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TESTIMONY OF PAUL A. CAMMER, Ph.D.
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BEFORE THE
SUBCOMMITTEE ON HEALTH AND THE ENVIRONMENT
OF THE COMMITTEE ON ENERGY AND COMMERCE
UNITED STATES HOUSE OF REPRESENTATIVES
REGARDING
INDOOR AIR QUALITY

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Paul A. Cammer, Ph.D.
President

Good morning. My name is Paul Cammer, President of the Business Council on Indoor Air (BCIA). I am pleased to be here this morning to present BCIA's views regarding indoor air quality.

BCIA represents a wide spectrum of industries interested in indoor air quality. Our membership is composed of firms with analytical and engineering expertise in monitoring, controlling, and improving the quality of the indoor environment, companies that are owners of and/or tenants in a wide variety of commercial buildings and manufacturers of chemicals, consumer products, and building materials.

BCIA agrees with Congressman Joseph Kennedy and the other sponsors of indoor air legislation that protecting indoor air quality is of primary importance. BCIA further agrees that federal resources should be directed at identifying indoor air quality problems and at finding the most efficient methods to remedy those problems. We worked with the staff of the House Science, Space and Technology Committee and other interested parties in the development of indoor air quality legislation in the last Congress.

This morning we would like to address both the general issues relating to a federal indoor air quality strategy and the specific issues raised by the provisions of indoor air legislation that has been introduced in the House. In this testimony, we will discuss the overall approach to addressing indoor air quality, the need for additional research on indoor air pollution, and the appropriate nature of any regulatory initiatives and public communications regarding this issue. Our testimony also will address interagency coordination of indoor air activities.

In general, BCIA questions the need for indoor air legislation, in light of existing federal authorities and programs. We do not oppose legislation, however, that would better clarify and coordinate federal research and other activities directed at cost-effective solutions to indoor air quality problems.

I. Building-Systems Approach[1]

The accumulation of contaminants indoors, whether visible (e.g., tobacco smoke) or invisible (e.g., radon), whether odoriferous (e.g., solvents) or odorless (e.g., biological contaminants), generally is symptomatic of a larger problem resulting from the energy conservation measures implemented since the early 1970s.

Two of the most common factors in buildings with reports of poor indoor air quality are inadequate ventilation and poor filtration. The results of building investigations by the National Institute for Occupational Safety and Health (NIOSH) show that 52 percent of indoor air quality problems were due to poor ventilation alone.[2] Ventilation problems, in turn, can result from insufficient outdoor air intake and/or poor distribution of that air. Inadequate filtration is frequently a major contributor to the third most common problem: the accumulation of dirt, dust, and microbes inside the air handling units and their associated duct work.

In a 1987 report, the National Research Council (NRC) noted the complexities associated with identifying the source of occupant symptoms and complaints related to indoor air quality problems as follows:

> A number of factors are involved in the generation of building-related occupant complaints. Many of these can occur simultaneously. It is rare that a specific source for the complaints can be identified, and solutions can usually be implemented without such identifications.[3]

The NRC report further noted that:

> The levels of both chemical and biological contaminants are strongly associated with the cleanliness of the heating, ventilation and air conditioning system.

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1 The building-systems approach is described in greater detail in Exhibit 1.

2 Wallingford, M. J. et al., 1984, Indoor Air Quality - The NIOSH Experience, Ann. Amer. Conf. Gov. Ind. Hyg., Volume 10.

3 NRC, 1987, Policies and Procedures for Control of Indoor Air Quality.

The U.S. Environmental Protection Agency (EPA), in its recent Report to Congress, further noted that "more can be done to reduce overall exposures and risks by altering building designs and ventilation patterns than by approaching the problem source-by-source or pollutant-by-pollutant."[4]

The American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), a standards-setting group that develops voluntary consensus guidelines for building designers and contractors, has recognized the importance of higher ventilation rates to improving overall indoor air quality. ASHRAE's new ventilation standard increases the minimum ventilation rate to 20 cubic feet of outside air per minute per person (cfm/person) from the previous 5 cfm.[5] In developing this new standard, ASHRAE recognized that the previously recommended ventilation rate was insufficient to provide adequate indoor air quality in most modern buildings.

