CBP Atmospheric Deposition Allocation

Water Quality Goal Implementation Team
Gettysburg, Pa

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Overview:

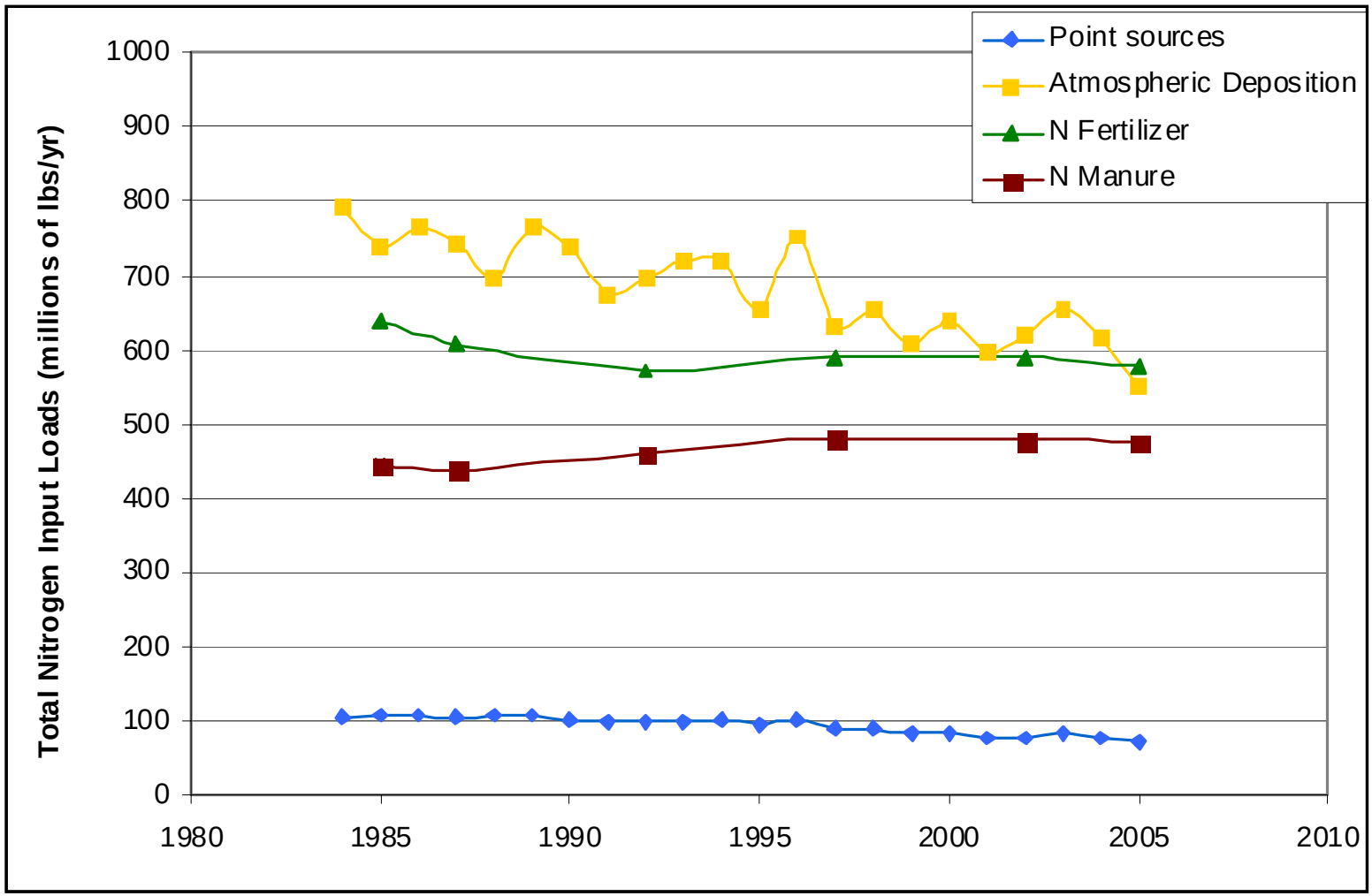
• Trends in NOx and ammonia - Loads of oxidized nitrogen (NOx) are decreasing and will continue to decrease until 2020 and beyond. Loads of reduced nitrogen or ammonia are steady or increasing.

• The large NOx load reductions are due to 1) federal level reductions in mobile emissions and 2) federal level reduction in the interstate CAIR and 3) State reduction due to current SIPs. These loads are estimated in the 2020 Air Scenario which account for full implementation of these measures.

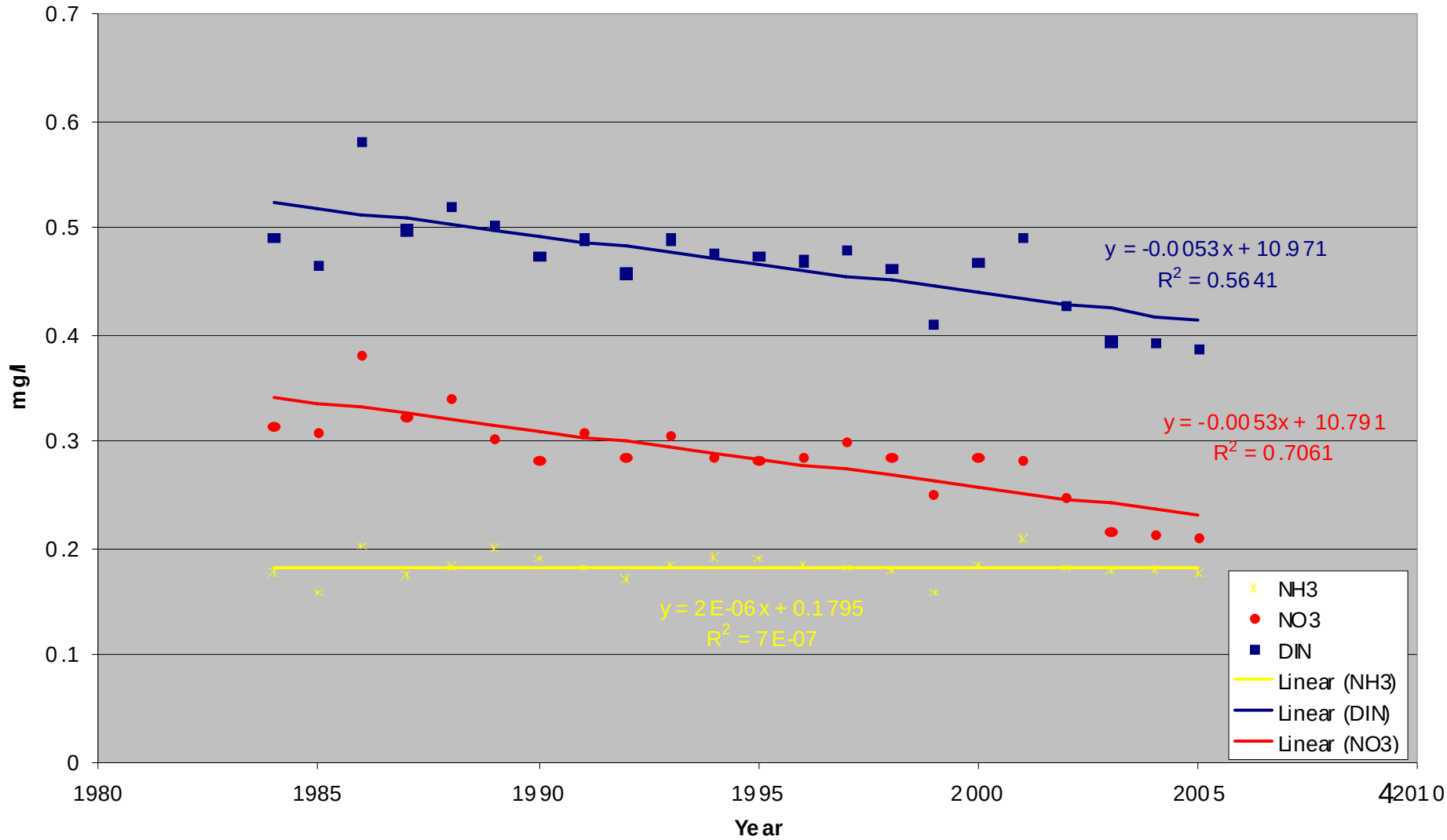
• Load reductions beyond 2020 Air Scenario (current SIPS, mobile emissions, and CAIR) would be due to the new proposed ozone standard will be in new State Implementation Plans due December 2013 These SIP load reductions can be credited toward Chesapeake Bay load reductions in the WIPs based on reduced loads delivered to the Bay

Trends in NOx and Ammonia:

Time series of atmospheric, fertilizer, manure, and point source nitrogen input loads to the Chesapeake Bay Water Quality and Sediment Transport Model.

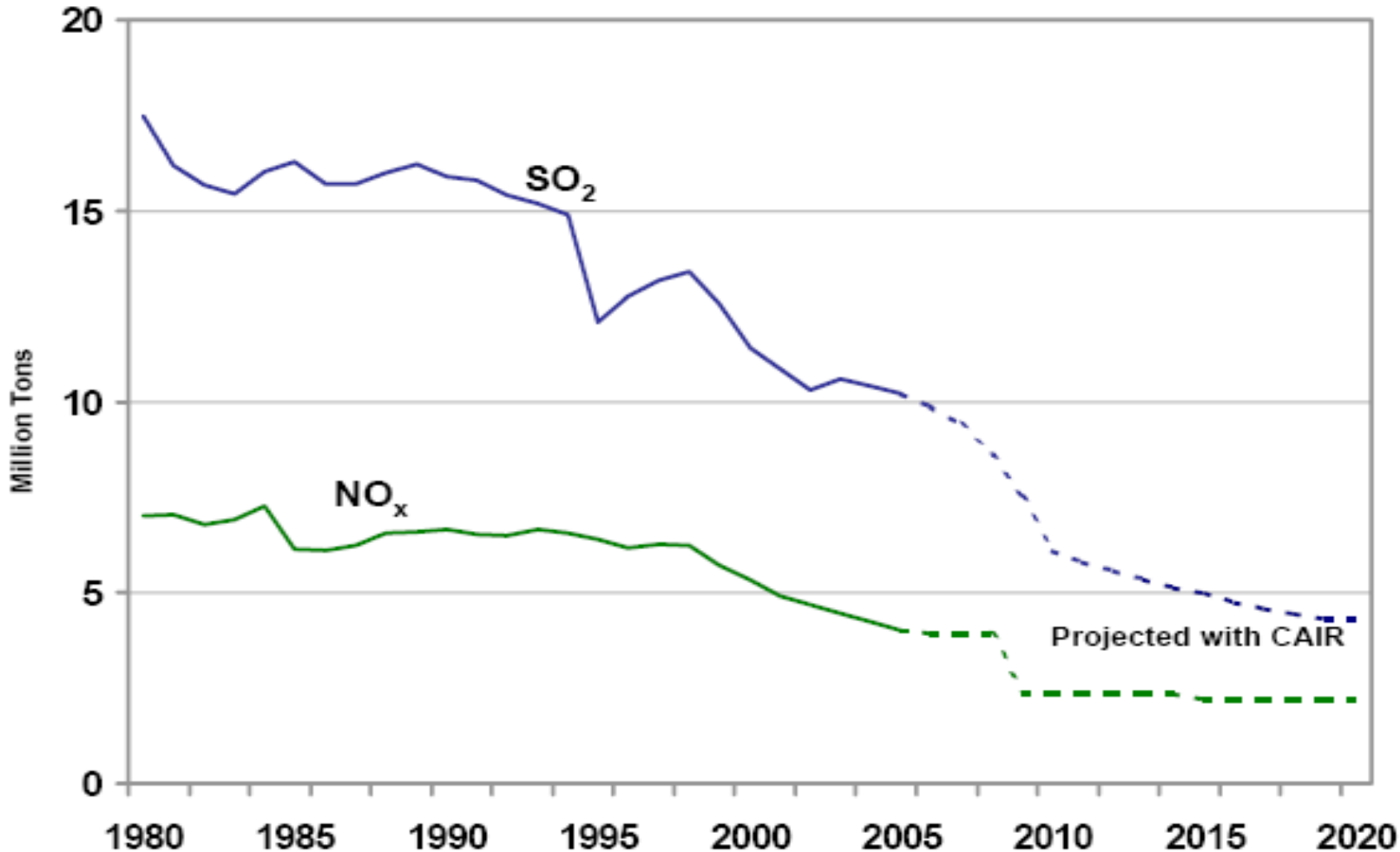


Trend of estimated average nitrate and ammonia deposition concentrations to the Phase 5 domain:



Trends in NOx and Ammonia:

Estimated nationwide emissions of NOx and SO_2 from electric generating units (EGUs) since 1980 and estimated emissions to 2020.



