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WHO European Centre for Environment and Health  
Bilthoven Division

# UPDATE AND REVISION OF THE AIR QUALITY GUIDELINES FOR EUROPE



WORLD HEALTH ORGANIZATION  
Regional Office for Europe  
COPENHAGEN

## TARGET 21

### AIR QUALITY

*By the year 2000, air quality in all countries should be improved to a point at which recognized air pollutants do not pose a threat to public health.*

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# UPDATE AND REVISION OF THE AIR QUALITY GUIDELINES FOR EUROPE

Report on a WHO Planning Meeting

Bilthoven, Netherlands

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## ABSTRACT

Since the publication of *Air quality guidelines for Europe* in 1987, new scientific data on air pollution toxicology and epidemiology have accumulated and new developments in risk assessment methodologies have taken place. These necessitate the updating and/or revision of the existing guidelines. To initiate the updating procedure, which will be conducted in collaboration with the European Union and the International Programme on Chemical Safety, a planning meeting was held at the Bilthoven division of the WHO European Centre for Environment and Health. The issues discussed included criteria for the inclusion of substances or mixtures, strategies for the derivation of guidelines, ways and means of regularly updating the guidelines, and the format of publication. A list of pollutants to be included in the second edition was agreed on, and it was recommended that working groups be set up to deal with methodologies as well as with specific groups of air pollutants. A provisional timetable was also agreed on.

### *Keywords*

AIR QUALITY

AIR POLLUTION - prevent/control

AIR POLLUTANTS

(4) CEC

(7) IPCS

## INTRODUCTION

The *Air quality guidelines for Europe*, published in 1987, have provided a uniform basis for developing strategies for the control of air pollution, and have contributed to the maintenance and improvement of public health in several countries. Since the publication of the guidelines, new scientific data in the fields of air pollution toxicology and epidemiology have accumulated, and new developments in risk assessment methodologies have taken place that require the updating and/or revision of the existing guidelines. This fact was recognized during the preparation of the initial workplan of the European Centre for Environment and Health, and it was recommended that the Centre undertake any necessary amendments to and extensions of the guidelines.

To initiate the updating procedure, which will be carried out in cooperation with the International Programme on Chemical Safety (IPCS) and the Commission of the European Communities (CEC), a planning meeting was organized by the WHO European Centre for Environment and Health in Bilthoven, Netherlands, on 11-13 January 1993. The project will be implemented through working group meetings that require the preparation of working documents on specific air pollutants or mixtures, together with a final consultation to discuss the updated document. The purpose of the planning meeting was to set the framework for the updating and revision process, and in particular to discuss the scope and purpose, content and format of the revised publication, to define the details of and the schedule for the updating process, and to identify the working groups needed and their way of operating.

The meeting was attended by experts from six countries, a representative of CEC, and WHO staff. Professor Bernd Seifert was elected Chairperson and Dr Robert Maynard Rapporteur. Dr Maged Younes was Scientific Secretary. The working papers and participants are listed in Annexes 1 and 2, respectively.

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## TOPICS THAT MIGHT BE DEALT WITH ANEW OR EXPANDED IN THE SECOND EDITION OF THE GUIDELINES

1. Specific guidance on how to move from guidelines to standards was felt to be particularly necessary in countries without a substantial research base in the air pollution field. It was stressed that realistic standards were important, and that simply adopting WHO guidelines might lead to standards that could not be achieved and that were therefore of little value. It was suggested that in addition to guideline values, action levels should be recommended; these might function as a guide for decision-makers on air pollution abatement policy. Additional advice on the exposure-response curves for individual pollutants should also, if possible, be provided. Advice on measures that might be taken when action levels were exceeded would also be appreciated.
2. Advice on how to calculate back from pollution levels to estimates of emissions, and from these to emission standards, was also suggested.
3. Guidance on how particular air pollution problems might be resolved was felt to be important, but not necessarily as a part of the guidelines.
4. Guidance on major sources of pollution, such as power plants, traffic or domestic use of fuel, was considered necessary for individual pollutants, as put forward in the first edition of the guidelines.
5. The difficult problem posed by pollutant mixtures was raised. It was noted that WHO had partially addressed the subject in dealing with winter and summer smog in a recent publication.<sup>a</sup>
6. In the first edition of the guidelines, unit risk estimates had been calculated for a number of carcinogens. In the second edition, advice on sensitive groups and the numbers of people likely to be affected at given levels of pollution would be useful.

