

# SENSOR Occupational Lung Disease Bulletin

A project of the Massachusetts Department of Public Health's Occupational Health Surveillance Program, the Massachusetts Thoracic Society, and the Massachusetts Allergy Society

Massachusetts Department of Public Health, Occupational Health Surveillance Program, 6th floor, 250 Washington Street, Boston, MA 02108, Tel: (617) 624-5632, Fax: (617) 624-5696

October 1999

Dear Health Care Provider:

Mass SENSOR routinely interviews all occupational asthma cases reported to the program to learn more about the worksite exposures which contributed to the patients' conditions. For some of these cases, worksite evaluations are conducted.

Worksite evaluations are considered a priority for cases where the asthma trigger is a known or suspected sensitizer and/or when co-workers appear to be at risk.

In this issue, we present the results of an interesting worksite evaluation. The case, which was reported to Mass SENSOR, involved a previously unrecognized source of isocyanate exposure (orthopedic casts) and provided an opportunity for Mass SENSOR to work with the National Institute for Occupational Safety and Health (NIOSH) through their Health Hazard Evaluation (HHE) Program. Isocyanates are known asthma causing agents.

Health Care Providers may request an HHE from NIOSH on behalf of their patients. If you see a case that you believe warrants a worksite investigation, please let us know when you report the case.

Sincerely,  
Catharine M. Tumpowsky, MPH

## Orthopedic Casting Materials: An Unusual Source of Isocyanate Exposure

### Introduction

Upon request from employees, employee representatives, or employers, NIOSH conducts field investigations of potential health hazards in the workplace. These investigations, called Health Hazard Evaluations (HHEs) are conducted to determine whether or not any substance normally found in the place of employment has potentially toxic effects. During the summer of 1998, MassSENSOR received a report of a case of work-related asthma in a chemist who had worked for a manufacturer of orthopedic materials. In November of 1998, after interviewing the patient to learn more about his exposures at the worksite, MassSENSOR requested assistance from NIOSH's HHE program. In particular, MassSENSOR requested NIOSH's assistance in gathering information about: chemicals in use; severity of inhalation exposures; the potential for dermal absorption; the adequacy of ventilation and work practices used to limit exposures. We were also interested in knowing if the employer had a Hazard Communication program and employee training related to exposures and controls. The specific purpose of the NIOSH

evaluation was to determine if currently employed workers were at risk for developing asthma from exposures at this workplace.

### Case History

The case involved a 63 year-old male who began working for the company in 1989. He was employed as a Ph.D. chemist primarily in charge of quality control testing. His job sometimes involved the mixing of chemicals, particularly isocyanates. The patient began experiencing respiratory symptoms soon after beginning work at the company. Two years after he began working there, the patient moved to a new facility. The severity of the worker's respiratory symptoms noticeably increased four years after moving to the new facility. There were no changes in processes, exposure controls, or job duties to correspond with this change in symptoms. The patient did not have a pre-existing history of asthma or allergies and had never smoked. He did not seek treatment until 1996 at which time he was diagnosed with new-onset work-related asthma. He began taking medication but found that he was increasingly sensitive to chemicals in the workplace. By 1997, he was no longer able to work and terminated his employment.

### Results

In December 1999, NIOSH industrial hygienists traveled to the workplace to gather information about the facility.

*Workplace conditions and processes:* The product research and development activities at both facilities were primarily related to synthetic orthopedic casting wraps. Job duties of the patient were similar in both facilities, i.e. developing formulations and troubleshooting products. Interviews with workers indicated that exposure conditions at the old facility were worse than those at the new facility based upon qualitative observations. The primary tasks performed by the patient involved quality control testing of synthetic casting wrap, which contained about 14% MDI (4,4-diphenylmethane diisocyanate). His tasks included opening the product container, dipping the casting wrap in water, and then wrapping it on appendages of either coworkers or laboratory models. The employer required the use of natural rubber latex gloves to protect against skin exposure to isocyanates during cast wrapping. The primary exposure potential in the process of product quality control testing was thought to be when the packages of casting wrap were opened and casting work was done.

**REPORT JULY-SEPTEMBER CASES NOW**  
By October 31st, report all occupational lung disease cases seen for the first time between July and September, 1999. If

*continued on other side*

**you have NOT seen any cases, it is not necessary to return the report form.**

All work other than casting was conducted within laboratory hoods.

