EPA's *Report to Congress on Black Carbon*: Key Messages and Critical Next Steps

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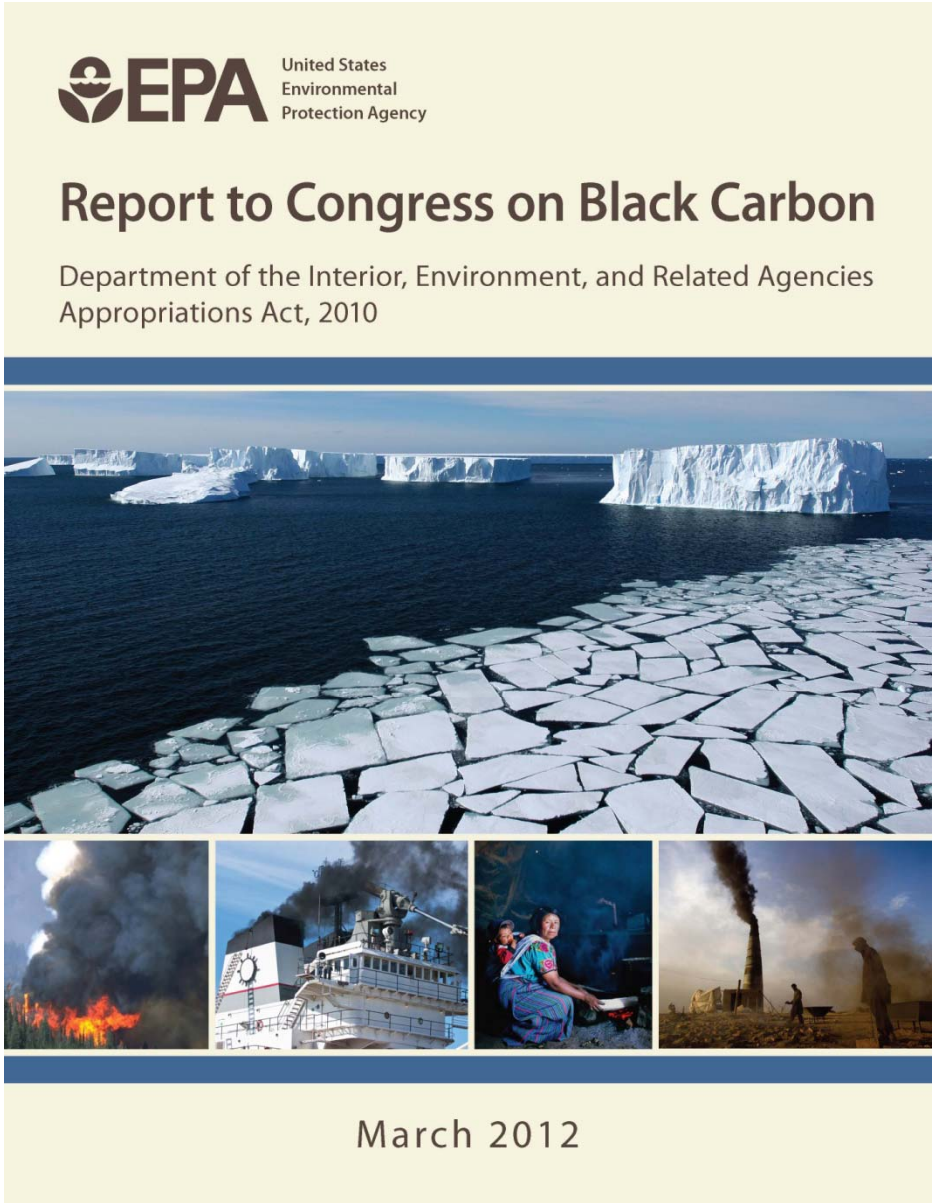
EPA's Report to Congress on Black Carbon

