



BUSINESS COUNCIL ON INDOOR AIR

1225 19th Street, N.W., Suite 300, Washington, D.C. 20036 ☐ (202) 775-5887

June 19, 1991

The Honorable John D. Dingell
Chairman
Committee on Energy and Commerce
U. S. House of Representatives
2125 Rayburn House Office Building
Washington, D.C. 20515-6115

Dear Mr. Chairman:

Thank you for your letter of April 8, 1991. It has provided BCIA with an opportunity to focus on a number of important questions about indoor air quality and to better clarify the building-systems approach, which we strongly believe should be the cornerstone of any legislative or regulatory approach to indoor air quality.

We have attempted to address each of the questions raised in your letter. The answers are organized according to the major subject areas outlined in your letter, and arranged in the approximate order in which they are asked.

Basis and Cost-Effectiveness of the Building-Systems Approach

The building-systems approach goes far beyond adequate ventilation, to include a comprehensive and continuing process which focuses on the design, operation, and maintenance of heating, ventilation, filtration, and air conditioning systems to improve indoor air quality. This approach is far superior in terms of cost-effectiveness to regulation of individual indoor air pollutants for several reasons.

First, the building-systems approach remedies a broad array of indoor air quality problems by increasing fresh air supply and decreasing exposure to biological and chemical contaminants. Moreover, this approach provides a practical solution for indoor air quality problems without the need for identification and control of myriad individual pollutants. Because such a large number of pollutants may be present in indoor air, and the mix of indoor air pollutants may change constantly, the most effective strategy is one that directs resources toward controlling the

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broadest array of indoor pollutants. The alternative, source control, must be accomplished on a source-by-source or pollutant-by-pollutant basis, and requires a lengthy process of scientific investigation, risk assessment, and risk management.

Second, the benefits provided by the building-systems approach remain intact as the mix of pollutants changes over time. Thus, if building use or interior furnishings change (thereby changing the degree and nature of the potential indoor air quality problem), the approach remains effective. Source controls designed to protect against exposure to a particular pollutant may be rendered obsolete when the pollutant mix changes.

Finally, the building-systems approach can be implemented without a detailed understanding of the potential interactions of a wide variety of pollutants at low levels. A system for evaluating such interactions likely will not be available for many years. In his testimony before the House Science, Space and Technology Committee's Environment Subcommittee, EPA's Michael Shapiro noted that "[t]he science gap between what we know about health effects of individual compounds at relatively low exposure levels and what we would like to know is . . . significant, and will take many years and substantial resources to understand."

In his testimony, Mr. Shapiro also noted that "occupant reactions to air quality indoors can be impacted by many factors which are extremely difficult and often impossible to sort out." He listed the following factors: a variety of chemical and biological contaminants; comfort factors such as temperature, humidity, ventilation (air supply and movement), and lighting; odor which has a strong perceptive influence; and psychosocial factors, including job stress and environmental aesthetics.

In our view, a comprehensive building-systems approach should certainly include, but not be limited to, specific performance guidelines for ventilation. As is often the case, however, the development of general, average guidelines or specifications may not adequately address the complexities and variations in commercial building environments. In our testimony to the Subcommittee on Health and the Environment, we included information on the variation in ventilation rate that can occur within a building. This information, developed by a BCIA member for a typical 100,000 square foot building in Washington, D.C., examined the summer and winter heat loads in both the perimeter and core. The total air supply required to dissipate the anticipated heat loads was calculated and related to the ventilation rate. The results of this study suggest the potential for wide variations in ventilation rate between summer and winter and between the zones of the building. They demonstrate the complexities associated with providing adequate ventilation, even in a well-designed building, and the limitations of using average values.

As you suggest in your letter, there is much more to the building-systems approach than ventilation rates. Proper maintenance of these systems is crucial to ensuring good indoor air, and we believe the following maintenance criteria are particularly important:

- o correct use of condensate drains, water baffles, mist eliminators, humidifiers, cooling towers, etc.
- o identification of access doors and/or inspection ports to chambers of air handling and ductwork systems
- o inspection of integrity, material type, and location of insulating materials associated with heating, ventilation, and air conditioning (HVAC) equipment, ducting and ceiling plenums
- o review of access to filters, coils, motors, reheaters, perimeter fan coils, and induction coils in variable air volume (VAV) and other air-handling unit components
- o evaluation of the integrity and fit of filters and the ease of their replacement

Adequate training also is an integral part of proper building-systems maintenance. We suspect that indoor air quality is not currently a major part of the various curricula offered for stationary (i.e., building) engineers. As you suggest in your letter, a certification program for these engineers might be one method for augmenting their training and awareness in this area.

