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From: Shusterman, Dennis (CDPH-DEODC) [Dennis.Shusterman@cdph.ca.gov]
Sent: Tuesday, January 05, 2010 4:33 PM
To: NIOSH Docket Office (CDC)
Cc: Materna, Barbara (CDC cdph.ca.gov); Robert Harrison
Subject: NIOSH-057 Information Docket (1-bromopropane)
Attachments: HESIS-DOSH_Memo_12-12-09.pdf

Dear Sirs:

Attached please find case report materials relevant to your docket on 1-bromopropane. The memo in question was completed just a few days prior to your nominal cutoff date for public comments.

Also of potential interest to NIOSH, the California Occupational Safety and Health Standards Board voted, on December 17, 2009, to adopt a Permissible Exposure Limit for 1-BP of 5 ppm (8-hour, time-weighted average).

I hope that this information will be of assistance to you in your risk assessment and risk communication processes.

Best regards-

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State of California—Health and Human Services Agency
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Date: December 12, 2009
To: Bob Barish, MPH, CIH
CA Dept. of Industrial Relations / DOSH / Research and Standards Unit
From: Dennis Shusterman, MD, MPH
Elizabeth Katz, MPH, CIH
E. Kainne Dokubo, MD, MPH (visiting fellow)
CA Dept. of Public Health / Occupational Health Branch / Hazard Evaluation System and Information Service (HESIS)
Re: Peripheral neuropathy case potentially related to 1-bromopropane exposure

The following is the summary of a case that came to the attention of HESIS staff and is relevant to a compound which is being considered for rulemaking by the California Occupational Safety and Health Standards Board – specifically, 1-bromopropane (1-BP). The affected employee (EE) is a machinist who worked for 24 years at (but is currently on leave-of-absence from) a Sacramento-area firm that manufactures microwave equipment.

Records reviewed:

- 1) Medical records from a multi-specialty medical group in Sacramento, including primary care, podiatry, and neurology spanning the approximate dates 2/95 to 4/08.
- 2) An Industrial Hygiene Assessment Report of the workplace dated June 30, 2008.
- 3) EE deposition before the CA Workers' Compensation Appeals Board dated September 11, 2008.
- 4) The report of a Qualified Medical Evaluator (QME) dated January 13, 2009.
- 5) Telephone interview of EE by HESIS personnel on December 9, 2009.
- 6) MSDS dated 4/12/05 for Lenium® ES obtained on-line from Petroferm, Inc.

To briefly synopsize the above records:

Medical records:

The EE is a 49 year-old male machinist who sought medical attention for bilateral heel pain of 4 months' duration in July of 2006. Upon referral to a podiatrist by his primary care physician, he was initially diagnosed with plantar fasciitis and metatarsalgia, and was treated with orthotics and anti-inflammatory medications. However, the podiatrist subsequently recommended a neurology consultation based on a revised diagnosis of peripheral neuropathy. In early 2007 the EE underwent nerve conduction studies which showed a symmetrical peripheral pure sensory polyneuropathy affecting the lower extremities.

The neurology workup included history, physical examination, and laboratory tests. Pertinent physical examination findings included decreased vibratory sense in the lower extremities, increased sensitivity to temperature, and decreased deep tendon reflexes at the ankles and knees. Laboratory tests included borderline elevated fasting blood sugar and borderline impaired glucose tolerance tests (but with a normal Hemoglobin A1c). In addition, the EE had normal vitamin B-6 and B-12 levels, normal urinary levels of

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heavy metals (lead, arsenic, mercury, zinc, copper, and cadmium), mildly elevated liver function tests (with negative hepatitis serologies), and normal thyroid function, erythrocyte sedimentation rate and C-reactive protein levels. Cancer screening tests (CEA and PSA) were normal. The neurologist's diagnosis was peripheral neuropathy. The leading suspected cause was initially stated as glucose intolerance, although the patient did not meet the diagnostic criteria for diabetes mellitus and had a normal glycosylated hemoglobin level. In the initial report the neurologist did not consider potential 1-BP toxicity in the differential diagnosis. However, 1-BP toxicity was considered after the EE performed an internet search yielding, among other materials, HESIS' 2003 Hazard Alert on this chemical.

In January of 2009 the EE underwent an examination by a QME at the request of the defense attorney for the then-pending workers' compensation case. At that time he had been off work several months because of his complaints of pain with prolonged standing and an unsteady gait. A detailed review was made of the medical history, prior medical records, work history, environmental history, personal habits, and pertinent toxicology literature, in addition to a physical examination being conducted. The diagnosis rendered was that of sensory peripheral neuropathy, with additional diagnoses including obesity, a history of plantar fasciitis, and obstructive sleep apnea. The QME report noted no evidence of dysfunctional behavior on the part of the EE and found the EE's account of his exposures and illness credible in nature. Note was made that for several years prior to onset of symptoms the EE worked on a daily basis with a degreasing substance with the trade name of Lenium ES (which consists of 80-90 % 1-BP, 5-10% isopropanol [rubbing alcohol], and 1-2% each of three minor constituents). Further, an estimate was made of a total cumulative exposure time to Lenium vapors of at least 702 hours based upon the occupational history. The QME concluded that it was "more medically probable than not" that Lenium exposure caused the peripheral neuropathy. With regard to the issue of apportionment, the QME report precluded a role for any "preexisting disability" or "progressive naturally occurring disease processes." In this regard, the report concluded "100% of his residual permanent disability can be attributed to the industrial exposure to Lenium..."

