

Indoor Air Quality UpdateTM

A Guide to the Practical Control of Indoor Air Problems, from Cutter Information Corp.

Vol. 1, No. 3

Hal Levin, Editor

November 1988

Lead Paint Abatement — A New Hazard

In This Issue

New & Analysis

- Lead Paint Abatement —
A New Hazard 1

Feature

- Selecting an IAQ Consultant . . . 2

Practical Research Briefs

- Adaptation to Indoor
Air Pollution 3
- Productivity and Indoor
Air Quality 7

From the Field

- Ozone in Office Buildings? . . . 7

Tools & Techniques

- Designing a High-
performance Building . . . 10
- Honeywell IAQ Diagnostics
Course 11

Products & Services

- Whole House Air Cleaners . . . 13

Information Exchange

- American Association of
Radon Scientists and
Technologists Inc. 13

- EPA Directory of State
Indoor Air Contacts 13

- And, EPA Releases "The
Inside Story — A Guide to
Indoor Air Quality" 14

- Asbestos Abatement Model
Guide Specifications 14

- "Blueprint for a Healthy Home"
Award, Catalog 14

- ASTM Indoor Air
Measurement Standards
Progressing 15

- Calendar 15

A new indoor pollution control effort is resulting in new indoor air pollution problems. According to the respected construction industry weekly, *Engineering News Record* (ENR, July 14, 1988), "As the federal government begins to mandate the abatement of lead-based paint, regulators are finding that sanding and burning off the material may be as obsolete and hazardous as ripping out asbestos without personal protective clothing."

Burning, sanding, or scraping lead paint can produce very fine lead dust, which sticks to available surfaces and also contaminates household dust. Lead can cause permanent brain damage, especially in children under seven years of age, who are susceptible due to their continuing neurological system development. Since children tend to inhale and inadvertently to ingest lead from their environment, lead is being removed from HUD-assisted housing as well as other buildings.

On June 6, HUD published rules in the Federal Register under the Housing and Community Development Act of 1987. The rules require testing of vacant dwellings prior to re-renting and of a random sample of occupied dwellings. Where lead contamination is found, HUD requires testing of all housing in the project.

Where tests show lead levels of one mg per cubic centimeter of paint, HUD's rules require abatement. Abatement may be achieved either by covering (with wallboard or other wall covering) or by removing the paint.

The rules do not permit machine sanding and the use of propane or gasoline torches. Removal by scraping, heat treatment, or chemicals is permitted. However, the National Institute of Building Sciences, (NIBS) reports that "In most cases, removing the paint by conventional means imposes a severe health risk upon workers and occupants in the home being 'abated.'" The analogy to asbestos abatement is obvious: improper abatement can result in serious contamination, often worse than the situation prior to the abatement activities.

Millions of buildings contain lead paint. NIBS estimates that lead paint was used in 65% of pre-1940 houses, 32% of 40s and 50s houses, and 20% of houses built between 1960 and 1975. The cost of abatement runs about \$8,000 to \$10,000 per typical three-bedroom row house.

The city of Baltimore has its own lead abatement program, including a demonstration project launched years ago. City rules require removing all furniture and sealing the work area with plastic. After paint removal with low-heat guns

or strippers not containing methylene chloride, all surfaces are cleaned with high-efficiency particulate air (HEPA) vacuum cleaners, phosphate washed, vacuumed again, and then repainted. Wood floors are washed and sealed and then vacuumed and washed again.

For more information:

National Institute of Building Sciences, 1015 15th Street, Suite 700, Washington, D.C. 20005; (202)347-5710.

James Keck, Deputy Commissioner, Department of Housing and Community Development, City of Baltimore, 417 East Fayette Street, Baltimore, MD 21202; (301)396-5000.

Feature

Selecting an IAQ Consultant

What do you do when you think you have an indoor air quality problem? Do you measure the air? What do you measure, how is it measured, and who does it? And who figures out what the results mean, especially when there aren't many useful guidelines?

You may have been among the fortunate few who have found consultants able to solve your problems in a timely, cost-effective fashion. With indoor air quality becoming an increasingly common concern of building occupants, a lot of firms are offering indoor air quality services, but many of them are not qualified to deal with this very complex issue.

We have seen many office building owners or leaseholders struggle with how to handle occupant com-

plaints. In most cases someone is eventually brought in to "measure the air," often at a cost of tens of thousands of dollars. And in most cases, the measurements prove inadequate to pinpoint the problem.

Building air quality problems are often complex. The various complaints may relate to different conditions prevailing in various areas of a building, rather than to a single problem or cause. Perhaps conditions are constantly changing, so that investigation at any particular time fails to reveal important facts. Many investigations occur long after the onset of symptoms or complaints; the indoor environment changes in the intervening time. The resulting measurements do not reflect the exposures which led to the original complaints or symptoms.

Air quality investigators tend to be limited by their backgrounds and training. They generally know how to look for problems only as defined by the methods of their own disciplines. Thus, there will be obvious differences between the types of investigations performed by a microbiologist, a chemist, or a ventilation engineer.

Our experience is that you must first define clearly the nature of the problem — health complaint, comfort complaint, absenteeism, disease, annoyance, odor, etc. This in itself may require a variety of skills and disciplines. But it does not necessarily begin with making measurements. If a serious, imminent health threat is apparent or if litigation or negotiations are likely to ensue, then immediate measurements are warranted. Sometimes conditions are transient; in general they are not constant. If they are likely to change rapidly, some early measurements might be

necessary to characterize the conditions prior to identification of causal relationships for the complaints or illnesses.

Finding IAQ consultants is not always easy; finding *qualified* consultants may be considerably more difficult. We suggest that you contact at least three firms and ask them to submit a statement of qualifications, a list of personnel, and pricing information. Conduct limited telephone interviews to determine each consultant's availability and appropriateness for the specific problem at hand. Then, arrange a site visit and interview for the leading candidate. You should pay the potential consultant for the time involved in the site visit without any commitment to continue on the project.

You should ask potential consultants for the following:

- a description of the qualifications of the key personnel who will be responsible for the work;
- a description of the overall approach that will be used;
- prior experience and references;
- estimated cost and time to perform the work;
- some preliminary hypotheses to be investigated;
- copies of relevant publications or professional work which demonstrates their knowledge and expertise in the field.

Some of the skills and activities which might be necessary for a thorough investigation are HVAC engineering analysis, air sampling and analysis (chemical and biological), statistical analysis and design, questionnaire design and administration, and public health or medical evaluation. Not all of

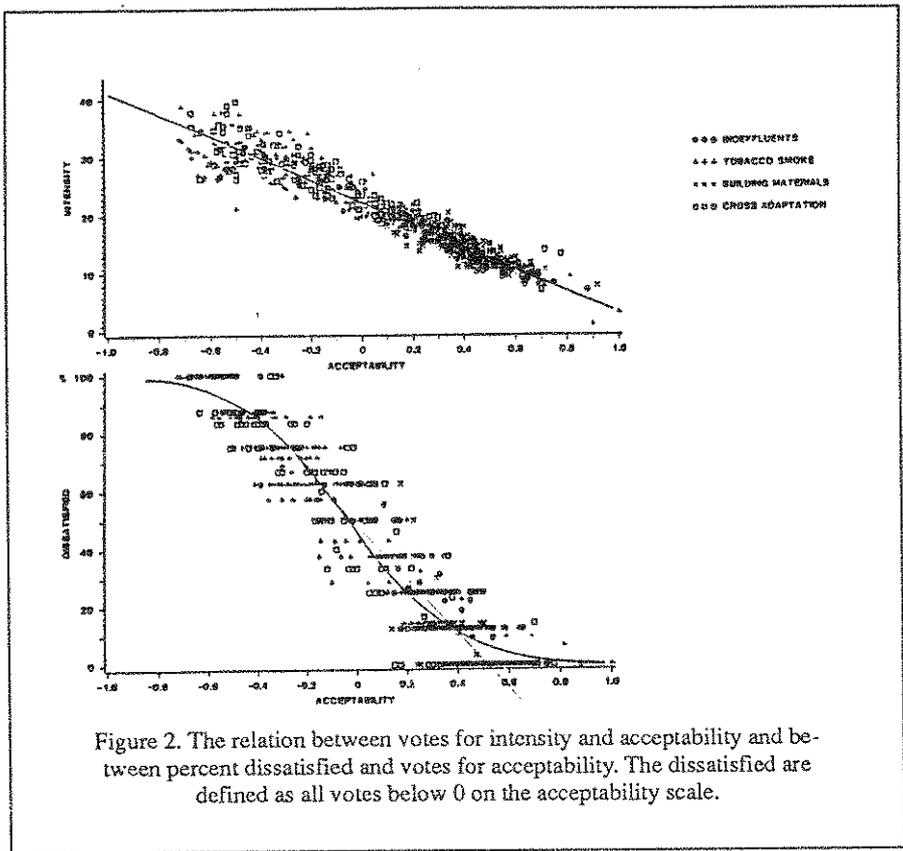


Figure 2. The relation between votes for intensity and acceptability and between percent dissatisfied and votes for acceptability. The dissatisfied are defined as all votes below 0 on the acceptability scale.

