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HEXANE SHEXANE

Recently, newsletters have been circulating to auto industries highlighting the toxic effects of hexane, a chemical commonly found in brake cleaners. The toxic effects such as peripheral neuropathy (damage to nerves) from exposure to n-hexane have been known for over two decades. The safe exposure limits for hexane specified by governmental agencies has also been 50 ppm for a while.

Problem: Research conducted by physicians and at UC-Berkeley in the last year has indicated that shop technicians' overexposure to n-hexane over the long term has caused damage to nerves in the feet, legs, hands and arms. The California Department of Health Services, Hazard Evaluation System and Information Service issued an advisory in June 2001 disseminating information regarding the harmful effects of n-hexane being used in vehicle repair. The advisory states that symptoms from over exposure to n-hexane include numbness, tingling, weakness in affected body parts, and reduced ability to feel touch, pain, vibration and temperature. Short-term effects, which disappear within hours of cessation to exposure, include headache, dizziness and drowsiness. Now the real issue to employers is how to ascertain if n-hexane is present in shop chemicals.

Find: A quick way to determine the presence of n-hexane is to review the Material Safety Data Sheet for the aerosol cleaner used in the shop area. The n-hexane ingredient in the cleaner may not be labeled as n-hexane as most manufacturers use commercial grade hexane. Hexane and n-hexane have similar atoms which are tied differently on a molecule. Just imagine them to be two similar models of an automobile with varying options! Now, the commercial grade hexane used in aerosol cleaners has about 50% n-hexane. We do this dichotomy between hexane (with no n-hexane) and n-hexane because of the difference in their harmful effects. Cal-OSHA permissible exposure limits (PEL) for hexane (PEL 500 ppm) is ten times that for n-hexane (PEL 50 ppm). In essence, one can be safely exposed to 10 times of hexane compared to n-hexane. The presence of other chemicals in the cleaners such as acetone and methyl ethyl ketone makes the damage to nerves more likely. To make matters worse, these are some of the chemicals found in aerosol cleaners with hexane. Harmful exposure of n-hexane to an employee can be determined by an occupational medical physician through medical tests including a urine test.

Cure 1: Once hexane is found on your work premises, steps should be taken to reduce exposure immediately. A sure shot way is to replace the n-hexane in aerosol cleaners. Increased ventilation, employee monitoring, providing personal protective equipment such as gloves and respirators, and employee training can also help reduce exposure. Though the list of replacement chemicals is extensive, they too have some harmful health effects. A survey of aerosol cleaners that contain n-hexane is enclosed.

Cure 2: The potential chemical candidate for hexane replacement is heptane. The PEL levels for heptane are 500 ppm with a better fire safety factor. Harmful health effects from heptane include irritation to mucus membranes and narcosis that can occur at higher exposures. **But:** In the South Coast Air Quality Management (SCAQMD) area, the users are limited to aerosol cans with hexane or heptane to 160 oz. per day. This is part of the law that allows each employer to utilize aerosol cleaners with greater than 50 grams per liter (g/l) of VOC to a maximum of 160 oz. per day.

In SCAQMD jurisdiction, the other options are acetone or water based cleaners. Acetone has an irritable smell and damages plastic and rubber parts. With a flashpoint of 0° F, it is also highly flammable. Low flame temperatures also make acetone difficult to extinguish once it catches fire. The only other choice for cleaning brake parts would be an aqueous based parts cleaner. Tabletop washers with Stoddard solvent are banned in SCAQMD jurisdiction. Of note, SCAQMD is tightening the rules on water-based cleaners too. As of January 1, 2003, only 25 grams per liter of VOC are allowed in water-based cleaners versus 50 grams per liter presently.
For those of us who are not in the SCAQMD jurisdiction, the Stoddard solvent is probably the best cleaning material. With great cleaning efficiency for oil, dirt and grease laden parts, it is considered to be safer than most other organic solvents.

News Reports
Chronic Exposure to n-Hexane May Cause Nerve Damage in Auto Repair Technicians
Report Number: NR-2001-11-09
Release Date: November 26, 2001
The solvent n-hexane is used in a variety of products, including automotive brake cleaners, degreasers, and other parts cleaners. A new report from the U.S. Centers for Disease Control and Prevention (CDC) suggests that chronic over-exposure to the solvent may cause peripheral nerve damage in automobile repair technicians. Although n-hexane's neurotoxicity has been reported in other industries, this is the first time that such a finding has been made with respect to auto technicians.

The report was published in the November 16 edition of *Mortality and Morbidity Weekly Report* (MMWR, 50.45 (2001) 1011-1013). It was submitted by the California Department of Health Services (CDHS). CDHS investigated a case of peripheral neuropathy in a 24-year old, male, auto repair technician. The symptoms of the technician were consistent with exposure to n-hexane. The technician reportedly used one to nine cans of brake cleaner daily during his 22-month employment. The brake cleaner contained a mixture of n-hexane with other petroleum distillates. Additional investigation by the CDHS identified two other cases of suspected solvent-related peripheral nerve damage in auto repair workers within the State.

Chronic exposure to n-hexane is known to cause nerve damage to the arms, legs, hands, and feet. Symptoms of nerve damage typically develop after a few months of overexposure. The symptoms include numbness, tingling, weakness, paralysis, and the reduced ability to feel pain, vibration, and temperature. Removal from exposure is the only known treatment for n-hexane-related neurotoxicity. The exposed person may recover, but recovery may take months to years depending upon the disease severity. In severe cases, the damage may be permanent. Inhalation of vapors or aerosols is the main route of occupational exposure, although exposure may also occur through skin absorption or ingestion. Occupational exposure limits for n-hexane vary widely. The U.S. Occupational Safety and Health Administration's (OSHA) Permissible Exposure Limit (PEL) for n-hexane is 500 partper-million (ppm), while the California-OSHA exposure limit is 50 ppm. The American Conference of Governmental Industrial Hygienists (ACGIH) recommends 50 ppm as its Threshold Limit Value (TLV).

CDHS has published a fact sheet describing the hazards of n-hexane and recommendations for reducing occupational exposure to the solvent in the auto repair industry. These recommendations include:
- Switching to n-hexane-free products
- Reducing the amount of solvent used
- Improving ventilation
- Using personal protective equipment

The fact sheet is available online at www.dhs.ca.gov/ohb/HESIS/nhexane.pdf. California has also published updated medical guidelines for diagnosing n-hexane exposures. It is available online at www.dhs.ca.gov/ohb/HESIS/nhexane.htm.