The building-systems approach to indoor air quality is not just a matter of increased ventilation, however, but a comprehensive process that promises to improve air quality indoors with a minimum of expense and regulatory effort. In the case of new buildings, this approach commences at the building-design stage, continues through the construction and commissioning stages, and includes proper operator training and effective building operation and maintenance throughout the entire life of the building. For existing buildings, it includes testing, maintenance, and possible redesign of ventilation, filtration, heating, and air conditioning systems. A list of design and maintainability criteria for implementing the building-systems approach is provided in Table 1.

In both new and existing buildings, the building-systems approach incorporates the principles of a number of ASHRAE standards and guidelines, including ASHRAE 62-1989. It also requires the use of appropriate design criteria and construction documentation, and the provision and implementation of operation and maintenance procedures to ensure the health and comfort of building occupants.

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4 EPA, 1989, Report to Congress on Indoor Air Quality, Volume III - Indoor Air Research Needs, Page 3.

5 ASHRAE Standard 62-1989, Ventilation for Acceptable Indoor Air Quality.

BCIA considers the building-systems approach to be an important management tool that should be applied to both existing and planned buildings. BCIA recommends that future regulatory approaches to indoor air include provisions for optimal air exchange and filtration and proper management of building systems. Specifically, BCIA recommends that a technology-based approach to addressing indoor air quality in commercial buildings include the following items:

- o minimum ventilation rates or other means of achieving acceptable indoor air quality as defined in ASHRAE Standard 62-1989;
- o higher rates of ventilation, as defined in ASHRAE 62-1989, for all designated areas of known increased pollution sources and utilization of local exhaust capabilities whenever possible;
- o annual inspections of the air handling equipment to confirm correct operating procedures and to ensure adequate standards of cleanliness;
- o use and maintenance of filters and other air cleaning devices that meet applicable ASHRAE guidelines; and
- o a comprehensive statement of the ultimate heating, ventilation and air conditioning (HVAC) system performance criteria.

A large body of experience from public and private organizations supports the building-systems approach. Extensive field experience in recent years has shown a very high level of success when applying these principles. Application of this approach has already proven itself to be the most economical and effective means of immediately making indoor environments more pleasant places to work. Because of its potential to address the majority of potential indoor air quality problems in the most cost-effective way, the building-systems approach also should receive high priority in federal indoor air research programs.

Energy Impacts

Without doubt, the major obstacle to implementation of a building-systems approach is the misperception that the increased ventilation aspects of the approach will result in a significant increase in energy consumption and costs. Since the early 1970s, most companies have incorporated energy management programs and operating budgets designed to maximize energy savings. If one reviews the actual increased energy costs and compares them to

the costs of maintaining healthy staff, however, it becomes clear that the past building management policies that have led to these conclusions generally have been misguided.

A recent study by the Walter Reed Army Institute found that the incidence of respiratory infection was 50 percent higher in modern, energy-efficient buildings than in older, less airtight buildings.[6] According to the National Center for Health Statistics, such respiratory ailments accounted for one half of all absenteeism of the U.S. labor force between 1983 and 1985.[7]

Compared to the potential impacts on productivity, an analysis of energy costs conducted by Healthy Buildings International (HBI), a BCIA member company, demonstrates only minimal savings. The HBI analysis, conducted on a typical ten-story building of 100,000 square feet in Washington, D. C., reveals the following significant facts: (1) ventilation rates can vary dramatically between perimeter (outside) and core (inside) areas of the building; and (2) increasing the ventilation rate to comply with ASHRAE 62-1989 generally required only a 1-percent increase in electrical consumption and resultant energy costs over a one-year operating cycle. Even under the most extreme conditions, compliance with ASHRAE 62-1989 created only a 4-percent increase in annual energy costs.

