



Organopollutants - 280.44

Working Group on Indoor Air Quality: Organics

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SUMMARY REPORT

The Working Group was convened to consider the state of knowledge of organic pollutants in indoor air, and to assess what is known about the adverse effects on health that could result from current levels of exposure. The Working Group was organized in connection with, and immediately following, the 4th International Conference on Indoor Air Quality and Climate in Berlin (West), which was held from 17 to 21 August 1987. It comprised 13 temporary advisers from seven countries and a representative of the Commission of the European Communities.

The Working Group considered the progress made in recent years in characterizing the nature and distribution of organic chemicals in the indoor atmosphere. The findings from a number of systematic studies of personal exposures and of studies of residential indoor environments were reviewed, and the results were integrated and consolidated, giving for each compound of significance the distribution of concentrations that had been reported. It was found that the concentrations and the species of volatile organic compounds were very similar in the studies considered. In each case, these concentrations were higher than the corresponding outdoor concentrations, indicating significant sources and emissions of these compounds in the indoor environment.

The Working Group also considered the state of knowledge about the health effects associated with each of these compounds, and in each case evaluated these effects both at high concentrations and at the concentrations reported in indoor environments. The health effects considered included genotoxic effects, systemic toxicity, irritant effects and odour and other sensory effects. For the large majority of the compounds involved, the concentrations reported in the indoor environment are several orders of magnitude lower than the concentrations at which adverse health effects have been reported. For sensory effects, this separation is much smaller and for some compounds it is absent.

Some of the chemicals, such as benzene, have been shown to be carcinogenic in humans while others, such as trichloroethylene, carbon tetrachloride and chloroform, have been demonstrated to be carcinogenic in

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rodents and are suspected human carcinogens. At the concentrations found in indoor environments, their contribution to causation of cancer in the population is judged negligible to minimal. The Working Group identified a number of organic contaminants where exposure distributions are inadequately known but which cause potentially more concern. Such contaminations are exemplified by the complex mixture of environmental tobacco smoke, soot from unvented combustion, and those associated with some forms of cooking. Similarly, biocides used in and about the home need to be evaluated with respect to the hazard associated with current usage.

The Working Group discussed methods that allow the simultaneous incorporation of exposure distribution data, carcinogenic unit risk estimates or other exposure-effect relationships, background incidence of the illness under consideration, and any workplace or indoor standards and guidelines into an overall impact on the health of the population of current exposures to a specific organic compound. Such standardized approaches are necessary to develop priorities for research and for mitigating exposure.

Many organic compounds found in indoor air have been reported to have toxic effects, but most of these reports concern industrial occupational exposures at concentrations considerably higher than those reported in nonindustrial indoor environments. The Working Group considered many of the most ubiquitous organic compounds reported in indoor air, and concluded that the reported concentrations in indoor air surveys were several orders of magnitude below the levels at which systemic effects have been reported for each compound. The same was found to be true for irritation characterized by tissue damage.

Organic compounds in indoor air can produce sensory effects such as perceptions of odour and irritation, which can severely affect human health and wellbeing. Some organic compounds have been shown to modify behaviour through their effect on the central nervous system at concentrations found in some industrial environments. In nonindustrial environments, however, concentrations are several orders of magnitude lower. Although considerable progress was noted in the evaluation of sensory effects of organic compounds in indoor air, this evaluation remains a difficult and complex problem. The effects are mostly acute, often transitory and usually reversible, but the total number of people involved can be quite large. As a result, the total public health importance and the effect of reduced wellbeing on quality of life and productivity is likely to be significant but as yet difficult to quantify.

Conclusions and recommendations

All the conclusions and recommendations agreed on by the Working Group refer specifically and only to indoor environments and indoor air quality.

Conclusions

1. The distribution of indoor concentrations of CO, NO₂ and volatile organic compounds is much better known than those of very volatile, semi-volatile and particle-bound organic compounds, and reactive substances from all these groups. There is a need to collect data on the distribution of the latter groups.

2. Organic compounds may cause odours, mucosal and sensory irritation and airway effects at levels encountered indoors. Any acute toxic effects to various organs usually occur only at concentrations higher than normally encountered indoors.
3. Evaluating the effect on health of single compounds may not always be adequate, because indoor pollutants usually occur in mixtures and many sources emit mixtures of pollutants. However, with the present state of knowledge, only a compound-by-compound approach can be applied to risk estimates in most instances.
4. Exposure to organic compounds, particularly semi-volatile and particle-bound compounds found in the indoor environment, occurs by various routes (inhalation, ingestion and skin absorption). The assessment of total dose and the relative contribution of indoor air exposure requires further study.
5. The detection limits of analytical instruments used at present do not coincide with the detection limits of human sensory systems. Therefore, many strong odorants may not yet have been chemically identified.
6. An indoor concentration limit value based on the detection or recognition of an odour or a sensory irritant by 50% of people (ED_{50}) will not protect the most sensitive part of the population. Also, such a limit does not protect against systemic or genotoxic effects of substances that are not odorants or irritants.
7. Methods are available to assess the total effect in terms of chronic disease of indoor organic air pollutants. These incorporate all available information on exposure distribution, health effects measured in other settings, and the background incidence of the disease in question.
8. The available information on the potency as odorants or sensory irritants of organic air pollutants commonly encountered indoors is inadequate.

Recommendations

1. To facilitate the use of data on exposure to organic compounds, the distribution of the respective concentrations should be reported as the 10th, 50th and 90th (and, if possible, the 95th and 98th) percentiles.
2. Because of the great variety of organic compounds in the indoor air and the difficulties in implementing indoor air quality standards, various approaches to source control should be studied and developed. Where appropriate, forms of social control (such as with environmental tobacco smoke) should be developed through education, mass media campaigns and, if necessary, legal action.
3. Methods for estimating exposure distributions over time (peak exposures versus long-term averages) and over space (exposures in many different spaces) from relatively few measurements need to be developed and validated.
4. Total personal exposure estimates for the organic compounds known to cause adverse health effects within populations should be assessed. This is especially true for exposures due to emissions from complex sources and emissions from multiple sources.

5. Methods for assessing biological burden and activity, including exhaled breath analysis and assays of secretions, should be further developed for organic compounds and their metabolites.
6. In planning studies concerned with health effects, exposure characterization and mitigation of organic compounds, attention should be focused on those compounds whose estimated contribution to the disease in question is more than 2% of the total background incidence.
7. Unwanted odorous compounds should not be present in concentrations exceeding the ED₅₀ detection threshold. Similarly, sensory irritants should not be present in excess of their ED₁₀ detection threshold.
8. Increased emphasis should be given to research in humans on the sensory effects of organic compounds in low concentrations. This is especially true for detection and recognition data, which should be collected in a way that allows the full dose-response curve to be determined, including the ED₁₀ and the ED₅₀ values.
9. The source strength, as well as the rate of change of emissions of organic compounds from building materials and consumer products, should be determined and evaluated in relation to actual human exposure and the associated health effects.
10. As the available information on indoor concentrations of pesticides and herbicides does not permit an adequate evaluation of the associated acute and chronic health effects and in view of the toxicity of these compounds, further data should be urgently generated.