



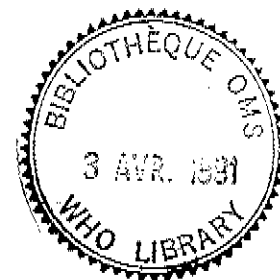
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SUMMARY REPORT

Working Group on Assessment of Risks to Health from Smog Episodes

's Hertogenbosch, Netherlands
30 October - 2 November 1990



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EUR/HFA target 21

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TARGET 21

Protection against air pollution

By 1995, all people of the Region should be effectively protected against recognized health risks from air pollution.

Index:

ENVIRONMENTAL HEALTH
AIR POLLUTION - adverse effects
SMOG - adverse effects
RISK FACTORS
EUR

The Working Group was convened to assess health risks associated with episodic exposure to elevated concentrations of air pollution in winter and summer ("winter-type" and "summer-type" smog). The meeting was organized with the cooperation and support of the Netherlands Ministry of Housing, Physical Planning and the Environment. Fifteen temporary advisers and three observers from eight countries took part.

The participants reviewed the effects on human health that are known or expected to be associated with episodic exposure to winter- and summer-type smog. For the purpose of this report, winter-type smog indicates mainly pollution from combustion of sulfur-containing fossil fuel. Sulfur dioxide and suspended particulate matter are usually measured as indicator pollutants of this mixture, although other components such as sulfuric acid may be primarily responsible for the health effects. Summer-type smog refers primarily to photochemical pollution arising from atmospheric reactions of hydrocarbons and nitrogen oxides stimulated by intense sunlight. Ozone is considered the most biologically active pollutant in this mixture.

However, there can be substantial variations in composition of both winter- and summer-type smog between different localities, and findings on effects in any one place will not necessarily apply elsewhere. For example, when locations at different latitudes with different solar-ultraviolet intensity and different source contributions are compared, the toxicity of the photochemical smog at the same ozone concentration is likely to be substantially different. Also, the uncertainties in the characteristics of air-pollutant exposure and the associated health effects in the centres of large cities with intensive motor-vehicle traffic urgently need to be reduced.

Some information on the health effects that are expected to be associated with the basic winter- and summer-type smog episodes is summarized in Annex 1. At increasing levels of exposure, these effects have been categorized as either "mild", "moderate" or "severe", with the understanding that with increasing seriousness of the effects, action becomes more urgent.

Peak exposure to winter- or summer-type smog can be reduced when action taken in response to an air-pollution alert results in reduced emissions from economic activity and/or reduction of exposure through restrictions on personal mobility. A pollution alert is defined as formal action by an appropriate authority, triggered by a predicted exceedance of the concentration of an indicator pollutant above a value predetermined to be associated with adverse health effects. Such alerts can only be invoked in practice a few times in any one season or year, and do not result in any substantial reduction in cumulative or long-term average exposure.

The official response to a prediction that alert levels will be exceeded in a given location or jurisdiction is the responsibility of the relevant authority. When effects are expected to be mild, the only action necessary seems to be to announce that the alert levels may be exceeded and to explain what this means for public health. When effects are expected to be moderate, some public advice about exposure reduction or dose reduction for sensitive individuals can be considered. When severe health effects are expected, additional measures can be recommended on a voluntary basis. Emergency short-term measures such as the closing of schools or limiting of traffic should be considered when the levels causing severe effects on human health are likely to be exceeded (Annex 1, Tables 1 and 2).

The levels given in the tables do not indicate thresholds of effects, but indicate an amount of air pollution high enough to cause effects that may be detected in well designed studies. Higher levels of exposure will cause effects of increasing severity in an increasing fraction of those exposed; however, it is not possible to define this increase in exact numerical values on the basis of the limited data now available. A level of pollution lower than the lowest in the tables is not thought to be without effect, but is not expected to cause effects of major health concern.

In general, people with pre-existing lung disease or circulatory deficiencies are more severely impaired than others even by relatively small effects brought about by winter-type smog episodes. For summer-type smog, those at special risk have not been clearly defined, although it is well known that some people are more responsive to it - and to ozone in particular - than others.

The Group as a whole felt that the fact that this meeting was convened to assess the risk to health from smog episodes was evidence of the failure of air-pollution abatement measures, and that its results should in no way distract the responsible authorities from the need to increase their efforts to reduce baseline levels of pollution. With reduced baseline emissions, the peak concentrations resulting from variable power demands and weather will also decline. Reductions in peak concentrations by this approach make it possible to avoid placing emergency restrictions on economic and personal activity and have the added advantage of reducing long-term cumulative exposure to smog pollutants. (In this connection, reference can be made to Impact on human health of air pollution in Europe, a report written by the WHO Regional Office for Europe for the United Nations Economic Commission for Europe, Geneva.^a)

Recent experience in several European countries has shown that air-pollution episodes can attract intensive media attention and consequently cause great concern among the general public, a concern that is not generally justified by the severity of the anticipated effects on human health. The psychological effects and their impact on wellbeing, however, may have been greatly underestimated. In particular, advice to the public which has a strong impact on their normal activity pattern (e.g. advice to stop outdoor physical activity and/or not to leave the house) is likely to be associated with an emergency by at least part of the population. Effective communication of the level of health risk associated with exposure to different levels of air pollution and of the level of air pollution at any given time is critically important in maintaining the necessary public confidence and cooperation. This means that a thorough educational programme for the general public is essential.

