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RESOLVING THE AMBIGUITIES: AN INDUSTRIAL HYGIENE INDOOR AIR QUALITY (IAQ) SYMPOSIUM[1]

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ABSTRACT

Resolving the Ambiguities: An Industrial Hygiene IAQ Symposium was a one-day event designed to inform practicing industrial hygienists about highlight presentations made at *Indoor Air '93*. A broad range of topics was presented by invited speakers. Topics included were attempts to deal with guidelines and standards, questionnaires, odors and sensory irritation, respiratory allergies, neuroses, sick building syndrome (SBS), and multiple chemical sensitivity (MCS).

DESCRIPTION AND SCOPE

This one-day symposium that I co-chaired was held in Anaheim, CA, on May 22, 1994, and was designed for the broad industrial hygiene community. The approach was to invite, in the main, speakers who were judged to have made striking and significant presentations at *Indoor Air '93* in Helsinki. Speaker invitations were issued by members of the American Industrial Hygiene Association (AIHA) Indoor Environmental Quality Committee who attended *Indoor Air '93*. The symposium itself was an expansion of the W6 workshop (Gammage and Tiffany, 1993) at *Indoor Air '93*.

About 500 persons registered for the one-day event, which was held in conjunction with the annual AIHA Conference. Materials presented ranged over a wide spectrum of issues that the industrial hygiene practitioner might have to contend with. In retrospect, the symposium title proved overly ambitious; the ambiguities proved to be more easily defined than resolved.

Sick Building Syndrome

The majority view is that SBS is an adverse sensory reaction of the normal population to substandard indoor air quality. Marilyn Black, Air Quality Sciences, Marietta, GA, cited the work of Lars Molhave (Molhave, 1990) who has developed a tentative dose relationship for discomfort caused by organic vapors; this relationship was obtained from the experimentally controlled exposure of subjects to VOC. Measurements of VOC in the field, however, have a poor record of correlation with SBS complaints. She also explained the lack of guidelines and

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regulatory standards for indoor VOC levels in non-industrial settings. Alan Hedge, Cornell University, spoke of his skepticism that occupants' assessments do accurately reflect the prevailing climate conditions. Instead, he stressed the importance of a variety of psychological factors including workstress, and social conditioning that guide one's perceptions and beliefs. In essence, Hedge was debunking SBS as a health issue related primarily to contaminants in indoor air.

Michael Hodgson, University of Connecticut Health Center, dealt with the design and value of questionnaires in relation to indoor air quality complaints. To avoid pitfalls, such as misclassifying individuals in various symptom categories or failing to reconcile psychological and organic aspects of sick building syndrome, there should be full recognition of the sensitivity and specificity of the questionnaire.

Hal Levin, editor of *Indoor Air Bulletin*, described his work on updating ASHRAE standard 62-1989. He discussed the need to try and pull everything together by assessing socio-psychological factors together with temperature, noise, illumination, as well as contaminant levels to determine acceptability of IAQ. Marco Maroni, University of Milan, Italy, described similar efforts within NATO to examine IAQ strategies and achieve good IAQ.

Black dealt with the growing movement of proactive efforts encouraging VOC reductions in buildings, including efforts that are directed toward the design and use of lower VOC emitting furnishings and building materials. In essence, this is de facto acquiescence to the belief that minimization of VOC will lessen the likelihood of occupant complaint.

The puzzlement about the role of VOC in SBS continues. Perhaps one can best summarize by saying that the ability of VOC to illicit SBS has to be viewed in the broader context of the total indoor environment. In practice, the role of VOC is devishly difficult to sort out from other factors. In the meantime, the pragmatic response of manufacturers, building owners and managers is to err on the side of prudence by producing and then installing lower-emitting materials.

Multiple Chemical Sensitivity

Claudia Miller, University of Texas, San Antonio, focused on the hypersusceptible individual and the contentious issue of multiple chemical sensitivity. She described MCS patients as exhibiting a unique type of sensitivity; after initiation has occurred, responses, which most often involve the central nervous system, can be triggered by very low levels of exposure. There is also the report of spreading of sensitivity to chemicals other than the one believed responsible for the original initiation. The initiating event is often reported to be a pesticide or solvent exposure.

