



OSHA ARCHIVE

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Solvents

Millions of workers are exposed to solvents on a daily basis. Health hazards associated with solvent exposure include toxicity to the nervous system, reproductive damage, liver and kidney damage, respiratory impairment, cancer, and dermatitis. (1) Also solvents share many chemical, physical and biological properties which warrant that national attention be directed to them as a group. In addition, many solvent groups or individual substances have special properties requiring more specialized control measures. OSHA is developing an action plan to reduce worker exposures to the hazards associated with solvents, but is not initiating rulemaking at this time.

Hazard Description

Solvents are used in a wide range of industries (construction, maritime, retail, and general industry). They are used in the extraction of fats and oils, in degreasing, in dry cleaning, and in the manufacture of many items including paints, varnishes, lacquers, paint removers, plastics, adhesives, textiles, impregnation agents, printing inks, rubber products, floor polishes, and waxes. (2)

Solvents include a variety of commonly used chemicals such as alcohol, mineral spirits, petroleum distillates, turpentine, benzene, toluene, xylene, perchloroethylene, trichloroethylene, methyl ethyl ketone (MEK), gasoline, and kerosene. (3) Early in the 20th century, there were perhaps only a dozen or so known and commonly used solvents. By 1981 there were approximately 350 different solvents commonly in use in the United States. (2) The National Institute for Occupational Safety and Health (NIOSH) estimates that there are almost 10 million workers potentially exposed to organic solvents in the workplace.(3) This number is likely to increase over time. Most exposed workers come in contact with a combination of several solvents (e.g., paint formulations, paint thinners, varnishes, etc.).

While many individual solvents or groups of solvents have unique properties, there are also common chemical, physical and biological features shared by large numbers of solvents. This makes it possible and prudent to develop and implement control strategies aimed at reducing inhalation and skin contact to solvents in general.

The principal health effects most typically associated with organic solvent exposure include nervous system damage (central and peripheral), kidney and liver damage, adverse reproductive effects such as sperm changes and infertility, skin lesions, and cancer. These agents can also cause death from acute exposure leading to depression of the brain's respiratory center and/or cardiac the brain's respiratory center and/or cardiac arrhythmias. Individual solvents may cause one or more of these.

- Solvents which cause damage to the nervous system include n-hexane, perchloroethylene, and n-butyl mercaptan. (4)
- Solvents associated with liver or kidney damage include toluene, and carbon tetrachloride, (4) 1,1,2,2-tetrachloroethane, chloroform. (5)
- Solvents known or thought to pose reproductive hazards include 2-methoxyethanol, 2-

- ethoxyethanol, and methyl chloride, among others. (6)
- Known or suspected solvent carcinogens include carbon tetrachloride, trichloroethylene, 1,1,2,2-tetrachloroethane, perchloroethylene, perchloroethylene, methylene chloride and others. (6)

Workplace solvent exposure levels vary widely. A review of OSHA's enforcement data base found exposure levels for various solvents ranging from trace amounts to levels in the upper explosive limit range (10,000 parts per million (ppm) and higher). (7) A recent review of OSHA records revealed eight worker deaths between 1975 and 1992 from over-exposure to a single solvent, trichloroethylene.(8) Other workers exposed below permissible limits are endangered because these limits are inadequate (e.g. methylene chloride). In other cases there are no permissible exposure limits at all but workers are exposed at levels reported to be dangerous in the scientific literature (e.g., trimethylbenzene and cyclopentane).

Current Status

OSHA has established permissible exposure limits (PELs) for over 100 solvents, including those most commonly used. (4) Most of these were established in 1971 and are considered to be out-of-date. The National Institute for Occupational Safety and Health (NIOSH) has Recommended Exposure Limits more stringent than the OSHA PELs for over 35 solvents. (1, 3, 4, 9, 10) The American Conference of Governmental Industrial Hygienists (ACGIH) has recommended Threshold Limit Values more stringent than the OSHA PELs for over 25 solvents. (4, 11)

The Environmental Protection Agency (EPA) promulgated National Emissions Standards for Hazardous Air Pollutants (NESHAP) for Halogenated Solvent Cleaners in December 1994 as part of the Clean Air Act Amendments of 1990.

The National Advisory Committee on Occupational Safety and Health (NACOSH) recommended that this issue be given a high priority. (November 1994)

Rationale

Solvents meet the criteria for designation as an OSHA priority. There is a large number of workers exposed across a wide range of industries. The health effects caused by solvent exposure are serious; there is extensive scientific evidence of risk in the literature; and there are a number of feasible and available control methods and technologies for reducing the extent of worker exposure. Government, industry, and labor are interested in working with OSHA to find ways to reduce the risk of employee exposure.

References

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