

In summary, (1) the numbers resulting from these calculations are quite small, and (2) the limitations of the accuracy and reliability of the input to the calculations produces numbers that cannot be defended, whether large or small. (Childs, 1994).

As noted in the discussion above, this is not simply a matter of uncertain and small risk estimates. On balance, several of the problems noted above served to inflate the overall estimates, and, depending upon local conditions and the implementation strategy assumed, could even call the direction of the results into question for some locations. Further, a significant bias, not highlighted in the cited reviews, is how well the assumed 10 ppb change in daytime O₃ levels averaged over an entire summer season (and over half the U.S.) reflects what might occur in response to the revised O₃ NAAQS.⁵⁷ In fact, this assumed change, as well as the assumptions regarding its spatial and vertical extent, are significantly larger than could reasonably be expected based on the revisions to the O₃ standard promulgated in 1997.

To provide a fair comparison, it is necessary to convert the 1-hour standard into its nearest 8-hour equivalent. As documented in the Staff Paper (U.S. EPA, 1996b), the nearest equivalent 8-hour standard would have a level of about 0.09 ppm. Superficially, this might appear to support a 10 ppb difference compared to the 0.08 ppm 8-hour standard set in 1997. The appropriateness of this comparison fades, however, when one considers that these standards are stated in reference to extreme high values in the distribution (e.g., the average of the 4th-highest daily maximum concentrations). Cupitt's analysis assumed that a "mixing layer" up to 2 km deep over a very large geographical region would experience a change of 10 ppb in daylight average O₃ for an entire O₃ season. This scenario would require a challenging regional strategy that would, on average, reduce each day for the over 150 day O₃ season by 10 ppb. Yet, the 0.08 ppm 8-hour O₃ standard would require that only the fourth-highest day of the O₃ season be reduced by about 10 ppb, as compared to the previous standard. Based on available O₃ trends information, strategies that reduce peak O₃ days would have far less effect on the far more numerous days toward the middle and lower-parts of the O₃ season distribution (e.g., U.S. EPA, 1996a, Figures 4-2, 4-3). In fact, as reported in the Response to Comments document,

based on earlier RIA projections of long-term O₃ reductions that might occur as a result of efforts to meet the 0.08 ppm 8-hour O₃ standard, the magnitude of the assumed average change appears to be overstated by more than a factor of 3 (U.S. EPA, 1997). When considered with the excessively high assumed mixing layer, the overly large geographical area requiring reductions (over 30 States), and the assumption that the entire population would be at the same risk as the more sensitive subpopulations, it is EPA's judgment, based on the record, that these readily identified biases could well be on the order of a factor of 10.

More subtle are the uncertainties and potential bias inherent in an essentially static comparison of two different O₃ values that are assumed to be uniform over a very large area. Dynamic, real-world implementation strategies would involve a number of alternative local and regional scale approaches that vary significantly in time and space, with a variety of possible outcomes with respect to the middle and lower portions of the O₃ distribution that are most relevant to estimating long-term summer averages over a period of decades into the future. An example of such local strategy-dependent outcomes would be control of NO_x emissions across a metropolitan area, which could reduce O₃ concentrations at downwind peak monitors, but also result in localized increases in lower concentrations in the center city area (National Academy of Sciences, 1991, Figure 11-2). As noted in section II.B.2 above and in Altshuller (1994), the interrelated indirect results from reduced O₃ and UV-B radiation could trigger feedbacks through increased O₃, aerosol, or cloud cover that could partially or fully offset the initial O₃ effects on UV-B radiation. Available data and assessment tools do not permit a reasonable quantitative assessment of these second- and third-order indirect effects (Altshuller, 1994; Childs, 1994).

Other potential problems associated with ignoring area-specific considerations in an O₃/UV-B risk analysis summarized in the previous section include: (1) The assessment of local physical factors (e.g., buildings) that reduce UV-B radiation exposure in outdoor microenvironments, (2) meteorological conditions (e.g., sea breeze) or local emissions patterns that reduce pollution in high UV-B radiation exposure microenvironments, (3) behavioral adjustments to information concerning UV-B radiation risk over time, and (4) local differences in the proportion of sensitive populations. Even Cupitt's assumption that 90

percent of exposure occurs during the summer O₃ season embeds an additional assumption about long-term personal behavior for which little empirical evidence exists.

In the proposed response, EPA solicited comment on the above discussion of the key assumptions used in the Cupitt analysis (66 FR 57285). None of the commenters disagreed with any specific aspect of EPA's evaluation of these assumptions as outlined in the proposed response, nor did any commenter disagree with EPA's judgement that the assumptions described above could introduce biases on the order of a factor of 10 to Cupitt's estimates of changes in UV-B radiation-related effects resulting from changes in ground-level O₃ projected to occur upon attainment of a more stringent O₃ NAAQS.

In summary, EPA continues to believe that the Cupitt (1994) white paper was useful for its intended purpose as a scoping analysis to identify the potential issues arising in any attempt to assess the potential shielding provided by changes in ground-level O₃. It established that any effects of even fairly large, long-term O₃ reductions in ground-level O₃ would be quite small, but as evidenced in the comments of the peer review and the discussion above, available data and modeling tools fall far short of permitting reliable quantitative risk estimates for consideration in standard setting or benefits assessments.

The analysis of this issue by U.S. Department of Energy (DOE) staff (1995) is summarized in a statement submitted as a part of public comments at a CASAC meeting. The exposition is far less complete than that of Cupitt, and it is quite difficult to reconcile the range of estimates for possible increased occurrences of NMSC, the lower bound of which are less than Cupitt, while the upper bound estimates are more than double his. The analysis apparently starts with the same assumptions regarding a constant change in summertime O₃ of 10 ppb through a 2 km mixing layer, but important information about the other assumptions is lacking. In any event, the paper does not appear to improve upon the methodology in the Cupitt analysis.⁵⁸ Given that the DOE

⁵⁷ Cupitt provides no rationale for the selection for this value where it first appears in a Table, which is characterized as addressing "questions from OMB."

⁵⁸ In addition to estimates for NMSC, the DOE statements also provided estimates for melanoma skin cancers and cataracts. As discussed above, the quantitative relationship between cumulative UV-B exposure and the latter effects are not as well established as for NMSC. Given the lack of documentation and the additional uncertainties over those for NMSC, neither the DOE estimates of