



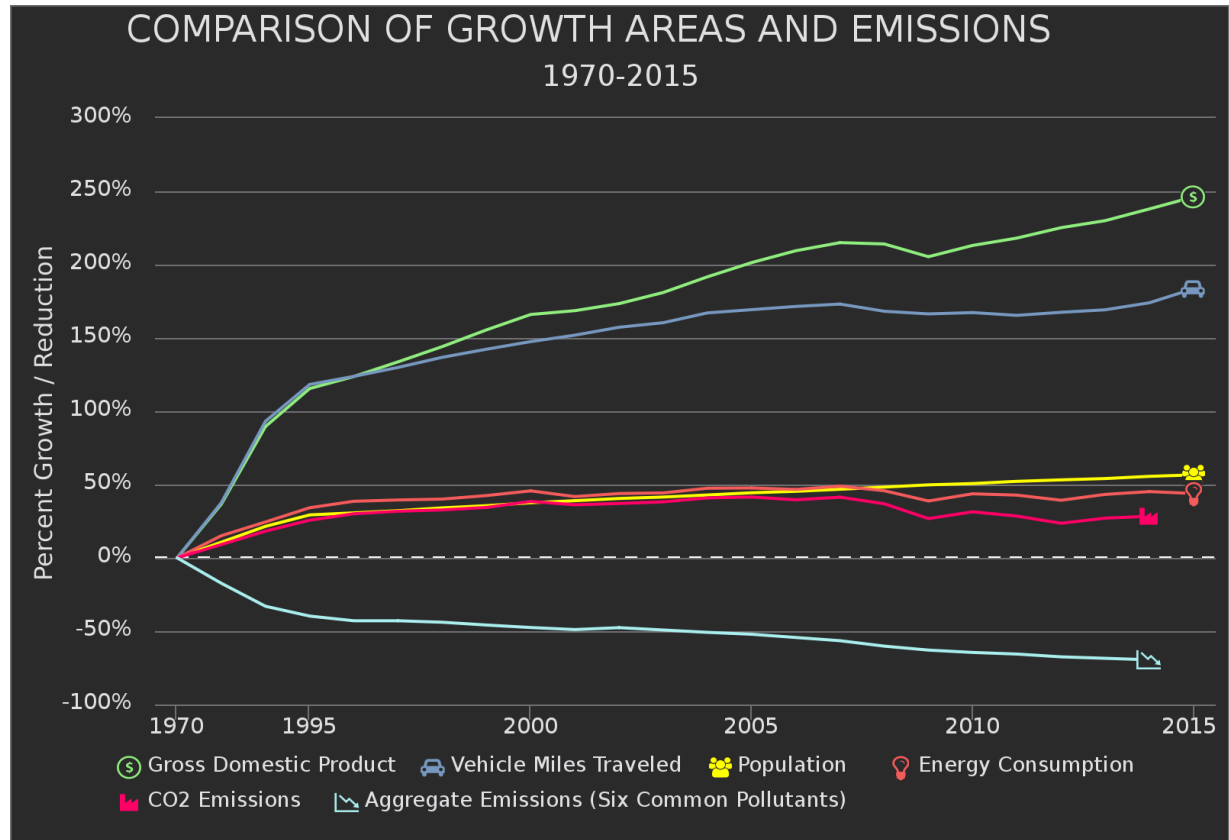
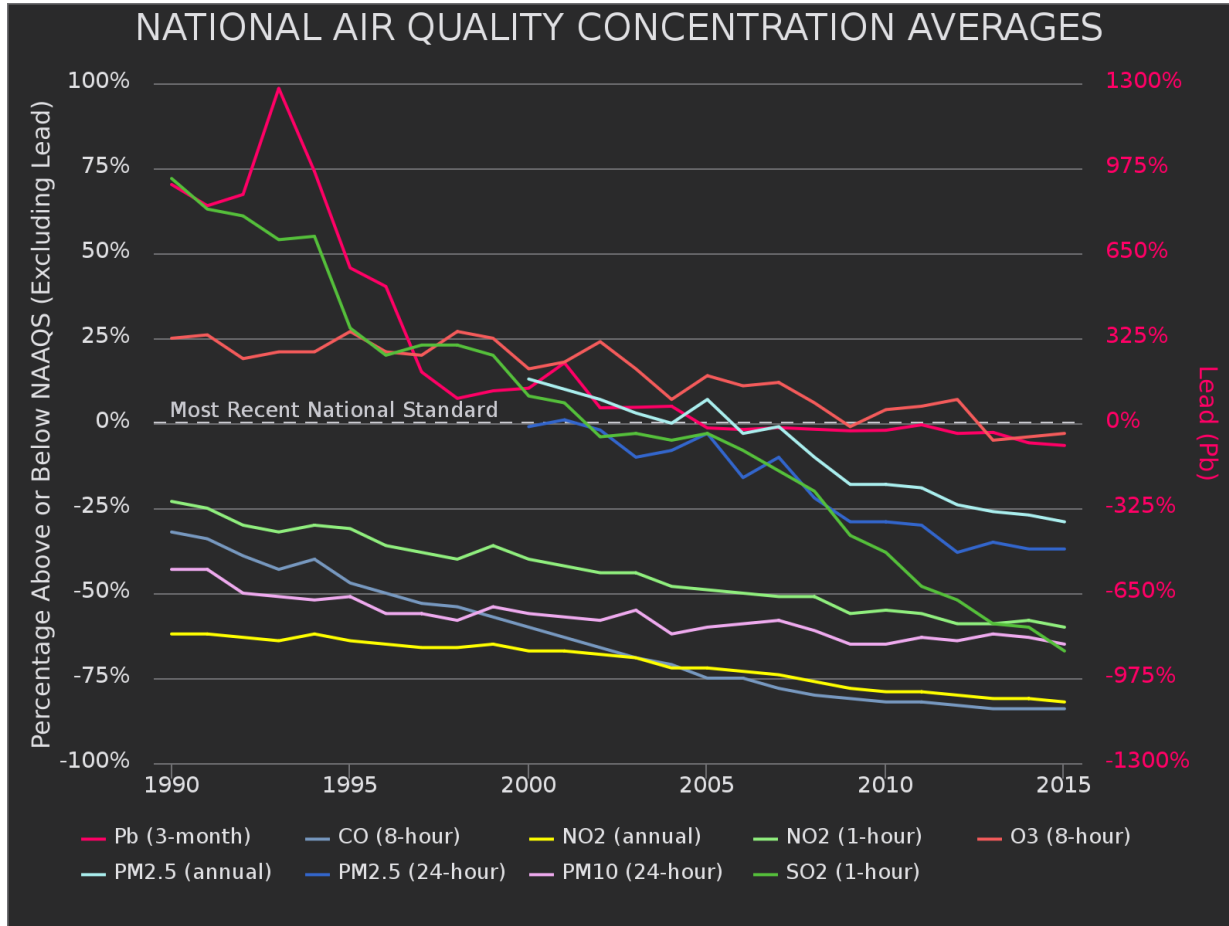
Office of Air Quality Planning and Standards

