

Interactive comment on “Perfluorocarbons in the global atmosphere: tetrafluoromethane, hexafluoroethane, and octafluoropropane” by J. Mühle et al.

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This paper offers an important improvement in understanding of the current picture of global emissions trends for CF₄, C₂F₆ and C₃F₈. However, the authors discussions on apportioning emissions among emissions sources is entirely conjectural and detracts from the main subject of the paper, global emission trends. I recommend eliminating that discussion or revising to present a more balanced view of the lack of availability of verifiable bottoms up emissions data, both on national and sectoral bases.

Specific comments follow:

p6489 lines 8-12 - This statement erroneously reports that the "detailed apportioning is C1184

difficult due to large uncertainties.....factors from aluminum production." In fact apportioning is impossible, because there is no viable methodology to apportion emissions among all the sources of PFC emissions. The methodology presented later in the paper of linear (I suppose) extrapolation of admittedly unreliable EDGAR data from 2005 to assign emissions to aluminum production is not justifiable.

p6490 line 10 - The EDGARv4 database lacks transparency in it's methodology and clearly contains serious flaws in some of the emissions data for aluminum production for countries that are major producers where we have good PFC measurement data as well as good International Aluminium Institute (IAI) data for anode effect performance and for production levels. If the EDGAR v4 data for semiconductors/electronics is of similar quality to that for PFCs from aluminum the authors have a base problem – and, the authors indicate that they made extrapolations from this poor base to reach some of the conclusions reported in Section 5.3.

I have unsuccessfully made efforts to make contact with the owners of the EDGAR database and engage them in their methodology.

p6507 starting line 4 "A recent IAI... - Statement is not factual correct. I recommend the following language. "PFC measurements made at Chinese smelters in 2008 as part of the Asia Pacific Partnership for Clean Energy and Climate and seven additional measurements reported by the Chinese producer CHALCO found a median emission factor for the measured Chinese PFPB smelters of 0.7 tons CO₂-e per ton aluminum produced compared with median performance of 0.27 tons CO₂-e per ton aluminum from IAI PFPB survey participants."

p6508 lines 6 - 11 - While I also hear of reports of technology upgrades in some electronics/semiconductor operations in some parts of the world, typically Annex 1 countries and those countries where reporting is more transparent, there is no data of which I am aware that shows a global reduction in the semiconductor/electronics industry's emissions. As has already been noted the agreement with EDGAR v4 has very little

significance.

p6508 starting line 11 through 15 - I don't understand the point being made here. Can this be restated to add clarity?

If the point being made is that there is some serendipitous congruence between IAI reported emissions and the total Annex 1 UNFCCC emissions then the statement is irrelevant.

p6510 line 4 - "Probably due" - Having been the source of the analysis I can say definitely the change is "definitely" due to the updates from the 2006 IPCC revisions.

The reason why the results for 2000, 2004 and 2005 remain very similar is that the technology mix has been rapidly changing to be predominated by the most modern point feed prebake technology and the IPCC 2006 methodology was essentially unchanged for the PFPB technology/

p6511 lines 4 - 6 - I recognize the interest in drawing comparisons to prior data; however, this comparison seems a shaky thing to do since the EDGAR v4 data base methodology is uncertain and the data contained within it is suspect. Extrapolations, particularly linear extrapolations are not meaningful. While the authors do not report details I assume it is a linear extrapolation. With the growth in the semiconductor/electronics industries some exponential method would likely be more appropriate. However, I question the EDGAR v4 2005 baseline veracity and extrapolated results would be even less viable.

p6511 lines 9 - 10 - It is a biased argument to point to aluminum CF4 as the reason for the gap mentioned here. To invoke the EDGAR v4 Database which is based on non-transparent methodology and which the authors contend contains circular data arguments to then conclude that "this indicates an inherent underestimation of CF4 emissions by the IAI Anode Effect survey" is totally unwarranted. There is no mention at all here that an equally valid explanation is the surge over the same time period

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in production of semiconductor materials and flat screen displays which result in large quantities of PFC emissions. There is, unfortunately, no similar industry report of global emissions of PFCs produced by the semiconductor/electronics industry to the report that the IAI produces.

p6512 lines 6-7 - The parenthetical expression is only notationally correct in that the C2F6 emissions are over 10% of the CF4 emissions, an order of magnitude higher than the C3F8 ratio to CF4 estimated from Harnisch's work.

p6512 line 26 - I am not aware of any specific literature reports of measurements of C3F8 from aluminum production (the authors refer to an estimate from Harnish) that would support the proposal that it amounts to 0.48% (by mass) of the CF4 emissions. If C3F8 were emitted from aluminum production in amounts equivalent to 0.48% of the CF4 emission rate and given the 0.7 t CO₂-eq/t Al in the 2009 IAI report of 2008 results and a weight ratio of 0.1 for ratio of C2F6/CF4 then the reported 0.0048 ratio of C3F8 to CF4 would result in an increase of about 0.5% in CO₂-eq rather than 8%.

p6514 line 20 - I agree with the authors assertion here that it is impossible with our current knowledge to determine which is true; however, this statement is at clear odds with the statement in line 10 p 6511 where it is asserted "indicates an inherent underestimation of CF4 emissions by the IAI Anode Effect surveys as found in Sect. 5.2." There should be mention here of the absence of an international report of electronics/semiconductor/plasma screen PFC emissions. This statement should be added to the rationale emphasizing the need for more accurate emissions inventory.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 6485, 2010.

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