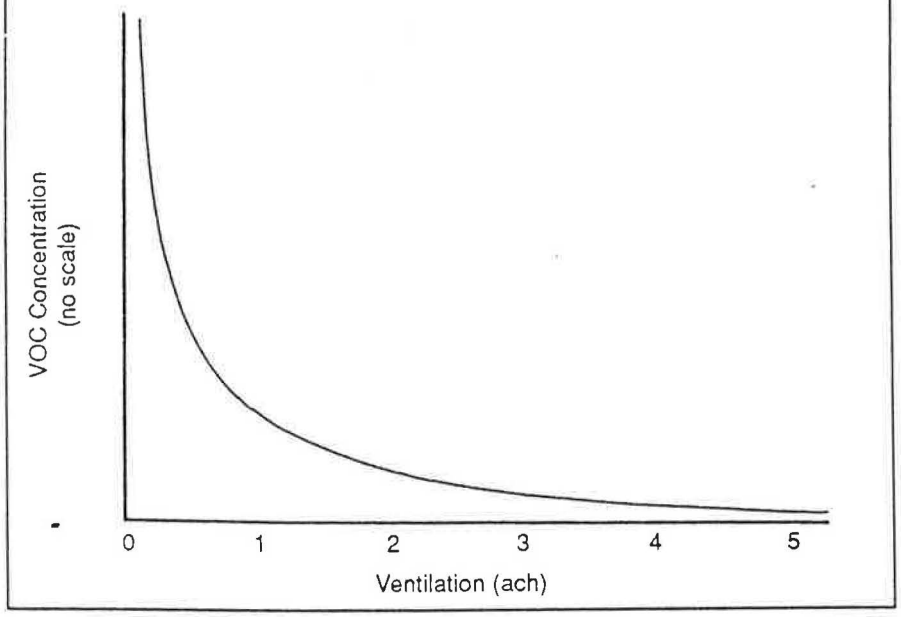
Figure 3 — VOC Concentrations vs Ventilation Rates



in the curve), VOC concentrations increase dramatically. As ventilation increases above the inflection point, VOC concentrations decrease much less rapidly. *The key to economical IAQ control is to maintain ventilation just above the inflection point whenever possible.*

Most ventilation rates measured in the study fell within the critical band where the inflection point usually occurs. Unfortunately, VOC measurements were not made. However, the measurements show that variations above or below typical ventilation rates significantly affect airborne VOC levels in many buildings. From this crude, general analysis, it seems that measurement of VOC levels and ventilation rates provides substantial information to building operators on how to improve both factors. Efforts to control VOC through ventilation without measurements might result in excessive energy consumption (and costs) or not enough ventilation to maintain VOC concentrations at the lowest practical levels.

For More Information

Contact: Andy Persily, National Institute of Standards and Technology, Gaithersburg, MD; (301)975-2000.

References

P. R. Morey and B. A. Jenkins, "What Are Typical Concentrations of Fungi, Total Volatile Organic Compounds, and Nitrogen Dioxide in an Office Environment?"

M. K. West and E. C. Hansen, "Determination of Material Hygroscopic Properties Which Affect Indoor Air Quality."

Dean R. Rask and Charles A. Lane, "Resolution of the Sick Building Syndrome: Part II, Maintenance."

A. Persily, "Ventilation Rates in Office Buildings."

All are to be published in ***The Human Equation: Health and Comfort. Proceedings of IAQ '89.*** Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (in press). Expected availability is early July. Contact ASHRAE Publications, 1791 Tullie Circle N.E., Atlanta, GA 30329 (404)636-8400.

News and Analysis

EPA IAQ Report to Congress

EPA's long-awaited "Report to Congress on Indoor Air Quality" identifies nearly $100 million worth of research needs. However, the Office of Management and Budget (OMB) has not authorized release of the report. Inside sources told *IAQU* that OMB will submit the report to the President's Domestic Policy Council. The council will develop both a position on the report and the Bush administration policy on indoor air. OMB gave no indication when the council would formulate the policy.