Perspectives on the ACE Centers

Some Initial Thoughts

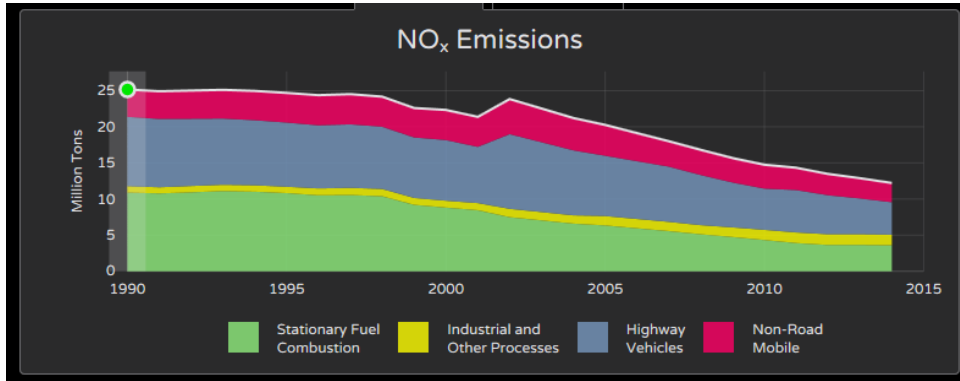
- In managing air quality and climate pollution, emissions, atmospheric processes, and exposures are multipollutant, even if regulations or standards are not – need to be aware of co-benefits or costs.
- We are on a regulatory path that will result in much lower emissions for power plants and many vehicles – there is an increasing need to find ways to efficiently address the remaining emissions sources that will contribute to air quality problems over the next decades. Might need more focus on industrial emissions, but these are more uncertain.
- Much of the reduction in ambient air pollution over the last 2 decades has been due to reducing regional transport, through programs like the Acid Rain program, CAIR/CSAPR, and MATS. Much of the remaining ambient air pollution is due to more local sources, and will require more local solutions.
- Interactions between air quality and climate are complex and multi-faceted, managing for both is challenging because of the differences in time- and spatial scales of impacts.
- The future atmosphere will have much lower concentrations of criteria air pollutants although elevated concentrations will remain in some areas and at some times.