Miller stressed that unraveling the reality and cause of patients symptoms requires carefully designed, proactive challenge testing in a controlled environment. Patients must be brought to a proper baseline condition in a very low-level chemical environment before challenge starts; otherwise development of tolerance will interfere with the symptoms of stimulation and withdrawal and likely produce a false negative outcome. This "yet to be done" work with patients with apparent MCS symptoms was endorsed in a recent National Research Council (NRC, 1992)

report. She also described the hypothesis of limbic (primitive smell brain shared by all mammals) kindling as a possible mechanism underlying MCS. Tony Pickering, Wythenshawe Hospital, Manchester, U.K., said that the United Kingdom doesn't believe in MCS-yet!

A major problem for MCS is the lack of a definition of what MCS really is--the questions of who, why, and what--let alone the finding of a medical solution. So where is the good science that might guide the way out of the morass? I felt fortunate to have attended the *Low Level Exposure to Chemicals and Neurobiological Sensitivity Conference* organized by the Agency for Toxic Substances and Disease Registry, and held in Baltimore, MD, April 6-7, 1994. Several cutting-edge research studies relevant to the MCS issue were presented that I would like to mention.

The phenomena of time dependent sensitization (TDS) and subconvulsive limbic kindling in animals were dealt with by several authors. TDS is the progressive and persistent amplification of behavioral, neurochemical, endocrine and/or immunological responses with the passage of time after exposure--the effect grows with time without further dose and the response to the repeated same dose becomes progressively greater. Effects can be extremely long lasting and there can be cross sensitization or spreading that expands the spectrum of agents triggering adverse response. Psychological stress, electric shock, or exposure to chemicals, such as pesticides, antidepressants, cocaine, opiates, ethanol, can initiate TDS. There are apparent similarities between MCS and TDS that are sufficiently compelling to focus on a TDS model for possible explanation of claimed human illness from low-level chemical exposures.

The IAQ community is surprisingly unfamiliar with this expanding line of research. The serious student of MCS would be well advised to become familiar with the research presented at this meeting. Three papers made available at the Neuroscience meeting are listed in the reference section (Bell, 1994; Miller, 1994; Gilbert, 1994).

Respiratory Allergy

The increasing allergic status of the general population, in relation to IAQ, was tackled by Tony Pickering. In Western Europe, bronchial asthma is increasing together with immunological status. Asthma has doubled in the period 1974-1988. Evidence is accumulating that indoor air pollution is making a significant contribution.

Modern domestic dwellings are increasing the intensity of allergen exposure in the home, especially dust mite allergen. The synergism between fitted carpets, low air exchange rates, central heating, high humidity levels and growth of dust mites was stressed. To prevent primary sensitization, reducing airborne allergen load during infancy is critical. Replacing carpets by linoleum or tiles often reduces asthmatic problems

The role of mold exposure indoors on development of allergic lung disease is less certain. Where high exposure to a single organism occurs, a variety of allergic responses have been described. An example was bronchial asthma in two children caused by fungal contamination of a cool mist

vaporizer. Examples of hypersensitivity pneumonitis and humidity fever were described as well as other types of allergic lung diseases associated with problems of excess moisture in buildings.

If Not TLVs/WEELs Then What?

Henry Trochimowicz, a standing member of the AIHA Committee on Workplace Environmental Exposure Limits (WEELS), explained the rationale and process by which TLVs and WEELs are established for single chemical compounds. He emphasized that these limits are intended to protect the healthy adult worker for an 8-hour time-weighed average exposure. In most cases, the chemical is encountered in an industrial workplace where that chemical or chemical group is in abundance compared to other background chemicals. For IAQ evaluations, he said that more sensitive protocols are needed because even when compliance with occupational limits are demonstrated, building-associated complaints from occupants may still persist. To this date, TLV/WEEL setting procedures have excluded parameters of general population susceptibilities, comfort, longer exposures than the traditional 8-hour workday and exposure to a complex mixture of chemicals at very low concentrations.

Dissatisfaction with the quality of indoor air is often related to sensory irritation. The work described by Bill Cain, Yale University, would seem to offer hope for making progress. Cain and his contemporaries are measuring and predicting pungency more objectively on a physico-chemical basis. Cain wishes to develop standardized protocols for researchers so that they can predict the irritancy response of persons exposed to chemicals. Perhaps the future paths pursued by Cain and the TLV/WEEL Committees will be able to converge to the benefit of all.

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KEYWORDS
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