Response to Anonymous Reviewer #2's referee comment on: Oh, Jenny, The atmospheric fate of 1,2-Dibromo-4- (1,2-dibromoethyl)cyclohexane (TBECH…) (egusphere-2023-1151)

Keywords: I did not actually see the keywords, but consider including the other name to TBECH there: DBE-DBCH

As the journal ACP appears to not require keywords, the manuscript will be modified to include DBE-DBCH in the abstract. Changes are made in bold: "Here, we report the concentration of the α- and β-isomers of 1,2-dibromo-4-(1,2-dibromoethyl) cyclohexane (TBECH**; also known as DBE-DBCH**) in over 300 air, water, and precipitation samples collected between 2019 and 2022 using active air and deposition sampling as well as networks of passive air and water samplers."

Line 50 - it could be mentioned that toxicity & effects can still occur with non-persistent contaminants - if they are continuously released.

Thank you very much for the feedback. While we share the opinion by the reviewer, we feel that it is not necessary to add a sentence on this matter.

Line 71-74 - There are a few other toxic effects - you could simply point readers to a recent review which covers many of them (Marteinson et al 2021: A review of 1,2-dibromo-4-(1,2-dibromoethyl)cyclohexane in the environment and assessment of its persistence, bioaccumulation and toxicity, Environmental Research, 195.)

Thank you for providing us with a reference to this comprehensive review on TBECH. We will modify the introduction to include the reference when describing the health effects of TBECH: "This disrupting potential of TBECH is also seen in the *in vivo* studies reporting changes in circulating hormones (Curran et al., 2017; Gemmill et al., 2011), organ structure (Park et al., 2011), and reproduction (Marteinson et al., 2012a; Marteinson et al., 2012b) after exposure to low concentrations of TBECH. **More details on the reported toxicological effects of TBECH from both *in vivo* and *in vitro* studies are discussed in Marteinson et al. (2021).**"

102 - 2019 - 22 - should any potential impacts of change human behaviour during the pandemic be mentioned? I am not sure what these might be given TBECH is likely emitted from finished imported products. However, it does come to the reader's mind that this might not be a representative period of time. There is no need to speculate, but it could simply be acknowledged a an unknown; perhaps there is some trend data on other similar air pollutants to indicate any changes (or not) during the pandemic that could be mentioned?

While the COVID-19 pandemic greatly disrupted anthropogenic activity worldwide, we do not believe that this would cause TBECH emissions to change greatly. Emission of TBECH to the atmosphere is not dependent on human behaviour. Therefore, products containing TBECH (e.g., electronics, plastics) already existing in Canada would simply continue to leak TBECH during the pandemic. Other atmospheric contaminants that showed elevated/decreased levels during the lockdown, such as O_3, NO_2, and NO are tied to pollution sources that saw drastic decrease in activity during the lockdowns, such as using vehicles and running factories (https://doi.org/10.1016/j.scitotenv.2020.140516).

Line 181-183 - I think it would be beneficial to summarize in a few lines what these tables show - otherwise the results for all of these other BFRs measured are only found in the supplemental information and that is unfortunate.

Thank you for the feedback. We have modified the manuscript to include a short description about the other BFRs we analyzed: "To a lesser extent, several other EBFRs and PBDE congeners were also detected in the samples of this study, with their detection frequencies or concentrations summarized in Tables S4 to S8. **Several legacy BFRs (BDE-190 and 85) and EBFRs (HBBz and PBBz) were occasionally detected in the PAS network samples, with detection frequencies ranging between 7 to 26%. These compounds, however, were not detected in the active air samples. Moreover, other BFRs that were detected frequently in water samples (BDE-17, 28, 99, and 100) were rarely detected in the other sample types.** Because of their much higher detection frequencies **in all samples**, the remainder of the manuscript is focused on TBECH and BDE-47."

Paragraph beginning line 185 - Note that concentrations of TBECH have already been reviewed (Marteinson et al 2020) which includes most of these same references - this should be acknowledged.

Thank you for pointing this out to us. Section 3.1.1 of the manuscript will be changed to include the given reference: "To place these concentrations into context, Table S13 summarises all atmospheric concentrations of TBECH previously reported in the literature. **A review of the occurrences of TBECH in other environmental media (e.g., soil, water, sediment) can be found in Marteinson et al. (2020)."**

Line 204-5 "in this study, BDE-47 was also detected in the air in all sampling regions, with comparable levels to TBECH." This is a very significant and important finding, adding important evidence to that mounting which suggests TBECH is an contaminant of concern to consider further in risk assessment.

We appreciate that the reviewer agrees with our conclusion that TBECH warrants further consideration for risk assessment.

The figures are excellent.

We are grateful for the positive feedback.

Line 318 - can you verify this error before publication?

Before the submission of the manuscript, we had notified the organizers of the Federal Whale Initiative about this possible error. We have not received a confirmation, but will delete the phrase in brackets if this should be resolved prior to publication: "The median water grab sampling concentrations of TBECH (sum of all isomers) and BDE-47 reported by the FWI were 22.9 pg/L ~~**(presumably incorrectly labelled as ng/L in the database)**~~ and 32 pg/L, respectively, which are one to two orders of magnitude higher than the PWS measurements."

Paragraph beginning on line 354 - This is also a very interesting/novel finding and useful for understanding of TBECH enantiomers in the environment.

We also agree that the results of the enantiomeric fraction analysis of TBECH in the environment is novel. We appreciate the favourable comment to our results.

Section 4.1.2 - It was striking to me that air concentrations of TBECH changed with the season, but precipitation concentrations did not - some discussion of this here and how it relates to the scavenging rations you have calculated would be beneficial/interesting.

Thank you very much for the suggestion. We will modify section 4.1.2 to include a paragraph on these observations and its relation to scavenging ratios:"**The month-to-month variability of the precipitation concentrations were also too large to reveal a clear seasonal pattern. This suggest that variability of TBECH levels in precipitation is controlled by factors that differ from those that control seasonal variability in air concentrations (e.g., temperature and air mass origin). Potential candidates for those factors are related to the nature of the precipitation events (e.g., frontal vs. convective storms, snow vs. rain, and precipitation rate). However, another phenomenon could also occur: Higher temperatures in summer favour higher air concentrations but lower the precipitation scavenging efficiencies of vapours, due to the temperature dependence of K_{WA}. This might explain why concentrations in precipitation do not peak in summer even if concentrations in air do.**"

4.2 - this is the only heading phrased as a question which seems out of place - you may want to change it.

We titled section 4.2 as one of the main questions we were aiming to answer with our results. There are rarely any studies on the environmental fate of TBECH, and even less on its isomers. With so little prior information available, we believe that leaving the title as a question highlights the novelty of its answer.