It was agreed that preparation of the updated guidelines could not be a "once only" event, and that some provision for regular

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<sup>a</sup> *Acute effects on health of smog episodes: report on a WHO meeting* (WHO Regional Publications, European Series, No. 43, 1992).

updating would be required. Some form of loose-leaf format would perhaps be most suitable, as this would allow continuous updating. The suggestion that the entire work might be provided on computer disk was also considered, and it was agreed that this possibility should be pursued.

It was accepted that the definition of exposure-response curves was difficult, particularly as regards effects of low levels of exposure to carcinogens, though it was desirable to include such information where possible.

It was agreed that a section on methodologies for setting air quality standards would be valuable, and various means of setting standards were discussed. It was clear that a variety of techniques for setting standards were in use in different countries, and it was felt that a discussion of these would be helpful.

A CEC Framework Directive was being developed. It was hoped that standards included in the Directive would be based in part on the second edition of the WHO guidelines, and that the "air quality objectives" for the Directive would be derived from it. It was also felt important that a copy of the report of the meeting should be sent to the Organisation for Economic Co-operation and Development.

The CEC Framework Directive would:

- require national surveys of pollution levels and include criteria for monitoring;
- define a list of substances to be monitored;
- set air quality objectives.

Air quality objectives would be defined in terms of mandatory limit values and non-mandatory target values and alert values. For member states of the European Union, such standards would take priority over national or local standards. It was stressed, however, that standards do not represent actual health risk; health risk assessment should be based on actual information on exposure at the local or regional level.

It was agreed that all the substances that had been covered by the first edition of the guidelines should be included in the second

edition. Criteria for inclusion of substances or mixtures of substances should include:

- (a) whether the substance or mixture posed a widespread problem in terms of resources;
- (b) whether the potential for personal exposure was large; it was agreed that this should take into account indoor as well as outdoor exposure;
- (c) whether important new data on health effects had appeared since the first edition of the guidelines;
- (d) whether monitoring was feasible;
- (e) whether significant non-health (e.g. ecotoxic) effects could occur; and
- (f) whether a positive trend in ambient levels was evident.

A number of substances and mixtures were considered for inclusion in the second edition, and ranked in order of priority (Table 1).

As regards the "better known" air pollutants, including the first seven compounds and mixtures listed under priority I in Table 1, there was a need to separate sulfur dioxide from particulate matter in terms of effects. It was also accepted that in some parts of the world the combination of sulfur dioxide and particulate matter was still an important pollutant, and that this combination required separate consideration.

Particulate matter should include acid aerosols, emissions from diesel vehicles, and consideration of absorbed polycyclic aromatic hydrocarbons.

For substances such as ozone, the oxides of nitrogen, sulfur dioxide and acid aerosols, separate sections dealing with the ecotoxicity of these compounds and mixtures would be required.

Metals associated with emerging technologies, including gallium and thallium, were thought at present to represent only theoretical risks to health. These might be addressed by a working group considering the more common toxic metals.

Discussion of asbestos and fibres led to the view that organic fibres should be excluded from consideration.