Conclusions

1. While it is possible to select certain "index" pollutants characterizing the two main types of smog under consideration - such as sulfur dioxide and particulate matter in the case of winter-type smog and ozone in the case of summer-type - there can be substantial variations in the composition of the

^a Obtainable from the Control of Environmental Health Hazards unit, WHO Regional Office for Europe, Scherfigsvej 8, DK-2100 Copenhagen Ø.

pollution mixture between different localities, and findings on effects in any one place will not necessarily apply elsewhere.

2. Although controls on emissions and changes in fuels have eliminated the severe health problems that used to occur in association with winter-type smog episodes, there are places where, due to inadequate emission control coupled with meteorological and topographical features, high pollution episodes of this type still occur, leading to acute effects on health.

3. Summer-type smog episodes have begun to occur in many areas of Europe over the past 20 years, their intensity and frequency tending to increase rather than decrease, and on the basis of experience elsewhere, acute effects on health are anticipated.

4. Peak exposures to winter- or summer-type smog can be reduced when action taken in response to an air-pollution alert results in reduced emissions from economic activity and/or reductions of exposure through restrictions on personal mobility. However, the much preferred alternative to alert systems is to reduce peak exposure by reducing the baseline exposure, using approaches such as fuel-switching, process changes and/or emission controls that lower baseline rates of emission in large enough areas.

5. Alert systems in respect of winter-type smog may need to be based on some combination of sulfur dioxide and particulate matter. In some circumstances it may be appropriate to use exceedances of just one of these as an indicator, but otherwise various combinations can be used, depending on local circumstances and the corresponding evaluation of the health risks.

6. In view of the different levels used to distinguish the various health effects of winter- and summer-type smog episodes, an accuracy of some 15% in determining the actual level of index pollutants is thought to be needed. In principle, the number of stations required to meet the demand for accuracy will depend on the spatial gradient over the area under consideration.

Recommendations

1. In areas subject to smog episodes of either winter or summer type, monitoring should be extended to a wider range of pollutants than the basic "index" ones, so as to characterize the mixture; where possible, epidemiological studies should be undertaken locally to provide information for health risk assessment.

2. Authorities should take action to educate the general public about the potential acute health consequences of winter- and summer-type smog episodes in a way commensurate with the seriousness of the problem, and should educate them about the action that individuals can take to protect themselves against adverse effects from these episodes.

3. With increasing levels of exposure during smog episodes, specific advice to the public should be considered about exposure reduction or dose reduction for sensitive individuals.

4. Short-term source-reduction strategies which require the continuous cooperation of a large number of people or which impose restrictions on the

free choice of many, should only be relied upon in severe smog episodes. When this kind of strategy is adopted, the budget should be sufficient to evaluate the effectiveness of the strategy in terms of a real reduction in health risk.

5. Measuring stations used to evaluate smog episodes should be sited in such a way that the results are representative of the exposure sustained by the population under consideration. Measurement results should be available on-line, with averaging times of three hours at the most, to make extrapolation to the next 24 or 48 hours possible.

6. To increase the quality of smog prognoses a simple model should be used, in which some characteristic meteorological factors are combined with measured pollution levels.

7. Professionals working in the health care system and other relevant staff should be provided with enough information to enable them to give advice to anyone concerned about the meaning of the health effects described in Annex 1.

Annex 1

SUMMARY OF HEALTH EFFECTS KNOWN TO BE ASSOCIATED WITH
WINTER- AND SUMMER-TYPE SMOG

Table 1. Levels of 24-hour average concentrations of air-pollutant mixtures containing SO₂ and particulate matter above which specific acute effects on human health are expected on the basis of observations made in epidemiological studies

SO ₂	Particles (µg/m ³)	Health effects	Overall classification of effects
200	200 (gravimetric)	Small, transient decrements in lung function (FVC, FEV ₁) in children and adults, which may last for 2-4 weeks. The magnitude of the effect is in the order of 2-4% of the group mean.	Moderate
250	250 (black smoke)	Increase in respiratory morbidity among susceptible adults (chronic bronchitis) and possibly children.	Moderate
500	500 (black smoke)	Increase in mortality among elderly and chronically ill people.	Severe

Note: Effects on human health are thought to become severe at levels of 400 µg/m³ for both sulfur dioxide and particulate matter.

Table 2. Expected acute effects of photochemical smog on days characterized by maximum 1-hour average ozone concentrations as indicated for children and nonsmoking young adults on the basis of observations made in toxicological clinical and epidemiological studies (chronic effects are not considered)

Ozone level $\mu\text{g}/\text{m}^3$	Eye, nose and throat irritation (in everyone)	Average FEV ₁ decrement in active people (outdoors)		Imposed avoidance of time and activity outdoors	Respiratory, inflammatory and clearance response, hyper-reactivity (in active people outdoors)	Respiratory symptoms (primarily in adults)	Overall classification of effect
		Whole pop.	Most sensitive 10% of pop.				
<100	No effect	None	None	None	None	None	
200	In a few sensitive subjects	5%	10%	None	Mild	Some chest tightness, coughing	Mild
300	<30% of people	15%	<30%	Some individuals	Moderate	Increased symptoms	Moderate
400	>50% of people	25%	>50%	Many individuals	Severe	Further increase of symptoms	Severe