

Compliance Headliner

Do contact lenses pose a greater risk for employees exposed to hazardous chemicals?

According to OSHA, 1,000 eye injuries occur in the American workplace every day.

The financial cost of these injuries is enormous, resulting in more than \$300 million per year as a result of lost production time, medical expenses, and workers compensation cases. The Bureau of Labor Statistics (BLS) reports that almost 70% of eye injuries result from flying particles or sparks striking the eye. Exposure to hazardous chemicals account for another 20% of the total number of eye injuries, with miscellaneous conditions such as tree limbs, ropes, tools, chains, etc. representing the cause of the remaining 10%. Workers engaged in skilled crafts, such as mechanics, repairers, carpenters and plumbers are apparently at the highest risk for enduring such injuries. The Bureau of Labor Statistics (BLS) reveals that these workers sustained more than 40% of the injuries studied.

However, studies have shown that over 90% of all eye injuries can be prevented by using the appropriate protective eyewear for the task. The term “protective eyewear” leaves room for interpretation... does this include prescription glasses? Contact lenses? Sunglasses? Safety glasses? Speaking in general terms, most industrial workers and those exposed to chemicals in the work environment



are encouraged not to wear contact lenses, because of a popular belief that chemicals can become trapped between the back of the lens and the front of the eyeball, resulting in serious injury to the outer tissues of the eye. It is the policy of some work places to strictly forbid employees from wearing contact lenses, requiring workers to resort to prescription safety glasses and/or bulky goggles that fit over the employee's glasses.

Potential chemical reactions, resulting from the combination or breaking apart of matter to form new types of matter, must also be considered when evaluating a potential exposure. Once a chemical comes in contact with the outer layer of the eye, a reaction may occur that: creates a precipitate (solid); emits or absorbs heat; neutralizes itself by exchanging opposite components; or causes a decomposition of the eye tissue. The types of chemicals handled, their physical form, the configuration of the work area and the concentration available may greatly affect the level of eye protection necessary (*continued on pg 4*).

Lungs provide a natural means for excretion of toxic chemicals, but high levels can saturate the system, causing irreversible damage...

Of the four routes of exposure to chemicals, *ingestion*, *absorption*, *injection* and *inhalation*, the latter has proven to be the most dangerous because it provides an efficient passageway for contaminants to enter the bloodstream. It has been stated that the tissue of an average person's pulmonary system (which consists of the lungs, bronchi, bronchioles, trachea, diaphragm and nerve supply) could cover a tennis court if unfolded. Our respiratory system is responsible for the intake of oxygen and the expiration of carbon dioxide. The efficiency of this cycle may be corrupted by airborne toxins. Once contaminants enter the bloodstream, they are transferred through the body and may cause damage to internal organs. Depending on the type, damaging effects may be evident immediately or may develop after a long period of time from the initial exposure, usually inhibiting the effectiveness of treatment. For this reason, airborne



Many chlorinated solvents are systemic toxins, capable of causing severe and permanent damage to vital organs in the body.

contaminants are a serious concern in the workplace and at home... indoor air quality are "buzzwords" of recent times and can be used to describe the level of toxins, particulates, allergens, mold, vapors, gases, etc. in a given interior space. For any given contaminant(s), the relative level is usually defined as a ratio to clean (normal) air (normal air contains approximately 21% Oxygen, 77% Nitrogen, and 2% other gases). The following is a general description of potential inhalation injuries, characteristics of gases that produce such affects and emergency treatment for persons suffering from overexposure.



Some gases displace air, specifically the oxygen in air, and produce asphyxia for an exposed person. Such gases include carbon dioxide, methane, propane and acetylene. Removal to fresh air is essential to minimizing permanent brain and heart injury. Medical treatment should follow as soon as possible.

Irritant gases, such as ammonia, chlorine and formaldehyde, chemically burn the nose, mouth and lungs when they come into contact with the wet mucous membranes. Gases that reach the lower portion of the lungs can cause the tissues to swell or scar, causing severe, even fatal damage. Administration of oxygen to the victim is crucial to "flush" the corrosive gas from the body.

Other gases (and many chlorinated solvents) are considered **systemic toxins**. Examples of gases in this category are carbon monoxide and hydrogen sulfide. The term systemic is defined as "affecting the whole body as distinct from having

a local effect". Excessive levels of carbon monoxide will interfere with the ability of the body to deliver oxygen. Systemic poisons can cause serious liver, kidney, brain, and/or pulmonary damage.

Another category of respirable contaminants are **sensitizers** (or allergens), which produce spasms usually in the upper respiratory tract, but can also be detected in dermal rashes, inflammation, etc. Respirable sensitizers can be in the form of gases, particles or aerosol mists. They are extremely dangerous, as their affects multiply with repeat exposure.

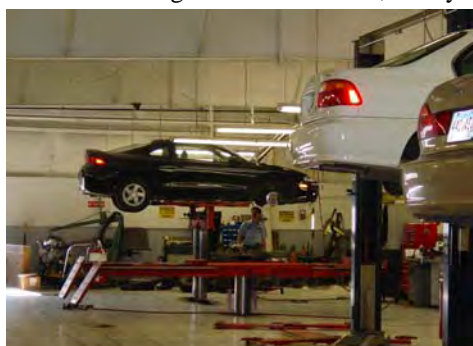
Reports attribute nerve damage diagnosed for auto mechanics to n-Hexane, a chemical found in many solvents

According to an article published by the California Department of Health Services, long-term overexposure to n-hexane can cause permanent damage to nerves in the feet, legs, hands and arms. Symptoms of long-term repeat overexposure can be characterized by numbness, tingling, pain, vibration and heat in the limbs. Nerve damage from hexane exposure usually occurs on both the left and right sides of the body equally. Short-term exposure can result in a headache, dizziness, nausea, loss of appetite and drowsiness.

