Comment on acp-2021-375
Anonymous Referee #2

Referee comment on "Opinion: The Germicidal Effect of Ambient Air (Open Air Factor) Revisited" by R. Anthony Cox et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-375-RC2, 2021

General Comments

This manuscript describes a fascinating and impressive study that revisits questions about the germicidal properties of rural air, which has been called the Open-Air Factor (OAF). This term was proposed roughly 50 years ago based on a few studies showing that microbes could be efficiently killed by exposure to rural air, but then subsequently received little attention. It is highly relevant today for obvious reasons. Here, the authors consider possible chemical components that could be responsible for the effect, using a combination of modeling and literature data to interpret the results of the experiments of Dark and Nash (1970), which clearly demonstrated this phenomenon by exposing microbes to ozone and the products of reactions of ozone with various alkenes. The re-analysis is exceptionally thorough, and employs state-of-the-art mechanisms and the latest data on the ozonolysis reactions, as well as careful consideration of factors such as VOC vapor pressure and lipid solubility, which influence the interactions between reaction products and microbes. The authors are able to rule out a number of possible chemical components, and then focus primarily on peroxides, which are known to be formed in alkene ozonolysis and to act as disinfectants. Though the results do not provide a definitive answer as to the chemical identity of the OAF, they provide an excellent starting point for others to explore this important and mysterious phenomenon. I think the manuscript should certainly be published in ACP, after the following few comments are addressed.

Specific Comments

- I did not see any mention of how much NO might have been present in the experiments of Druett and May (1968) and Dark and Nash (1970), and how this might have impacted the concentrations of peroxides formed through either bimolecular reactions or autoxidation. I can imagine that even in a rural area at this time NO might have been sufficient to quench the peroxide-forming reactions, though the authors probably have information on this.
- The uptake of VOCs to the brass tube walls in the Dark and Nash (1970) experiments is likely to have been more complicated than the treatment used in the modeling. I suggest the authors read the paper by Deming et al., AMT, 2019, which shows that...
VOC adsorption to metal tubing walls is highly dependent on the composition and concentrations of VOCs in the mixture and the RH. Depending on the experimental conditions, this could possibly have resulted in complete removal of oxygenated VOCs of the type discussed here for periods on the order of an hour or more before surfaces became passivated.

Technical Comments

- None