Source: EPA

Trends in NOx and Ammonia:

Estimated portion of deposited NOx loads on the Chesapeake watershed from four sectors including EGUs, mobile sources, industry, and all other sources in 1990 and 2020

Watershed		
	1990	2020 Preliminary
Power Plants (EGU's)	40%	17%
Mobile Sources (on-road)	30%	32%
Industry	8%	20%
Other (off-road-construction; residential & commercial)	21%	31%

Trends in NOx and Ammonia:

Estimated Direct atmospheric deposition loads of nitrogen to the tidal Chesapeake Bay for key scenarios. Units in millions of pounds as N.

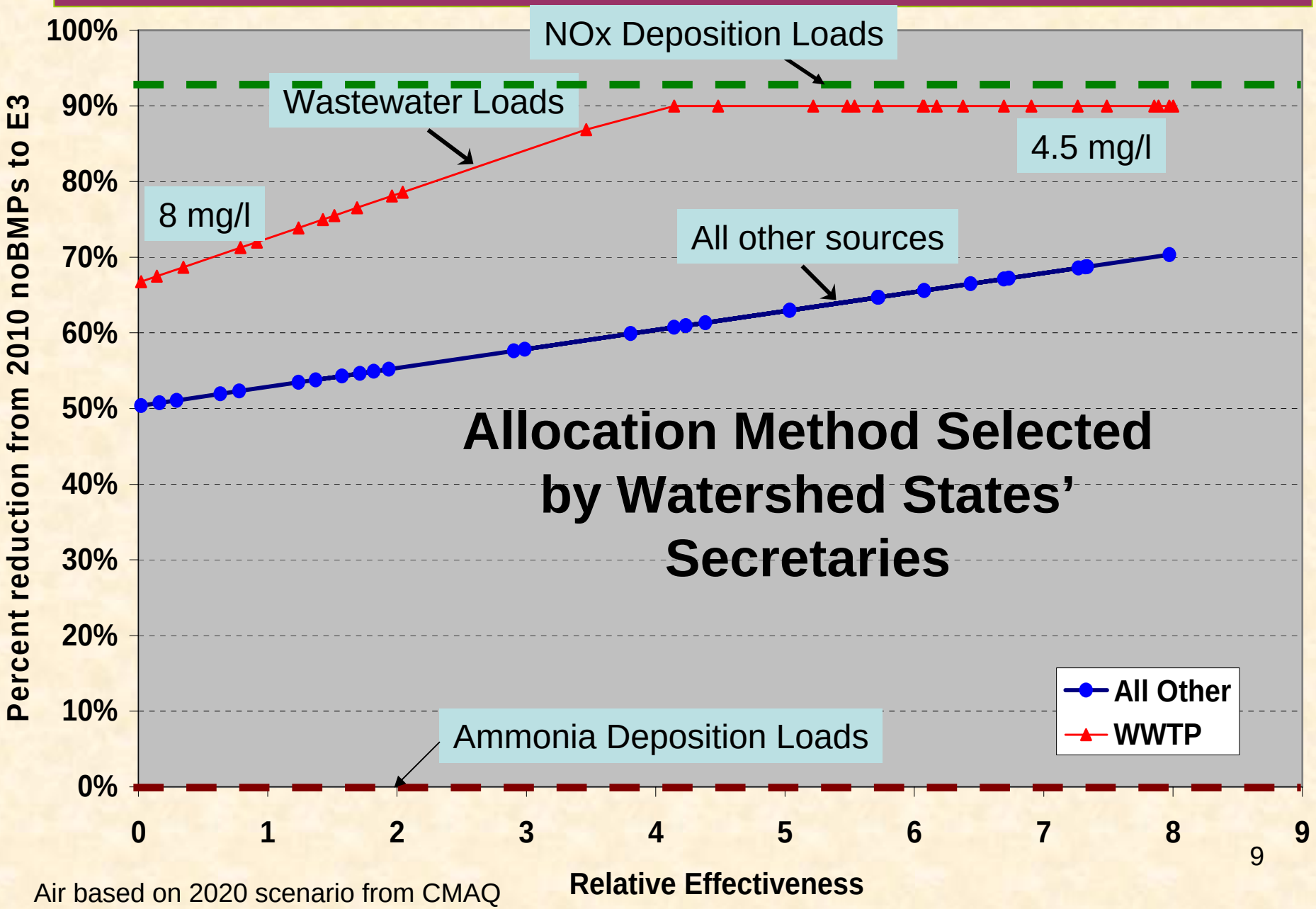
SCENARIO	Wet NO_X Deposition	Dry NO_X Deposition	Wet NH_3 Deposition	Dry NH_3 Deposition	Total Inorganic Nitrogen Deposition	Wet Organic Nitrogen Deposition	Total Nitrogen Deposition	Wet PO_4 Deposition	Wet Organic Phosphorus Deposition	Total Phosphorus Deposition
1985 Scenario	6.57	13.15	3.34	1.97	25.03	1.05	26.08	0.33	0.98	1.30
2002 Scenario	4.81	10.04	3.57	2.12	20.54	1.05	21.60	0.33	0.98	1.30
2010 Scenario	3.27	6.85	3.49	2.76	16.36	1.05	17.42	0.33	0.98	1.30
2020 Scenario	2.56	5.11	3.72	3.24	14.63	1.05	15.68	0.33	0.98	1.30
2020 Maximum Feasible	2.30	4.48	3.64	3.41	13.84	1.05	14.89	0.33	0.98	1.30
2030 Scenario	2.22	4.30	3.96	4.08	14.56	1.05	15.61	0.33	0.98	1.30

Trends in NOx and Ammonia:

Atmospheric Deposition Nitrogen Delivered to the Bay Under Key Scenarios Units in millions of pounds as N (Phase 5.2 - August 2009 Version).

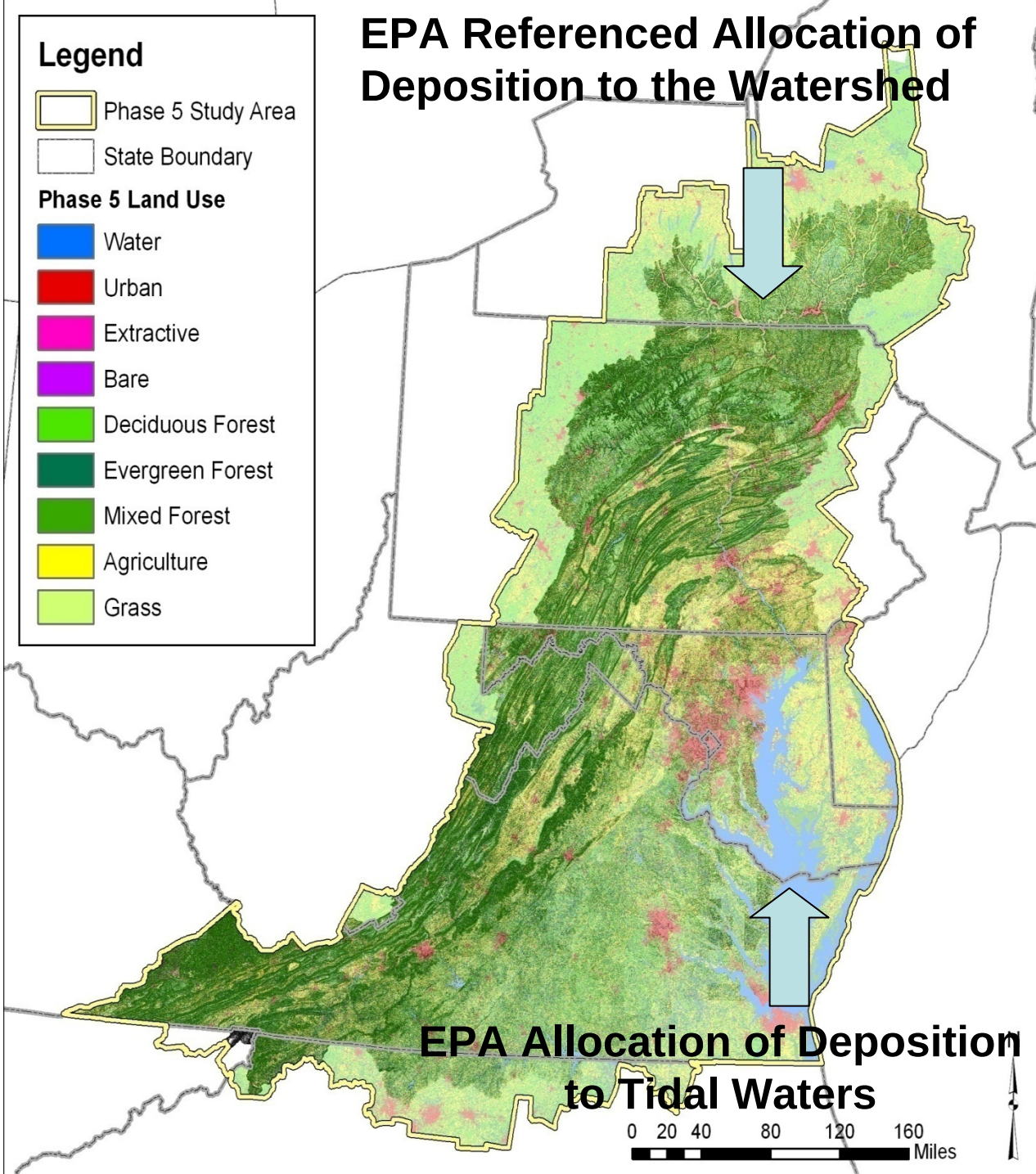
Basins	1985 Scenario	2002 Scenario	2010 Scenario	2020 Scenario	2020 Maximum Feasible Scenario	2030 Scenario
Susquehanna	160.43	148.09	141.44	138.68	137.60	139.28
West Shore	15.72	15.30	15.07	14.98	14.94	14.99
Potomac	77.00	72.15	69.41	68.34	67.87	68.58
Patuxent	4.82	4.54	4.38	4.32	4.29	4.31
Rappahannock	10.96	9.83	9.99	9.83	9.77	9.81
James	37.89	36.67	35.61	35.15	35.01	35.11
York	9.33	8.88	8.55	8.41	8.36	8.39
East Shore MD-DE	31.57	29.77	29.19	29.18	29.06	29.69
East Shore VA	3.01	2.91	2.84	2.83	2.81	2.83
Total	**350.74**	**328.13**	**316.50**	**311.71**	**309.72**	**312.98**

Air vs Land target load controls (% controllable N load)



