

April 14, 1998

EPA-SAB-IHEC-COM-98-001

The Honorable Carol Browner  
Administrator  
United States Environmental Protection Agency  
401 M Street, SW  
Washington, DC 20460

Subject: Integrated Human Exposure Committee Commentary on Indoor  
Air Strategy

Dear Ms. Browner:

This Commentary was developed by the Integrated Human Exposure Committee (IHEC) of the Science Advisory Board (SAB) in response to a consultation on the draft Indoor Air Strategy from the Office of Air and Radiation (OAR). The consultation took place at a public meeting on July 22, 1997. The Integrated Human Exposure Committee has generated this commentary in order to express its support of the Agency's efforts to address the cross-cutting public health issues raised by pollutant exposures in indoor environments. This commentary also includes recommendations for areas in which the Agency should expand its activities in indoor air to increase the understanding of indoor air risks and risk reduction opportunities.

## **BACKGROUND**

The indoor environment presents an important crosscutting issue for the Agency in its mission to "protect public health and safeguard the natural environment." Since most of the population spends about 90% of its time in indoor environments, exposures to most pollutants occur indoors, whether from outdoor or indoor sources. Furthermore, many of the greatest environmental health risks are encountered in indoor environments. Frequently, indoor levels of many air pollutants are two to five times higher than corresponding outdoor levels. Pollutants released outdoors can be brought into buildings with ventilation air. In some cases, the chemicals that infiltrate into buildings undergo chemical reactions once indoors to generate secondary pollutants. Pollutants released into the outdoor environment are also brought indoors in food, water and tracked-in soil. Indoor pollution can also originate from indoor sources, such as carpet, plywood, and other building materials. Examples of these consumer and commercial products may include carpet, plywood, and other building materials. Indoor pollutants, such as environmental tobacco smoke and household pesticides, may add to or potentiate the effects of

outdoor pollutants. Thus, cost-effective reduction of risks from environmental pollutants requires understanding total exposures (i.e., all sources, media, and exposure pathways) and the relative contributions of both indoor and outdoor sources to total exposure and risk.

In 1990, in its report "Reducing Risk: Setting Priorities and Strategies for Environmental Protection," the Science Advisory Board identified indoor pollution as a high risk deserving EPA's attention (SAB, 1990). Subsequent and, in some cases, more quantitative relative risk rankings by EPA Headquarters, regional offices and several states, have often identified indoor pollution as being among the top four or five environmental risks to human health when included in the list of risks to be ranked. Other scientific committees have also identified indoor air as an important issue that needs further attention. For example, in March 1997, the Presidential and Congressional Committee on Risk Assessment and Risk Management highlighted indoor environmental issues as a problem that needs attention by Congress and the Administration. Efforts to address human health issues in the indoor environment are widely distributed across the EPA and other federal agencies. These efforts are often poorly integrated because they cut across agency missions. Thus, the indoor environment presents a number of challenges to EPA as well as the opportunity to be a national leader in addressing these issues.

## **CONCLUSIONS AND RECOMMENDATIONS**

The Integrated Human Exposure Committee of the SAB strongly supports and encourages efforts by the Agency to address the cross-cutting public health issues raised by pollutant exposures in indoor environments through its Indoor Air Strategy, the Human Health Indoors Policy Committee (HHIP), and its strategic goals for reducing environmental health risks. The purpose of the HHIP Committee is "to develop an Agency-wide action plan to ensure that EPA is prepared to meet the challenges of protecting human health indoors in the 21st Century." The current efforts to set priorities and target reductions in the concentration of selected indoor air pollutants are based on our limited analysis and understanding of indoor health risks and risk reduction opportunities. However, there are many sources of indoor air exposure data from government programs outside of the EPA that frequently do not reach the peer-reviewed literature. One example is state, county and city health department programs that routinely conduct environmental measurements as part of investigations of indoor air complaints. IHEC recommends that the Indoor Air Strategy serve to facilitate communication and coordination between the EPA and such programs. In addition, the IHEC recommends that the EPA consider updating the last comprehensive assessment of the indoor environment which was conducted by the National Research Council (NRC, 1981) over a decade ago. The Agency should also consider broadening the indoor air assessment to include issues such as the interaction and relative contributions of indoor and outdoor pollutants to total human exposure and risk.

