Simulating Atmospheric Deposition in the Phase II WIPs If a New Ozone Standard is Established

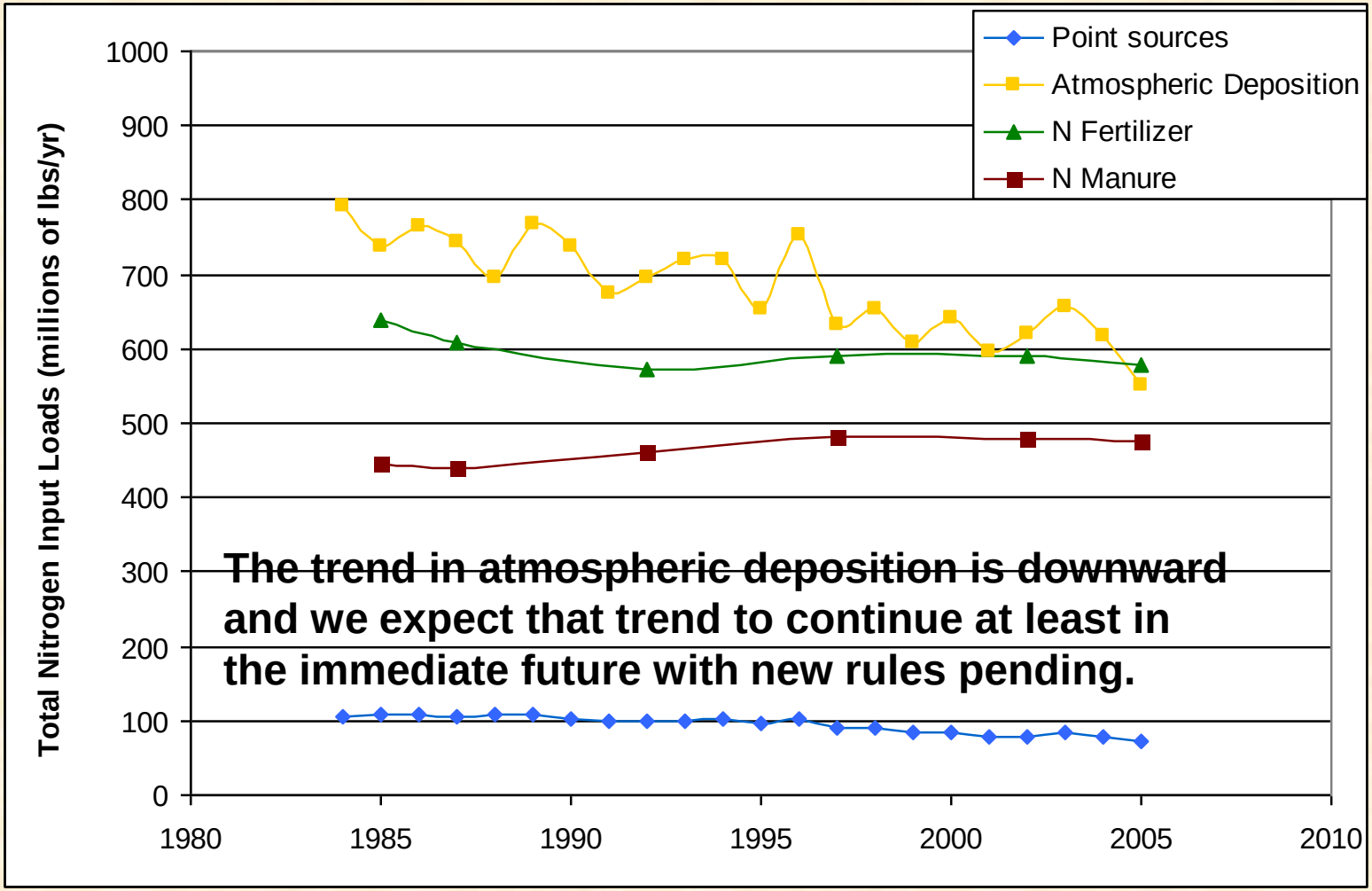