- In October 2009, Congress requested that EPA conduct a comprehensive study on black carbon to evaluate domestic and international sources, and climate/health impacts
- EPA completed this report on March 30, 2012
- Available online at: www.epa.gov/blackcarbon



The Report:

- Defines black carbon (BC) and describes its role in climate change.
- Characterizes the full impacts of BC on climate, public health, and the environment based on recent scientific studies.
- Summarizes data on domestic and global BC emissions, ambient concentrations, deposition, and trends.
- Discusses currently available mitigation approaches and technologies for four main sectors:
  - Mobile Sources
  - Stationary Sources
  - Residential Cooking and Heating
  - Open Biomass Burning
- Considers the potential benefits of BC mitigation for climate, public health, and the environment.

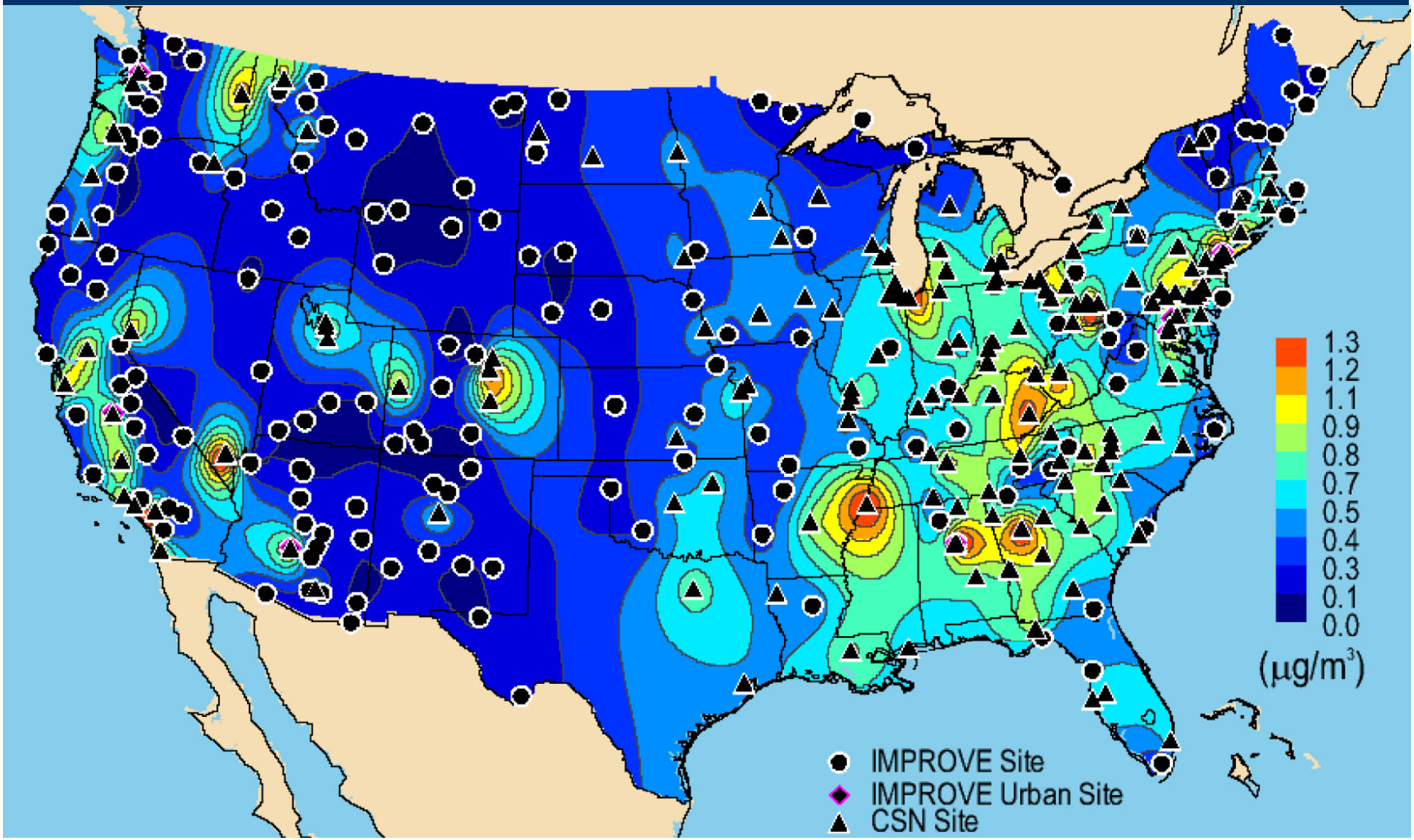
Key Messages from the BC Report to Congress