The major thermal loads in the two zones of the building analyzed are indicated in Table 2. Based on these loads, the interior zone needs only cooling capacity, whereas the perimeter zone needs heating and cooling, depending on the season.

To provide thermal comfort, the ventilation rate in the building during the summer was 8 cfm/person in the core zone and 35 cfm/person in the perimeter zone, as shown in Table 3. Although the average outside air ventilation rate was 21.5 cfm/person, the distribution of that air was such that the perimeter offices received four times more air per square foot than the core areas. In fact, the interior zone received an outside air supply well under the ASHRAE prescribed minimum of 20 cfm/person. As a consequence, there was significant potential

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6 Brundage, J. et al., 1988, Building-Associated Risk of Febrile Acute Respiratory Diseases in Army Trainees, J. Am. Med. Assoc., 259(14): 2108-2112.

7 National Center for Health Statistics, 1989, Vital and Health Statistics - Health Characteristics by Occupation and Industry: United States, 1983-85, Series 10, No. 170, Page 25.

for indoor air pollution problems in the core of the building in the summer cooling season. This problem may be exacerbated by the typically higher occupancy rates in core areas.

During the winter heating season, the ventilation rate was about the same in the perimeter and core zones, but the overall ventilation rate dropped significantly. During these periods, indoor pollution problems were not only likely, but were as likely to occur in the perimeter area as in the core area.

To satisfy ASHRAE 62-1989 ventilation rates throughout this building during summer cooling conditions, outside air would need to compose 25 percent of the total air supply in the core zone (instead of the normal 10 to 15 percent). The perimeter zone, on the other hand, would require only 6 percent outside air. Under winter heating conditions, the core and perimeter zones would require 25 and 33 percent outside air, respectively.

The actual changes in annual energy usage in this building when moving from a minimal 5% outside air to 20% outside air (to achieve compliance with ASHRAE 62-1989) for both perimeter and core zones are shown in Table 3. A similar set of calculations for worst-case conditions shows that even in the most extreme weather, the total energy cost required to meet the suggested ASHRAE ventilation rate of 20 cfm/person of outside air represents only a 4-percent increase in energy costs. This equates to a cost of approximately $13 per building occupant per year.

The results of the HBI analysis have been confirmed by other researchers.[8] While the numbers will vary, depending on where the building is located and on the efficiency of its HVAC system, the energy costs required to meet ASHRAE 62-1989 generally are not substantial. In fact, the Bonneville Power Authority has concluded that ASHRAE 62-1989 has a minimal impact on energy use and energy cost regardless of building type or location.[9]

In addition, tailoring a building's zoning to its HVAC system type and configuration can be helpful in achieving occupant comfort needs. Such a comprehensive approach balancing

8 Eto and Meyer, ASHRAE Journal, September 1988.

9 Steele, T. and Brown, M., 1990, Energy and Cost Implications of ASHRAE Standard 62-1989, Report prepared for the Bonneville Power Authority, January 15.

the use of increased outdoor air and filtration/cleaning systems may be particularly useful in certain urban areas where EPA's National Primary Ambient Air Quality Standards are exceeded.

It is important to recognize that BCIA does not mean to imply that building owners have been negligent, or that they have deliberately exposed occupants to poor indoor air. Until recently, however, indoor air quality was not a major issue in the eyes of the general public and thus not generally regarded as an important factor in the decision-making process in commercial building design or operation.

New Versus Old Buildings

Not all buildings can comply with the ventilation requirements of the building-systems approach. Some older buildings may not have HVAC systems that are capable of achieving the air exchange rates specified by ASHRAE 62-1989. In these cases, however, proper maintenance and operation of the existing ventilation and filtration systems remains important. Certainly directives should be issued to operate such building ventilation systems at their maximum design potential whenever occupant levels in the buildings are high. Furthermore, the filtration status of these buildings should be reviewed to ensure that the most efficient filtration designs are used within the constraints of the air-handling capacities of the HVAC fans.

On the other hand, all aspects of the building-systems approach should be applied to the renovation of older buildings. It is during such renovation that particular attention must be given to ensuring good indoor air quality.

