

# Question 8: Emissions sources

## Pre-synthesis

- The discussion of Chapter 4 can follow the report outline, or it can focus on major themes that the comments align with:
  - Source characterization
  - OC speciation issues, mainly OC:BC ratios
  - Accuracy and uncertainties
  - Geographic characterization
  - Insufficient Future BC discussion
  - Editorial communication clarity

# Source characterization

- Discussion items identified in comments so far:
  - “Domestic sources” ill-defined, needs clarification
    - International sources in U.S., U.S. sources operating outside U.S.
    - Has relevance for Arctic sources, shipping, perhaps others
  - Commercial Marine is ill-defined, needs clarification
    - Number error is small, but important: Operating in U.S., U.S. registered, or U.S. registered and operating domestically?
  - “Contained Combustion” ill-defined, new term(?)
    - Combustion types include: a) open burning (biomass); b) open combustion (inclusive of steam boilers, some gas turbines) c) closed combustion (internal combustion, reciprocating diesel engines).
    - Defined vaguely in Section 8.3 for the first time
  - Characterization is really for diesels using distillate
    - Examples for clarifying diesels on distillates v. diesels using residual fuels
  - Is SPECIATE for HDDV exhaust a single value or a tight whisker plot in comparison with other ranges (Fig. 4-1)?

# OC issues including OC:BC ratios

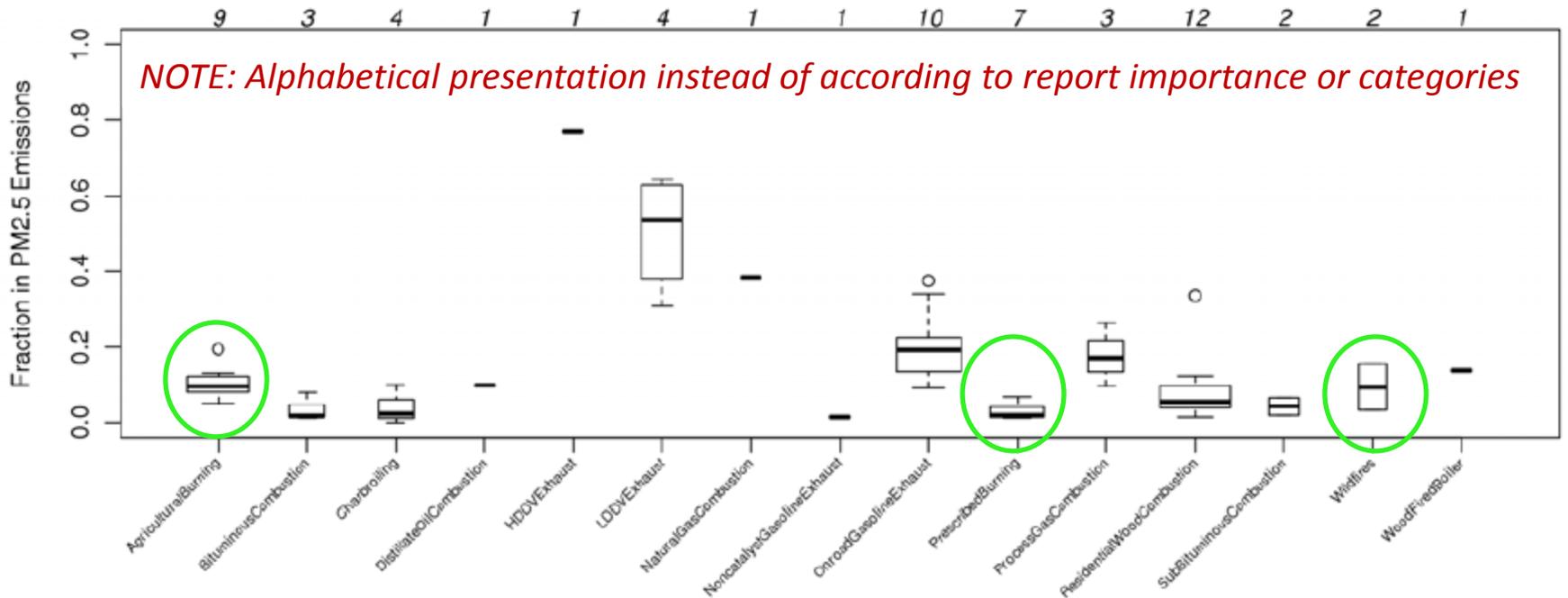
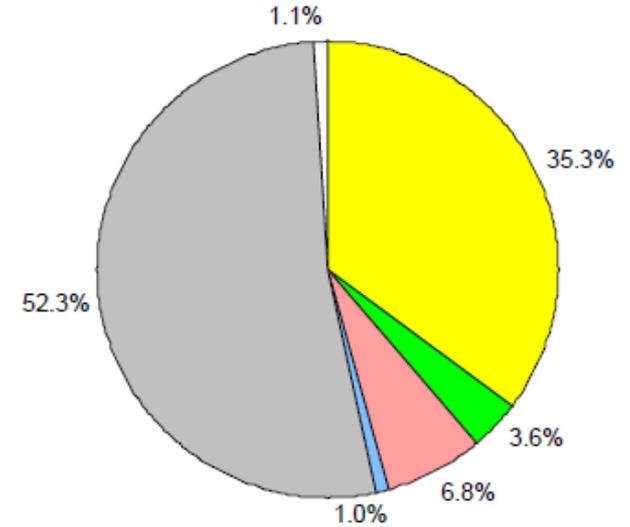
- Clarification: *The ratio and mass of BC and OC varies by source. Diesel combustion emissions produce the largest fraction of BC while emissions from open biomass burning are dominated by OC due to different combustion conditions and various fuel specifications (e.g., onroad diesel, nonroad diesel, and heavy fuels used in diesel systems). **Section 4.1: Lines 9-10***
  - Also Lines 14-17: I don't understand this conditional statement
  - Section 4.3.2.2, Page 4-13, Line 18: valid only for distillate-fueled diesel mobile sources
- Two comments correcting the scientific description of formation of OC (OM) in most climate models.
  - Poirot and Russell at least.

