



## **INDOOR DAMPNESS, MOLD AND HEALTH**

The following information is from the EPA and Lawrence Berkeley National Laboratory study of “Public Health and Economic Impact of Dampness and Mold”.

The performance of office and school work is affected by indoor environmental conditions and by the features of buildings that influence indoor environmental conditions. Work performance may be improved from a few percent to possibly as much as 10% by providing superior indoor environmental quality (IEQ). The economic benefits of the work performance improvements will often far outweigh the costs of providing better IEQ [1].

Based on the available surveys, approximately half of U.S. homes have visible evidence of a dampness problem or mold contamination [2]. Surveys also indicate that dampness and mold are common in schools and office buildings [2]. Building dampness problems arise from a range of sources including, but not limited to, water leakage through roofs and walls, plumbing system leaks, groundwater entry, damp construction materials, high indoor rates of moisture generation, entry of humid outdoor air with insufficient dehumidification, water vapor condensation on cold surfaces of windows and walls, and floods [3]. When materials in a building become sufficiently damp for an extended period, mold and bacteria will often colonize the materials. The molds and bacteria can lead to microscopic airborne particles, some containing allergens or chemicals with the potential to induce inflammation in the respiratory system. Molds and bacteria are also sources of odorous volatile organic compounds in the indoor air. High indoor relative humidity in damp buildings also can increase the number of house dust mites present indoors and these mites are a very important source of indoor allergens [4]. Dampness in building materials may also lead to increases in emission rates of gaseous non-microbial chemicals, for example formaldehyde, from those materials into the indoor air [3].

In 2004, the Institute of Medicine (IOM) of the National Academy of Sciences completed a major review of the available scientific literature pertaining to the health consequences of building dampness and mold [3]. Based on this review, dampness and mold in homes is associated with increases in several adverse health effects including upper respiratory symptoms, cough, wheeze, and asthma exacerbation. The available data were sufficient to suggest, but not confirm, that dampness and mold in houses were associated with increases in development of the disease of asthma. The IOM indicated that the specific agents, e.g., molds, bacteria, or organic chemicals, causing these health effects were uncertain and that insufficient scientific data were available to draw conclusions about the association of dampness and mold with several other health effects. Nevertheless, the IOM concluded that building dampness and mold represented a public health problem and that steps should be taken to reduce building dampness



and mold, including various education efforts, reviews of buildings codes and contracts, and an exploration of financial incentives for reduced dampness.

Since completion of the IOM review, two new related analyses were completed for this Scientific Findings Resource Bank. A quantitative statistical evaluation of the available scientific literature produced estimates and uncertainty bounds for the average magnitudes of increases in various respiratory health effects in homes with dampness and mold [5]. Building dampness and mold were determined to be associated with 30% to 50% increases in a variety of respiratory and asthma-related health outcomes and the observed increases in these adverse health effects in damp or moldy homes were very unlikely to be the result of chance. The second analysis estimated the U.S.-wide public health impact of dampness and mold in houses, focusing on current asthma, defined as doctor-diagnosed asthma plus recent asthma symptoms, as the health outcome [2]. The proportion of current U.S. asthma cases attributable to dampness and mold exposure was estimated to equal 21% with uncertainty bounds of 12-29%. Of the 21.8 million people reported to have asthma in the U.S., approximately 4.6 (range: 2.7-6.3) million cases were estimated to be attributable to dampness and mold exposure in the home. The associated annual cost of current asthma attributable to dampness and mold in the U.S was estimated to be \$3.5 billion (range: \$2.1 - 4.8 billion).

### **LIST OF CITED DOCUMENTS**

1. Olli Seppänen, Fisk, W.J., and QH Lei, "Ventilation and Performance in Office Work". *Indoor Air*, 2006. Vol. **18**: p. 28-36.
2. Mudarri, D. and W.J. Fisk, "Public health and economic impact of dampness and mold". *Indoor Air*, 2007. **17**(3): p. 226-235.
3. IOM, *Damp indoor spaces and health*, Institute of Medicine, National Academy of Sciences. 2004, Washington, D.C.: National Academy Press.
4. IOM, *Clearing the air: asthma and indoor air exposures*, Institute of Medicine, National Academy of Sciences. 2000, Washington, D.C.: National Academy Press.
5. Fisk, W.J., Q. Lei-Gomez, and M.J. Mendell, "Meta-analyses of the associations of respiratory health effects with dampness and mold in homes". *Indoor Air*, 2007. **17**(4): p. 284-295.