In Figure 4, results of the study for adapted and nonadapted subjects are plotted against ventilation rates with an assumed constant CO₂ emission rate of 16.9 l/s. It also shows a plot of Fanger's definition curve for one olf = one standard person for comparison. (Fanger defines the olf, a unit of measure for odor, as the emission rate of bioeffluents from a "standard" person — a person under normal activity, sedentary in thermal comfort, with a hygienic standard equivalent to 0.7 bath/day).

Figure 5 shows intensity and acceptability votes versus CO₂ concentration, which was measured and used as an indicator of tobacco smoke air level. In contrast to votes during exposure to human bioeffluents, the voted "intensity" was higher and voted "acceptability" was lower for both

the subjects had been previously exposed to one of the other odorants). This reflects fairly good consistency in the subjects' responses during the various components of the study.

The exposures were for 15 minutes, but 95% of the changes in votes (apparently due to adaptation) occurred in the first six minutes.

Figure 3 shows the votes during exposure to bioeffluents, with the strength of bioeffluent exposure indicated by CO₂ concentration. Note that adapted subjects voted low intensity and high acceptability regardless of pollutant concentration. In contrast, non-adapted subjects voted higher intensity and lower acceptability for increasing levels of air pollution.

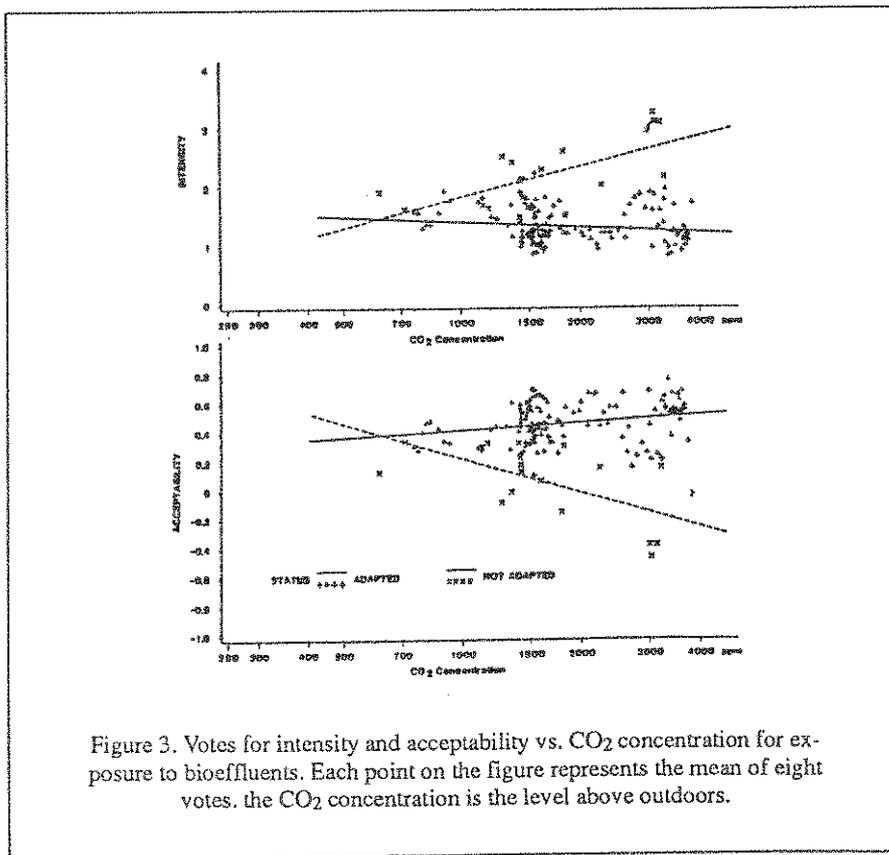


Figure 3. Votes for intensity and acceptability vs. CO₂ concentration for exposure to bioeffluents. Each point on the figure represents the mean of eight votes. the CO₂ concentration is the level above outdoors.

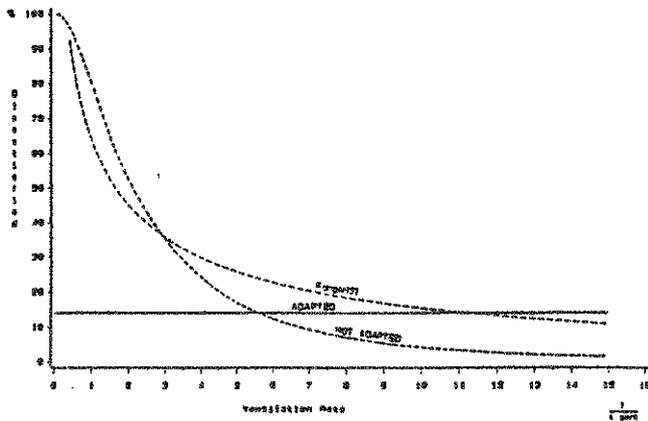


Figure 4. Relation between steady-state ventilation rates and dissatisfaction shown for adapted and nonadapted persons exposed to bioeffluents. Fanger's (7) definition curve for one oil = one standard person is shown for comparison.

The votes for intensity and acceptability of odor from building materials are very similar for adapted and nonadapted subjects. Furthermore, they do not change as pollution levels increase. These results, presented in Figure 7, are hard to interpret other than to suggest that pollution from building materials does not appear to affect people significantly. This seems counter-intuitive and is certainly counter to the experience of many who have found the odor of new carpet or fresh paint unpleasant. The materials used include gypsum board with water-based acrylic paints, stainless steel plates with acrylic sealant and isocyanurate lacquer, chipboard, carpet. However, pollution levels were calculated rather than

adapted and nonadapted subjects during exposure to increasing levels of tobacco smoke. Nonetheless, the adapted subjects voted the concentration less intense and more acceptable than the non-adapted.

Figure 6 illustrates the relationship between steady-state ventilation per cigarette (assuming a CO emission of 44.4 ml/cig.) and percent dissatisfied for adapted and nonadapted persons exposed to cigarette smoke. It also shows the results of work by Bill Cain and his co-workers for comparison. This indicates that the amount of ventilation required for adapted versus nonadapted subjects in order to achieve 80% acceptability is very different. In fact, more than twice as much ventilation per cigarette is required for non-adapted subjects as for adapted subjects.