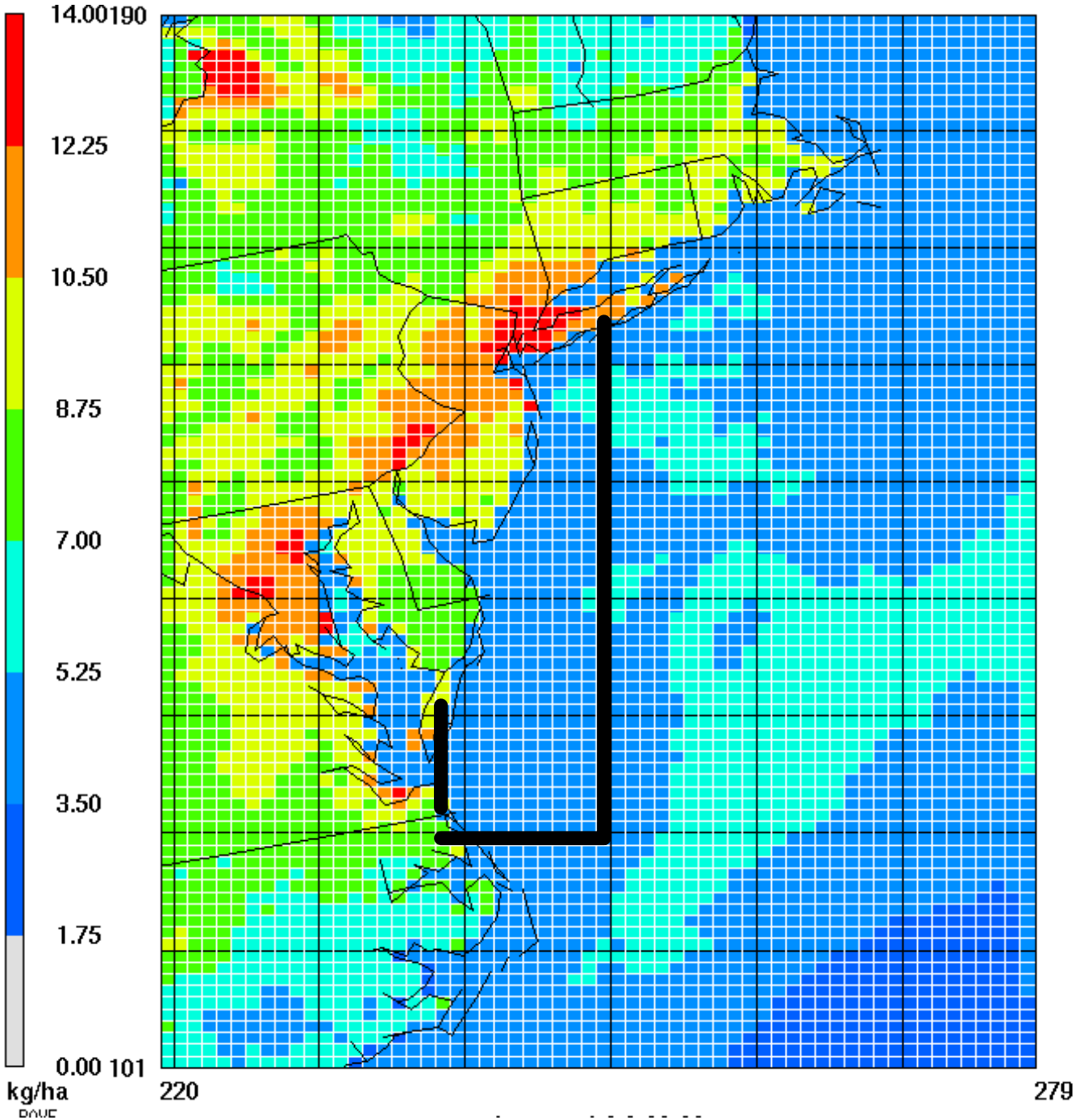
Air based on 2020 scenario from CMAQ

Latest thinking is that the EPA air allocation may be the load reductions up to and including the 2020 Air Scenario. Beyond the 2020 Scenario air emission load reductions that result in decreased delivered loads to the Chesapeake made by CBP States will be credited to the CB States.



Boundaries of the coastal ocean region used to adjust the ocean boundary conditions in the WQSTM.

Emission reductions beyond the 2020 Scenario resulting in loads to the coastal ocean may also be allocated to the States, but the load reductions would be trivial.



CMAQ 2020 Scenario

The 2020 Scenario has all components of the 2010 Scenario and includes the Clean Air Mercury Rule (CAMR), the Best Available Retrofit Technology (BART) used for reducing regional haze, and the off-road diesel and heavy duty diesel regulations. The 2020 Scenario represents emission reductions due to regulations implemented through the Clean Air Act authority to meet National Ambient Air Quality standards for criteria pollutants in 2020. These include:

On-Road mobile sources: For On-Road Light Duty Mobile Sources this includes Tier 2 vehicle emissions standards and the Gasoline Sulfur Program which affects SUV's pickups, and vans which are now subject to same national emission standards as cars.

On-Road Heavy Duty Diesel Rule – Tier 4: New emission standards on diesel engines starting with the 2010 model year for NOx, plus some diesel engine retrofits.

Clean Air Non-Road Diesel Rule: Off-road diesel engine vehicle rule, commercial marine diesels, and locomotive diesels (phased in by 2014) require controls on new engines.

Off-road large spark ignition engine rules affect recreational vehicles (marine and land based).

EGUs: CAIR second phase in place (in coordination with earlier NOx SIP call); Regional Haze Rule and guidelines for Best Available retrofit Technology (BART) for reducing regional haze; Clean Air Mercury Rule (CAMR) all in place.

Non-EGUs: Solid Waste Rules (Hospital/Medical Waste Incinerator Regulations).

What We're Now Using For Our E3 Loads: The CMAQ 2020 Maximum Feasible Scenario

The 2020 Maximum Feasible Scenario includes additional aggressive EGU, industry, and mobile source controls. Emissions projections were developed that represented incremental improvements and control options (beyond 2020 CAIR) that might be available to States for application by 2020 to meet a more stringent ozone standard (stricter than 0.08 ppm, i.e., the new proposed 0.06-0.070 ppm ozone standard of January 2010).

Incremental control measures for 5 sectors were developed:
EGUs: lower ozone season nested emission caps in OTC states; targeting use of maximum controls for coal fired power plants in or near non-attainment areas.
Non-EGU point sources: new supplemental controls, such as low NOx burners, plus increased control measure efficiencies on planned controls and step up of controls to maximum efficiency measures, e.g., replacing SNCRs (Selective Non-Catalytic Reduction) with SCRs (Selective Catalytic Reduction) control technology.
Area (nonpoint area) sources: switching to natural gas and low sulfur fuel.
On-Road mobile sources: increased penetration of diesel retrofits and continuous. inspection and maintenance using remote onboard diagnostic systems.
Non-Road mobile sources: increased penetration of diesel retrofits and engine rebuilds.
Reduced NOx emissions from marine vessels in coastal shipping lanes.

CMAQ 2020 Maximum Feasible Scenario *(continued):*

The 2020 Maximum Feasible Scenario also includes a reduction of ammonia deposition of 15% due to estimated ammonia emission programs within the Bay Program States. Estimates of a 30% ammonia emission reduction from manures can be achieved through rapid incorporation of manures in to soils at the time of application, biofilters on poultry houses, and other management practices (Mark Dubin 2009, personal communication). From a State and Sector analysis of NOx emissions and deposition, an estimated 50% of emissions from Bay States becomes deposition to the Chesapeake watershed. Applying this attenuation estimate for ammonia emissions, we assume a 15% decrease in wet and dry ammonia deposition for the Maximum Feasible Scenario due to ammonia emission control management practices in the Bay Program States.

Load Reductions Beyond the Current Federal and State Efforts (2020 Scenario)

New Ozone Standards:

• On January 6, 2010, EPA proposed revisions to the National Ambient Air Quality Standards (NAAQS) for ground-level ozone.
• The proposed revisions are based on scientific evidence about ozone and its effects on people and sensitive trees and plants.
• The proposed revisions would affect two types of ozone standards:
–*Primary standard to protect public health, including the health of at-risk populations such as children, people with asthma, and older adults.*
–*Secondary standard to protect public welfare and the environment, including sensitive vegetation and ecosystems.*
• Specifically, EPA is:
–Proposing to revise the level of the *primary8-hour ozone standard to a level within the range*
of 0.060-0.070 parts per million (ppm).
–Proposing to establish a separate cumulative *secondary standard within a range* of 7-15 ppm-hours.
• EPA is also proposing to update the Air Quality Index (AQI) for ozone.
• EPA plans to issue final standards by August 31, 2010.
• For more information go to http://www.epa.gov/ozonepollution

New Ozone Standards *(continued):*

- EPA last reviewed and revised the ozone standards in 2008 and set both the primary and secondary standards at a level of 0.075 ppm.
- On Sept. 16, 2009, EPA announced it would reconsider this decision.
- The proposed range is within the range recommended by CASAC.

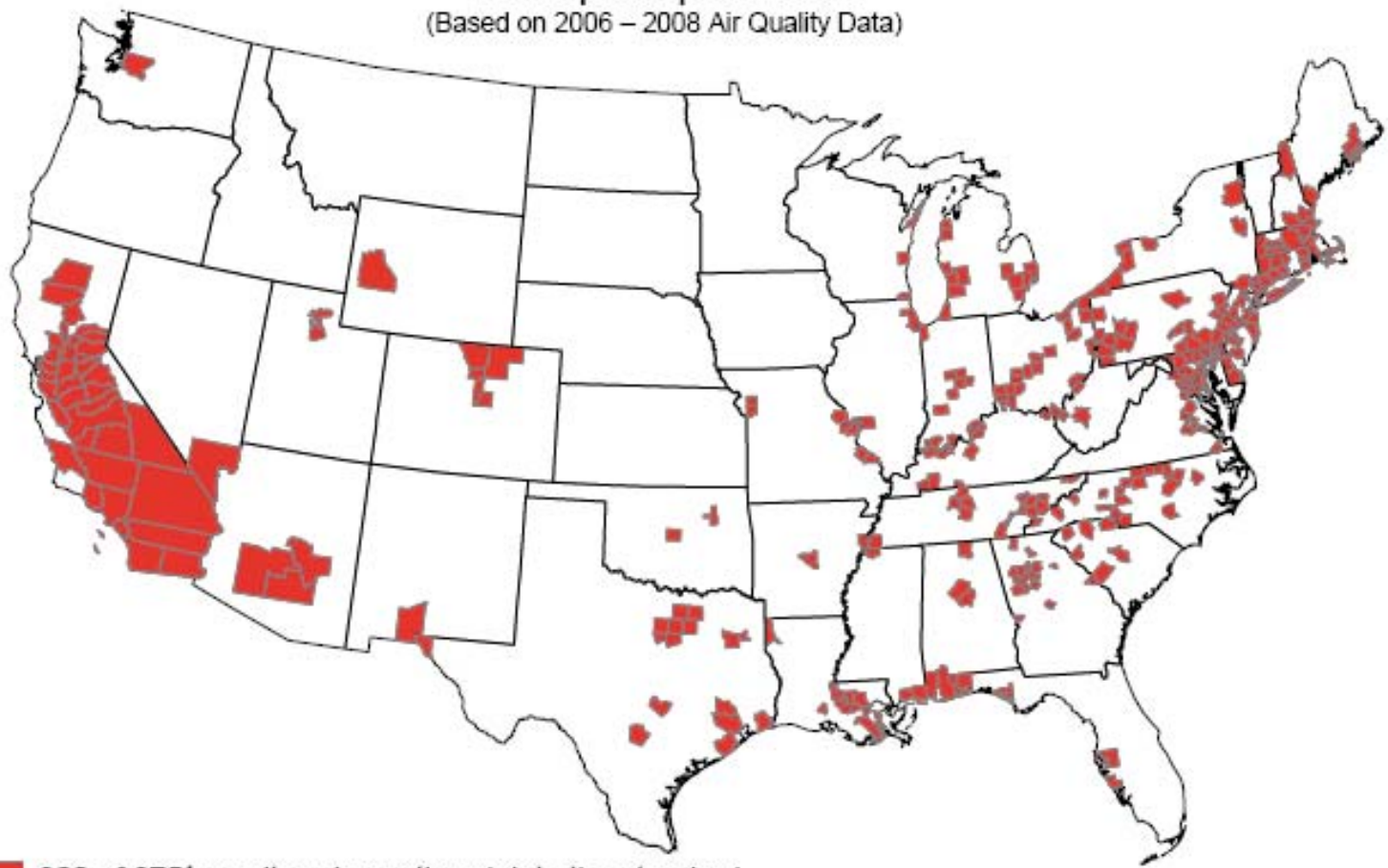
–The ozone standards set in 2008 were not as protective as recommended by EPA's panel of science advisors, the Clean Air Scientific Advisory Committee (CASAC). EPA is proposing to strengthen the level of the 8-hour primary ozone standard to a level within the range of 0.060-0.070 parts per million (ppm).

- Proposal for reconsideration signed on January 6, 2010.
- Public comment period for 60 days after proposal is published in Federal Register (now closed?).
- Final Rule signed by August 31, 2010.