When the Building-Systems Approach is Not Enough

BCIA recognizes that not all indoor air quality problems may be solved through improved design, operation, and maintenance of building systems. In some situations, it ultimately may be necessary to isolate or eliminate the pollutant source in order to ensure adequate indoor air quality. This often can be achieved through proper scheduling of renovation, maintenance, and cleaning activities, air cleaning, and enhanced local ventilation. In the cases of asbestos and lead in paint, however, conventional wisdom now tells us that removal may create a greater health risk than leaving the material in place.

In addressing indoor air quality problems, BCIA strongly recommends a two-phase program that first implements and evaluates the effectiveness of the building-systems approach before significant resources are devoted to source- or pollutant-specific measures. If such a program is not pursued, two sources of inefficiency and delay would be created: (1) pollutants that become insignificant with adequate building systems would be regulated unnecessarily, and (2) it would be necessary to develop a risk assessment framework for the evaluation of simultaneous exposures to low levels of multiple indoor air contaminants from multiple sources.

No adequate framework has ever been developed or validated to reflect actual human risk from low levels of exposure to pollutants in changing indoor environments, and it is very unlikely that one can be developed in the near future. Consequently, BCIA generally does not regard a source-by-source or pollutant-by-pollutant approach to be a cost-effective method for improving general indoor air quality in the majority of commercial or residential buildings.

II. Research

We fully agree that further research on indoor air quality is needed. We believe, however, that research and mitigation efforts should be prioritized and focused, so that the most promising steps to protecting and improving indoor air quality can be identified, evaluated, and implemented.

It is essential that the many public information, research, and mitigation programs now underway, and those planned for the near future, be coordinated to provide the most valuable information for improving indoor air quality in a cost-effective manner. A fundamental step in that coordination effort is the setting of realistic priorities so that the limited federal funds available are used in the most efficient way possible. In our 1989 comments to EPA's Science Advisory Board on research needs for indoor air quality, we urged that the Agency adopt criteria for setting priorities based upon sound scientific principles, and that these criteria be applied in such a way that the projects yielding the most timely and useful information are funded first.

Clearly, the most important and cost-effective step toward preventing, mitigating, or eliminating indoor air quality problems is improvement of building-systems design, operation, and maintenance. Because a source-by-source or pollutant-by-pollutant approach is fraught with inefficiencies and scientific problems and uncertainties, BCIA strongly recommends that research funds should be directed first toward strategies that have been demonstrated to provide practical, effective, and permanent solutions. Improvement of ventilation and filtration is one such strategy.

Building-Systems Research

While much is known about the potential for the building-systems approach to eliminate or mitigate potential indoor air quality problems, additional research is necessary to refine our understanding of the application of such an approach. Among those areas requiring additional research, BCIA includes ventilation optimization, filtration, air cleaning, and the relationship between indoor air quality and worker productivity.

In this area, research that can be conducted in cooperation with the private sector should be given high priority. Such research will promote (a) non-adversarial partnerships between government and industry, (b) development of, and access to, highly advanced technology in industry, and (c) credibility in project planning, implementation, analysis, and interpretation.

Healthy Buildings Baseline Study

Monitoring data collected over the past ten years by EPA show concentrations of some contaminants to be considerably higher indoors than outdoors. These studies, such as EPA's Total Exposure Assessment Methodology (TEAM) research program,[10] have not addressed the broad range of indoor air contaminants, however, nor have they incorporated consideration of ventilation conditions and other mechanical systems in the buildings in which the measurements were taken.

Without the knowledge of the ventilation and other building systems at monitoring sites or the health and comfort of occupants, it is difficult to assess the significance of TEAM and other data to evaluate potential remedial actions. It is equally difficult to assess the contribution of particular sources of contaminants without first developing some baseline against which it can be compared.

