

Healthy air, better work—now and forever

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Reijula K. Healthy air, better work—now and forever. *SJWEH Suppl. 2008;(4):83–86.*

A recent survey revealed that indoor air problems are common. One out of three office workers complained about constant problems with the indoor environment, and one of five reported indoor-air related symptoms. Dry or stuffy air, dust or dirt, draft, and room temperature that was too high or too low were the most common problems. Poor quality of the indoor environment can lead to work-related symptoms and diseases, while high quality improves well-being, work performance, and productivity. New strategies have to be developed for dealing with problems with the indoor environment, and methods should be improved for planning and designing premises. The identification and management of indoor-air problems should be carried out using multiprofessional expertise with goal-oriented and project-based models in which users of the facilities are closely involved. High quality with respect to the indoor environment should be recognized as a production resource that generates added value to the organization.

Key terms disease related to indoor air; indoor environment; office work; ventilation.

Occupational health and safety professionals often need to consider problems in indoor air while evaluating the health risks of a work environment. On the other hand, a high-quality indoor environment has a beneficial effect on the health of employees, the social atmosphere at work, and productivity in offices (1–3).

The World Health Organization stated already in the 1980s that up to 30% of employees in new or renovated buildings report an unusually high number of complaints concerning the work environment, enabling classification of the buildings as “sick” (4). This appears to be a problem especially in countries with a colder climate. However, problems can also occur in air-conditioned offices in tropical regions.

Working in problem buildings may lead to respiratory symptoms (stuffy and irritated nose, rhinitis, cough, sore throat, and shortness of breath), skin symptoms, and even general symptoms (fatigue, headache, fever), all of which are typical of the sick building syndrome (5–7). Some researchers consider the sick building syndrome to be more of a reaction to the work environment than a disease per se (6).

In studies of the quality and prevalence of symptoms, the symptoms can, in some cases, be associated with the

indoor environment, especially when there are enough people working in the building, and the manifestation of the symptoms can therefore be studied at the group level. According to current knowledge, the sick building syndrome is a multifactorial problem, behind which can be found dirt in air-conditioning channels or emissions from construction or surface materials, for example. The psychosocial atmosphere of the work organization partially affects the prevalence of the syndrome and is an important factor in work to solve the related problems (3).

There is lack of information on the causal relations of indoor air problems, especially concerning the mechanisms behind them. Too seldom it is easy to find the cause of an indoor-air problem in a targeted building when the air conditioning is not working properly or if there is obvious moisture damage or mold growth in the structures of the building (1), for example. Often the situation is far more complex. Previous experience has shown that even extensive technical and microbiological studies, or a clinical examination of the employees, have difficulties in confirming the exact problem area in a building. Systematic investigations of the work environment, combined with information gathered from the employees in interviews or questionnaire surveys,

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form a basis for further investigation and restorative measures (5, 8–10).

Complaints about environmental factors

In a recent questionnaire survey (11), the most common indoor air problems that had occurred every week at work were dry air (35% of the respondents), stuffy air (34% of the respondents), dust or dirt (25% of the respondents), draft (22% of the respondents), too high a room temperature (17% of the respondents), noise (17% of the respondents), odors (17% of the respondents), and changing temperature (16% of the respondents).

According to experience from field practice in the Finnish Institute of Occupational Health (FIOH), the most common indoor-air problems related to certain typical substances are as follows: (i) problems related to the HVAC (heating, ventilation, and air conditioning) systems (physical), that is, dry air, stuffy air and draft; (ii) unpleasant odor (chemical substances, volatile organic compounds); (iii) moisture problems and mold exposure (microbes); (iv) problems related to cleaning (eg, dust and dirt); (v) environmental tobacco smoke; (vi) ozone, radon, asbestos; and (vii) manmade mineral fibers.

In a previous Danish study, the most common complaints about environmental factors reported at the Copenhagen City Hall were dry and stuffy air, varying temperature, and draft (9). In a Dutch study covering over 7000 office employees and 61 buildings, the most common complaints concerned indoor air temperature, dry air, lighting (too bright or dim), and noise (10).

In a recent survey (11), men and women differed clearly in their complaints about environmental factors. The women had more complaints concerning environmental factors than the men. Similar observations have been made in other studies as well (8–9). The significance of age could not be proved with certainty, based on the results of this study. The complaints concerning environmental factors differed between the age groups. This finding may have partially been due to different job descriptions in that the complaints may have been different in the jobs to which employees of various ages were assigned.

Symptoms

According to a recent survey (11), the most common symptoms related to the indoor air among office workers were irritated, stuffy or runny nose (20%), itching, burning or irritation of the eyes (17%), fatigue (16%), dry skin on hands (15%), and hoarse or dry throat (14%).

In another study, the effect of mechanical ventilation on symptoms of the sick building syndrome was assessed in an office building with 1719 employees (12). The survey focused on symptoms during the past 7 days, both at work and at home. About a half of the participants complained of dryness of the skin, nose and throat, as well as of stuffiness of the nose. In their study, one-third reported itchiness of the skin, headache, and fatigue, while one-fifth complained about irritated, itchy, or dry eyes. More symptoms prevailed if the room temperature was above 22°C.

Fatigue, headache, and mucous membrane and nasal symptoms were the most common symptoms related to the work environment in mechanically ventilated buildings in England (6). Burge et al (13) found that the most common symptoms related to the indoor climate among over 4300 employees were fatigue, stuffy nose, dry throat, and headache. When work-related and other symptoms were taken together, the most common symptoms were irritation of the nose, fatigue, and dryness of the hands. The most common symptoms reported by the people who worked in the Copenhagen City Hall were fatigue, headache, and irritation of the nose and throat (9). In addition, general symptoms (fatigue, headache, etc) were higher than in other studies.