Water Quality Goal Implementation Team

May 23, 2011

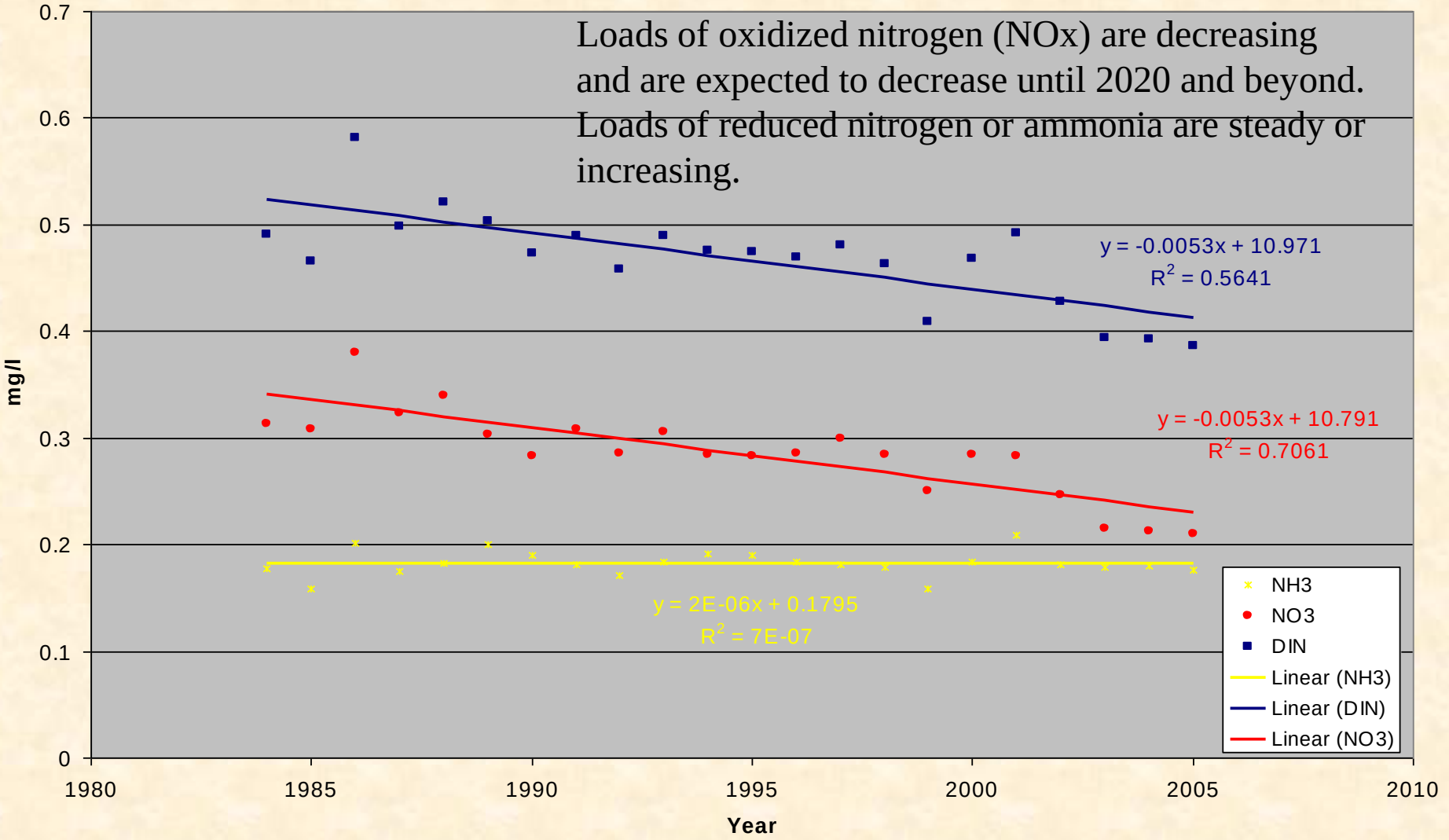
Lewis Linker and the CBP Modeling Team
linker.lewis@epa.gov