Schedule Milestones in the Development of the New Ozone Standards

Milestone	Date
Signature—Final Rule	**August 31, 2010**
State Designation Recommendations to EPA	**January 2011**
Final Designations	**August 2011**
Attainment SIPs Due	**December 2013**
Attainment Dates (depends on severity of problem)	**2014-2031**

Counties With Monitors Violating the March 2008 Ground-Level Ozone Standards
0.075 parts per million
(Based on 2006 – 2008 Air Quality Data)



322 of 675[1] monitored counties violate the standard

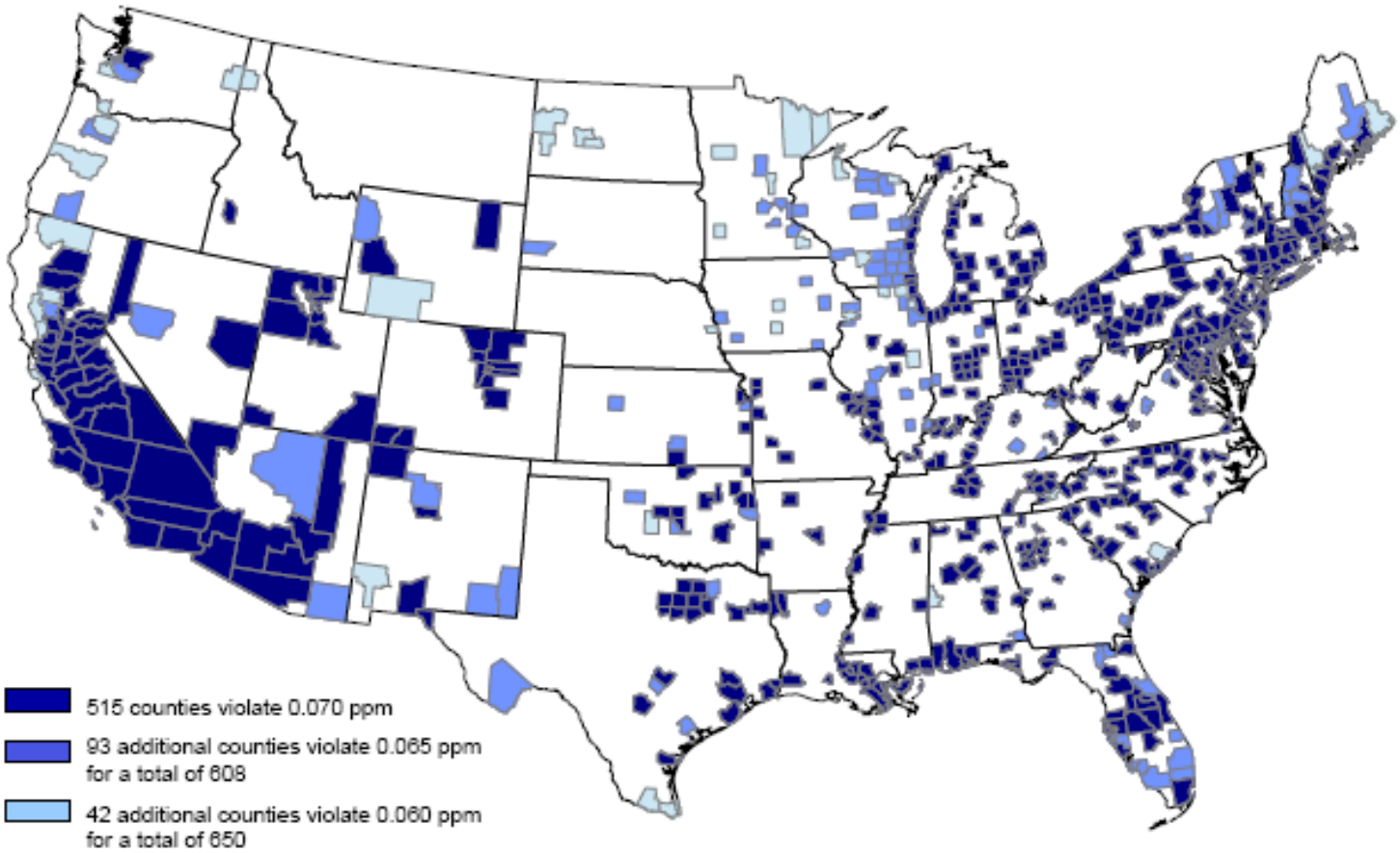
Notes:

1. Counties with at least one monitor with complete data for 2006 – 2008
2. To determine compliance with the March 2008 ozone standards, the 3-year average is truncated to three decimal places.

Counties With Monitors Violating Proposed Primary 8-hour Ground-level Ozone Standards
0.060 - 0.070 parts per million

(Based on 2006 – 2008 Air Quality Data)

EPA will not designate areas as nonattainment on these data, but likely on 2008 – 2010 data which are expected to show improved air quality.



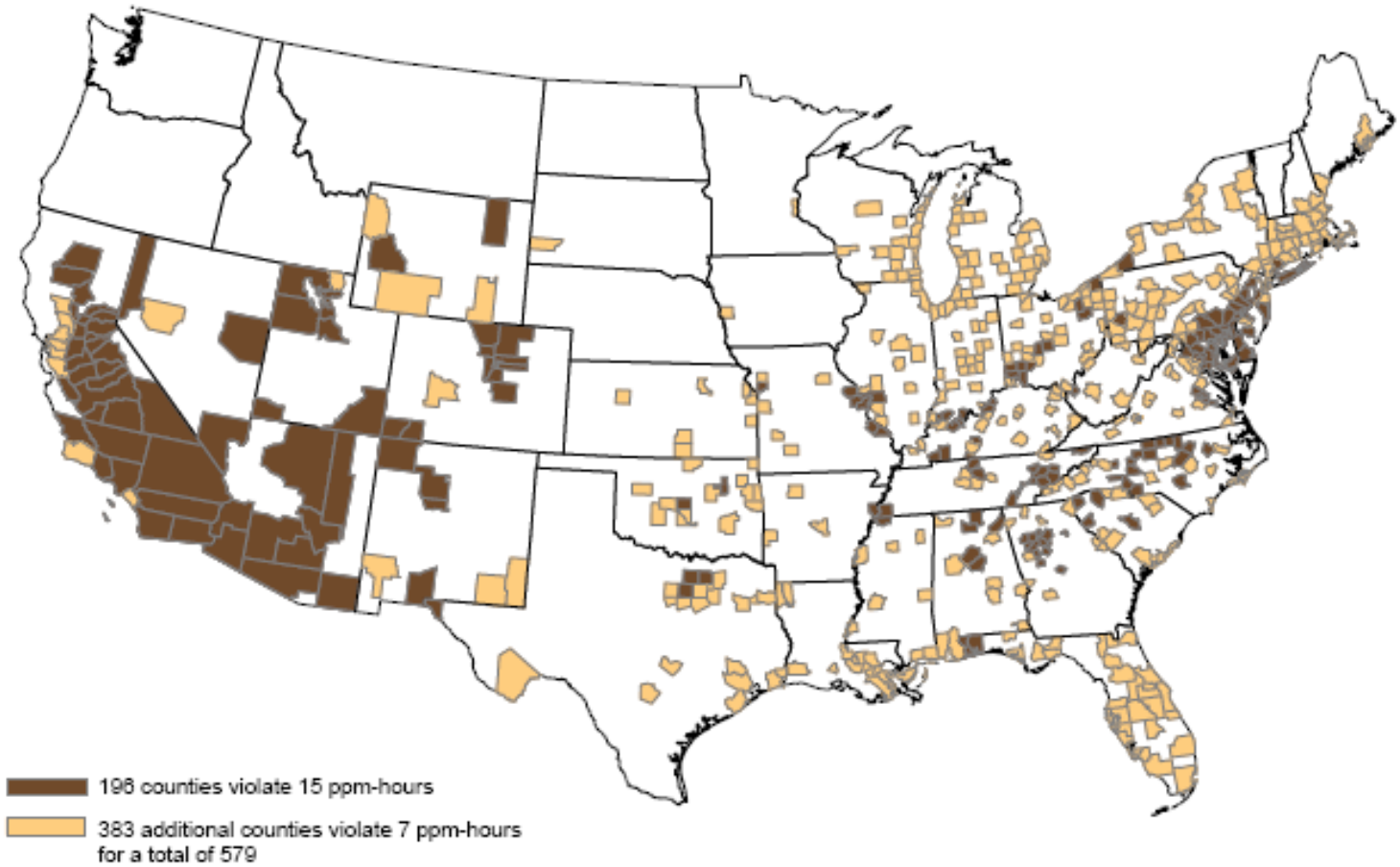
Notes:

1. No monitored counties outside the continental U.S. violate.
2. EPA is proposing to determine compliance with a revised primary ozone standard by rounding the 3-year average to three decimal places.

Counties With Monitors Violating Proposed Secondary Seasonal Ground-Level Ozone Standards
7 – 15 parts per million - hours

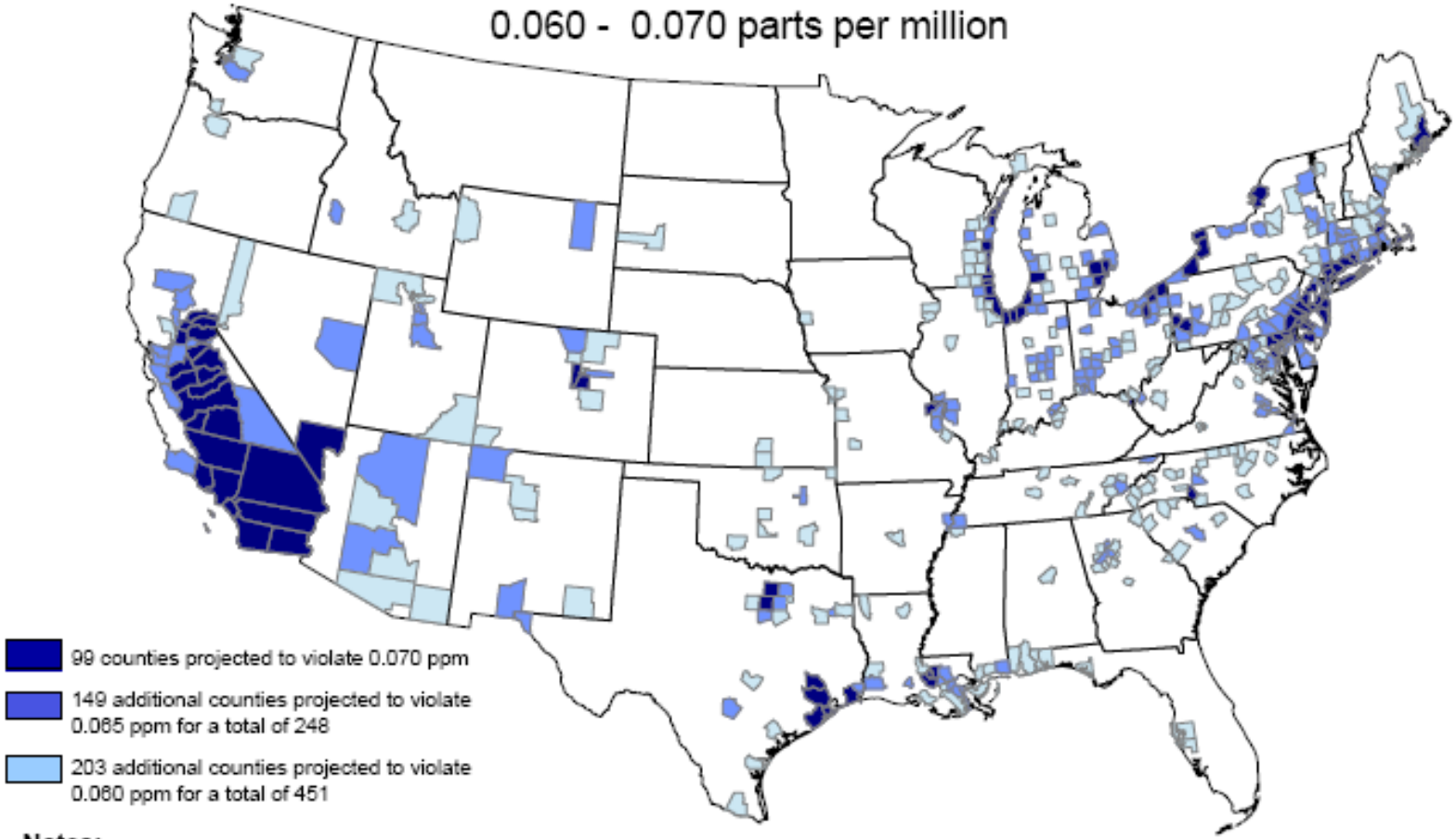
(Based on 2006 – 2008 Air Quality Data)

EPA will not designate areas as nonattainment on these data, but likely on 2008 – 2010 data which are expected to show improved air quality.