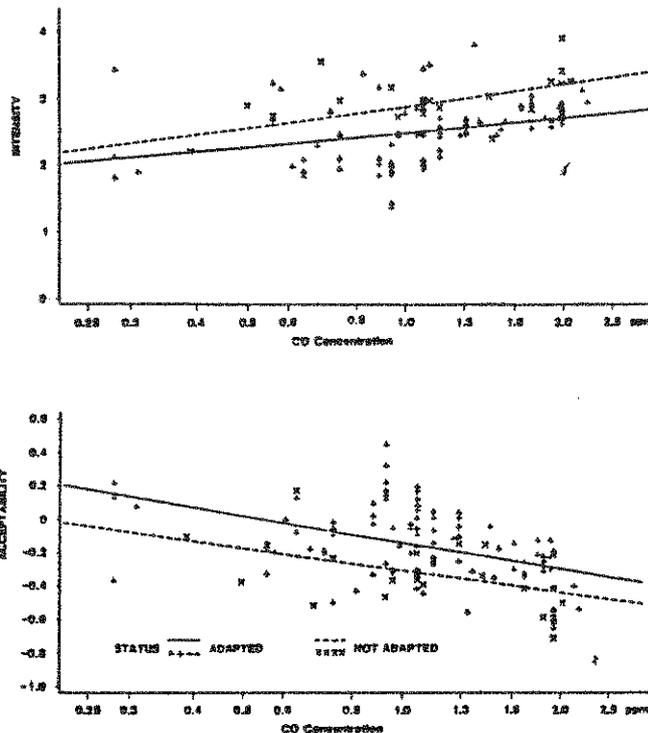


Figure 5. Votes for intensity and acceptability vs. CO concentration above outdoors. Each point on the figure represents the mean of eight votes.

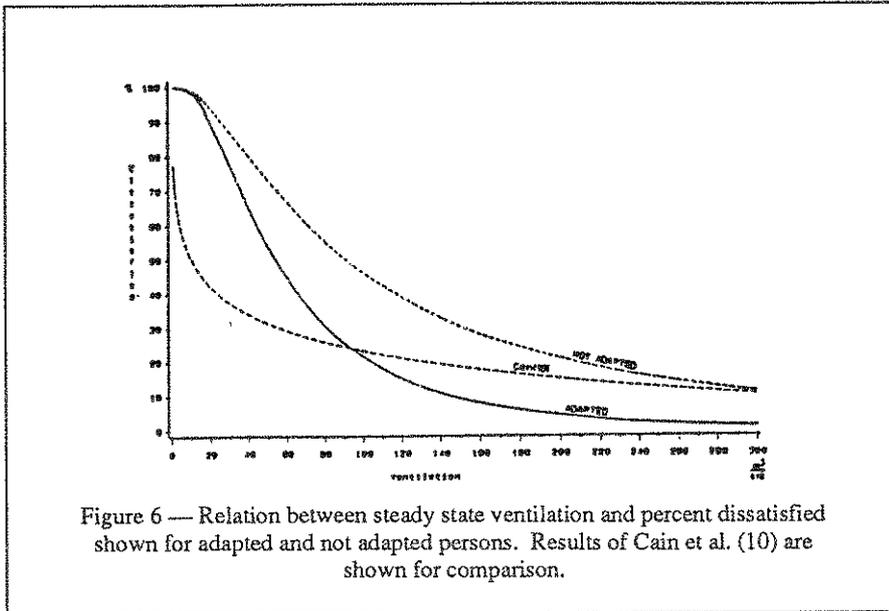


Figure 6 — Relation between steady state ventilation and percent dissatisfied shown for adapted and not adapted persons. Results of Cain et al. (10) are shown for comparison.

not distinguish between smoking and nonsmoking environments, and many criticize it for that reason. Those critics say the absence of the distinction removes some of the presumed or potential health protection and makes the standard strictly an “acceptability” standard. However, Gunnarsen’s work shows that it may not even be adequate as an acceptability standard where tobacco smoke is concerned.

Additionally, the adaptation phenomena indicate that we need to consider both initial responses (upon first entering a space or encountering an odor) and longer-

measured, and it was assumed that the levels were inversely proportional to ventilation rate. In fact, indoor air levels for volatile organic compounds are usually inversely proportional to the log of the ventilation rate.

Practical Implications

An important finding of the study is that “when people enter a space with air pollutants, the air quality initially perceived is least acceptable.” Adaptation takes place during the first few minutes and the air is found to be more acceptable as time passes. If the major pollutant source is human bioeffluents, the air is found to be significantly better after a short period of exposure. If it is tobacco smoke, it is found to be somewhat better after a short period, and if building materials emissions are the major pollutant, it is found to be only slightly better over time.

The study indicates that permitting smoking in buildings significantly increases ventilation requirements. The draft revised ASHRAE ventilation standard (62-1981R) does

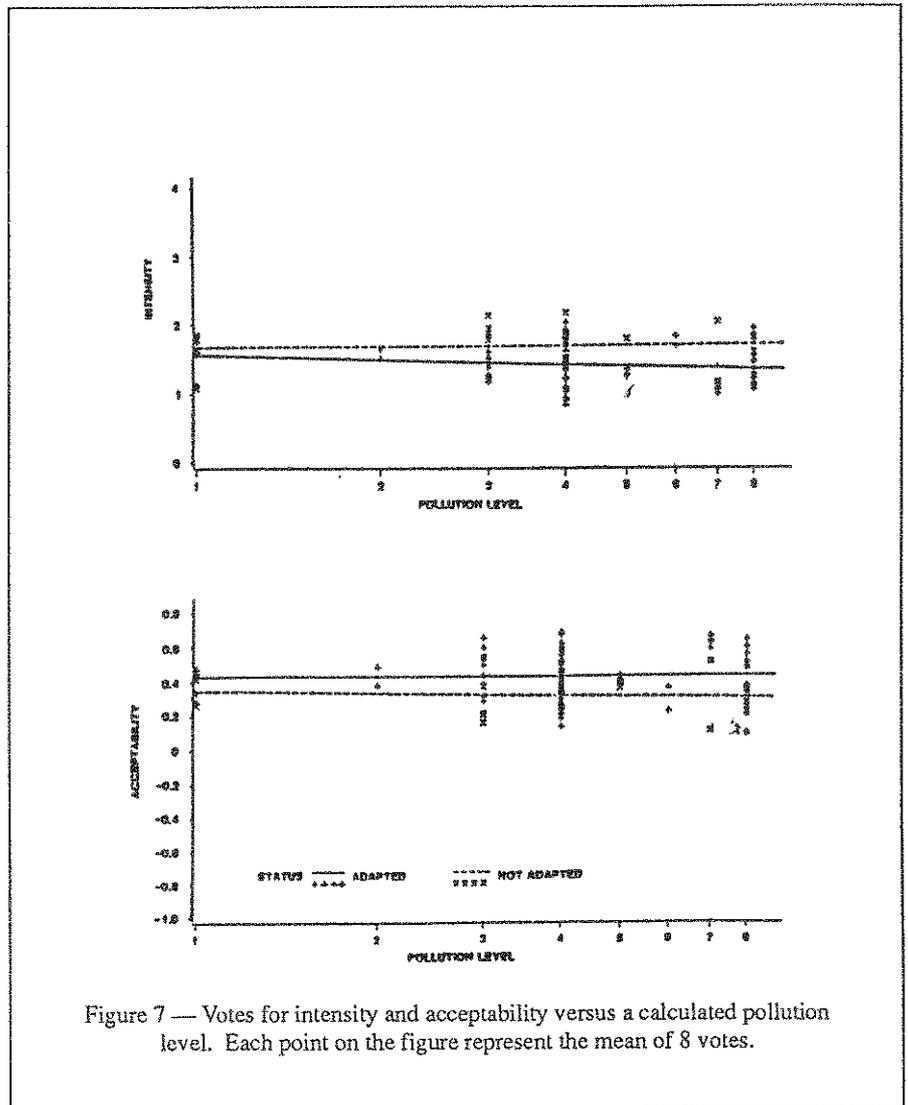


Figure 7 — Votes for intensity and acceptability versus a calculated pollution level. Each point on the figure represent the mean of 8 votes.

term responses (more than 15 minutes) to odors when determining acceptability for the purpose of setting ventilation standards. Gunnarsen calls for longer time periods (several hours) to be used in future studies.

In sum, the question of odors and the acceptability of indoor air is a complex one, we need sophisticated techniques and multiple study conditions to clarify the factors which building operators must understand. Until that research is completed, ventilation should be maintained at relatively high levels when the majority of building occupants first enter any space to minimize dissatisfaction and complaints.

For More Information

Gunnarsen, Lars and Ole Fanger, 1988. "Adaptation to Indoor Air Pollution." in *Healthy Buildings '88*, Vol. 3, Stockholm: Swedish Council for Building Research. pp. 157-167.