Overarching Trends

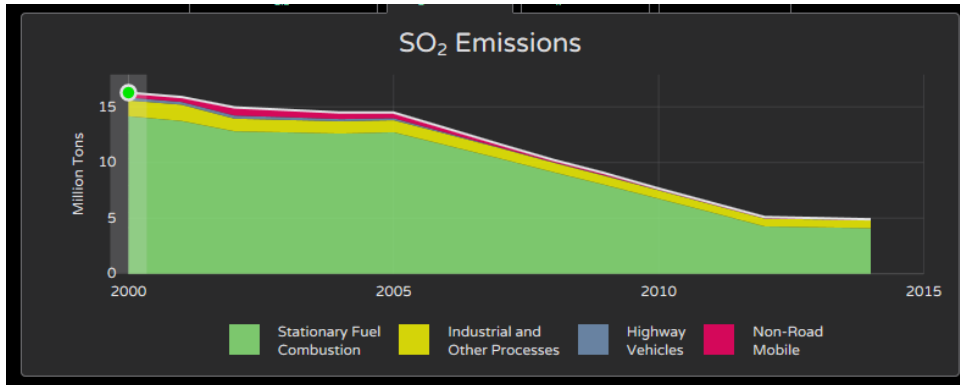
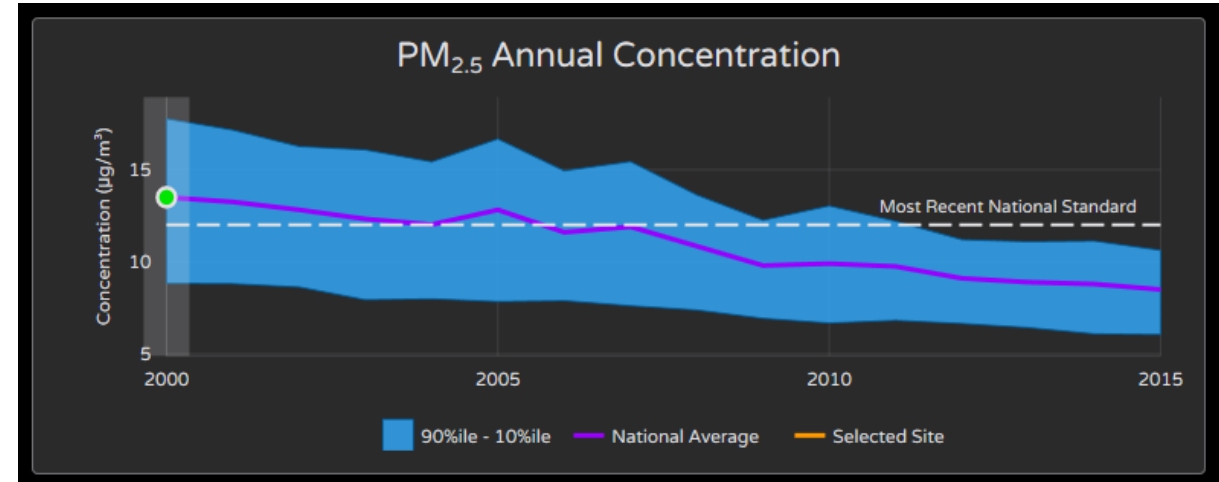


