Multi-Pollutant Risk-Analysis & Reduction Strategy for South Carolina

AAPCA SPRING MEETING
April 28, 2016

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Background

- Collaborative effort between EPA, SC DHEC, and the local air coalition "Clean Air Upstate" (CAU) with participation from community and business leaders in ten SC upstate counties (*known as Ten at the Top* (TATT)) to develop and analyze a multi-pollutant, risk-based air quality management strategy.

- Goal was to identify and evaluate a local control strategy to reduce both ozone and PM2.5 precursor emissions as well as target emissions of air toxics of concern for communities to maximize both health benefits and air quality improvements.

- Local emission reduction measures for the Upstate that address multiple pollutants were identified by DHEC, EPA, and CAU/TATT.

- Started under the Advance program and focused on the upstate due to the impending 2015 ozone NAAQS and the local coalition's commitment to air quality.

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Project Details

• Control measures and their costs were identified.

• Air quality modeling was conducted to assess emission reduction effects on ozone, PM2.5, and other pollutants.

• Population risk exposure was assessed using the 2011 National Air Toxics Assessment (NATA) and Benefits Mapping and Analysis Program – Community Edition (BenMAP–CE).

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Control Strategy Analysis

- Focused only on non-EGU point and area sources and did not include mobile sources.

- Maximum emissions reductions method was chosen to see what is potentially available in terms of controls and emissions reductions. Conducted a max controls CoST run "robust strategy."

- Also included local CAU/TATT Strategies: 1) new gas stoves and gas logs and 2) open burning curtailment (both included in the CoST run). Anti-idling was also evaluated as a local control measure, but was analyzed by DHEC separately.

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Control Measures

Area Sources

Low NOx Burner (1997 AQMD)
RACT to 25 tpy (Low NOx Burner)
Low NOx Burner
Water and Space Heaters
Curtailment Program, aka “Burn Ban”*
New gas stove or gas logs*
Control Technology Guidelines
LPV Relief Valve
Motor Vehicle Coating MACT
Process Modification
Reformulation (OTC Rule)
Reformulation (Phase II)
Reformulation-Process Modification
Reformulation-Process Modification (OTC Rule)
Solvent Utilization

Point Sources

Low Emission Combustion

Low NOx Burner

Selective Catalytic Reduction

Dry Injection / Fabric Filter System (DIFF)

Wet Scrubber

Add-on controls, work practices, and material reformulation/substitution

Permanent Total Enclosure (PTE)

Solvent Recovery System

Control Strategy Reductions

The breakdown for reductions by pollutant was:

NOx: almost 1,600 tons reduced (of ~46,000)
Primary PM2.5: about 200 tons reduced (of ~8,000)
SO2: almost 800 tons reduced (of ~8,700)
VOC: almost 3,000 tons reduced (of ~46,453)

Control Strategy Costs

- Total costs for this strategy was ~$20 million ($2011):
  - The breakdown for this cost by pollutant was:
    NOx at $2 million (10% of total cost)
    Primary PM2.5 at $2 million (10% of total cost)
    SO2 at $3 million (14% of total cost)
    VOC at $13 million (66% of total cost)
  - The breakdown by sector was:
    Non-EGU point sources: almost $8 million (40% of total cost)
    Non-point sources: $12 million (60% of total cost)

- The effectiveness of the NOx control measures varied widely based on the cost which ranged from ~$300-$13,000 per ton of emissions reductions.

