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International Notes

Occupational Mercury Poisoning — Nicaragua

In May 1980, the detection of inorganic mercury in drinking water in Managua, Nicaragua, led to the discovery that a chemical plant had been discharging mercury into Lake Managua, the source of the city's water supply. An estimated 40 tons of mercury has been discharged, at increasing annual rates, into air and water during the 12 years of the plant's operation; the rate of discharge in 1980 was approximately 50 pounds per day. On further investigation, a major outbreak of occupational mercury poisoning was discovered in workers at the plant.

The plant, partially owned and managed by a firm based in the United States, manufactures chlorine gas and sodium hydroxide (caustic soda) from sodium chloride by the chloralkali process; this process involves the separation of sodium from chlorine by direct electric current in the presence of a mercury cathode (*1*). Inspection of the plant showed visible contamination with metallic mercury, including pools of mercury on the floor of several work areas. Since metallic mercury is highly volatile and vaporizes readily at room temperatures, there was also inhalation exposure. Workers had been provided no personal protective equipment and had not been informed of the hazards of this element.

Physical examinations were conducted on all 152 workers at the plant. Fifty-six (37%) were found to have clinical evidence of mercury intoxication with central nervous system (CNS) damage. Initially, the criteria of such intoxication were the presence of specific signs and symptoms (tremor, emotional lability/irritability, metallic taste, and gingivitis) plus the presence of one or more non-specific symptoms (insomnia, memory deficit, inability to concentrate, depression, dysarthria, diaphoresis, chills, cramps, weakness, and sialorrhea). Fifteen other workers (10%) were found to have at least 3 specific and 2 non-specific symptoms of mercury intoxication.

Fifty-four of the initial 56 workers with CNS signs or symptoms were examined further by a neurologist. Forty-five had objective tremor, 45 memory deficit, 45 difficulty in concentration, and 52 paresthesias. One had undergone hospitalization for treatment of psychiatric symptoms; later, he and 3 co-workers had been removed from the plant by health officials following the development of mercurialism.

Epidemiologic investigation indicated that the highest prevalence of mercurialism had occurred in "mercury cell" (vat) workers (12 of 16, 75%) followed by process operators (16 of 33, 48%), and maintenance workers (23 of 62, 37%); in office workers, supervisors, and others the prevalence rate was 12% (5 of 41). The interval from beginning of employment to onset of symptoms ranged from 7 months to 7 years.

As a result of this investigation, Nicaraguan authorities have ordered (1) lowering of

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mercury levels in the air in the plant; (2) improved maintenance; (3) construction of eating, showering, and changing facilities for workers; (4) provision of work clothes; and (5) periodic biologic monitoring of workers.

Reported by E Velasquez, MD, Ministry of Labor, Nicaragua; A Hassan, MD, Ministry of Health, Managua, Nicaragua; R Belmar, MD, E Drucker, PhD, D Michaels, MPH, Div of Occupational Health, Dept of Social Medicine, Montefiore Hospital, Bronx, New York; Div of Surveillance, Hazard Evaluations and Field Studies, National Institute for Occupational Safety and Health, CDC.

Editorial Note: Outbreaks of mercurialism are seldom seen today. Chronic mercury poisoning occurs in 2 distinct clinical forms. Inorganic or elemental mercury typically produces a syndrome of dermatitis, gingivitis, stomatitis, and tremor together with CNS dysfunction (*2*). The CNS manifestations—including irritability, pathologic shyness, and the loss of attention span, memory, and intellect—are referred to as erethism (*3*). Nephrosis may occasionally occur (*4*). As in the present outbreak, inorganic mercurialism is almost always an occupational disease, and may be seen in such occupationally exposed groups as miners, mirror makers, mercury battery makers, jewelers, photographers, dentists, and dental assistants.

Poisoning by the organic compounds of mercury produces an almost purely neurologic illness (*5*). Early symptoms include paresthesias, numbness, and other manifestations of sensory neuropathy. With continued exposure, the syndrome progresses to a triad of dysarthria, ataxia, and visual field constriction (*6*). Organic mercury poisoning has occurred in occupationally exposed groups such as pesticide formulators and seed handlers (*7*).

Much greater attention has, however, been directed to the widespread outbreaks of organic mercury poisoning that have occurred as the result of the consumption of mercury-contaminated foodstuffs (*8*). Major epidemics have occurred in Minamata Bay, Japan, where exposure resulted from ingestion of contaminated shellfish (*9*), and in Iraq (*10*), Pakistan (*11*), and Guatemala (*12*), where exposure was caused by consumption of seed grain that had been treated with mercurial fungicides. In 1969, an episode occurred in the United States among members of a New Mexico family who ate pork from hogs that had been fed mercury-treated seed grain (*13*). Lake Managua serves as a major source of fish for Managua residents, and there is concern that a syndrome similar to that which occurred in Minamata may develop among consumers of fish from the lake. Additional investigations are underway to evaluate possible organic mercury intake in persons consuming water or fish from Lake Managua.

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Epidemiologic Notes and Reports

Formaldehyde Exposure at a Mortuary Science Embalming Laboratory – Ohio

In October 1979, a health hazard evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) at an embalming laboratory at an Ohio college of mortuary science to determine if chemicals used during embalming operations were presenting a potential exposure problem. The request was prompted by the early-disability retirement of a 30-year-old embalming instructor, who had developed asthmatic bronchitis after 5 years of laboratory exposure.

Medical histories of 4 instructors who were working in the laboratory at the time of the investigation revealed that all gave positive histories of allergy. All were exposed to embalming fluids consisting of formaldehyde, phenol, unspecified preservatives, ketone, and ester solvents. This exposure was on a daily basis for periods ranging from 3 to 12 years. All noted symptoms of burning eyes and nose, dryness of mouth and throat, cough, headache, and lacrimation while using these chemicals.

To evaluate environmental exposures, air samples were taken for phenol and formaldehyde determination during a 2-day period. One the first day, when a greater-than-usual number of bodies were embalmed, the ventilation system was not in operation (not an unusual condition), and airborne contaminants accumulated. The second day's embalmings were performed while the exhaust system was in operation.

Environmental sampling indicated the phenol concentrations were below the limits of detection (0.4 mg/sample). Formaldehyde, on the other hand, was found to exceed the current Occupational Safety and Health Administration (OSHA) standard of 3 parts per million (ppm) (*1*) in 2 samples (3.93 and 3.65) on the first day of evaluation. All sample concentrations exceeded the NIOSH-recommended ceiling of 1.0 ppm. On the second day of the evaluation, with ventilation and exhaust systems working properly, concentrations in all samples were within the NIOSH-recommended and OSHA standards.

Reported by the Hazard Evaluations and Technical Assistance Br, Div of Surveillance, Hazard Evaluations, and Field Studies, NIOSH, CDC.

Editorial Note: Formaldehyde gas may cause severe irritation to the mucous membranes of the respiratory tract and eyes. Sensory irritation (itching of the eyes, dry and sore throat, increased thirst, disturbed sleep) has been reported in workers in paper-processing plants at concentrations of 0.9 to 1.6 ppm (*2*). In another study, intense irritation of the eyes, nose, and throat was reported at levels ranging from 0.13 to 0.45 ppm (*3*). More recent studies conducted in funeral homes indicated that concentrations of airborne formaldehyde from 0.25 to 1.39 ppm evoked complaints of upper respiratory tract and eye irritation and headache among embalmers (*4*). The levels at which serious inflammation of the bronchi and lower respiratory tract would occur in humans are unknown;