# The Importance of Collaborative Efforts between the Building, Medical and Public Health Communities to Achieve Health-Promoting Changes in Indoor Environments

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Dr. Jonathan Samet initiated a discussion of the collaborative efforts needed to reduce the public health burden related to inadequate indoor environment quality and pollution. He noted that reducing the public health burden related to inadequate indoor air quality and indoor air pollution (IAP) inherently involves multiple professional disciplines. The occurrence of exposures to IAP reflects many decisions made in the design of a building, choice of materials, uses of the building, and the operation of the building. Health care professionals and researchers are involved in establishing linkages between exposures in the indoor environment and adverse health effects, but problem mitigation is likely to involve indoor environment specialists as well as other building professionals. Thus, some of the professionals involved in preventing and solving health problems arising from IAP include architects, engineers, industrial hygienists, physicians and other health professionals, and indoor environment specialists. Unfortunately, professional disciplines tend to follow their disciplinary interests and establish "silos" of focus on the specific concerns of their constituents. Interactions among groups have been limited, both among the relevant professional organizations and among individual practitioners around specific buildings or health problems. A physician dealing with health outcomes may be interested in understanding etiology to affect a long-term solution, but his or her primary focus is on treatment of the patient's specific symptoms.

The need for cooperative effort was recognized at a 1995 American Thoracic Society (ATS) Workshop (Achieving Healthy Indoor Air. Report of the ATS Workshop: Santa Fe, New Mexico, November 16–19, 1995. *American Journal of Respiratory and Critical Care Medicine,* 1997;156:33S–64S.). Among other recommendations, participants at that meeting suggested that some organization should:

- Take the lead in addressing indoor air quality-related health effects;
- Encourage interdisciplinary participation in developing solutions; and
- Assemble a body of successful and non-successful case studies to help determine viable approaches to correcting indoor air quality problems.

Studies of second-hand smoke provide an example of one such case study, demonstrating the lack of health benefits from separating smokers and non-smokers in the same air space.

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Mr. John Girman followed with a discussion of a successful case study describing collaborative efforts to address the problem of indoor radon as an etiologic factor in lung cancer from the 1970s to the present. Radon is estimated as the second leading cause of lung cancer after smoking, accounting for approximately 20,000 lung cancer deaths per year. The problem was recognized in the late 1970s as winter weatherization programs tightened up homes and reduced natural air exchange. The initial focus was on building materials as a radon source, but the Department of Energy (DOE) quickly realized that soil gas (such as in the Reading Prong Physiographic Province in Pennsylvania and other regions) was a major source. Understanding the problem and how to address it involved building scientists, geologists, physicists, and state agencies. The EPA, DOE, and Canadian agencies were instrumental in developing mitigation methods. By the mid-1980s, public guidance was provided by EPA, the Department of Health and Human Services (DHHS), and CDC with publication of *A Citizen's Guide to Radon* (now on the web in the May 2004 revision, http://www.epa.gov/radon/pubs/citguide.html ).

Through the 1980s, a number of collaborative activities refined approaches to dealing with radon issues and made the public aware of the need for action. A federal interagency Committee on Indoor Air Quality (CIAQ) was established with the participation of EPA, DOE, NIOSH, Occupational Safety and Health Administration (OSHA), and the Consumer Products Safety Commission (CPSC). The Voluntary Radon Measurement Proficiency Program (involving DOE, EPA, and the radon industry) was established to guide residential measurement and mitigation. Additional collaborative efforts for informing the public through public service announcements (involving the Ad Council) and promoting remediation practices included public health officials at federal, state, and local levels, physical scientists, engineers, and the American Association of Radon Scientists and Technologists (AARST; http://www.aarst.org/ ), a radon industry association. The National Research Council's (NRC) Committee on the Biological Effects of Ionizing Radiation (BEIR IV) established a firm scientific basis for assessing health effects associated with radon. Continuing action through the late 1980s and 1990s included the U.S. Surgeon General's radon warning to the public, Radon Training Centers and State Indoor Radon Grants Program (established by EPA), publication of radon potential maps of the United States, and new construction standards developed for reduced radon exposure. The real estate industry and home inspection have become the primary point of action for radon testing and remediation at the time of home sales.

As a result of these collaborative efforts, an estimated 1.2 million homes have been built with radon-resistant construction since 1990; about 0.5 million homes have installed active radon mitigation systems (as of 2003); and radon standards have been adopted into building codes (National Fire Protection Association [NFPA] 5000, International Residential Code). The main conclusions that can be drawn from this case history are that:

- Many disciplines need to interact to define the problem and develop effective solutions;
- Many stakeholders need to be involved in implementation of solutions (epidemiologists, realtors, the radon industry, residential construction industry,

building scientists, communications specialists, and code officials, for example); and

- Government agencies need to provide the stimulus to develop information and serve as an "honest broker" of that information.

Mr. Girman listed several other areas where similar collaborative efforts could be applied: environmental tobacco smoke (ETS), mold/moisture, indoor air toxics, asthmagens and triggers, human performance/productivity, and green buildings and green building management. He suggested that the *Damp Indoor Spaces and Health* report provides enough information for taking action, noting that an EPA study of office buildings indicated that 45% have leaks and 34% have leaks in occupied spaces. In addition, the EPA study found that a high percentage of workers may be frequently exposed to indoor air toxins (resulting from pesticides, paint fumes, new carpets, etc.). In another report by the IOM entitled *Clearing the Air*, the section on asthma triggers indicated that fewer than 50% of asthma patients state that their doctors have suggested environmental management. The EPA Office of Air and Radiation has proposed collaborative efforts in its *Healthy Buildings, Healthy People* report (http://www.epa.gov/iaq/hbhp/ ). The public is willing to pay for better air quality, as indicated by the approximately $1 billion spent per year on stand-alone air cleaners and more spent on cleaning heating and air conditioning ductwork. This occurs in spite of a lack of evidence that these are effective approaches to improving the indoor environment.

