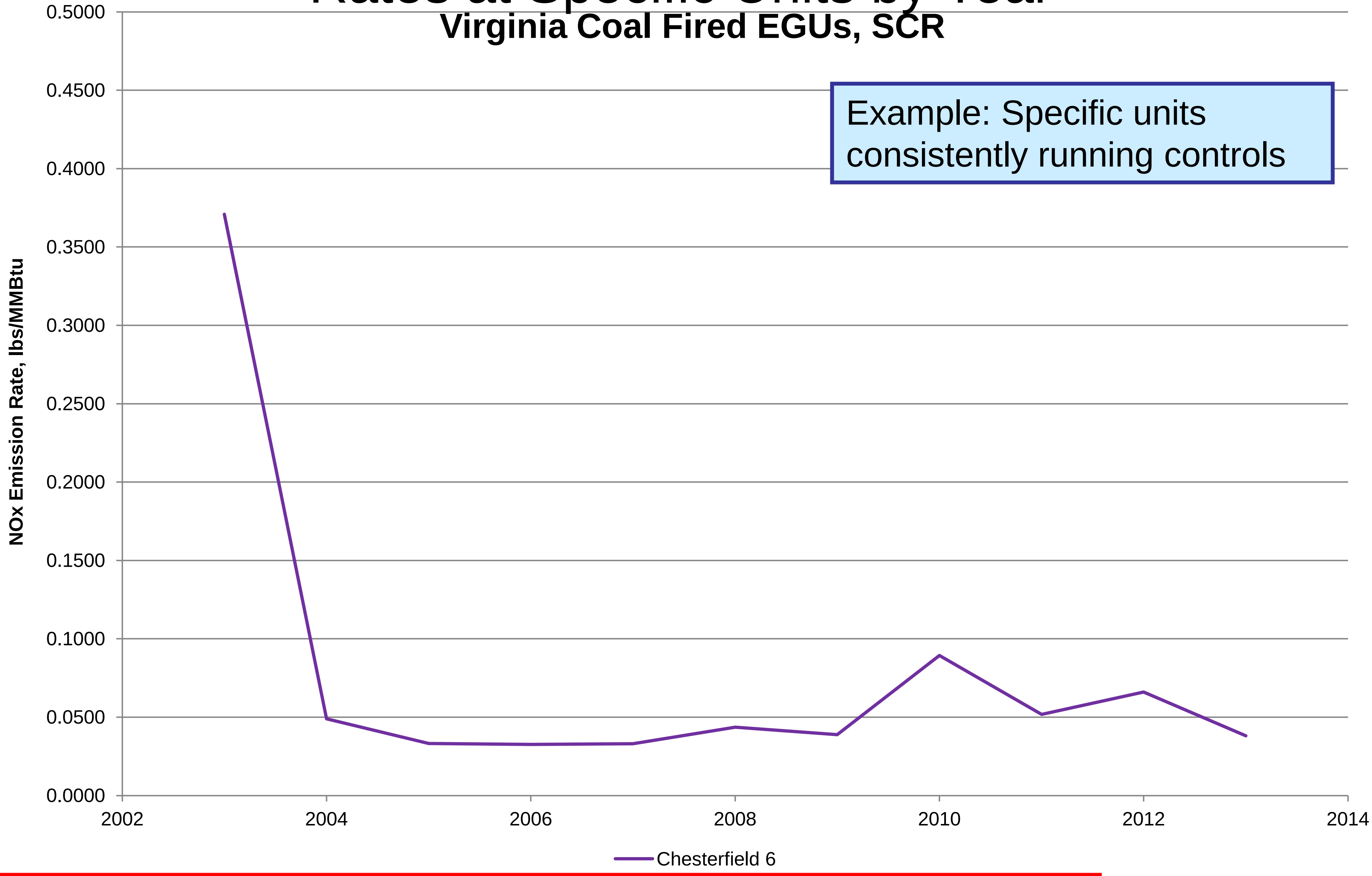
VA: Small (< 3000 MMBtu/hr) Coal-Fired EGU NOx Emissions Rate Analysis

	Facility Name	Unit ID	Lowest OS Emission Rate Year	Lowest OS Emission Rate (lbs/MMBtu)	2007 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2007 OS ER (% Change)	2011 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2011 OS ER (% Change)	Comments/ ERTAC Closure Date
Controlled with SCR	Facility	1	2008	0.0879	0.1106	26	0.1113	27	
	Chesterfield Power	4	2004	0.0487	0.0546	12	0.1124	131	
Controlled with SNCR	Spruance Genco, LLC	BLR01A	2004	0.2538	0.294	16	0.2996	18	
	Spruance Genco, LLC	BLR01B	2004	0.2538	0.292	15	0.2985	18	
	Spruance Genco, LLC	BLR02A	2004	0.2527	0.2864	13	0.3047	21	
	Spruance Genco, LLC	BLR02B	2004	0.2527	0.2831	12	0.3039	20	
	Spruance Genco, LLC	BLR03A	2004	0.2448	0.3021	23	0.2896	18	
	Spruance Genco, LLC	BLR03B	2004	0.2449	0.3048	24	0.2906	19	
	Spruance Genco, LLC	BLR04A	2005	0.2648	0.2819	6	0.2764	4	
	Spruance Genco, LLC	BLR04B	2005	0.2647	0.2805	6	0.2773	5	
Adding Controls or Fuel Switches by 2019	Bremo Power Station	3	2004	0.474	0.6644	40	0.6121	29	NG (2014)
	Bremo Power Station	4	2008	0.2305	0.2796	21	0.4278	86	NG (2014)
	Clinch River	1	2012	0.1899	0.3494	84	0.2064	9	Has SNCR, NG (2015)
	Clinch River	2	2012	0.194	0.3507	81	0.2105	9	
No Controls or Fuel Switches by 2019	Chesterfield Power	3	2010	0.3527	0.379	8	0.3572	1	
	Cogentrix-Hopewell	BLR01A	2004	0.2853	0.3163	11	0.3578	25	
	Cogentrix-Hopewell	BLR01B	2004	0.2831	0.3157	12	0.3646	29	
	Cogentrix-Hopewell	BLR01C	2005	0.2838	0.318	12	0.3533	24	
	Cogentrix-Hopewell	BLR02A	2004	0.2681	0.317	18	0.371	38	
	Cogentrix-Hopewell	BLR02B	2004	0.2669	0.3147	18	0.3697	39	
	Cogentrix-Hopewell	BLR02C	2004	0.2686	0.3156	17	0.3548	32	
	Cogentrix-Portsmouth	BLR01A	2006	0.2875	0.3172	10	0.4048	41	
	Cogentrix-Portsmouth	BLR01B	2006	0.288	0.3182	10	0.3842	33	
	Cogentrix-Portsmouth	BLR01C	2006	0.2873	0.3162	10	0.3821	33	
	Cogentrix-Portsmouth	BLR02A	2006	0.2752	0.329	20	0.3855	40	
	Cogentrix-Portsmouth	BLR02B	2006	0.2379	0.3267	37	0.3618	52	
	Cogentrix-Portsmouth	BLR02C	2006	0.2742	0.326	19	0.36	31	
	Mecklenburg	1	2008	0.2375	0.2731	15	0.2854	20	
	Mecklenburg	2	2004	0.2562	0.2822	10	0.2881	12	
Retiring by 2018	Altavista Power Station	1	2008	0.2234	0.2641	18	Not Operating	N/A	Has SNCR, 12/31/2013
	Altavista Power Station	2	2008	0.2232	0.2639	18	Not Operating	N/A	
	Chesapeake Energy	1	2008	0.2211	0.2773	25	0.6463	192	Has SNCR, 7/1/2015
	Chesapeake Energy	2	2008	0.2315	0.2855	23	0.6434	178	
	Chesapeake Energy	3	2009	0.0269	0.0283	5	0.2024	652	
	Chesapeake Energy	4	2007	0.0356	0.0356	0	0.2063	479	
	Clinch River	3	2012	0.181	0.3425	89	0.1912	6	Has SNCR, 6/30/2015
	Glen Lyn	6	2010	0.3771	0.4154	10	0.4011	6	6/30/2015
	Glen Lyn	51	2010	0.3221	0.3756	17	0.4182	30	6/30/2015
	Glen Lyn	52	2004	0.3352	0.3572	7	0.4038	20	6/30/2015
	Hopewell Power Station	1	2009	0.2277	0.2622	15	0.2711	19	Has SNCR, 12/31/2013
	Hopewell Power Station	2	2009	0.2278	0.2634	16	0.2706	19	
	Mirant Potomac River	1	2012	0.2739	0.3242	18	0.2929	7	12/31/2013
	Mirant Potomac River	2	2012	0.2581	0.2948	14	0.2853	11	12/31/2013
	Mirant Potomac River	3	2012	0.1964	0.2185	11	0.2406	23	12/31/2013
	Mirant Potomac River	4	2012	0.1946	0.2091	7	0.238	22	12/31/2013
	Mirant Potomac River	5	2012	0.196	0.2161	10	0.24	22	12/31/2013
	Southampton Power	1	2004	0.3472	0.3766	8	0.3913	13	12/31/2013
	Southampton Power	2	2004	0.3413	0.3763	10	0.3881	14	12/31/2013
	Yorktown Power Station	1	2008	0.2242	0.2402	7	0.5235	133	Has SNCR, 7/1/2015
	Yorktown Power Station	2	2008	0.2204	0.2412	9	0.5321	141	

Part 2

Operation of Controls: Changes in Control Efficiency 2003 to 2013

Average Ozone Season Emission Rates at Specific Units by Year



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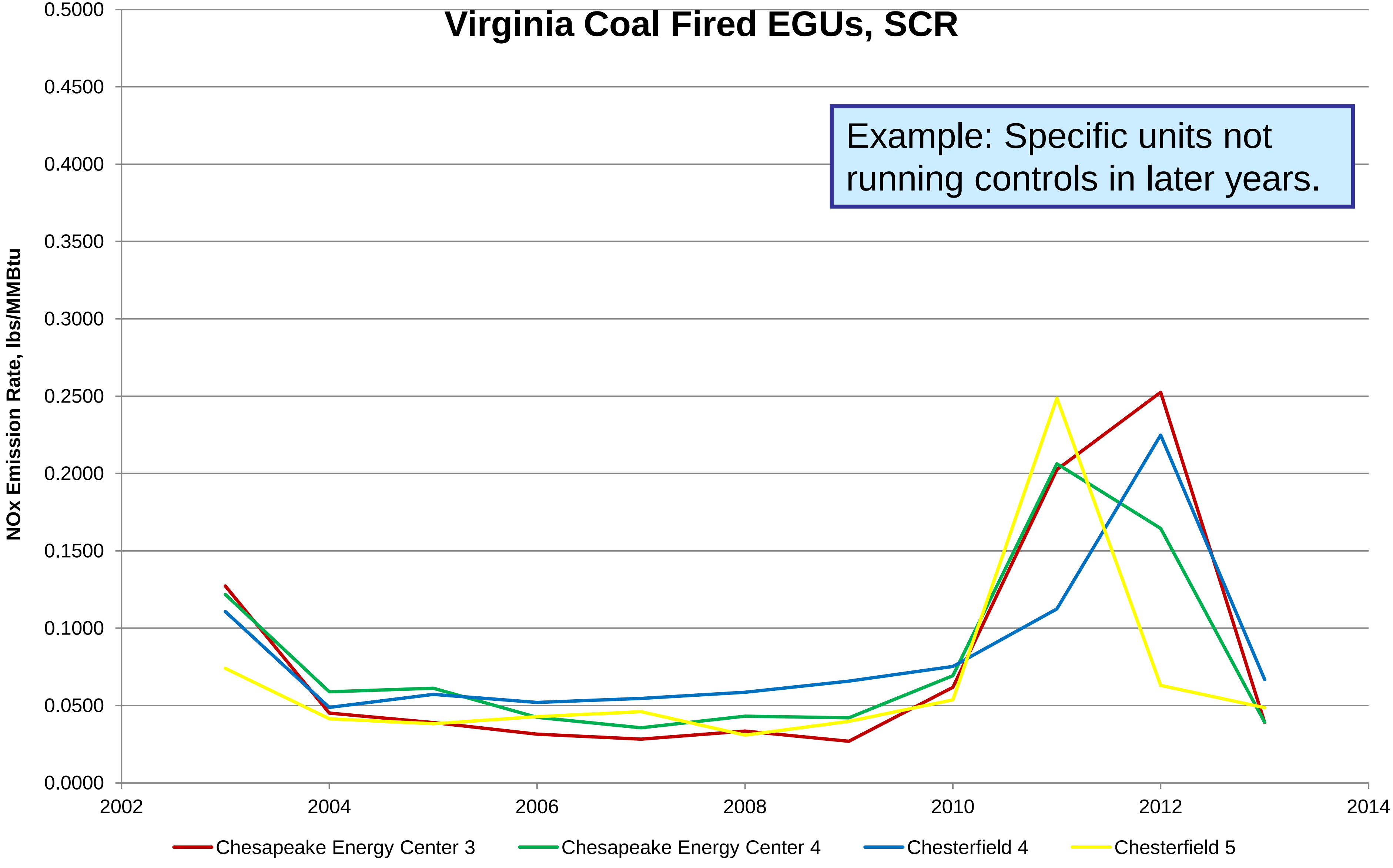
Average Ozone Season Emission Rates at Specific Units by Year



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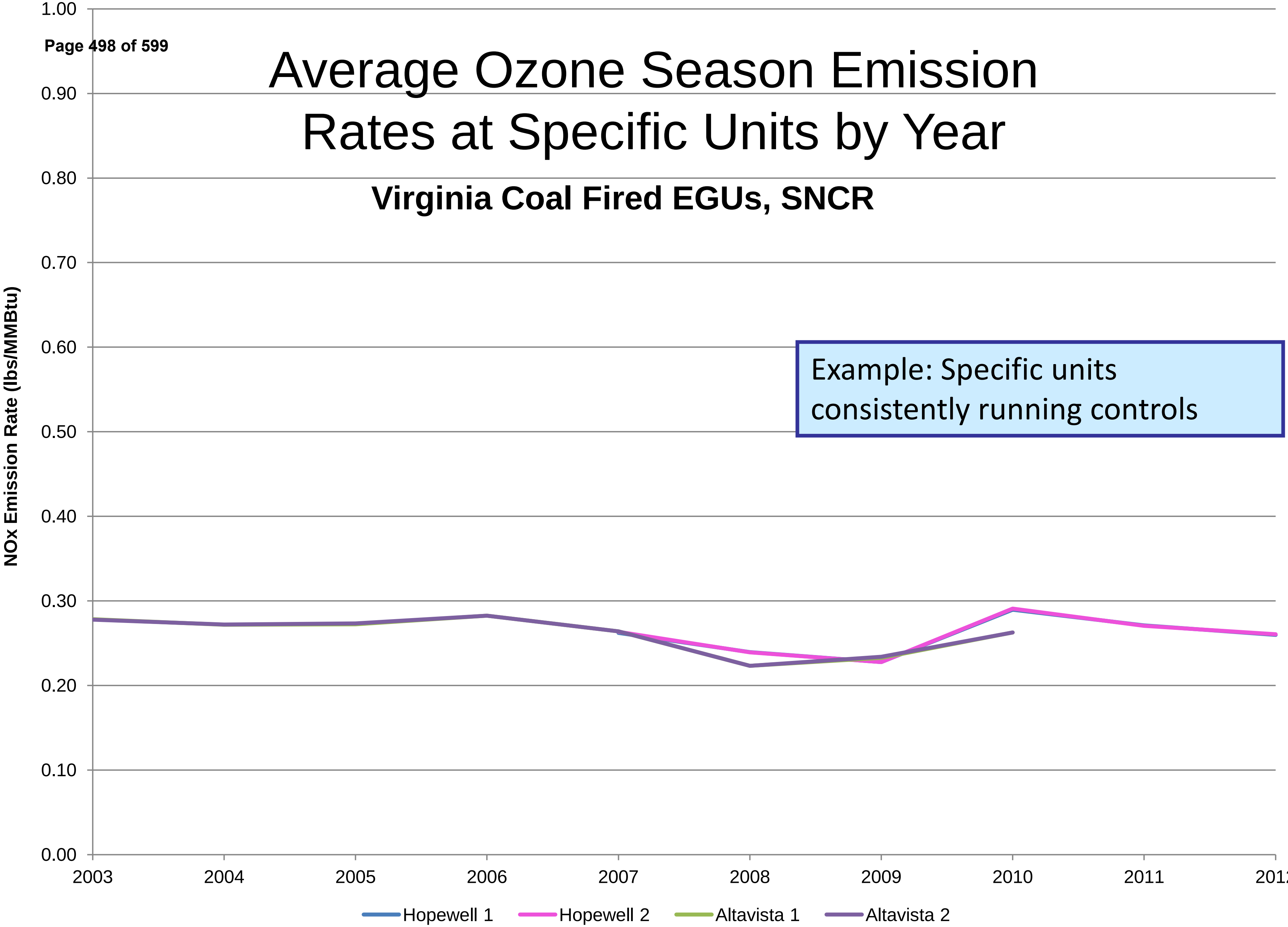
Average Ozone Season Emission Rates at Specific Units by Year

Virginia Coal Fired EGUs, SNCR



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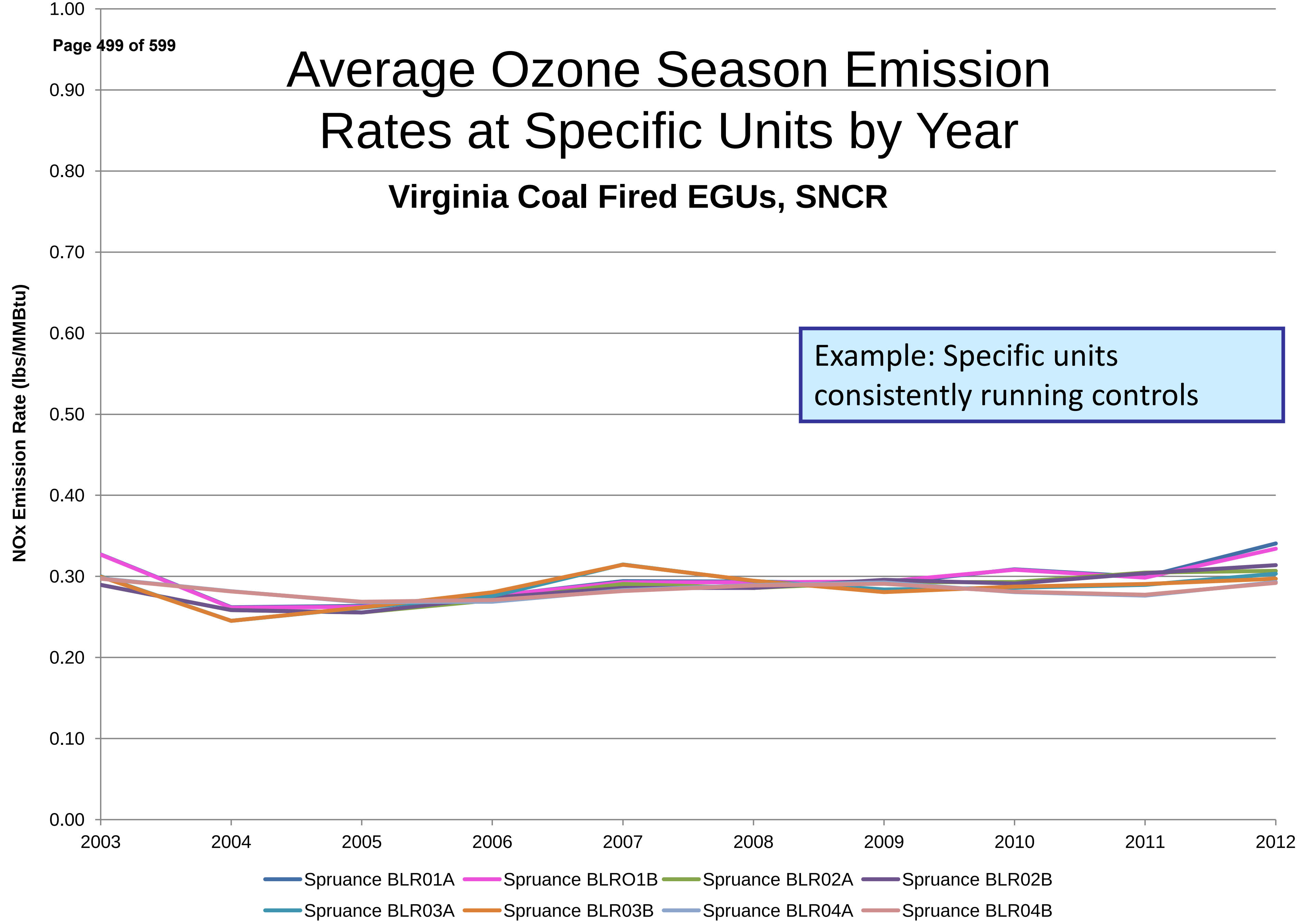

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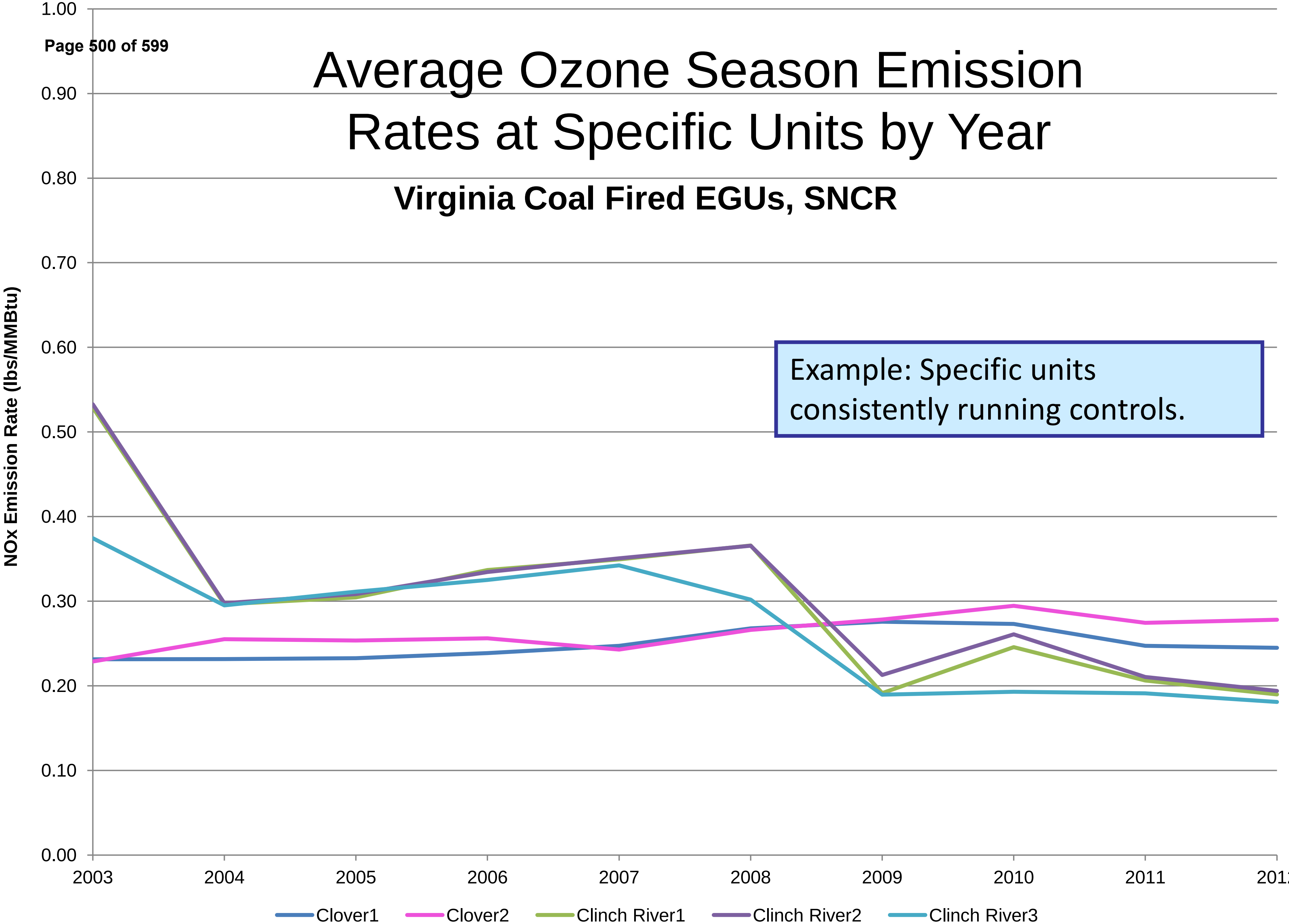

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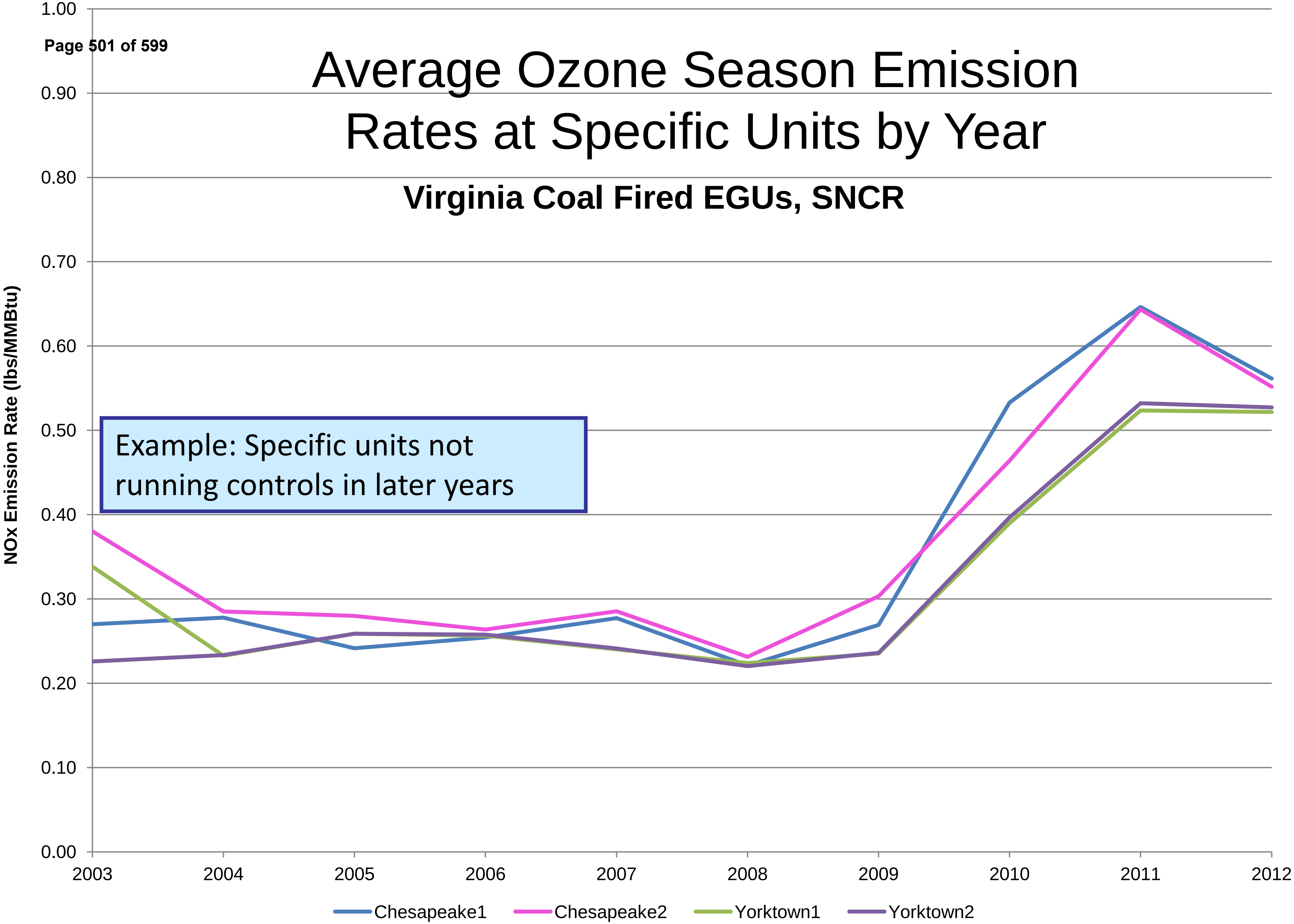
Average Ozone Season Emission Rates at Specific Units by Year



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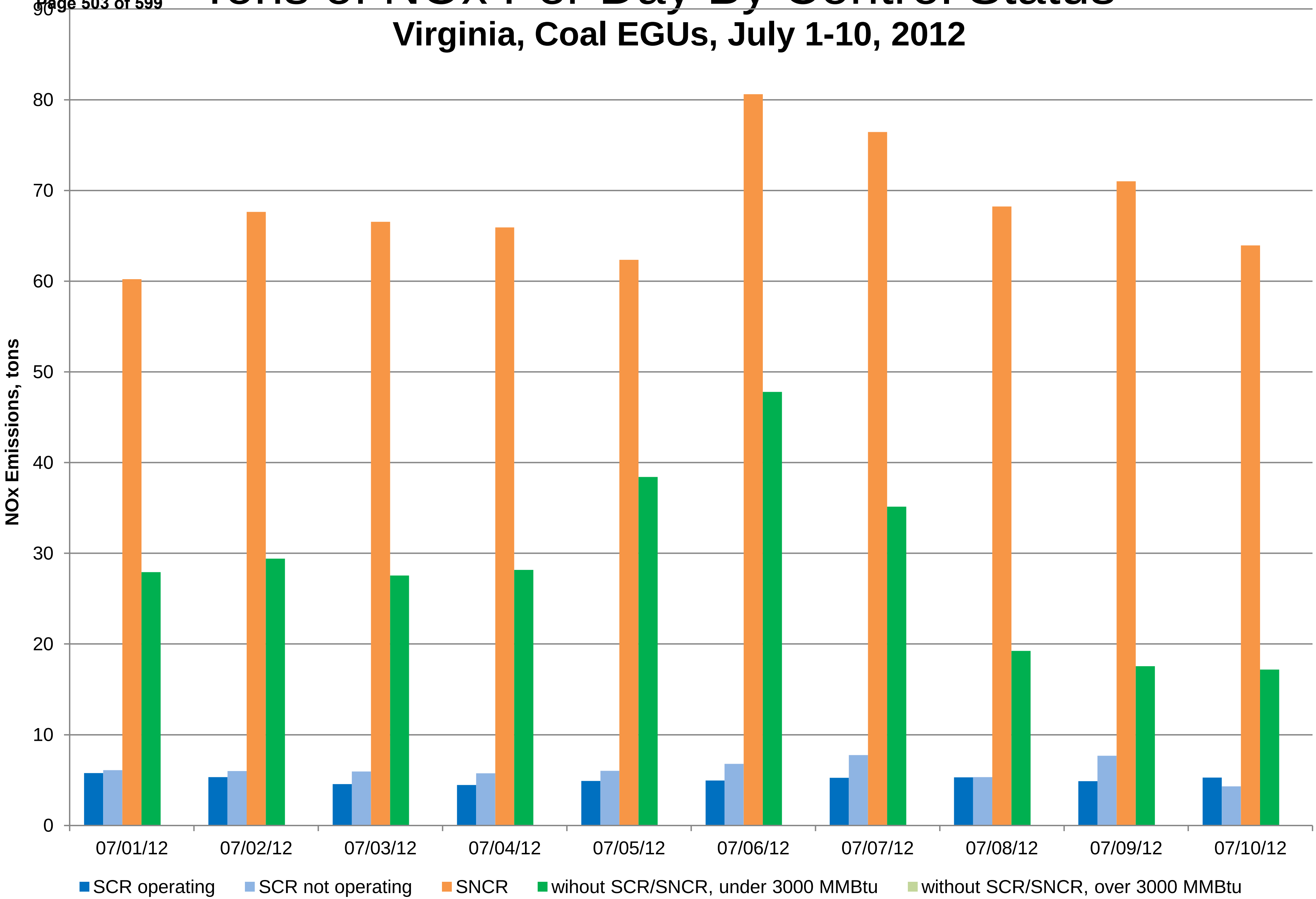
Part 3

July 1 to 10, 2012 Ozone Episode:

Analysis of Emissions and Controls

Tons of NOx Per Day By Control Status

Virginia, Coal EGUs, July 1-10, 2012



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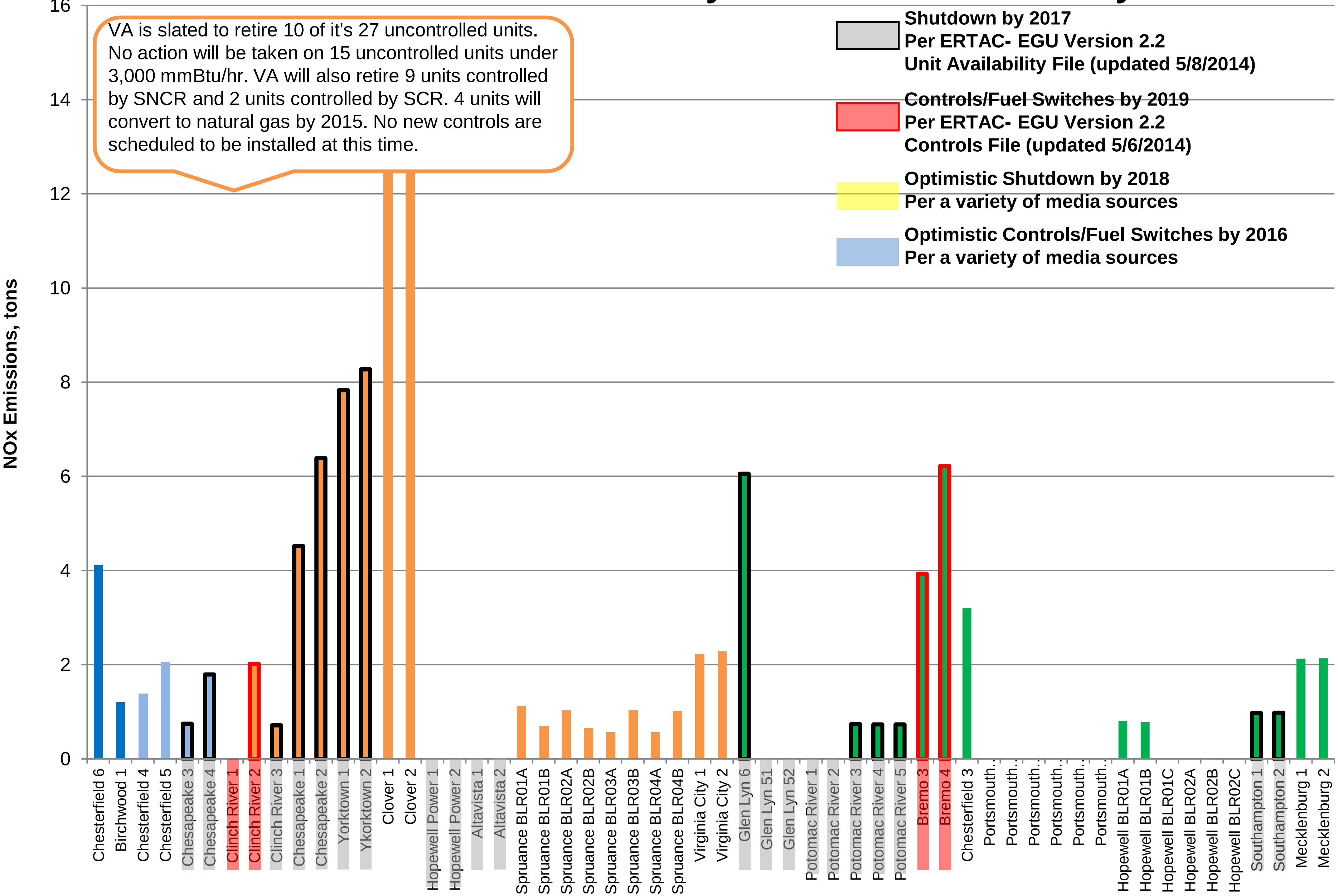
VA – Tons of NOx Per Unit By Control Status, July 2, 2012