Source: <https://gispub.epa.gov/air/trendsreport/2016/>

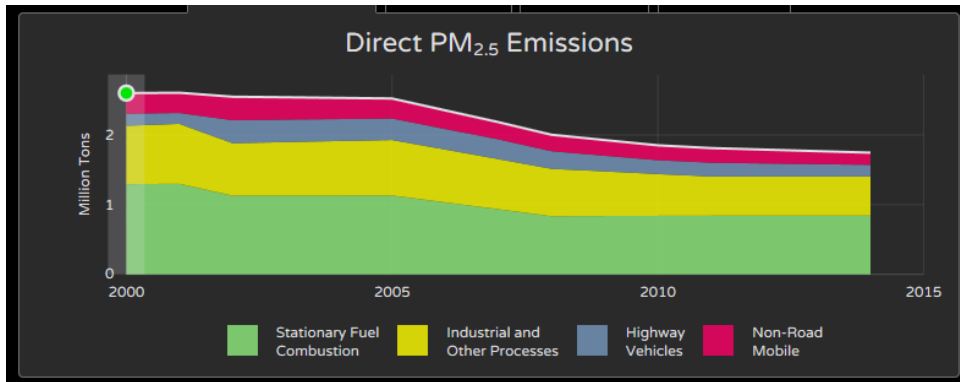
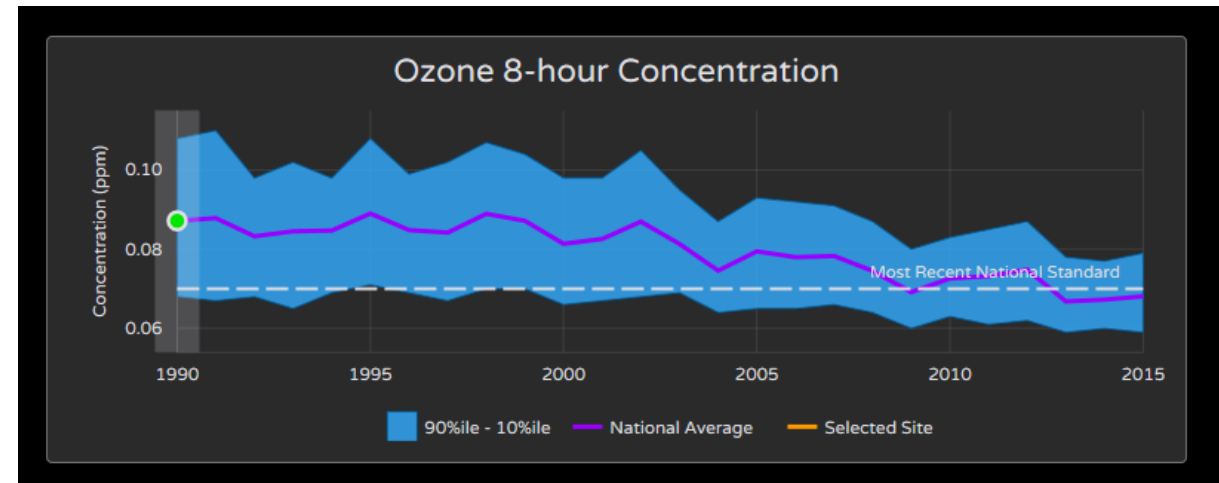
Trends in Emissions and Air Quality



2030 No-CPP EGU
NO_x: 1.3 million tons (-64% from 2014)



2030 No-CPP EGU
SO₂: 1.3 million tons (-73% from 2014)



Source: <https://gispub.epa.gov/air/trendsreport/2016/>

Mixtures and low concentrations

- Research does not seem to be identifying specific components of PM_{2.5} or specific mixtures which are the “silver bullet” for addressing risks from air pollution exposures
 - There is evidence that some mixtures or sources may be more associated with health effects, and this can be useful during implementation
- As the air pollution mixture changes over time and concentrations of criteria pollutants are decreased, information on the potential health impacts of those future, low concentration mixtures will be increasingly valuable
- The changing climate will also affect both the mixture and human responses, understanding how temperature and other climate variables impact vulnerability to air pollution will be informative
- This information will be especially useful as urban areas consider multipollutant, risk based approaches to addressing their air quality and climate goals.

