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Assessment of Ozone Depletion and its Impact Revised Text for Effects

Submitted by the Chemical Manufacturers Association

Comments from the FPP on "Effects"

Biological Effects

The most notable fact with regard to increased UV-B radiation at the earth's surface is that, for most biological systems, firm conclusions cannot be drawn from the current scientific data base. The conclusions in this entire section tend to be stated more strongly than the data would justify. We suggest revision of the language to reflect the true degree of certainty. In 1979, the National Academy of Sciences report[1] on biological effects of UV-B radiation stated:

> "One cannot convincingly demonstrate that a 16 percent ozone reduction would cause significant decrease in yields from agricultural crops or from nonagricultural land or aquatic ecosystems. Neither is it clear that a 16 percent ozone reduction would not entail important losses in these yields." (NAS, 1979, p.69).

Computer model calculations at that time indicated about 16 percent steady state ozone depletion from CFCs, hence the reference to that value. Today, the models produce a much lower calculated value (5-7 percent in published work and 2-6 percent in more recent, but not yet published studies) of CFC-induced ozone depletion, from which one infers smaller increases in UV-B radiation. However, as stated in the CCOL report, these calculated values of ozone depletion are also uncertain and do not include other effects of man's activities, e.g., changes in emissions of CO_2, N_2O, CH_4, etc. The net change in total ozone from all these perturbations is thought to have almost no effect on the amount of UV-B radiation reaching the earth's surface for the next several decades, at least.

Page 12 Effects on Terrestrial Plants

The statements contained in the second and third paragraphs of this section conflict with those in the National Academy of Sciences report of 1979:

> "However, the environmental conditions under which many of the experiments have been performed may in some cases have altered the sensitivity of plants and animals to UV-B radiation. For example, the UV sensitivity of plants appears to be as much as fourfold greater in the artificial illumination of plant environment growth chambers, or in greenhouses, than in the open-field environment, possibly because of the different level of photosynthetic illumination. Unfortunately, this means that the experiments

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[1] Protection Against Depletion of Stratospheric Ozone by Chlorofluorocarbons. National Academy of Sciences, 1979, Washington, D.C. See also Causes and Effects of Stratospheric Ozone Reduction: An Update. National Academy of Sciences, 1982, Washington, D.C.

> providing the most completely controlled conditions (which should therefore allow more refined testing) are not by themselves able to evaluate the consequences of increased solar UV on plants. Also, in most experiments, plants and animals have been subjected to environmental conditions free from other stresses besides the UV radiation. Thus, the interaction of such other stresses with the UV-B has not yet been evaluated."

The NAS report of 1982 adds further support to this statement.

We understand that the action spectra for most plants and biological processes have not been measured. If so, the fourth paragraph of this section is misleading.

Page 12 Effects on Aquatic Organisms

This entire section conflicts with the following statement from the recent NAS report (NAS, 1982, p. 11; see also p. 63 and supporting material):

> "The effects of UV dose on elements of aquatic food chains cannot be determined unless (a) the underwater spectral irradiances are integrated over the varying positions of organisms in water columns to obtain the exposures that simulate spectral intensities in the natural systems, and (b) damage to individuals can be related to population dynamics in the natural ecosystem. This would require an integrated research approach involving physical hydrography, physical optics, and organism physiology. It would take about five years to develop this approach and obtain results. Unless UV-B studies are made as a part of an ecosystem study, effects on populations and interactions among populations cannot be predicted."

Page 13 Effects on Human Health

In view of the high degree of uncertainty associated with the relationship between malignant melanoma and UV-B, we would revise the final sentence in the fifth paragraph of this section to read as follows: "This is a possibility but it cannot be substantiated on the basis of presently available data, which suggest UV-B is not a direct causative factor for melanoma."

In the last paragraph of this section, and generally throughout the discussion of biological effects, the levels of UV-B used in the experiments should be stated. Very high levels of UV-B may give results which are difficult to extrapolate to natural real-world situations. Any discussion or analysis should take this possibility into account.

Page 13 Effects of climate

The first sentence should read, "might have climatological consequences." The phrase "is expected to" is too strong and is not supported by existing knowledge.

Recommendations (pertaining to "effects" viz 20 to 28):

These recommendations are scientifically sound and desirable. It would assist the reader if the recommendations were listed in a distinct subsection and the order of priority were indicated.

January 14, 1983