We also believe that indoor air quality should play a stronger role in the design of new and remodeled buildings. One way this can be accomplished is through modification of building codes. Some examples of design review criteria that may need to be addressed are as follows:

- o documentation procedures and compliance of design with indoor air standards
- o ventilation rates and air distribution systems under all projected modes of operation and anticipated outdoor conditions
- o provision of exhaust from known indoor air pollution sources (e.g., photocopiers, cooking ovens and ranges)
- o projected occupant activity, density, and locations upon which the HVAC design was based

- o major outdoor sources of pollutants in the vicinity of the building site, and guidance on prevailing winds for orientation of air intakes and exhausts
- o configuration of office partitions with respect to compatibility of HVAC design
- o choice of filtration type and design, materials, and location within the ventilation system

BCIA is reluctant to characterize the views of other industry groups as either agreeing or disagreeing with the building-systems approach. We are aware that some groups do not support the development of a federal standard to implement some aspects of this approach. We note, however, that these groups do not oppose the codification of the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Standard 62-1989 (Ventilation for Acceptable Indoor Air Quality) by regional and state organizations. We further note that most, if not all, groups recognize that implementation of the ventilation rate procedure of ASHRAE 62-1989, which forms a key part of the building-systems approach, could be an important step toward improving indoor air quality.

Expected Health Benefits

Poor indoor air quality can cause a wide range of occupant complaints and health concerns. The effects on occupants include absenteeism and loss of productivity, which cost considerable time and resources. Indoor air pollutants also can cause immediate and long-term health disorders. Symptoms may include headache, skin and eye irritation, itching, drowsiness, dizziness, digestive and sleep disorders, breathing difficulty, coughing, wheezing, and other complaints. Specific illnesses such as allergies, hypersensitivity pneumonitis, humidifier fever, Pontiac fever, and Legionnaire's Disease also can be associated with indoor air quality problems.

The evidence is mounting that inadequate ventilation and poorly maintained building systems are a major cause of indoor air quality problems. A few relevant studies are described below (full citations are enclosed):

- a. A study by Walter Reed Army Institute demonstrated a significantly higher incidence of respiratory illness in newer "tight" military barracks than in older, naturally ventilated barracks (Brundage et al, 1988).
- b. Two studies reported in the British Medical Journal have demonstrated that health-related symptoms are significantly more prevalent in

buildings with mechanical ventilation than in buildings with natural ventilation (Robertson et al, 1985; Finnegan, 1984).

- c. In several studies, complaints of eye, nose and throat irritation, headache and fatigue were found to diminish with an increase in fresh air ventilation and to return to high levels when ventilation was decreased (Creiss et al, 1984; LaForce, 1986).
- d. Studies also have shown that dampness and molds are strongly associated with an increase in respiratory illnesses (Dales, 1990; Brunekreff, 1989; Martin, 1987).
- e. Between 1978 and 1988, the Hazards Evaluation and Technical Assistance Branch of the National Institute of Occupational Safety and Health (NIOSH) completed 532 investigations of buildings in which indoor air quality problems were suspected. NIOSH found that 53 percent of the health complaints in these buildings were the result of inadequate ventilation (Seity, 1989).
- f. As noted in our April 10 testimony to the Health and Environment Subcommittee, the presence of biological contaminants has been found to be a major source of building-related complaints. The data we presented was compiled by one of our members, and we understand that comparable results have been observed by other indoor air quality monitoring and mitigation firms. While NIOSH reported biological contamination in only five percent of buildings investigated, it is important to note that the Institute has only recently begun investigating for such contamination and that these investigations are limited to visual inspection (i.e., do not involve sampling and measurement).

BCIA believes that existing research has demonstrated the important roles played by adequate ventilation and proper maintenance of building systems in reducing health problems attributable to poor indoor air quality. Indeed, the above studies are only a fraction of the outstanding research on this topic. The overwhelming weight of the evidence demonstrates the importance of well designed and maintained building systems in any effort to reduce indoor air quality problems.

Impact of Clean Air Act and OSHA Authority

Your letter asks about the potential impact on BCIA's recommendations of the Clean Air Act, as amended in 1990, and the laws administered by the Occupational Safety and Health Administration (OSHA). As you know, Section 183(e)(2) of the 1990 Clean Air Act Amendments is intended to address emissions of volatile organic compounds (VOCs) from consumer and commercial products that may contribute to ambient ozone (smog). As such, this provision does not directly affect our recommendations. The requirements of this section, however, may have an indirect impact on indoor air quality by resulting in a general reduction of VOCs in consumer products.

