

Response to letter of Drs. Andrews and Tans

Dear Editors:

With respect to the elements of our paper (Skrable et al. 2022), our responses to this lengthy letter to the Health Physics Journal, which mostly contains extraneous comments and critiques that are wrong, are as follows:

1. Assumptions: No specific critique of our assumptions is given in the letter. Other related criticisms include the value of $S(0)$, the specific activity in 1750, and the assumption that bomb-produced ^{14}C being released from reservoirs was not significant. Our use of the likely elevated $S(0)$ value is explained and justified in the paper. Regarding the use of bomb-produced ^{14}C recycling from reservoirs to the atmosphere, we did express our belief that this influence would be small because most of it remains in the oceans, and the entire bomb ^{14}C represents a small fraction of all ^{14}C present in the world.
2. Methodology: No specific critique of our methodology is given in the letter. The major thrust of our paper was to describe a simple methodology for determining the anthropogenic portion of CO_2 in the atmosphere, based on the dilution of naturally occurring $^{14}\text{CO}_2$ by the anthropogenic fossil-derived CO_2 , the well-known Suess effect as acknowledged by Andrews and Tans.
3. Equations: Our D^{14}C equation expressed in per mil was obtained from the $\Delta^{14}\text{C}$ equation reported by Miller et al. referenced in our paper. Our D^{14}C equation is the same as NOAA's $\Delta^{14}\text{C}$ equation, and it does not agree with that in the letter. Our equation was not used to calculate D^{14}C values. Rather, we extracted annual mean D^{14}C values directly from a file provided by NOAA and used them to calculate annual mean values of the specific activity. The annual mean D^{14}C values in our

paper are consistent with those displayed in a figure by NOAA (<https://gml.noaa.gov/ccgg/isotopes/c14tellsus.html>).

4. Results: As a consequence of our disagreement in (3) above, many of the comments, criticisms, and suggestions of why we did certain things are wrong in paragraph 3 and others.
5. Technical Merits: The letter does not have any specific comments or criticisms of the simple equations used to estimate all components of CO_2 by either of two independent pathways, which rely on the estimation of the annual changes since 1750 in either the ^{14}C activity per unit volume or the ^{14}C activity per gram of carbon in the atmosphere.
6. Practical Significance: Andrews and Tans do not agree with our conclusion (10) on page 303 of our paper, which includes the practical significance of our paper that is not recognized by Andrews and Tans.

We stand by our methodology, results, and conclusions.

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REFERENCE

- Skrable K, Chabot G, French C. World atmospheric CO_2 , its ^{14}C specific activity, non-fossil component, anthropogenic fossil component, and emissions (1750-2018). *Health Phys* 122(2): 291–305; 2022.