# Accuracy and Uncertainties

- Insufficient presentation of uncertainty, especially in the context of the overall weight of evidence – no judgment from the analysis
  - Should use “estimates of emissions” and more fully recognize the uncertainties
  - *Important to articulate source uncertainty in comparison with other uncertainties discussed: Model uncertainty, BC v. BrC, mixing, metrics, etc.*  
**Do emissions uncertainties dominate or pale by comparison?**
- RPO v. EPA details on biomass burning could say, “Nonetheless, biomass burning BC estimates remain more uncertain than engine combustion BC due to year-year variability and for other reasons addressed in this chapter.”
  - Poirot comments re: alternate terms, and fraction wild v. prescribed v. agricultural
  - Reinforced by Russell comments
- Tables 4-4 and 4-5: uncertainties presented absolutely affect (confound) the ratios presented comparing emissions from other countries with U.S. BC emissions
  - Comment applies to may bar graphs and comparisons as well, and should be carried into these discussions (at least Chapter 4)

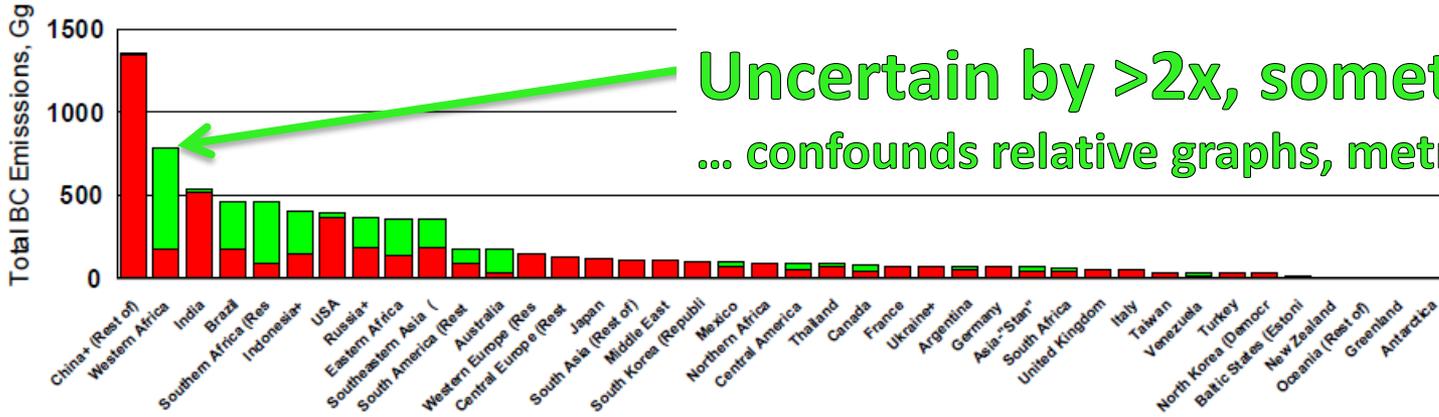
# Example: Figure 4-1

- Presentation here can be propagated through other figures
  - Should be aligned with discussion (e.g., Fig. 4-3)
  - Not simply editorial



