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Interactive comment on "Record high peaks in PCB concentrations in the Arctic atmosphere due to long-range transport of biomass burning emissions" *by* S. Eckhardt et al.

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This excellent article raises some important questions, and proposes new mechanisms/processes, concerning the sources and recycling of polychlorinated biphenyls (PCBs) - and potentially other persistent organic pollutants (POPs).

The observation of elevated PCB concentrations in remote Arctic air led Eckhardt et al to trace back trajectories (BTs) to try to determine their origin. The BTs suggest the origin of these elevated levels may be 100s-1000s km away, from 'natural' biomass burning sources. The authors suggestion is not that these anthropogenic substances are naturally formed by combustion, but that there is a re-emission of the cumulative

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atmospherically deposited PCB burden which resides in the soils/vegetation subjected to burning. This mechanism of re-emission and re-cycling has really not been considered previously in discussions of the global cycling of PCBs and other POPs. One might imagine, however, that it can be rather important, as a means of re-emitting compounds deposited to and stored within soils - perhaps years or decades before, in areas of the world which are prone to deliberate burning, or liable to accidental biomass burning. Indeed, emissions of PCBs and other POPs from waste dumps and landfills subject to deliberate or accidental burning could also constitute an important source to atmosphere.

There is ongoing debate and discussion as to the extent to which deposited PCBs can be re-emitted from soils and vegetation. POPs can be rather 'sticky' in soils, and may be retained by them, rather than re-emitted from them. Residues could then accumulate and build up on soils, over many decades, an effect compounded by the generally slow degradation of POPs in soils. However, POPs would clearly be 'less sticky' in soils during the elevated temperaturtes produced during a burning event, and if the soil organic matter burden was depleted by the combustion event.

The authors have derived estimated emission factors (mass PCB emitted per kg biomass burned), needed to account for the elevated levels in air. They freely acknowledge that it is difficult to accurately quantify the amounts of compound which may be emitted during such a burning event. The burning conditions, temperatures, and degree of 'smouldering' will presumably all be important, as will the heat storage capacity of the soils post-burning and - presumably - the degree of charring and black carbon (BC) formation (PCBs and other POPs partition strongly to BC in aerosols and in soils). As such, emission factors (or 'retention factors') maybe conceivably vary widely between events and locations.

It will be important to conduct future studies, where the timing of emission (i.e. its 'pulse') in relation to the biomass burning event is measured. These would be aimed at discriminating between an emission during the burning event itself, and the post-

ACPD
7, S3802–S3804, 2007

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burning event - when soil temperatures remain high. However, this is easier said than done! Where will the sampler(s) be located, and how can the measurements be made close to a natural biomass burning event? Sampling of the soil may provide valuable clues as to the sources and processes involved. In the meantime, in may be instructive to examine other air monitoring datasets, for evidence that biomass burning has exerted an influence, at other places, times and under different conditions.

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