In contrast, the Occupational Safety and Health Act of 1970 is directly relevant to indoor air quality. The law requires OSHA to set mandatory safety and health standards which require practices reasonably necessary or appropriate to provide safe or healthful employment or places of employment (29 U.S.C. Section 652(8)). This requirement does not differentiate between industrial and non-industrial workplaces. Thus we believe it can be applied in every workplace, including offices, public transportation facilities, and other public places.

BCIA believes that the building-systems approach, in its entirety, is adequate to address OSHA's workplace concerns. BCIA further believes that OSHA has adequate authority to promulgate a safety and health standard and/or guideline that outlines a building-systems approach to solving or preventing indoor air quality problems in most workplaces. We have informed OSHA of our support for a rulemaking to investigate such a standard. We are informed that they intend to issue a request for information in the Federal Register in the near future, as the first-step in the rulemaking process. BCIA believes that many indoor air quality problems can be addressed as part of an OSHA rulemaking, and that legislation is not necessary for OSHA to adequately address the issue.

Applicability of the Building-Systems Approach

The ventilation rate procedure of ASHRAE 62-1989, in which prescribed ventilation rates are defined for a wide range of indoor activities, can and should be applied to new structures and all refurbishments or remodelled buildings. Furthermore, many existing buildings can easily adapt to these recommended ventilation rates. Indeed, many existing buildings exceed these recommended values, especially when operating on energy-economizer cycles. At such times, it is common for some buildings to switch to predominantly outside air when the prevailing thermal conditions are temperate enough to allow such a practice.

BCIA recognizes, however, that retrofitting of certain buildings built after 1975 to increase ventilation capacity may not be possible. In these cases, it is possible to implement those aspects of the building-systems approach relating to training of maintenance staff, improved hygiene standards, and the use and maintenance of efficient filtration systems. In the event that complaints continue to arise or tests show significant pollutant accumulation, other engineering solutions are available including air cleaning, source control, local exhaust ventilation, and/or the use of transfer air from other areas of the building. Of particular interest, the ASHRAE standard contains a procedure for the use of cleaned, recirculated air that can treat both constant volume and VAV ventilation systems. Such a procedure may be particularly valuable in areas (e.g., Los Angeles) where concentrations of criteria and other pollutants consistently exceed specified federal or state levels.

Your letter also requests information on the applicability of the building-systems approach in specific regions of the country. While we are not aware of information for all of the cities listed in your letter, we do have data for a few. Certainly, the operation and maintenance of building systems can be implemented equally throughout the country. Information on the energy requirements associated with the ventilation aspects of the approach is included in the next section.

Energy Efficiency

BCIA appreciates your concerns about the potential impact of the building-systems approach on energy efficiency. While increasing the ventilation rate may increase total energy consumption, studies have projected that for typical buildings the annual cost will be minimal both in absolute terms and relative to the costs associated with poor indoor air quality.

In testimony submitted to the Subcommittee on Health and the Environment on April 10, BCIA cited an analysis conducted on the energy impact of increasing the outside air intake from 5 to 20 cubic feet per minute per person (cfm/person) in a new 100,000 square foot office building in Washington, D. C. This study concluded that increasing the ventilation rate to comply with ASHRAE 62-1989 would increase annual energy costs for the building by a maximum of 4 percent. This data agrees with information recently presented by EPA's Office of Research and Development for Washington, Miami, Minneapolis, and San Diego indicating that the annual increase in energy costs associated with increasing the ventilation rate to 20 cfm/person was 5 percent or less.

Energy experts, including the Bonneville Power Authority and the Department of Energy, also have estimated the energy penalty for bringing ventilation rates into compliance with the ASHRAE standard to be in the range of 4 to 5 percent. Placing this

"penalty" in perspective, however, is no less important than quantifying it. BCIA agrees with the testimony of John Milhone, DOE's Deputy Assistant for Building Technologies, before the Environment Subcommittee that a 5-percent increase in energy costs is not significant enough to forestall moving in the direction of improved ventilation for the sake of a healthier environment.

In testimony presented to the Environment Subcommittee on May 9, the Sheet Metal and Air Conditioning Contractors' National Association cited an analysis conducted by the National Energy Management Institute. Using the example of a 100,000 square foot office building in the Washington, D.C. area, the study concluded, through two energy cost simulations, that increasing the outside air intake from 5 to 20 cfm/person resulted in an increased annual energy cost of \$1,800, or 2 cents per square foot.