- Targeted reductions in black carbon (BC) emissions can provide significant near-term climate benefits.
- The health and environmental co-benefits are very large.
  - Emissions and ambient concentrations of directly emitted $PM_{2.5}$ are often highest in urban areas, where large numbers of people live.
  - Average public health benefits of reducing directly emitted $PM_{2.5}$ in the U.S. are estimated to range from $290,000 to $1.2 million per ton $PM_{2.5}$ in 2030.

Source: Reuters

Source: EPA

Annual Mean BC Concentrations (µg/m3) for 2005-2008



POTENTIAL BENEFITS = MITIGATION POTENTIAL +/- CONSTRAINING FACTORS

Goals

Climate
Radiative Forcing
Temperature
Ice/Snow Melt
Precipitation

Health
Ambient Exposures
Indoor Exposures

Environment
Surface Dimming
Visibility

Emissions sources

Stationary Sources
Brick Kilns
Coke Ovens
Diesel Generators
Utilities
Flaring

Open Biomass Burning
Agricultural Burning
Prescribed Burning
Wildfire

Mobile Sources
On-Road Diesel
On-Road Gasoline
Construction Equip.
Agricultural Equip.
Locomotives
Marine

Residential Cooking and Heating
Cookstoves
Woodstoves
Hydronic Heaters

Mitigation options

Available Control Technologies
e.g. Diesel Particulate Filters

Alternative Strategies to Reduce Emissions
e.g. Efficiency Improvements, Substitution

Constraining factors

- Timing
- Location
- Atmospheric Transport
- Co-Emitted Pollutants
- Cost
- Existing Regulatory Programs
- Implementation Barriers
- Uncertainty