Improved understanding of within and between city heterogeneity is valuable

- Our experiences in Detroit and South Carolina have shown that by understanding the sources of air pollution and the nature of population exposures, including for sensitive populations, urban areas can increase public health benefits from reducing emissions to meet NAAQS, address climate pollution, and reduce air toxics exposures.
- Understanding the sources of heterogeneity between urban areas in air quality concentrations, mixtures, exposures, and health responses is important, as well as understanding the contributors to air pollution and the potential effectiveness of strategies to reduce emissions and exposures. Improving these understandings can help to identify the next generation of air quality strategies, including for areas that may have less experience in addressing air quality or climate challenges.
- Interested in methods and results for clustering areas into regions, especially where this can help to differentiate which types of strategies will be most effective to address air quality and health by region

Vulnerability and Modifiable Factors

- Understanding modifiable factors has great potential to inform actions to improve public health
 - However, useful to clarify different levels of modifiable factors, e.g. personal, community, regional
 - Also useful to recognize different time frames (short term vs long term) for modification, e.g. change my bike route to avoid exposures vs changing city infrastructures
- Also useful to understand both the factors that affect vulnerability to air pollution, e.g. increased biological susceptibility, co-occurring stress factors, proximity to multiple sources, as well as modifiable factors, as they may be correlated, and can inform both emissions reductions strategies as well as individual and community actions to reduce exposures or health effects. Study of rural populations will help fill a gap in the evidence base
- The investigation into the effects that the AQI has had on health effects from PM and O3 can be helpful to understand how to target messages about the NAAQS.
 - OAQPS has been working to understand this as well through our analysis of the National Scale Activity Survey
 - NSAS obtained information on awareness, knowledge and stated responses to air quality warnings, and collected activity diary data to measure actual behavioral changes on poor air quality days
 - Initial analysis for the O3 NAAQS review
 - As low cost sensors provide additional information on personal exposures, need to also think about how they will affect behaviors and health risks.

Multipollutant risk based strategies can increase benefits

- Our Detroit study showed that a multi-pollutant risk based strategy provided greater air quality benefits to at-risk populations and reduced risk inequality compared to a “status quo” strategy

	Per-person change in PM_{2.5} exposure	
	<i>Among susceptible and vulnerable populations</i>	<i>Among rest of population</i>
Status-quo strategy	0.33	0.28
Risk-based, multi-pollutant strategy	1	0.5
Percentage difference	300%	180%

- Findings from this study were published in *Atmospheric Pollution Research and Risk Analysis*.
- *This did not include adjustments to the concentration-response functions which could further increase benefits*

Additional Lessons Learned

- Even without complex analyses, air quality managers can apply some of the “lessons learned” from this study to develop effective multipollutant, risk-based control strategies by taking into account the following:
 - Nature of the pollutant being controlled
 - Source(s) of the emissions being controlled
 - Co-control potential
 - Important risk drivers
 - Populations being most affected
- ... and using answers to these questions allow air quality managers to focus on emission reductions strategies that can show “attainment,” take advantage of co-pollutant reductions when & where feasible, and lower risk for vulnerable and susceptible populations.
- Similar approach has been applied in South Carolina, documentation is available at <https://www.epa.gov/advance> (“Resources” panel) or <https://www.epa.gov/advance-participants-south-carolina>
- The SC assessment showed that there can be significant benefits to controlling emissions even in areas that already meet the NAAQS
- Reduction efforts to reduce precursors such as NO_x and other criteria pollutants can have a co-benefit in reducing risks from air toxics.

Air Quality Management Plan (AQMP) Pilot Projects

- OAQPS explored the Air Quality Management Plan (AQMP) concept via pilot planning efforts with NY, NC, and IL/MO (St. Louis area)
 - Our goal was to test the real-world application of the concept
 - Different states used different approaches. NY conducted the most extensive analyses, including application of NE-MARKAL for energy system modeling.
- In our view, an AQMP is a comprehensive, multi-pollutant plan that integrates the following:
 - Attainment/maintenance of the NAAQS
 - Sector based reductions
 - Risk reductions from hazardous air pollutants (HAPs)
 - Visibility and ecosystem protection
 - Land use, transportation, energy, environmental justice, and climate
- We concluded that the AQMP concept has significant merit and should be encouraged. However, real (e.g. upfront investment to initiate plan) and perceived (e.g. NAAQS review cycle) obstacles are challenging to areas that want to shift to more integrated planning.
- More info is available at:
<https://archive.epa.gov/airquality/aqmp/web/html/pilot.html>