Dr. James E. Woods, Professor of Building Construction at Virginia Polytechnic Institute, has estimated that 20 to 30 percent of the nation's buildings have indoor air quality problems, and that an additional 10 to 20 percent are characterized by conditions that will lead to indoor air problems in the future. Even in buildings that are not experiencing severe problems, poor indoor air quality has been associated with declines in worker productivity and absenteeism which, according to work conducted by Dr. Woods, could be costing the economy tens of billions of dollars annually. Data collected by the National Center for Health Statistics indicate that as much as one-half of all absenteeism can be attributed to upper respiratory ailments, which often are a result of microbial contamination indoors.

Status of ASHRAE Standard 62-1989

As outlined in testimony presented before the Environment Subcommittee, the current system for the development of building codes begins with the adoption of an ASHRAE standard after a long process of deliberation and debate by building experts. It then proceeds to review and subsequent adoption by the American National Standards Institute (ANSI). The standard next is considered by the three regional code organizations (the Southern Building Code Congress International, the International Conference of Building Officials, and the Building Officials and Code Administrators), and then by the state and local code organizations where it is customized and converted into code and ordinance language.

The American National Standards Institute (ANSI) has approved the ASHRAE 62-1989, which makes it an American National Standard and clears the way for incorporation of the standard into state building and ventilation codes. Currently, the three regional code organizations are in the process of adopting the ASHRAE standard. In general, after these groups adopt a

standard, the state and local code organizations will consider incorporating it into their codes. States and cities, however, can adopt a new standard at any time. The information that we have received indicates that adoption of the ASHRAE standard by individual cities may require changes to building codes. According to testimony presented in recent weeks, this process already appears to be underway.

As to your question concerning the role of ventilation in addressing concerns other than air quality, we believe that the control of temperature, humidity, electrostatic charges and air movement should continue to be important functions of the ventilation system. The optimization of these other factors need not be compromised as building engineers adjust the ventilation system to provide acceptable indoor air quality. In fact, in many cases, these other factors also can be very important to the overall perception of indoor air quality.

Role of Source Control

BCIA disagrees with the perspective that additional regulatory authority directed at contaminant or source control is necessary to address indoor air quality. As you are aware, considerable statutory authority exists within EPA, OSHA, and CPSC to regulate pollutants and sources, and a vast array of regulatory and voluntary initiatives have been implemented or are underway. The implementation of the building-systems approach to addressing indoor air problems will not eliminate the usefulness for such programs. It will, however, allow the agencies to focus these programs far more effectively.

The administration of the existing pollutant- or source-specific laws is necessarily complex and time-consuming, requiring, among other things, health-effects research, risk assessment, and risk management. By addressing a wide variety of pollutants at one time, the building-systems approach can avoid the substantial time and expense required to address pollutants or sources individually.

While the current "carpet policy dialogue" conducted by EPA's Office of Toxic Substances (OTS) will result in a significant voluntary testing program to address VOC emissions from the carpet manufacturing process, the actual impact on indoor air quality may be relatively minor. This conclusion is based on the tenuous relationship between the emissions at manufacture and potential consumer exposure, and the minor contribution of carpet emissions to total indoor contaminant levels.

BCIA recognizes that the OTS/industry dialogue has been expanded to include carpet installation and other related activities and products. We wonder, however, about the efficiency of such an activity given that potential exposures to

carpet emissions can be easily addressed by appropriate scheduling of carpet installation and increased ventilation during such installation. We also note that the underlying reason for initiating the dialogue process was the concern over 4-phenylcyclohexene (4-PC), a substance with a characteristic odor at very low levels that does not appear to have adverse health effects. Concentrations of 4-PC can be reduced dramatically with proper ventilation.

Concerning your request for our views on the March 27 letter from CPSC, BCIA strongly believes that the Commission plays an important role in the federal indoor air program. We are encouraged by Chairman Jones-Smith's response to your request for information on federal indoor air activities. We believe that the CPSC programs outlined in her response reinforce our position that sufficient statutory authority exists within the federal agencies to address indoor air quality concerns. We note, however, that the list of CPSC programs included in Chairman Jones-Smith's response does not include the Commission's recent proposal for chronic hazard labeling guidelines under the Federal Hazardous Substances Act. These guidelines, when implemented, will be far more comprehensive and useful than the proposed labeling provisions of H.R. 1066.