Frustrated with the administration's slowness in coming to grips with indoor air issues, Senator Frank Lautenberg released the report at the May 3rd subcommittee hearing on the Mitchell IAQ bill. EPA prepared the report in response to Title IV of the Superfund Amendments and Reauthorization Act of 1986 (SARA). The report consists of an Executive Summary and two volumes as follows:

Volume I: Federal Programs Addressing Indoor Air Quality.

Volume II: Assessment and Control of Indoor Air Pollution.

Executive Summary

The Executive Summary of the report states that "sufficient evidence exists to conclude that indoor air pollution represents a major portion of the public's exposure to air pollution and may

pose serious acute and chronic health risks. This evidence warrants an expanded effort to characterize and mitigate this exposure. Consequently, EPA makes the following recommendations:

1. *Research to better characterize exposure and health effects of chemical contaminants and pollutant mixtures commonly found indoors should be significantly expanded.*
2. *A research program to characterize and develop solutions to biological contaminants in indoor air should be developed.*
3. *Research to identify and characterize significant indoor air pollution sources and to evaluate appropriate mitigation strategies should be significantly expanded.*
4. *A program is needed to develop, promote, in conjunction with appropriate private sector organizations, guidelines covering ventilation, as well as other building design, operation, and maintenance practices for ensuring that indoor air quality is protective of public health.*
5. *A national program of training, technical assistance, and information dissemination is needed to inform the public about the risks and mitigation strategies, and to assist state and local governments and the private sector in solving indoor air quality problems. Such a program should include an indoor air quality clearinghouse.*
6. *The Federal government should undertake an effort to characterize the nature and pervasiveness of the health impacts associated with indoor air quality problems in commercial and public buildings, schools, health care facilities, and residences, and develop and promote recommended guidelines for diagnosing and controlling such problems.*

Volumes I and II

Volume I contains an overview of federal indoor air quality programs.

Volume II provides a wealth of information about indoor air quality and is a valuable asset for indoor air researchers and consultants. Senator Lautenberg made a few copies of the report available at the hearing, but since OMB has not approved the report, it is not available from EPA. Interested parties should contact Sen. Lautenberg's office for information on how to obtain the document.

Volume II identifies the major areas of research needs and project costs as follows:

- Risk assessment methods: $4.95 million for health and hazard identification, dose response assessment, exposure assessment, and risk characterization frameworks and methods.
- Exposure assessment and modeling needs: $13.55 million for methods development and evaluation, measurement studies, development of predictive models, and the management of measurement data.
- Source-specific needs: $42.05 million for research needed regarding indoor air pollution sources. Indoor combustion sources such as tobacco products and indoor combustion appliances, building materials and furnishings, activity sources that emphasize product use and storage, ambient sources of urban pollutants, and biological contaminants are examples of the source category.
- Control techniques: $6.5 million for the evaluation of techniques for controlling specific sources of indoor pollutants and examining the effectiveness of ventilation strategies.
- Building system needs: $14.6 million for studies of infiltration and ventilation in both large and small buildings; field measurements in complaint and non-complaint buildings; and research devoted to building system design.
- Technology transfer: $10.0 million for programs to transfer research results to users in the public and private sectors.

The identified total funding requirements add up to $99.15 million, most of it in five-year research programs. Interestingly, this is almost exactly the $20 million/year for five years authorized by the Mitchell bill. Obviously, some EPA staff think EPA could usefully spend $20 million per year on indoor air research.

On The Horizon

Space-age Technique Aids SERI Ventilation Research

The Solar Energy Research Institute (SERI) in Golden, Colorado, is using an image analysis system to study the performance of ventilation systems. The technology is similar to that used in satellite-based remote sensing applications. SERI is trying to determine how building ventilation rates affect indoor air quality in the "occupied zone," a room's volume to a height of about six feet.

According to SERI Senior Engineer Ren Anderson, the research project will provide technical support to users of ASHRAE Standard 62, "Ventilation for Indoor Air Quality." Standard 62 bases ventilation system design on either a ventilation-rate procedure or an air-quality procedure. Both require the designer to forecast ventilation efficiency in the completed structure.