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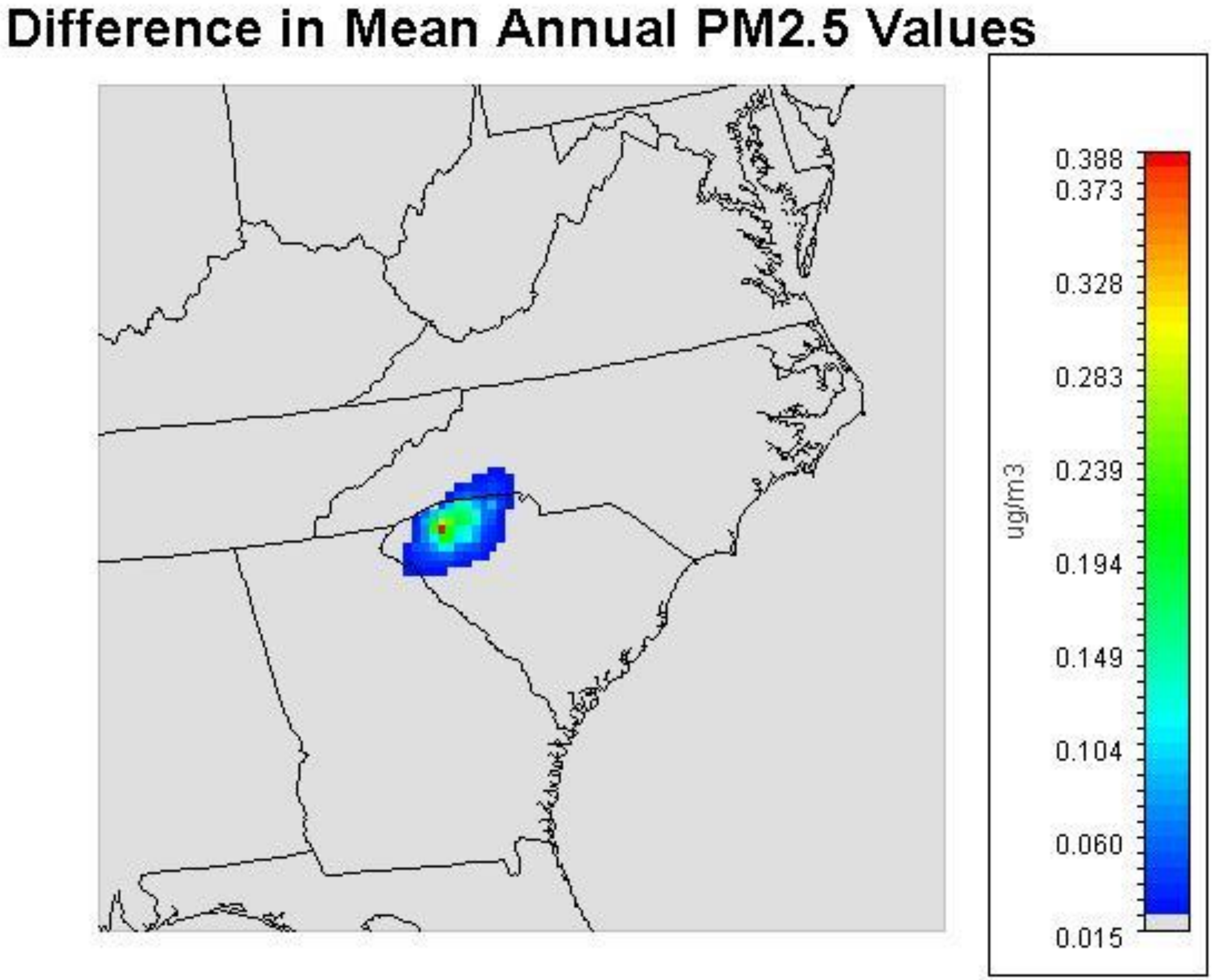
Results – PM2.5