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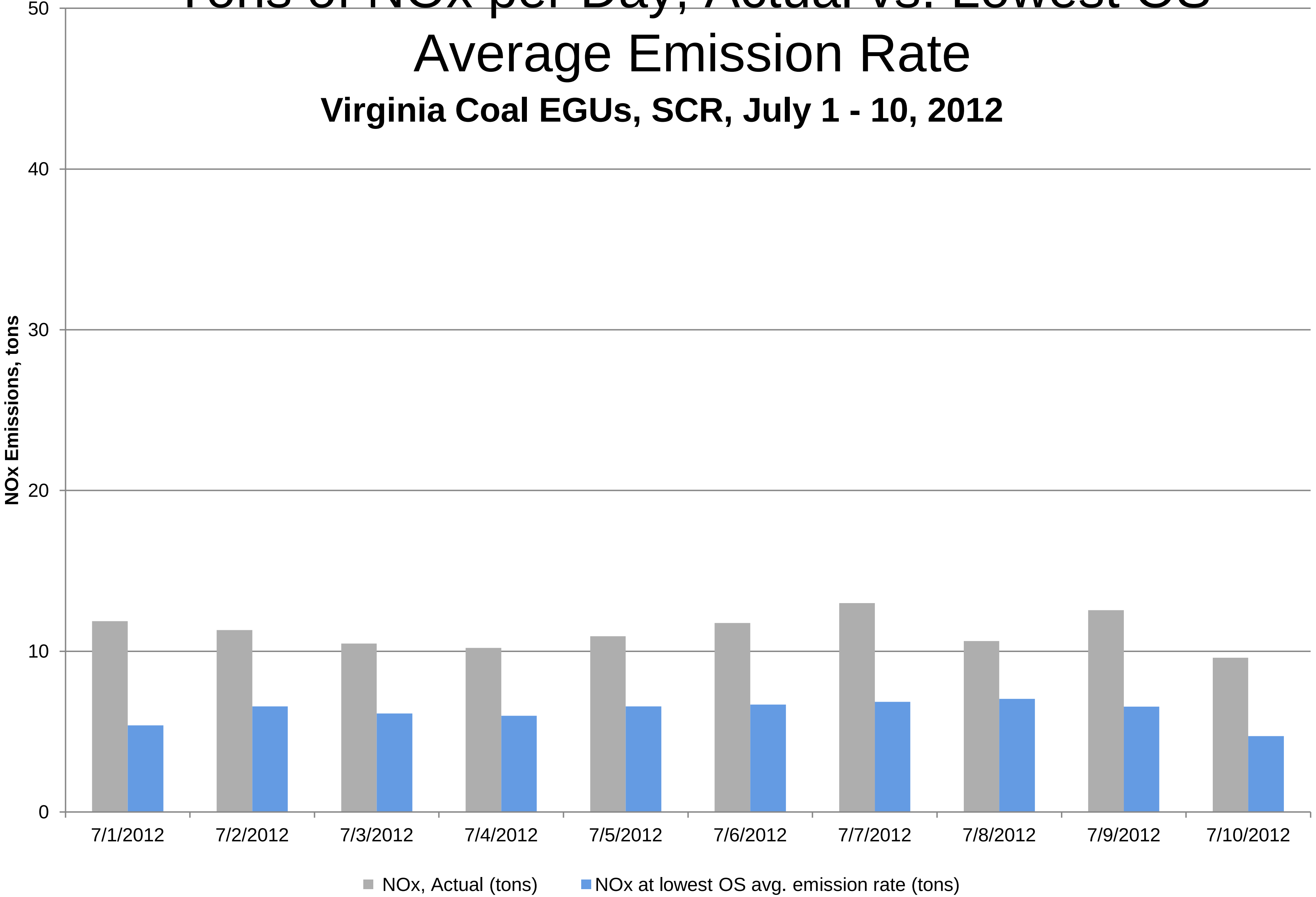
Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate

Virginia Coal EGUs, SCR, July 1 - 10, 2012



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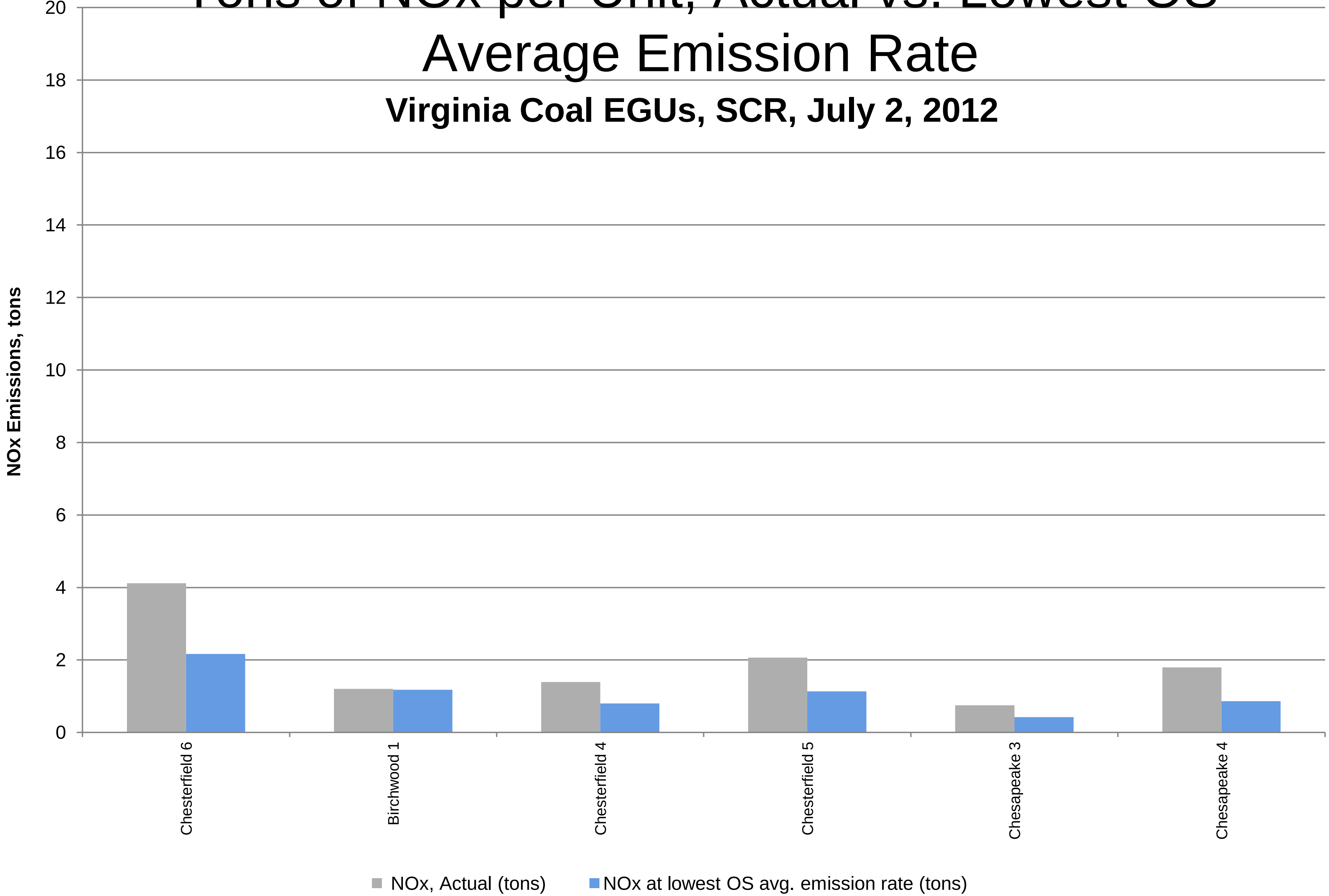
Tons of NOx per Unit, Actual vs. Lowest OS Average Emission Rate



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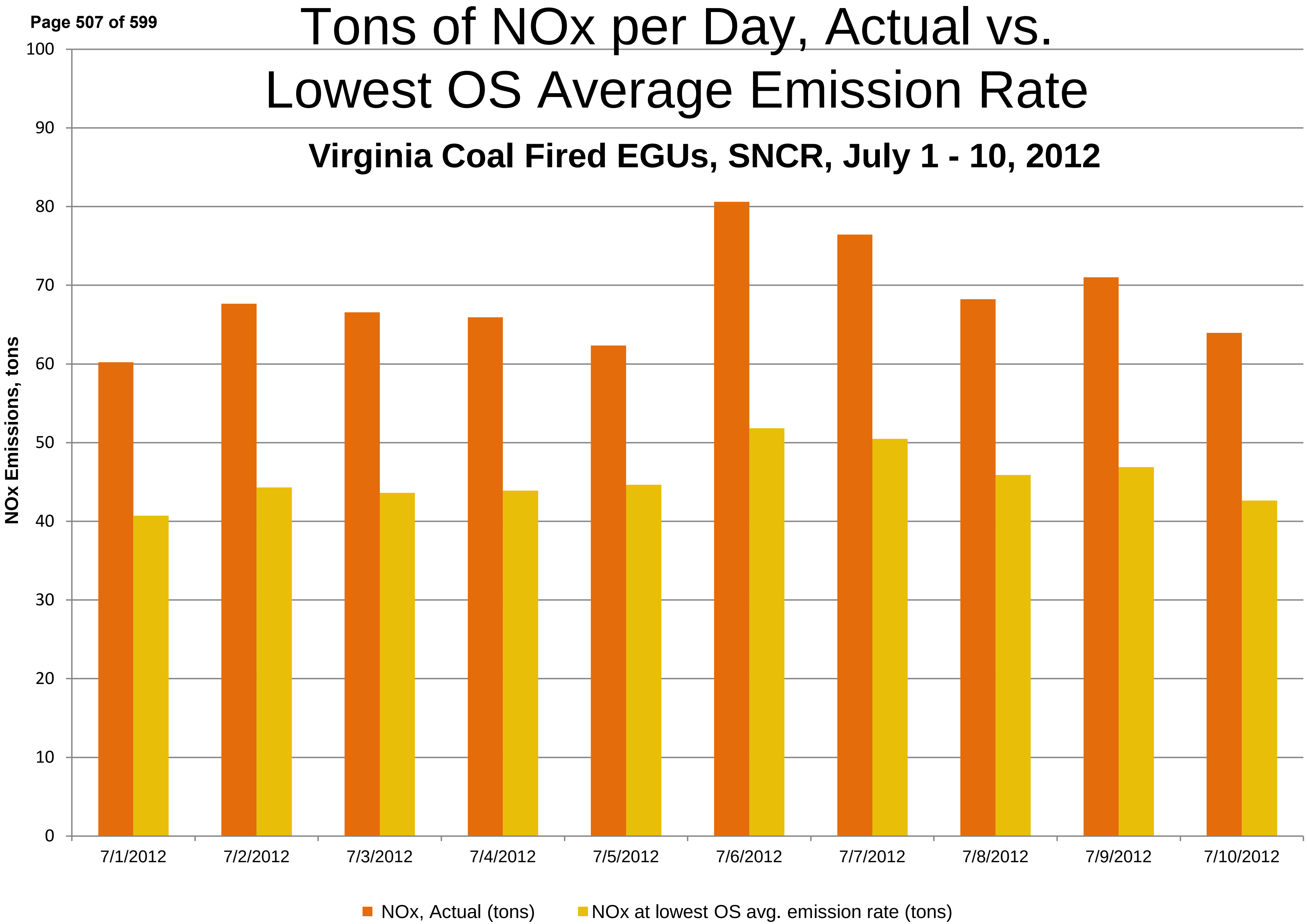

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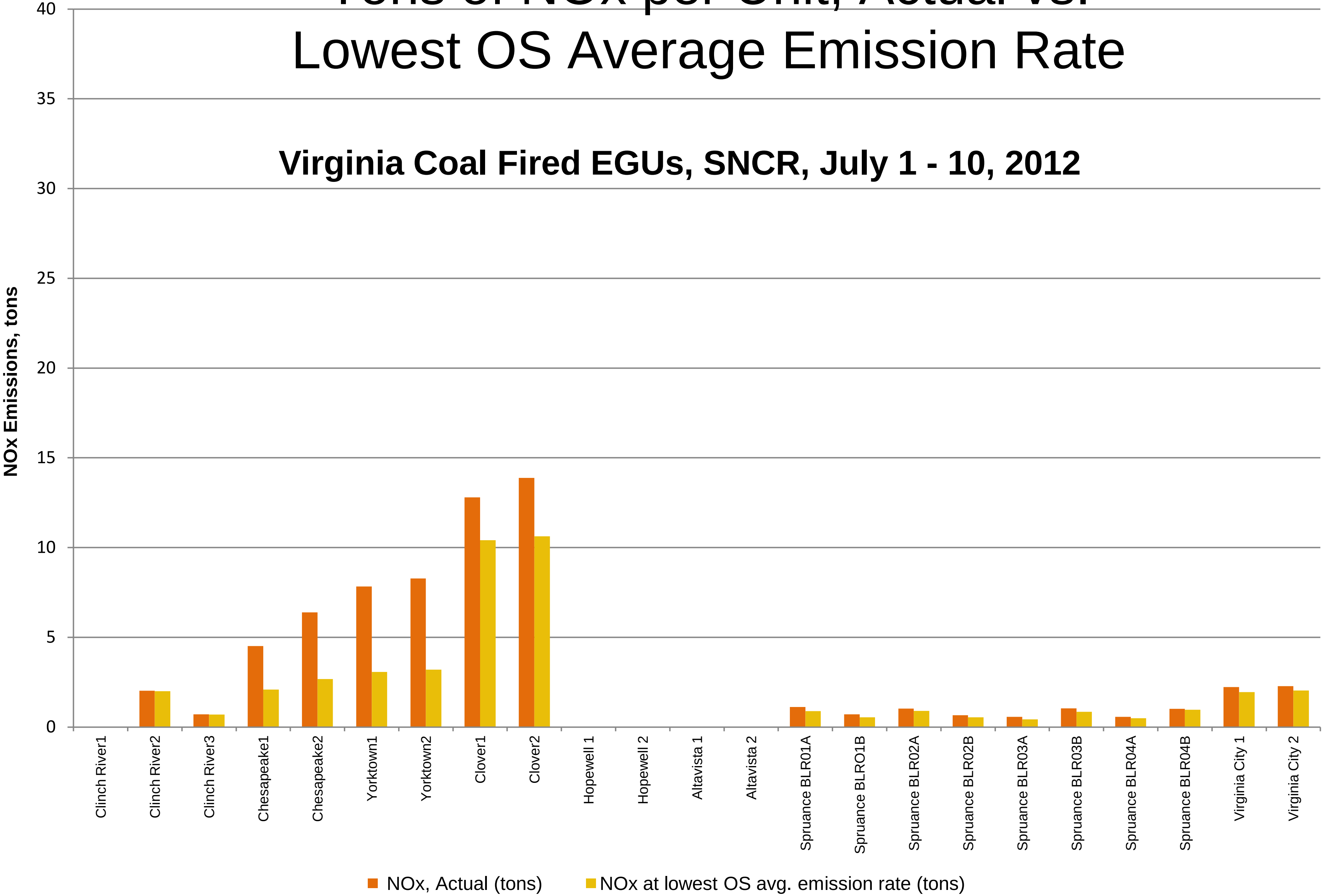
Tons of NOx per Unit, Actual vs. Lowest OS Average Emission Rate



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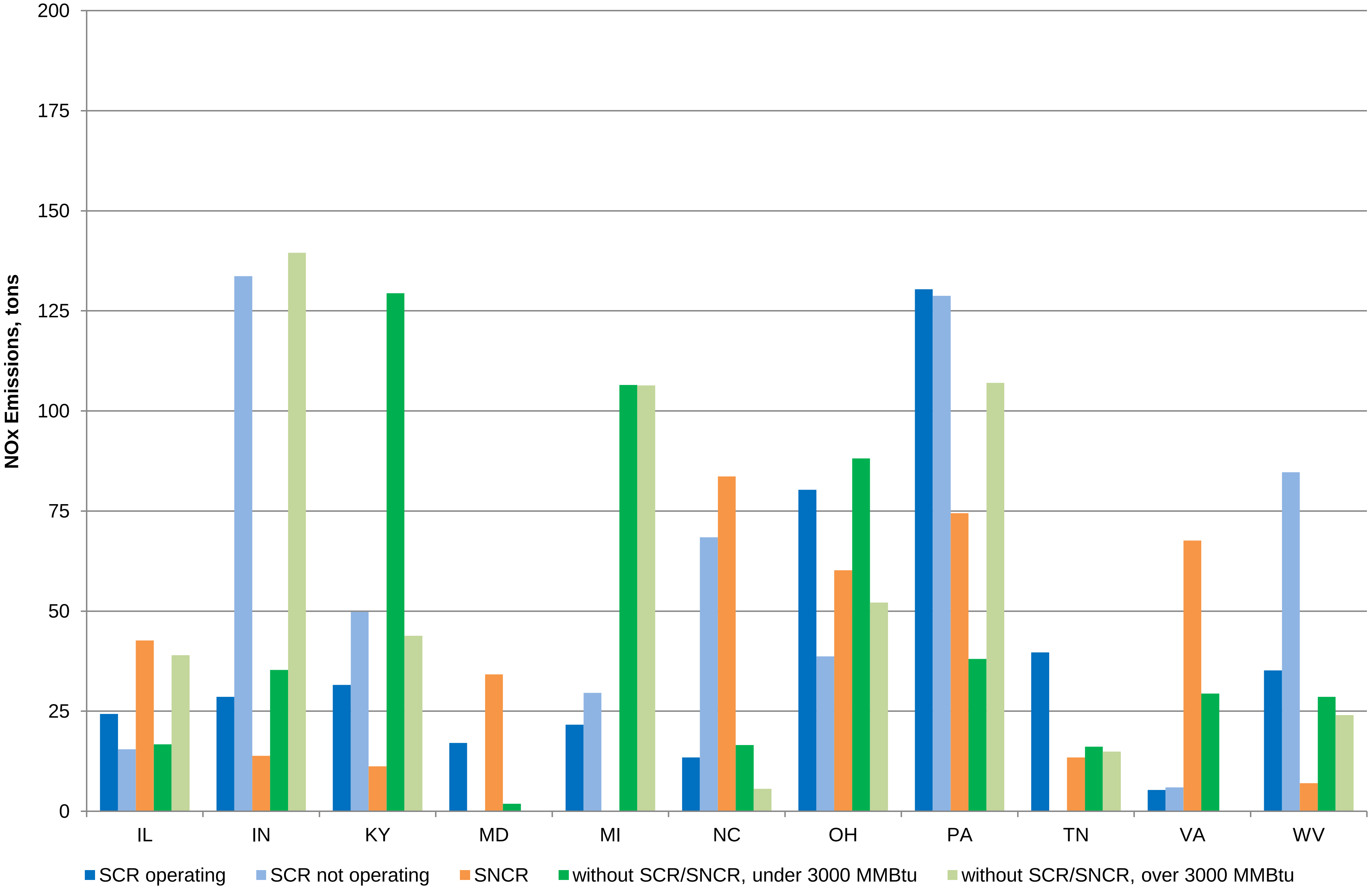
July 2, 2012 – Tons of NOx per State by Control Status



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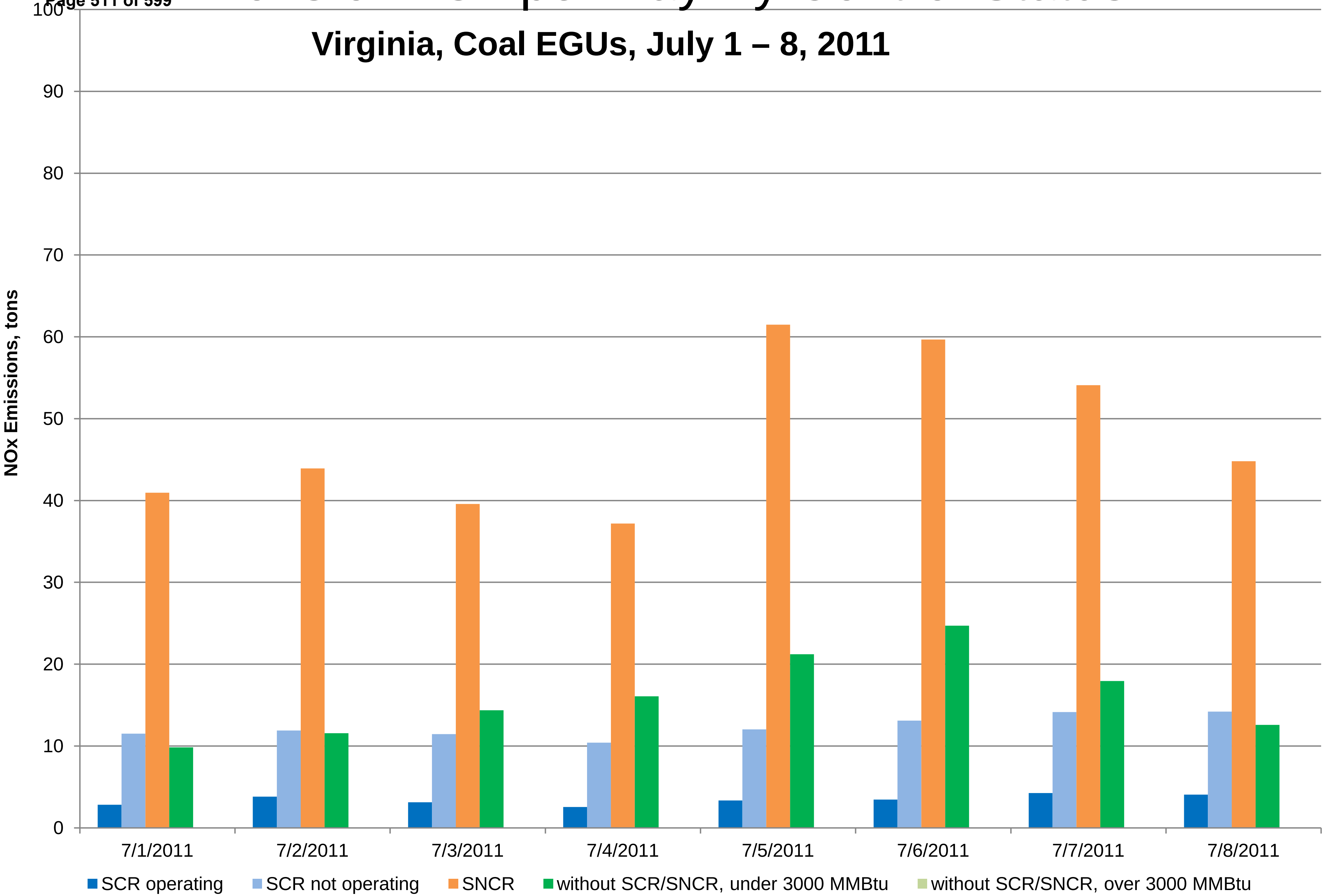
Part 4

July 1 to 8, 2011 Ozone Episode:

Analysis of Emissions and Controls

Tons of NOx per Day By Control Status



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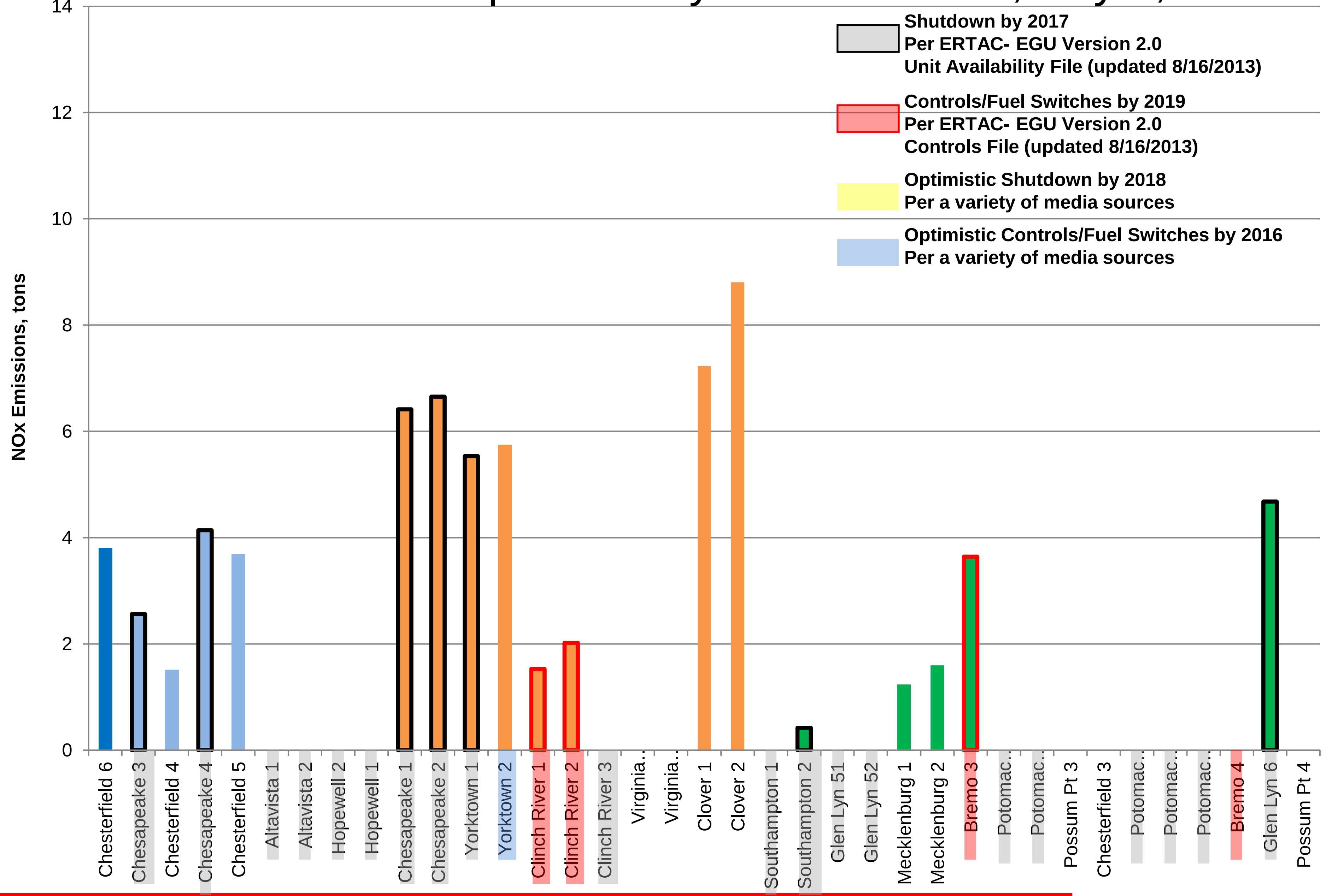
VA – Tons of NOx per Unit By Control Status, July 2, 2011



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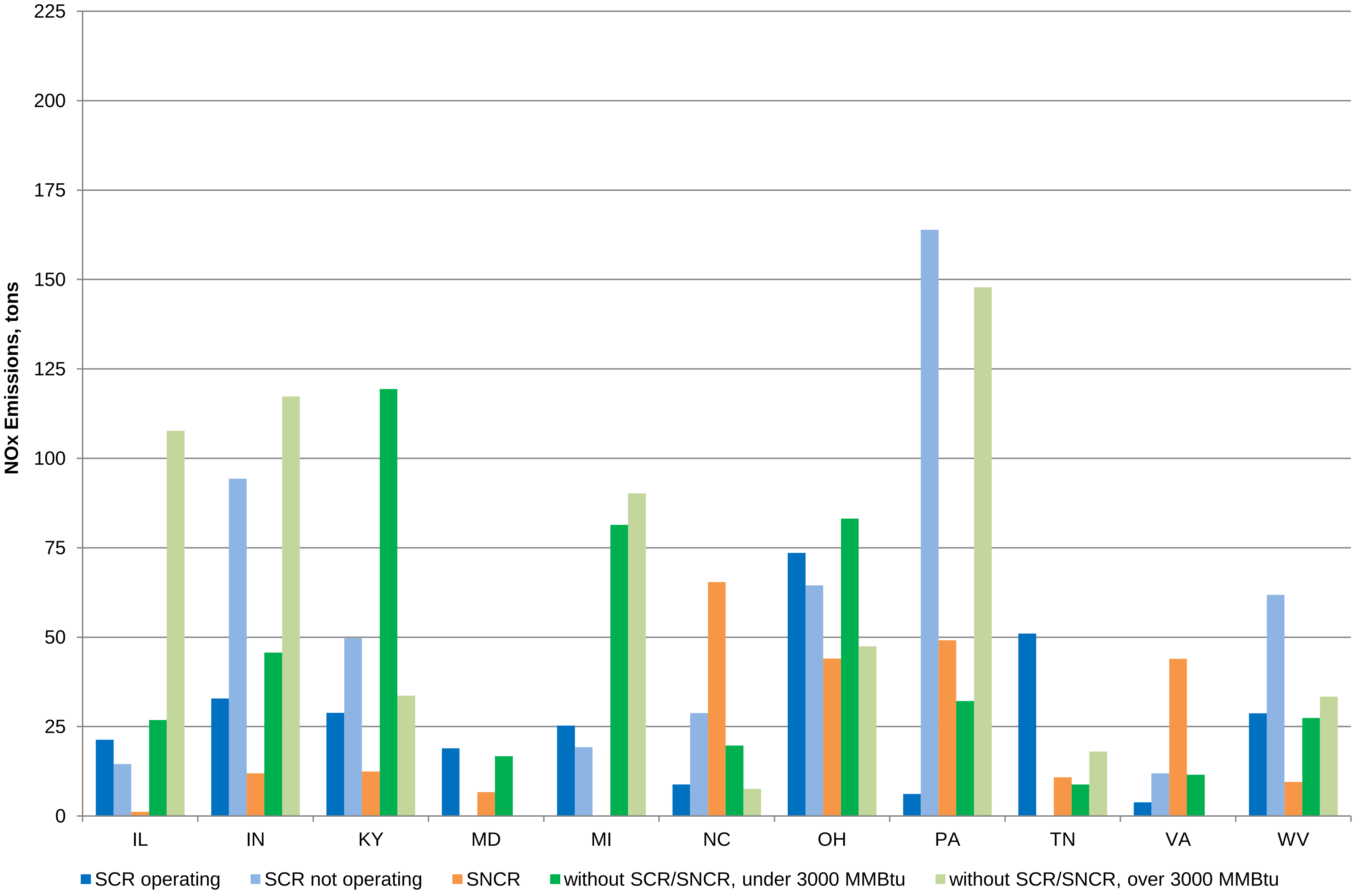
July 2, 2011 - Tons NOx per State by Control Status



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Part 5

11 State Totals

July 1 to 8, 2011 Ozone Episode:

Analysis of Emissions and Controls

11 Upwind States, 2012

- Total number of units = 1,432
- Total heat input capacity = 2,730,239 MMBtu/hr
  = 304,354 MW
- Total MW Capacity in %
  - **Total number of Coal units = 547 = 55%**
  - Total number of NG units = 672 = 25%
  - Total number of other (oil, etc.) units = 173 = 6%
  - Total number of Nuclear units = 40 = 14%
- **Total Capacity Coal = 165,910 MW**
  - 156 units with SCR = 88,783 MW = 53%
  - 114 units with SNCR = 27,561 MW = 17%
  - 277 units without SCR/SNCR = 49,566 MW = 30%

Basis – CAMD (as of 5/13/2014), NEI (for Nuclear), ERTAC (5/6/2014, 5/8/2014)

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11 Upwind States, 2018

- Total number of units = 1,199
- Total heat input capacity = 2,449,194 MMBtu/hr
  = 274,300 MW
- Total MW Capacity in %
  - **Total number of Coal units = 361 = 49%**
  - Total number of NG units = 686 = 32%
  - Total number of other (oil, etc.) units = 115 = 5%
  - Total number of Nuclear units = 37 = 14%
- **Total Capacity Coal = 134,121 MW**
  - 166 units with SCR = 93,776 MW = 70%
  - 60 units with SNCR = 17,868 MW = 13%
  - 135 units without SCR/SNCR = 22,477 MW = 17%

Basis – ERTAC (5/6/2014, 5/8/2014), NEI (for Nuclear)

