



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
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OFFICE OF  
THE ADMINISTRATOR

SUBJECT: CASAC Review and Closure of the OAQPS Staff Paper  
for Nitrogen Oxides

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

TO: Anne M. Gorsuch  
Administrator

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The Clean Air Scientific Advisory Committee has completed its third and final review of OAQPS's revised staff paper entitled Preliminary Assessment of Health and Welfare Effects Associated with Nitrogen Oxides for Standard-Setting Purposes. The Committee has prepared this closure memorandum to inform you of its major conclusions and recommendations concerning the various scientific and technical issues associated with the revision of the National Ambient Air Quality Standards (NAAQS) for nitrogen dioxide, and to advise you of the scientific quality of the staff paper. This memorandum is the outcome of three CASAC review meetings of the staff paper held on November 14, 1980, February 6, 1981, and November 18, 1981. It supplements CASAC's closure letter on the air quality criteria document for nitrogen oxides sent to you on June 19, 1981. In that letter the Committee advised that the criteria document was scientifically adequate for use in standard setting.

CASAC is satisfied that its recommendations for improving the scientific quality of the staff paper have been incorporated in successive revisions of the document. It is now a balanced and thorough interpretation of the scientific evidence pertaining to this pollutant. It is also consistent with the evidence presented and interpreted in the nitrogen oxides criteria document. Thus, the Committee believes that the revised staff paper for nitrogen oxides provides you with the kind and amount of technical guidance needed to make any appropriate revisions to the primary and secondary standards.

Attachment

CASAC Conclusions and Recommendations on Major Scientific Issues and Studies Associated with the Development of Revised NAAQS for Nitrogen Oxides

A. Critical Elements in the Primary Standard Review

During the review of both the NO<sub>x</sub> criteria document and staff paper it became apparent that no single study could provide the scientific basis for revising the primary standard for nitrogen dioxide. Rather an accumulation of evidence from animal toxicology, human clinical, and epidemiological studies furnishes both qualitative and quantitative support for a revised standard. Each class of study is subject to certain methodological limitations but, taken together, these studies provide sufficient evidence to guide you in making an appropriate public health policy decision. In addition, the Committee concludes that all of the key studies related to human health effects were identified and discussed in the staff paper. Based on a discussion of these issues CASAC recommends that you retain the annual primary standard and select the concentration level at the lower end of a range between .05-.08 parts per million (ppm). Discussed below are CASAC's conclusions and recommendations concerning the critical issues associated with revising the primary NO<sub>2</sub> standard.

1. Animal Toxicology Studies

Three alternatives regarding the use of animal toxicology data for standard-setting were reviewed by the Committee. These included: 1) using animal data as qualitative support in developing a margin of safety; 2) using data from animal studies as quantitative support in developing a margin of safety; 3) identifying each type of biological effect which

has been found to occur in animals from exposure to NO<sub>2</sub> and assessing the extent to which specific studies reporting a given effect can be used to estimate the lowest effects level for humans. CASAC concludes that option 3 is the most reasonable approach to employ in evaluating a data base whose quality and relevance of animal response vary widely. Thus, the Committee recommends that results from animal studies should be considered on a case-by-case basis in making extrapolations to human health effects.

## 2. Human Clinical Studies

The Committee concludes that none of the controlled human exposure studies offer definitive evidence that adverse health effects occur at levels below one part per million (ppm). Studies have reported mild symptomatic effects (e.g. dizziness, headache, nasal discharge) in some sensitive population subjects after a two-hour exposure to .5 ppm (Kerr, et al, 1979). However, the Committee would not go so far as to describe such symptoms as "adverse health effects." In addition, CASAC recommends that reported results of the Orehek et al. (1976) and Von Nieding (1977) studies (i.e. dose-response curves for changes in specific airway resistance after exposure to 0.1 ppm NO<sub>2</sub> and a bronchoconstrictor) not be considered in establishing a lowest observed effect level. This recommendation reflects the Committee's concern over uncertainties in the statistical analysis and uncertainty regarding the significance of responses observed in studies that use a bronchoconstrictor. These studies should instead

be used along with other qualitative and quantitative evidence in selecting a margin of safety for a revised standard.

### 3. Epidemiological Studies

Community epidemiological studies identified and discussed in the staff paper and criteria document do not provide quantitative evidence of identifiable public health effects linked to specific ambient air concentrations of NO<sub>2</sub>. With respect to specific studies the Committee concludes that the Chattanooga (Shy et al., 1970, 1973 and 1979) and the Japanese (Kagawa and Toyama, 1975) studies do not establish quantitative dose-response information for revising the present standard. The studies do provide, however, limited qualitative support for the hypothesis that higher levels of NO<sub>2</sub>, in association with other pollutants in the ambient air, may affect lung function and/or the onset of respiratory illness in children.

The Committee devoted considerable discussion to epidemiological studies assessing NO<sub>2</sub> exposures to people residing in homes with gas stoves. These studies have reported a higher incidence of acute respiratory disease for children living in homes equipped with such stoves than for those residing in homes in which electric stoves were utilized. Although gas stoves tend to emit large amounts of NO<sub>2</sub>, numerous other factors (e.g. humidity, carbon monoxide, formaldehyde) may affect and confound the results of the studies. The

Melia et al. (1977), 1979) studies do not provide quantitative dose-response data for NO<sub>2</sub> exposures due to the absence of short-term NO<sub>2</sub> measurements in the residences of the subjects evaluated and due to incomplete analysis of the aforementioned possible confounding or covarying factors. In a limited qualitative sense, however, the studies do suggest an association between higher NO<sub>2</sub> levels and increased respiratory symptoms and illness in children.