To establish an acceptable baseline for comparing and assessing indoor monitoring data, BCIA proposes the development of a federal research project to evaluate indoor air quality in buildings that comply with the generally accepted principles incorporated in our building-systems approach. Such a program, to be conducted by EPA and the National Institute for Occupational Safety and Health (NIOSH) in cooperation with

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10 Wallace L. A., 1987, The Total Exposure Assessment Methodology (TEAM) Study: Summary and Analysis, Vol. I, EPA Office of Research and Development, EPA/600/6-87/002a.

private industry, would build on the existing research to include the following significant additions: (1) the buildings to be sampled would be selected on the basis of compliance with the building-systems approach, and (2) the list of contaminants to be monitored would be expanded to include biological contaminants, respirable particulates, CO, and CO_2. The study also should include an evaluation of the buildings' indoor air quality histories, including the health and comfort of building occupants.

Such a study of indoor environments would provide the much needed baseline data for evaluating indoor air quality.

Biological Contamination

Biological contaminants in industrial and nonindustrial environments encompass a wide range of pollutants including bacteria, fungi, viruses, exoskeletons and feces of mites and insects, animal dander, and dead human skin tissue. Micro-organisms can survive and grow in numerous indoor environments that provide moisture and nutrients. The effect of biological contaminants on human health is dependent on the type and magnitude of contamination and on individual susceptibility.

There is an abundance of data indicating that microbial contaminants are a major contributor to indoor air problems. Recent information collected by the Consumer Product Safety Commission (CPSC) indicates that 30 to 50 percent of all structures have damp conditions that may encourage the growth of biological pollutants.[11] Data from BCIA members and other private firms indicate that biological contamination may be the cause of 40 to 50 percent of the indoor air problems in commercial buildings. One of BCIA's member companies has tabulated its experience in indoor air analysis and mitigation over the past 10 years. Figure 1 shows the primary contaminants identified in investigations of about 700 commercial buildings worldwide.

Despite its apparent importance, there is insufficient information about the extent, routes of exposure, and health consequences of microbiological contamination within buildings. Given that great variations occur with regard to the numbers of a particular species of microbes required to trigger infections or allergic reactions, compounded with the variability of individual

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11 CPSC, 1989, Summaries of Workshops on Biological Pollutants and Asbestos Abatement in the Home.

susceptibility, research is needed to elucidate the role of microbes in the indoor air. It also is essential that standard methods of sampling and culturing be established so that the results of independent researchers are comparable.

Environmental Illness[12]

Environmental illness is a controversial human health phenomenon similar to other ill-defined syndromes which have been described for over 100 years.[13] It has attracted attention from such diverse groups as lawyers, physicians, insurance companies, scientists, and industry. Those who suffer from environmental illness maintain that the condition is an acquired disorder resulting in an aversion to a wide variety of synthetic materials, ingested foods, and drugs, culminating in symptoms that may be multiple and wide ranging.

Because of the controversy surrounding environmental illness, BCIA strongly believes it is premature to develop governmental policy based on the vague and anecdotal information currently available. Accordingly, the initial focus of environmental illness research should be to seek clarification of the medical/physiological, psychological nature of the syndrome. To this end, EPA's Indoor Air Division commissioned the National Academy of Sciences (NAS) to conduct a workshop to discuss environmental illness-related research needs. The workshop was held last month and a final report should be available in the near future.

BCIA wishes to emphasize that all people deserve quality medical care including correct diagnosis and appropriate treatment. Our nascent understanding of environmental illness, however, does not allow us to adequately assess proper diagnosis or treatment. Therefore, it is of paramount importance that the issues surrounding environmental illness be resolved and that the significance of environmental exposure, if any, be established. To address this issue, only research of the soundest scientific design should be supported, employing double-blind, placebo-controlled techniques.

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12 Environmental illness is discussed in greater detail in Exhibit 2.

13 Environmental illness is known by at least 20 synonyms, including multiple chemical sensitivity, total allergy syndrome, and twentieth-century disease.

III. Public Communication

Public communication of information on potential health risks presents a difficult challenge to any federal program. BCIA agrees that it is important to communicate information to persons who are actually at risk from indoor air exposures that may result in adverse health effects. It is equally important, however, that the information accurately portray the potential health risks, and that it be provided in a form that can be readily understood and applied. It also is critical that the public have sufficient context in which to evaluate the information they are given.