No monitored counties outside the continental U.S. violate.

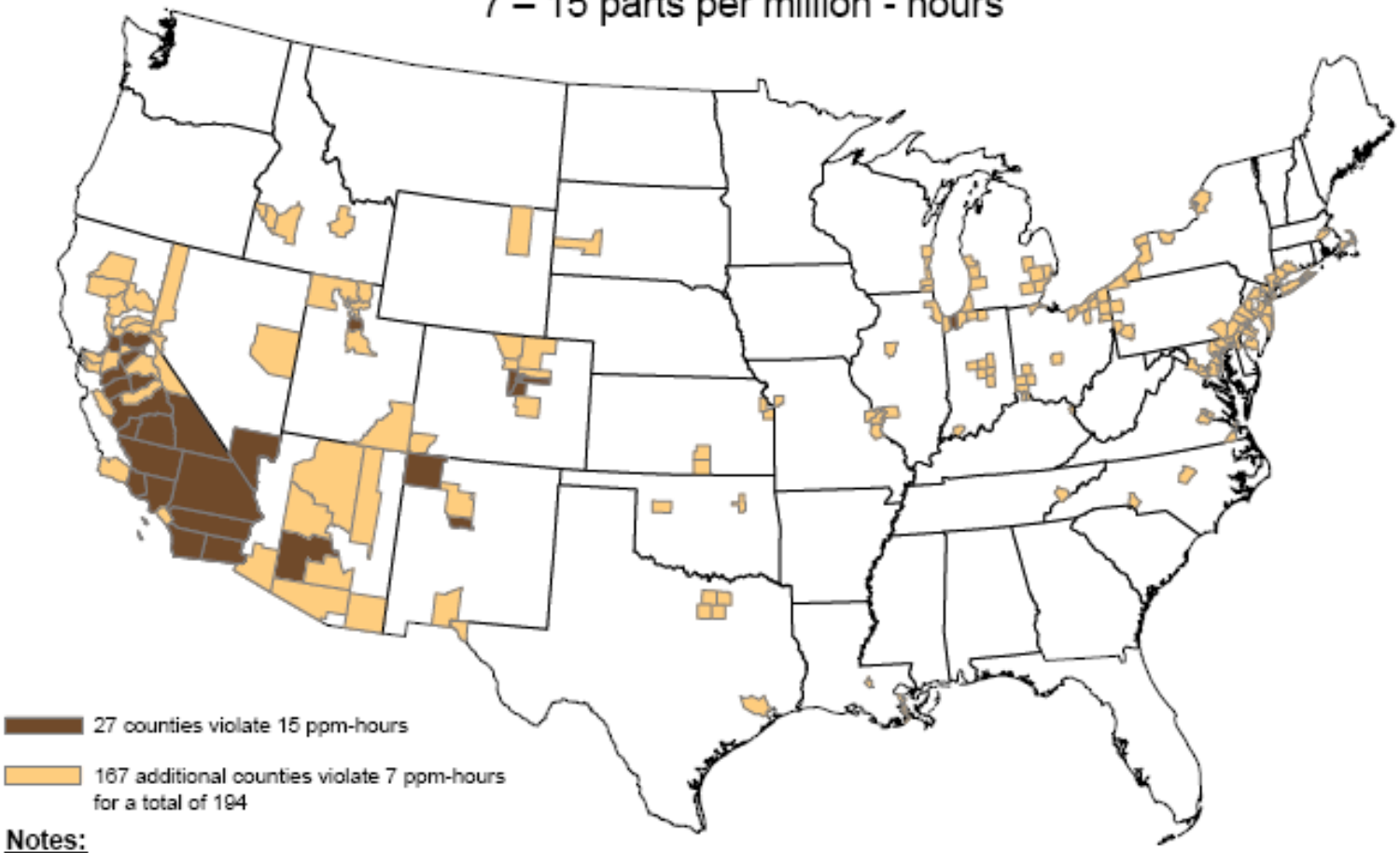
Counties With Monitors Projected to Violate Proposed Primary 8-hour Ground-Level Ozone Standards in 2020
0.060 - 0.070 parts per million



Notes:

1. The modeled emissions in 2020 reflect the expected emissions reductions from federal programs by 2020 including: the Clean Air Interstate Rule, the Clean Air Mercury Rule, the Clean Air Visibility Rule, the Clean Air Nonroad Diesel Rule, the Light-Duty Vehicle Tier 2 Rule, the Heavy Duty Diesel Rule, the proposed rules for Locomotive and Marine Vessels and for Small Spark-Ignition Engines, and an estimate of State-level mobile and stationary source controls that were projected to be needed to attain pre-existing PM 2.5 and ozone standards.
2. Controls applied are illustrative. States may choose to apply different control strategies for implementation.
3. EPA did not model future violations outside the continental U.S.
4. EPA is proposing to determine compliance with a revised primary ozone standard by rounding the 3-year average to three decimal places.

Counties With Monitors Projected to Violate the Proposed Secondary Seasonal Ground-level Ozone Standards in 2020
7 – 15 parts per million - hours



Notes:

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3. EPA did not model future violations outside the continental U.S.

Additional Quantification of the Ammonia and NOx Air Sources

KEY SCENARIOS AND ANALYSES UNDERWAY WITH CMAQ:

•State and Sector Analysis of Ammonia: An initial fast track assessment will be for a 2020 State analysis of reduced nitrogen at a 36 km grid to complement the 2002 assessment of reduced sources by sector (assuming little sector change between 2002 and 2020) and to pair with the 2020 assessment for the oxidized (NOx) sources.

•A 2010 State and Sector (12 km grid) analysis of ammonia deposition and NOx deposition, including emissions from electrical generation units and industrial boilers, is required in assessing the deposition load from and to the Chesapeake Bay State's. We'd first want to tag the Bay Program States all together. Then we'd want to tag each of the CBP States for both major NOx and ammonia sources. This will be done with one run with many tags.

•A 2020 State and Sector (12 km grid) analysis of ammonia deposition and NOx deposition as done for ammonia.

* Each CB State will have ammonia tags for poultry, dairy and beef, swine, all manures, chemical fertilizers, and all other ammonia sources and also NOx tags for EGUs, area sources, mobile, off road, industry, and all other NOx sources.

KEY SCENARIOS AND ANALYSES *(continued)*

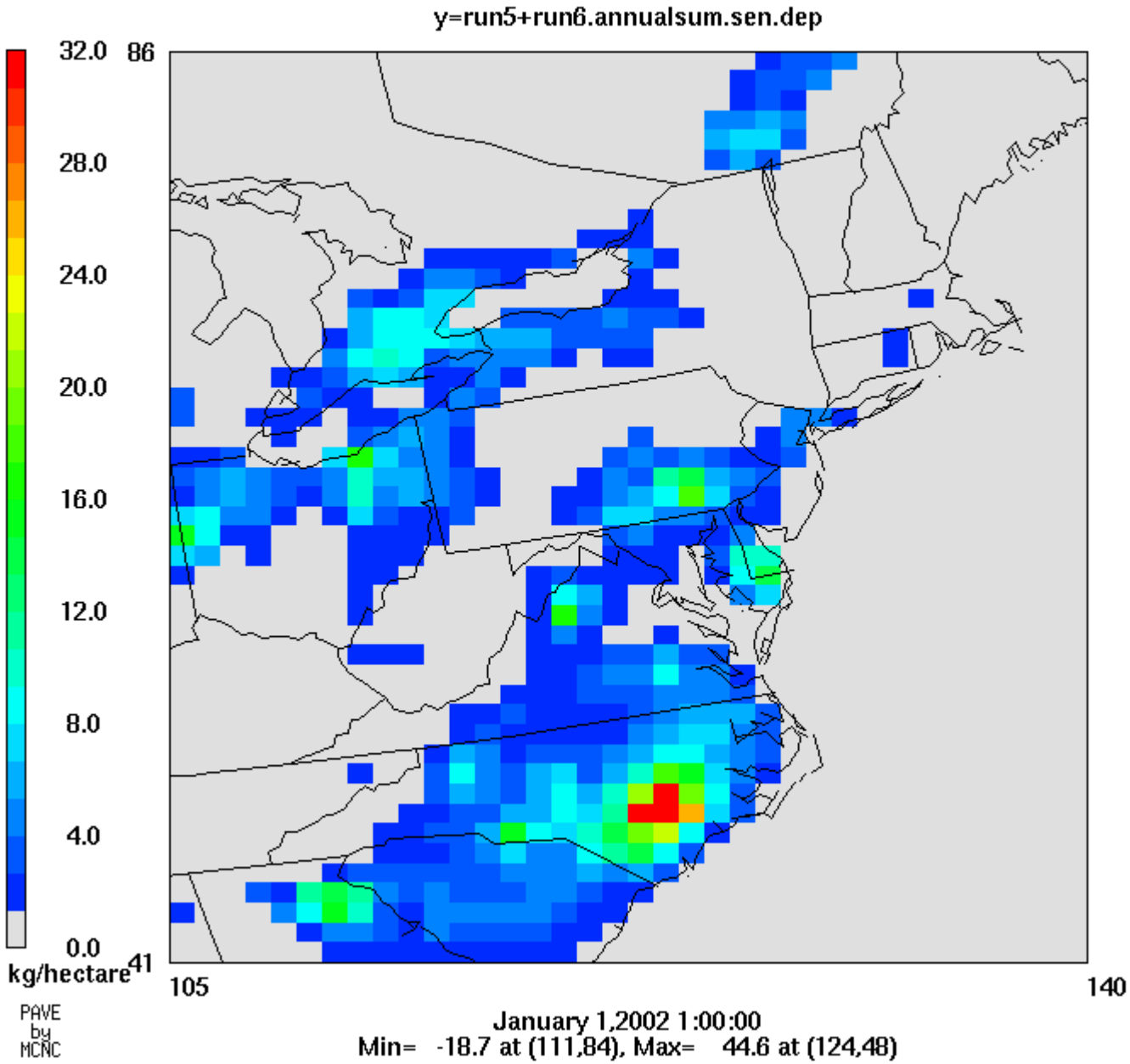
State and Sector Analysis of Ammonia

An initial fast track assessment will be for a 2020 State and sector analysis of reduced nitrogen will be at a 36 km grid to pair with the 2020 assessment for the oxidized (NOx) sources. This work, done by July 2010, ensures our assessment of ammonia management is appropriate in the key CBP air scenarios going into a milestone Executive Council meeting in August 2010.

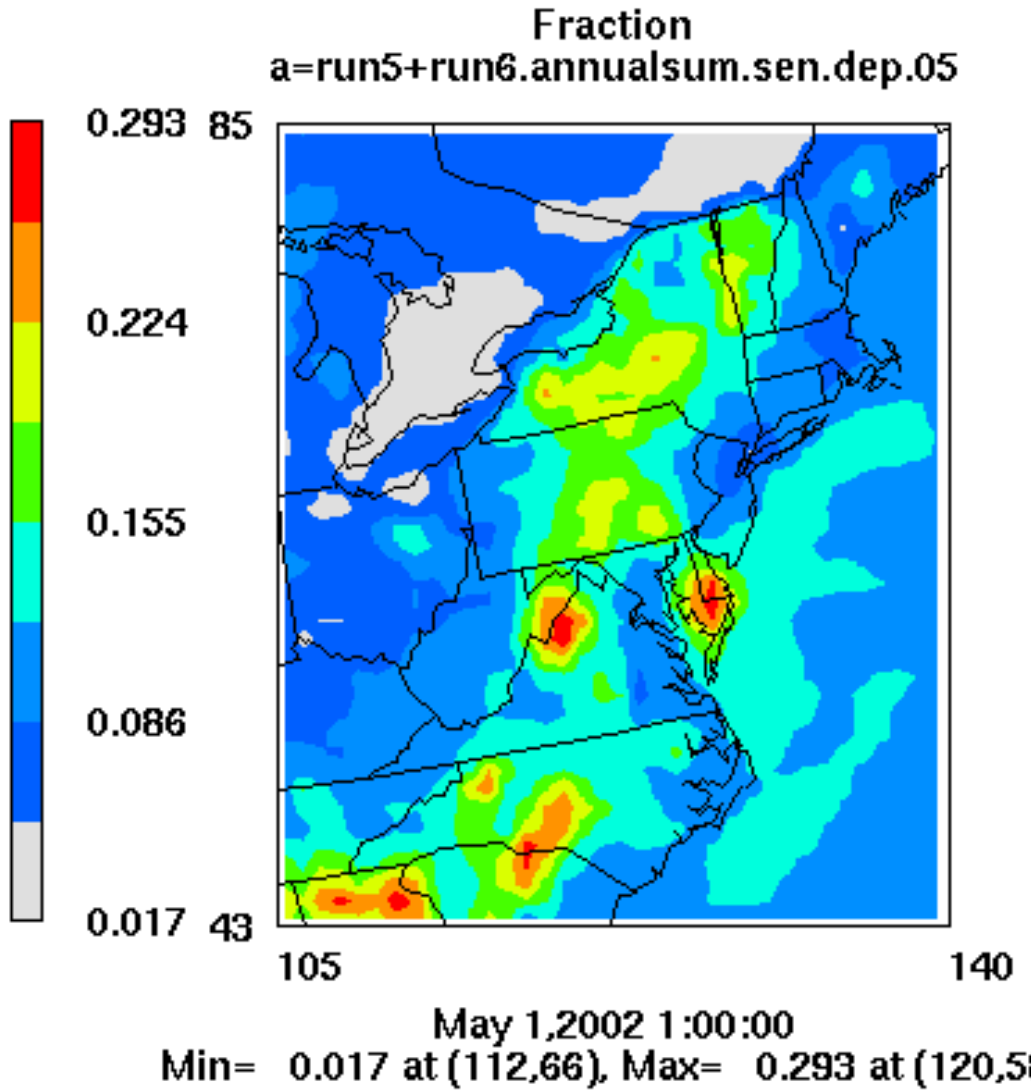
Comparison of Watershed Model and CMAQ Manure and Fertilizer Emissions