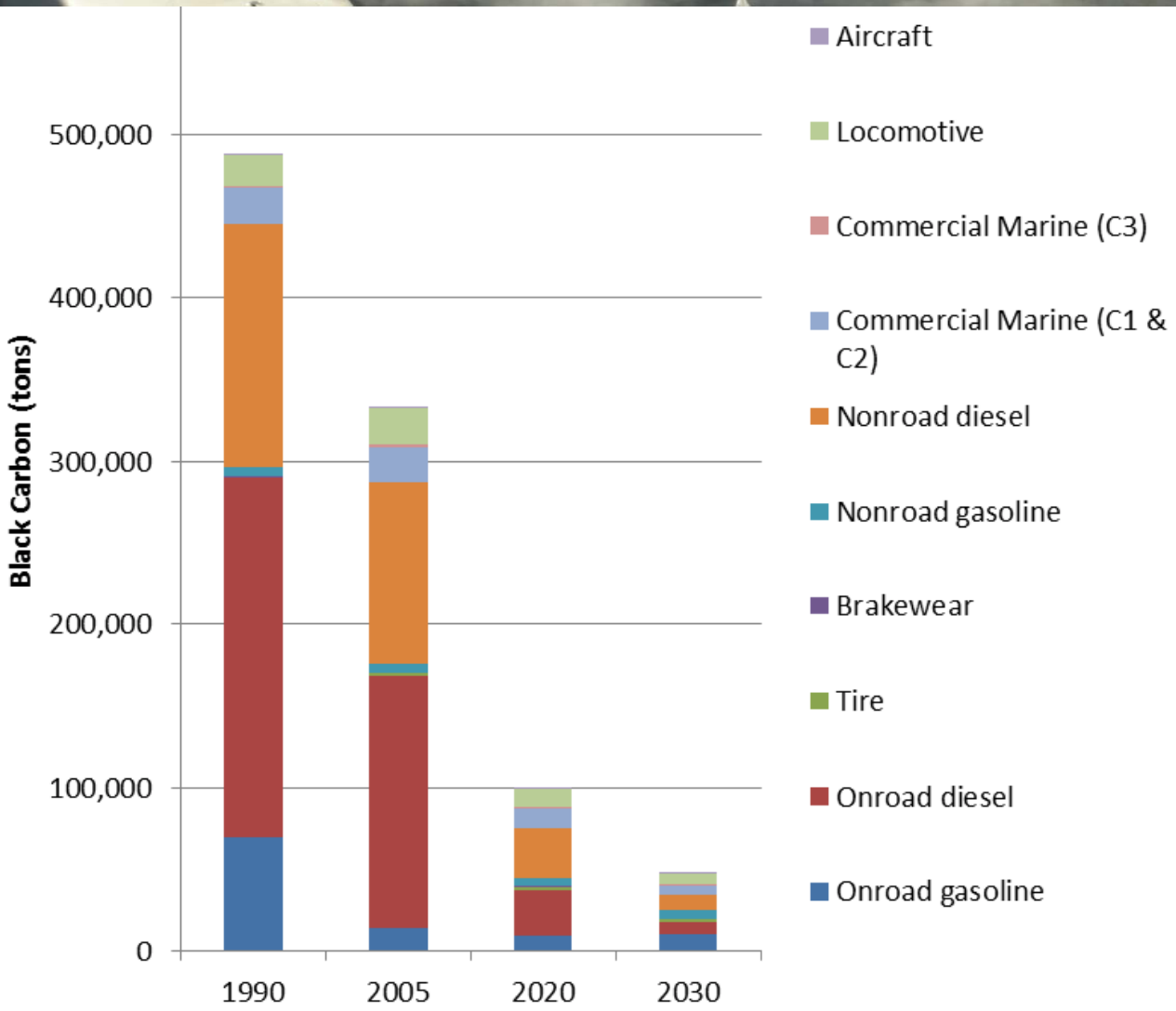
Key Messages from the BC Report (cont.)

- Effective control technologies and approaches are available to reduce BC emissions from a number of key source categories.

- U.S. BC emissions have been declining, and additional reductions are expected by 2030 due to controls on mobile diesel engines.
  - Controlling direct $PM_{2.5}$ emissions from sources can be a highly effective air quality management strategy, with major public health benefits.

- In other world regions, emissions have been increasing and growth in some sectors (e.g., transport) may continue.
- Therefore: BC reduction opportunities exist, but realizing additional reductions will require tailored approaches.

U.S. Mobile Sources



Emissions from U.S. Mobile Sources Are Projected to Decline by 86% by 2030 due to Existing Regulations

Who is Listening?

Climate and Clean Air Coalition to Reduce Short-Lived Climate Pollutants

- Announced by Secretary Clinton and Administrator Jackson February 16, 2012
- Goal is to accelerate reductions in BC, methane, and HFCs
- Administered by UNEP
- Participants: U.S., Canada, Sweden, Mexico, Ghana, Bangladesh, Colombia, Japan, Nigeria, the European Commission, Norway, World Bank
- On April 24, 2012, announced 5 major initiatives:
  - Diesel emissions reductions (black carbon)
  - Brick kilns (black carbon)
  - Landfills (methane)
  - Oil and Gas (methane)
  - HFC alternatives