*Exposure Monitoring:* The company conducted extensive sampling for airborne MDI, all of which indicated non-detectable concentrations upon analysis. The employer had equipped the laboratory with a closed-circuit television camera for use when the patient worked with isocyanate-containing products. In the event that the patient had to work alone in the laboratory, the camera was activated by security. The purpose of this self-initiated added security effort was to ensure that assistance could be provided if the worker experienced a severe reaction to the product. The patient did not experience such a reaction while working in the laboratories, but was witnessed experiencing milder respiratory symptoms at work. Air flow through laboratory hoods was monitored and controlled by a computerized variable air volume system designed to increase air flow to each hood in the event of a sensed pressure drop. Supply air for the ventilation system was pulled from the manufacturing area.

*Hazard Communication:* The employer had an extensive Hazard Communication Program in place both while the patient was employed and when NIOSH visited the workplace. Interviews indicated that the Hazard Communication Program did not include a teaching unit specific to isocyanates, but did include information about where to find information on the chemicals with which the laboratory researchers worked. Interviewed co-workers were aware of the hazards associated with isocyanate exposure.

*Other cases:* A literature search was conducted and one case related to the use of orthopedic casting products was identified as was a case of skin sensitization related to the use of isocyanate-containing casting products.

#### *Discussion*

The most common and debilitating health effect associated with isocyanate exposure is respiratory sensitization. This condition is indistinguishable from asthma, and is commonly referred to as isocyanate-induced asthma; i.e. a generalized airway obstruction that is usually reversible. Prevalence estimates for isocyanate-induced asthma in exposed worker populations vary from 5 – 30%. A worker with this disease will present with acute symptoms of asthma; e.g. coughing, wheezing, shortness of breath, tightness in the chest, and nocturnal awakening. After sensitization, any exposure to isocyanates, even to levels below any occupational exposure limit or standard, can produce an asthmatic response, which may progress to respiratory distress. This asthmatic reaction may occur minutes after workplace exposure (immediate), hours after exposure (late), or a combination of both immediate and late components after exposure (dual). The percentage of sensitized workers with persistent symptoms of asthma after years of no isocyanate exposure may be 50% or higher. Studies have shown that workers with persistent asthma have a significantly longer duration of symptoms prior to diagnosis, larger decrements in pulmonary function, and a severe degree of nonspecific bronchial hyperactivity

at diagnosis. Hypersensitivity pneumonitis (allergic alveolitis) has been described in workers exposed to diisocyanates, but is considered a rare event.

Traditionally, the industrial hygiene and occupational medicine communities have centered their research and intervention efforts on airborne isocyanate exposures. Recent animal studies show that dermal exposures to diisocyanates play an important role in the development and progression of respiratory sensitization. This finding has yet to be tested in dermally exposed workers, but may explain why this worker developed asthma in the absence of measurable airborne MDI exposure.

It is interesting to note that the worker was reported to have used latex rubber gloves when exposed to isocyanates. For some workers, exposure to latex results in sensitization reactions including asthma. No medical information was available to allow NIOSH to determine if a specific agent challenge test was done to establish MDI as the causative exposure. It is plausible that the etiologic agent could have been either MDI or the latex gloves.

The choice of protective gloves should be appropriate for the exposure. Guidelines for glove selection based on the chemical of exposure have been established by the American Society for Testing and Materials (ASTM). NIOSH recommended that the company provide a laminate glove for protection against skin exposure to MDI. Natural rubber latex gloves of the thickness commonly used with medical supplies provide poor protection for exposure to organic chemicals that permeate through the material very quickly.

### **Wheezing at Work**

The Massachusetts Nurses Association, with funding from the Department of Industrial Accidents, has developed a training program for nurses and other health care professionals who suffer from latex allergy or work-related asthma.

Two training sessions will be offered on **November 8, 1999** at Olympus Specialty Hospital in Springfield, MA. For more information, please call Susan Clish in the MNA Nursing Department at 800-882-2056, X723.

### **Number of Work-Related Asthma Cases Reported to Massachusetts SENSOR, March 1992- June 1999**

<b>April 1999</b>	<b>May 1999</b>	<b>June 1999</b>	<b>Total to Date (3/92-6/99)</b>
61*	6	1	711

\*The majority of these cases came from one occupational health clinic which reports to Mass SENSOR on a quarterly basis.