An important step needed to ensure the CBP Airshed and Watershed models are appropriately integrated is the comparison of the nitrogen emissions we estimate from manures and fertilizers in both the Watershed and CMAQ models. Ensuring the integrated mass balance of the two models is correct is key to an appropriate atmospheric deposition allocation.

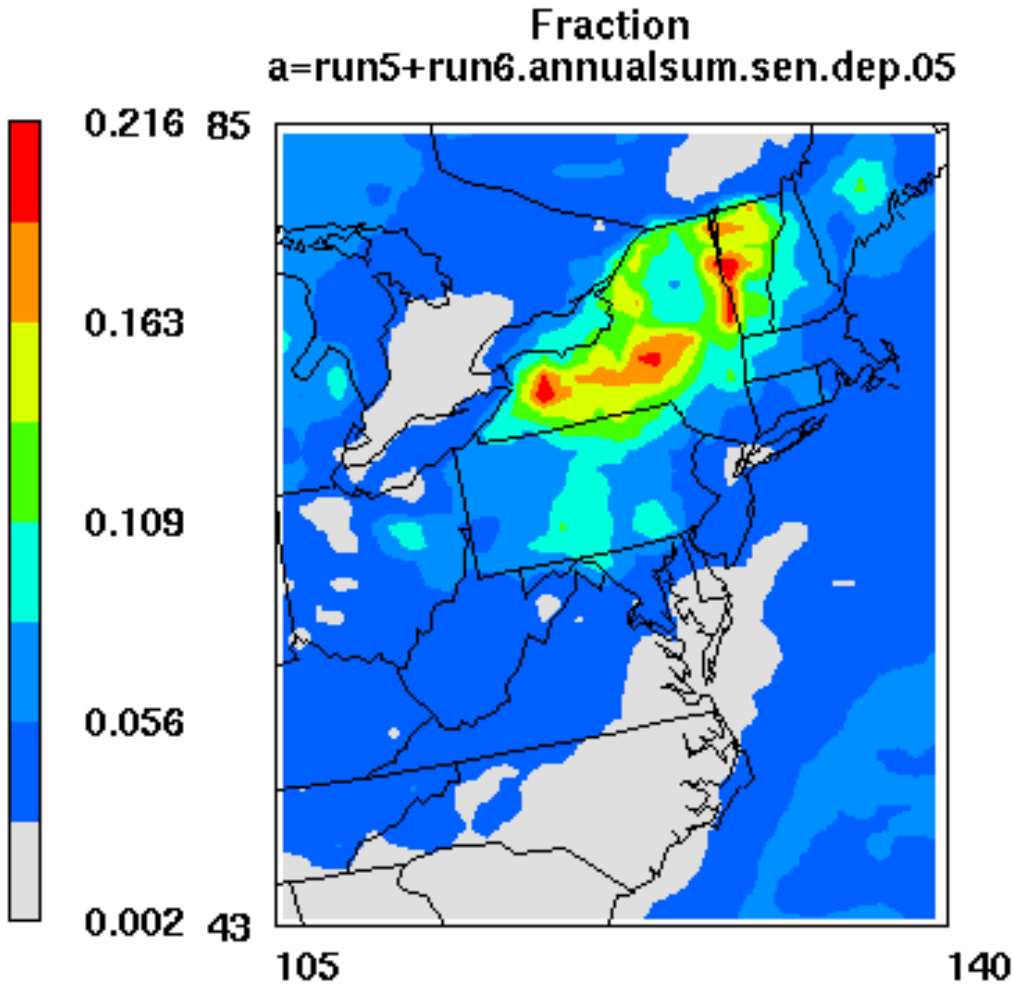
Layer 1 TOTNHX_TOTy



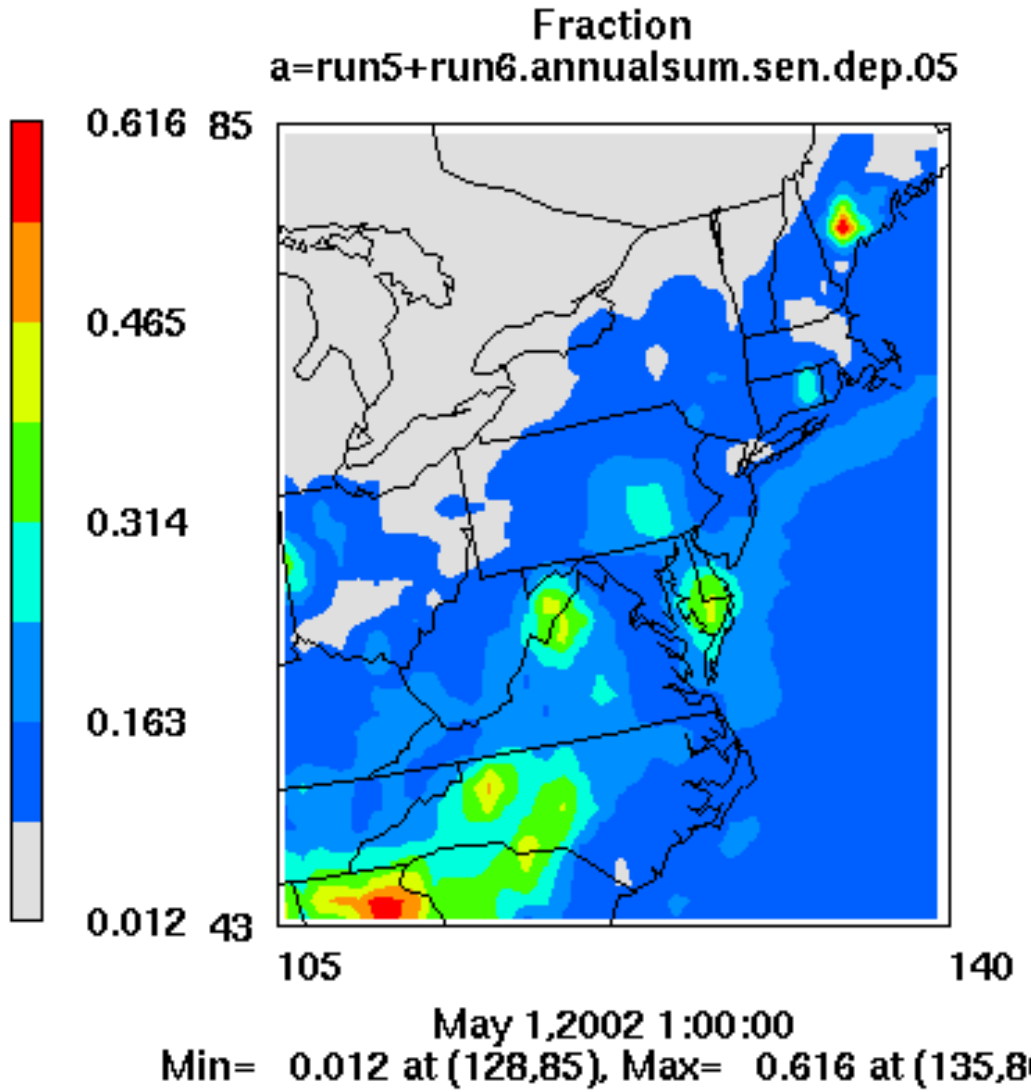
Manure DRY+WET NHX DDM



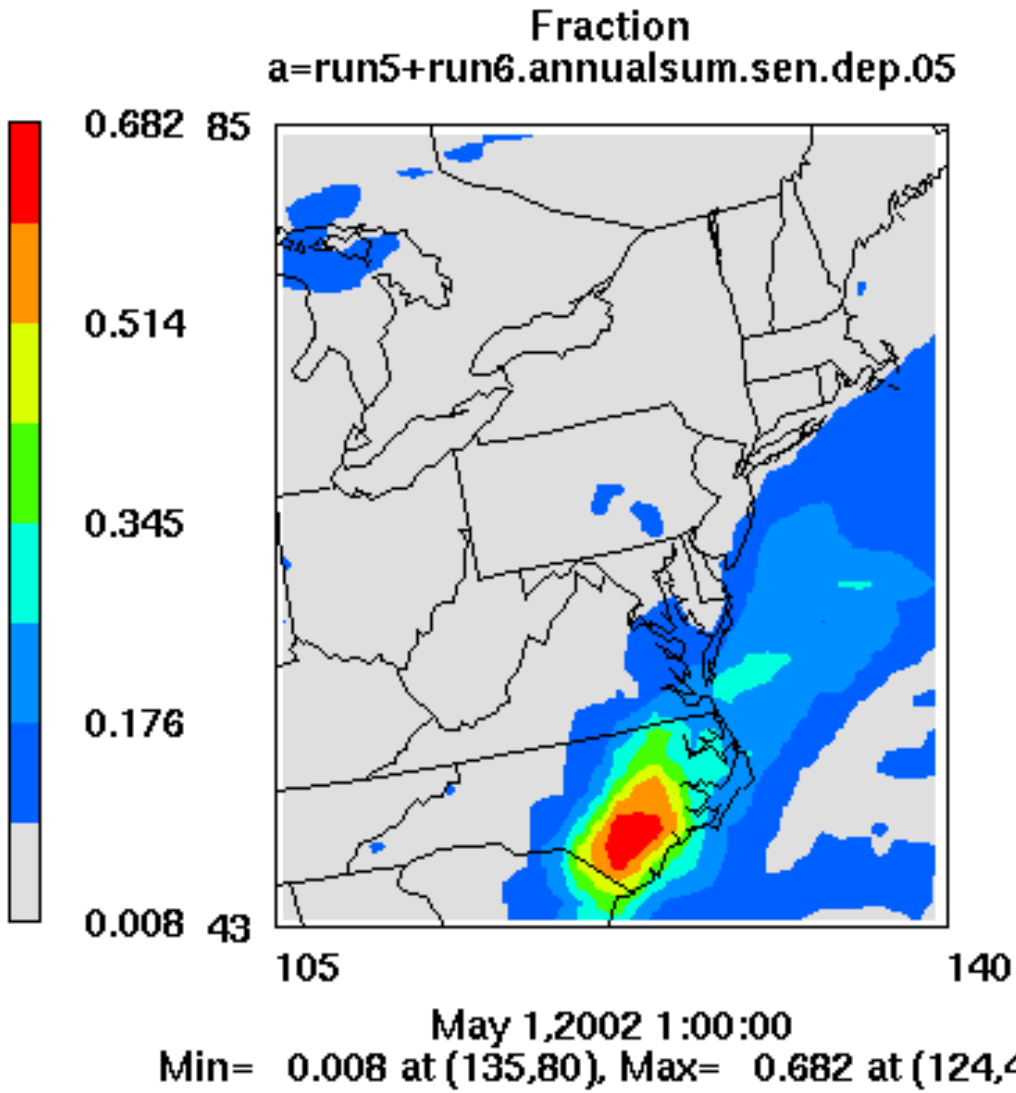
Dairy DRY+WET NHX DDM



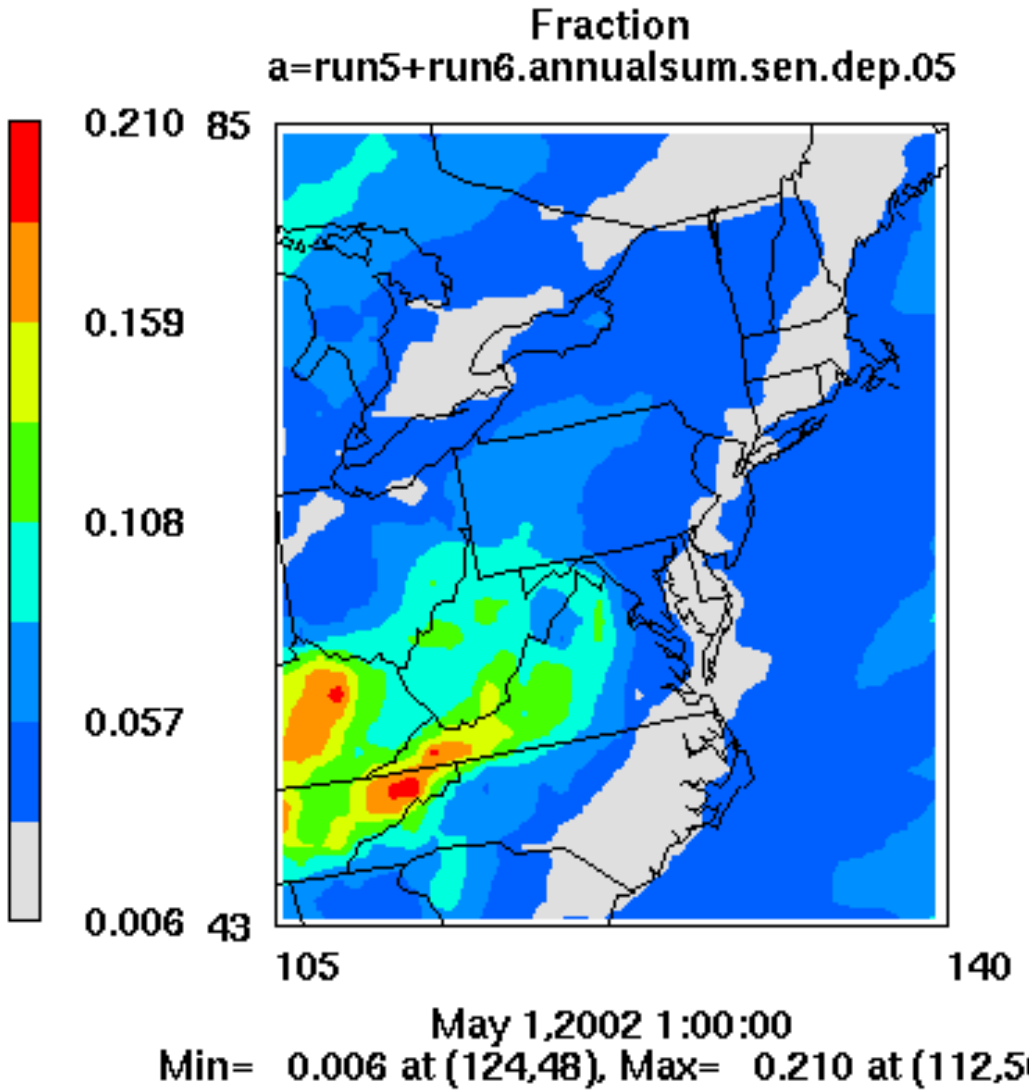
Poultry DRY+WET NHX DDM



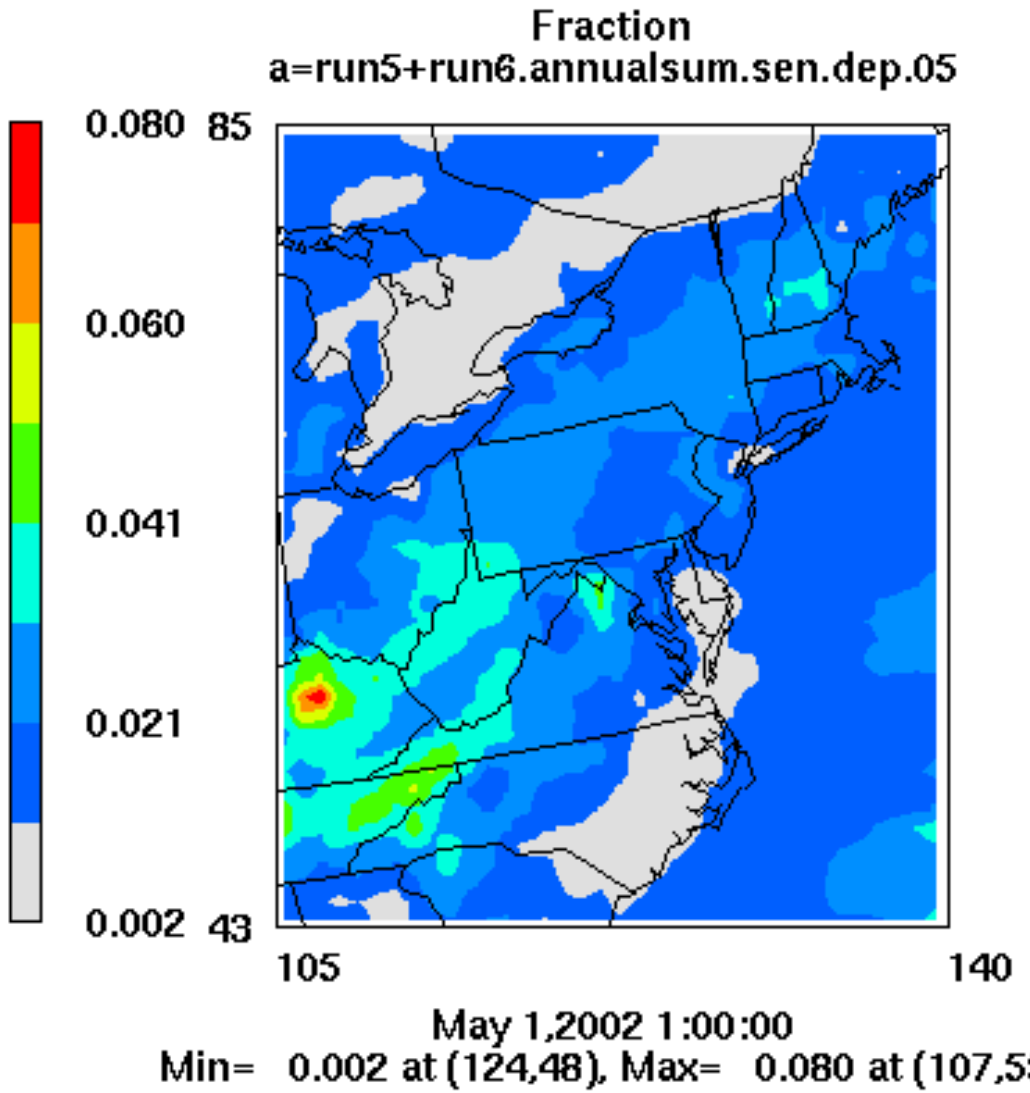
Swine DRY+WET NHX DDM



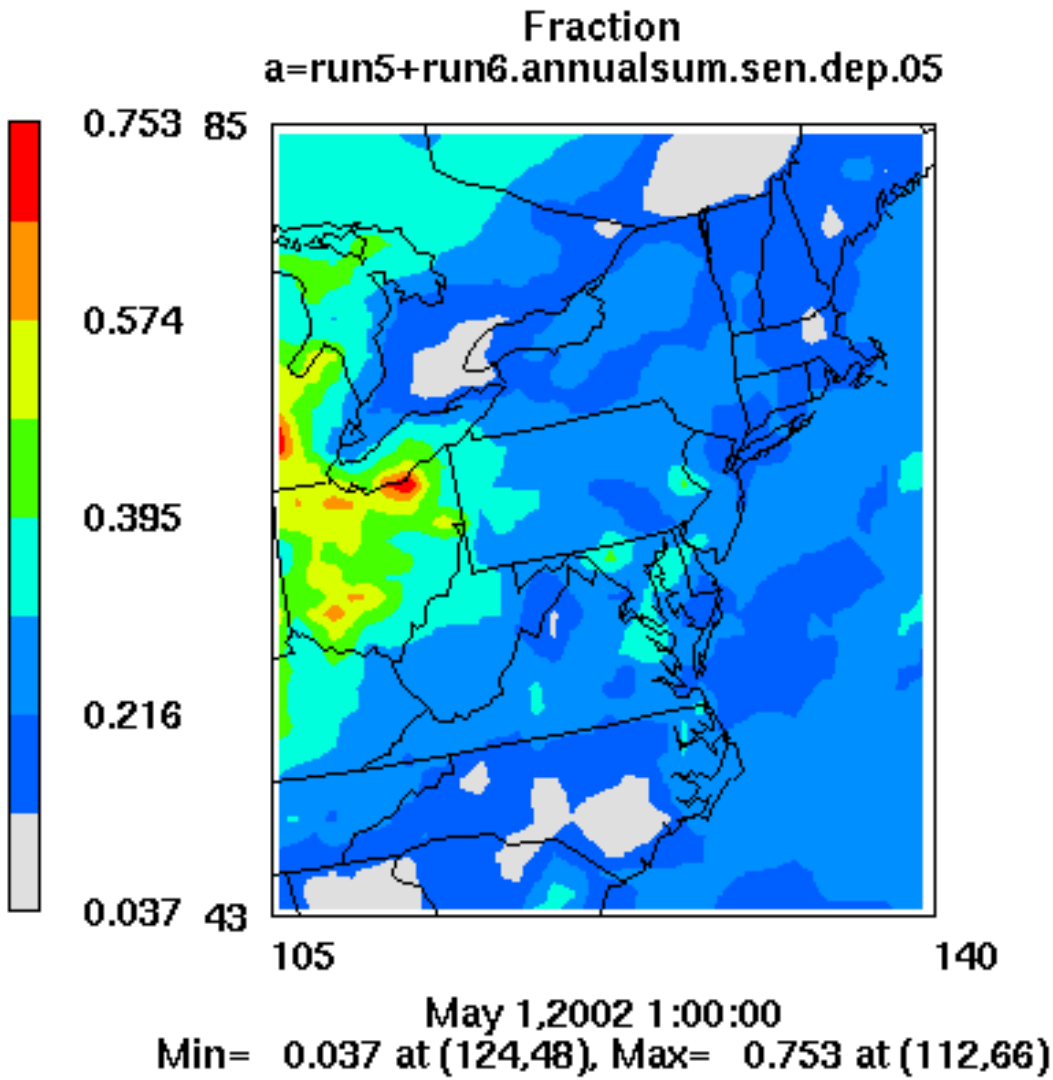
Beef DRY+WET NHX DDM



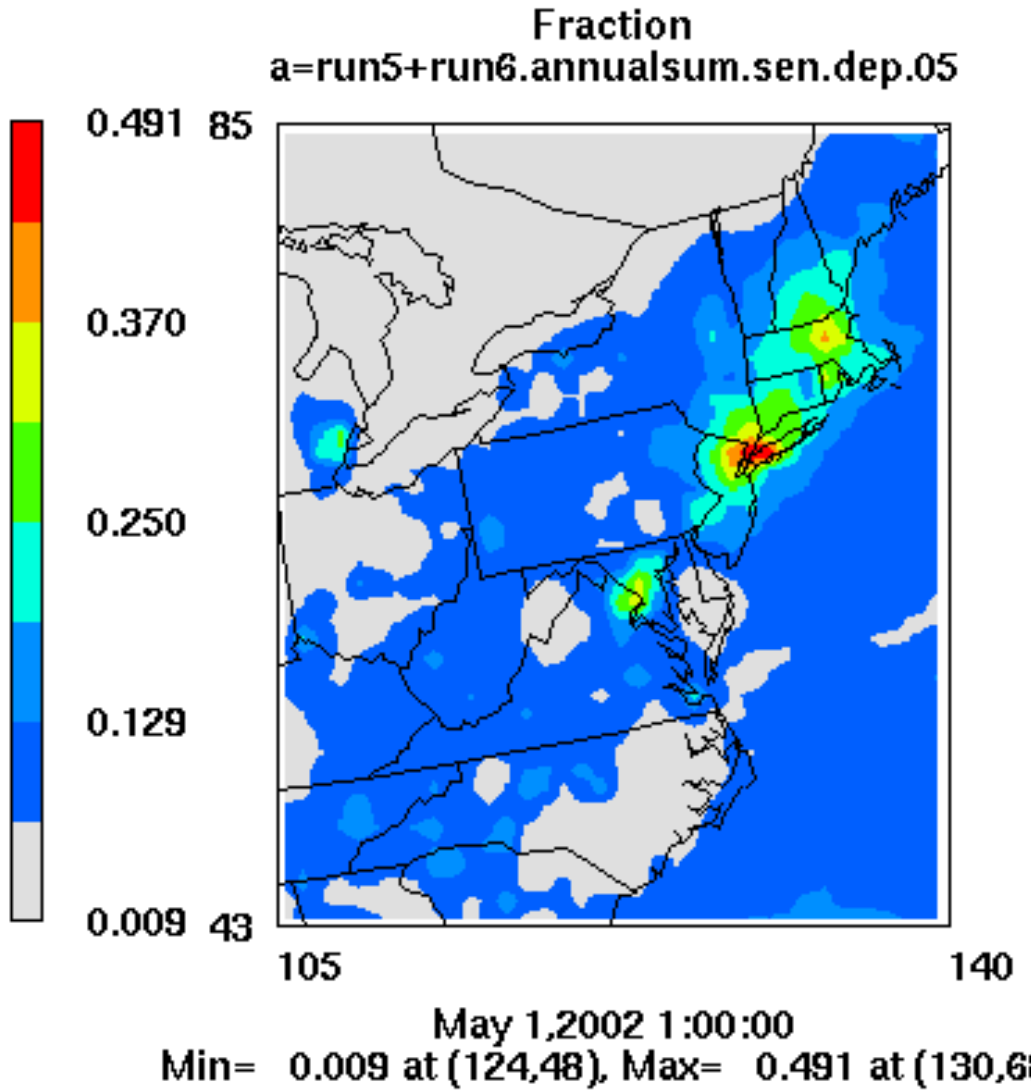
AnimalOth DRY+WET NHX DDM



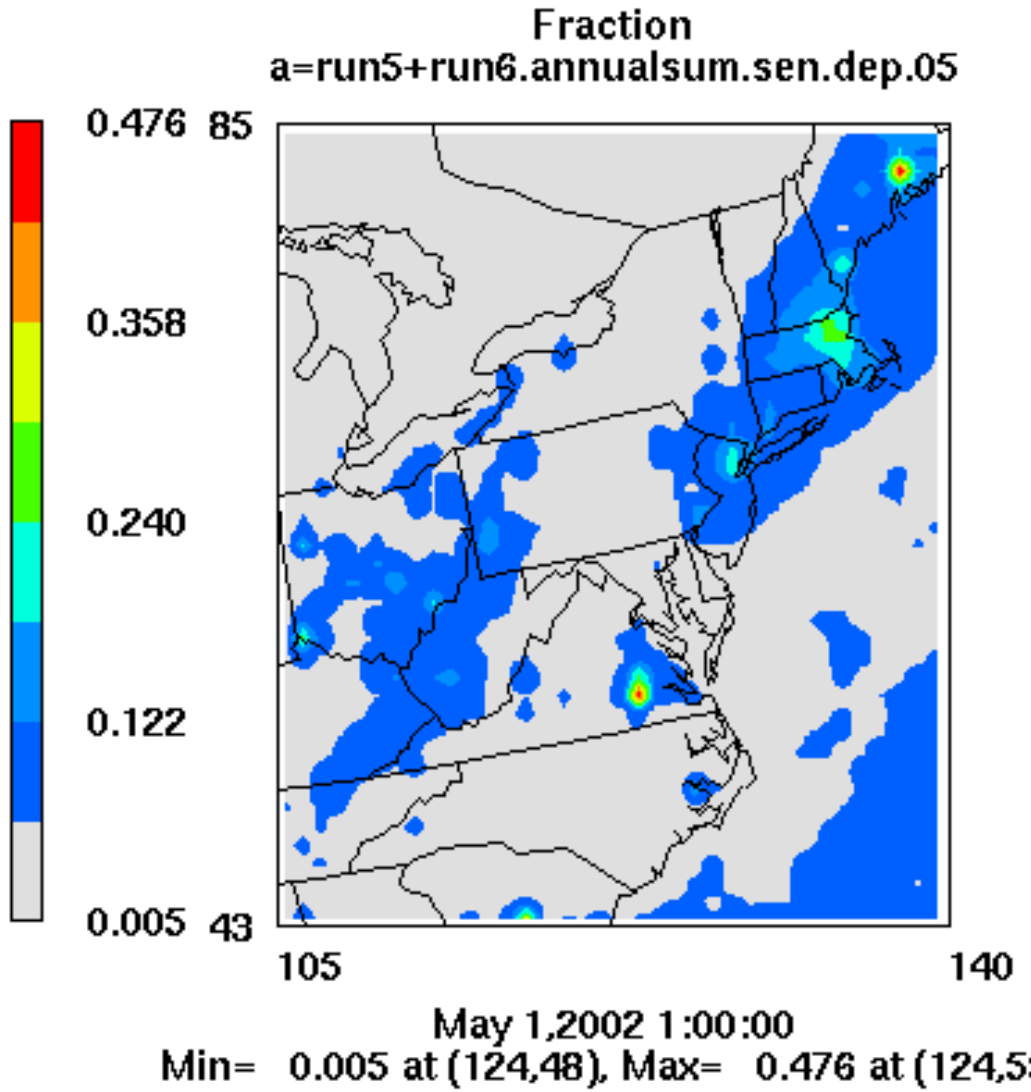
Chem DRY+WET NHX DDM



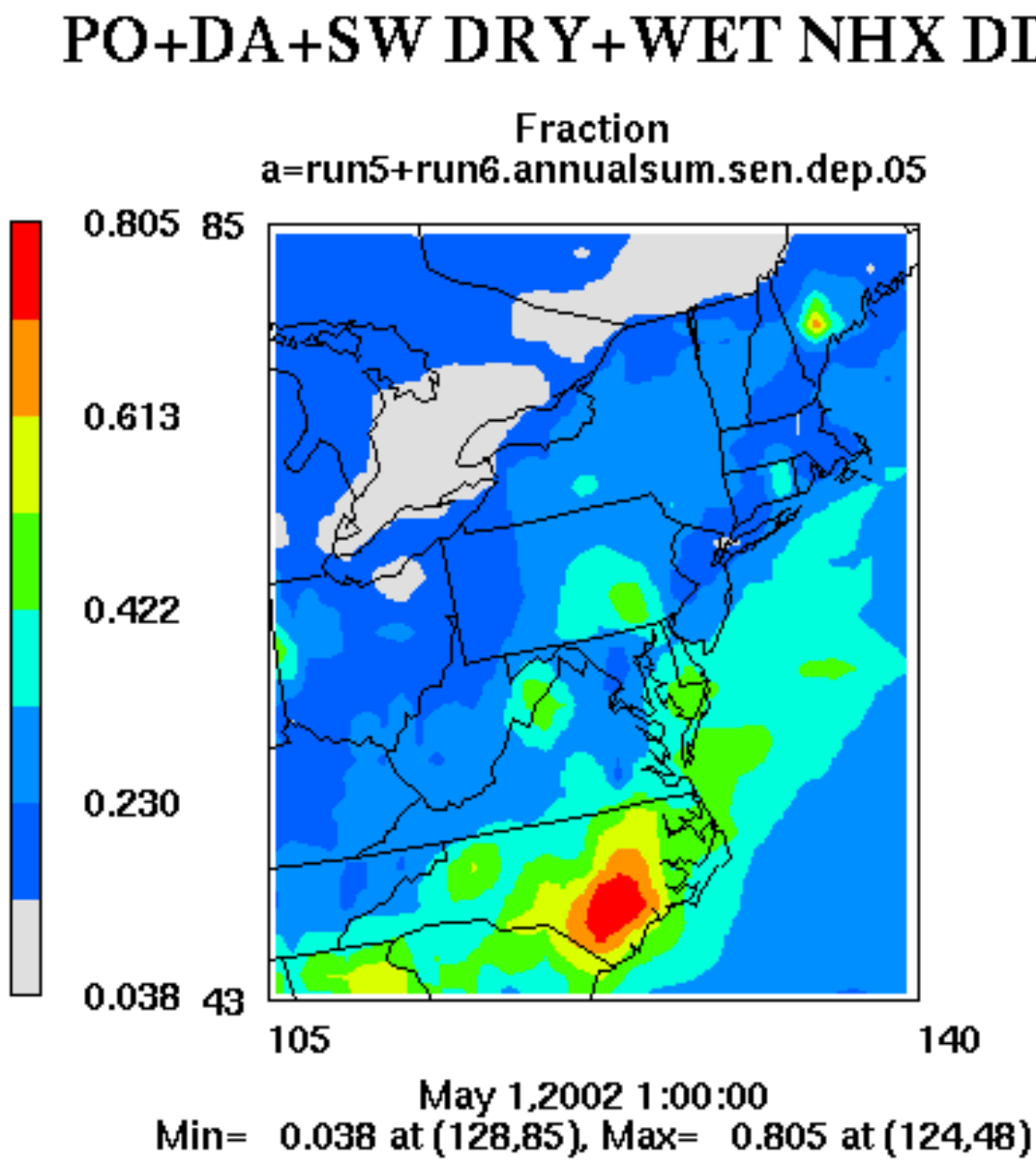
OnRoad DRY+WET NHX DDM



Othnonag DRY+WET NHX DDM



BIG THREE


PO+DA+SW DRY+WET NHX DDI
Fraction
a=run5+run6.annualsum.sen.dep.05
0.805
85
0.613
0.422
0.230
0.038
43
105
140
May 1,2002 1:00:00
Min= 0.038 at (128,85), Max= 0.805 at (124,48)

Excerpt from Expectations Letter, November 4, 2009