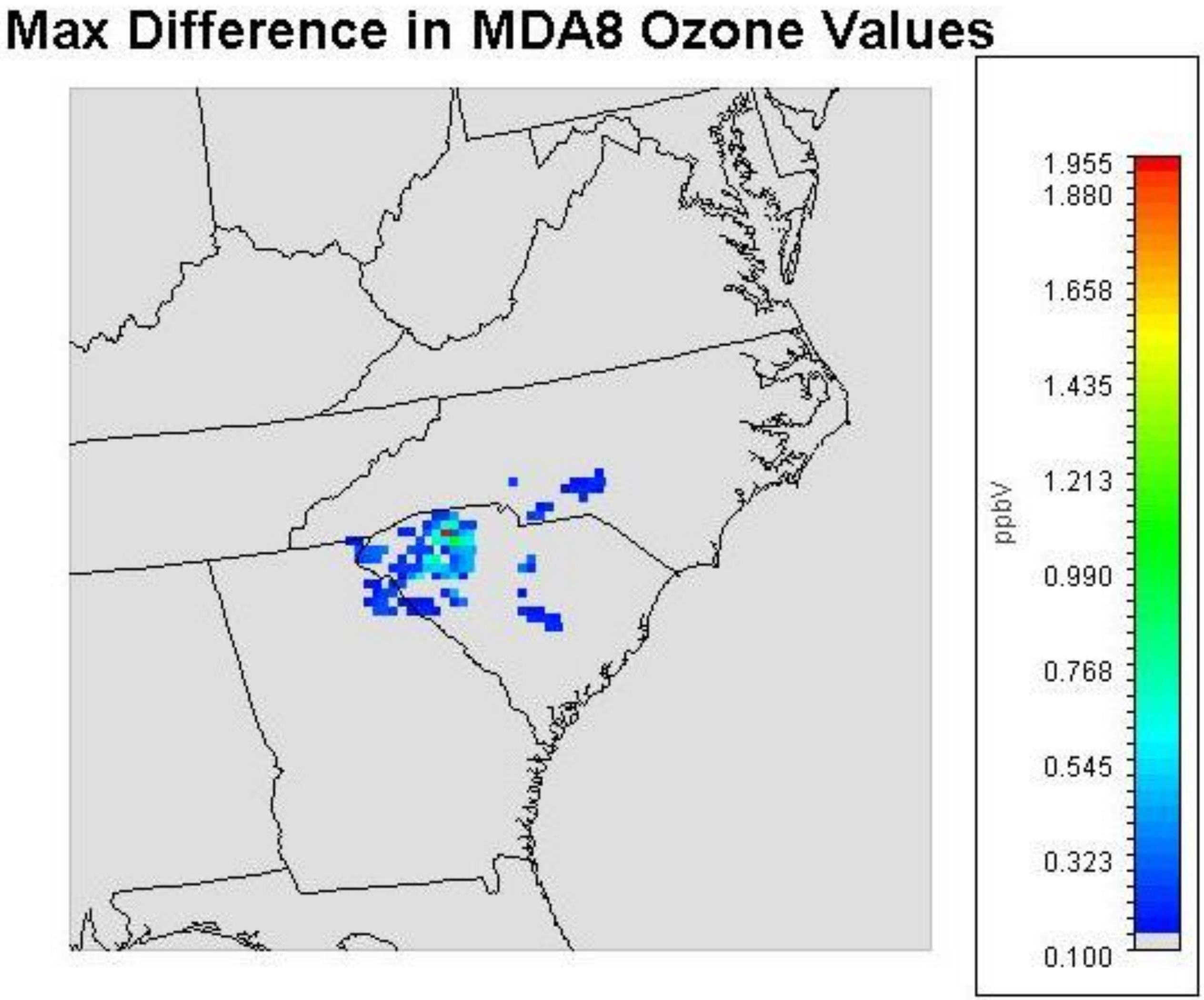
Results – PM2.5

Monitor ID	date	Base DV	Future DV	%
450450015	Q4	10.44	9.944	4.8
450450015	Q1	10.15	9.701	4.4
450450015	Q2	11.04	10.96	0.7
450450015	Q3	11.98	11.96	0.2
450450015	Annual	10.9	10.64	1.9
450450009	Q4	9.929	9.5	4.3
450450009	Q1	9.551	9.199	3.7
450450009	Q2	11.12	11.04	0.7
450450009	Q3	11.84	11.83	0.4
450450009	Annual	10.6	10.39	2.4

crustal	Elemental carbon	nh4	Organic carbon	so4	no3	water	salt
0.999	0.9851	0.9972	0.9615	0.9982	0.9764	0.9985	0.9955
0.9991	0.9843	0.9971	0.9558	0.9982	0.9753	0.9986	0.9944

The biggest reductions occurred in the colder months in the organic carbon species. wood to natural gas control strategy likely had a lot to do with this temporal and species reduction profile.