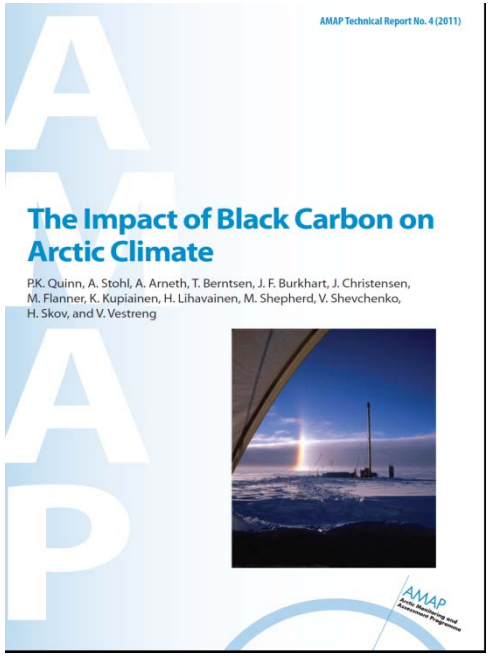
Other International Efforts

Gothenburg Protocol

- In May 2012, the Convention on Long-Range Transboundary Air Pollution (LRTAP) adopted new PM requirements as part of revisions to the Gothenburg Protocol, including specific language on BC