For more information on the Fanger approach to odor evaluation and its relation to ventilation requirements, see *IAQU*, October 1988, and also the November 1988 issue of the *ASHRAE Journal*.

Productivity and Indoor Air Quality

EPRI Sponsors User-Controlled Workstation Discussion

The Electric Power Research Institute (EPRI), looking for ways to utilize electric power to improve office environments, recently hosted a two-day workshop to explore possible research topics related to user-controlled workstations. A major concern was to find ways in which research, new

technology, or designs could provide improved indoor air quality through the user-controlled workstation.

"Improved environmental quality improves office worker productivity" is an assumption that the more than thirty participants discussed at length. There seems to be a strong belief among building designers that productivity increases would easily pay the costs of environmental improvements. However, no evidence of such a relationship could be identified, nor was there any agreement about how to define or measure productivity in office environments.

The participants identified a major research need: to identify indices of office worker productivity and to devise ways to measure these indices. Keystrokes or other quantitative measures that reflect industrial productivity are not widely accepted as adequate indices. Corporate or institutional goals such as profitability, public image, and customer satisfaction are among the multitude of indices which might be considered more important in different organizations.

Only after defining office worker productivity, participants said, could studies of the relationship between air quality and other environmental parameters be systematically studied. They agreed that such studies need to be done, but will be difficult due to the problems of defining and measuring office worker productivity.

For more information or a copy of the workshop report, contact Mort Blatt, EPRI, 3412 Hillview Avenue, Palo Alto, CA 94304; (415)855-2000.

Other Related Efforts

EPRI is not alone in its interest. The Gas Research Institute (GRI) and EPA's Division of Indoor Air have expressed interest in exploring the presumed relationship. These institutions as well as most design professionals assume that if building owners appreciated the economic importance of environmental quality, they would be willing to pay the cost of better buildings.

EPA's report to Congress on indoor air (due out at the end of the year) will explore the economic impact of indoor air quality problems. Since indoor air quality often has rather obvious, although not always very specific, physiological and psychological effects on office workers, it is natural that the rapidly increasing interest in indoor air has invigorated the long-standing impact in the economic interest of environmental quality.

Dr. Irv Billick has indicated a strong interest in the issue of productivity and office environments and says GRI would like to conduct research in this area.

Contact: Irv Billick, Gas Research Institute, 8600 Bryn Mawr, Chicago, Illinois 60631; (312)399-3100.

From the Field

Ozone in Office Buildings?

Depletion of the ozone layer in the Earth's atmosphere and the potential resulting global warming effects have received much media coverage lately, but only modest attention has been paid to the existence of elevated local ozone levels, particularly in urban areas. When we looked into indoor

ozone, we were quite surprised by what we discovered.

We were recently challenged to consult on indoor air quality for the design of a new southern California office building, which is to have "model" indoor air quality. We wondered what ozone levels might be found in this area, what was the latest thinking on ozone-related human health effects, and what could be done to control ozone levels indoors.

Indoor Air Ozone Sources

The major identified sources for indoor air ozone are outdoor air, building equipment, and office machines. Indoor devices which cause electrical arcing, including some photocopiers and most electrostatic precipitators, result in elevated ozone levels. Investigators of indoor air quality problems in offices have expressed concern regarding ozone produced by office copiers.

Photocopiers are common in offices, but not all photocopy processes produce ozone. Those that don't usually emit some sort of volatile organic chemicals (see the October 1988 *IAQU*, "Wet Process Photocopiers and VOC").

Electrostatic precipitators are often used in building filtration systems because, when properly maintained and operated, they are effective in removing the small particles that are not well controlled by most in-duct panel filters, even those with very high ASHRAE dust spot efficiency ratings. (But the filter collection surfaces must be cleaned regularly or the removal rate will drop to zero.) The small particles are the ones that penetrate deepest into the respiratory tract, where they can do the greatest health damage (see

the October 1988 *IAQU*, "Air Filtration for IAQ Needs More Study").

Outdoor air in some urban areas, especially in southern California, is contaminated by excess ozone during more than half the days of the year, especially during the summer. And the outdoor levels are highest during the work day. Outdoor levels tend to begin rising between 5 and 7 AM and peak at or shortly after solar noon. Then they fall off rather sharply starting between 1 and 3 PM (daylight time) to negligible levels in early or mid-evening.

Ozone level peaks are observed in the afternoon after a series of hot, sunny, windless days. In southern California, the National Ambient Air Quality Standard (NAAQS) is exceeded for at least one hour on 40% of the days per year and ozone reaches peak levels three times the standard.

Indoor Air Levels

It was believed in the past that "structures protect occupants" from excess ozone levels. This myth prevails today, 15 years after definitive contrary evidence was published in a prominent scientific journal, *Environmental Science and Technology*.

Researchers found that indoor ozone air levels track outdoor levels and lag behind them by a matter of two to four hours. In one report of measurements from both residences and offices, ozone levels indoors began rising between 9 and 11 AM, peaked at about 60 to 80% of outdoor levels just after solar noon, and closely tracked outdoor levels into early evening. (See Figures 1, 2, and 3.)

These data and measurements made elsewhere suggest that indoor ozone levels generally tend to shadow (resemble but lag behind) outdoor levels and reach indoor/outdoor (I/O) ratios of 0.2 to 0.8. In tightly sealed houses with little outside air ventilation, I/O ratios have been found well below the 0.5 I/O ratio, down to 0.2 and 0.3 times the outdoor level. This is one pollutant where more outdoor ventilation will result in higher pollutant levels and minimal ventilation may keep ozone levels low.

People who do not own air conditioning or other effective home cooling methods are likely to open their homes to the outdoors during warm weather, increasing air movement and air exchange between the home and the outdoors. Office workers in non-air conditioned buildings during hot spells are also likely to be exposed to increased ventilation through open windows. Such increases in air exchange would likely be accompanied by an increased indoor/outdoor (I/O) ozone ratio.

Ozone oxidizes materials made from chemicals with unsaturated bonds (such as neoprene and rubber). This might explain the deterioration of some critical building materials such as gaskets used in glazing systems, roof covering components, or expansion joints.

Ozone-related Human Health Effects

The current NAAQS standard for ozone is 120 ppb for one-hour. Recently reported research suggests that a three-hour, 80-ppb ozone air concentration might be a more appropriate standard based on human health effects. Some

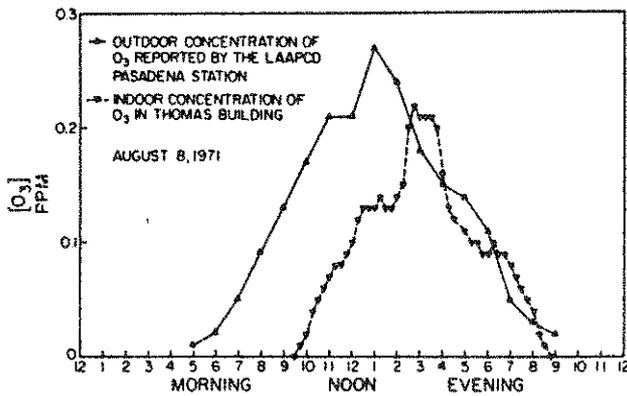


Figure 1. Ozone concentration vs. time of day for Thomas building, August 8, 1971

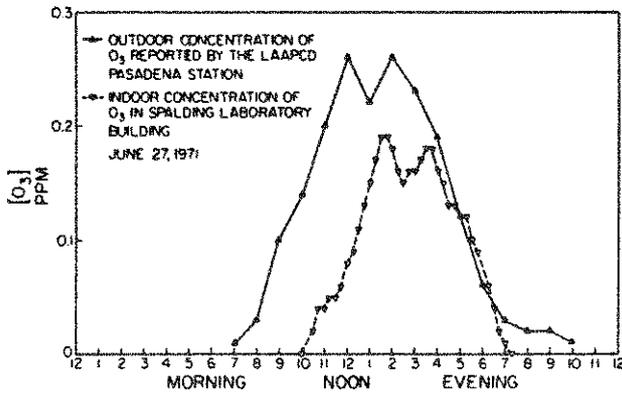


Figure 2. Ozone concentration vs. time of day for Spaulding Laboratory Building, June 27, 1971.