The Integrated Human Exposure Committee also recommends continued EPA efforts in the measurement of indoor contaminant concentrations and exposures given their importance in assessing risk. For example, the EPA Total Exposure Assessment Methodology (TEAM) studies of volatile organic compounds in several U.S. cities, and the Particle (PTEAM) studies in

California were important in characterizing the normal ranges of residential indoor and personal air exposures for US populations and serve as the best available comparative, normative reference (EPA, 1996; 1997). The Office of Radiation and Indoor Air's Indoor Environments Division, through the Building Assessment Survey and Evaluation (BASE) study, has extended the TEAM methodology to develop both measurement data on volatile organic compounds in office buildings and related questionnaire data on health symptoms. This database provides a major resource for advancing our understanding of exposures to these pollutants and "sick building syndrome" in office workers.

Scientific understanding of indoor pollutants is still in its infancy when compared to environmental science in outdoor environments. For example, several pollutants are not currently detected during indoor air investigations due to the limitations of analytical techniques that are routinely employed. There are multiple reasons that some indoor air pollutants are "missed." Some compounds are missed because they are highly reactive (e.g., free radicals), thermally labile, difficult to desorb from sampling media or chromatographic columns, or do not produce an adequate response for the detectors that are used. Thus, there is a need for some intermediate to long-term research to better understand the nature of indoor pollutants, their sources and their dynamic behavior. The IHEC recommends that EPA's strategic planning include plans for research to address these scientific gaps.

In addition to indoor air exposures, biomonitoring is an important tool for assessing risk. The ability to measure indoor air pollutants or their metabolites in biologic tissues, in conjunction with environmental air measurements, is an important next advancement in characterizing the exposure chain. The biomonitoring activities under the third National Health and Human Nutrition Examination Survey III (NHANES III) provided data that have already strengthened the Agency's risk assessments, including some data that is specific to children's risk. NHANES IV, which is being conducted by the National Center for Health Statistics with partial funding from the EPA, will significantly increase this database. The National Human Exposure Assessment Survey (NHEXAS) projects, which are managed by the Office of Research and Development's National Center for Environmental Assessment, National Exposure Research Laboratory, are examples of how to apply advancements in laboratory science to get closer to understanding total, integrated exposure through all media and exposure routes (e.g., inhalation, ingestion, and dermal exposure). The IHEC strongly supports the EPA's efforts in both the NHANES and the NHEXAS projects.

A more extensive analysis of opportunities for risk reduction, including risk associated with exposure to indoor air contaminants, might also be undertaken as an Agency implementation of the Integrated Environmental Decision Making Framework which the SAB is just completing. The IHEC will be pleased to support the Agency in such an effort.

We trust that this Commentary will offer some insights on the importance of the Indoor Air Strategy in expanding our understanding of indoor health risks and risk reduction options, and on the opportunity for the EPA to further contribute to improving the scientific basis for indoor air exposure and health risk assessment.

Sincerely,

/signed/

Dr. Henry A. Anderson, Chair  
Integrated Human Exposure Committee

/signed/

Dr. Joan M. Daisey, Chair  
Executive Committee and Past Chair,  
Integrated Human Exposure Committee

## REFERENCES CITED

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## **APPENDIX A - ACRONYMS AND ABBREVIATIONS**

BASE	-	Building Assessment Survey and Evaluation
HHIP	-	Human Health Indoors Policy
NHANES	-	National Health and Human Nutrition Examination Survey
NHEXAS	-	National Health Exposure Assessment Survey
TEAM	-	Total Exposure Assessment Methodology

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- \* Dr. Weschler is a new Member who joined the Committee after the July meeting but contributed to this commentary letter.



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