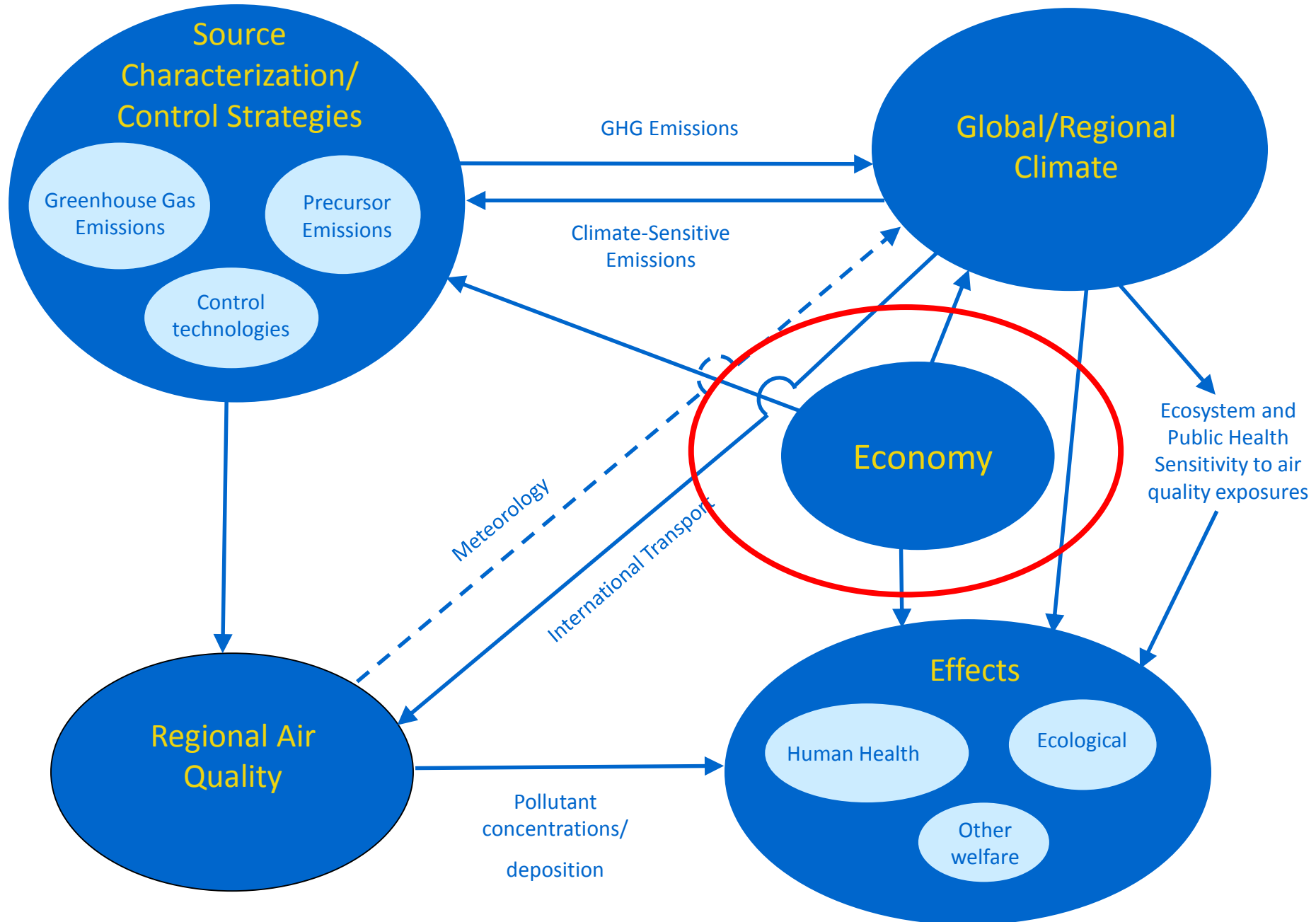
Thoughts on Air Quality Characterization

- The ACE Centers will implement and make advances in many areas of importance including reduced-complexity models, fused spatial fields, emissions (past, present, future), and air quality modeling
- Studies will likely have the greatest impact when they are based on the most up-to-date information (e.g., emissions, models, methods) at the appropriate resolution
- Studies that develop credible new tools, methods, and algorithms that can be readily incorporated into future policy-relevant assessments will be valuable
- We value the knowledge and skills of the researchers in the Centers and want to offer our tools that might be useful in collaborations; tools such as emissions and modeling platforms
 - Information available includes multiple current, retrospective, and future-year national 12-km air quality simulations as well as gridded emissions fields based on the latest version of the 2011 National Emission Inventory and fused spatial fields at regional/local scales
- We look forward to the Center's work and would like to actively contribute and participate in the process toward developing results and products that will be relevant for the air quality management community