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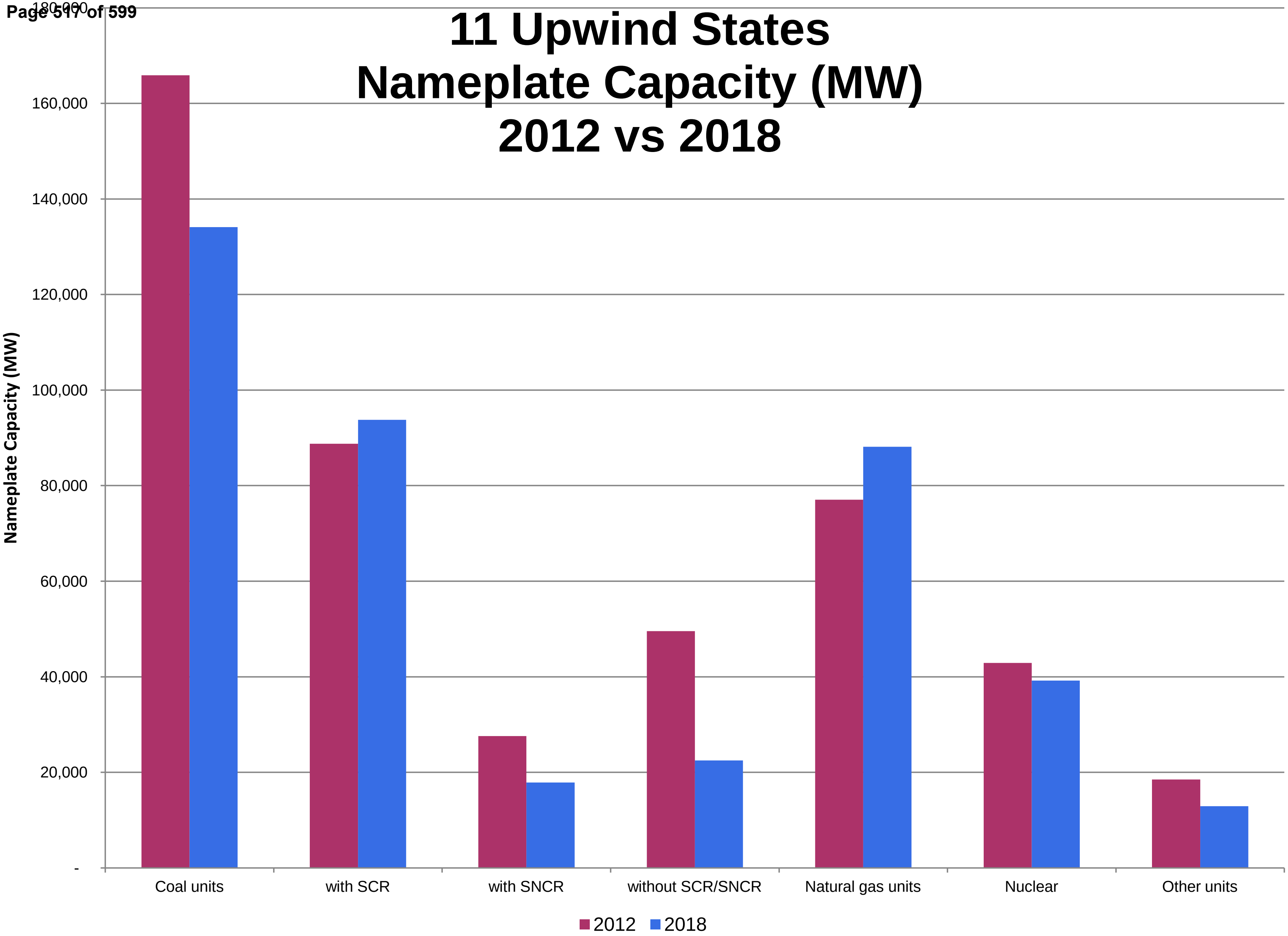
11 Upwind States
Nameplate Capacity (MW)
2012 vs 2018



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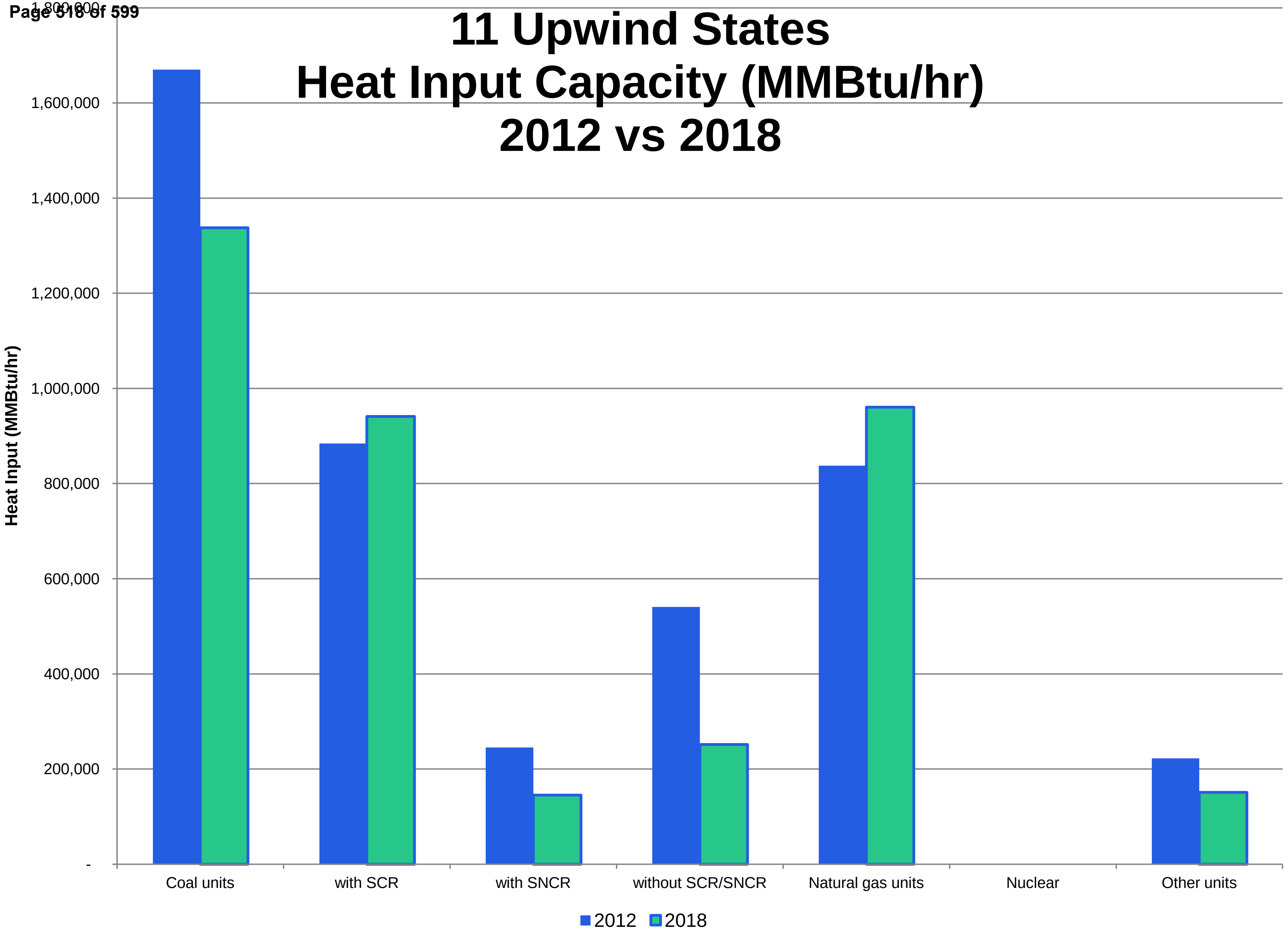
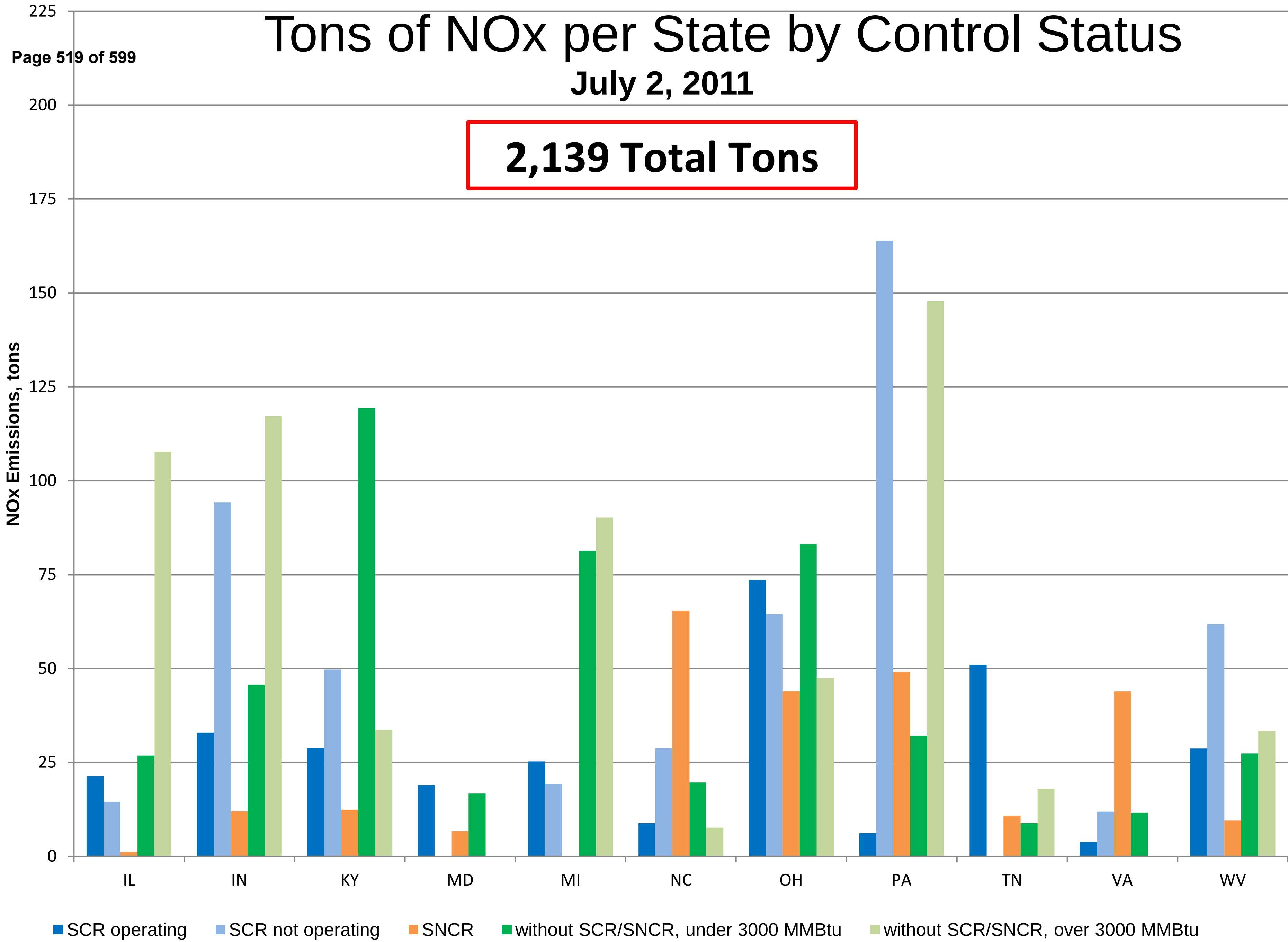


DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Tons of NOx per State by Control Status

July 2, 2011



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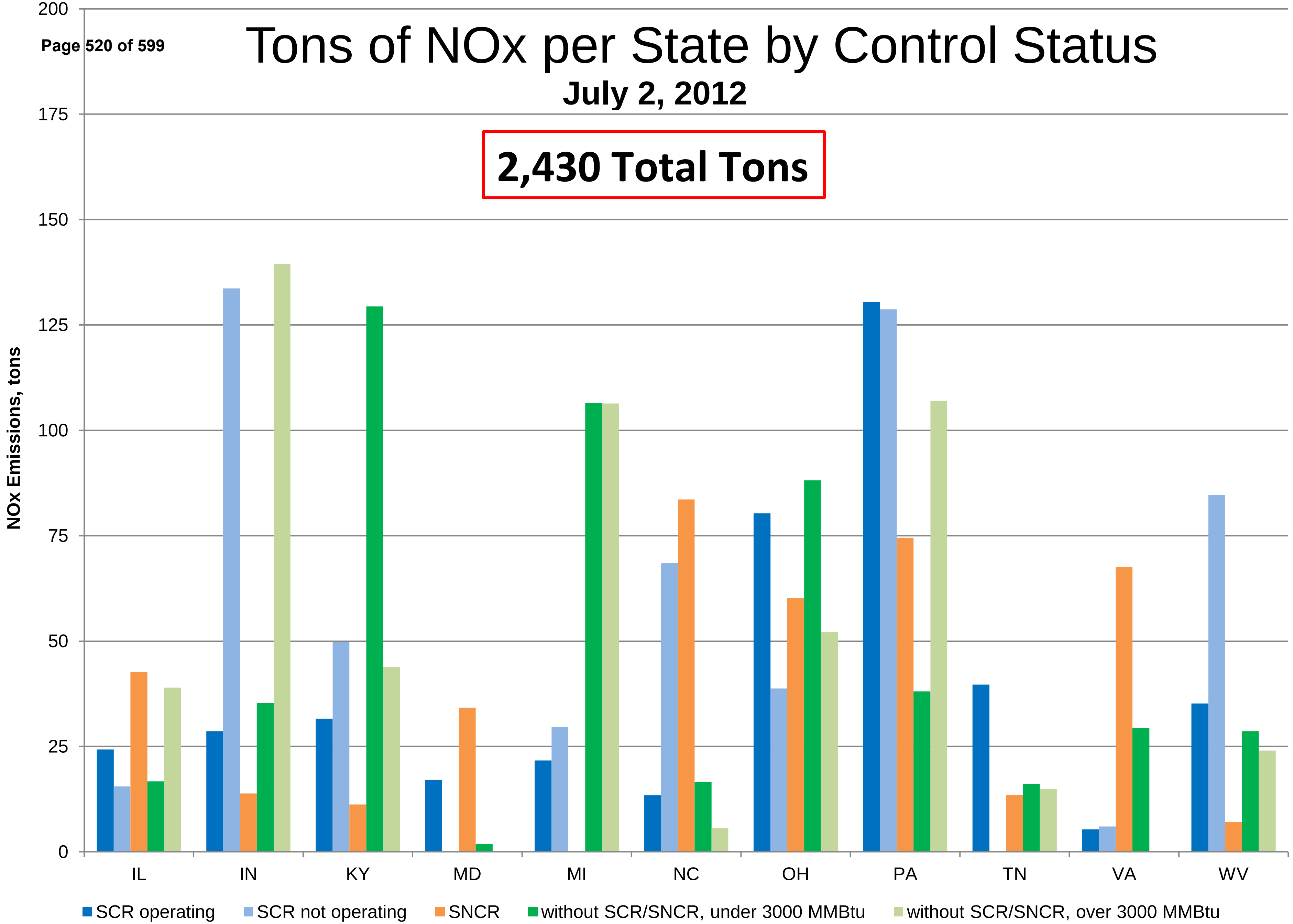
Tons of NOx per State by Control Status

July 2, 2012



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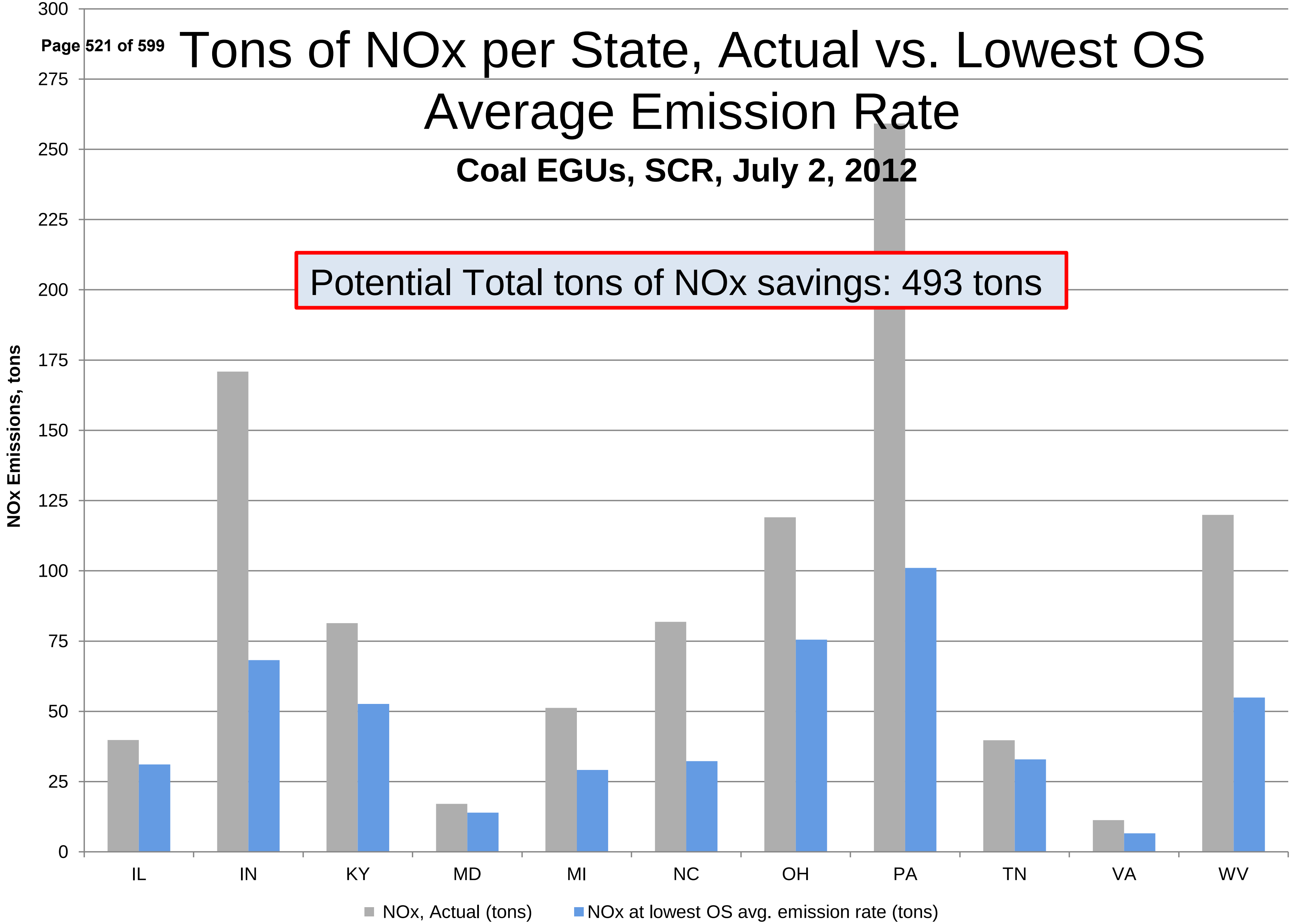
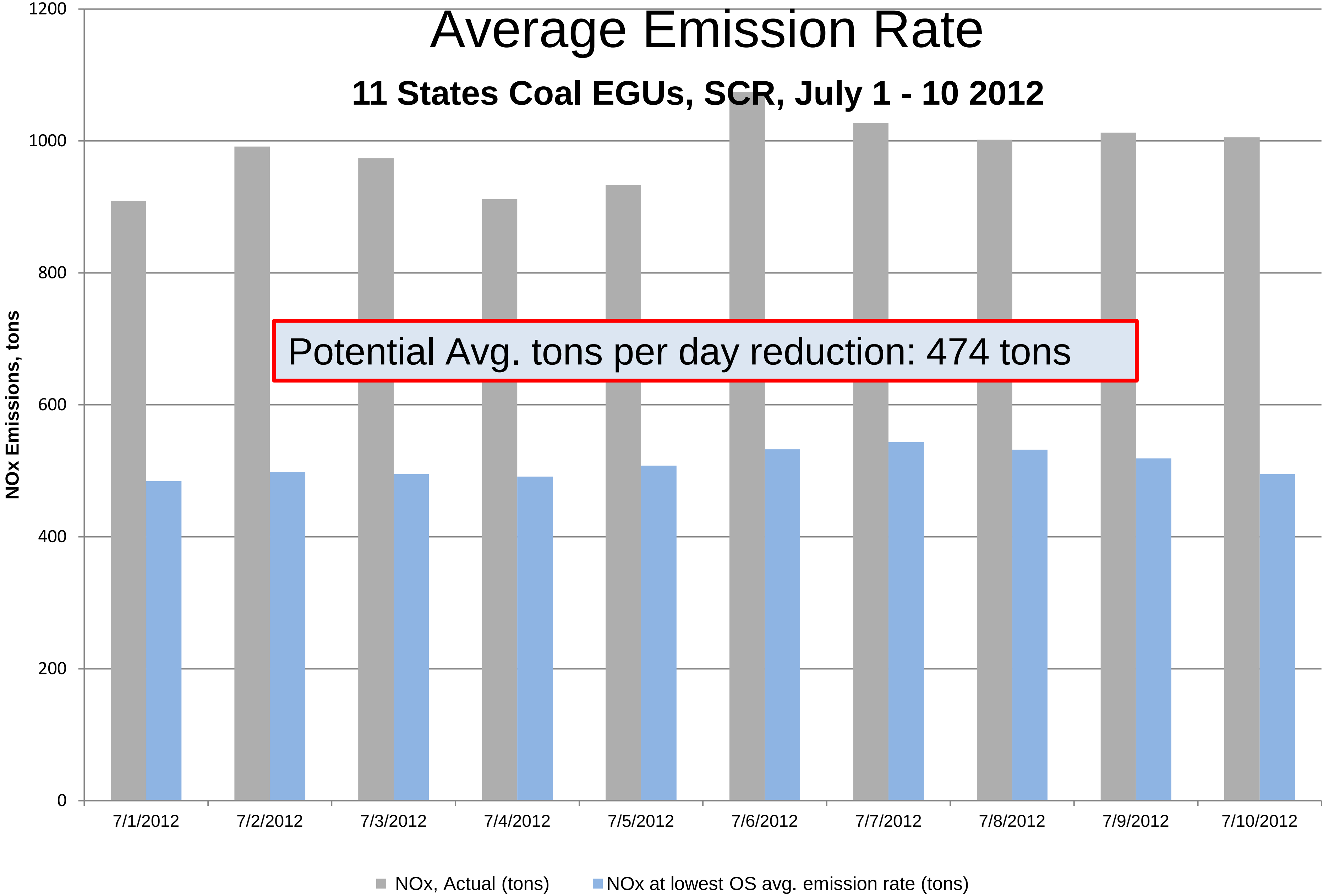


DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

11 State Summary

After performing similar analysis of EGUs in IL, IN, KY, MD, MI, NC, OH, PA, TN, VA and WV, the following potential total tons of lost NOx reductions was calculated:

- On July 2, 2012 actual NOx emissions in the 11 states (listed above) was 991 tons
  - If EGUs in those states were to have run their controls at the best rates observed in the data, emissions would have been 498 tons
  - This represents a single day loss of NOx reductions of 493 tons on that day
- During the 10 day episode between July 1 and 10, 2012 actual NOx emissions in the 11 states (listed above) was 9,840 tons
  - If EGUs in those states were to have run their controls at the best rates observed in the data, emissions would have been 5,099 tons
  - This represents a loss of NOx reductions of 4,741 tons over that 10-day episode

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Part 6

Potential Lost Ozone Benefits from Controls Running Less Effectively in Recent Years

Preliminary Photochemical Modeling

Virginia Monitors

How Might This Affect Ozone?

- Maryland has performed several very preliminary model runs to look at how much running EGU controls inefficiently might increase ozone levels
- Three runs:
  – Scenario 2B – A worst case run
    - Assumes SCR and SNCR controls are not run at all
  – Scenario 3B – A worst data run
    - Assumes SCR and SCR units all run at worst rates seen in CAMD data - 2005 to 2012
  – Scenario 3C – Based upon CAMD data analysis for EGU performance in 2011 and 2012
    - Assumes that units that had higher ozone season emission rates were operating at the best ozone season rates observed since 2005

Lost Ozone Benefits
Potential PPB Increases

Virginia Monitors	Potential Increased Ozone in 2018 – 3 EGU Control Scenarios		
County	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Alexandria City	4.1	0.9	0.5
Arlington	4.1	0.8	0.5
Caroline	5.1	1.9	0.8
Charles	5.2	2.9	1.9
Chesterfield	6.0	3.6	2.6
Fairfax	4.4	1.0	0.5
Fairfax	4.3	0.9	0.5
Fairfax	4.2	0.9	0.5
Fairfax	4.4	0.9	0.5
Fairfax	3.9	0.9	0.5
Fauquier	4.8	1.1	0.6
Frederick	5.4	1.2	0.7
Hampton City	2.2	0.4	0.2

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Lost Ozone Benefits
Potential PPB Increases

Virginia Monitors	Potential Increased Ozone in 2018 – 3 EGU Control Scenarios		
County	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Hanover	5.3	2.7	1.7
Henrico	6.2	3.7	2.5
Loudoun	3.9	0.9	0.5
Madison	8.6	1.8	1.1
Page	8.3	1.7	1.0
Prince William	3.8	0.8	0.5
Roanoke	4.6	1.0	0.6
Rockbridge	5.7	1.4	0.7
Rockingham	8.2	1.8	1.2
Stafford	4.4	1.2	0.6
Suffolk City	2.2	0.4	0.2
Suffolk City	3.5	0.8	0.5
Wythe	4.5	0.9	0.5

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Lost Ozone Benefit – 2018 Design Values

… EPA will propose a new ozone standard soon … 60 to 70 ppb range … designations to most likely be based upon 2014 to 2016 or 2015 to 2017 data

Projected to be Clean in 2018 … Potentially at Risk		Increased Ozone in 2018 – 3 EGU Control Scenarios		
Virginia Counties	**2018 – Controls Running Well (Scenario 3A)**	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Alexandria City	64.0	68.1	64.9	64.5
Arlington	68.6	72.7	69.5	69.1
Caroline	62.3	67.4	64.1	63.0
Charles	68.3	73.5	71.1	70.2
Chesterfield	64.4	70.4	68.0	66.9
Fairfax	68.5	72.9	69.5	69.0
Fairfax	67.3	71.7	68.3	67.8
Fairfax	65.7	69.9	66.6	66.2
Fairfax	65.8	70.2	66.7	66.4
Fairfax	60.8	64.7	61.7	61.3
Fauquier	57.4	62.2	58.6	58.0
Frederick	60.4	65.8	61.6	61.1
Hampton City	64.0	66.2	64.4	64.2

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Lost Ozone Benefit – 2018 Design Values

… EPA will propose a new ozone standard soon … 60 to 70 ppb range … designations to most likely be based upon 2014 to 2016 or 2015 to 2017 data

Projected to be Clean in 2018 … Potentially at Risk		Increased Ozone in 2018 – 3 EGU Control Scenarios		
Virginia Counties	**2018 – Controls Running Well (Scenario 3A)**	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Hanover	64.6	69.8	67.2	66.3
Henrico	68.4	74.7	72.1	71.0
Loudoun	65.2	69.1	66.0	65.7
Madison	61.0	69.6	62.8	62.1
Page	57.5	65.9	59.2	58.5
Prince William	60.6	64.4	61.4	61.1
Roanoke	57.7	62.2	58.7	58.2
Rockbridge	50.6	56.4	52.0	51.4
Rockingham	53.7	61.9	55.6	54.9
Stafford	61.5	65.9	62.7	62.1
Suffolk City	63.2	65.4	63.6	63.4
Suffolk City	60.2	63.7	61.0	60.7
Wythe	56.7	61.2	57.6	57.2

DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

EGU Data Package #3

Operation of Existing SCR, SNCR

West Virginia

Sample of draft data and analyses developed by the Maryland Department of the Environment

Contact: Tad Aburn, Air Director, MDE
(410) 537-3255

September 18, 2014

Purpose

- Maryland is the only Moderate nonattainment area in the East for the 75 ppb ozone standard.
  - This means that Maryland is the only state required to submit an attainment SIP
  - Only state required to perform attainment modeling.
- We are now beginning to build our “SIP Quality” modeling platform.
- One major issue that our data analyses have uncovered is that many EGU units appear to not be running their control equipment in recent years as efficiently as they have demonstrated they can do in earlier years. This issue is driven by recent changes in the energy market, reduced coal capacity, inexpensive allowances and a regulatory structure driven by ozone season caps not daily performance. In many states, including Maryland, this has lead to controls not always being used efficiently on the days when they are needed the most … this is perfectly legal.
- This is a critical issue that we would like to continue to discuss with you. There appears to be an interest from the private sector to discuss this issue and see if a common sense fix can be designed. Maryland believes this fix would be relatively cost-effective compared to the capital cost of the control technologies.
- MDE has focused our analyses on two of the worst large, regional scale ozone episodes from recent years: July 1-8, 2011 and July 1-10, 2012.
- The primary data used in these analyses include:
  - CEMS data from CAMD
  - Emissions and projection data from ERTAC
  - Other data we have received from individual states
- More detailed data and analyses and spreadsheets are available upon request.

How the Data Analyses Were Built

- Maryland began the data analyses in late 2012
  - Looked at EGUs in the 9 upwind states named in the 176A Petition (IL, IN, KY, MI, NC, OH, TN, VA, WV) … MD and PA
- Shared a draft package with Air Directors on April 21, 2014
  - This package focused on a bad ozone episode: July 1 – 8, 2011
- Shared a second draft package with Air Directors on May 13, 2014
  - This package focused on second bad ozone episode: July 1 – 10, 2012
  - This package also included update to specific material after receiving comments from numerous states
- The 2011 and 2012 episodes analyzed capture two of the worst regional ozone periods in 2011 and 2012
  - Other states, like Wisconsin and Delaware have done similar analyses and reached similar conclusions
- This is the third draft package, and builds on to the prior two draft packages, while incorporating input from individual states and updates to ERTAC.
- This third draft package also includes preliminary photochemical modeling performed by MDE to look at the potential loss of ozone reduction benefits.

Help Us QA the Data

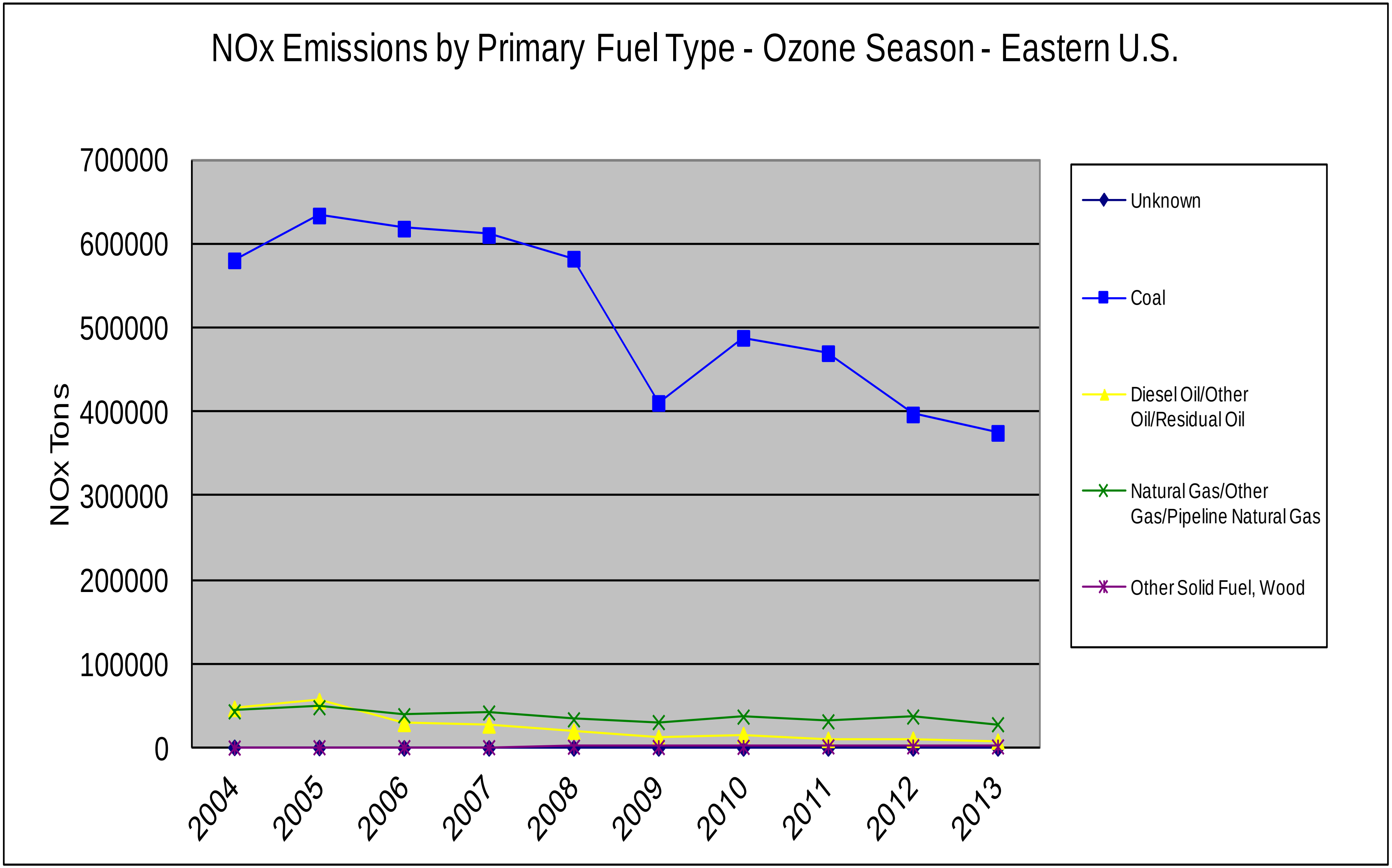
- We have used readily available data, like the CAMD and ERTAC data, but we recognize that these data sources can be out of date, or not include recent changes.
  - We hope you can help us with making sure we have the best possible data.

- This package reflects recently updated data, including but not limited to:
  - CAMD updates
  - May 8, 2014 ERTAC updates
  - PA comments to OTC, forwarded to MDE, Spreadsheets detailing "EGU Shutdowns, EGU Controls and New Natural Gas Power Projects" for the state of PA. Sent from Randy Bordner, Environmental Group Manager - Bureau of Air Quality, PA Department of Environmental Protection to Andy Bodnarik, OTC. Received as FWD from Andy Bodnarik on 4/23/2014
  - VA comments to MDE, "Electric Generation Sector Summary for Virginia" received from Thomas R. Ballou, Director - Office of Air Data Analysis and Planning, VA Department of Environmental Quality on 5/12/2014

Part 1

Background:
Generation in 2012 and 2018
Projected Changes

Why Coal?