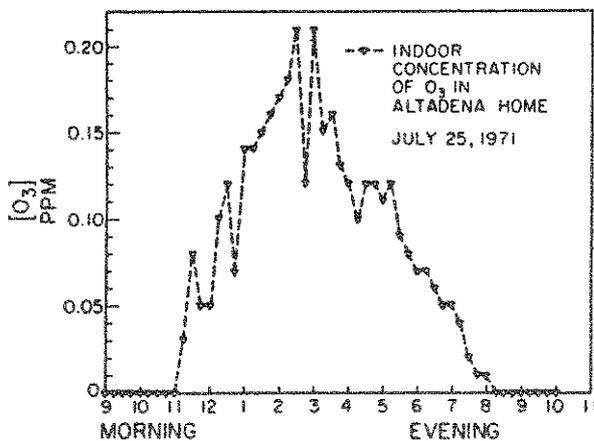


Figure 3. Ozone concentration vs. time of day in private home in Altadena, July 25, 1971.

scientists are urging a lower level over a longer period of time because recent research has shown that human lung functioning is impaired by exposure to lower concentrations over several hours. This was true in studies of children of both sexes at a YMCA camp and for two separate studies of adult, nonsmoking males.

How to Control Ozone Indoors

Some authorities have suggested activated charcoal filters, but surface area and the contact time between ozone and the filter media might have to be quite large to remove the excess ozone present in polluted urban air.

Copper (or other metal) screen coated with a transition metal (such as manganese) as a catalyst is effective for removing ozone, and we are told a similar device is used to filter ozone for aircraft cabin air.

Researchers investigating the removal of ozone by materials found inside buildings discovered that cotton muslin and lamb's wool are the most effective ozone decomposition surfaces, followed closely by neoprene. Plywood and nylon are less than one-third as effective, followed by polyethylene sheet, linen, and lucite. Virtually no decomposition occurs on aluminum or plate glass. We wonder whether the observed ozone decomposition rates for these materials were a function of adsorbed VOC with which the ozone reacted, or whether the reaction was directly with the materials themselves.

The researchers did indicate that a long contact time (perhaps minutes or hours rather than seconds) is required for the decomposition to occur. This might have implica-

tions for the rate at which air is circulated in buildings as opposed to the quantity of outside air that is brought indoors.

There is a price to be paid for the decomposition of ozone: the materials involved, particularly rubber, will deteriorate over time. This can be (and is) a problem for some building materials exposed to high ozone levels inside or outside building walls.

Ozone levels can be lowered by a decrease in ventilation rates, especially during periods when outdoor levels are elevated. This reduces intake and also provides a longer residence time, which is required for removal of ozone by materials within the building interior.

Implications

Based on the information we have seen recently, we consider ozone a seriously neglected indoor air pollutant. All the ingredients are there for significant concern: large segments of the population exposed for significant time periods to levels known to cause acute and chronic health effects.

We do not expect the federal ambient air quality ozone standard to be lowered soon; it would simply be impractical for most major metropolitan areas to comply with an 80-ppb, three-hour ozone standard without massive reductions in the use of motor vehicles and some industrial activities. A tighter ozone standard would create major problems for many urban areas around the country, which are not able to comply with the current standard of 120 ppb.

But we do believe it is reasonable to expect some new guidelines for indoor levels. These should be

levels that provide reasonable protection for public health and can be achieved with presently available, economically feasible filtration technology.

Tools and Techniques

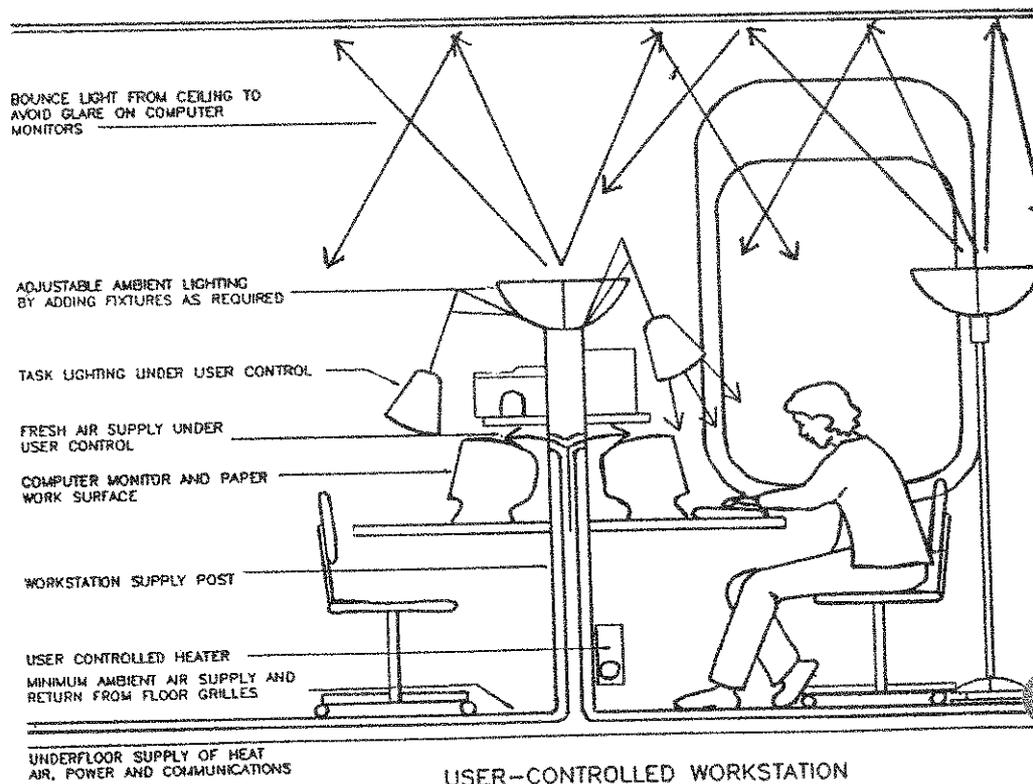
Designing a High-performance Building

On August 25th and 26th, 17 building professionals ranging from architects and engineers to realtors and developers brainstormed the design of a new office building, with an emphasis on air quality, lighting, and energy efficiency. The design charette was sponsored by Energy, Mines and Resources, Canada (EMRC) and hosted by The Iredale Partnership, a Vancouver architectural firm. The EMRC sponsorship was for the purpose of testing "the effectiveness of additional preliminary design effort in improving the en-

vironmental quality and energy efficiency of the work environment."

The product of the charette was a design scheme for an 80,000-square-foot office addition to an existing office facility of 52,000-square-feet. The existing space is occupied by a governmental agency; the new space will be offered for lease to high-tech tenants, a restriction imposed by local zoning ordinances.

The design team focused on building materials as pollution sources, air quality problems from tight envelopes and reduced ventilation rates, and poor lighting quality and thermal comfort. The designers tried to solve these problems without generating excessive capital costs, a major client concern. We participated in this exercise and were surprised to see the very sophisticated appreciation of IAQ



issues and solutions shared by the participants.

The resulting solution started with the individual workstation and the site constraints and ended with a conceptual design and schematic for the whole building. The workstation concept included user control of the lighting, ventilation, and thermal environment (see Figure 1).

Desk-top air supply outlets are fed through flexible ducts under the raised floor. Illumination is with maximal daylight from perimeter windows and a light shelf, indirect (uplights) for general area illumination, and desk-top task lights.

Several aspects of the design reflect the participants' generally shared concern with IAQ and other work environment concerns:

- User-controlled, individual, desk-top air supply distribution units allow direct supply of air into the breathing zone and allow individuals to regulate the quantity and direction of the flow.
- The general upward flow of supply air to returns means one person is not receiving air supply that is essentially exhaust from the upwind person(s).
- Heating is separated from the air supply system by providing radiant heating units located near the floor, possibly one per work station.