Trends in Atmospheric Deposition:

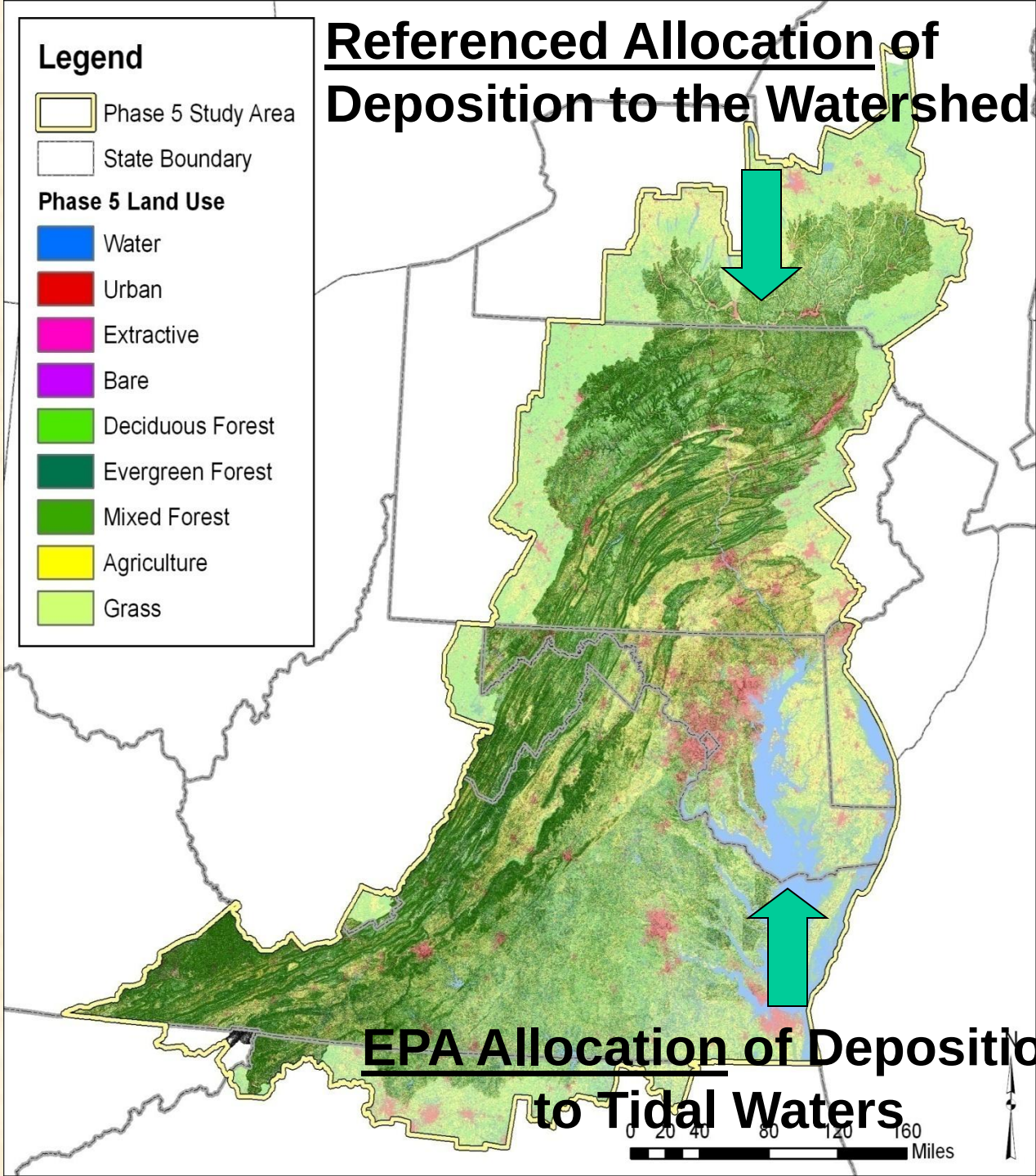
Time series of atmospheric, fertilizer, manure, and point source nitrogen input loads to the Chesapeake Bay Water Quality and Sediment Transport Model.