Table 1. Substances and mixtures of substances considered for inclusion in the second edition of the guidelines

Priority I	Priority II	Priority III
Carbon monoxide	Nickel	Vanadium
Nitrogen oxides (nitrogen dioxide)	Platinum	Carbon disulfide
Ozone/photo-oxidants	Asbestos/fibres	Hydrogen sulfide
Sulfur dioxide	Styrene	Acrylonitrile
Particulate matter <sup>a</sup>	1,3-butadiene	1,2-dichloroethane
Sulfur dioxide/ particulate matter	Fluoride	Vinylchloride
Lead	Dioxins/polychlorinated biphenyls	Gallium
Cadmium	Total volatile organic compounds(/indoors)	Rhodium (new technology metals)
Manganese	(Alternative fuels) <sup>b</sup>	Thallium
Mercury	Dichloromethane	
Arsenic		
Hexavalent chromium		
Formaldehyde		
Radon		
Toluene		
Benzene		
Trichloroethylene		
Environmental tobacco smoke		

<sup>a</sup> Including polycyclic aromatic hydrocarbons, acid aerosols and diesel particulates.

<sup>b</sup> Including alcohols, ethers and aldehydes.

Discussion of total volatile organic compounds (TVOC) led to the view that their use as an indicator of pollution (commonly indoors) was valuable, but that definition of health effects on a

compound-to-compound basis would be particularly difficult. A holistic approach to TVOC was suggested.

A number of substances associated with the development of new fuels and new fuel additives were considered, including alcohols, aldehydes and ethers. It was agreed that it was important that these should be included in the second edition of the guidelines.

A number of other compounds that had not been dealt with in the first edition of the guidelines, including 1,3-butadiene, fluorides and compounds associated with global warming and alterations in global air pollution (and possibly with secondary health effects) were also considered.

Following discussion of individual compounds, a series of working groups was recommended. These included a group charged with examining methodologies used for the derivation of guidelines and standards, and with reaching a consensus on the state of the art with respect to a number of issues listed in the conclusions and recommendations.

A provisional timetable for the preparation of the second edition of the guidelines was devised, with the aim of publication in January 1996. Because of the demanding timetable, it was agreed that a steering group, possibly based on the planning group, should meet on an ad hoc basis throughout the preparation of the guidelines, to monitor progress and recommend such action as necessary to keep the project on course.

## CONCLUSIONS AND RECOMMENDATIONS

1. The WHO *Air quality guidelines for Europe* (1987) was a valuable publication, and had been widely used by those with responsibility for setting air quality standards.
2. A second edition of the guidelines should be produced.
3. In the second edition, greater emphasis should be placed on discussions and identification of major sources of pollutants.

4. The introductory chapters of the guidelines should be expanded to include discussion of different means of setting standards.
5. Preparation of the guidelines should not be a "once only" task but should represent an ongoing programme.
6. The second edition could not easily be produced in precisely the same format as the first edition; the format of publication should allow updating as necessary.
7. The revised edition should, in the first place, focus on Europe and similar regions; it was expected, however, that it would also play a useful role in other areas of the world.
8. Working groups should be set up to draft the revised guidelines.
9. Criteria for inclusion of substances or mixtures of substances should include:
  - (a) whether substances or mixtures posed a widespread problem in terms of sources;
  - (b) whether the potential for exposure was large, taking into account indoor exposure;
  - (c) whether important new data on health effects had become available since the first edition;
  - (d) whether monitoring was feasible;
  - (e) whether significant non-health (e.g. ecotoxic) effects could occur.
10. Guidance on exposure-effect and exposure-response relationships (and, where appropriate, dose-effect and dose-response relationships) should be provided where possible.
11. The group concluded that pesticides were a significant problem in some parts of the world, air being often the transport medium rather than the major source of intake. It was

recommended that WHO convene a suitable group to examine effects of pollution caused by the use of pesticides on health.

12. It was recommended that the following working groups or interactive groups be established.

I. *Working group on methodology and format*

This group should be composed of senior workers in the field who could advise on how the following more specialized groups should tackle assignments, and on the format of the second edition of the guidelines. In particular, advice on methods of risk assessment should be provided.

II. *Working group on major or "classical" air pollutants*

It was considered likely that some overlap between the membership of groups I and II would occur. Group II might need to be split into two subgroups to deal with:

- (a) carbon monoxide, ozone and nitrogen oxides; and
- (b) sulfur dioxide and particulates.

It was recommended that sulfur dioxide and particulate matter be considered both separately and in combination. Diesel emissions, polycyclic aromatic hydrocarbons, acid aerosols and silicates (wind-blown dust) should also be considered.