The image analysis system, which was developed at SERI, allows researchers to study two factors. One is the ability of a ventilation system to deliver air to the occupied zone. The other is the system's ability to remove pollutants before they mix with occupied-zone air. The technique facilitates the study of both advanced and conventional ventilation systems. It also helps determine the effect of room dividers on ventilation.

Rather than sampling air at only a few points in the occupied zone — the limitation of previously used point-measurement systems — the image analysis system digitizes a photo of a tinted fluid simulating air as it moves through the occupied zone. The digitized image provides tremendous resolution. A scientist determines pollutant concentration by measuring optical density at any of the 367,000 pixels in the image.

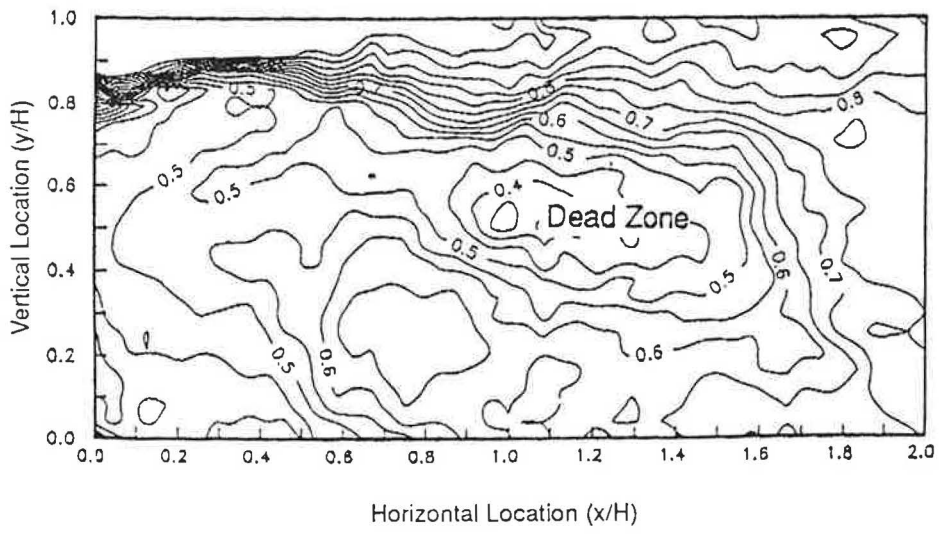
The greater spatial resolution provided by this system results in highly accurate local measurements of air movement and pollutant distribution. Detailed measurements make possible realistic assessments of exposure to room contaminants and allow researchers to validate detailed numerical models of room air movement.

Figure 4 shows an isothermal test with a simple slot diffuser as analyzed by the SERI image analysis system. Note the "dead zone" just to the right and slightly above the middle of the diagram. This sort of image will help design engineers, architects, and testing companies predict and measure ventilation effectiveness.

We visited the SERI laboratory last month and were very impressed with the system's capabilities. We think it is a powerful tool when used in conjunction with design modeling or environmental testing. It will reduce the cost of testing and design studies for implementing Standard 62.

More information on the system is available from Ren Anderson, Technology Leader, Systems Integration, SERI, 1617 Cole Boulevard, Golden, Colorado 80401; (303)231-1736.

Figure 4 — Isothermal Test as Analyzed by SERI's Image Analysis System



Information Exchange

Design and Protocol for Monitoring Indoor Air Quality

Designing studies or investigations of indoor air quality is complicated. Comprehensive investigations are costly. Selecting appropriate methods is difficult, and there are so many factors which affect the concentrations of indoor air constituents.

When monitoring indoor air, the investigator must consider or measure source characteristics, chemical and physical sinks, occupant activities, building ventilation, and many other factors.

Publications that comprehensively address indoor air quality monitoring are scarce. ASTM Subcommittee D22.05 sponsored a three-day symposium in April, 1986, which brought together researchers and investigators with expertise in indoor air monitoring. A collection of papers from that symposium has finally been