CASAC also evaluated the Harvard "Six Cities Study" (Speizer et. al. 1980) during its review of the staff paper and criteria document. This study was designed to gather information on long-term health effects. The increased incidence of respiratory disease reported in the "Six Cities Study" may be caused by repeated short-term peak exposures rather than long-term NO<sub>2</sub> concentrations of 24 hour or annual averages; however, this has not yet been conclusively demonstrated due to the scarcity of short-term indoor NO<sub>2</sub> monitoring data. In using the Six Cities Study data, both the study authors and CASAC caution the Agency against overinterpretation of the study data in selecting revised NO<sub>2</sub> standards.

4. Short-Term vs. Long-Term NO<sub>2</sub> Standard, and Scientifically Acceptable Ranges for a Revised Standard

The Committee spent considerable time discussing the extent to which available animal, human clinical, and epidemiological studies cited in the staff paper provide a scientific basis for retention of an annual primary standard. It also reviewed whether such evidence would provide scientific support for the establishment of a short-term (1-3 hour) primary standard. Evidence reviewed by the Committee clearly documents the existence of health effects due to short-term peak exposures that are distinct from the effects associated with longer-term average exposures. The evidence does not, however, distinguish whether the latter effects are the result of a series of short-term peak exposures or the result of lower level long-term exposures or some combination of both. The CASAC has concluded that any revised NO<sub>2</sub> standard needs to offer sufficient protection against both the short-term as well as the long-term reported effects.

For both scientific and practical reasons related to the implementation of standards, the Committee recommends that you retain an annual standard and that you do not need to establish a separate short-term primary standard at this time. Qualitative support for an annual standard is based on results from animal test data. For example, from animal inhalation studies in which several species were used, investigators have reported that long-term NO<sub>2</sub> exposures produced structural

alterations in the distal bronchioles and alveolar regions of the lung at long-term NO<sub>2</sub> levels in the range of .25 - .50 ppm. Quantitative evidence of short-term effects at higher NO<sub>2</sub> exposure levels (.5 ppm NO<sub>2</sub>) has been reported in human clinical studies. Community epidemiological and "gas stove" study data furnish additional support for retaining the annual primary standard. In particular, the "gas stove" studies suggest that multiple exposures to short-term NO<sub>2</sub> levels below 0.5 ppm are of concern and should be avoided in the ambient air. For example, the "gas stove" studies and related studies in which NO<sub>2</sub> was measured in homes utilizing gas stoves suggest that repeated short-term peaks in the range of 0.15 - 0.30 ppm may be of concern for children and thus should be limited in the ambient air. Revision of the primary annual standard to control long-term NO<sub>2</sub> concentrations can, however, be set at a level that also provides adequate protection against repeated short-term peak exposures.

The staff paper suggests an annual standard set within the range of .05-.08 ppm. Based on the above discussion, the need to provide adequate protection against repeated short-term peak exposures, and due to the uncertainties of the data base, the CASAC recommends that you consider selecting a primary annual standard level at the lower end of the .05-.08 ppm range to ensure an adequate margin of safety of protection against both long-term and short-term health effects. The

factors you should consider to determine a margin of safety and to identify the sensitive population groups are appropriately discussed in the staff paper.

Factors related to the implementation of the standard were also discussed by CASAC. Retention of an annual average standard would be the least burdensome option for the states to incorporate into revised State Implementation Plans (SIPs) because individual SIPs already are based on such an approach.

B. Critical Elements in the Secondary Standard Review

The Committee is satisfied with the scientific quality of the staff paper's presentation of information concerning welfare effects. The discussion of materials damage, personal comfort and well-being, vegetation effects, and visibility impairment was comprehensive and well written.

Acidic deposition is also a welfare effect associated with the oxides of nitrogen. Because of the great complexity of this issue CASAC had previously recommended that the Agency prepare a Critical Assessment Document for Acidic Deposition that would evaluate the contribution of NO<sub>x</sub> and other precursor pollutants to the formation, transport, and effects of the total acidic deposition problem. CASAC thus agrees with the OAQPS staff decision not to address acidic deposition in the NO<sub>2</sub> staff paper, and it looks forward to the submission of the critical assessment document for its review.



CASAC concurs with the staff paper recommendation that an annual primary standard within the range of .05-.08 ppm will offer sufficient protection for the various welfare effects of concern.

Summary

CASAC recognizes that your statutory responsibility to set standards requires both scientific and policy judgments to protect public health and welfare. While the Committee is willing to further advise you on the NO<sub>2</sub> standards, we see no need, in view of the already extensive comments provided, to review the proposed NO<sub>2</sub> standards prior to their publication in the Federal Register. In this instance the public comment period will provide sufficient opportunity for the Committee to submit any additional comment or review that may be necessary.

The Committee made scientific and editorial comments during the review of the revised staff paper. These remarks, as well as a more detailed discussion of the conclusions and recommendations provided above, are included in the transcripts of the three CASAC meetings (held on November 14, 1980, February 6, 1981, and November 18, 1981) to review this document. With the understanding that these minor changes will be incorporated in the final staff paper, the Committee is satisfied that this document is scientifically adequate for use in standard setting.