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

West Virginia EGUs, 2012

- Total number of units = 60
- Total heat input capacity = 171,721MMBtu/hr = 17,310 MW
- Total State MW Capacity in %
  - **Total number of Coal units = 35 = 88%**
  - Total number of NG units = 20 = 9%
  - Total number of other (oil, etc.) units = 5 = 3%
  - Total number of Nuclear units = 0 = 0%
- **Total Capacity Coal = 15,213 MW**
  - 15 units with SCR = 11,478 MW = 76%
  - 4 units with SNCR = 495 MW = 3%
  - 16 units without SCR/SNCR = 3,240 MW = 21%

Basis – CAMD (as of 5/13/2014), NEI (for Nuclear), ERTAC (5/6/2014, 5/8/2014)

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Capacity and Fuel: 2012 to 2018

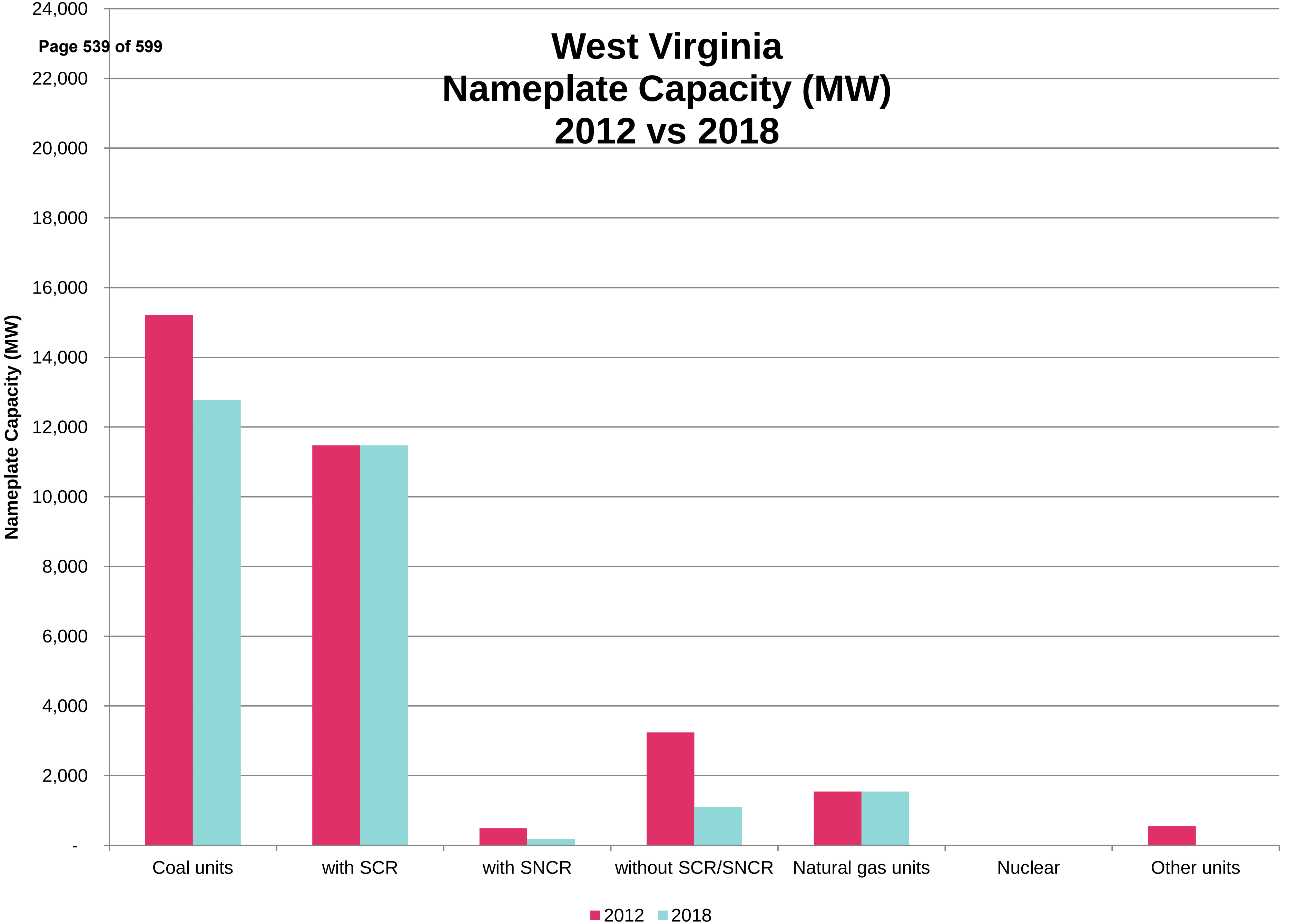
A detailed review of ERTAC data for 2018 was completed, and an evaluation of the following characteristics performed.

- ❖ Total Number of units
- ❖ Heat input capacity - MMBtu/hr
- ❖ Nameplate capacity – MW
- ❖ Presence of advanced post combustion controls – SCR, SNCR
- ❖ Fuel switching
- ❖ Shutdown, retirements

West Virginia EGUs, 2018

- Total number of units = 39
- Total heat input capacity = 142,376 MMBtu/hr = 14,323 MW
- Total State MW Capacity in %
  - **Total number of Coal units = 19 = 89%**
  - Total number of NG units = 20 = 11%
  - Total number of other (oil, etc.) units = 0 = 0%
  - Total number of Nuclear units = 0 = 0%
- **Total Capacity Coal = 12,776 MW**
  - 15 units with SCR = 11,478 MW = 90%
  - 2 units with SNCR = 191 MW = 2%
  - 2 units without SCR/SNCR = 1,107 MW = 8%

Basis – ERTAC (5/6/2014, 5/8/2014), NEI (for Nuclear)



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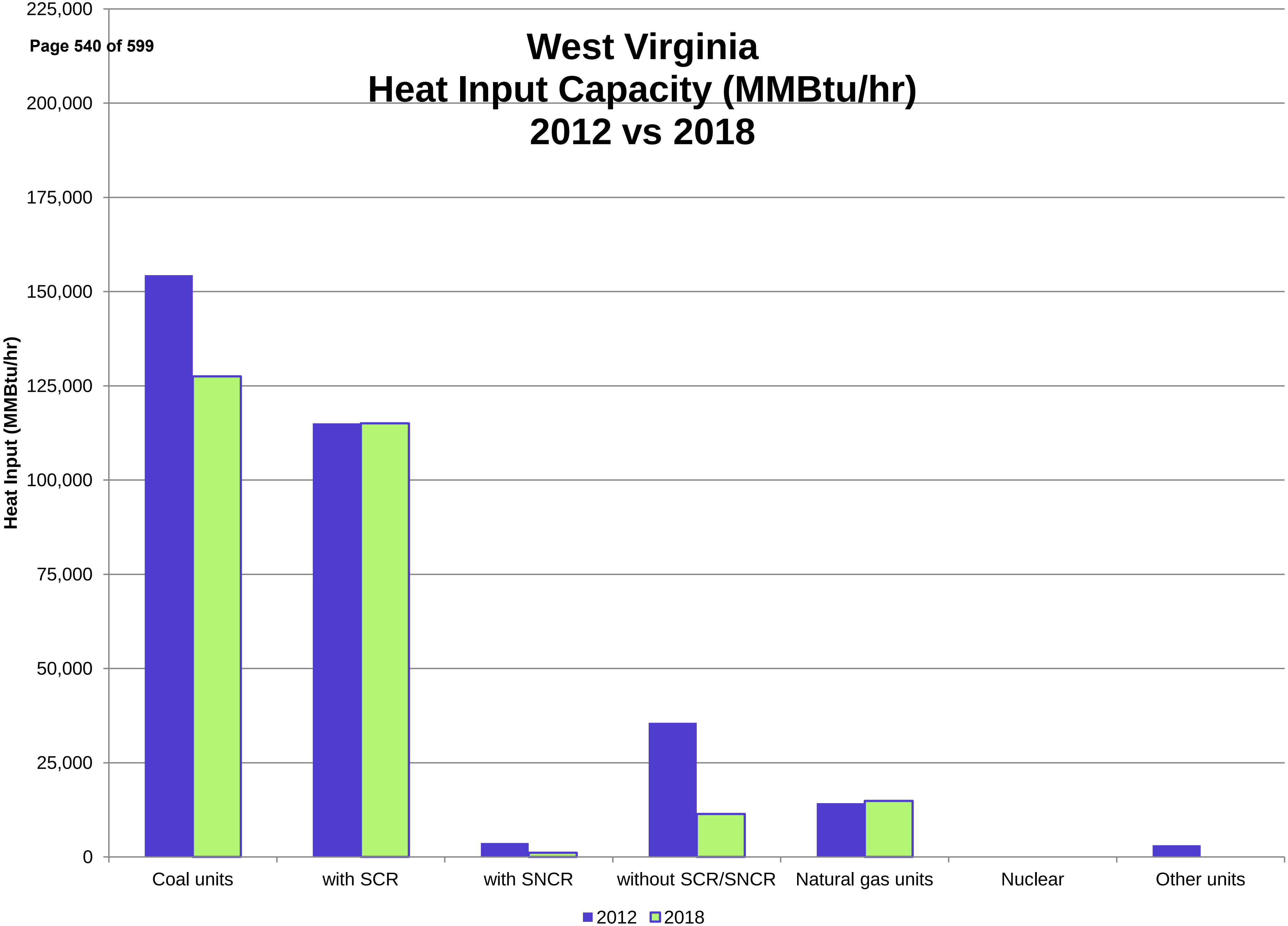

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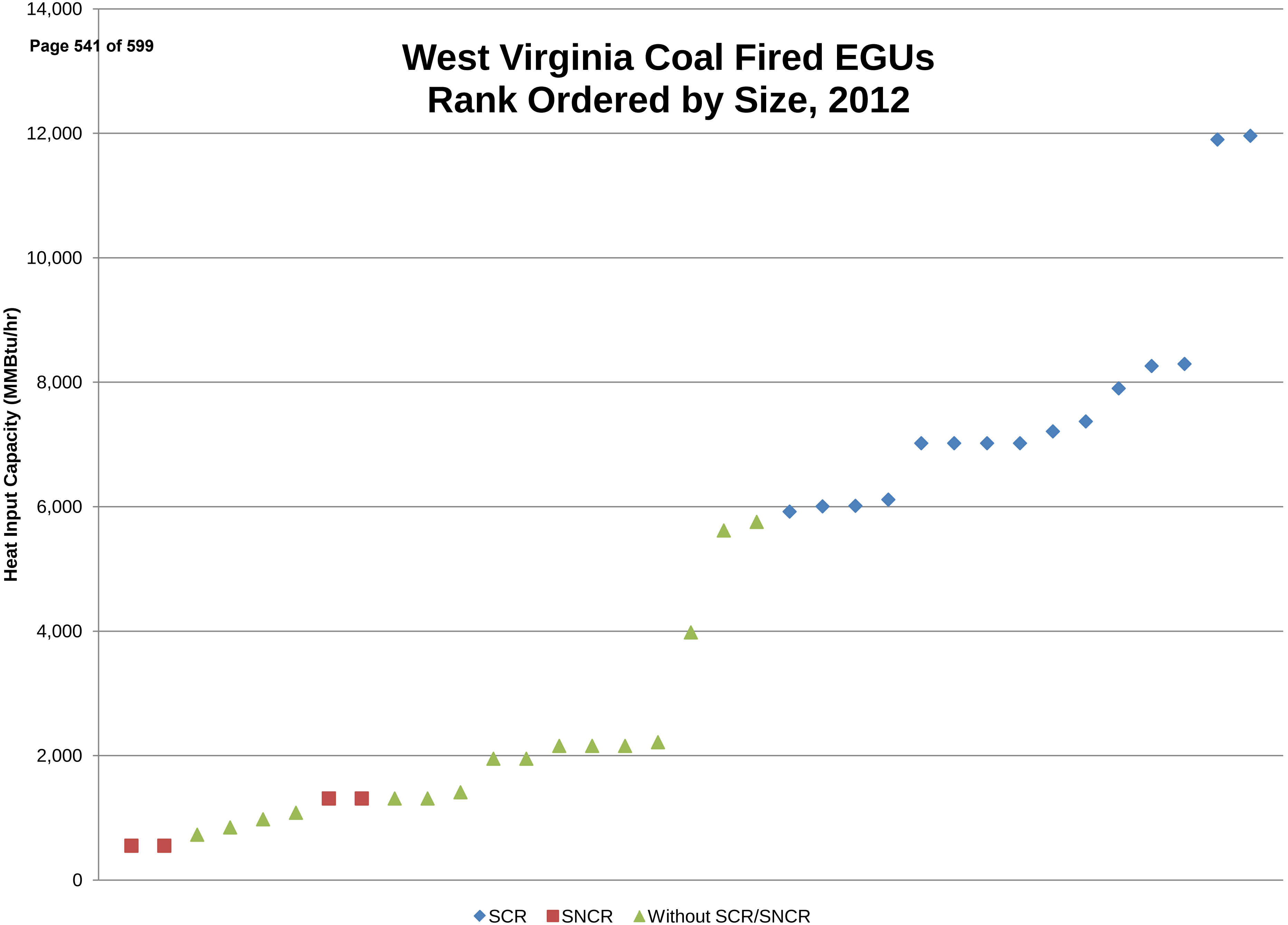
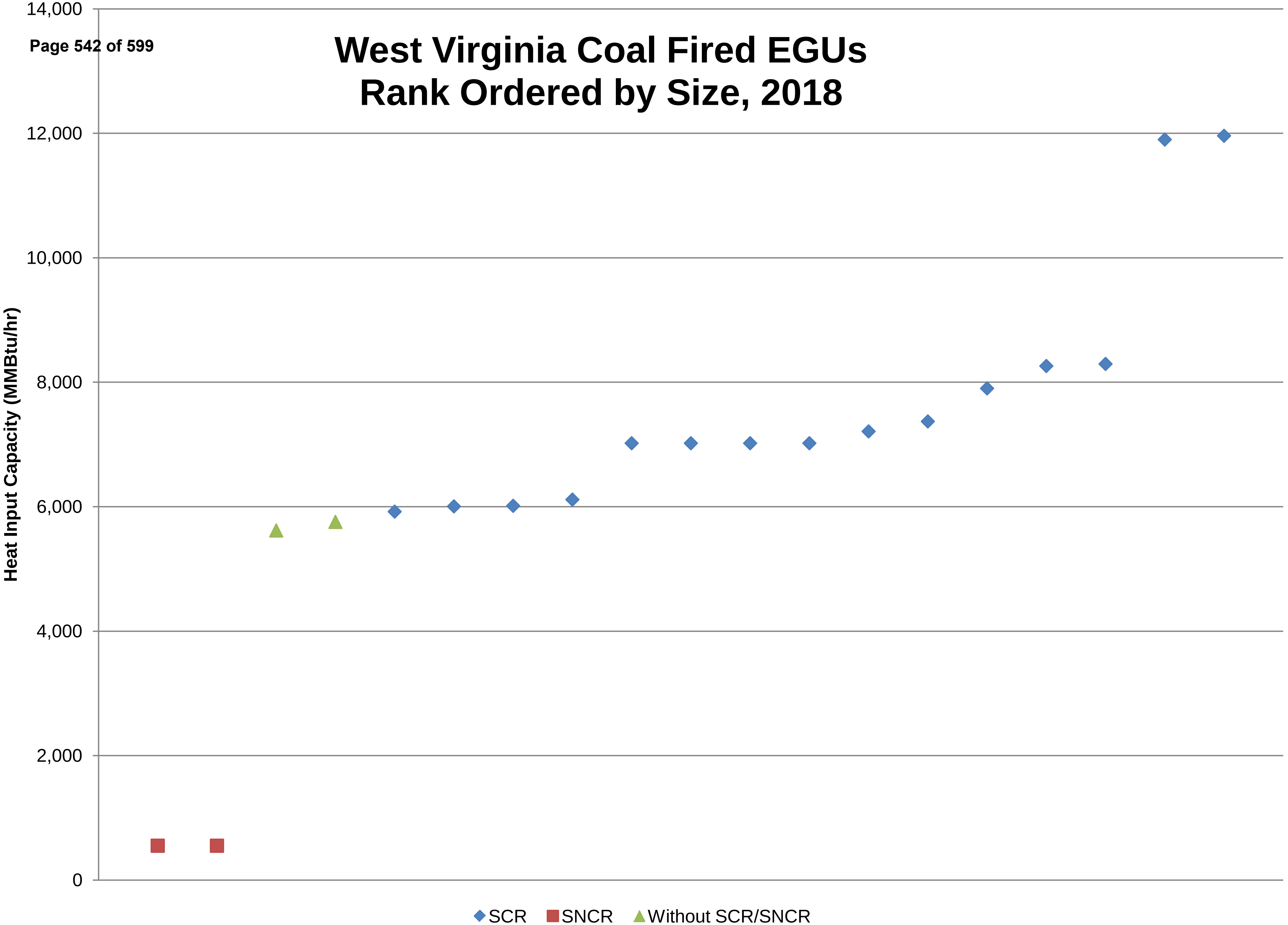


DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

West Virginia Coal Fired EGUs
Rank Ordered by Size, 2018



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

WV: Large (> 3000 MMBtu/hr) Coal-Fired EGU NOx Emissions Rate Analysis

	Facility Name	Unit ID	Lowest OS Emission Rate Year	Lowest OS Emission Rate (lbs/MMBtu)	2007 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2007 OS ER (% Change)	2011 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2011 OS ER (% Change)	Comments/ ERTAC Closure Date
Controlled with SCR	Harrison Power Station	1	2005	0.0634	0.0683	8	0.1951	208	
	Harrison Power Station	2	2005	0.0662	0.0906	37	0.2062	211	
	Harrison Power Station	3	2005	0.0658	0.0723	10	0.2149	227	
	John E Amos	1	2006	0.0317	0.0489	54	0.0538	70	
	John E Amos	2	2006	0.0312	0.0520	67	0.0504	62	
	John E Amos	3	2012	0.0614	0.1251	104	0.0724	18	
	Longview Power	1	2012	0.0681	Not Operating	N/A	Not Operating	N/A	New 2012
	Mitchell (WV)	1	2009; 2010	0.0547	0.1077	97	0.0644	18	
	Mitchell (WV)	2	2008	0.052	0.096	85	0.0523	1	
	Mount Storm	1	2006	0.0539	0.0742	38	0.0806	50	
	Mount Storm	2	2006	0.0485	0.0545	12	0.0811	67	
	Mount Storm	3	2006	0.0768	0.0894	16	0.0859	12	
	Mountaineer	1	2007	0.0387	0.0387	0	0.0566	46	
	Pleasants Power Station	1	2005	0.0394	0.0677	72	0.1386	252	
	Pleasants Power Station	2	2005	0.039	0.0505	29	0.1279	228	
Controlled with SNCR	N/A								
No Controls or Fuel Switches by 2019	Fort Martin Power Station	1	2005	0.2352	0.2636	12	0.3514	49	
	Fort Martin Power Station	2	2006	0.2347	0.2561	9	0.3042	30	
Retiring by 2017	Albright Power Station	3	2007	0.1891	0.1891	0	0.2856	51	9/1/2012

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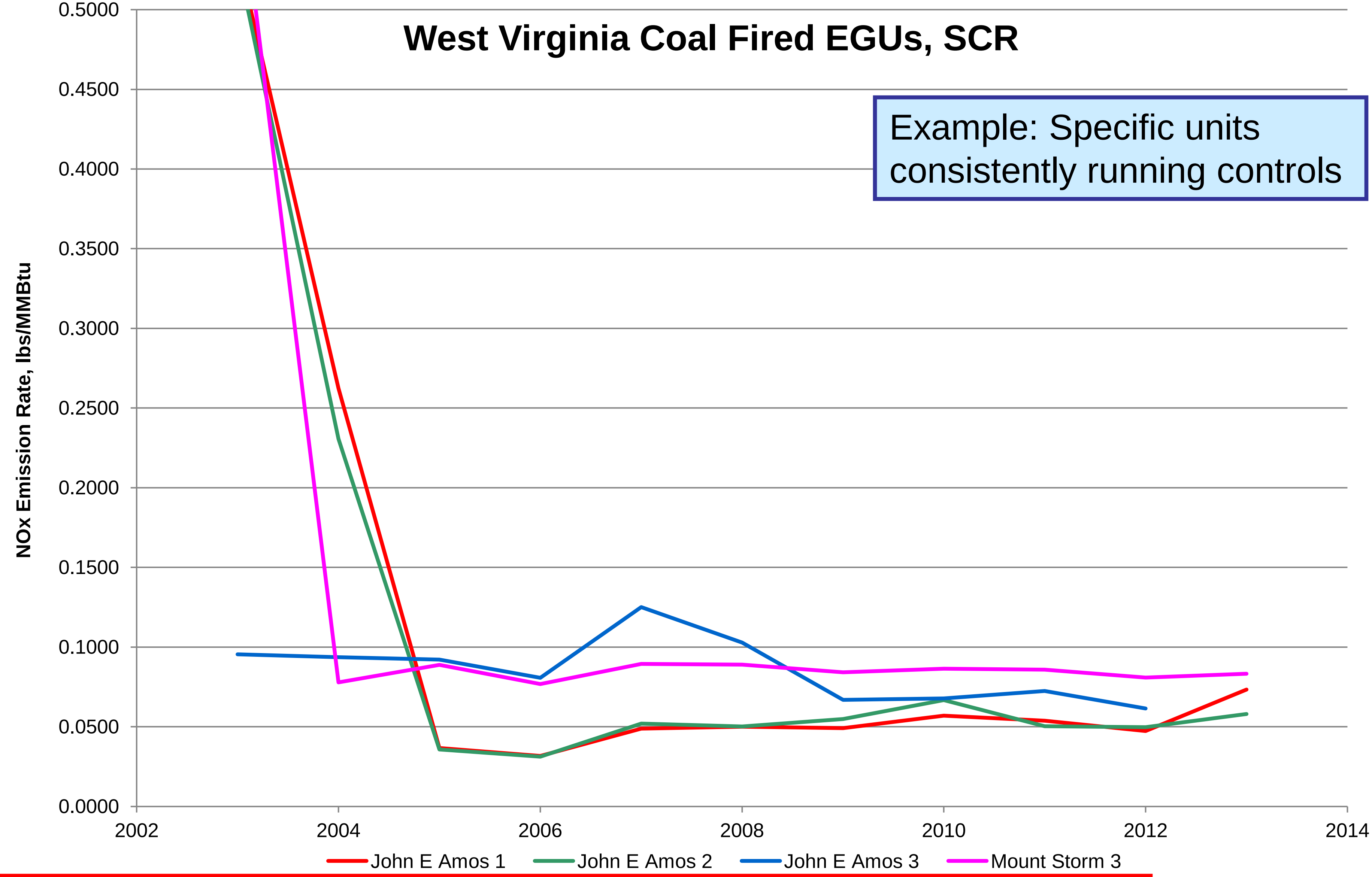
WV: Small (< 3000 MMBtu/hr) Coal-Fired EGU NOx Emissions Rate Analysis

	Facility Name	Unit ID	Lowest OS Emission Rate Year	Lowest OS Emission Rate (lbs/MMBtu)	2007 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2007 OS ER (% Change)	2011 OS Emission Rate (lbs/MMBtu)	Percent Difference Between Lowest OS ER and 2011 OS ER (% Change)	Comments/ ERTAC Closure Date
Controlled with SCR	N/A								
Controlled with SNCR	Grant Town Power Plant	1A	2005	0.0721	0.1400	94	0.2699	274	
	Grant Town Power Plant	1B	2005	0.0722	0.1376	91	0.2637	265	
No Controls or Fuel Switches by 2019	N/A								
Retiring by 2017	Albright Power Station	1	2004	0.4744	0.5165	9	0.7003	48	9/1/2012
	Albright Power Station	2	2009	0.3586	0.4484	25	0.3932	10	9/1/2012
	Kammer	1	2009	0.3963	0.4118	4	0.4215	6	6/1/2015
	Kammer	2	2009	0.3978	0.4161	5	0.4310	8	6/1/2015
	Kammer	3	2009	0.401	0.4160	4	0.4206	5	6/1/2015
	Kanawha River	1	2012	0.2469	0.3344	35	0.3027	23	6/1/2015
	Kanawha River	2	2012	0.2555	0.3291	29	0.2968	16	6/1/2015
	Phil Sporn	11	2012	0.2317	0.3463	49	0.2734	18	6/1/2015
	Phil Sporn	21	2012	0.2281	0.3417	50	0.2703	19	6/1/2015
	Phil Sporn	31	2012	0.2406	0.3430	43	0.2686	12	Has SNCR, retire 6/1/2015
	Phil Sporn	41	2012	0.2448	0.3428	40	0.2811	15	
	Rivesville Power Station	7	2009	0.3781	0.9026	139	N/A	N/A	9/1/2012
	Rivesville Power Station	8	2004	0.5428	0.5678	5	0.6327	17	9/1/2012
	Willow Island	1	2009	0.3093	0.3690	19	0.3574	16	9/1/2012
	Willow Island	2	2009	0.4636	0.6304	36	0.6393	38	9/1/2012

Part 2

Operation of Controls:
Changes in Control Efficiency
2003 to 2013

Average Ozone Season Emission Rates at Specific Units by Year



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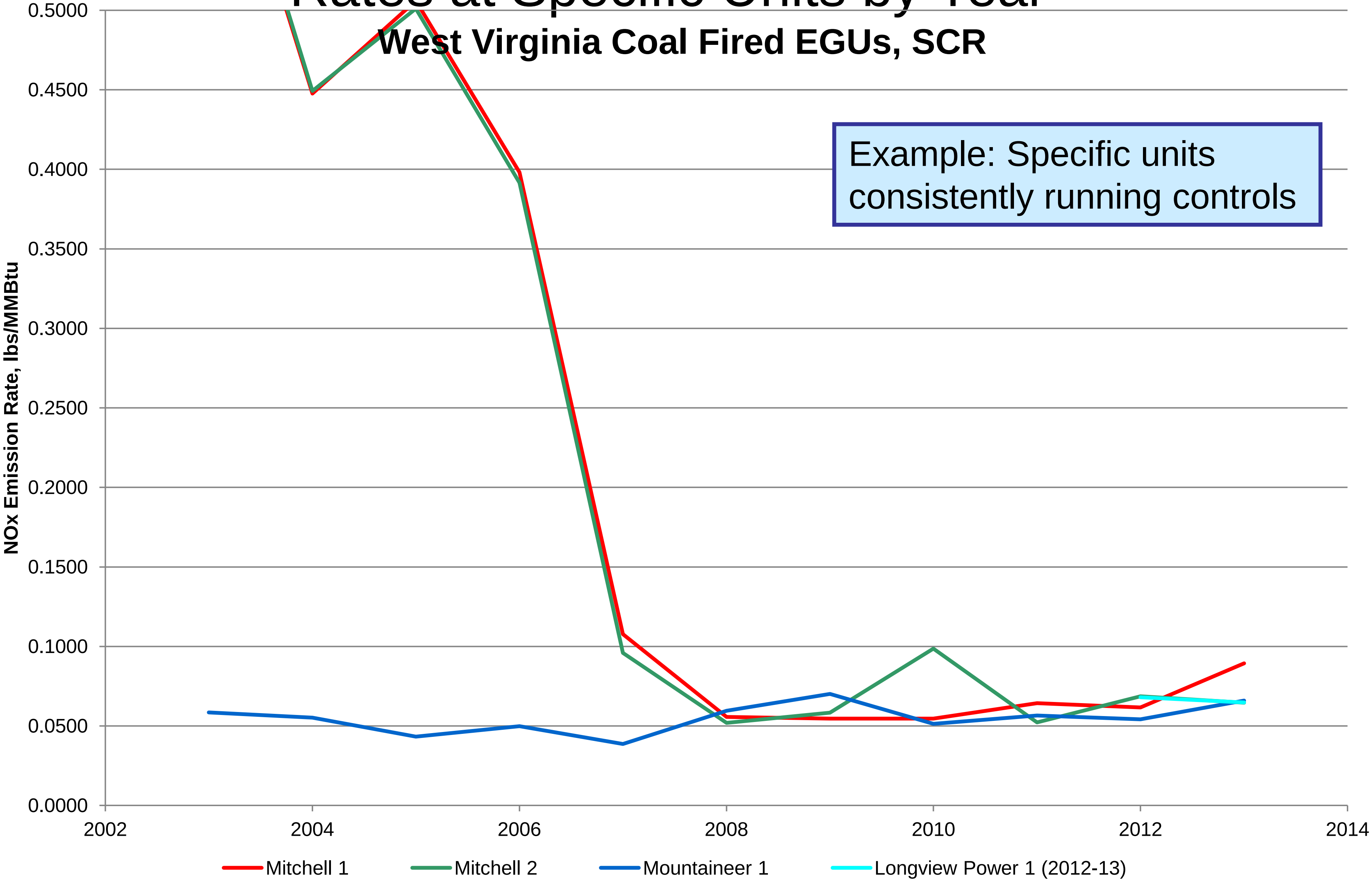
Average Ozone Season Emission Rates at Specific Units by Year



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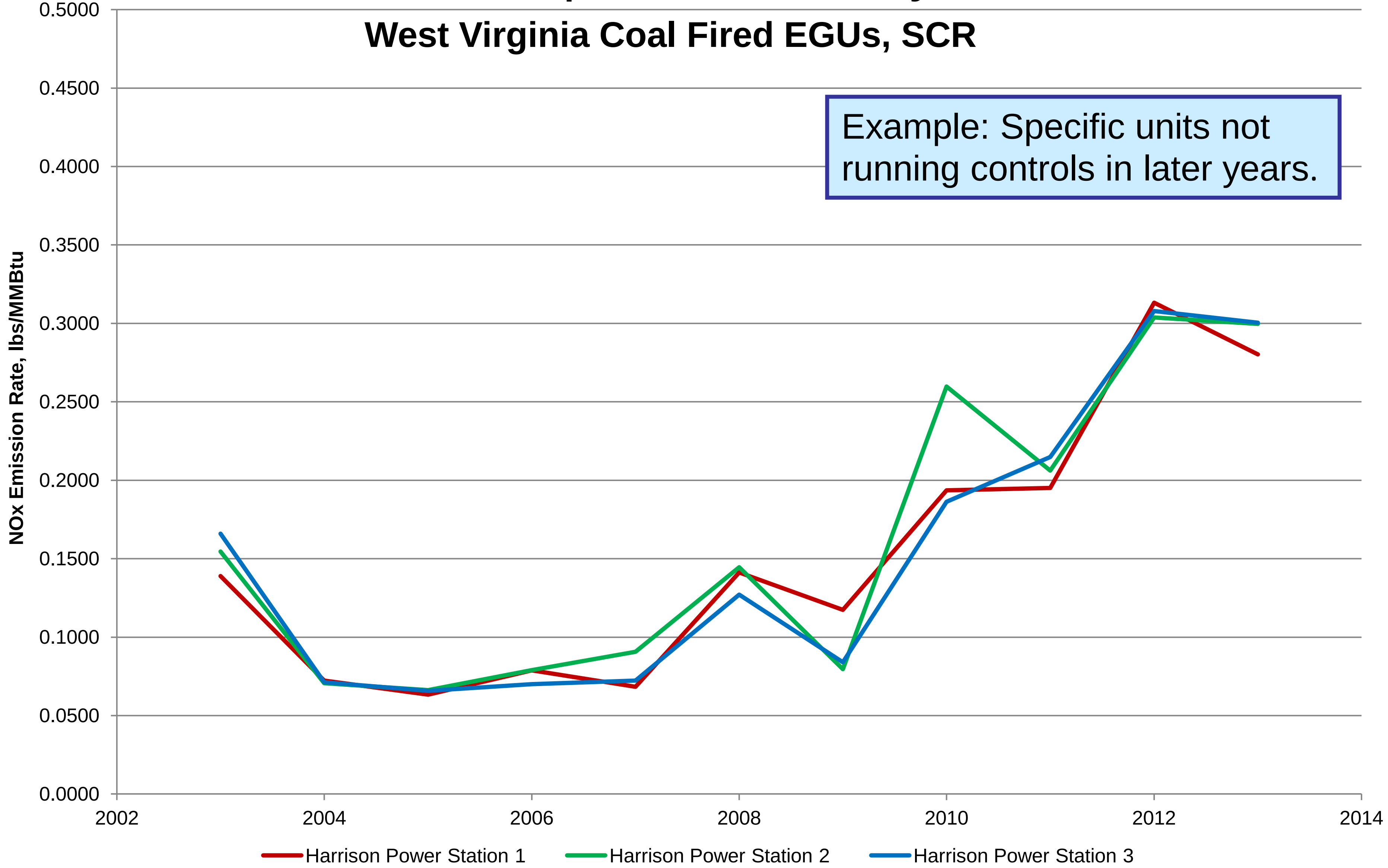
Average Ozone Season Emission Rates at Specific Units by Year



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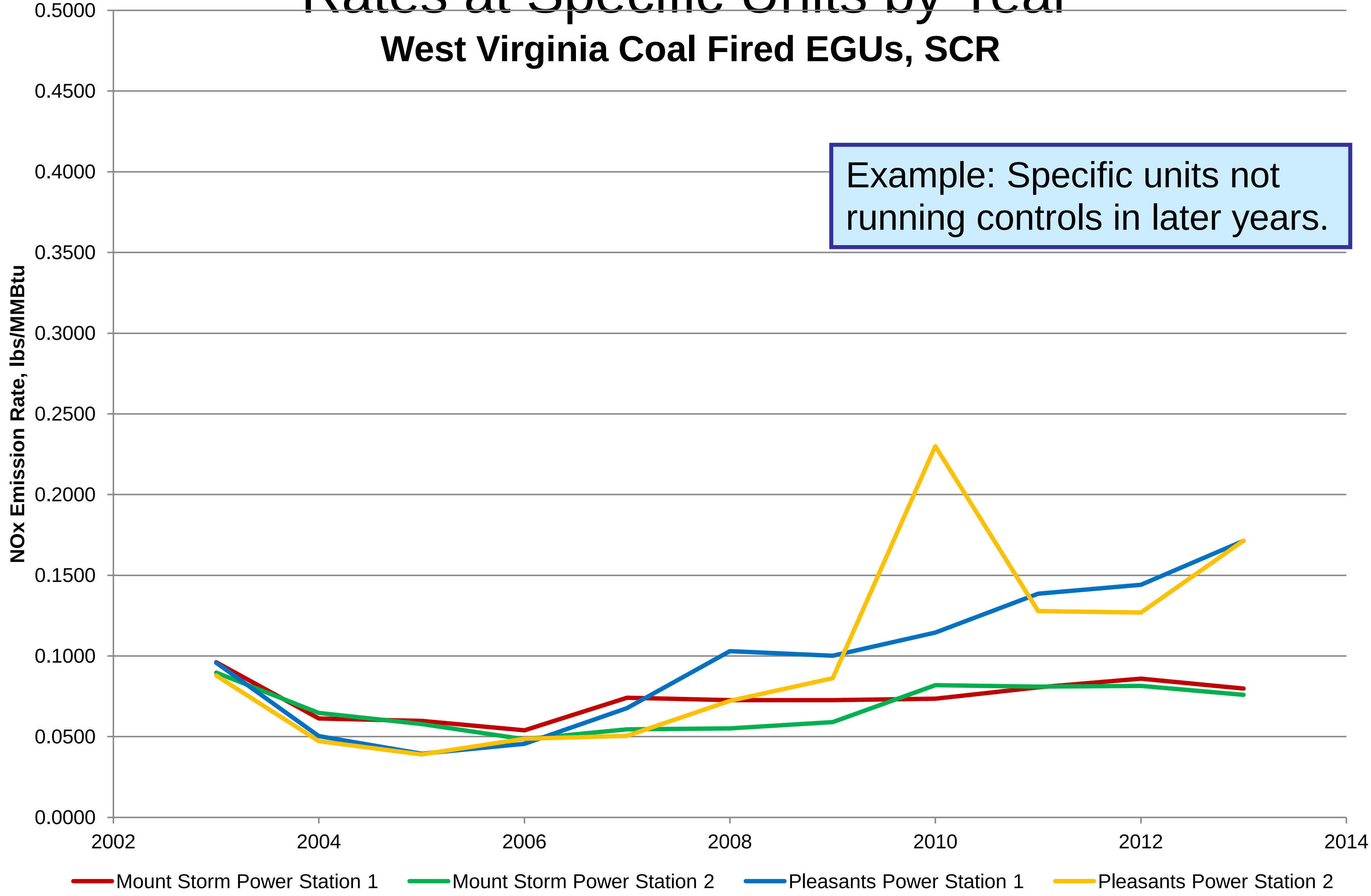
Average Ozone Season Emission Rates at Specific Units by Year