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



The atmospheric deposition NOx reductions of the 2020 Air Scenario. Beyond the 2020 are already factored into the State WIPs through the "referenced allocation" in the watershed. The EPA Air Allocation is 15.7 million pounds to the tidal waters of the Bay.



The Allocation to Tidal Waters and the Referenced Allocation:

The EPA Allocation to the tidal waters is an explicit allocation that's quantified and tracked in the 2-year milestones.

The Reference Allocation is implicitly quantified. It is a load to the watershed along with point source, manure, fertilizer, and septic system loads. The referenced allocation is tracked in the CBP models, specifically the CMAQ and the Watershed Models.

If there are any reductions in the referenced air allocation the other nitrogen reductions became easier, and the point source or nonpoint source controls can be eased by the same amount that the reference air allocation is decreased (using the metric always of delivered loads to the Bay).

CMAQ 2020 Scenario – The Allocation 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 (C3 Rule)

CMAQ 2020 Maximum Feasible Scenario *(continued):*

The 2020 Maximum Feasible Scenario when applied to E3 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.

How the Reference Load Would Change Under A 2020 Maximum Feasible Allocation Scenario

If we did use the Maximum Feasible Scenario in the WIPs we'd have about two million pounds of additional nitrogen reductions delivered to the Bay. That would automatically be credited to all the Bay Program States as a load reduction in the referenced allocation load of atmospheric deposition.

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**

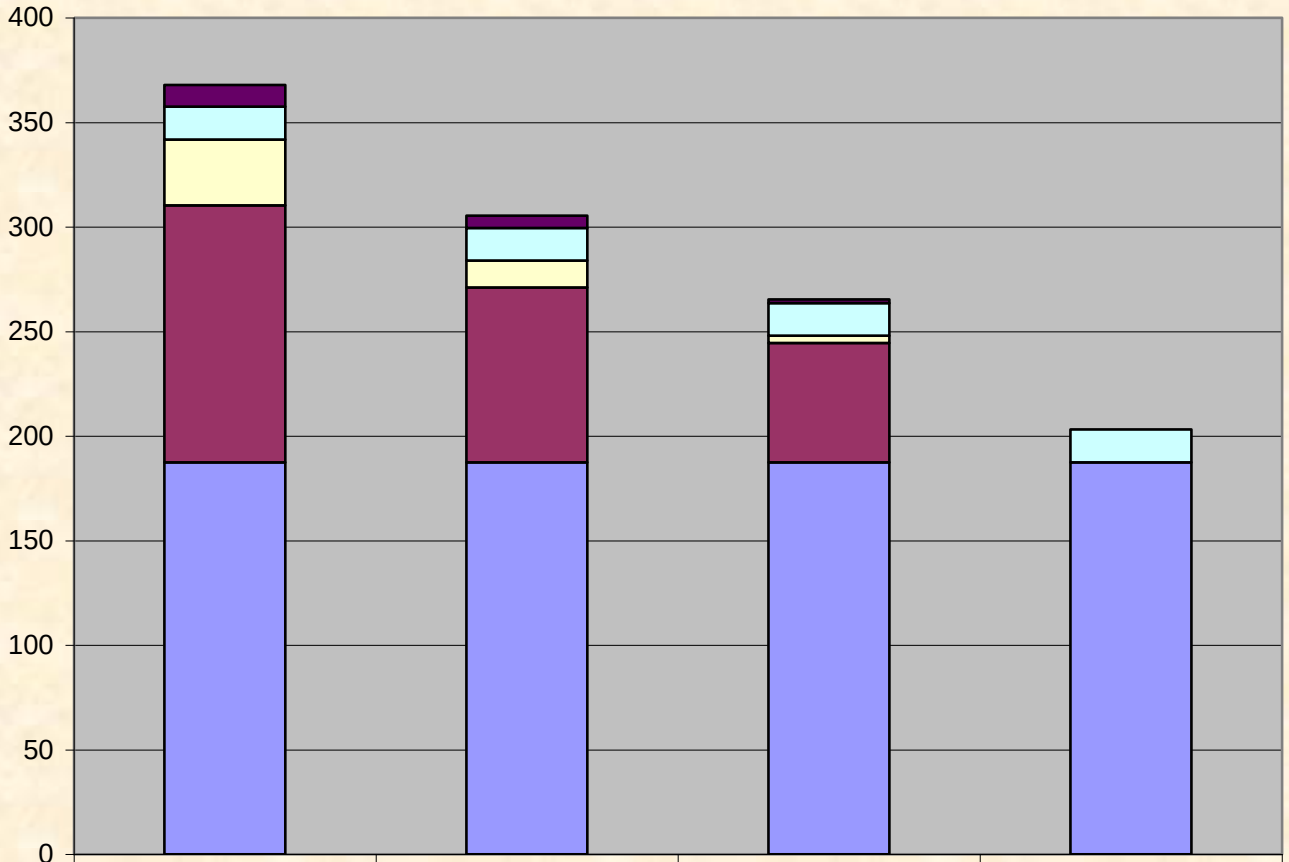
Atmospheric Deposition Nitrogen Delivered to the Bay Under Key Scenarios Units in millions of pounds as N (Phase 5.2 - August 2009 Version).