The two indoor air contaminants typically used as examples when discussing public communication are asbestos and radon. While many other contaminants have been addressed by federal information programs, these two have received the most attention. They also may represent opposite ends of the spectrum of public concern. Awareness of the health risks from exposure to asbestos has sometimes approached hysteria, while federal and state agencies have struggled to raise the public's concern about the potential health risks of radon. This difference results from several factors, and exemplifies the complexities of communicating risks to the public.

Indoor air legislation introduced in the House contains two major public communications programs. The first would require the development of health advisories, and has been a part of indoor air legislation since it was first introduced. The second program is a recent addition that would require that certain products include labeling that would describe the emission rate of indoor air contaminants. We would like to address each of these in turn.

Health Advisories

The current language of the House legislation requires that, for at least 12 contaminants, EPA issue health advisories that describe (1) the potential adverse human health effects of exposures to various concentrations, and (2) any existing federal or other standards or action levels that have been established. The legislation does not establish any priorities for selecting the contaminants to be subjects of health advisories.

Unlike the requirements of existing statutes listed elsewhere in the bill, this legislation does not hold EPA to the same minimum standard of scientific evidence that must be satisfied before action could be taken under current laws. The legislation provides simply that health advisories be based on "the most current substantial scientific evidence and related findings or information." Under this rather loose legislative language, it is unclear what standard must be satisfied before a health advisory may be issued in an area of controversial scientific theory.

If a comparison is made between this standard and the standard that governs agency action under existing statutes, it becomes clear that this legislation would conflict with the evidentiary criteria of those statutes.

Health advisories likely will have a significant impact on the public's use of products and services, including those already regulated under specific laws. In fact, a health advisory may have the same effect as a regulatory action under Section 6 of the Toxic Substances Control Act (TSCA), or another regulatory action under another statute. Yet action under existing laws must be supported by specific scientific findings that can be tested in court when necessary. The informational intent of health advisories does not justify a lesser degree of scientific scrutiny.

BCIA also is concerned that a health advisory that describes potential health effects at "various concentrations" of a contaminant likely would convey information about risks that bears no relationship to actual exposure conditions. Such an approach will cause unnecessary alarm and concern among consumers who may be exposed to little or no risk. The public may believe that they are being exposed to significant health risks, when actual risks may be nonexistent. Issuance of health advisories, therefore, may not result in the dissemination of relevant information about real and significant risks. It may, instead, provide misleading information about risks that are sometimes over-estimated or are nonexistent.

The inclusion of specific indoor air standards or action levels will significantly increase the potential for health advisory information to be incorporated into state and local regulation. Regardless of the "advisory" nature of these materials, inclusion of an action level in a federal publication will undoubtedly be interpreted by states as a scientific finding about that level. Inclusion of such levels, regardless of their scientific basis, further lessens the integrity of the advisory and implies a greater degree of certainty in evaluating health risks than generally exists.

Finally, it is important that the legislation not abandon the valuable scientific review process already in place for health advisory documents under other programs. For example,

advisory documents issued under the Safe Drinking Water Act are reviewed by EPA's Science Advisory Board. Such review should be applied to indoor air contaminant health advisories.

Product Labeling

BCIA believes that additional labeling authority is not necessary. Moreover, we have several concerns about the product labeling requirements that have been added to the House legislation. Specifically, we question the utility of emission-rate data and the advisability of a consumer education program to emphasize the selection of products with lower emission rates.

EPA, CPSC, and the Occupational Safety and Health Administration (OSHA) currently may require product labeling under the authorities of TSCA, the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), the Federal Hazardous Substances Act (FHSA), and the Occupational Safety and Health Act, respectively. Section 6 of TSCA grants EPA the authority to require labeling of articles containing substances or mixtures determined to "present an unreasonable risk of injury to health or the environment." EPA's Office of Toxic Substances referenced this authority when it began the ongoing "policy dialogue" with the carpet industry to investigate volatile organic compound (VOC) emissions from carpets.[14] Under the authority granted to it by Section 3 of FIFRA, EPA requires that pesticide product labels include warning and precautionary statements, a statement of hazards to humans, and directions for safe use.