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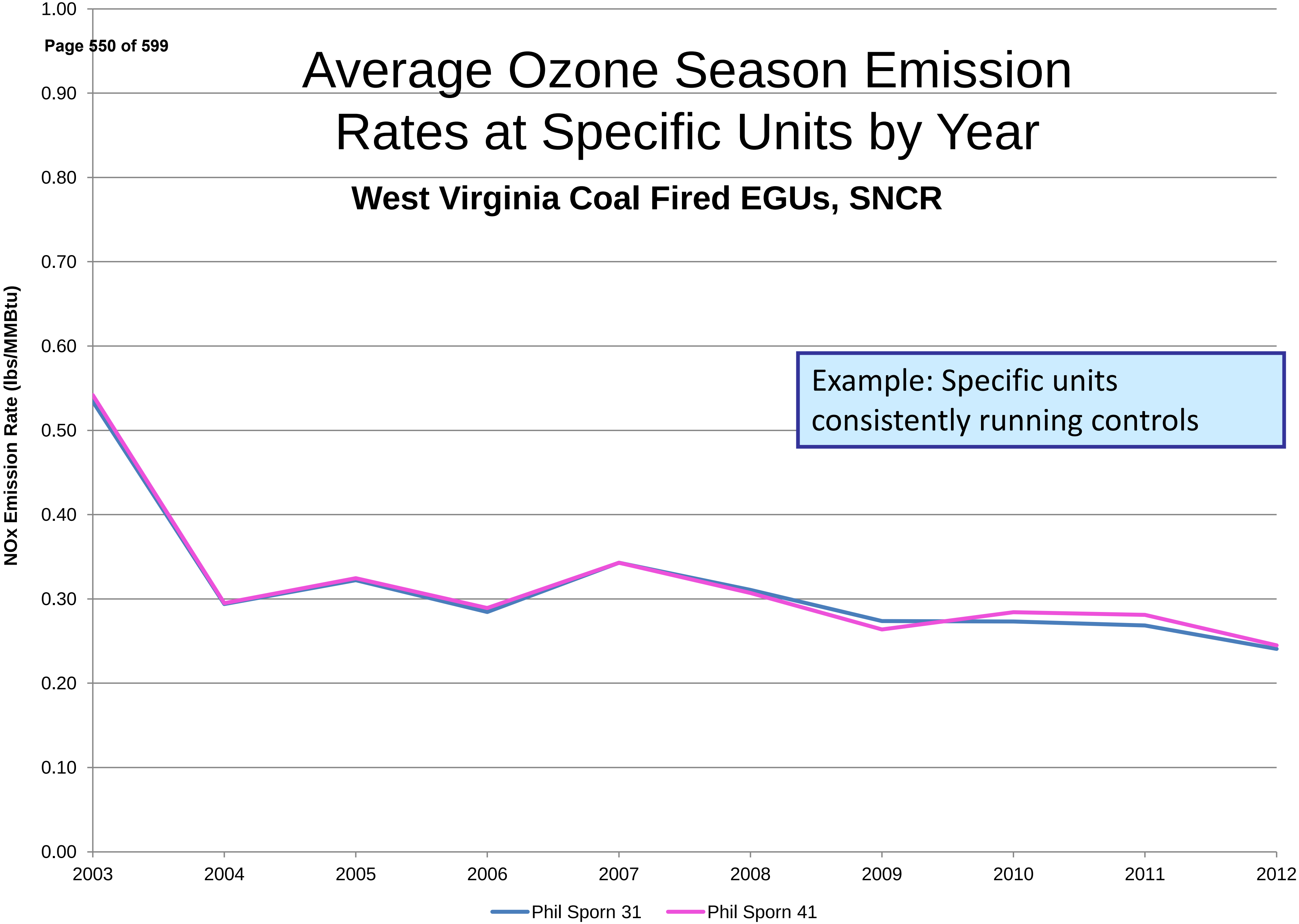

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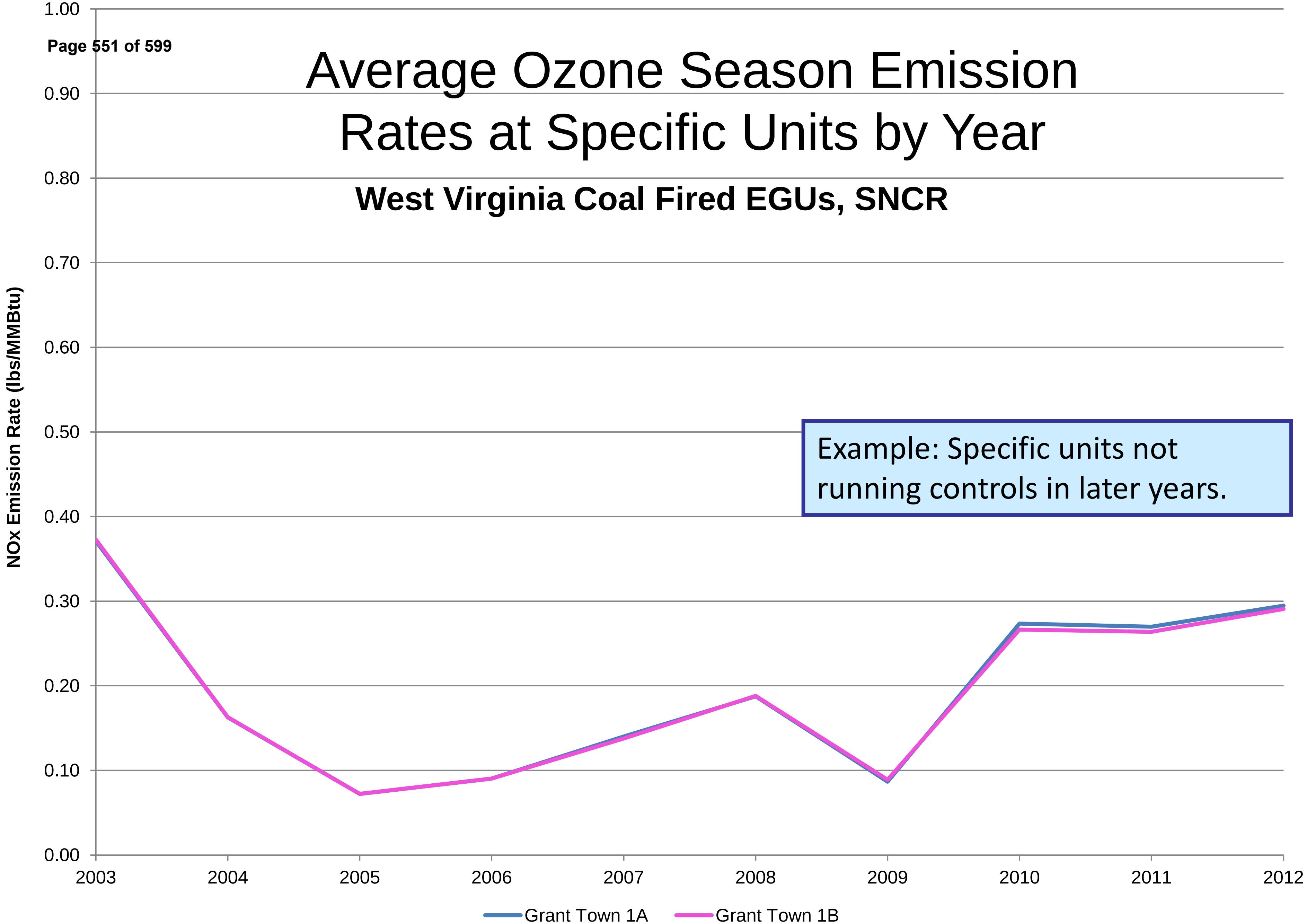


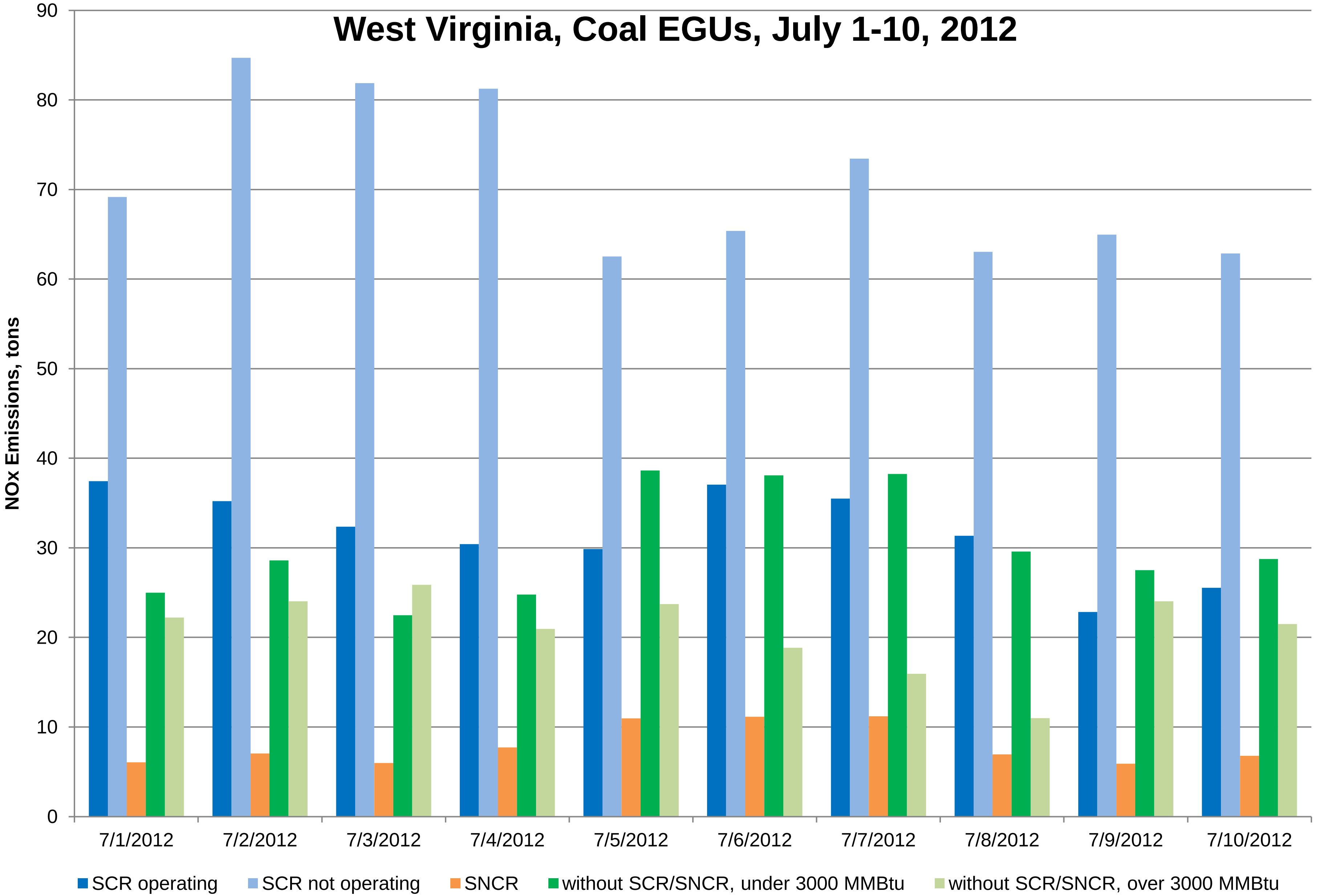
DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Part 3

July 1 to 10, 2012 Ozone Episode:

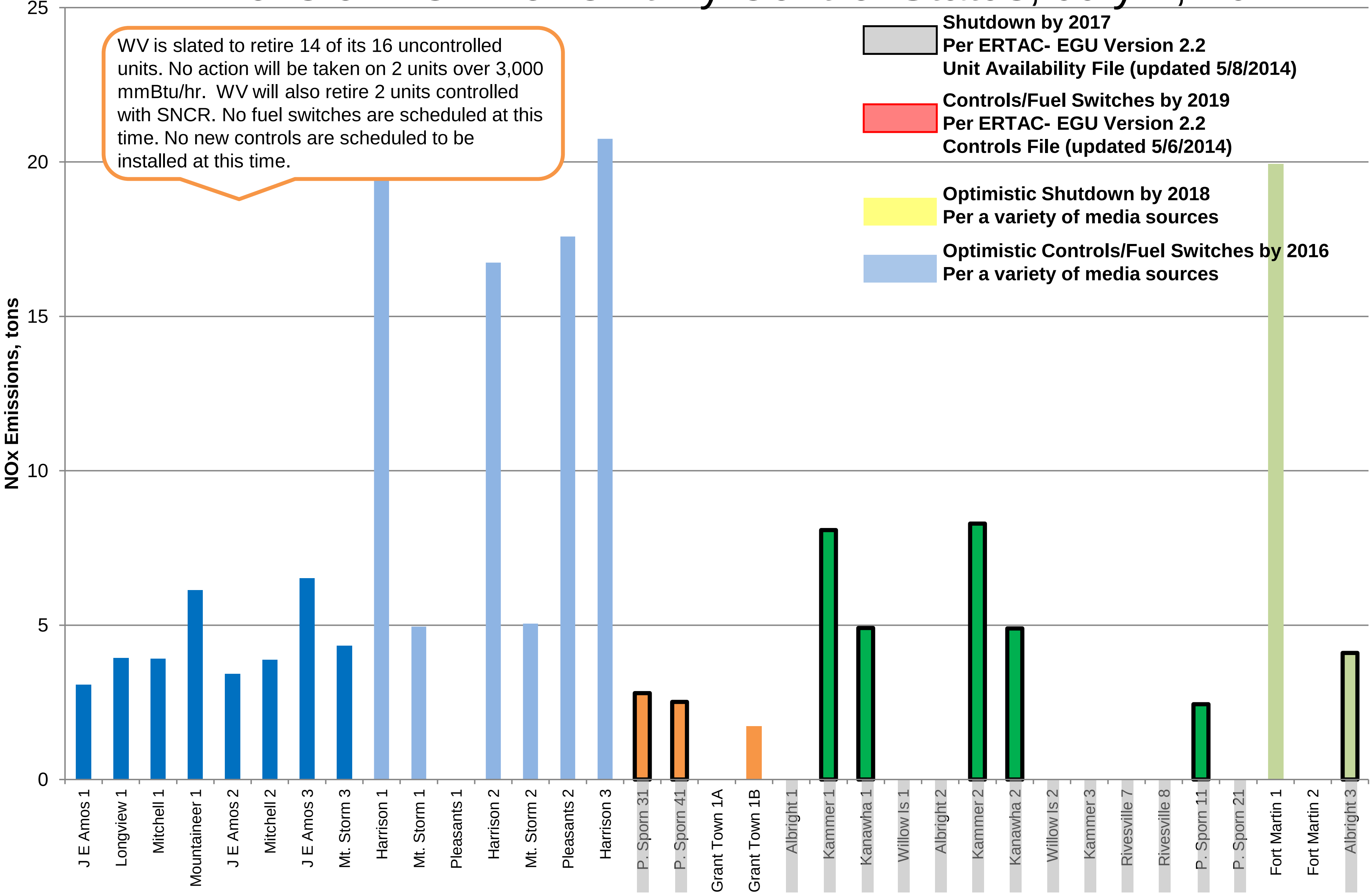
Analysis of Emissions and Controls

Tons of NOx per Day By Control Status



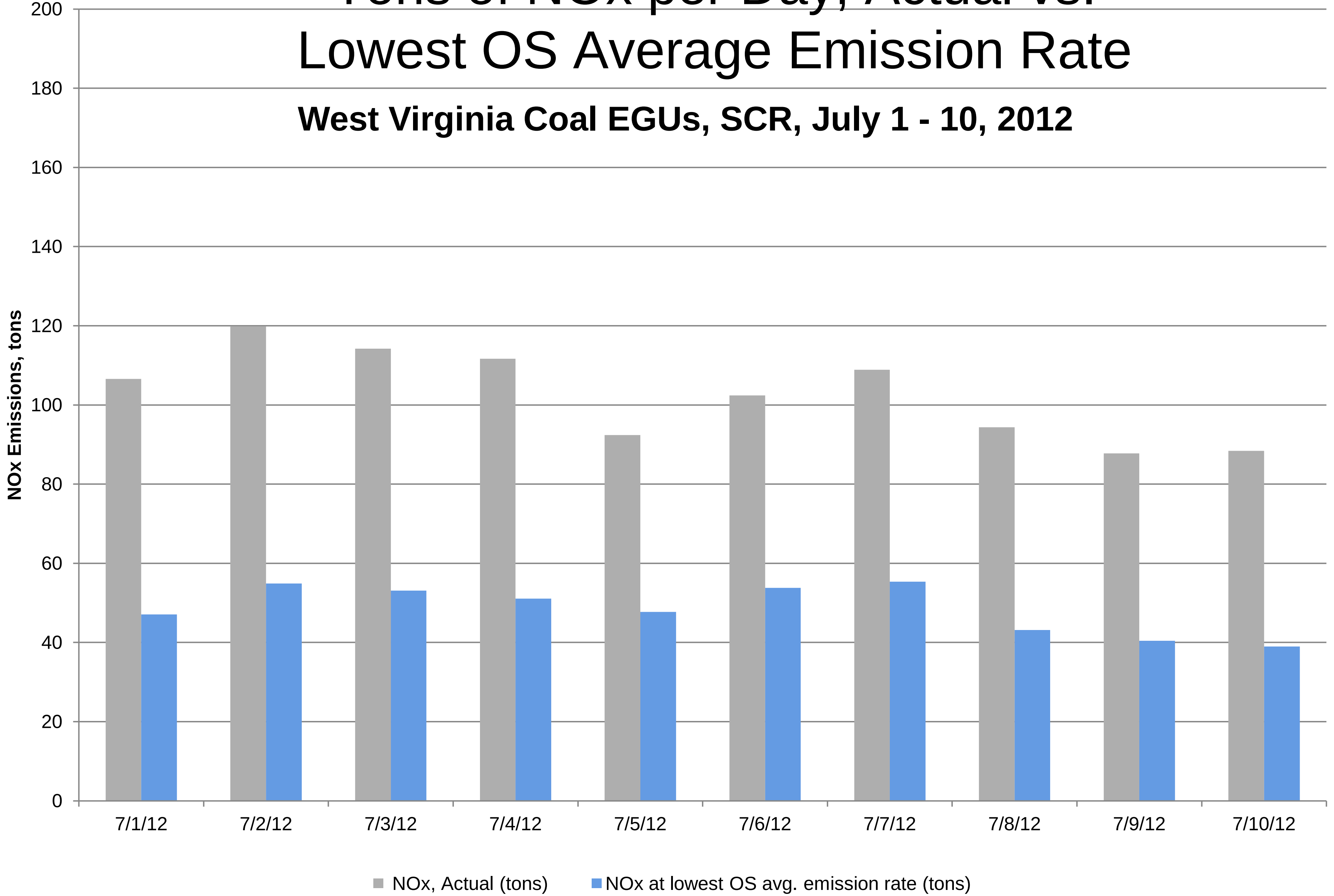
DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

WV – Tons of NOx Per Unit By Control Status, July 2, 2012



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

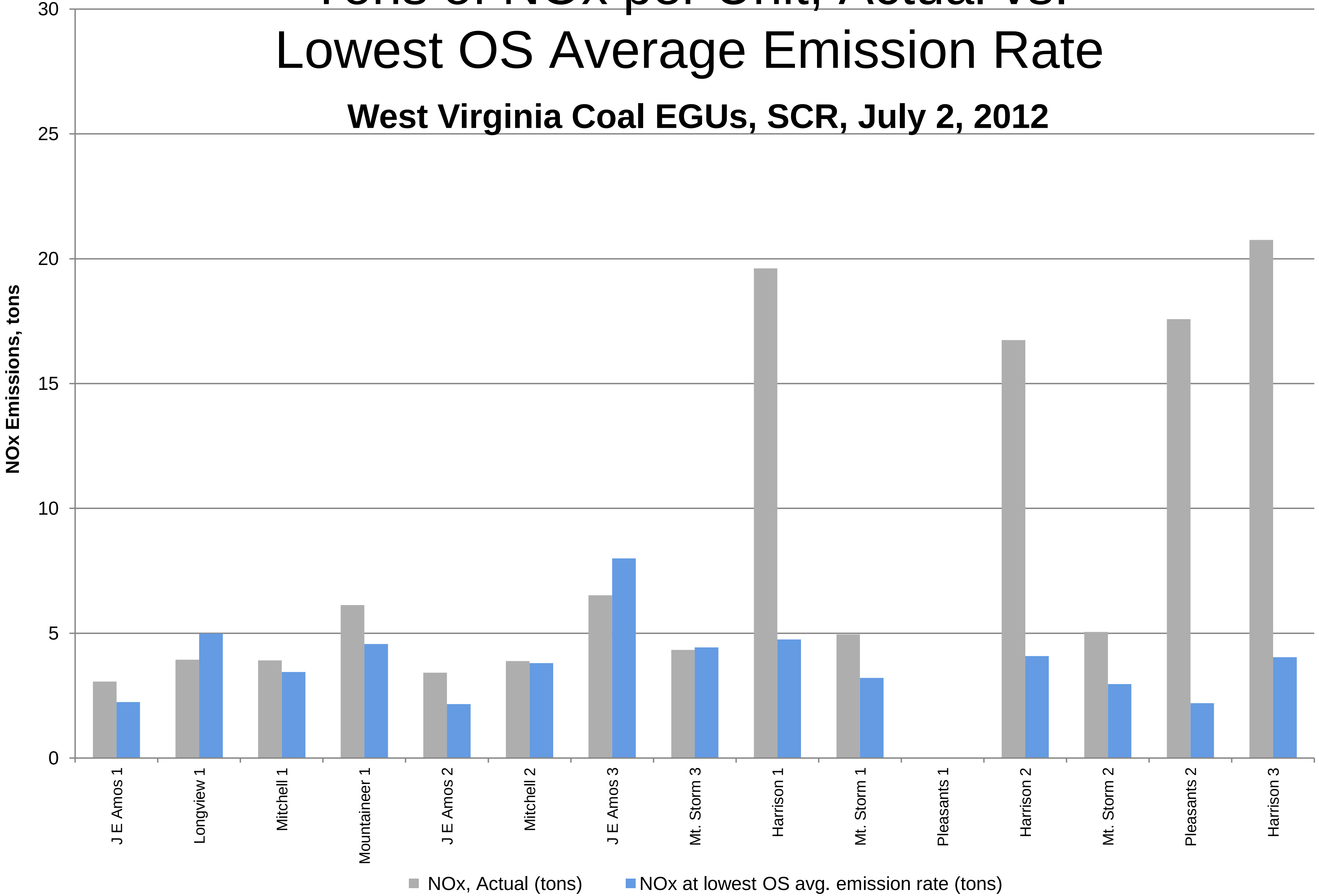
Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Tons of NOx per Unit, Actual vs. Lowest OS Average Emission Rate

West Virginia Coal EGUs, SCR, July 2, 2012



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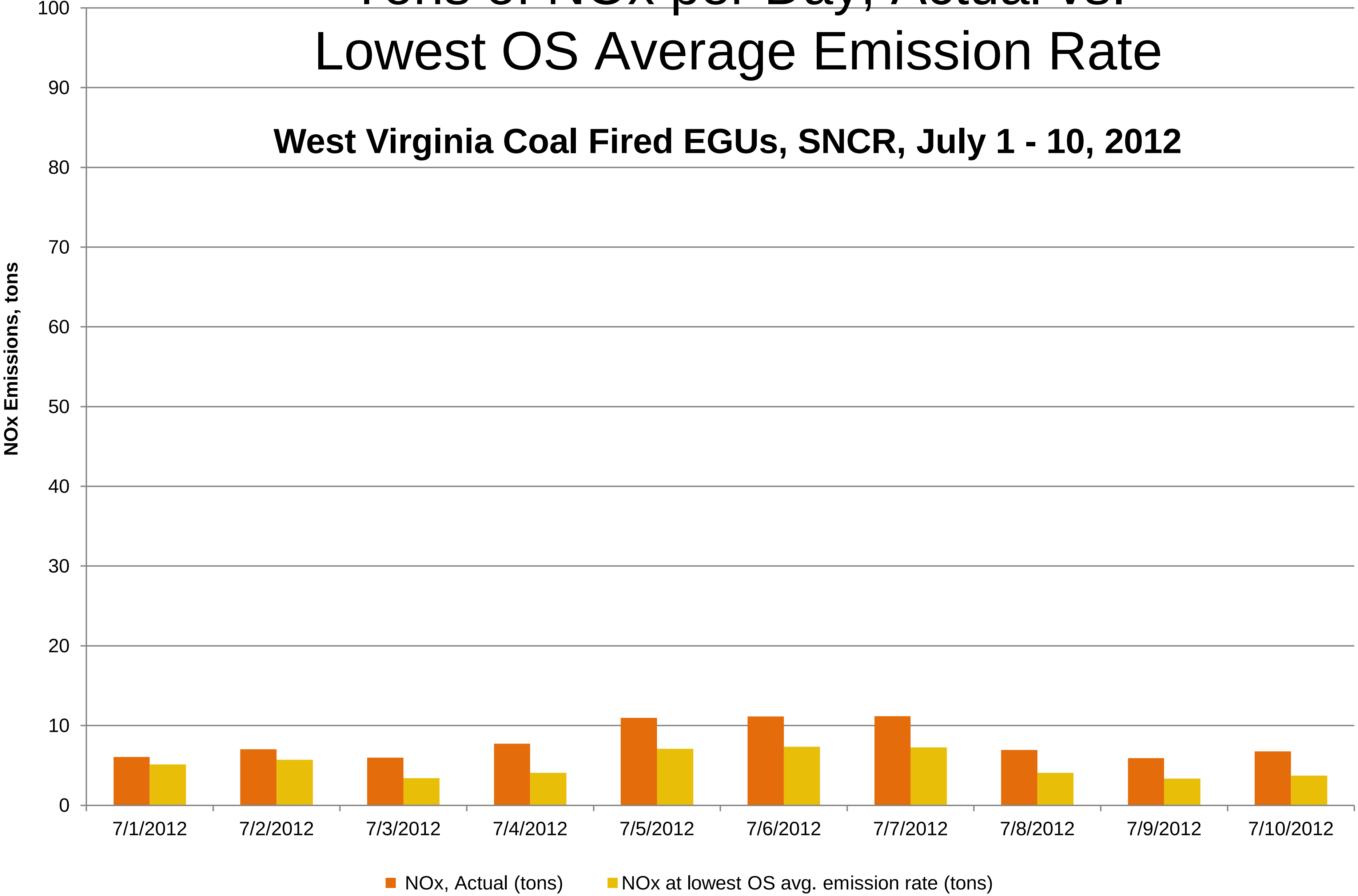
Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate



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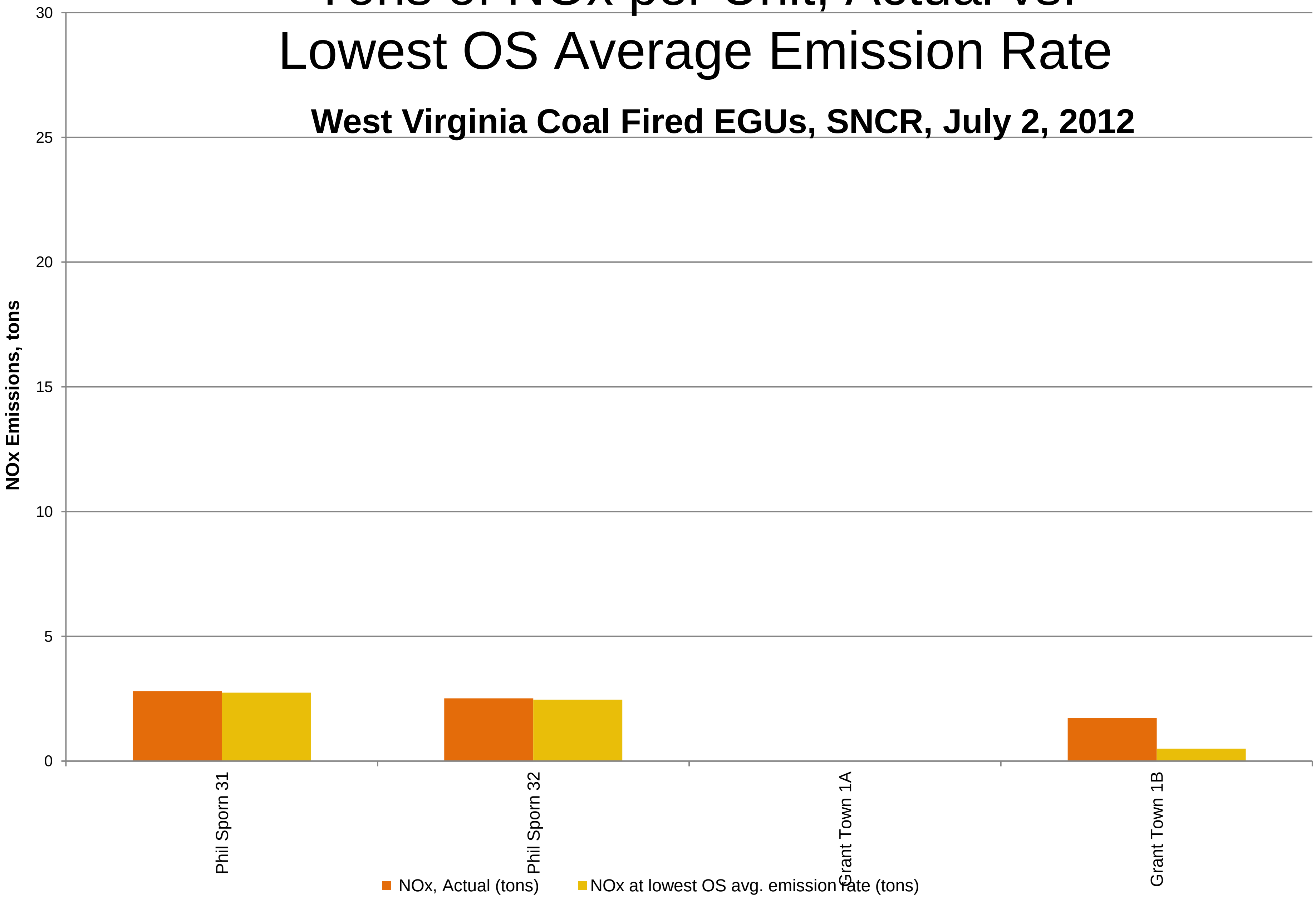
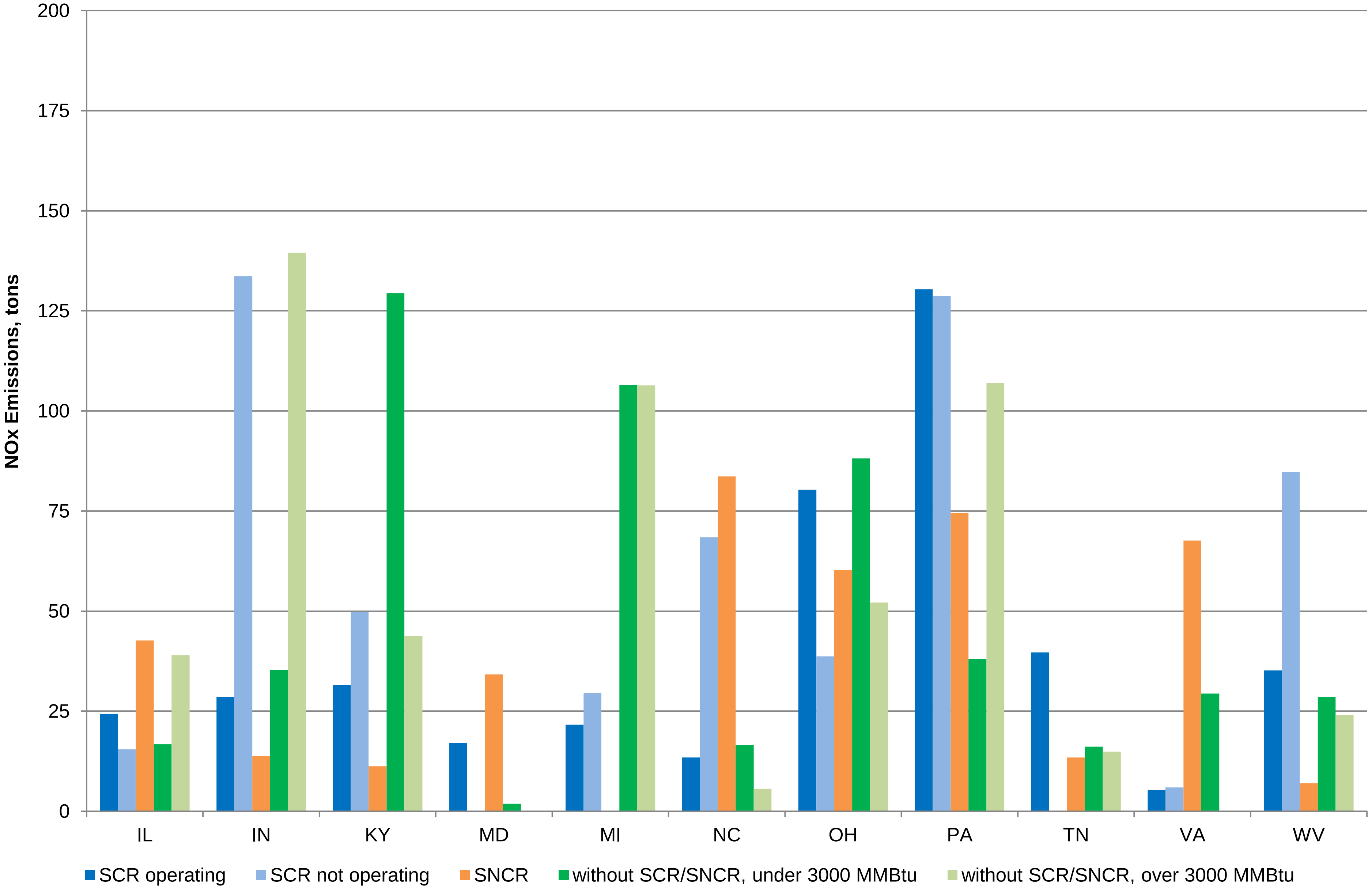
Tons of NOx per Unit, Actual vs. Lowest OS Average Emission Rate