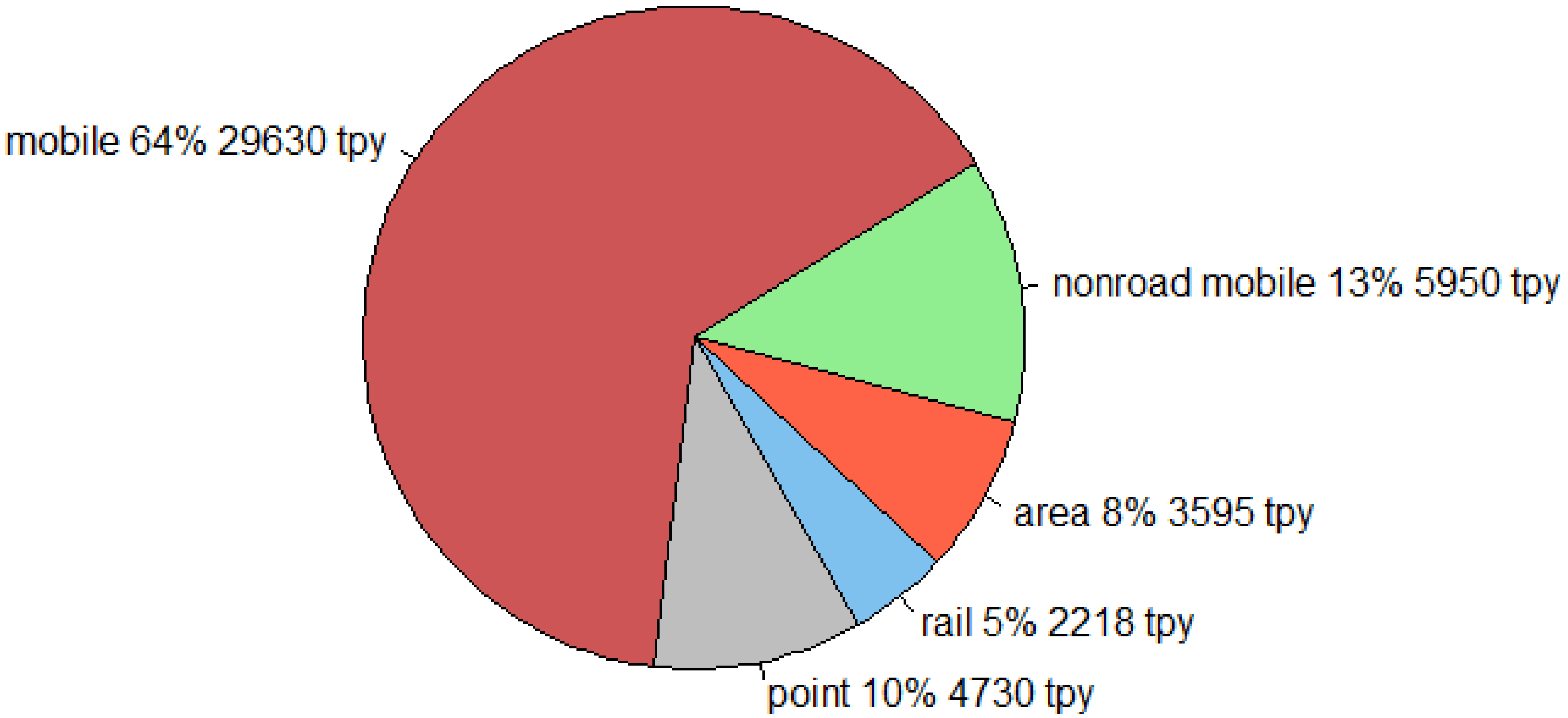
Results - Ozone



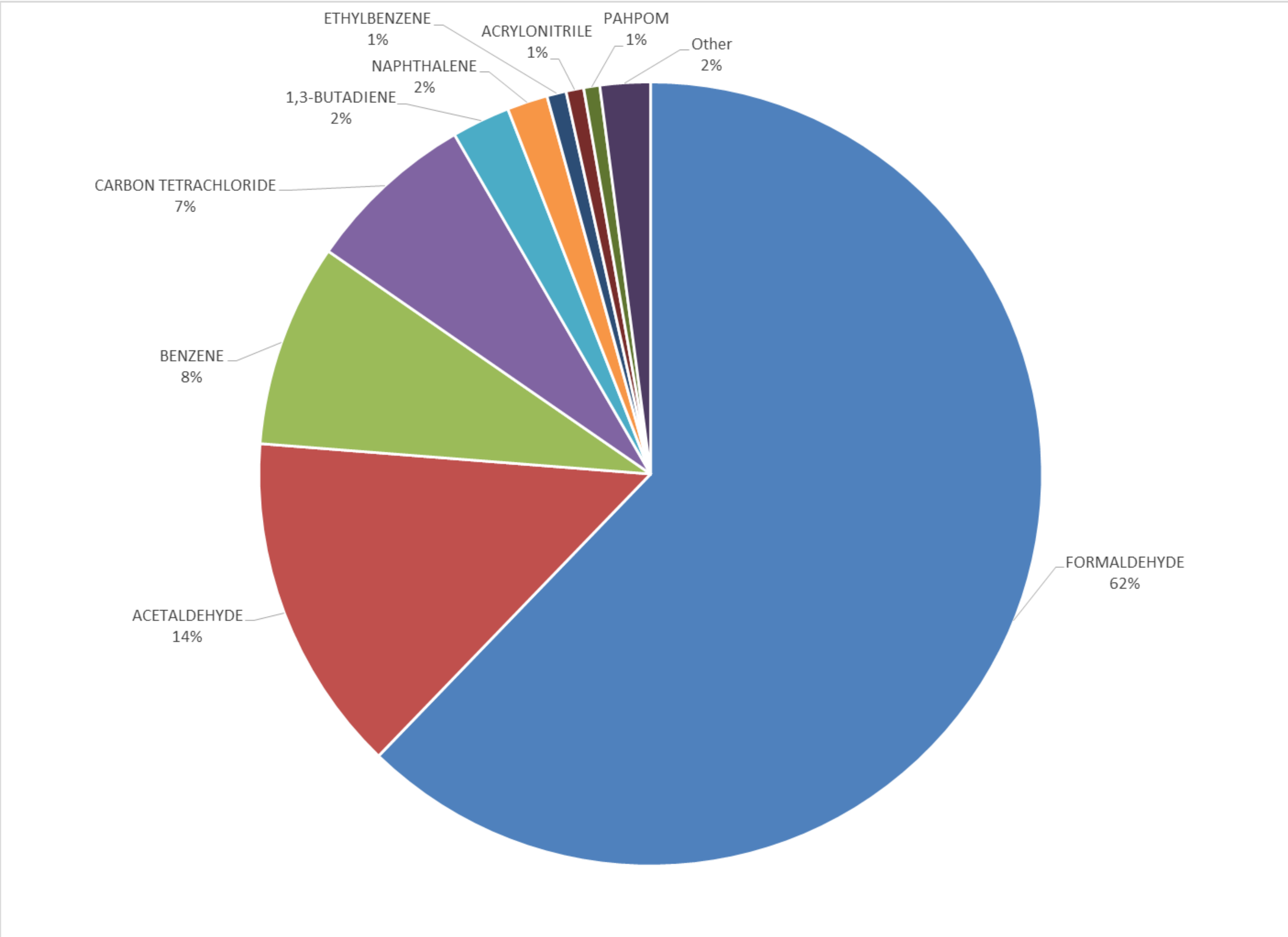
Results - Ozone

Monitor_ID	Monitor_Name	Base_DV	Future_DV	%
450010001	Due West	62	61.7	0.48
450070005	Big Creek	70	69.8	0.29
450210002	Cowpens	67.3	67.2	0.15
450450016	HillCrest	68	67.3	1.03
450451003	Famoda Farms	65.3	65.2	0.15
450730001	Long Creek	64.5	64.4	0.16
450770002	Clemson	69.7	69.5	0.29
450770003	Wolf Creek	69	68.8	0.29
450830009	North Spartanburg	73.7	73.3	0.54