Under Section 2 of FHSA, CPSC requires that consumer products containing hazardous substances bear a label that includes a warning, an affirmative statement of the principal hazard or hazards, and precautionary measures describing actions to be followed or avoided. CPSC also has drafted criteria and guidelines to codify current policy for determining whether a consumer product presents a potential chronic hazard under the requirements of the Labeling of Hazardous Art Materials Act passed by Congress in 1988. These guidelines will be applied to all consumer products, and will provide systematic guidance for determining whether the labeling requirements of FHSA are triggered for specific products.

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14 Federal Register, 1990, Vol. 55(79), April 24, Page 17408.

In addition, OSHA's Hazard Communication Standard requires that all non-consumer and non-drug products containing certain hazardous substances bear labels indicating the potential health and physical hazards of the product.

The House legislation currently targets several specific product types for emission-rate labeling. All of these products have been, or are being, addressed under existing federal regulatory authority (i.e., pesticides) or through voluntary programs (i.e., carpets, combustion appliances, pressed wood products). As the other product type identified in the legislation (i.e., products containing solvents) encompasses such a large number and variety of products, it is beyond the scope of this testimony to list federal efforts in this area.

BCIA does not believe that emission-rate data for indoor air contaminants will provide the public with information that it can use effectively to reduce exposures to these contaminants. More importantly, reduction in emission rate may not necessarily result in exposure reduction or safer products. For solvent-containing products, exposure will depend to a large extent on how the product is used, rather than on the specific formulation. For example, a product with half the concentration (and half the emission rate) of a solvent compared with competing products may require that twice as much be used in order to be effective. BCIA believes, therefore, that instructions for safe use are far more valuable than an emission-rate value. In fact, existing labeling requirements under both FHSA and FIFRA specify that directions for proper use be included on the label.

For these reasons, BCIA also is concerned about the development of a consumer education program to emphasize the importance of low-emission products without consideration of product safety and efficacy. Even in cases where emission rate data can provide some basis for comparison between competing products, they do not provide a context in which to evaluate indoor exposures resulting from that product relative to other potential indoor exposures.

The other major question concerning the implementation of such a labeling program for emission rates is the basis for determining that a significant health threat exists. Do the authors intend that labeling be based on emissions of the total number of contaminants (VOCs, combustion products, etc.), on the assumption that all contaminants pose a significant health threat? If not, is the intent to focus on a short list of specific contaminants, or on a large number of contaminants? BCIA has concerns about all of these options.

Combining the emission rates of all contaminants into one value does not distinguish among the potential health effects of the various contaminants. Moreover, a total contaminant approach would tie the hands of a product formulator in evaluating alternative substances. Specifying a long list of substances subject to the emission-rate labeling requirements similarly does not provide any basis for relative comparisons, and would dilute the effectiveness of the labeling. Alternatively, specifying a short list of contaminants would imply that products not emitting these few contaminants are "safe." While these problems are not unique to the labeling program specified in the House indoor air legislation, they cast further doubt on the effectiveness of such a program in improving indoor air quality.

IV. Technology-Based Standard

BCIA supports the development of a uniform criteria relating to ventilation and other building systems that addresses certain compliance limitations of older buildings. If a formal, technology-based standard is to be pursued, we believe that leadership in its development on the federal level should rest with OSHA. In fact, we have encouraged OSHA to begin such a program under its existing authority, and it is our understanding that an OSHA rulemaking on indoor air quality may be initiated in the near future.

On the state level, an increasing number of states have already adopted technology guidelines such as the ASHRAE standard. In most cases, these guidelines do not encompass the operation and maintenance of building systems, and further efforts to encourage a uniform approach to this issue would be helpful.