Women seem to report more work-related symptoms than men do (8–9, 11). Gender-based differences may be related to the differences in the worktasks and work arrangements of men and women or to differences in the psychosocial work community, as well as in other spheres of life, such as home and family relations (14). Women describe changes in their health more easily than men do; it was suggested that the overall life situation, both at home and at work, should be considered when reports of symptoms are assessed (15).

In indoor-air surveys, factors that affect the reporting of symptoms include the physical and social work environment, as well as the physiological and psychological characteristics of the employees (16). In studies on indoor air, it is important to consider the symptoms and sensations of the participants, even though the mechanisms affecting them are not known. The observed differences between the genders are real, and they are partly explained by work-related factors, factors outside work, and physiological factors (16). When the results of a survey are examined, gender-based differences should be considered, especially when a workplace is clearly dominated by either gender.

People with allergies report environmental problems related to the work environment and work-related symptoms more often than nonallergic persons (10–11). On the basis of over 100 indoor-air symptom surveys, Andersson (8) concluded that atopic persons have more symptoms of the mucous membranes and skin symptoms than nonatopic persons do. Allergic persons may react

to environmental factors earlier than others, and their awareness of their sensitization helps them to pay attention to different hazards known to cause symptoms.

Healthy air, better work—strategies for action

Preventing indoor-air problems

The most effective and economical outcomes to prevent indoor environment problems can be achieved by using good practices when premises are planned and designed. The main objective of proper planning is to see that new facilities do not cause health risks to the occupants. On the contrary, the facilities should promote work processes, optimal work performance, and even innovation.

Anticipatory planning of the premises should develop new work strategies that would help designers and building experts when constructing workplaces with a healthier and safer indoor environment that promotes the well-being of employees.

There is an urgent need to use modern technology in developing and implementing modeling and calculation methods when premises are planned. The anticipatory design of the indoor environment, based on different visualization techniques, should be used to demonstrate the objectives to the users of the facilities. Moreover, interaction should be encouraged between the various actors that take part in resolving indoor-air problems.

In addition, a classification system with target levels should be developed for indoor air and the environment, and new guidelines that help maintain a high-quality indoor environment should be launched. At the same time, property management should be improved so that it promotes a healthier and safer indoor environment.

If products that would improve the quality of the indoor environment are to be developed, technical expertise and resources are needed, along with more information about the objective conditions indoors and the specific factors that can affect them.

Identification and management of indoor-air problems at workplaces

Exposure to chemical substances, microbes, and particles in indoor environments can cause an increased health risk among exposed workers. Working in hospitals and laboratories or in water-damaged buildings may lead to occupational exposure to hazardous microbes. The emission of chemical substances from building materials may cause complaints and symptoms especially in new and refurbished buildings. It is important to know the extent, main causes, and typical outcomes of indoor-air problems in different occupational settings. Finally,

warnings or indications of indoor environment problems should not be ignored.

Experts investigating indoor-air problems have to learn how the exposure occurs, how the amount of exposure can be measured, and how risk assessment should be carried out. Work-related exposure to microbes and chemical substances emphasizes the need for multiprofessional teamwork. The management of indoor-air problems is even more important than the measurements of different hazardous substances. In this area, we have to be innovative and open to novel methods of investigation.

The use of multiprofessional teamwork and project orientation usually helps to resolve indoor-air problems in workplaces. In the future, more emphasis should be paid to good practices in renovation and construction work.

What standards should workplaces with a high-quality indoor environment have? Guidelines based on health consequences are still lacking. Different national air quality standards have been proposed, but there is an urgent need to develop acceptable guidelines that are based on scientific evidence and that can be followed by everyone. Standards and guidelines for the quality of indoor environments in occupational settings should be the first to be launched.

Good practices for solving indoor-air problems at workplaces

Previously, indoor-air problems were solved by focusing on individual factors such as ventilation systems, chemical emissions, or water-damage problems. In the future, indoor environment problems should be addressed by including the different parties (workers, employer) of the workplace, as well as the owner and facility management, in the problem-solving processes.

Unfortunately, the problems in indoor environments are usually associated with several substances, varying from physical factors to multichemical exposure. Moreover, the psychosocial elements of the work organization make the situation even more difficult. Good practices are needed to solve the problems in indoor environments. Different professionals who are already involved with the problem building should be included in an indoor-air group, which could take the role of the organizer during the problem-solving process. The problem-solving process could be organized as a project with a realistic time frame and widely accepted goals.

Well-being and indoor air in workplaces

The most important aspect of high-quality indoor environments is associated with the possible health effects

of indoor air. Indoor-air professionals should be aware of the extent and main causes of symptoms and diseases related to the indoor air.

What good practices and proper tools are needed for handling problems in indoor environments from the medical point of view? The role of the work organization in resolving indoor-air problems should be emphasized. Those who have to take care of problem buildings and symptomatic workers have to have the needed knowledge about modern tools for assessing the extent of indoor-air problems in workplaces. They need to know how to carry out risk assessments and how to examine symptomatic employees.

A good indoor environment in workplaces should be recognized as a significant resource for the organization in that it generates added value to production. New strategies for tackling indoor environment problems should be developed and implemented in occupational settings. They should emphasize interaction and close cooperation between various actors and a multiprofessional approach to the work. New methods should not only be related to planning and designing facilities, but also to good property maintenance and processes for solving indoor-air problems.

Indoor environments should be recognized as a key production resource and an indispensable element for the well-being of employees at work, and this element must be taken into account in all new and restorative construction work.

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