Accountability

- Results of causal modeling will be interesting for a number of reasons. In general, would be useful for many levels of decisionmaking to know if this type of modeling
 - can help with mid-course corrections?
 - can identify what caused the difference between expected and actual outcomes?
 - can inform design of future strategies or transfer of strategies between locations?

Climate Change and Air Quality Management



Blast from the Past (Circa 2009): Data Needs for a Joint Climate/AQ Management Framework

- Integrated emissions inventories (criteria, toxics, GHG)
- Improved understanding of control technologies for GHG, along with associated reductions in criteria and toxics pollutants
- Improved understanding of impacts of current and future air pollution emissions controls on GHG emissions
- Assessment of impacts combined impacts of energy, transportation, and land use policies, e.g. demand side impacts of energy efficiency on emissions of GHG and air pollution
- Integrated system of models including:
 - Sectoral, regional, national, and global economic models for modeling climate and air quality policies
 - Fully linked climate/AQ models
 - Integrated climate/AQ health and welfare impact models

Adapting AQ Management to a Changing Climate

- Four challenges:
 - Adapting AQM to climate change itself (e.g. temperature change causes \uparrow in ozone)
 - Adapting AQM to effects of climate change (e.g. increases in temps cause wildfire frequency to increase, increasing PM_{2.5})
 - Adapting AQM to adaptations to climate change (e.g. shifts in population locations resulting from sea level rise or increased temperatures)
 - Adapting AQM to climate change mitigation strategies
- A potential fifth challenge is recognizing that in addition to climate and AQ policies, energy security/independence policies may drive the structure of transportation and energy delivery in the next decades
- And then there is global change for other reasons...

Some relevant questions for managing climate pollution and air quality

Climate & Air Pollution Interactions

- How and to what degree will changes in climate impact the effectiveness of air quality management programs?
- What quantifiable effects will domestic air quality programs, such as the Clean Air Interstate Rule (CAIR) and the regional haze program, have on regional climate, and in turn, on air quality?
- Can we effectively integrate climate and air quality assessments (health & ecological impacts and economic valuation)?

Control strategies

- Which air pollution control scenarios are worth pursuing in a changing climate regardless of the uncertainties associated with various future scenarios?
- What opportunities are there to devise and implement strategies that reduce climate gases and air pollutants simultaneously?
- What are the difference in outcomes for scenarios where AQ policy is the driver vs climate policy is the driver vs energy security is the driver, compared to a true multi-objective policy that goes after all three simultaneously?

Some relevant questions

Economics

- How can we improve our ability to predict social, economic and technological developments affecting future emissions?
- How do we effectively take into account global growth (economic and emissions) in developing future emissions and air quality scenarios for the US?
- How can we design effective and efficient control strategies taking into account economic modeling at the local, regional, national, and global scales?

Geographic & temporal scales of assessments

- How can we effectively address the differences in temporal and spatial scales between GHG and traditional air pollutant assessments (in economic modeling, impacts assessments, mitigation program design, etc.)?

Projections, Scenarios, and Uncertainty

- Understanding how robust AQ and climate outcomes are to uncertainties in projections and models is potentially very useful
 - Will be useful to see the outputs from multiple climate, air quality, energy, and economic models
 - Will also be useful to see the results across diverse scenarios of energy transitions, economic patterns, and population dynamics
- Will be informative to see the AQ co-benefits that result from alternative state and region-level carbon policy implementation.
 - Would be interested in hearing more about how the Centers are developing the various strategies and scenarios for different carbon reduction strategies
- Improved understanding of the implications of life cycle modeling on the relative impacts of strategies will be useful, especially for strategies that incorporate a number of different spatially and temporally diverse components, e.g. alternative fuels, energy efficiency
- OAQPS has a project currently underway to review and improve emission projection methods for point non-EGU and nonpoint sources. We are interested in sharing information with the Centers and would be happy to provide more details on the project.