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

July 2, 2012 – Tons of NOx per State by Control Status



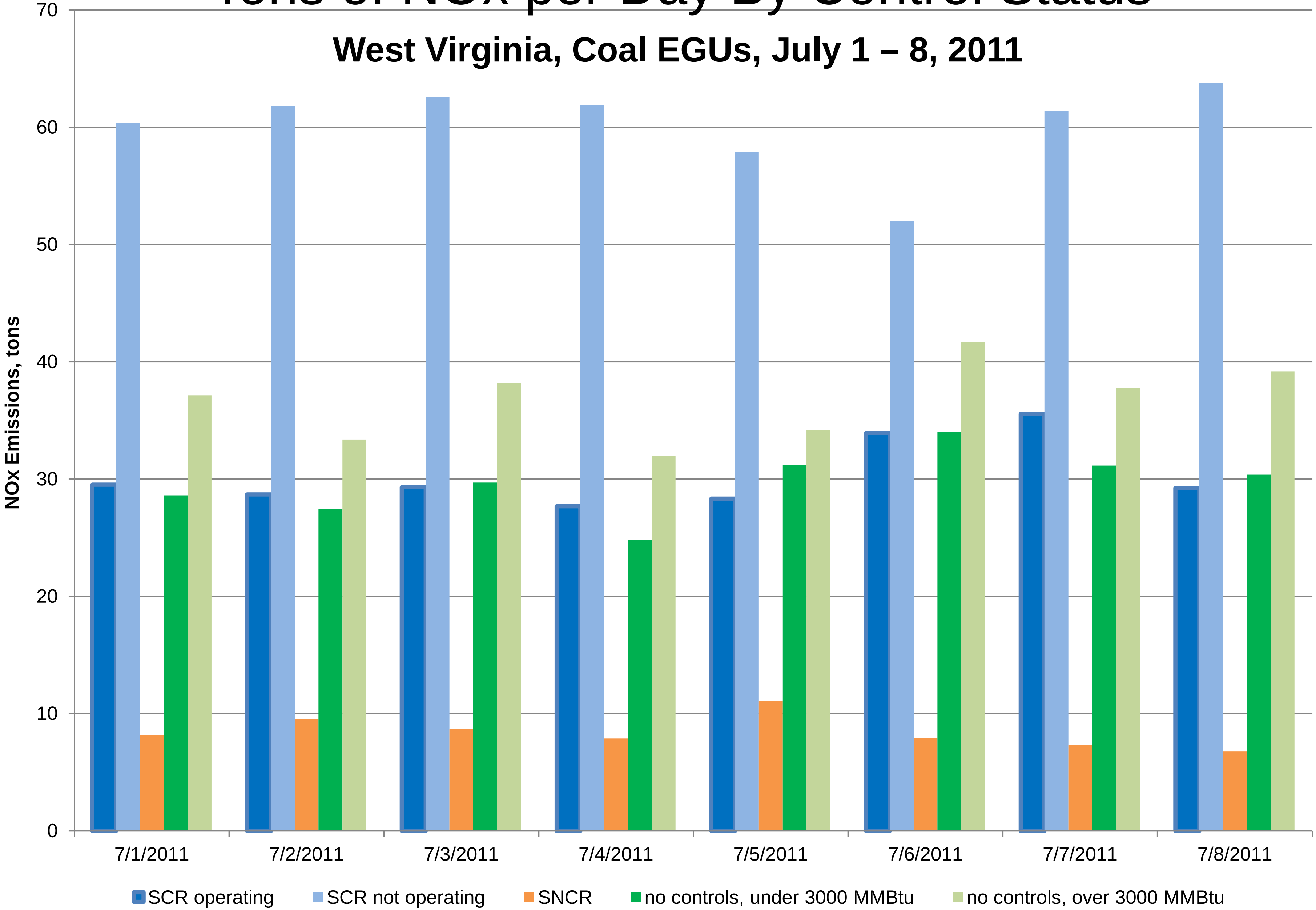
DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Part 4

July 1 to 8, 2011 Ozone Episode:

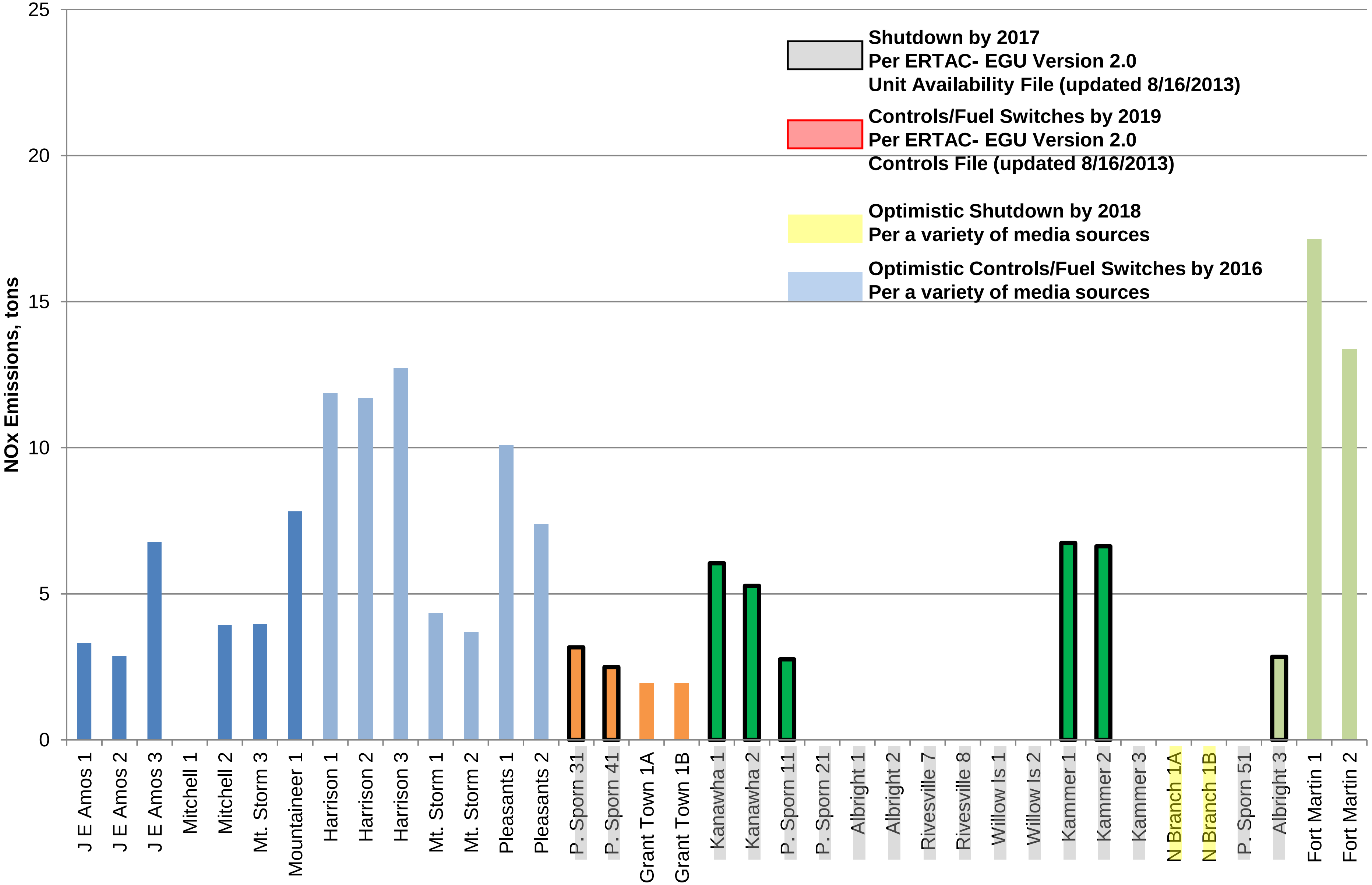
Analysis of Emissions and Controls

Tons of NOx per Day By Control Status



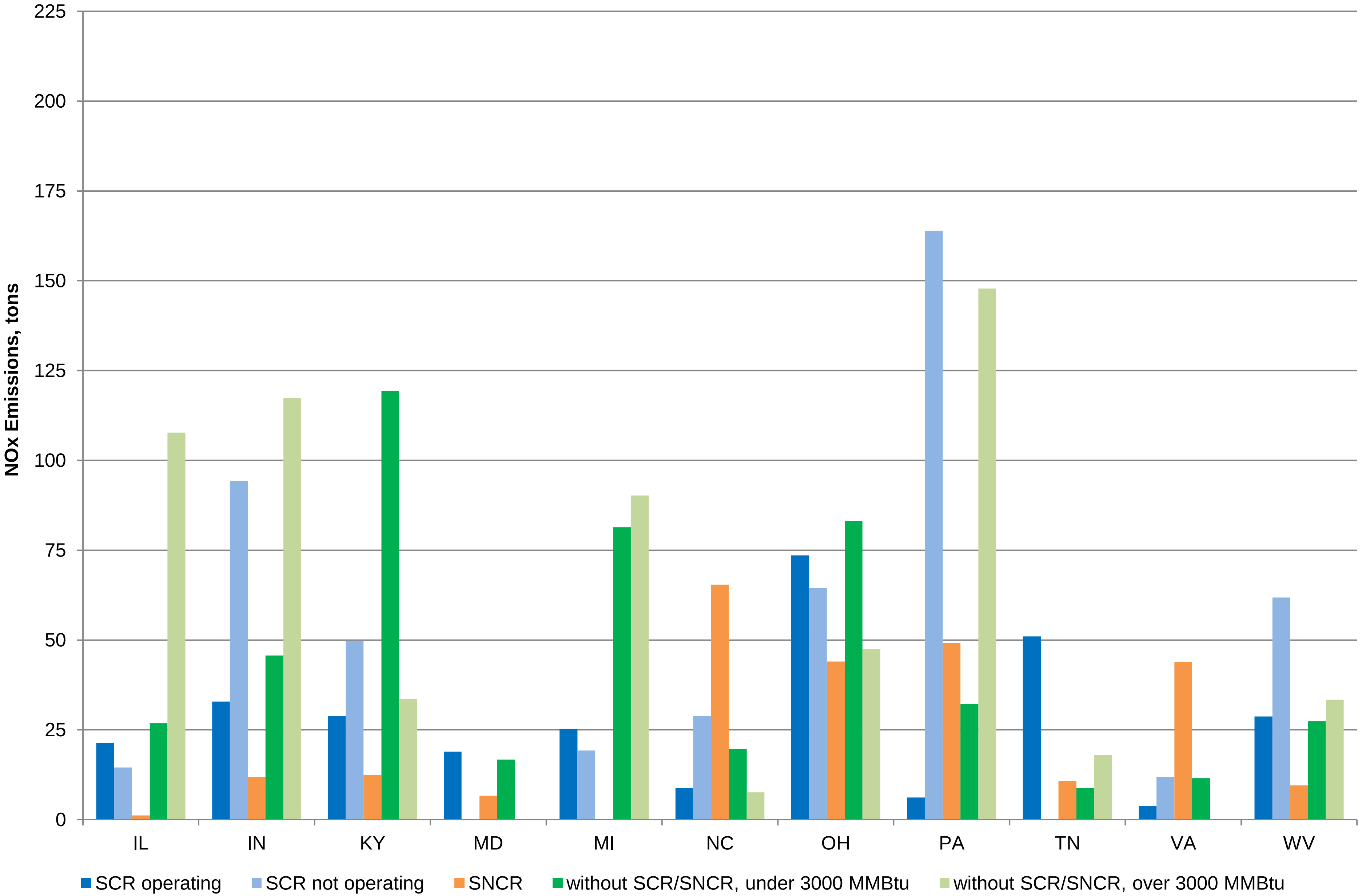
DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

WV – Tons of NOx per Unit By Control Status, July 2, 2011



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

July 2, 2011 - Tons NOx per State by Control Status



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Part 5

11 State Totals

July 1 to 8, 2011 Ozone Episode:

Analysis of Emissions and Controls

11 Upwind States, 2012

- Total number of units = 1,432
- Total heat input capacity = 2,730,239 MMBtu/hr
  = 304,354 MW
- Total MW Capacity in %
  - **Total number of Coal units = 547 = 55%**
  - Total number of NG units = 672 = 25%
  - Total number of other (oil, etc.) units = 173 = 6%
  - Total number of Nuclear units = 40 = 14%
- **Total Capacity Coal = 165,910 MW**
  - 156 units with SCR = 88,783 MW = 53%
  - 114 units with SNCR = 27,561 MW = 17%
  - 277 units without SCR/SNCR = 49,566 MW = 30%

Basis – CAMD (as of 5/13/2014), NEI (for Nuclear), ERTAC (5/6/2014, 5/8/2014)

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11 Upwind States, 2018

- Total number of units = 1,199
- Total heat input capacity = 2,449,194 MMBtu/hr
  = 274,300 MW
- Total MW Capacity in %
  - **Total number of Coal units = 361 = 49%**
  - Total number of NG units = 686 = 32%
  - Total number of other (oil, etc.) units = 115 = 5%
  - Total number of Nuclear units = 37 = 14%
- **Total Capacity Coal = 134,121 MW**
  - 166 units with SCR = 93,776 MW = 70%
  - 60 units with SNCR = 17,868 MW = 13%
  - 135 units without SCR/SNCR = 22,477 MW = 17%

Basis – ERTAC (5/6/2014, 5/8/2014), NEI (for Nuclear)

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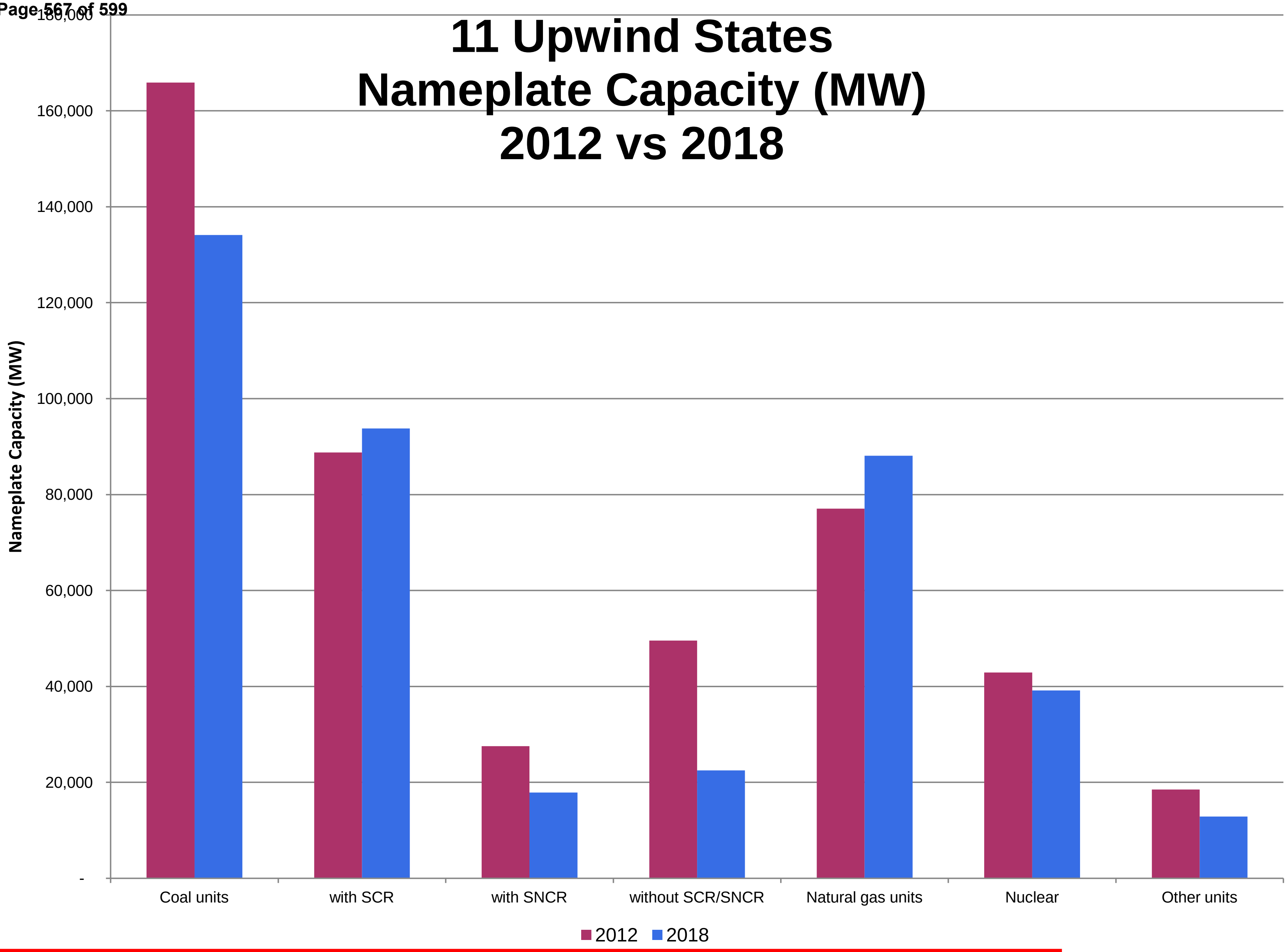
11 Upwind States Nameplate Capacity (MW) 2012 vs 2018



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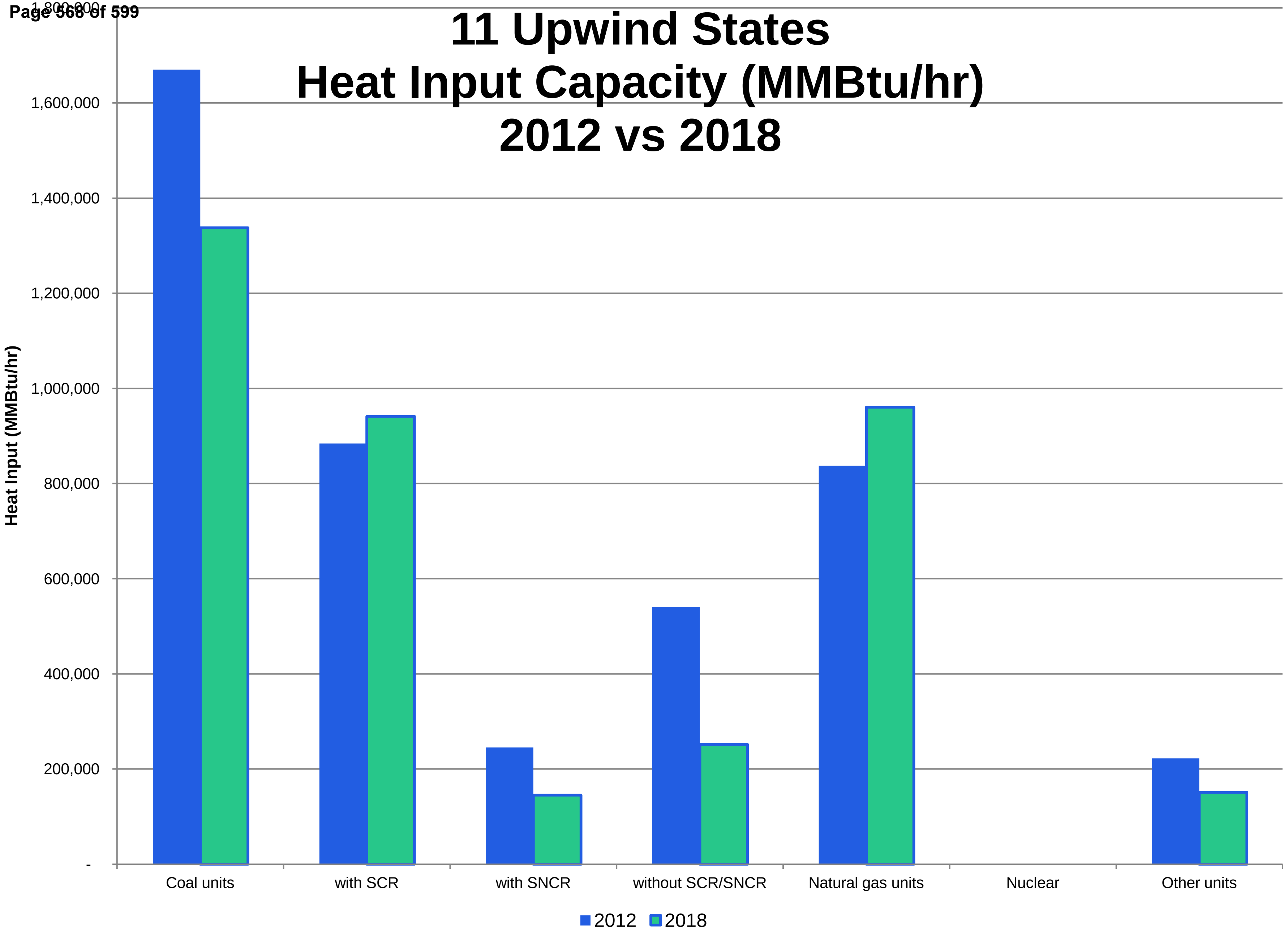

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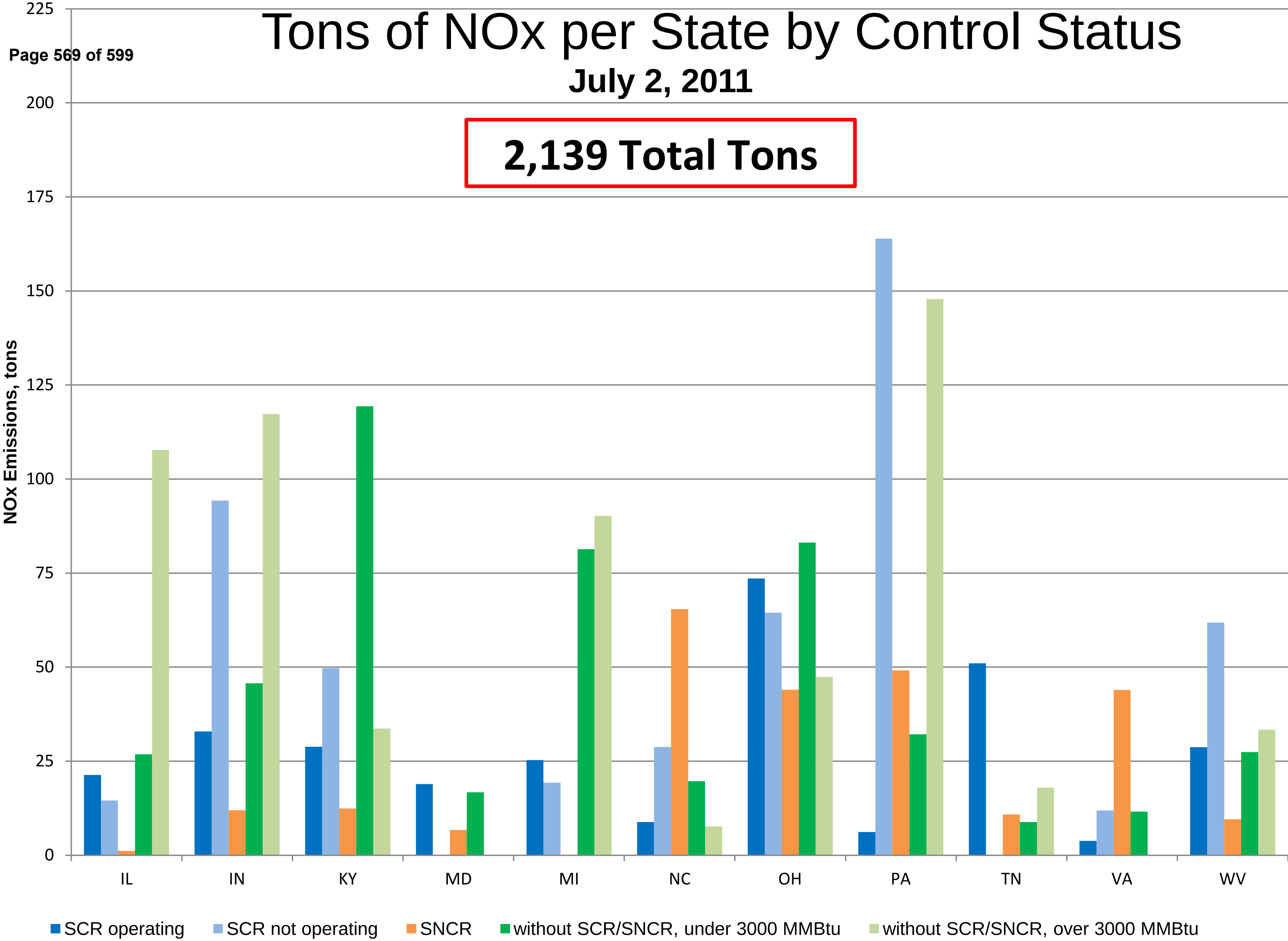

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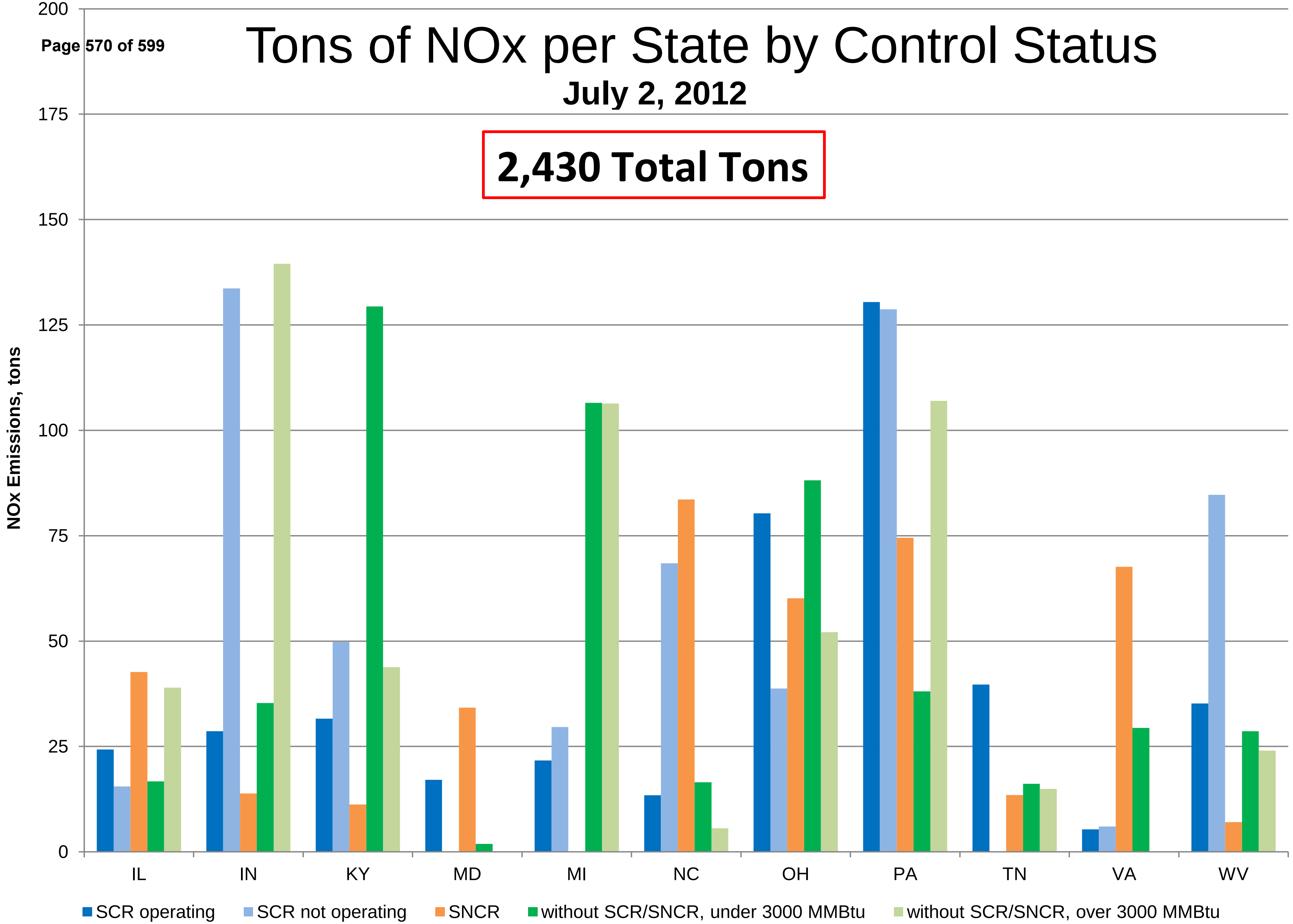
Tons of NOx per State by Control Status

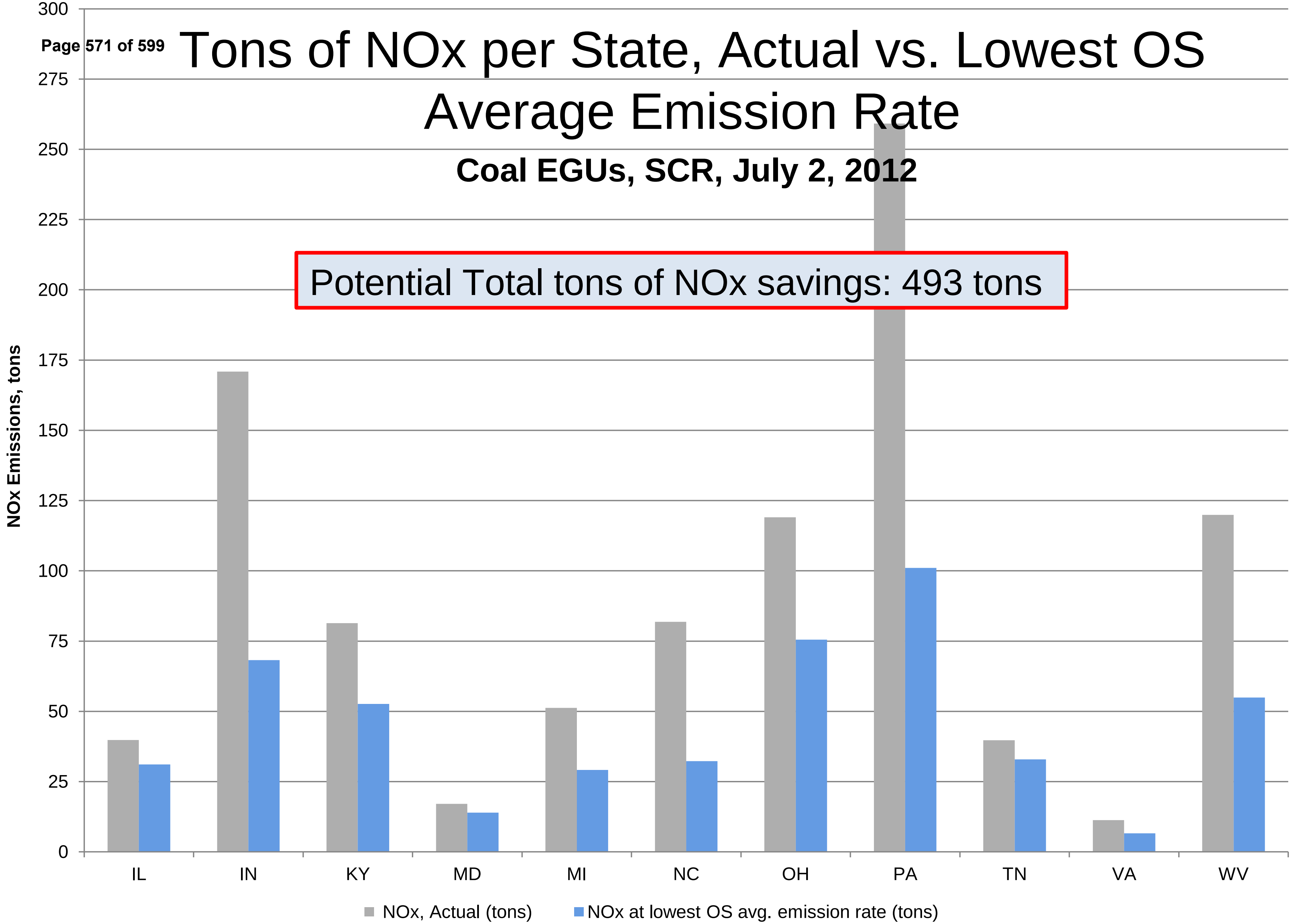
July 2, 2012



DRAFT – September 18, 2014 – Requesting QA of data. For discussion purposes only.