One of the major challenges in developing a building is the coordination of the various specialized technical consultants involved. Bringing the disciplines together at the outset is recommended by many authorities, and we found the exercise a rewarding one. We believe that this practice is

worthwhile and should be replicated whenever possible.

For more information

Rand Iredale, The Iredale Partnership, 1151 West 8th Avenue, Vancouver, British Columbia, Canada V6H 1C5.

Honeywell IAQ Diagnostics Course

In the premier issue of *IAQU* (May 1988) we described Honeywell's proposed one-week IAQ Diagnostics course. The course has run twice now, and Jim Woods of Honeywell told us that it was even more successful than he had expected. He was particularly pleased with the mix of professionals who have attended and the degree to which they were willing to consider other disciplinary viewpoints. Woods said, "We're very pleased with the success of the course in integrating the viewpoints of the engineer, the industrial hygienist, and the architect."

The course has two focal points: the first is the principles of diagnostics, with practical resolution of a problem based on examination of construction documents (working drawings). The second is the actual inspection of an occupied space.

One of the requests from participants is for more information on psychometrics, air movement, and air distribution including ventilation. Woods is pleased with these requests and says Honeywell will respond to them in future offerings.

The program is set up to handle 16 people per course, and it fills up fairly quickly. Four are planned for next year, with the next one probably near the end of February.

For more information, contact IAQ Diagnostics, Honeywell, Golden Valley, MN 55422-3922; (612)542-7043.

Products and Services

Whole House Air Cleaners

Thurmond Air Quality Systems

The Thurmond IAQ-2000 is the only HVAC system we have seen that is designed for the whole house with indoor air quality as a primary objective. It contains a high-efficiency final filter and a carbon module to remove both particles and gases from indoor air. Its three-stage filter train comprises a pre-filter, a carbon module, and a final filter (see Figure 1.)

The pre-filter is a medium-efficiency, pleated disposable unit with an ASHRAE dust spot rating of 25-30%. The carbon module is 2,000 cubic inches of one of four available types. The final filter is a high-efficiency extended surface medium with an average ASHRAE dust spot efficiency of 90-95%. HEPA 99.97% filters are available as an optional final filter where air quality requirements make them necessary.

The carbon modules are available in four different types for various applications. The Type I activated carbon is made from natural grain coconut shell for general purpose odor and gaseous contaminant removal. The manufacturer states the unit is designed to provide one year of removal for space volumes up to 40,000 cubic feet in a standard installation. This would be ten times the volume of a typical 1,250-square-foot house with eight-foot ceilings. The actual life of the filter will depend on the

level of contamination of the space being conditioned. Type II is chemically treated activated carbon designed especially for enhanced formaldehyde removal. The Type III module is made from various special-purpose media targeted at specific gaseous contaminants. The Type IV medium consists of a combination of Types I, II, and III in separate racks to avoid common contact and reduced adsorption efficiency.

While the unit is designed for residential use, it could be installed in a small commercial office space or other environments that require improved indoor air quality. Options available include a hot water heating coil, two- to five-ton cooling coils (refrigera-

tion or chilled water), and various enclosure options to adapt the unit to various purposes and installations.

Pricing varies with the product and installation. Current experience is that the installed price will be in the \$3,500 to \$4,500 range. Filtration only may be purchased as a retrofit, and costs about \$1,900 to \$2,500 installed.

You should obtain information on availability and pricing for specific jobs from a local contractor, installer, or mechanical engineer.

For more information

Thurmond Development Company, P.O. Box 23037, Little Rock, AR 72221; (501)227-8888.

QualitAire Fan Coil/Filtration Units

QualitAire, Inc., (formerly Scan Aire) manufactures compact air handlers, rated at two through eight tons, designed to be connected to remote condensing units, chillers, and water heating systems. They have three filter stages, like the Thurmond systems described above. These units are intended primarily for commercial installations, but they are also used for other specialized applications. (See Figures 2 and 3.)

The pre-filters are ASHRAE 30% disposable units intended to remove the large particles and protect the heat transfer surfaces for efficient operation. The Gas/Odor Module contains an alumina substrate impregnated with potassium permanganate for removal of common gases and odors. The Primary, Final Particle Filter is an ASHRAE 90-95% disposable pleated filter for removal of mists and solid and microbiological particles down to 0.3 micrometers. QualitAire told us that a DOP-rated HEPA final filter is also available and would add about 10 to 15% to the cost of a unit.

Filter options are available as custom designed options for special applications. QualitAire estimates filter life at one year for typical applications. But you should base replacement frequency on the actual installation, pollution generation, and other requirements.

The units are available in a variety of sizes to meet different installation requirements. The filtration section is available separately from the heat exchanger and fan of the fan coil units described above. Options include the High Effici-

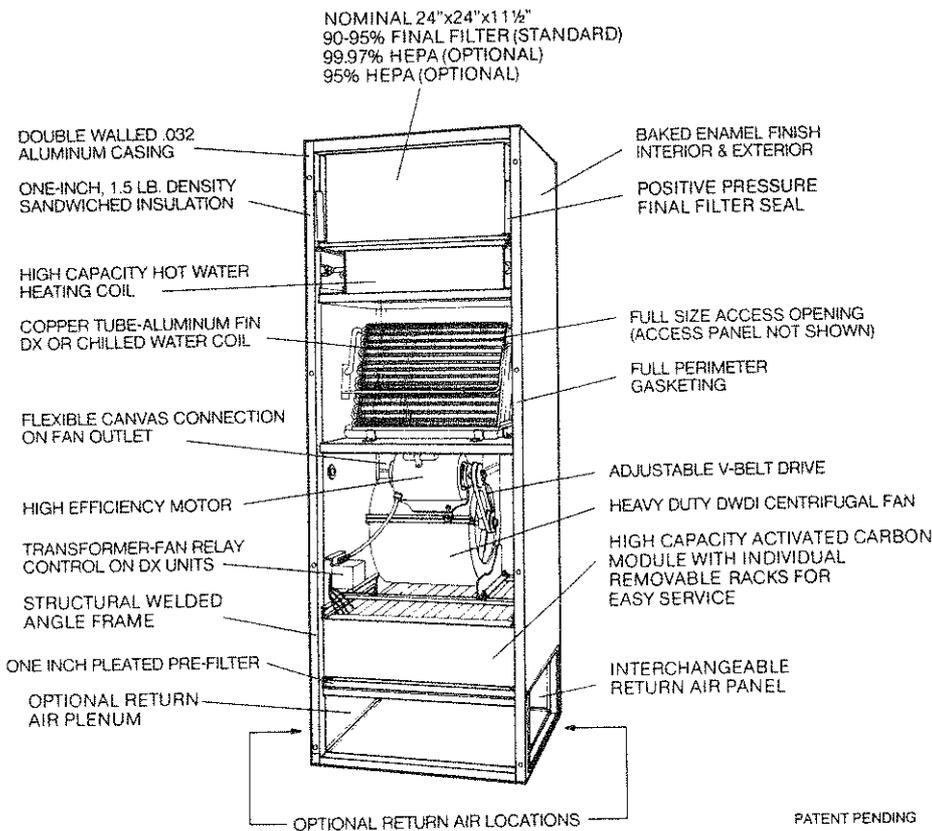


Figure 1: Thurmond IAQ unit

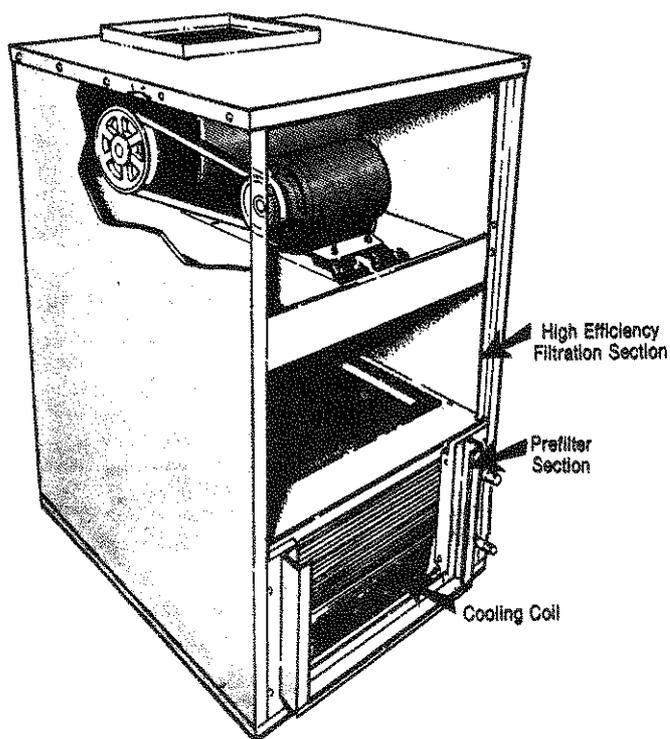


Figure 2. QualitAire air handler.