Upstate NOx Emissions by Source Category



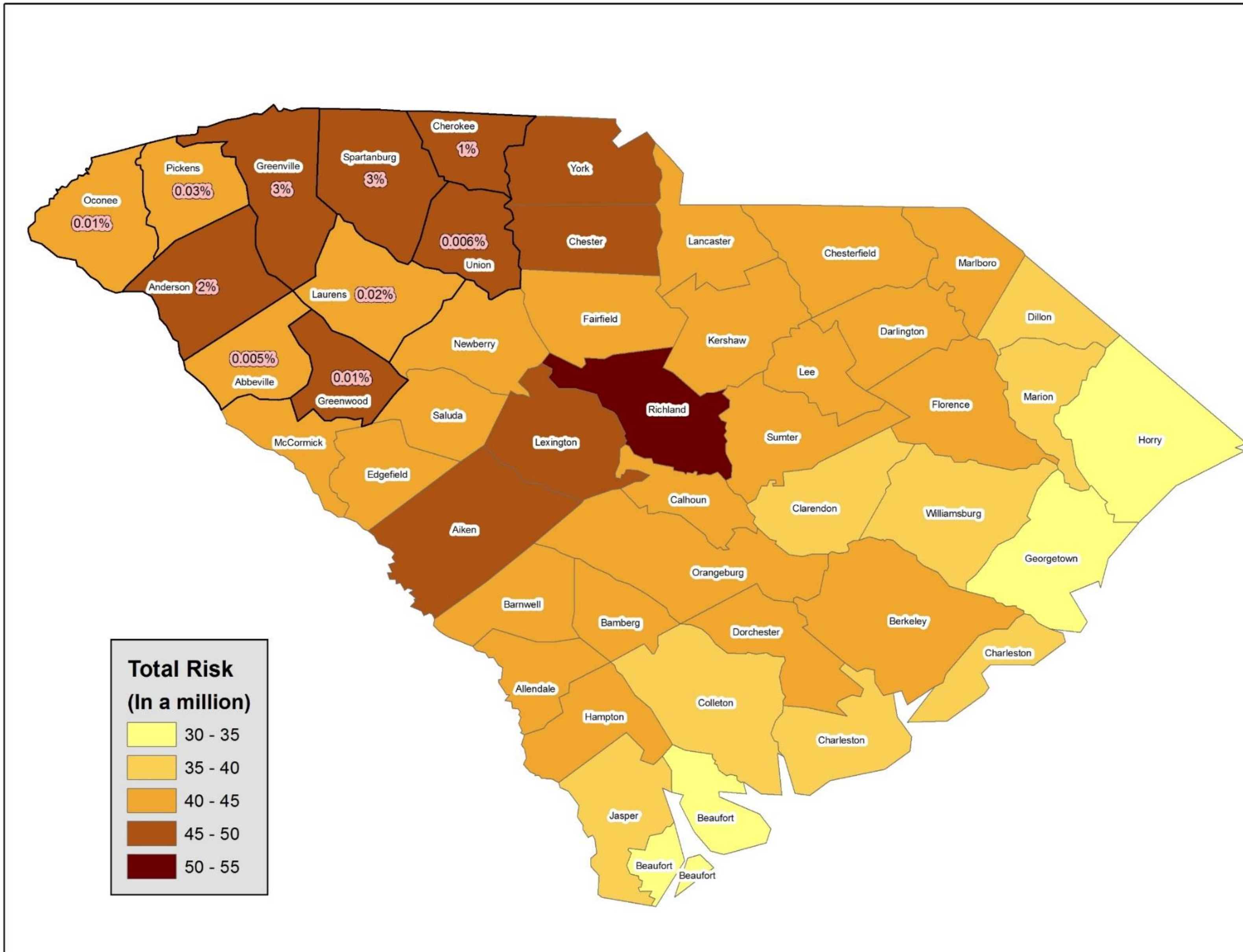
2011 NATA Cancer Risk – SC TATT Counties Pollutant Contributions (47 in a million)



Approach to Estimate Air Toxic Risk Reductions

- Based on the 2011 NEI, 28,000 tons of air toxics are emitted each year from the SC TATT counties.
- Apply countywide percentage reductions from TATT inventory to NATA point and nonpoint risk results on a pollutant-by-pollutant basis.
  - Reductions only for point and nonpoint sources, which contribute only about 5% to the total risk in the TATT counties (Secondary, mobile, and biogenics are over 80%).
- Limitations:
  - Assumes reductions equal across all NATA point and nonpoint source categories.
  - Based on 2011 NATA.
- Most of the risks are from secondary formed pollutants (mainly formaldehyde), so reduction efforts to reduce precursors such as nitrogen oxides and other criteria pollutants would have a co-benefit in reducing risks from air toxics.

Final 2011 NATA
Expected % Cancer Risk Reductions - SC TATT



Cost-Benefits Analysis
(Millions of 2010 Dollars)

Total Air Quality Benefits	$PM_{2.5}$	Ozone
Maximum Air Quality Change in any TATT County[1]	0.251 µg m^{-3}	0.106 ppb
Total Control Strategy Cost	$20	
Total Benefits of Avoided Mortality and Morbidity (PM: Krewski-Lepeule; Ozone: Bell-Levy)	$92-220	$3.1-4.4
Net Total Benefits	$82-210	
Benefit-Cost Ratio	4.1-10	

[1]The maximum change for $PM_{2.5}$ is expected at Greenville County, SC; the maximum change for ozone is expected at Spartanburg County, SC