California's Hazard Evaluation System & Information Service issued an advisory after identifying numerous cases of nerve damage among auto mechanics using spray brake cleaners that contain n-hexane. Products included in the list compiled by the Department are Amrep Brake Parts Cleaner, Berryman B-12 Chemtool Carb and Choke Cleaner, Drummond American Corporation Strafe, Loctite Disc Brake Quiet, Sherwin Williams Non-Chlorinated Brake Cleaner, Wurth Brake and Parts Cleaner, Zep Brake Parts Cleaner and Zep Brake Wash. Although pure n-hexane is not common among industrial, construction and automotive repair facilities, even "diluted" amounts can cause serious ailments to exposed workers. We recommend that the Material Safety Data Sheet (MSDS) for each product used in the workplace be evaluated to identify hazardous substances, their physical form and consequent routes of entry into the bloodstream and health affects associated with overexposure.

The risk of health affects depends on the amount of n-hexane that enters the body and the length of exposure. California Department of Health Services reports that exposure to concentrated levels of n-hexane, either in the form of respirable vapors or liquid, for a few months can cause peripheral neuropathy (or nerve damage to anterior and posterior limbs). Symptoms were evident among workers exposed to air concentrations of n-hexane only a little above OSHA's Permissible Exposure Limit, established at 50 ppm. The Department reports that this level can easily be exceeded if application is not controlled, through appropriate ventilation and personal protective equipment.

It was also reported that the adverse affects of n-hexane can be multiplied in workers who use it together with acetone, methyl ethyl ketone, methyl isobutyl ketone or lead acetate. This toxicological characteristic is referred to as *synergism*, meaning the combined effect of two chemicals is much greater than the sum effect of each agent acting independently.



Not to encourage skepticism, but pay attention to verbal information received from distributors or salespersons concerning the characteristics of their products. "Environmentally friendly", "non-hazardous", "bio-degradable" and other terms may be misleading... describing disposal practices and exclusions from RCRA hazardous waste characterization. Such terms usually do not refer to human exposure hazards during handling and application. A Compliance Services Specialist from Crandall can assist you in evaluating new products and/or reviewing the MSDS' for existing products to provide a healthier workplace.

The California Department of Health Services recommends that products containing n-hexane be substituted with products that lack this ingredient. However, when choosing substitutes, be careful not to introduce another toxin. Establishing a "restricted use policy" that advocates using only the necessary amount of hazardous chemicals will lessen the potential for health problems. Ventilation is also important to keep contamination at a safe level...either through local exhaust that captures the contaminated air at the source or through general ventilation that brings fresh air into the work area.



Many common brake and parts cleaners used in repair shops were identified by the California Department of Health Services as sources of n-hexane exposure.

Do contact lenses pose a greater risk for employees exposed to hazardous chemicals? *(Continued from page 1)*

According to Dr. H. Dwight Cavanagh, University of Texas Southwestern Medical Center, recent scientific studies indicate that contact lenses (soft and hard) do not intensify the potential damage to the eye from chemical exposure, but actually decrease the exposure of their wearer's eyes to toxic irritants in the environment. Dr. Cavanagh references that researchers who examined 128 cases of occupational eye injuries in individuals who were wearing contact lenses at the time confirmed this conclusion and even extended their findings that contact lenses partially protected and minimized, rather than worsened, injuries. He believes this data demonstrates that contact lenses can provide important protection by decreasing the exposure of the eyes to volatile or toxic solvents in the air.

In another study of hard contact lenses, researchers simulated chemical splash accidents, including some strong acids, and found that eyes fit with hard contact lenses experienced less corneal damage (than an unprotected eye). Chemicals used in this study included acetic acid, n-butylamine, or acetone. A similar study examined the rate of absorption by soft contact lenses, specifically of trichloroethylene (TCE) and xylene vapors. This study found that contact lenses did absorb a higher concentration of the vapors (than the tissues of an unprotected eye); however, the solvent vapors were released primarily back into the air, not the eye. In other words, wearing contact lenses did not increase exposure of the cornea to potential damage from chemicals. Dr. Cavanagh believes these observations have major relevance, especially for industrial and laboratory workers, who may be laboring under traditional workplace restrictions that bar them from using contact lenses while on duty. Such restrictions appear to be unnecessary in many instances. However, he is careful to mention that these findings do not apply to all chemicals and solvents, so great care and knowledge of various chemicals and their affects continue to



be necessary. Additional safety precautions should be taken when working around concentrated chemicals that can cause severe eye irritation or surface damage to the cornea. This information should not be misconstrued to suggest that contact lenses provide the same level of protection as a pair of well-made safety goggles. In occupations that put employees at risk of exposure to severely toxic chemical splashes, protective goggles that comply with OSHA standards must be worn. Harmful levels of toxic vapors can also be absorbed through the uncovered mucous membrane of the eye, causing an employee to exceed established permissible exposure limits. It's also important to remember that OSHA regulations stipulate emergency flushing devices in any area where employees are exposed to hazardous chemicals, particularly corrosives. Specifically, flushing devices, should provide hands-free operation of clean, tepid water for at least 15 minutes. It's important not to consider showers as adequate means for eye and face flushing. The victims face should be pointed down during flushing to allow water under the lids to remove trapped contaminants.

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