Tons of NOx per State, Actual vs. Lowest OS Average Emission Rate

Coal EGUs, SCR, July 2, 2012



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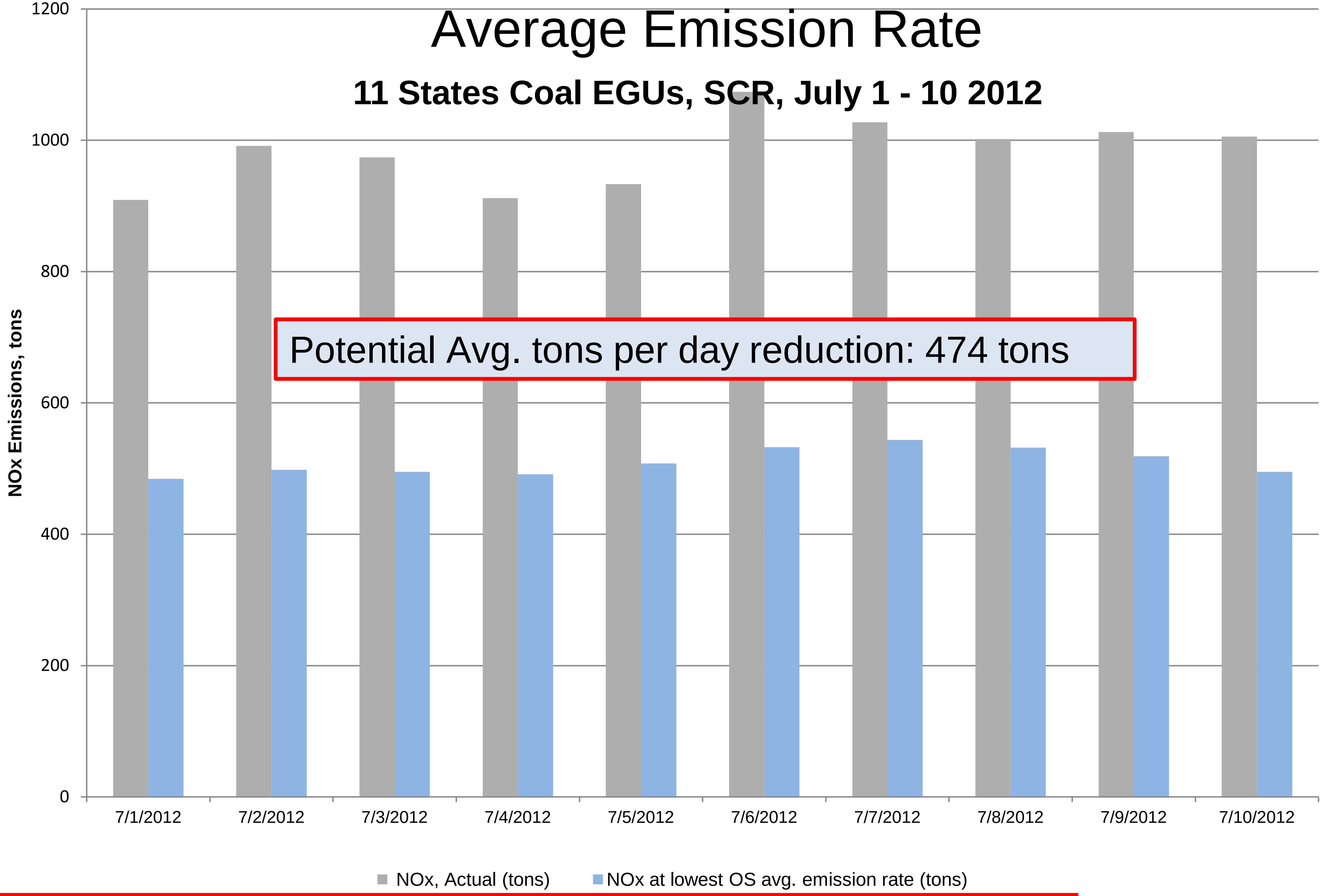
Tons of NOx per Day, Actual vs. Lowest OS Average Emission Rate

11 States Coal EGUs, SCR, July 1 - 10 2012



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11 State Summary

After performing similar analysis of EGUs in IL, IN, KY, MD, MI, NC, OH, PA, TN, VA and WV, the following potential total tons of lost NOx reductions was calculated:

- On July 2, 2012 actual NOx emissions in the 11 states (listed above) was 991 tons
  - If EGUs in those states were to have run their controls at the best rates observed in the data, emissions would have been 498 tons
  - This represents a single day loss of NOx reductions of 493 tons on that day
- During the 10 day episode between July 1 and 10, 2012 actual NOx emissions in the 11 states (listed above) was 9,840 tons
  - If EGUs in those states were to have run their controls at the best rates observed in the data, emissions would have been 5,099 tons
  - This represents a loss of NOx reductions of 4,741 tons over that 10-day episode

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Part 6

Potential Lost Ozone Benefits from Controls Running Less Effectively in Recent Years

Preliminary Photochemical Modeling

West Virginia Monitors

How Might This Affect Ozone?

- Maryland has performed several very preliminary model runs to look at how much running EGU controls inefficiently might increase ozone levels
- Three runs:
  - Scenario 2B – A worst case run
    - Assumes SCR and SNCR controls are not run at all
  - Scenario 3B – A worst data run
    - Assumes SCR and SCR units all run at worst rates seen in CAMD data - 2005 to 2012
  - Scenario 3C – Based upon CAMD data analysis for EGU performance in 2011 and 2012
    - Assumes that units that had higher ozone season emission rates were operating at the best ozone season rates observed since 2005

Lost Ozone Benefits

Potential PPB Increases

West Virginia Monitors	Potential Increased Ozone in 2018 – 3 EGU Control Scenarios		
County	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Berkeley	6.4	1.3	0.8
Cabell	7.4	1.7	1.1
Greenbrier	NA	NA	NA
Hancock	5.3	5.1	1.6
Kanawha	15.7	3.3	1.8
Monongalia	15.7	3.0	1.7
Ohio	12.9	5.5	1.8
Wood	16.3	3.9	2.3

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Lost Ozone Benefit – 2018 Design Values

… EPA will propose a new ozone standard soon … 60 to 70 ppb range … designations to most likely be based upon 2014 to 2016 or 2015 to 2017 data

Projected to be Clean in 2018 … Potentially at Risk		**Increased Ozone in 2018 – 3 EGU Control Scenarios**		
West Virginia Counties	**2018 – Controls Running Well (Scenario 3A)**	**Worst Case – No SCRs or SNCRs (Scenario 2B)**	**Using worst rate CAMD Data (Scenario 3B)**	**Using actual 2011/2012 Data (Scenario 3C)**
Berkeley	59.8	66.1	61.0	60.5
Cabell	69.0	76.4	70.7	70.1
Greenbrier	NA	NA	NA	NA
Hancock	64.1	69.3	69.1	65.7
Kanawha	64.5	80.2	67.8	66.3
Monongalia	61.4	77.1	64.4	63.1
Ohio	63.3	76.2	68.8	65.1
Wood	58.7	75.0	62.6	61.0

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Department of the Environment

The SCOOT 2015 Voluntary Control Effort

An effort to optimize the use of existing control technologies

An Assessment of Optimization of Controls At Coal-Fired Units in the Eastern Modeling Domain

November 12, 2015

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Last SCOOT Meeting

Newport RI - August 30, 2015

- This is an updated version of the briefing provided at the August 30th SCOOT meeting in Newport, RI
- Now covers the entire 2015 ozone season - not just May and June
- Includes analyses of coal-fired EGUs in many more states in the East
  - Now 29 eastern states - not just 11 states

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What We Did

- Analyzed the emissions data submitted by sources for 2015 Ozone Season in the Eastern Modeling Domain
  - AL, AR, DE, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, MI, MN, MO, NC, NE, NH, NJ, NY, OH, PA, SC, TN, TX, VA, WI & WV
- Looked at 2015 ozone season average emission rates at 385 individual units
  - 3 Units Did Not Report
- Compared those rates to the lowest demonstrated ozone season average emission rate from the past
- Placed individual units into three bins based upon the above rate comparisons
  - **BIN 1** - Review not needed - Equal or better performance compared to past - optimization underway (58 units)
  - **BIN 2 -** Review needed but lower priority - Slightly poorer performance compared to past (241 units)
  - **BIN 3** - High priority for review - Noticeably poorer performance compared to past (73 units)
  - 10 units did not operate, retired or switched fuels
- Calculated potential lost NOx reductions

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BIN Number 1

… units with 2015 rates better than … or close to … best historical rates

State	Facility	Unit	2015 OS Rate (lb/mmBtu)	Best OS Rate (lb/mmBtu)	Deviation	State	Facility	Unit	2015 OS Rate (lb/mmBtu)	Best OS Rate (lb/mmBtu)	Deviation
AL	Barry	1	0.05	0.26	-82%	MD	Wagner	3	0.06	0.06	-9%
AL	Barry	2	0.05	0.26	-81%	MD	Dickerson	1	0.22	0.24	-7%
FL	Crist	5	0.12	0.14	-12%	MD	Dickerson	2	0.22	0.24	-7%
FL	C H. Stanton	2	0.10	0.15	-30%	MD	Dickerson	3	0.22	0.24	-7%
IA	Lansing	4	0.05	0.10	-43%	MI	Dan E Karn	1	0.05	0.06	-24%
IL	E D Edwards	3	0.07	0.08	-14%	MI	Campbell	2	0.04	0.14	-73%
IL	Joliet 29	71	0.09	0.10	-7%	MI	Campbell	3	0.04	0.07	-40%
IL	Joliet 29	72	0.09	0.10	-7%	MO	Thomas Hill	MB2	0.12	0.42	-73%
IL	Marion	4	0.08	0.10	-19%	NC	Wstmrln'd II	2	0.13	0.16	-20%
IL	Powerton	62	0.09	0.10	-9%	NE	NE Cty	2	0.06	0.06	-8%
IN	Bailly	8	0.11	0.12	-7%	NJ	Logan	1001	0.10	0.11	-11%
IN	F B Culley	3	0.09	0.10	-8%	NJ	Mercer	2	0.05	0.08	-28%
KS	Jeffrey	3	0.12	0.12	-7%	PA	Shawville	1	0.31	0.37	-16%
KY	H L Spurlock	3	0.06	0.06	-11%	PA	Shawville	2	0.30	0.39	-24%
KY	J S. Cooper	2	0.12	0.13	-10%	WI	Edgewater	4	0.13	0.14	-9%
KY	Trimble	2	0.04	0.05	-25%	WI	Manitowoc	9	0.04	0.05	-23%
MD	B Shores	2	0.07	0.08	-11%	WI	N Dewey	1	0.23	0.25	-7%
MD	C P Crane	1	0.28	0.35	-20%	WI	N Dewey	2	0.23	0.25	-8%
MD	C P Crane	2	0.24	0.26	-9%	WI	South Oak	7	0.06	0.07	-14%
MD	Wagner	2	0.22	0.27	-18%	WI	South Oak	8	0.06	0.07	-7%

Top 40 – out of 58

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BIN Number 2

… Units with 2015 rates that are worse than (but not more than double) best historical rates and an emission rate greater than 0.1 lb/mmBtu for SCR and 0.2 lb/mmBtu for SNCR

State	Facility	Unit	2015 OS Rate (lb/mmBtu)	Best OS Rate (lb/mmBtu)	Deviation	State	Facility	Unit	2015 OS Rate (lb/mmBtu)	Best OS Rate (lb/mmBtu)	Deviation
AL	Barry	4	0.35	0.23	53%	NC	G G Allen	5	0.31	0.19	60%
AL	C R Lowman	2	0.24	0.16	45%	NC	Marshall	3	0.13	0.07	93%
AL	E C Gaston	5	0.12	0.08	55%	NC	Marshall	4	0.27	0.20	38%
DE	Indian River	4	0.10	0.07	52%	NC	Roxboro	1	0.16	0.08	87%
GA	Hammond	4	0.10	0.06	86%	NC	Roxboro	4A	0.16	0.08	97%
IL	Dallman	32	0.12	0.08	47%	NC	Roxboro	4B	0.16	0.08	98%
IL	Duck Creek	1	0.10	0.07	39%	NY	Somerset	1	0.23	0.14	72%
IN	Gibson	4	0.11	0.06	80%	OH	Avon Lake	12	0.40	0.28	39%
IN	Harding St	70	0.10	0.07	55%	PA	B Mansfield	3	0.14	0.07	90%
IN	Tanners Crk	U2	0.38	0.28	39%	PA	New Castle	3	0.28	0.20	45%
IN	Tanners Crk	U3	0.44	0.27	64%	PA	New Castle	4	0.32	0.16	99%
KY	Paradise	3	0.15	0.10	54%	SC	Cope	COP1	0.11	0.08	43%
MO	New Madrid	1	0.13	0.09	45%	SC	Williams	WIL1	0.11	0.06	90%
MO	New Madrid	2	0.16	0.09	72%	VA	Clinch River	1	0.35	0.19	85%
MO	Sibley	2	0.65	0.42	57%	VA	Clinch River	2	0.33	0.19	73%
MO	Thomas Hill	MB1	0.16	0.10	65%	VA	Clinch River	3	0.26	0.17	51%
NC	G G Allen	1	0.29	0.16	79%	VA	Yorktown	1	0.37	0.22	64%
NC	G G Allen	2	0.28	0.16	78%	VA	Yorktown	2	0.37	0.22	67%
NC	G G Allen	3	0.32	0.17	87%	WI	Bay Front	2	0.22	0.14	55%
NC	G G Allen	4	0.33	0.18	83%	WV	J E Amos	3	0.11	0.06	85%

Top 40 – out of 85. There are a total of 254 units in this Bin – 85 have rates above 0.1 or 0.2 lb/mmBtu.

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BIN Number 3

- BIN Number 3 includes 73 units that warrant the most significant review.
- It has been subdivided into three categories - All units in BIN 3 have rates that are more than double best historical rates:
  - 6 units have 2015 rates less than 0.1 lb/mmBtu
  - 26 units have 2015 rates between 0.1 and 0.2 lb/mmBtu
  - 41 units have 2015 rates greater than 0.2 lb/mmBtu

*Units with 2015 rates that are **more than double** best historical rates and 2015 NOx rates **between 0.1 and 0.2 lb/mmBtu***

State	Facility	Unit	2015 OS Rate (lb/mmBtu)	Best OS Rate (lb/mmBtu)	Deviation	State	Facility	Unit	2015 OS Rate (lb/mmBtu)	Best OS Rate (lb/mmBtu)	Deviation
AL	Gorgas	10	0.17	0.07	151%	NC	Mayo	1A	0.17	0.06	179%
IN	A B Brown	1	0.15	0.08	104%	NC	Mayo	1B	0.17	0.06	177%
IN	Gibson	1	0.11	0.03	235%	NC	Roxboro	2	0.14	0.06	146%
IN	Gibson	2	0.14	0.07	110%	NC	Roxboro	3A	0.19	0.07	155%
KY	Big Sandy	BSU2	0.20	0.10	106%	NC	Roxboro	3B	0.19	0.08	153%
KY	Ghent	3	0.17	0.03	533%	OH	Gavin	1	0.17	0.07	151%
KY	Mill Creek	3	0.18	0.05	307%	OH	Gavin	2	0.15	0.06	164%
KY	Mill Creek	4	0.16	0.04	327%	OH	Miami	7	0.15	0.05	177%
KY	Trimble Cty	1	0.13	0.03	323%	OH	Miami	8	0.16	0.05	190%
MA	Brayton Pt	3	0.14	0.04	255%	PA	B Mansfield	2	0.17	0.08	106%
NC	Belews Crk	1	0.13	0.03	374%	PA	Scrubgrass	1	0.12	0.06	108%
NC	Belews Crk	2	0.11	0.04	193%	WV	J E Amos	2	0.10	0.03	233%
NC	Cliffside	5	0.13	0.06	137%	WV	Mtn'eer	1	0.11	0.04	180%

* All but 1 with SCR

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BIN Number 3

*… units with 2015 rates that are **more than double** best historical rates and 2015 NOx rates **above 0.2 lb/mmBtu***

State	Facility	Unit	2015 OS Rate (lb/mmBtu)	Best OS Rate (lb/mmBtu)	Deviation	State	Facility	Unit	2015 OS Rate (lb/mmBtu)	Best OS Rate (lb/mmBtu)	Deviation
AL	C R Lowman	3	0.26	0.06	342%	OH	Kyger Creek	3	0.26	0.08	225%
FL	St. Johns Rvr	1	0.41	0.13	221%	OH	Kyger Creek	4	0.28	0.08	258%
FL	St. Johns Rvr	2	0.38	0.13	200%	OH	Kyger Creek	5	0.30	0.08	276%
IN	Alcoa	4	0.28	0.09	198%	OH	W HZimmer	1	0.23	0.06	306%
IN	Clifty Creek	1	0.23	0.07	210%	PA	B Mansfield	1	0.24	0.08	195%
IN	Clifty Creek	2	0.23	0.08	205%	PA	Cheswick	1	0.25	0.09	181%
IN	Clifty Creek	3	0.23	0.07	208%	PA	Homer City	1	0.35	0.07	425%
IN	Gibson	3	0.20	0.07	204%	PA	Homer City	2	0.35	0.08	325%
IN	Gibson	5	0.34	0.06	471%	PA	Homer City	3	0.28	0.09	223%
IN	Petersburg	2	0.20	0.05	301%	PA	Keystone	1	0.23	0.04	438%
IN	Petersburg	3	0.27	0.05	478%	PA	Keystone	2	0.24	0.04	460%
KY	East Bend	2	0.22	0.05	316%	PA	Montour	1	0.31	0.06	432%
KY	Elmer Smith	1	0.36	0.12	190%	PA	Montour	2	0.34	0.06	482%
MO	Sibley	1	0.70	0.34	106%	WV	Grant Town	1A	0.34	0.07	375%
MO	Sibley	3	0.24	0.08	203%	WV	Grant Town	1B	0.34	0.07	370%
MO	Thomas Hill	MB3	0.23	0.10	138%	WV	Harrison	1	0.32	0.06	401%
NH	Merrimack	1	0.52	0.16	224%	WV	Harrison	2	0.36	0.07	450%
NH	Merrimack	2	0.44	0.16	175%	WV	Harrison	3	0.34	0.07	420%
OH	Killen	2	0.24	0.09	172%	WV	Pleasants	1	0.22	0.04	455%
OH	Kyger Creek	1	0.21	0.08	170%	WV	Pleasants	2	0.37	0.04	850%
OH	Kyger Creek	2	0.20	0.08	155%						

* All but 3 with SCR

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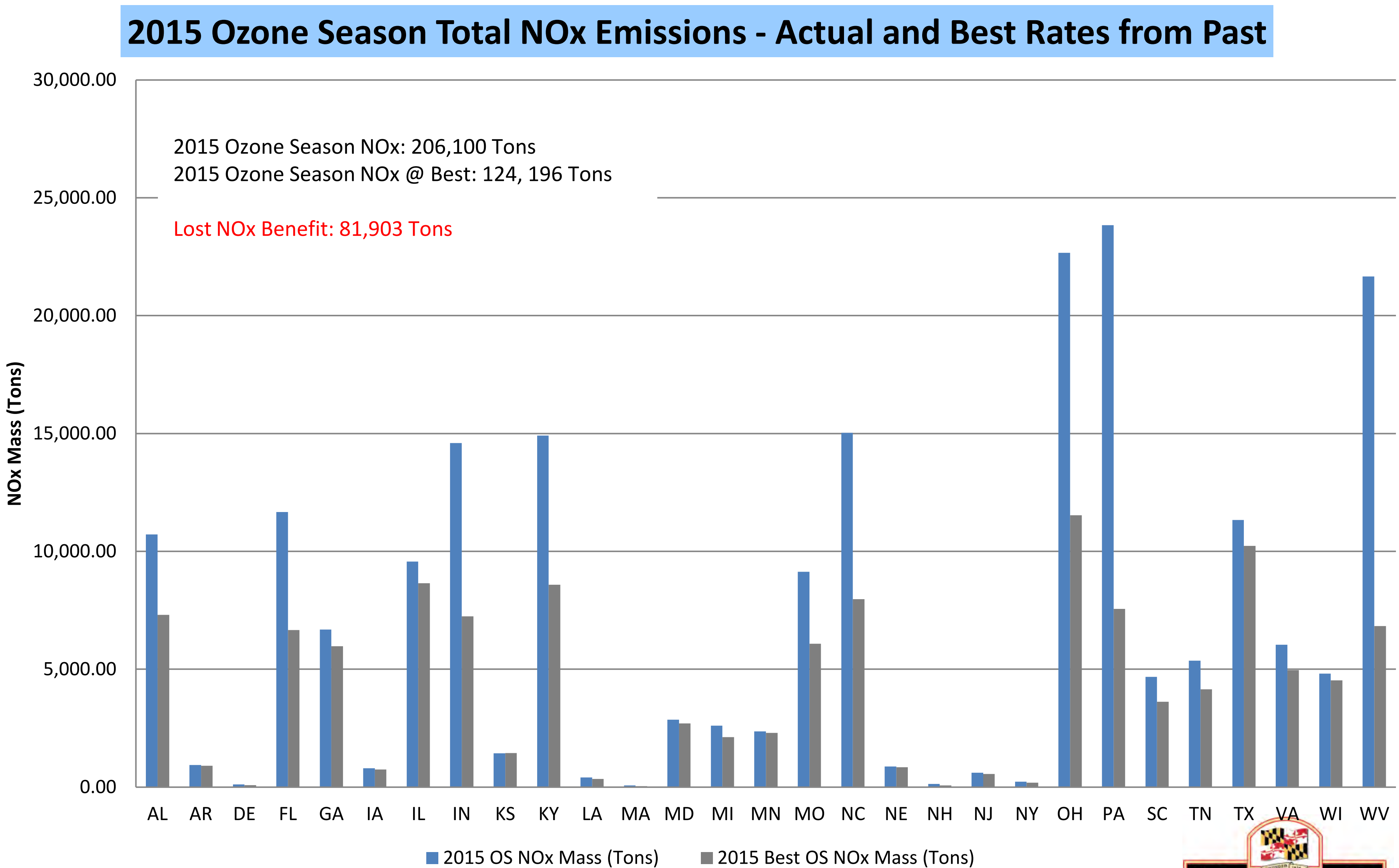
Lost NOx Reductions - By State



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* Ongoing analyses are looking at how to adjust “best rates from the past” to account for operation at lower capacity and equipment age

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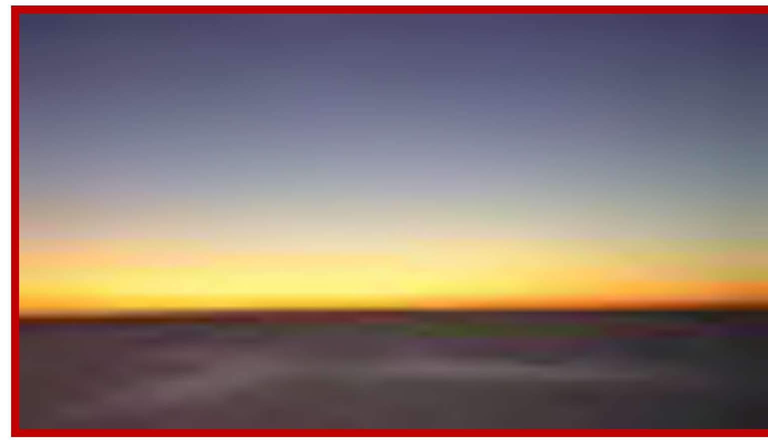
Optimization Appears to be Underway

- States with the majority of their units meeting or out-performing best historical rates
  - Arkansas
  - Delaware
  - Georgia
  - Iowa
  - Illinois
  - Kansas
  - Louisiana
  - Massachusetts
  - Maryland
  - Michigan
  - Minnesota
  - Nebraska
  - New Hampshire
  - New Jersey
  - New York
  - South Carolina
  - Tennessee
  - Texas
  - Virginia
  - Wisconsin



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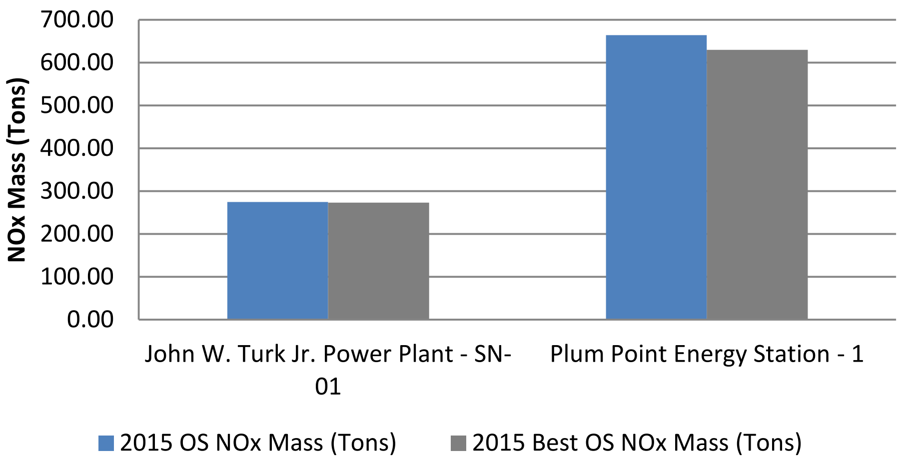
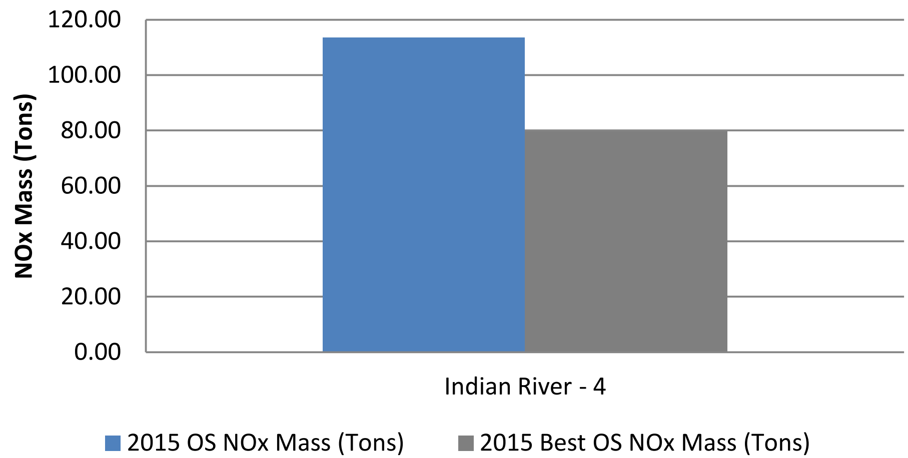
Optimization Appears to be Underway

2015 Ozone Season Total NOx Emissions – Actual and Best Rates from Past

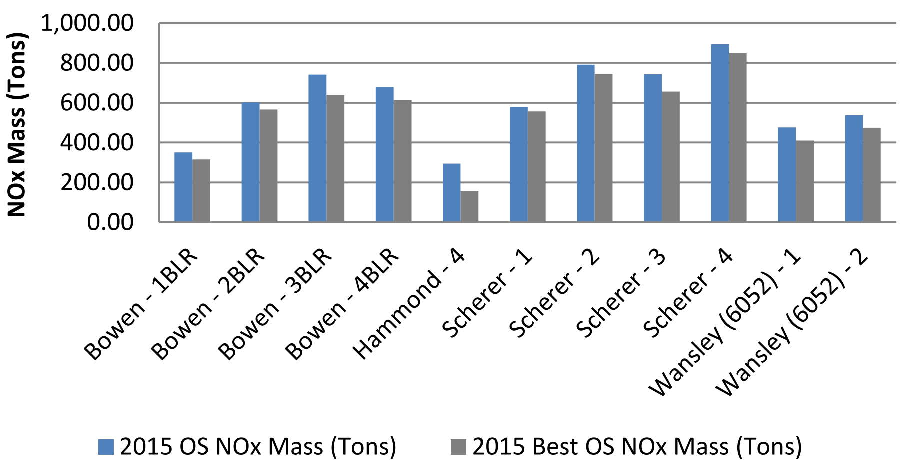
Arkansas



Delaware



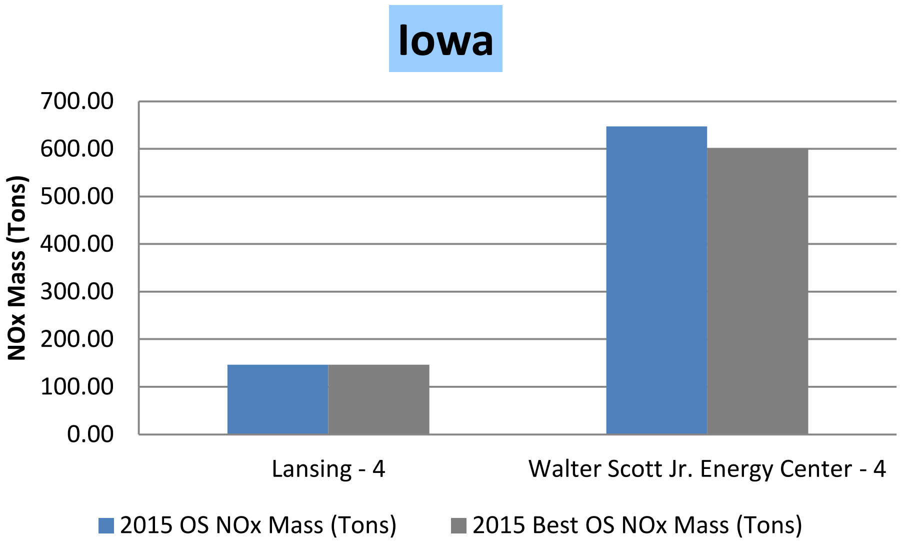
Georgia

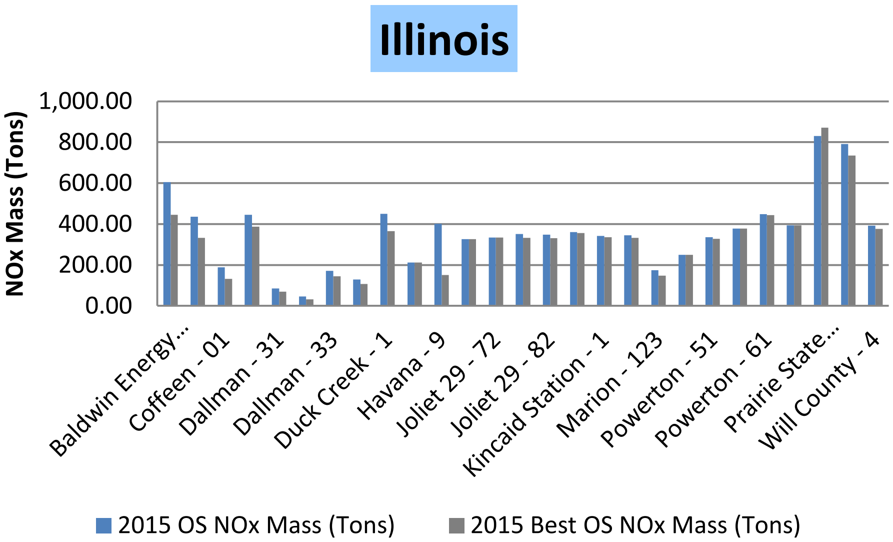


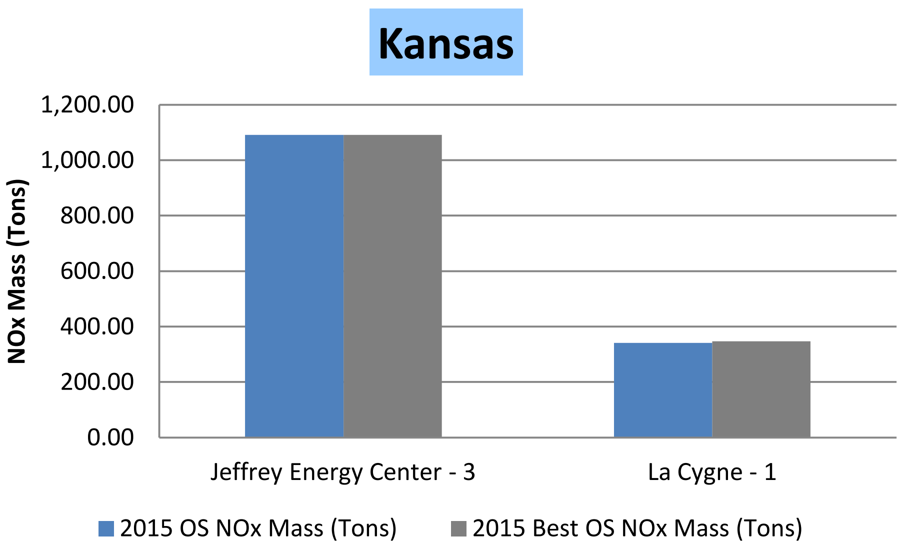
	2015 Actual OS NOx Mass (Tons)	2015 @ Best Rates OS NOx Mass (Tons)	Lost Savings (Tons)	% of Total Loss
Arkansas	938	902	36	0.04%
Delaware	114	80	34	0.04%
Georgia	6,682	5,973	708	0.86%

Optimization Appears to be Underway

2015 Ozone Season Total NOx Emissions – Actual and Best Rates from Past







	2015 Actual OS NOx Mass (Tons)	2015 @ Best Rates OS NOx Mass (Tons)	Lost Savings (Tons)	% of Total Loss
Iowa	793	748	46	0.06%
Illinois	9,569	8,652	917	1.12%
Kansas	1,432	1,438	6	0.01%

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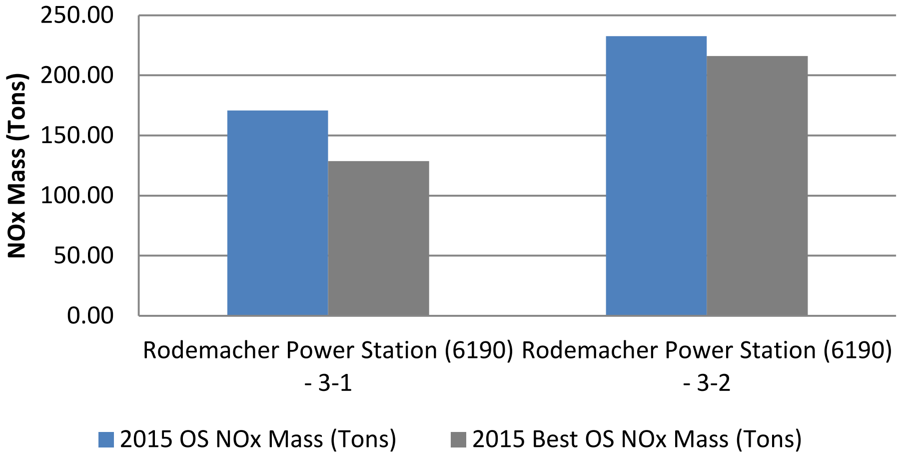
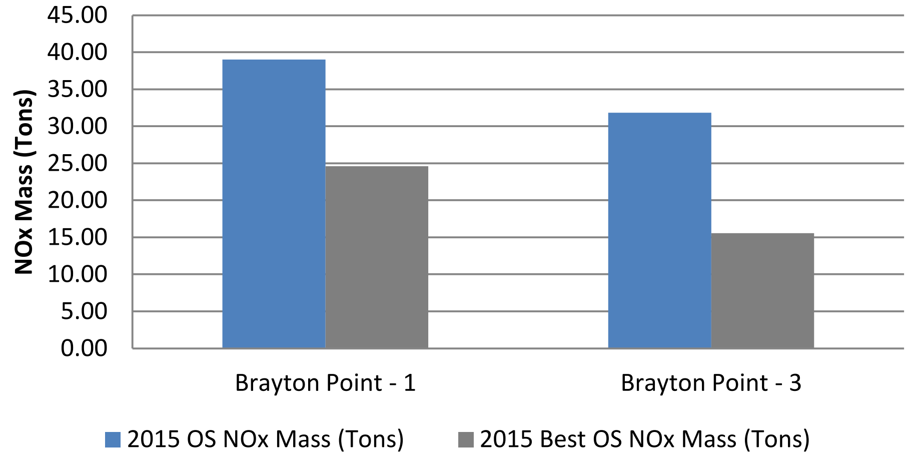
Optimization Appears to be Underway