"EPA recognizes and applauds the substantial efforts the States and District are prepared to take to enhance their program capacity and meet the TMDL's nutrient and sediment reduction targets. Leading by example, EPA and its federal partners are prepared to meet similar expectations and be fully accountable and transparent to the public. As proposed in the draft Executive Order 13508 recommendations released on September 10, 2009, EPA will assume responsibility for the Bay TMDL's load allocations for atmospheric deposition of nitrogen to the Bay watershed and tidal waters by establishing federal standards and working with jurisdictions to comply with these standards.

Specifically, EPA will:

1) analyze reductions of nitrogen from atmospheric sources that could be achieved, known as controllable loads;
2) establish separate load allocations to tidal waters;
3) build quantitative assumptions into load allocations in the watershed that a portion of necessary reductions will be achieved through compliance with federal standards and regulatory actions to further reduce atmospheric deposition;
4) work with States to implement the federal regulations and encourage additional voluntary programs; and
5) set specific commitments and track progress through EPA's own set of two-year milestones."

So, who “owns the air”?

Current thinking is:

- States can credit their WIPs for any ammonia emissions reduced that result in reductions in delivered, direct deposition or indirect, loads to the Bay.

- States can get credit in their WIPs for any NOx emissions reduced beyond the 2020 CMAQ Scenario that result in reductions in delivered direct or indirect loads to the Bay including additional NOx reductions needed in the 2013 SIPS for the new ozone air quality standard.

- The Federal allocation, based on national actions in CAIR, mobile rules, and other current reductions planned up to 2020 will probably be around 15.7* million pounds, which is down from a “no-action” like 1985 estimate of 26.1** million pounds nitrogen.

* Estimated 2020 total TN deposition to the tidal Bay.

** Estimated 1985 total TN deposition to the tidal Bay.

Feedback Requested:

Does the basis of these anticipated atmospheric nitrogen reduction make sense? Do the proposed reductions present an equivalent level of reduction to reductions expected from the other source sectors? What should we present at to the Principals' Staff Committee at their April meeting?