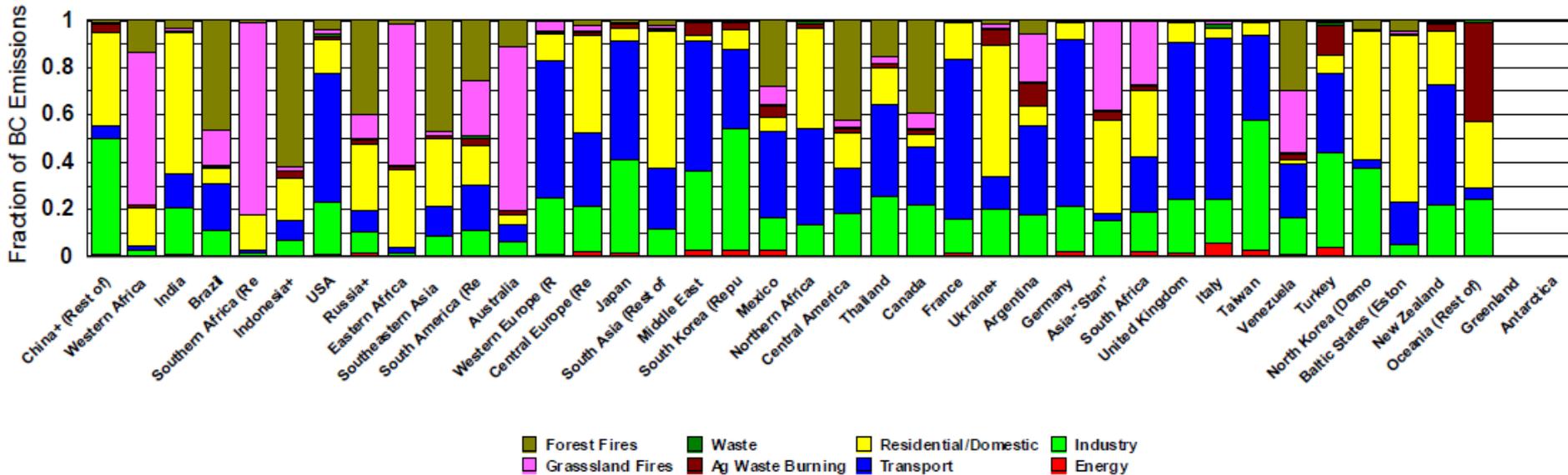
# Why uncertainty should be propagated

Global BC Emissions by Region



Uncertain by >2x, sometimes >>2x  
 ... confounds relative graphs, metrics, conclusions

Global Fractional BC Emissions by Sector and Region



# Other accuracy/uncertainty comments

- TF HTAP summary is okay, but “Given the paucity of anthropogenic sources of BC in the Arctic ...” can be updated already from HTAP
- Inverse modeling methods could be included
- Report can address: Are there large differences in estimates depending upon if you use a bottoms-up versus a top-down approach? ... Bell and Russell comments at least

# Technology assessment, descriptions

- Diesel engines use many fuels, but report implies that diesel fuel is one type
  - Large stationary diesels, commercial marine, other
  - IC diesels and nonroad (non-distillate) fuels present validity issues for catalytic DPF discussions
    - Example: EPA lower fuel sulfur standards for marine engines, specifies 1000 ppm (ECA standard); too much S for catalytic DPFs.
    - *Claim of report that low-sulfur fuels a precondition NOT strictly correct for all diesel sources – comments disagree with report draft*
  - Convention v. Clean diesel v. other not distinguished
  - Existing engine technologies (DPFs) more applicable than EPA articulates (add states examples)
  - Technology focus ignores possible systems effects, e.g., infrastructure development (especially globally)

# Geographical Characterization

- Table 4-5 and Table 4-5: How is the Arctic region, discussed above allocated within these domains?
  - Shipping - stated to be included – may not be allocated in domains, activity occurs outside national boundaries
  - Arctic importance not well presented:
    - Additional citations to Arctic work needed (AMSA, etc.)
    - It's not until Section 4.4.2 when we learn about which areas might be important contributors to Arctic BC problems.
  - Table 4.7 could be expanded to also include relative contributions of BC from all countries and sources north of the 40th parallel. Include in that shipping. (Similarly for the Himalayas (Section 4.5, pg. 4-32)). Bell comment and Poirot comment
  - Affects not well articulated: seasonality, temperature, etc.
  - Global comparisons seem arbitrary: why choose 40<sup>th</sup> parallel? What is purpose of similarity analysis by nation?

# Future BC (and OC)

- Trends are addressed in earlier chapters but absolutely NO presentation of future emissions, per question 8.
- ...