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.

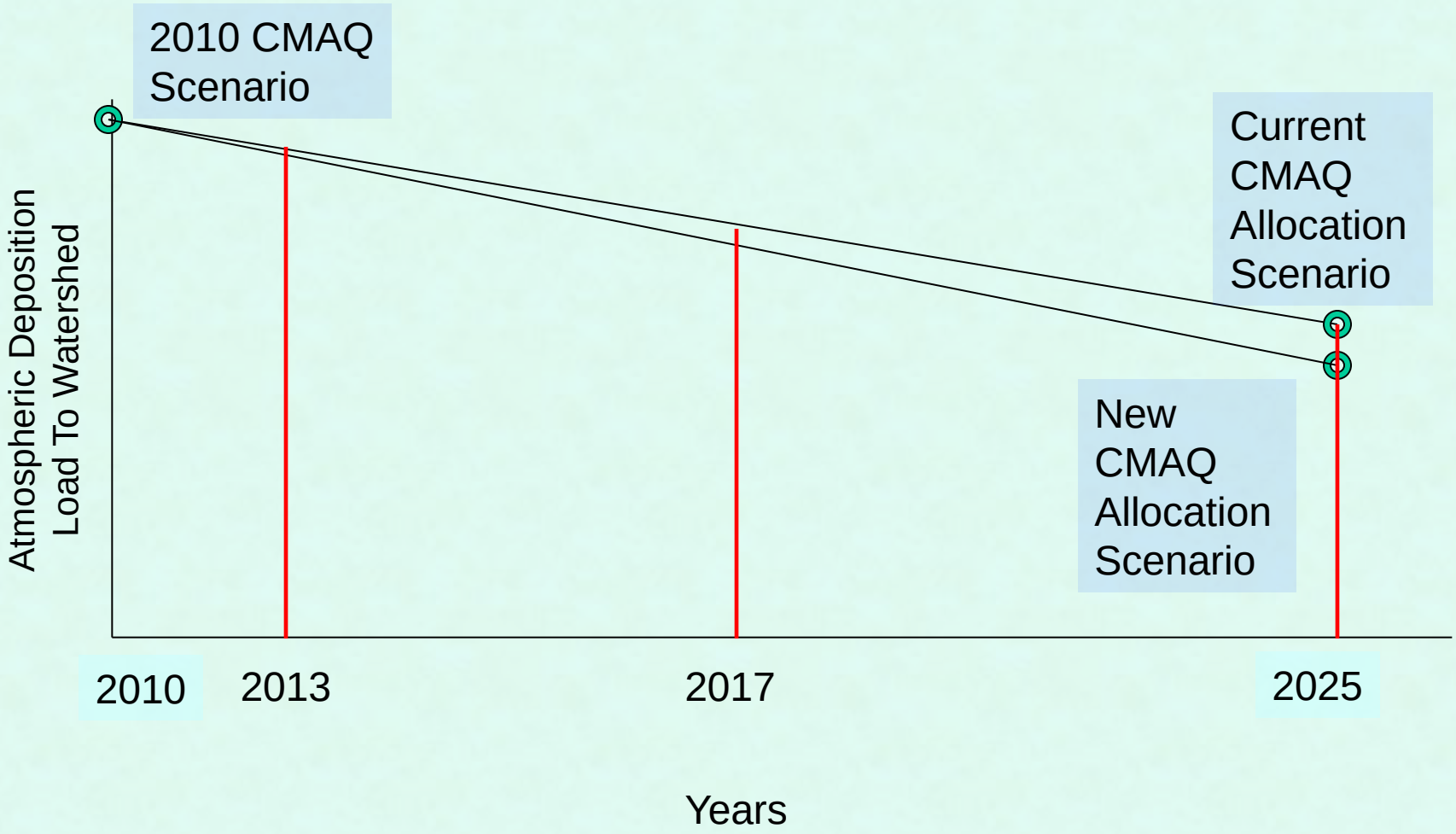
SCENARIO	Wet NO_X Deposition	Dry NO_X Deposition	Wet NH_3 Deposition	Dry NH_3 Deposition	Total Inorganic Nitrogen Deposition	Wet Organic Nitrogen Deposition	Total Nitrogen Deposition	Wet PO_4 Deposition	Wet Organic Phosphorus Deposition	Total Phosphorus Deposition
1985 Scenario	6.57	13.15	3.34	1.97	25.03	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