BCIA also recognizes that the building-systems approach may not address all pollutants. In particular, we would highlight asbestos, lead, and existing biological contamination. The operation and maintenance aspects of the building-systems approach can serve to prevent the onset of biological contamination. Where such contamination already exists, however, remedial actions will be necessary to remove it. Once established, no amount of increased ventilation or air flow can address such contamination, and may, in fact, exacerbate the problem. In the case of asbestos and lead, it is generally believed that encasement may be the best mediation technique. Depending on the individual circumstances, removal and/or increased ventilation may result in greater exposure than if the material is left in place.

Role of OSHA and EPA

BCIA believes that OSHA, acting under the Occupational Safety and Health Act, and EPA, acting under a variety of environmental statutes, have complimentary and overlapping roles on the indoor air quality issue. We also believe that extensive discussion and coordination between EPA and OSHA is important to avoid duplicative regulatory requirements that unduly burden affected industries.

We agree with the AFL-CIO that ventilation is the preferred means of addressing workplace air quality concerns and that OSHA is the proper agency to conduct rulemaking proceedings to determine whether and, if so, what type of regulation is appropriate.

BCIA further agrees with the AFL-CIO's recommendation for greater involvement by NIOSH, but believes NIOSH's involvement should be limited to building-related research.

We disagree, however, with the AFL-CIO's conclusion that science has established that the health threat from low level exposure to VOCs and other indoor air pollutants warrants immediate regulation to protect health. In our view, the AFL-CIO's rush to regulation is unjustified. The sound scientific information necessary to address low level interactions of these indoor pollutants will not be available for some time to come.

Comments on H.R. 1066

BCIA believes that a serious federal effort to identify, and provide protection from, harmful concentrations of indoor air pollutants is warranted. We further believe that a focused program of research and careful coordination of federal regulatory efforts is needed. In this regard, we fully support the purposes set forth in H.R. 1066.

A number of laws administered by federal agencies provide abundant authority to identify and solve indoor air quality problems, and research and regulatory programs already are underway within these agencies. With the exception of those provisions of H.R. 1066 that seek to encourage additional research and to improve coordination of federal indoor air activities under existing statutes, however, our reading of the legislation strongly suggests that it would not add meaningfully to federal indoor air efforts and, thus, is not necessary to achieve the goal of improved indoor air quality.

BCIA recognizes that its views are not shared by all interested parties, and has sought to play a constructive role in legislative discussions. We believe a consensus approach will best serve the interests of our members and the public at large.

Future Regulatory Approaches

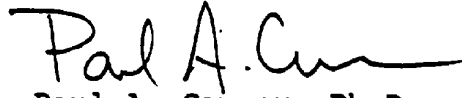
To date, the most frequently proposed regulatory approach to improving indoor air quality through ventilation and building-systems management has been the adoption of federal performance standards. H.R. 1066, for example, proposes that EPA issue regulations establishing ventilation standards for both pre-existing and newly constructed public and commercial buildings, delegating enforcement powers to OSHA. This provision, which would mandate a ventilation rate of 20 cfm/person (60 cfm/person where smoking is permitted) for new and renovated buildings, has been criticized by most organizations as too rigid and of questionable value in most settings. While objections might be raised regarding the development of a more comprehensive federal standard, such a standard, if implemented, could include the

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flexibility provided for in ASHRAE 62-1989 as well as provisions to address the operation and maintenance aspects of the building-systems approach.

I appreciate the opportunity to share BCIA's views with you, and look forward to continued discussions on indoor air quality. Please do not hesitate to call me if you have any questions or comments on the above information.

Sincerely,


Paul A. Cammer, Ph.D.
President

Enclosure

cc: The Honorable Norman F. Lent
Committee on Energy and Commerce

The Honorable Philip R. Sharp
Subcommittee on Energy and Power

The Honorable Carlos J. Moorhead
Subcommittee on Energy and Power

The Honorable Henry A. Waxman
Subcommittee on Health and the Environment

The Honorable James D. Watkins
Department of Energy

The Honorable Lynn Martin
Department of Labor

The Honorable William K. Reilly
Environmental Protection Agency

The Honorable Richard G. Austin
General Services Administration

The Honorable Jacqueline Jones-Smith
Consumer Product Safety Commission

Mr. Thomas Cole
Rubber Manufacturers Association

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Mr. Robert A. Roland
Chemical Manufacturers Association

Mr. Jay Powers
AFL-CIO

Ms. Teresa Pugh
National Association of Manufacturers

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