III. *Working group on inorganic air pollutants*

This group would consider lead, chromium, cadmium, manganese, mercury and arsenic as first priorities, and nickel and platinum as second priorities. It would also address fluorides, and whether future contributions should deal with thallium, gallium and other new technology metals. The group would also reproduce those sections of the first edition of the guidelines dealing with vanadium, hydrogen sulfide and carbon disulfide.

#### IV. *Working group on organic air pollutants*

This group would consider toluene, trichloroethylene, tetrachloroethylene, benzene and formaldehyde as first priorities, and 1,3-butadiene, dichloromethane and styrene as second priorities. The group would also reproduce those sections of the 1987 guidelines concerned with acrylonitrile, vinyl chloride and 1,2-dichloroethane.

#### V. *Working group on particular indoor air pollutants*

This group would consider radon, asbestos and other mineral fibres, and environmental tobacco smoke.

#### VI. *Working group on polychlorinated biphenyls and dioxins*

#### VII. *Working group on ecotoxicity*

This group would select, from the list of compounds and mixtures defined by the planning group, those for which ecotoxic effects should be evaluated. Particular attention would be paid to (a) the direct phytotoxic effects of ozone and other photochemical oxidants, nitrogen dioxide and sulfur dioxide, (b) acid deposition, (c) heavy metals and (d) persistent organic compounds.

Collaboration with groups from the United Nations Economic Commission for Europe would take place in respect of (a), (b) and (c).

#### VIII. *Interactive group on total volatile organic compounds*

This group would collaborate with a group from the European Union on work in this area.

#### IX. *Interactive group on compounds generated by the use of alternative fuels*

This group would address alcohols, ethers and aldehydes, especially acetaldehyde and formaldehyde, and would collaborate with the US Environmental Protection Agency.

*X. Interactive group on direct and indirect effects of global air pollution*

The National Institute of Public Health and Environmental Hygiene, Bilthoven, and the US Environmental Protection Agency would collaborate on draft chapters, which would then be reviewed.

13. Working papers would be prepared by experts prior to meetings of each working group.
14. The working group on methodology and format should provide guidance, by writing an appropriate general chapter, to the other groups on:
  - types of health effect — acute, sub-chronic and chronic;
  - threshold and non-threshold effects for carcinogens and non-carcinogens;
  - effects at different levels of exposure (and/or dose) and how these should be discussed and illustrated;
  - the significance of observed effects of exposure to pollutants, including discussion of annoyance, adverse and acceptable effects;
  - the choice of appropriate averaging times for guidelines in relation to observed exposure-response relationships;
  - the realistic estimation of population exposure;
  - the need for the incorporation of confidence limits in unit risk estimates;
  - recent developments in physiologically based pharmacokinetic/pharmacodynamic modelling;
  - the value of the pollutants in question as indicators of air quality;
  - how to combine risk estimates for predicting effects of mixtures of pollutants and combined exposures.

15. The chapter format used in the first edition of the guidelines should be broadly retained.
16. The format of the contributions on ecotoxicity and the topics recommended as additional to the first edition should be decided by working groups.
17. Decisions as to how the contributions on ecotoxicity should appear in the second edition (either as separate chapters or adjacent to the discussions of the individual pollutants) should be left to the editors.
18. More use should be made of tables and illustrations.
19. A statement indicating the end of the period covered by literature reviews should be added to each chapter.
20. Advice contained in the introductory chapter on the inadvisability of using numerical guidelines without reference to the relevant chapters of the book should be strengthened.

*Annex 1***WORKING PAPERS<sup>a</sup>**

- ICP/CEH 230/6 Summary of WHO Air quality guidelines
- ICP/CEH 230/7 Suggested priorities for updating existing air quality guidelines' evaluations for hazardous air pollutants

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<sup>a</sup> Copies can be obtained from the European Centre on Environment and Health unit, WHO Regional Office for Europe, Scherfigsvej 8, DK-2100 Copenhagen Ø, Denmark.

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