Exposure potential:

The EE's exposure potential to this [predominantly 1-BP containing] degreasing product is summarized here from review of: 1) the QME report; 2) an Industrial Hygiene report authored by the workers' compensation carrier's risk control contractor; 3) the EE's deposition before the CA WCAB, and from 4) a direct telephone interview of the EE by HESIS staff. The EE states that, until he went on leave-of-absence in February of 2008, his main job duty was to machine electronics housings from either aluminum or brass. After machining, these housings would be cleansed of any remaining metal chips or cutting oils using a vapor degreasing apparatus located in the "Environmental Lab," a work area separate from the machining area. The EE would enter this area, remove the top of the vapor degreaser, manually spray degreasing liquid onto the housing(s) to dislodge any metal fragments, and then set the housing(s) in a basket that would be lowered over the portion of the vapor degreaser containing heated degreaser liquid. After approximately two minutes, the cover of the apparatus was removed again, the parts shaken to remove liquid adhering to openings in the housings, and the part dipped in cold ("clean") degreaser for about two minutes. The total time per cycle was approximately 6 minutes, and the EE would repeat this process from 2-12 times per day, 5 days per week over a 9-year period.

The EE wore thick black protective gloves and a face shield during this operation, but was not provided with a respirator. In addition, he would occasionally get direct splashes of Lenium liquid on his bare forearms, above the glove line. On at least two occasions (in approximately 2006 and 2007), he felt lightheaded while processing unusually large numbers of housings. He also recalls having developed watery eyes and perennial [year-round] "hay fever-like" symptoms (sneezing, rhinorrhea, and stuffy

nose). Although he does not specifically recall having his nasal symptoms predominantly on working days, he does state that they have resolved since he has been on leave-of-absence from work.

According to the EE, prior to approximately 1997, the degreasing liquid used was a Freon compound. Subsequent to that date, the same apparatus was used with Lenium liquid. The next major work process change occurred in approximately 2004, when a new health and safety director instituted the use of an automated timer to regulate dipping operations. The EE states that the characteristic smell of Lenium liquid remained strong throughout the period that he performed degreasing operations, any work practice changes notwithstanding. In addition, although the employer (ER) installed local exhaust ventilation above the vapor degreaser, the ER was compelled to remove it within a few weeks' time by local air pollution officials, who stated that direct venting of the operation to the ambient environment was not permitted. As a consequence, for the majority of the time the EE performed these duties, the nearest exhaust plenum was located behind and above him (i.e., with his breathing zone between the vapor source and the exhaust plenum).

The risk management contractor for the workers' compensation carrier conducted personal- and area-sampling for both 1-BP and for isopropyl alcohol in the Environmental Lab approximately three months after the EE went on leave-of-absence. All sampling took place for approximately 2 hours, 40 minutes, and was extrapolated to an 8-hour time-weighted average (8-hr TWA) using the assumption that no exposure occurred during the remainder of the workshift, outside of the sampling period. Three employees with differing job duties wore personal samplers (including one full-time worker in the Environmental Lab who was not directly involved in using the degreasing tank). They found personal sample results for 1-BP to vary between 0.99 to 5.4 ppm (extrapolated to 0.33 to 1.8 ppm for an 8-hr TWA), and the area sample (above the degreaser) was measured at 6.0 ppm (extrapolated to 1.9 ppm for an 8-hr TWA). The level of activity involving the degreasing tank during sampling was not specified in the industrial hygiene report.

Literature review:

HESIS personnel were able to identify a total of four peer-reviewed publications documenting symptomatic human neurotoxicity from 1-BP. These reports described findings in a total of 13 workers. Although many of the affected workers complained predominantly of central nervous system problems, the majority also complained of peripheral neuropathic symptoms, including lower extremity paresthesias (abnormal sensations), numbness, pain, and gait disturbances (1-4). In addition, two occupational cohort studies were identified, one of which included nerve conduction studies (5,6). The latter study showed significant decrements in lower extremity nerve conduction velocities among female workers exposed to 1-BP at a time-weighted average [geometric mean] concentration of 2.9 ppm, compared to unexposed controls matched for age, smoking status, and alcohol consumption (6). Approximately half of the exposed workers also showed decreased vibratory sense in the lower extremities, compared to no controls. A number of animal toxicology reports also confirm the neurotoxic potential of 1-BP exposures (7-18).

Conclusions:

Based upon the information reviewed to date, HESIS staff concurs with the conclusions of the QME report. Specifically, HESIS staff agrees that the EE's peripheral neuropathy was, with reasonable medical probability, attributable to Lenium ES [i.e., 1-BP] exposure on-the-job. We further concur that no potential competing disease entities (e.g., metaplastic, infectious, inflammatory, metabolic, nutritional,

traumatic or toxic) were likely to have been responsible for the clinical presentation in this case. HESIS staff believes that this case reinforces the need for appropriate workplace controls of 1-BP exposures.

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