UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

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OFFICE OF
THE ADMINISTRATOR

SUBJECT: CASAC Review of the Air Quality Criteria Document for Nitrogen Oxides

FROM: Sheldon K. Friedlander, Chairman
Clean Air Scientific Advisory Committee

TO: The Administrator

Introduction

On November 13, 1980, the Clean Air Scientific Advisory Committee of the Science Advisory Board completed its review of the revised air quality criteria document for the oxides of nitrogen. This was the second review of the criteria document by the Committee. The first review, held January 29-30, 1979, resulted in major CASAC recommendations for revisions in the criteria document. In its most recent meeting the Committee concluded that its recommendations had received a fair and thorough evaluation by the Agency, evidenced in the changes incorporated into the criteria document. The purpose of this memorandum is to summarize for you the Committee's major conclusions to assist you in reviewing the scientific data necessary for proposing an ambient air quality standard for nitrogen dioxide as required by law. This memorandum further advises you of the Committee's conclusion that the criteria document fulfills the criteria set forth in section 108 of the Clean Air Act as amended, which requires that such a document accurately reflect the latest scientific knowledge useful in indicating the kind and extent of all identifiable effects on public health or welfare from pollutants in the ambient air.

A separate memorandum which will address the review of the Staff Paper for nitrogen oxides will be sent to you following completion of the Committee's review of that document.

Major Issues Pertaining to the NOx Criteria Document

Air Quality

Nitrogen Cycle--There is much duplication of information concerning the nitrogen cycle throughout the document which could be presented more succinctly in Chapter 4. Nevertheless, Chapter 4 itself is well written.

Sources and Emissions--As requested by CASAC, the revised document contains more information on NO/NO_2 ratios and this is adequately presented.

Environmental Transport & Transformation--The criteria document adequately addresses current knowledge in this area. Very importantly, it discusses the need for additional information on NOx--organics chemistry and the dearth of quantitative knowledge of wet and dry removal processes and rates for NOx.

Sampling and Analysis for Ambient NO_2 and NOx--Derived Pollutants--This section of the criteria document describes the methods, procedures, and problems in the determination of the ambient levels of NOx in a useful and complete fashion. Of particular importance is the identification of uncertainties in the earlier measurements of NO_2 (Jacobs-Hochheiser method), and for nitrate (artifact formation). Characterization of such uncertainties should ensure against the use of suspect data in setting the standard.

Welfare Effects

Perturbations of the Stratospheric Ozone Layer--The relevant studies are included in this section of the document. It brings out the important point that NO and NO_2 released from surface sources are not expected to significantly effect stratospheric ozone.

Effects of Nitrogen Oxides on Visibility--The chapter presents a good review of the scientific issues related to visibility. The role of NO_2 in atmospheric discoloration is well described. The chapter also adequately points out the multi-pollutant aspects of the regional haze problem.

Acidic Precipitation--Chapter 11 is to be retitled "Acidic Deposition" to better define its contents and to ensure that the role of dry deposition is recognized. The information presented in the criteria document is a useful tutorial for understanding acidic deposition. As requested by CASAC the very importance of multi-pollutant aspects of this environmental problem are being addressed by a separate document that is now in preparation; thus, for the purpose of this criteria document this chapter is adequate in ensuring that the role that nitrogen compounds play in acidic deposition reactions is recognized.

Effects on Natural Ecosystems, Vegetation, and Micro-organisms--The criteria document provides a good review of background information concerning potential effects on ecosystems as well as the relations of the nitrogen cycle. Regarding potentially harmful effects of NOx, the document correctly emphasizes NO_2 since this is the most harmful oxide for the effects of concern. Both visible effects and effects not readily perceptible are discussed thoroughly.

Threshold doses are given for the inhibition of photosynthesis under laboratory conditions. However, it would be desirable if sensitivity under these predisposing conditions could be compared with sensitivity under field conditions. The plant varieties used for these studies are relatively sensitive, but how does this compare with more important and widely planted species? Taylor, et. al. reported mostly no effects occurred on several field crops exposed to 10 ppm for 90 minutes.

From the document, we can conclude that sensitive plant species may be injured by one-half hour to eight-hour exposure to concentrations of 10 to 2 ppm, respectively. If exposed for several days, concentrations as low as 0.15 ppm may have some effect, but a safe limit seems to be in the neighborhood of 0.5 to 1 ppm NO_2. It would be helpful if these values were compared with ambient baseline concentrations as reviewed in Chapter 8.

Toxicity of NO_2 seems to be enhanced when SO_2 also is present. However, much of the laboratory research is inconsistent and cannot provide a sound basis for criteria. The relations are especially indefinite in the field. This issue is discussed well in the document.

Finally, the Committee would prefer to see the bibliography of this and other chapters arranged alphabetically.

Health Effects

Effects of Nitrogen Compounds on Animals-There are some problems with the overall format. There is both detailed description of individual papers and an unreferenced interpretive discussion of the patterns of cellular and tissue response to oxides of nitrogen. What appears to be missing is interpretation of individual papers and groups of papers. There is little attempt to reconcile, or even point out, seemingly contradictory findings. Nor does the review come to grips with the implications of the findings. One also expects a critique of those findings reported to occur at relatively low levels of nitrogen dioxide. Also of value would be some discussion of species difference in findings, particularly as this would pertain to generalization in humans. With the understanding that these issues will be resolved in this chapter in the revision of this draft document, the Committee will advise that the chapter is scientifically acceptable.

Effects on Humans of Exposure to Oxides of Nitrogen--The discussion primarily focused on the revisions made to the document since the last CASAC meeting, and whether those revisions adequately dealt with previous comments from CASAC and the public. In reviewing Chapter 15, the Committee specifically addressed the question of whether the chapter adequately identified, discussed, and evaluated the critical health studies for the oxides of nitrogen.

In general, it was concluded that the current revision of the criteria document presented a balanced and comprehensive critical review of the pertinent literature on human health effects of the oxides of nitrogen. It was agreed that new literature is continually being added to the subject, but that an arbitrary limit had to be set for the current document and that no studies unpublished at the time of the meeting should be included.

The emphasis placed upon specific studies was appropriately altered from the previous draft criteria document following comments by CASAC. Specifically, it was concluded that the current document adequately de-emphasized the significance of the Chattanooga studies of Shy, et al. The Committee also believed that the study by Orehek had been appropriately considered as relevant to safety factor considerations, and that it should not be used for identifying a specific level for setting a standard.

CASAC also concluded that the discussion of gas stove studies was scientifically acceptable. The Committee believed that there might be a more concise summary of the indoor NO exposurers relevant to the gas stove studies, but this represents only a minor refinement in the chapter.

The criteria document appropriately separated effects on sensory organs, pulmonary function and respiratory systems or infection. When possible, most of these effects were considered separately in healthy and sensitive populations. The limitations of the different types of studies (human exposure, epidemiologic) were also considered.

The studies relevant to the critical issue of level of lowest observed effect were discussed in the document in a balanced manner. It was recognized by CASAC that no body of data is perfect and, subject to the recommendations suggested in the paragraphs above, the criteria document had critically and satisfactorily reviewed the existing data on human health effects of the oxides of nitrogen.

Summation

The Committee made additional comments of an editorial nature. These remarks, as well as a more detailed discussion of the recommendations and review provided above, are included in the transcript. With the understanding that the advised changes are incorporated in the revised criteria document, the Committee is satisfied that the air quality criteria document for the oxides of nitrogen is scientifically adequate for use in standard setting.