If we did use the Maximum Feasible Scenario in the WIPs we'd have about 0.8 million pounds of nitrogen "freeboard" in the Federal air allocation to the tidal Bay. That additional freeboard could be used as 1) a strategic reserve, 2) a "gap closer", 3) to incentivize other reductions, or could be used for some other purpose.



	1985	2002	2009	2025
What EPA is responsible for in atmo dep nitrogen reductions to tidal water.	10.38	5.89	1.72	0
EPA allocation to tidal water.	15.7	15.7	15.7	15.7
EPA's contribution in reducing atmo dep nitrogen in the watershed*	31.43	12.78	3.45	0
What the States are responsible for in PS and NPS reductions in the watershed	122.97	83.65	57.05	0
States watershed allocation	187.44	187.44	187.44	187.44

How we could use a new CMAQ Scenario that would best represent atmospheric deposition in 2025.



Schedule Milestones in the Development of the New Ozone Standard

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

Key Points:

If the current ozone standard of 0.075 parts per million (ppm) is revised to 0.070 ppm or less before the Phase II WIP process is completed in late 2012, EPA is planning to use an alternative air Scenario in its allocations that will reduce nitrogen deposition across the watershed and make it easier to achieve the TMDL allocations.

EPA plans to revise the ozone standard by July 2011. The revised standard is expected to be in the range of 0.060 to 0.070 ppm.

Key Points *(continued):*

EPA can provide the States with credit toward the revised ozone standard by replacing the **CMAQ 2020** Scenario with the 2020 **Maximum Feasible** Scenario that was developed to account for more aggressive EGU, industry, and mobile source controls. This scenario was designed to achieve, but did not quite achieve, an ozone standard of 0.070 ppm.

Substitution of the 2020 Maximum Feasible Scenario for the 2020 CMAQ Scenario will reduce nitrogen deposition loads delivered to the Bay from the watershed's land area by about 2.0 million pounds, and reduce atmospheric deposition directly to the tidal Bay by about 0.8 million pounds.