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My name is Joshua Cohen and I am a Research Associate Professor of Medicine and Deputy Director of the Center for the Evaluation of Value and Risk in Health at Tufts Medical Center in Boston. I served on the 2006 NAS dioxin committee, although I am providing this statement on my own behalf.

In my oral statement made during the EPA-SAB public conference call on June 24, I argued that EPA had not adequately addressed NAS recommendations regarding uncertainty. EPA's novel interpretation of "volitional uncertainty" as a justification for considering only a single possibility in many cases for dose-response assumptions and for the selection of data sets is inconsistent with risk analysis best practices. As I mentioned in my June 24 comments, NAS recommended in 2002 that EPA probabilistically characterize key sources of uncertainty in its air pollution regulation benefits assessment, including the functional form of the pollution concentration-response relationship.[1] The BEIR-VII assessment of low level ionizing radiation conducted by NAS assigned probabilities to alternative dose-response relationships.[2] Many additional references also recommend or demonstrate a more comprehensive and more quantitative approach to uncertainty than EPA has taken in its 2010 dioxin analysis.[3-6]

I hope that SAB will encourage EPA to quantitatively explore the implications of the uncertainty it has collapsed by limiting attention to a single "best" choice in many cases. Identifying the assumptions requiring further attention will require input from toxicologists and epidemiologists. It seems to me, however, that EPA should at the very least explore:

1. Risk estimates calculated using alternative epidemiologic data sets.

2. Risk estimates calculated using alternative animal data sets. If it turns out that the range of risks consistent with alternative animal data sets is extremely broad, then a finding that risks inferred from human data fall within that range does not add much credibility to the final risk estimate(s).

3. The impact of stochastic uncertainty on EPA's risk estimate. As I noted in my July 24 comments, EPA reported risk estimates for only the central tendency and upper bound slope factor derived from one model in the Cheng et al. study, a key result from this assessment.[7] Table III in Cheng et al. reported a central estimate of 3.3×10^{-6} and a standard error of 1.4×10^{-6} for the TCDD coefficient. The 95th percentile of this distribution is approximately 5.6×10^{-6} (the value emphasized by EPA), but the 5th percentile value is approximately 1×10^{-6}, less than one-fifth the upper end value EPA emphasized. That is, even sampling, a relatively limited source of uncertainty, comes close to swinging the result by an order of magnitude.

In short, even *if* it turns out that EPA has selected the best assumptions in each of the cases where they made a choice, the resulting combination of "best" choices can remain far from probable. NAS demonstrated in its 2006 critique[8] of EPA's 2003 dioxin report that considering plausible alternative assumptions yielded a range of risk estimates

that spanned several orders of magnitude. That result can convey a very different message regarding the conclusiveness of the science.

If the stakes involved in managing dioxin risks were limited, understanding the uncertainty associated with these risks would be less important. Dioxin, however, may be present throughout the population and throughout our environment at levels EPA's most recent analysis suggests could be of concern. Mitigation of these risks could involve substantial resources and even risk tradeoffs. When the stakes are high, a more comprehensive treatment of uncertainty is warranted.[9] Risk managers and the public must understand how conclusive the science is when considering the risks, benefits, and costs of alternative courses of action.

References

1. National Research Council. Estimating the Public Health Benefits of Proposed Air Pollution Regulations. 2002. Washington, DC, National Academies Press. Ref Type: Report

2. National Research Council. Health Risks from Exposure to Low Levels of Ionizing Radiation. BEIR VII Phase 2. 2006. Washington, DC, National Academies Press.

3. Morgan MG, Henrion M. Uncertainty: A Guide for Dealing With Uncertainty in Quantitative Risk and Policy Analysis. Cambridge, UK: Cambridge University Press; 1990.

4. Evans JS, Graham JD, Gray GM, Sielken RL, Jr. A distributional approach to characterizing low-dose cancer risk. Risk Anal 1994; 14(1):25-34.

5. Hoffman FO, Kaplan S. Beyond the domain of direct observation: How to specify a probability distribution that represents the state-of-the-knowledge about uncertain inputs. 1 1999; 19:131-134.

6. Pate-Cornell E. Risk and uncertainty analysis in government safety decisions. Risk Anal 2002; 22(3):633-646.

7. Cheng H, Aylward L, Beall C, Starr TB, Brunet RC, Carrier G et al. TCDD exposure-response analysis and risk assessment. Risk Anal 2006; 26(4):1059-1071.

8. National Research Council. Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment. 2006. Washington, DC, National Academies Press.

9. National Research Council. Science and Decisions: Advancing Risk Assessment. 2009. Washington, DC, National Academies Press.