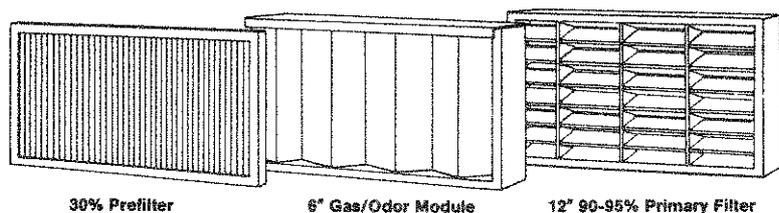


Figure 3. Standard filter configuration

ency Fan Filtration units available either as a terminal for a standard constant-volume air supply system or as a self-contained filtration unit. QualitAire also offers the Model MA 5 Air Filtration Unit for installation above dropped ceilings of commercial office space or other commercial spaces where improved indoor air quality is required.

Industrial models are also available and can be tailored to remove individual pollutants.

Michael Lawler of QualitAire in Atlanta told us that they developed their products to replace electrostatic precipitator (ESP) units, which they were installing and servicing in bars, restaurants, and designated smoking areas for smoke control. They found that the

ESP units did nothing to control gaseous contaminants and were not trouble-free. Five years ago they designed the QualitAire products to use in those installations and to market to the general building industry.

For more information
QualitAire, 5000 Highlands Parkway, Suite 180, Smyrna, GA 30080; (404)431-0025.

Information Exchange

American Association of Radon Scientists and Technologists Inc. (AARST)

Scientists and consultants involved in radon assessment and mitigation formed this association in 1986, and it has been getting more active as the issue receives increased attention. The group is currently attempting to cooperate with state and federal officials to bring about certification of radon investigators and firms offering mitigation services.

Mike Terpilak, chairman of the mid-Atlantic chapter and a radon mitigation specialist, says that protecting consumers from ill-trained or ill-equipped firms offering assessment or mitigation services is the group's number-one priority.

For more information, contact AARST, P. O. Box 70, Park Ridge, NJ 07656; (201)391-6445.

EPA Directory of State Indoor Air Contacts

The U.S. Environmental Protection Agency has published a handy guide to state IAQ contacts. For each state, the guide presents a list of state agencies involved in IAQ

issues and a list of contacts by pollutant or type of problem.

The directory includes names, addresses, and phone numbers of contact individuals for each listing. It also lists the members of the Federal Interagency Committee on Indoor Air Quality (CIAQ), national hotlines and information services, and EPA regional IAQ contacts. The publication is numbered EPA/400/1-88-003, and is available at no charge from EPA Regional Offices or by calling the Public Information Center at EPA in Washington, (202)382-2080.

...And, EPA Releases "The Inside Story — A Guide to Indoor Air Quality"

On November 10, as we went to press, the EPA announced the release of three publications: the "Directory of State Contacts" described above; a 32-page booklet for homeowners entitled "The Inside Story — A Guide to Indoor Air Quality"; and a massive report of a four-year study involving the monitoring of IAQ in 10 public access buildings and the testing of emissions from 50 common building materials. The report is titled "Indoor Air Quality in Public Buildings."

The homeowners' guide is the first EPA publication on indoor air that translates research into practical advice for the public. It provides a clear description of the sources of indoor air pollution, their health effects, and what to do about them. It is an attractive booklet and will be useful for consultants doing both residential and nonresidential indoor air work. The guide (EPA/400/1-88/004) is available by calling the Public Information Center at EPA in Washington,

(202)382-2080, or from regional EPA offices, while the supply lasts.

"Indoor Air Quality in Public Buildings" is a weighty tome (over 1,000 pages in two volumes). It represents a very substantial amount of well-conducted research, which gives valuable information about the contributions of different building materials to indoor air pollution and about the changes in emissions over the early life of a building.

Lance Wallace, who managed the study for EPA, told us that the highest emitter was adhesive used for base moldings, followed by paints and caulks. Surprisingly, he said, urethane sealants were pretty low emitters. He commented that the vinyl and hard rubber base cove moldings were fairly high emitters as well.

Wallace calculates that the half-life for the materials they tested was generally about 2-8 weeks in the laboratory and closer to 6-12 months in the buildings. We speculate that the differences relate to sink effects (or sponge effects as we called them in the October *IAQU*), to reduced ventilation in the buildings, or to some combination of the two.

We will describe the results and implications of the study in greater detail in the December *IAQU*.

The two volumes of "Indoor Air Quality in Public Buildings" are numbered EPA/600/6-88/009 A and B. Copies of the report, while they last, are available at no charge from the Center for Environmental Research Information, Cincinnati, OH 45268 from EPA Regional Offices, or by calling the Public Information Center at EPA in Washington, (202)382-2080.

After the freebies are gone, they will be available at a substantial cost from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. Brief summaries (eight pages for each volume) will be published as EPA/600/6-88/009AS and EPA/600/6-88/009BS.

Asbestos Abatement Model Guide Specifications

The National Institute of Building Sciences (NIBS) has just published the second edition of the *Asbestos Abatement and Management in Buildings, Model Guide Specifications*. This is a comprehensive guide and resource for people involved in design, construction, management, or operation of buildings involving asbestos abatement. (We described it briefly in the September 1988 *IAQU*.) It has been revised to include changes reflecting AHERA and to incorporate knowledge gained during the time since the first edition was published.

This is a consensus document reflecting concerns of various viewpoints from building owner to insurer, from government to asbestos manufacturer, from architect to abatement contractor. It is particularly useful in the preparation of contract documents for construction, remodeling, or asbestos management and abatement projects.

The guide is available in hardcopy or on diskette in major word processing formats. The cost is \$125 for hardcopy and \$175 for hardcopy and diskette (discounts are offered to NIBS members). Diskettes cannot be purchased separately.

Contact: Pamela R. Williams, Publications Manager, National In-

stitute of Building Sciences, 1015 15th Street, Suite 700, Washington, DC 20005; (202)347-5710.

"Blueprint for a Healthy House" Produces Award, Catalog

At their recent 2nd Annual Conference for the Housing Industry, the Housing Resource Center and other sponsors presented "Blueprint for a Healthy House." Along with the many speakers was the selection of Healthy House Award winner. This year's award went to Rad Elec Inc.'s E-Perm System for radon gas detection.

The Rad Elec E-Perm uses an electrostatically charged plastic sheet, which can be directly read by professionals possessing the necessary voltmeter and conversion tables. The devices are reusable. Homeowners can send the device to the manufacturer for a readout. (See the September 1988 *IAQU* for a more complete description of the product.) Rad Elec Inc. can be contacted at (301)694-0011.

The Healthy House Catalog contains a few short but useful articles on residential indoor air quality control and 100+ pages of lists and descriptions including 493 products, services, organizations, and businesses that help identify or control indoor air pollutants, particularly in the residential environment. To obtain a copy of the catalog, contact: Housing Resource Center, 1820 W. 48 St., Cleveland, OH 44102; (216)281-4663.

ASTM Indoor Air Measurement Standards Progressing

A major barrier for people working on IAQ is the absence of standardized methods for sampling and

analyzing indoor air. Such methods, if available and widely used, would contribute substantially to progress in indoor air research, product development, investigations of problem buildings, and many other key IAQ concerns.

