LETTERS

Neutron Scattering: Biological Applications

In her otherwise excellent article "Neutron scattering: New look at biological molecules" (Research News, 4 Nov. 1977, p. 481), Jean L. Marx can leave the reader with the impression that research in this area is supported in the United States only by the Department of Energy (Brookhaven National Laboratory) or the Department of Commerce (National Bureau of Standards). One should also stress the participation of the National Institutes of Health, which of course do not own a reactor but nevertheless finance a considerable fraction of the biological neutron scattering work done in this country. In particular, the NBS program is a joint venture between the Laboratory of Molecular Biology of the National Institute of Arthritis, Metabolism, and Digestive Diseases and the Institute for Materials Research at NBS. Biological diffraction studies utilizing the NBS reactor were made possible only by this cooperative approach.

ALEXANDER WLODAWER
Reactor Radiation Division, Institute for Materials Research, National Bureau of Standards, Washington, D.C. 20234

Benzene in Consumer Products

Benzene has recently become the focus of regulatory activity in the United States, because of concern in general for its bone marrow toxicity and specifically for its leukemogenic properties. The Occupational Safety and Health Administration (OSHA) has proposed a lowering of the occupational exposure limit to an average atmospheric concentration of 1 part per million (ppm) (*1*). Additionally, the Consumer Product Safety Commission has been petitioned to remove all products containing benzene from the market (*2*). A previous report (*3*) has indicated that consumers may be exposed unknowingly to benzene in the home. Subsequently, numerous inquiries have been received concerning the identity of products that contain benzene and the potential adverse effects that may be associated with normal home use. Concurrently, an investigation was being made to evaluate the magnitude of benzene exposure associated with the use of a benzene-containing paint stripper in the home. We report here the methodology and results of that investigation.

The experiment took place in a two-car garage measuring approximately 8 by 21 by 20 feet on a clear day with an outside ambient temperature of 76°F and a wind velocity of 10 miles per hour. An overhead door was opened intermittently. Personnel used a self-contained breathing apparatus [Mine Safety Appliances Co., Air Mask model 401 (*4*); Bureau of Mines Approval No. 13E-10] which included a mask and a tank of compressed air to provide an uncontaminated air supply. They also wore rubber gloves impervious to organic solvents. To simulate a typical consumer exposure, paint was removed from an end table with a paint stripper purchased in a local department store. Analysis of the paint stripper by gas chromatography revealed a content of 52 percent benzene by volume.

Table 1. Atmospheric benzene concentrations during a household furniture stripping operation.

Sample number	Benzene concentration (ppm)
Blank*	0
1	78
2	73
3	79
4	225
5	195
Mean (five samples)	130

*A blank charcoal tube was used to validate the laboratory methodology.

Approximately 18 ounces of the stripping solution was applied with a paint brush. The resulting paint debris was removed with a scraper. Air samples in the breathing zone were collected on standard 150-milligram activated coconut charcoal tubes placed on the investigator's lapel. A flow rate of 1 liter per minute was provided by a battery-operated sampling pump [MSA model G (*4*)] placed on the investigator's belt. Air samples were collected for five sequential 5-minute time periods. The charcoal was desorbed by carbon disulfide and analyzed by gas chromatography using conventional methodology (*5*). The sampling and analytical relative error associated with this procedure is estimated to be 13 percent (*6*).

The above-mentioned sources of benborne concentrations ranging from 73 to 225 ppm. The increase in concentrations for sequential samples reflects the build-up of benzene vapors as the stripping operation progressed over the 30-minute sampling period. The data clearly indicate atmospheric concentrations in excess of the current OSHA standard (now being modified to lower the exposure level) for benzene concentrations in the occupational setting (*7*). The results are consistent with those reported several years ago for concentrations of benzene vapor during commercial furniture stripping operations (*8*).

Bone marrow toxicity associated with home usage of benzene-containing paint strippers has been documented previously. Rawson (*9*) reported the case of a policeman with "myeloid metaplasia," who had given "a history of using large amounts of benzol-containing paint remover."

Other commercial products that may also contain benzene include carburetor cleaner, denatured alcohol, rubber cement for tire-patch kits, and art and craft supplies. The misuse of gasoline [containing 1 to 2 percent benzene by volume in the United States and up to 16 percent in some European gasolines (*10*)] for cleaning purposes around the home may also result in unnecessary exposure. In addition, exposure to benzene occurs in high school and university chemistry classes as well as in professional laboratories.

The above-mentioned sources of benzene exposure outside the occupational setting are now being brought to the attention of the scientific community and the public at large so that, until regulatory action is taken by appropriate government agencies or voluntary action is taken by responsible industries, concerned citizens may take action to protect themselves.

RONALD J. YOUNG
ROBERT A. RINSKY
PETER F. INFANTE
Industry-Wide Studies Branch, Division of Surveillance, Hazard Evaluations and Field Studies, National Institute for Occupational Safety and Health, Center for Disease Control, 4676 Columbia Parkway, Cincinnati, Ohio 45226
JOSEPH K. WAGONER
Office of the Assistant Secretary, Occupational Safety and Health Administration, Washington, D.C. 20210

References and Notes

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