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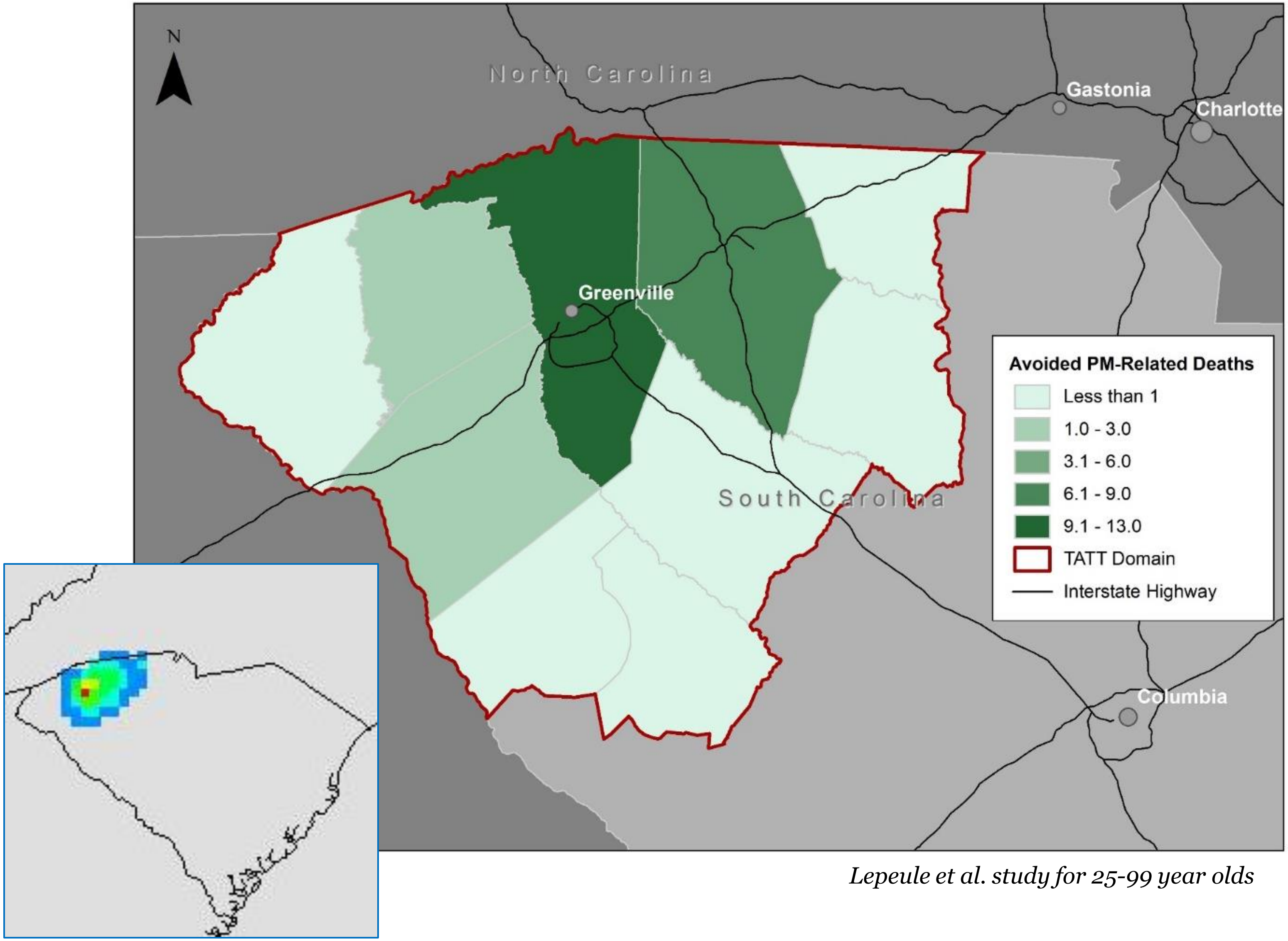
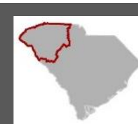
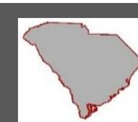
Avoided PM-Related Deaths