ASTM Subcommittee D22.05 on Indoor Air is developing standard methods for testing indoor air as well as for measuring related factors important to IAQ evaluation. Its work is progressing toward publication as standards for many chemical and biological agents affecting in indoor air. [Note: Hal Levin, editor of *IAQU*, is chairman of the subcommittee.]

The first method to come from the committee's work is for monitoring pesticides and PCBs. EPA developed the method and it has been used widely for its field studies. The committee has also successfully balloted a practice specifically for chlordane and heptachlor, which should soon be published.

A method for passive monitoring of NO₂ (using Palmes tubes) has been published as a proposal in order to obtain more field data from those using it. This is necessary before it can be adopted as a standard method through ASTM's voluntary, consensus-based standards writing process. If you have such experience, please contact the lead author, Roy Fortmann, at GEOMET, Inc., (301)428-9898.

Other standards under development now include a guide for chamber testing to evaluate emissions from materials and consumer products which are potential sources of indoor air pollutants, several methods for asbestos sampling and analysis, several

methods for radon measurement, and guides for the application of asbestos or radon measurement methods. The subcommittee is also working on methods for sampling and analysis of nicotine, PM₁₀ (particles less than 10 microns in diameter), CO₂, ozone, and several methods for formaldehyde and for volatile organic compounds, among others.

The subcommittee is also developing a guide for the investigation of indoor air quality problems in offices and will eventually develop similar guides for schools and residences.

The subcommittee meets twice a year and its meetings and membership are open to all interested parties. Membership is not a requirement for participation, although it is required to vote on proposed standards. The cost is reasonable and a free volume of ASTM standards is sent to each member each year, thus practically paying back the cost of membership.

The next meeting will take place in Philadelphia, June 6-9, 1989. The subcommittee will sponsor a symposium on biological contaminants in indoor air, July 16-19, 1989, in Boulder, Colorado.

Interested readers should contact George Luciw, Staff Manager, at ASTM Headquarters, 1916 Race Street, Philadelphia, PA 19103; (215)299-5571.

CALENDAR

North America

November 28-29, **Asbestos: The \$100 Billion Challenge**, New York, New York. Sponsored by ENR and Tectron Group, Inc. Contact: Tectron Group, Inc., 123 Main St., White Plains, NY 10601; (800)223-2170, or in NY State, (914)428-0800.

January 22-25, 1989, **Cooling Tower Institute Annual Meeting**, New Orleans, Louisiana. Contact: CTI, P.O. Box 73383, Houston, TX 77273; (713)583-4087.

January 22-26, 1989, **American Society of Mechanical Engineers Annual Meeting**, Houston, Texas. Contact: Frank Demerest, ASME Petroleum Division, 13773 North Central Expressway, Suite 1314, Dallas, TX 75243; (214)437-0094.

January 28 February 1, 1989, **ASHRAE Winter Meeting and Exhibition**, Chicago, Illinois. Contact: Jim Norman, ASHRAE, 1791 Tullie Circle, N.E., Atlanta, GA 30329; (404)636-8400.

February 3-4, 1989, **Symposium on Architecture and Building Construction Issues, with Consideration of Regional Climatic Conditions**, Baton Rouge, Louisiana. Contact: Dr. Jason Shih, School of Architecture, Louisiana State University, Baton Rouge, LA 70803.

April 17-20, 1989, **IAQ 89: The Human Equation: Health and Comfort**, San Diego, California. Contact: Jim Norman, ASHRAE, 1791 Tullie Circle, N.E., Atlanta, GA 30329; (404)636-8400.

May 2-5, 1989, **EPA/APCA International Symposium on Measurement of Toxic and Related Air Pollutants**, Raleigh, North Carolina. Contact: Seymour Hocheiser, Environmental Monitoring Systems Laboratory, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.

July 16-19, 1989, **Symposium on Biological Contaminants in Indoor Environments**, ASTM Subcommittee D22.05 on Indoor Air, Boulder, Colorado. Contact: Staff Manager, Subcommittee D22.05 on Indoor Air, ASTM, 1916 Race Street, Philadelphia, PA 19103; (215)299-5400.

October 11-13, 1989, **Blueprint for a Healthy House Conference**, Cleveland, Ohio. Contact: Housing Resource Center, 1820 W. 49 St., Cleveland, OH 44102; (216)281-4663.

INTERNATIONAL

November 22-26, **Expoclima: Symposium on Air Conditioning, Refrigeration and International Trade**, Brussels, Belgium. Sponsors: European Committee of Manufacturers of Ventilation Equipment and the European Committee of Air Handling and Air Conditioning Manufacturers. Contact: Brussels International Trade Fair, Place de Belgique, 1020 Brussels.

November 23-24, **Symposium: Air Conditioning and Refrigeration**, Brussels, Belgium. Contact: M. van der Horst, Fabrimetal, Rue des Drapiers 21, B-1050 Brussels, Belgium; phone: (32)2/510 25 18.

February 14-16, 1989, **Present and Future of Indoor Air Quality**, Brussels, Belgium. Sponsored by the Belgian Ministry of Public Health, The World Health Organization, and the Belgian Ministry of Hygiene and Epidemiology. Contact: D. Shanni, E.C.C.O. sprl, Rue Vilain XIII, 17 A, B-1050 Brussels, Belgium.

June 19-22, 1989, **11th International Congress on Quality for Building Users**, Paris, France. Sponsored by the Council for Building Research, Studies and Documentation (CIB). Contact: Jean-Louis Feliz, Centre Scientifique et Technique du Batiment Relations Exterieurs, 4 avenue du Recteur-Poincare, 75782 Paris Cedex 16 France; phone: (1) 45 24 43 02.

June 20-24, 1989, **ASHRAE Annual Meeting**, Vancouver, British Columbia, Canada. Contact: Jim Norman, ASHRAE, 1791 Tullie Circle, N.E., Atlanta, GA 30329; (404)636-8400.

June 23-24, 1989, **"Building Simulation '89: Technology Improving the Energy Use, Comfort, and Economics of Buildings Worldwide"**, Vancouver, British Columbia, Canada. Sponsored by the International Building Performance Simulation Association. Contact Dr. Marianne McCarthy Scott, MCC Systems Canada Inc., 30 Wellington Street East, 202 Toronto, Ontario, Canada M5E 1S3; (416)368-2959.

September 1, 1989, **CLIMA 2000, the Second World Congress**, Sarajevo, Yugoslavia. Contact: CLIMA 2000, Massinski Fakultet, Prof. Dr. Emin Kulic, 71000 Sarajevo, Omladinsko Setaliste bb, Yugoslavia

October 16-20, 1989, **The Sick Building Syndrome**, Copenhagen, Schafergarden. Sponsored by the Nordic Institute of Advanced Occupational Environment Studies (NIVA). Contact: NIVA, c/o Institute of Occupational Health, Topeliuksenkatu 41 a ASF-00250 Helsinki, Finland; phone: +358-0-47471.

July 29-August 3, 1990, **5th International Conference on Indoor Air Quality and Climate**, Toronto, Ontario, Canada. Contact: Dr. Douglas S. Walkinshaw, Centre for Indoor Air Quality Research, University of Toronto, 223 College Street, Toronto, ON Canada M5T 1R4.

Editor: Hal Levin

Publisher: Karen Fine Coburn

Circulation Manager: Kim Gay

Reprint Manager: Ed Coburn

Production: Ellen Bluestein

Editorial Office:

INDOOR AIR QUALITY UPDATE
2548 Empire Grade
Santa Cruz, CA 95060
Phone: (408)425-3846

Circulation Office:

CUTTER INFORMATION CORP.
1100 Massachusetts Avenue
Arlington, MA 02174, U.S.A.
Phone: (617)648-8700
Telex: 650 100 9891 MCI UW
Fax: (617)648-8707

Subscriptions:

\$207 per year for single subscription (U.S. and Canada); \$247 foreign subscription. Published monthly by CUTTER INFORMATION CORP. Copyright © 1988. All rights reserved. Reproduction in any form whatsoever forbidden without permission.

When changing your address, please include both old and new addresses with Zip code numbers, accompanied by a recent mailing label.