Cross-cutting Issues

- Some source-category have cross-sectoral relevance. In such a case, the following is to be checked that:
  - ✓ associated SLCFs have not left unaccounted in table 2 of relevant sectors
  - ✓ double-counting in table 2 of any associated SLCF has not occurred
  - ✓ sectoral allocation in table 2 of the source-category and associated SLCFs has been agreed by all relevant sectoral BOGs

- Ozone formation in the troposphere depends on direct sunlight concurrence with ozone-precursor emissions (e.g., NMVOC and NOx). Similarly, secondary aerosol formation depends on concurrence with PM-precursor emissions (e.g., NH3, SO2, NOx, NMVOC) and primary aerosol emissions (BC, OC). Timing (i.e., hour to monthly frequency) and place (i.e., within 50-100 km spatial resolution) of emissions do matters then for an inventory.

- Should specific NMVOCs be prioritized given their higher impact on climate?

- How should emission uncertainties be quantified? (OR) Can current IPCC methodology guidelines be applied to proposed methods for all SLCF compounds and source categories?

- On Black Carbon:
  - ✓ Consideration of BC quantification vs EC measurements.
  - ✓ PM10 relevance for BC estimates

Issues identified by the Energy BOG are reported below.

- **Consistency between tiered-approaches**: In certain occasions the tiered approach from alternative methodologies to estimate emissions for SLCFs is not entirely consistent with the IPCC three-tiered approach to estimate GHG emissions. (One example of this is the EMEP methodology for coal mining and handling in which the Tier 2 approach provides information at a more aggregated level than the IPCC Tier 1 approach). When selecting methods from an alternative methodological framework the characterization for the tiers in the report on SLCFs estimation methods should be consistent with those defined by IPCC, independently from the characterization given in the alternative methodological framework.

- **Decision tress**: The basic decision process in the IPCC guidance indicates the use of higher tier methods (Tier 2 or Tier 3) when the detailed data needed are readily available or the category being estimated is key. Otherwise, if the category is non-key a Tier 1 approach may be applied. For GHG, key category analysis (KCA) is performed on the basis of CO2-equivalent emissions using global warming potentials as metrics. Emissions of SLCFs would be estimated in mass units and therefore KCA as that for GHG would not be possible. Decision trees are at the core of the IPCC methodology, therefore a substitute/equivalent for the key category concept needs to be found/identified if the basic decision process for GHG would hold for SLCFs.

- **Black carbon / Effective black carbon / Elemental carbon**: The material known as "black carbon" (BC) is identifiable by its particular properties: strong visible light absorption, refractory, insoluble, and composed of aggregated carbon spherules. Many common measurement methods do not quantify this material specifically, instead reporting a proxy like light absorption or refractory component, with names like "effective black carbon" or "elemental carbon"(EC). This working group recognizes that these analytical differences create uncertainty in emission factors and predicted light absorption. However, the working group also acknowledges the need to constrain highly variable emissions and the small number of input measurements. For practical purposes, emission measurements, where any standard method is used to

quantify black carbon, effective black carbon, or elemental carbon are to be considered equivalent for the development of BC emission factors. During the development of the methodological report on SLCFs, the authors may revisit this consideration in light of the likely availability of more abundant and differentiated information on the carbon fraction of carbonaceous aerosols.

- **Organic carbon / Organic material**: Organic carbon (OC) is the amount of carbon present in carbonaceous aerosols excluding EC (defined above) and mineral carbon (dust carbon occurring as calcite, dolomite or other C-bearing minerals). Thermal-optical analysis is used to quantitatively determine OC and EC.
  Organic aerosols and organic matter can be considered equivalent terms and refers to the mass concentration of organic particulate species present in the aerosols. This mass might be built by hundreds of organic compounds. The difference with OC is that OM and OA consider the mass of heteroatoms, such as O and H, having a relevant contribution. OM could be 20-100% more than OC, depending on the duration of ageing of organic carbon in the atmosphere.
  Two options exist for emission factors and for inventories: Using OC values may increase consistency of reporting but OM mass will have in total to be assessed by modelling activities. OM is atmospherically more relevant but it may be inconsistently reported, depending on sampling conditions at time of the measurement. At this stage and due to the fact that not many data exist for different sectors and classes at least transparency on whether OC or OM values are reported would be necessary.

- **PM2.5**: PM2.5 is considered a SLCP highly heterogeneous spatially and temporally (varying from positive to negative radiative forcing depending on sources and meteorological characteristics). Measurements and modeling of particles concentration have been used to evaluate the radiative effect of absorption or scattering. One example is the effect of light-absorbing particles reducing the cryosphere not only due to Black Carbon but also other absorbing compounds (e.g. brown carbon, dust). The PM2.5 concentration is the proxy for the radiative impact of all kinds of particles. Although the composition is not always known, the effect of PM2.5 is evaluated based on average compositions determined by local/emissions characteristics (many countries have emission factors for PM2.5)
  Given that most BC and OC EFs are expressed as fraction of PM2.5, the participants of this BOG decided to include primary PM2.5 in the list of emissions to be estimated not only because it is as SLCF but as an intermediate variable often needed to estimate BC and OC emissions.

- **Precursors of secondary organic aerosols.** There is an asymmetry in the set of selected SLCFs regarding the role of aerosols precursors. While the precursors of inorganic aerosols have been clearly targeted, the precursors of organic secondary organic aerosols (SOA) have not been considered. A large source of uncertainty stands in the actual SOA formation yields in real-world conditions. However, the precursors are better known: aromatic NMVOC + intermediate volatility OCs (iVOCs). Semi-volatile compounds are also important but they could be already partly accounted for in current primary OC inventories. It is important to note that in a first approximation, precursors of anthropogenic SOA can be represented therefore with a few classes of organic compounds, hence not requiring a molecular-level speciation (which for compounds with molecular carbon numbers of 10 to 25, it would be even impossible). At this stage, this may be flag as a scientific gap and a topic for future research.