Lepeule et al. study for 25-99 year olds

PM Benefits and Valuation Summary

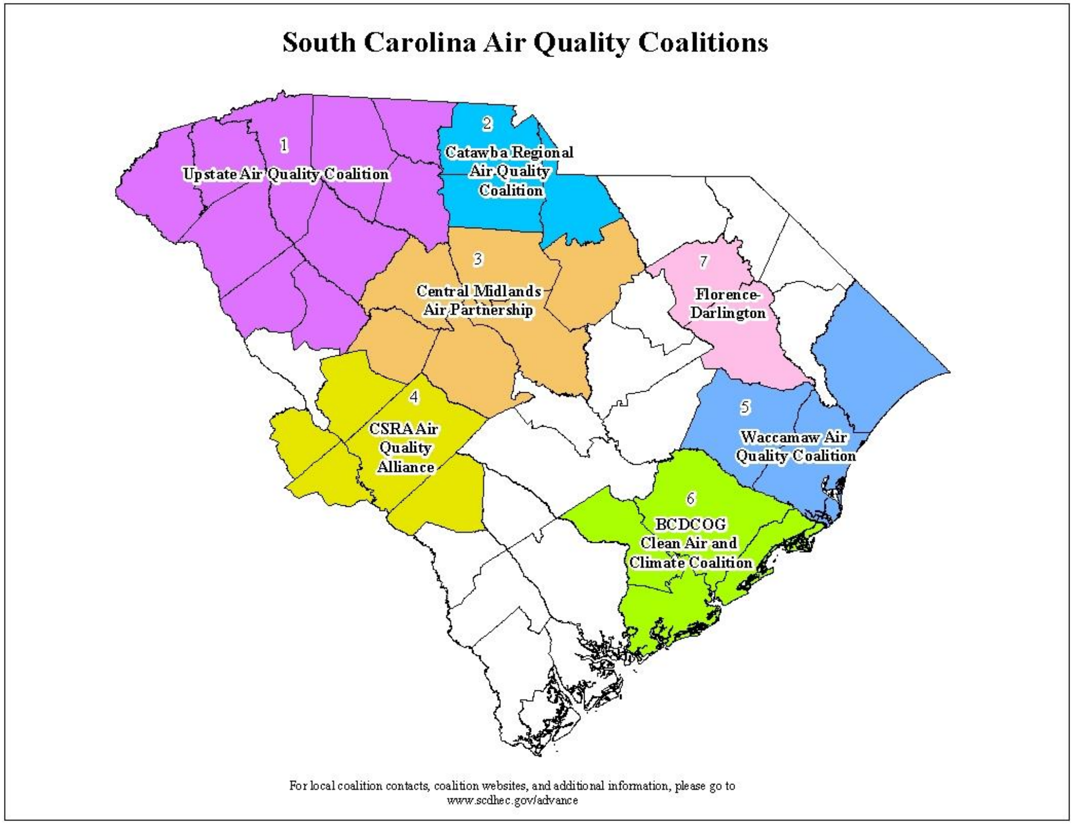
(Millions of 2010 Dollars)

	TATT 	South Carolina 	Modeling Domain 
Population	930,000	3,000,000	43,000,000
PM Avoided Deaths (Krewski and Lepeule)	10-23	11-24	16-36
PM Benefits (Peters, 3% Discount)	$92-210	$97-220	$140-320
Ozone Avoided Deaths (Bell, 2004)	<1	<1	1.0
Ozone Benefits (Bell, 2004 + Morbidity)	$3.2	$4.3	$10
Total PM and Ozone Benefits (95% Confidence Interval)	$95 ($9.3-260)	$101 ($9.8-270)	$150 ($15-420)

Establishing Local Air Quality Coalitions

- Implementing local control strategies is an ever increasing important component of successful air quality management programs.

- SC DHEC has established regional "air quality coalitions," engaging local communities in areas of the state that have issues with air quality or one of the NAAQS.



Conclusions

- Improving air quality in areas already attaining the NAAQS can yield significant health and associated costs benefits.

- Mobile source reductions should be an area of focus for reduction strategies in the future in this area since mobile source emissions contribute significantly to NAAQS and air toxics levels.

- Reduction efforts to reduce precursors such as nitrogen oxides and other criteria pollutants can have a co-benefit in reducing risks from air toxics.

- Implementing local control strategies in an area with a mix of sources is an important component of successful air quality management programs. In light ever decreasing standards, we will rely on local governments and coalitions to pursue proactive transportation strategies that reduce pollutants…because creating nonattainment strategies will be difficult.

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Lessons Learned

• Local area perspective and expertise play a large role in successfully implementing any voluntary emissions reduction program.

•Project allowed for knowledge transfer and feedback. CAU supports the development of tools and resources for local coalitions aimed at allowing them to easily understand the effect that certain activities will have on air quality and various pollutant levels. This analysis is helpful in determining whether programs (like Breathe Better at Schools) and their financial costs are supported by the likely outcomes.

• When EPA and state partners work together closely, it's possible to gather and use the data needed for the benefits analysis. Helpful information can be gathered from even a moderate amount of data.

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