## Questions and Comments

The discussion following these presentations continued with several topics raised earlier. One audience member discussed the importance of people with MCS. The heightened allergic responses of people with MCS due to other exposures may make them sentinel indicators of more subtle indoor environment problems. Dr. Samet commented that researchers do tend to oversimplify problems by focusing on one or two elements, and a broader, more ecologic approach may be needed to address issues such as MCS.

The issue of defining levels of dampness was raised again. Dr. Cox-Ganser said that NIOSH has used ranking based on semi-quantitative environmental assessments to compare locations within a study area. Dr. Eggleston and Mr. Fisk suggested that while 40%–50% relative humidity is generally considered optimal, there is no humidity standard used to define "damp." It is also not clear whether damp spots (i.e., local damp areas that can produce mold in an indoor environment where the overall indoor humidity is within normal limits) are as harmful to health as more generalized dampness. One function of a workshop such as this might be to propose a standard that could be tested. A consultant questioned Mr. Girman's statement that the government was perceived as an "honest broker," indicating that industry does not see dampness as a major health problem and does not want to fund research that could be used to generate restrictive standards. There needs to be more effort to involve industry, since at present they will only reluctantly fund research to resist regulation or block litigation. Mr. Girman replied that he thinks the public sees government as an honest broker, but perhaps industry less so. Industry is involved in the guidance process and Mr. Girman believes that EPA is

responsive to industry concerns, but perhaps the agency could do better. One commenter suggested that industry gets involved too late in the process, after regulations or guidelines are already proposed, and it ends up taking a defensive position. Local governments sometimes pass restrictive regulations that have a poor scientific basis, placing government and industry in an adversarial position.

Commenting on how government can lead the way, one audience member described a major study conducted in Hong Kong to monitor 50 buildings for 12 indoor air quality parameters. The study resulted in a voluntary program that allowed building owners to certify their buildings and advertise them as meeting indoor air quality standards. The participant suggested that a similar standard could be prepared based on current World Health Organization (WHO), Nordic, and Canadian recommendations to establish a certification program that would "pull people into the program rather than pushing them." Mr. Girman responded that there might be problems in agreeing exactly on target levels for various agents; moreover, EPA lacks a legislatively mandated authority to establish such a program. A federal Congressional aide in the audience encouraged people attending the workshop to work with his office and with some of the Representatives who have strong interests in improving the indoor environment. Ms. Loftness commented on her experience in trying to inform Congressional decision-making about funding for health and productivity research in relation to building quality. She suggested that there is opportunity through National Science Foundation (NSF) and National Institutes of Health (NIH) to provide collaborative teams with the resources they need to investigate these issues. Dr. Samet pointed out that radon is an example of a health concern that caught the interest of Congress and resulted in targeted funding, which led to a coordinated inter-agency effort of research and development that had a very favorable outcome.

A consultant suggested there are missed opportunities in not involving the building cleaning industry, a group that has already developed expertise in improving conditions in buildings and is highly motivated to maintain a healthy indoor environment. Dr. Samet commented that he did not mean to exclude cleaning professionals from his list of stakeholders. He also noted, however, that there is a lack of research on the effectiveness of cleaning practices in terms of health effects. The same applies to the air cleaning industry. Ms. Loftness mentioned observations made in several government office buildings that when cleaning was moved to daytime hours as an economy measure, there was an increased pest problem in the building as a consequence of late afternoon food remnants being left in trash containers overnight. Therefore, unintended consequences of cost-cutting in cleaning practices need to be monitored and evaluated. Another participant commented on generally lax practices in the residential building industry, where most homes are not individually designed by architects and most contractors are not educated about the best available practices. This individual suggested a need to work with the trades (roofers, plumbers, and remodelers, as well as builders) to encourage practices that would reduce water penetration problems in buildings.

Dr. Woods expressed concern that the afternoon panel consisted of only researchers and no members of the general public or industry representatives. Returning to a theme of his

earlier presentation, he suggested that dampness is a source problem for which there are already good solutions that can be applied once accountability is established. Dr. Eggleston disagreed, indicating that there is still important research issues involved in linking dampness to health effects. Reports of health effects are inconsistent in part because there are no standard ways of describing degrees of water incursion into a building. While there are clear recommendations on how to avoid sources of water or how to correct water problems, there are no standards that can be used to evaluate successful remediation from a health effects standpoint.

**Highlights from Importance of Collaborative Efforts between the Building, Medical, and Public Health Communities to Achieve Health-Promoting Changes in Indoor Environments Session**

Building design and operation involves a large number of diverse professions with different interests and priorities. Collaboration is the key to improving the indoor environment. Bringing affected stakeholders (e.g., the public and industry associations) into the process early is advantageous.

There is a lack of research on the effectiveness of many building and cleaning practices and technologies that claim to improve the indoor environment.

The successful program of radon testing and remediation serves as a model that can be applied to other indoor environmental problems. The evolving programs and efforts to reduce exposure to ETS could also serve as models.