2015 Ozone Season Total NOx Emissions – Actual and Best Rates from Past

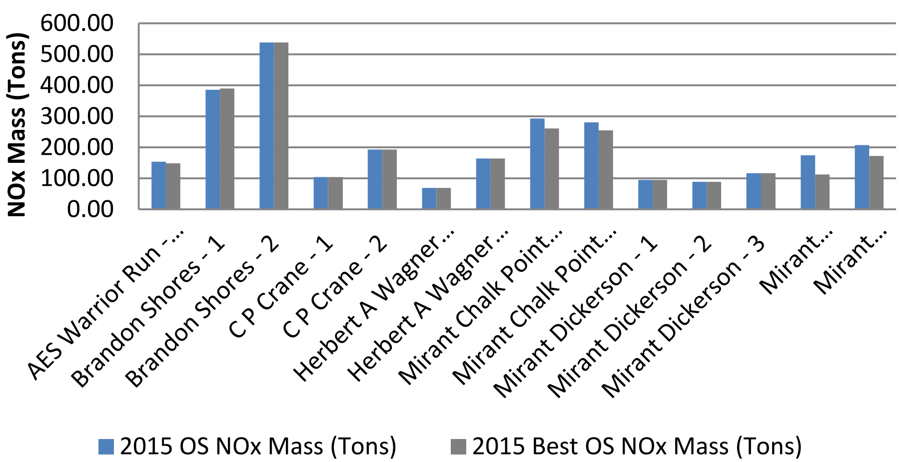
Louisiana



Massachusetts



Maryland



	2015 Actual OS NOx Mass (Tons)	2015 @ Best Rates OS NOx Mass (Tons)	Lost Savings (Tons)	% of Total Loss
Louisiana	403	345	59	0.07%
Massachusetts	71	40	31	0.04%
Maryland	2,859	2,702	156	0.19%

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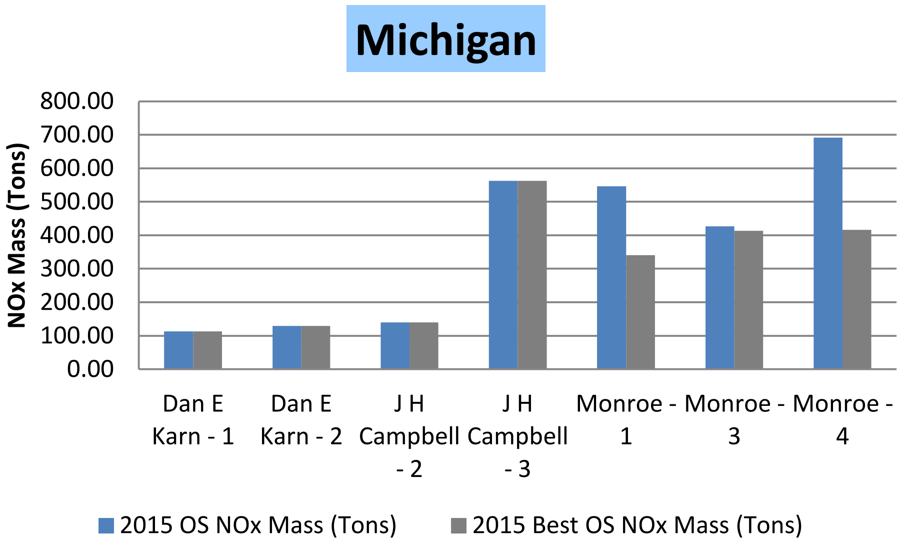
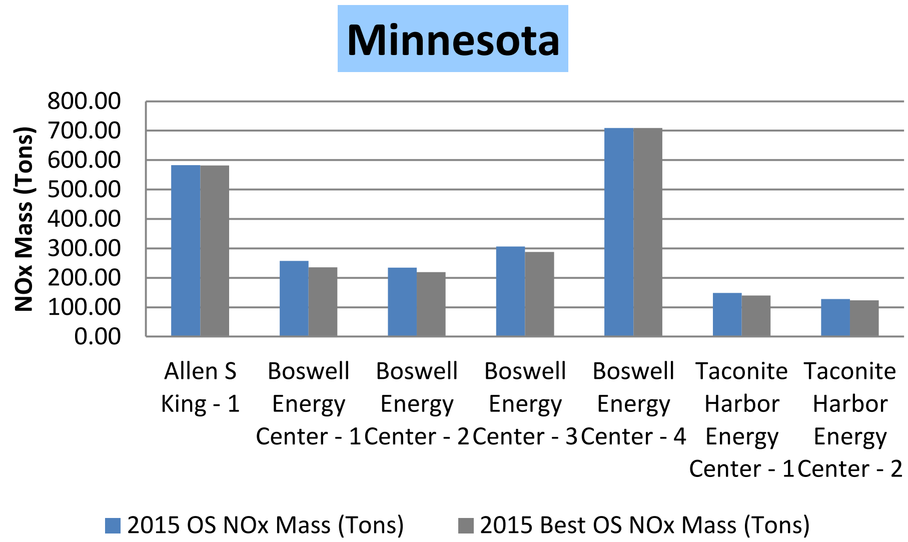
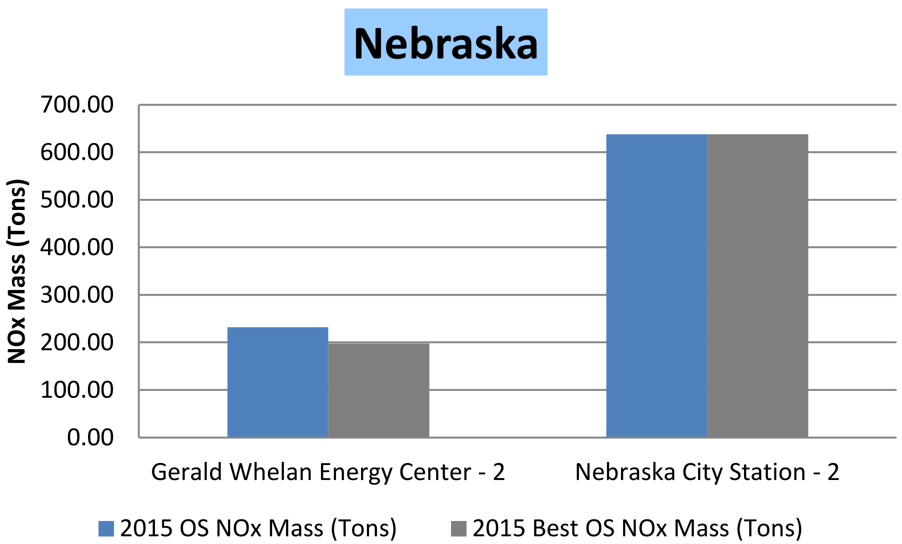
Optimization Appears to be Underway

2015 Ozone Season Total NOx Emissions – Actual and Best Rates from Past





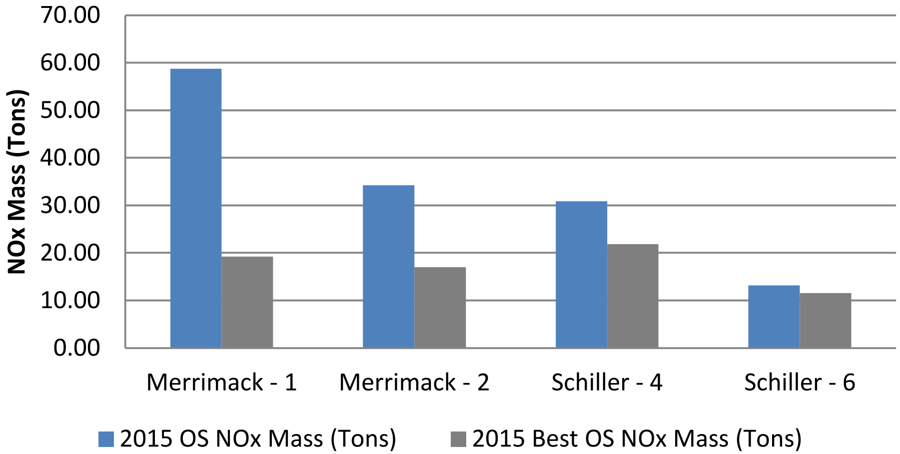


	2015 Actual OS NOx Mass (Tons)	2015 @ Best Rates OS NOx Mass (Tons)	Lost Savings (Tons)	% of Total Loss
Michigan	2,608	2,115	494	0.60%
Minnesota	2,366	2,296	69	0.08%
Nebraska	870	835	35	0.04%

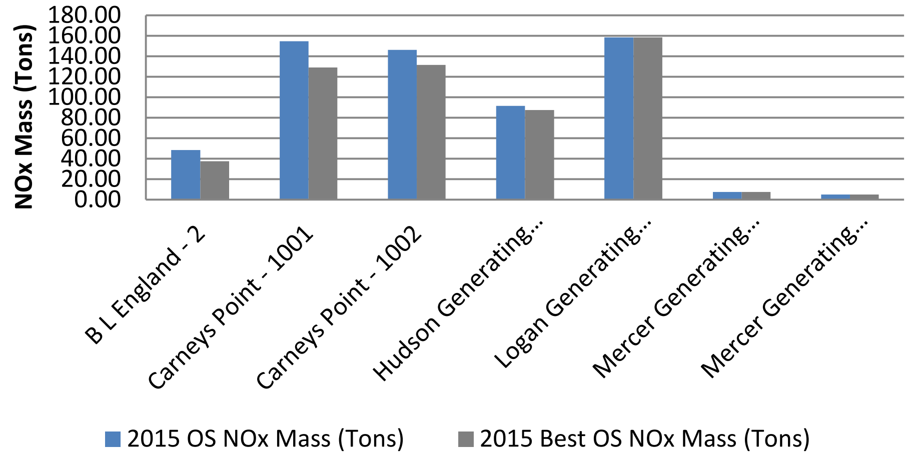
Optimization Appears to be Underway

2015 Ozone Season Total NOx Emissions – Actual and Best Rates from Past

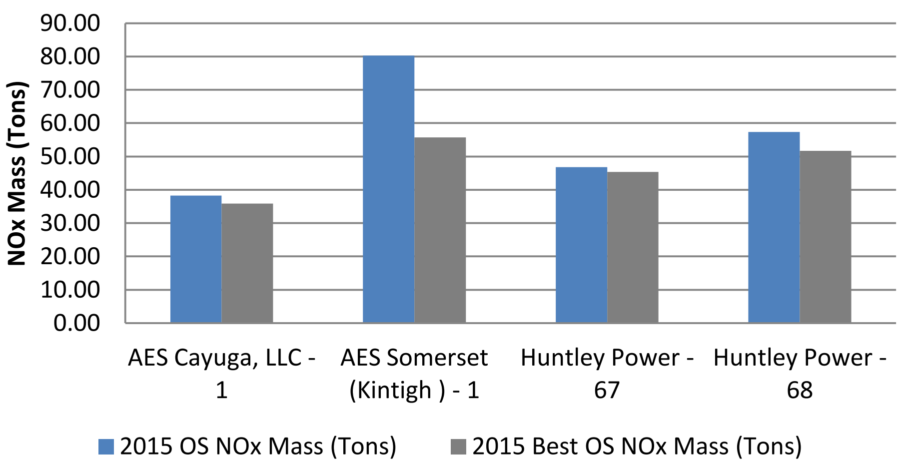
New Hampshire



New Jersey



New York



	2015 Actual OS NOx Mass (Tons)	2015 @ Best Rates OS NOx Mass (Tons)	Lost Savings (Tons)	% of Total Loss
New Hampshire	137	70	67	0.08%
New Jersey	611	556	55	0.07%
New York	223	189	34	0.04%

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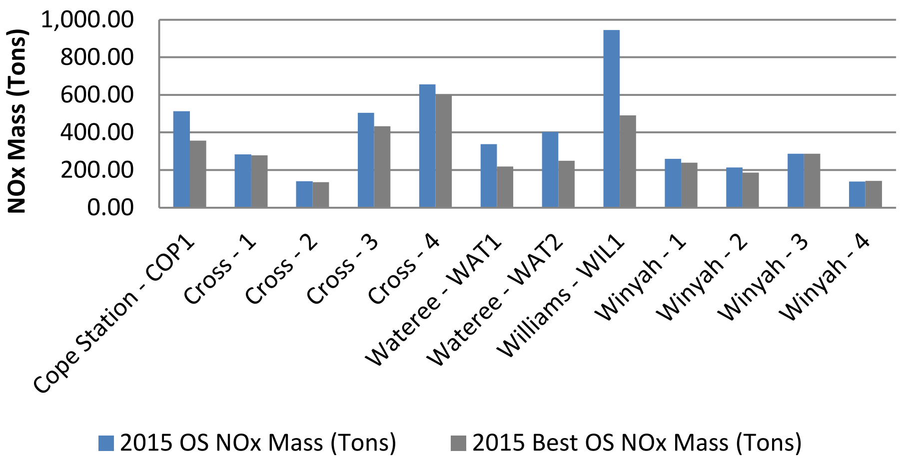
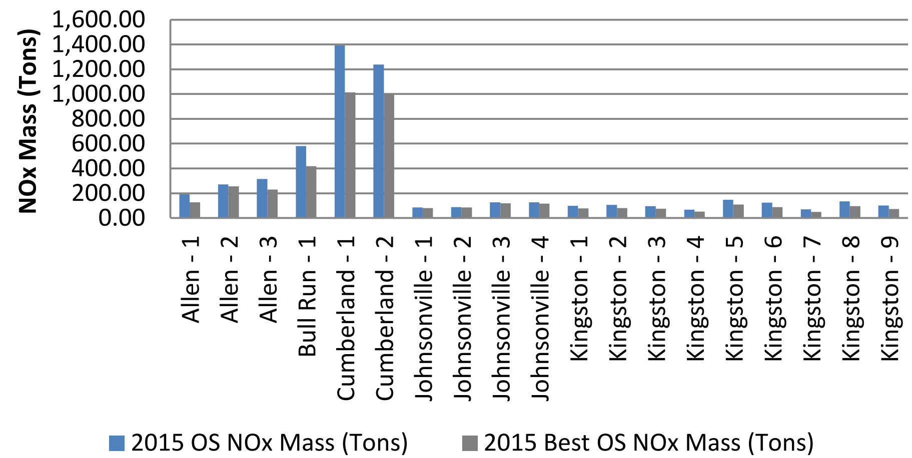
Optimization Appears to be Underway

2015 Ozone Season Total NOx Emissions – Actual and Best Rates from Past

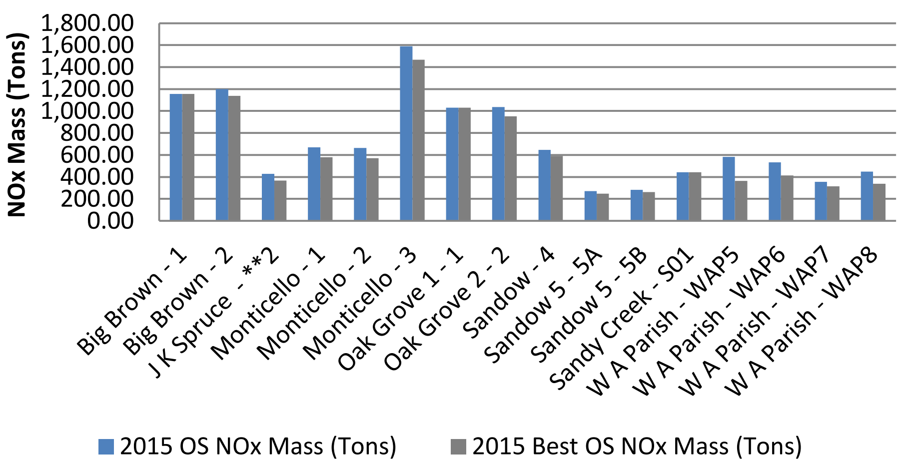
South Carolina



Tennessee



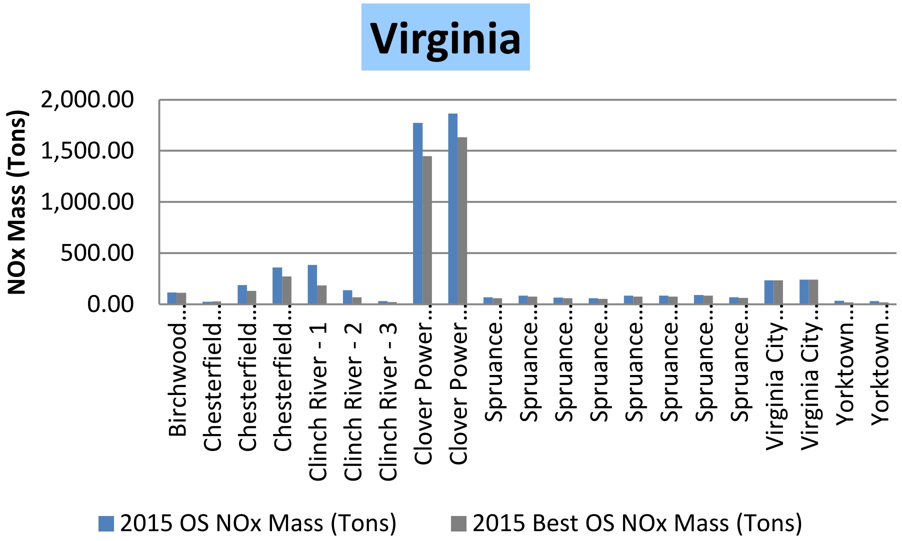
Texas

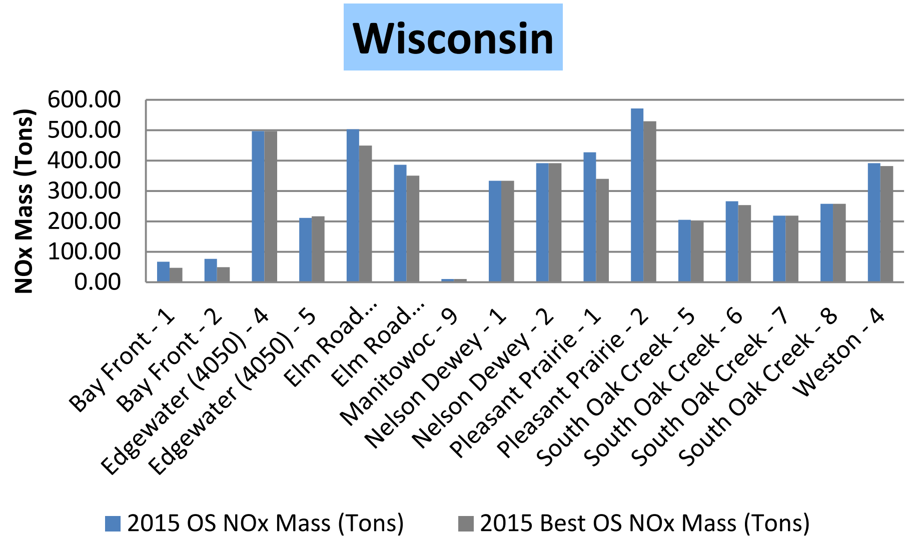


	2015 Actual OS NOx Mass (Tons)	2015 @ Best Rates OS NOx Mass (Tons)	Lost Savings (Tons)	% of Total Loss
South Carolina	4,678	3,613	1,065	1.30%
Tennessee	5,361	4,144	1,216	1.49%
Texas	11,372	10,231	1,096	1.34%

Optimization Appears to be Underway

2015 Ozone Season Total NOx Emissions – Actual and Best Rates from Past





	2015 Actual OS NOx Mass (Tons)	2015 @ Best Rates OS NOx Mass (Tons)	Lost Savings (Tons)	% of Total Loss
Virginia	6,034	4,962	1,072	1.31%
Wisconsin	4,811	4,525	287	0.35%

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Review of Optimization Needed

- States with a meaningful portion of their units with rates exceeding best historical rates and higher than expected 2015 rates

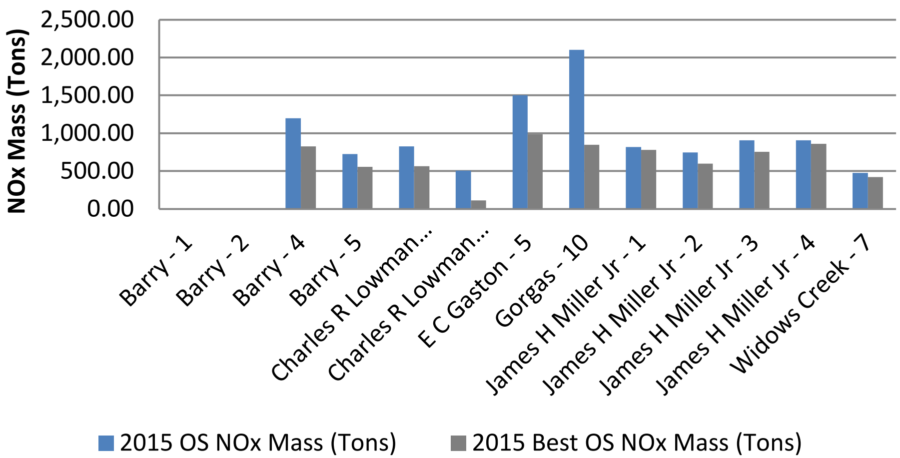
- Alabama
- Florida
- Indiana
- Kentucky
- Missouri
- North Carolina
- Ohio
- Pennsylvania
- West Virginia

MARYLAND

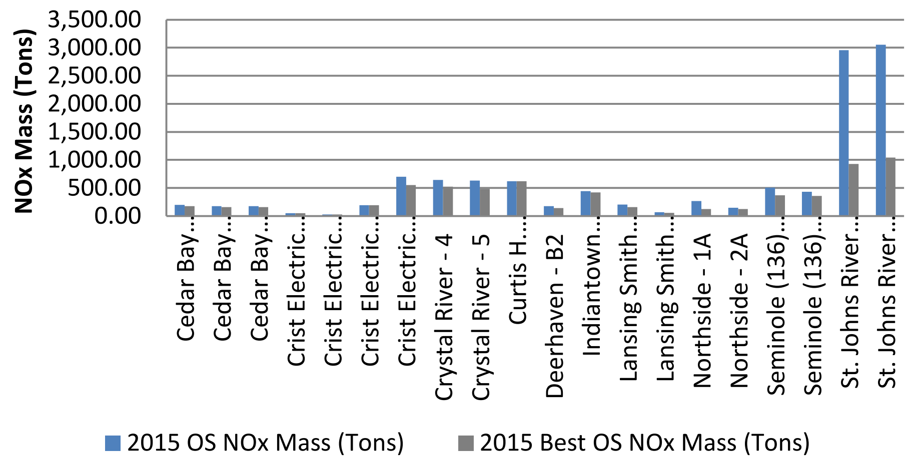
Review of Optimization Needed

2015 Ozone Season Total NOx Emissions – Actual and Best Rates from Past

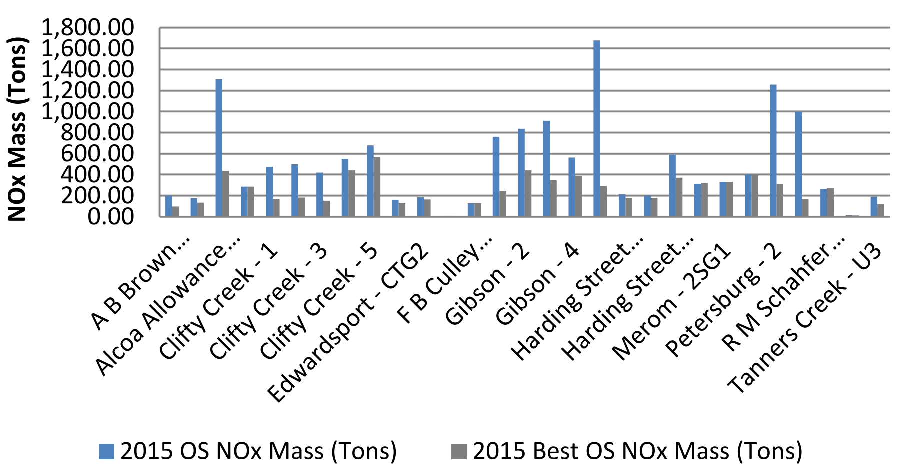
Alabama



Florida



Indiana



	2015 Actual OS NOx Mass (Tons)	2015 @ Best Rates OS NOx Mass (Tons)	Lost Savings (Tons)	% of Total Loss
Alabama	10,713	7,308	3,405	4.16%
Florida	11,666	6,659	5,007	6.11%
Indiana	14,591	7,246	7,344	8.97%

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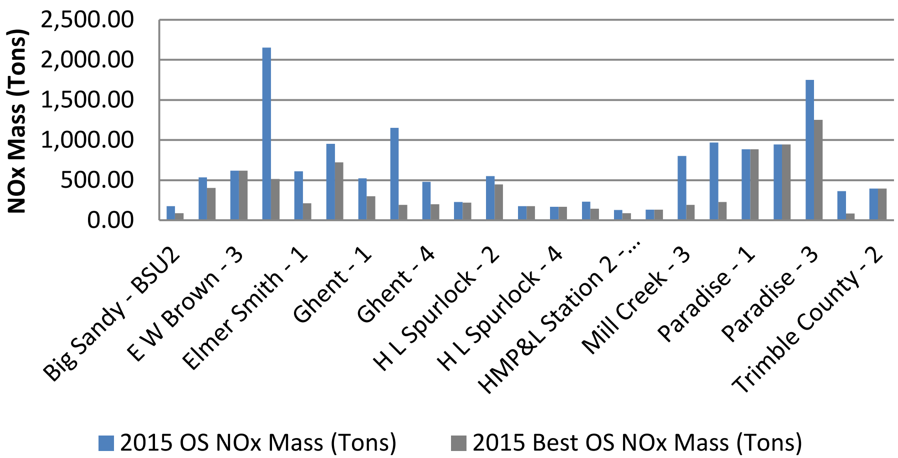
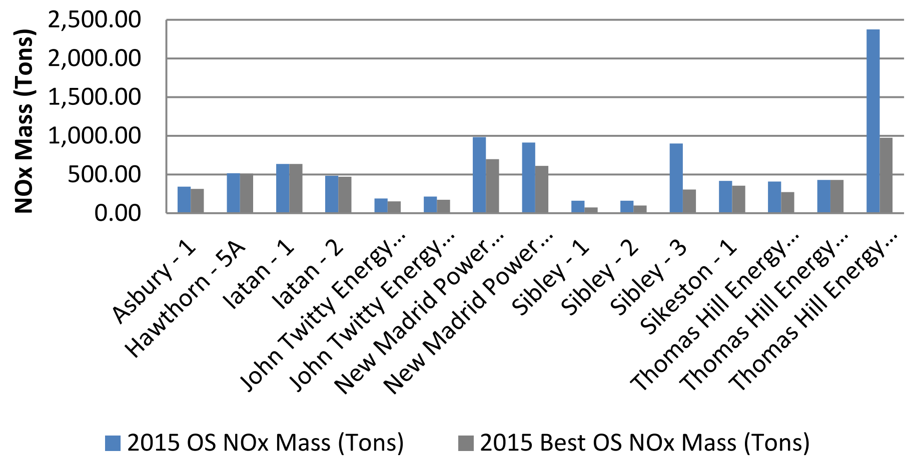
Review of Optimization Needed

2015 Ozone Season Total NOx Emissions – Actual and Best Rates from Past

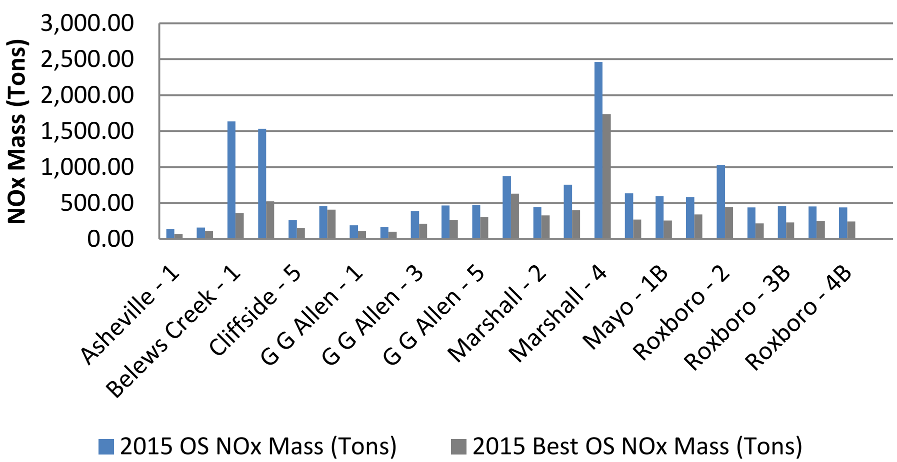
Kentucky



Missouri



North Carolina



	2015 Actual OS NOx Mass (Tons)	2015 @ Best Rates OS NOx Mass (Tons)	Lost Savings (Tons)	% of Total Loss
Kentucky	14,907	8,588	6,319	7.72%
Missouri	9,138	6,082	3,056	3.73%
N. Carolina	15,025	7,973	7,052	8.61%

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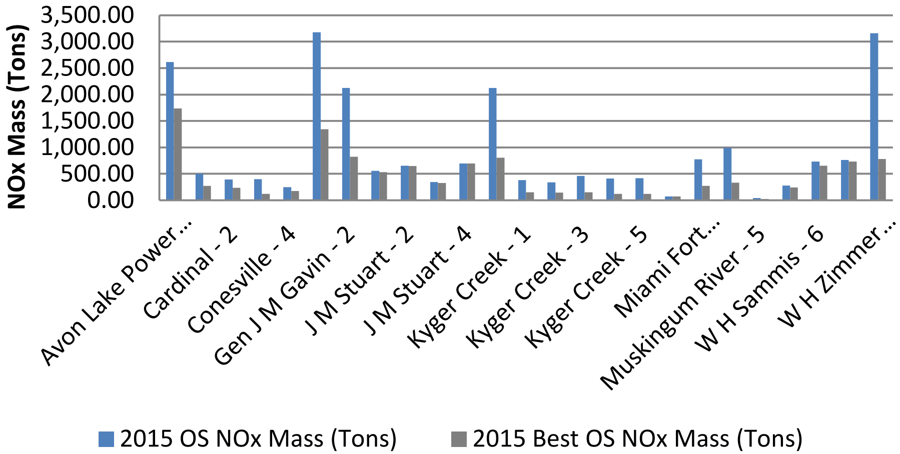
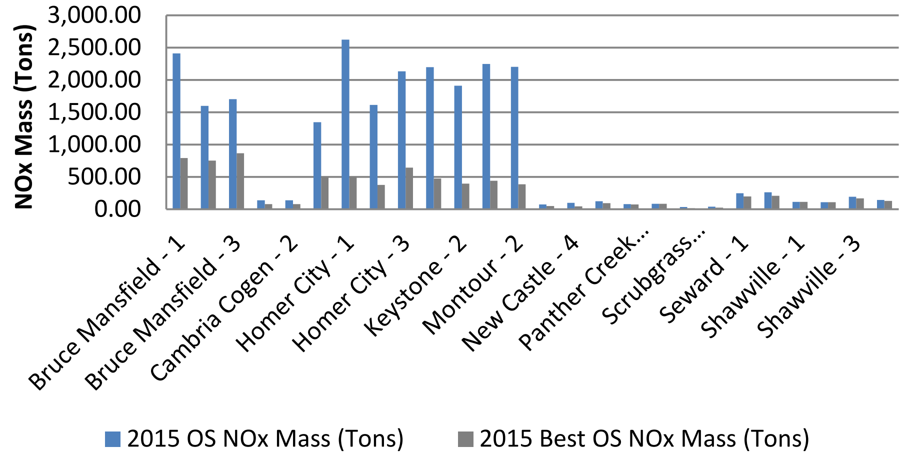
Review of Optimization Needed

2015 Ozone Season Total NOx Emissions – Actual and Best Rates from Past

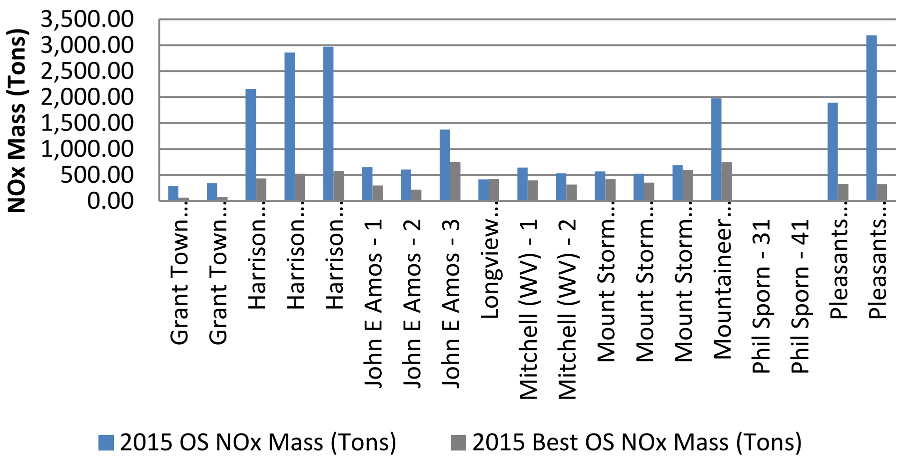
Ohio



Pennsylvania



West Virginia



	2015 Actual OS NOx Mass (Tons)	2015 @ Best Rates OS NOx Mass (Tons)	Lost Savings (Tons)	% of Total Loss
Ohio	22,668	11,532	11,136	13.60%
Pennsylvania	23,841	7,562	16,279	19.88%
West Virginia	21,662	6,827	14,835	18.11%

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Some Observations

- There are more states with units that appear to be optimizing controls than states with units that are not
  - Many of the states identified in the 176A Petition appear to have many units not optimizing controls
  - With reasonable efforts to optimize controls approximately 400 tons of daily NOx reductions could be achieved on high ozone days
- Many states have a majority of their units close to meeting best historical rates.
  - AR, DE, GA, IA, IL, KA, LO, MA, MD, MI, MN, NE, NH, NJ, NY, SC, TN, TX, VA and WI all have a majority of reported units close to best historical rates
- Many states have a significant number of units emitting at rates that are noticeably higher than best historical rates
  - AL, FL, IN, KY, MO, NC, OH, PA and WV all have units exceeding best historical rates
- Ozone has been low in some areas despite optimization concerns … Reduced emissions, kind weather and chemistry appear to have all played a role

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Wrap-Up/Next Steps

- Additional continuing analysis appears to be called for
  - Charge the Air Directors to increase efforts to better understand why optimization is not occurring in some states and is clearly taking place in others?
- Highlights the need for "common" federally enforceable requirements to optimize controls as a playing field that is not level creates competitive advantages for some … which can affect a voluntary effort
- Good Neighbor SIPs are now required/past due for many states
- Many of the units that routinely optimize controls have language similar to the language below (discussed by SCOOT Workgroups) as part of federally enforceable regulations, permit conditions or consent decrees

… for each day during the ozone season, the owner or operator of an affected EGU shall minimize NOx emissions by operating and optimizing the use of all installed pollution control technology and combustion controls consistent with the technological limitations, manufacturers specifications, good engineering practices and good air pollution control practices for minimizing emissions (as defined in 40 CFR Section 60.11(d)) …