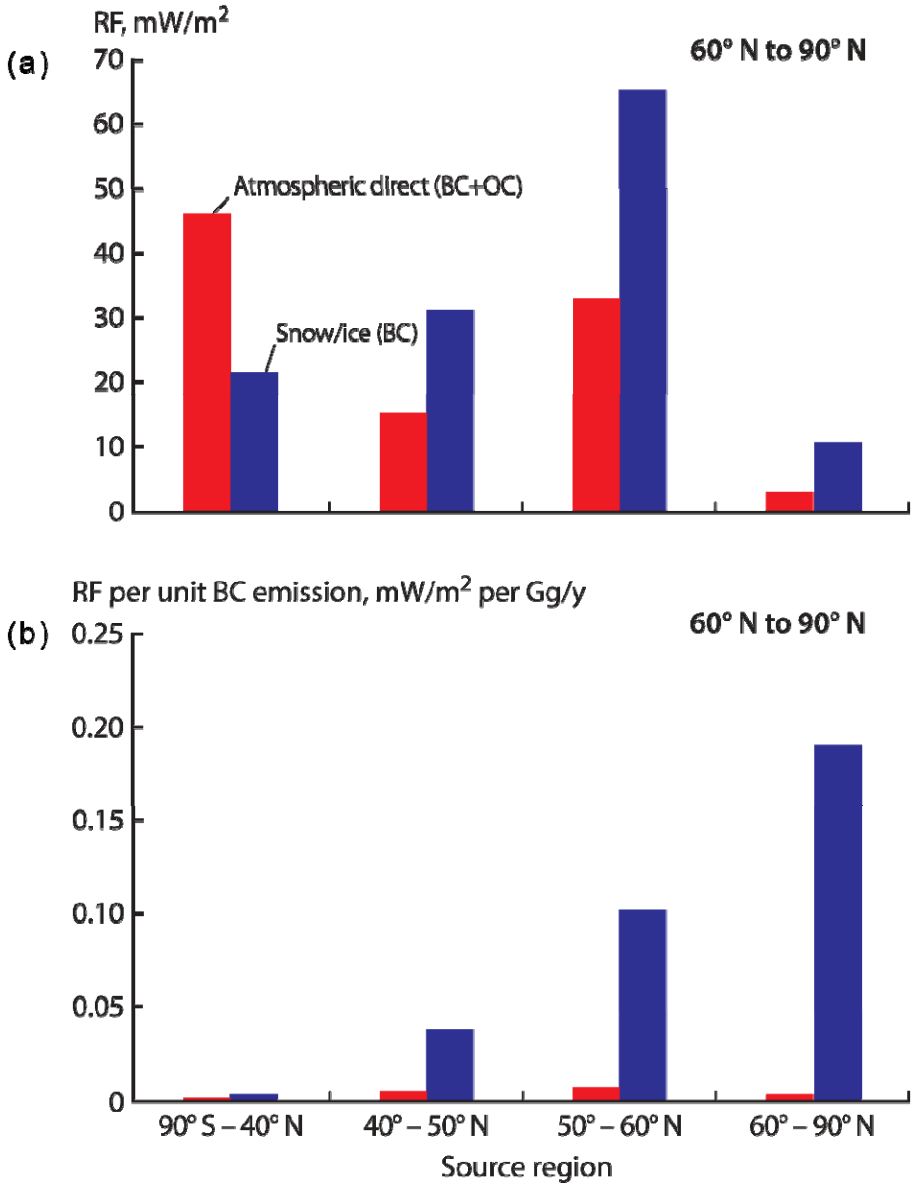
Arctic Council

- Task Force on Short Lived Climate Forcers (2011) 3-0a_TF_SPM_recommendations_2May11_final.pdf
- Arctic Monitoring and Assessment Program (AMAP): The Impact of Black Carbon in the Arctic (2011) (www.amap.no)
- Short-Lived Climate Forcers Project Steering Group (under the Arctic Contaminants Action Program (ACAP), see http://www.epa.gov/international/io/arctic.html)



The Impact of Black Carbon in the Arctic

(AMAP, 2011) (www.amap.no)



Absolute

Normalized

Figure 6-7. Contribution to Radiative Forcing of Carbonaceous Aerosol Emissions within Different Latitude Bands. (a) Absolute and (b) Normalized per unit emission atmospheric direct radiative forcing due to BC+OC and BC-snow/ice radiative forcing as a function of latitude band.

International Efforts (cont.)

International Maritime Organization (IMO)

- Considering whether to control BC emissions from ships (particularly in the Arctic)
- North American emission control area (ECA) for marine emissions (adopted March 2010) is expected to reduce emissions of NOx, PM2.5, and SOx, but– does not cover shipping in the Arctic

Global Alliance for Clean Cookstoves

- Announced by Secretary Clinton September 2010
- Administered by UN Foundation
- Goal: 100 million clean and efficient stoves by 2020

	Key Policy-Relevant Research Need	BC STAR Grants
1.	Continued investigation of basic microphysical and atmospheric processes affecting BC and other aerosol species to support the development of improved estimates of radiative impacts, particularly indirect effects.	Asa-Awuku Kroll Pandis Riemer Schauer
2.	Improving global, regional, and domestic BC emissions inventories with more laboratory and field data on activity levels, operating conditions, and technological configurations, coupled with better estimation techniques for current and future emissions.	Bond Carmichael Edwards Pandis Schauer
3.	Focused investigations of the climate impacts of brown carbon (BrC).	Bond Carlton Kroll Schauer
4.	Research on the impact of aerosols in snow- and ice-covered regions such as the Arctic.	Doherty

	Key Policy-Relevant Research Need	BC STAR Grants
5.	Standardized definitions and improved instrumentation and measurement techniques for light-absorbing PM, coupled with expanded observations.	Doherty Edwards Kroll
6.	Continued investigation of the differential toxicity of PM components and mixtures and the shape and magnitude of the PM health impact function.	N/A
7.	More detailed analysis and comparison of the costs and benefits of mitigating BC from specific types of sources in specific locations.	Bond Carmichael Pandis
8.	Refinement of policy-driven metrics relevant for BC and other short-lived climate forcers.	Bond Carmichael
9.	Analysis of key uncertainties.	Bond Carmichael Riemer

What do we hope to learn?

- The full extent of BC climate impacts (and BrC too!)
- What to mitigate, and where
- How to represent BC and other aerosols more fully in models for both climate and air quality purposes
- How much uncertainty remains, and which uncertainties matter