V. Interagency Jurisdictional Issues

While EPA may have devoted the most resources to indoor air quality, other federal agencies also are engaged in indoor air activities. As a consequence, many jurisdictional issues will arise as we attempt to develop a comprehensive federal indoor air quality program. Earlier versions of indoor air legislation have tended to assign most of the authority for implementing such a program to EPA. Subsequent revisions have recognized roles for OSHA, CPSC, NIOSH, and other agencies.

Coordination of federal indoor air activities through the Council for Indoor Air Quality (CIAQ) is essential. While direct interaction among high level representatives of the CIAQ member agencies is important, BCIA believes it would be advantageous to formalize a few working committees of mid-level representatives on key issues. These working committees would be chaired by a representative from the most appropriate agency. We wish to offer the following examples of committees that should be considered:

> Research - This group would examine the broad scope of proposed research, prioritize the projects, and coordinate the conduct of the research programs.
> (Chair - EPA and/or NIOSH)
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> Workplace Indoor Air Quality - This group would focus on workplace guidelines and/or rulemakings, as well as worker information programs.
> (Chair - OSHA)
>
> Consumer Education - This group would coordinate all consumer information programs.
> (Chair - CPSC)

In addition, other agencies such as the Departments of Energy and Housing and Urban Development need to be active on these committees.

In developing a national response strategy, it is important that each agency be given the lead role in its area of expertise, while coordinating its activities with the other agencies. BCIA does not believe that insufficient funding is an acceptable reason for failure to assign authority to the proper agency.

BCIA also supports the continued involvement of EPA's Science Advisory Board (SAB) in indoor air issues. We believe that the Indoor Air Quality and Total Human Exposure Committee of the Board has considerable technical expertise. This Committee can add the necessary component of independent, external review and oversight to the complex array of different, yet often overlapping, federal indoor air programs. In fact, BCIA has submitted recommendations to EPA officials urging the Agency to propose that the role of SAB's indoor air committee be expanded to oversee coordination of indoor air research across the federal government.

VI. Conclusion

BCIA is convinced that technology-based criteria based on the total building-systems approach outlined in this testimony has the best chance of improving indoor air quality in the near future. Other, more traditional, approaches would lead to high costs for little or no gain. A well-coordinated federal program, aimed at developing uniform guidelines and conducted in cooperation with industry, academia, and state entities, is both promising and achievable.

TABLE 1. Building-Systems Approach - Design and Maintainability Criteria

Design Criteria

review of design documentation procedures and compliance of design with indoor air standards

review of ventilation rates and air distribution systems under all projected modes of operation and anticipated outdoor conditions

review of provision of exhaust from known indoor air pollution sources

review of projected occupant activity, density, and locations on which HVAC design was based

identification of major outdoor sources of pollutants in vicinity of building site and prevailing winds

guidance on orientation of air intakes and exhausts

assessment of configuration of office partitions with respect to compatibility of HVAC design

review of choice of filtration type and design, materials, and location within the ventilation system

Maintainability Criteria

correct use of condensate drains, water baffles, mist eliminators, humidifiers, cooling towers, etc. to control presence of free water within air handling systems and minimize microbial contamination

identify the availability of access doors and/or inspection ports to chambers of air handling system, plenums, ductwork systems, including access to reheaters, turning vanes, smoke detectors, etc.

integrity, material type and location of insulating materials associated with HVAC equipment, ducting and ceiling plenums

review access to filters, coils, motors, etc. of variable air volume (VAV) boxes, reheats, perimeter fan coils, or induction, etc.

evaluate integrity of fit of filters and ease of replacement

TABLE 2. Comparison of Air Supply and Ventilation Rate for Summer and Winter Conditions[1]

	Core	Perimeter	Average
Heat Load (BTU/hr)			
Winter	1286	956	
Summer	1286	5846	
Total Supply Air[2] (cfm/person)			
Winter	80	58	
Summer	80	350	
Ventilation Rate[3] (cfm/person)			
Winter	8	6	7
Summer	8	36	21.5

1 - Source: Healthy Buildings International.
2 - Air supply required to dissipate heat load.
3 - Assumes outside air at 10 percent of total air supply.