ENVIRONMENTAL Fact Sheet

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

29 Hazen Drive, Concord, New Hampshire 03301 • (603) 271-3503 • www.des.nh.gov

ARD-EHP-30 2010

1,4-Dioxane: Health Information Summary

1,4-Dioxane is a clear liquid with a slight, ether-like odor. At one time, it was added to chlorinated solvents as a stabilizer but that use has been discontinued. Current uses of 1,4-dioxane are as a solvent in paints, varnishes, adhesives, detergent and cleaning preparations, cosmetics, and pesticides. It is also used during the production of flame retardant chemicals, pharmaceuticals, and magnetic tape. 1,4-Dioxane can be found in antifreeze from the breakdown of common antifreeze compounds. 1,4-Dioxane may be produced as a contaminant during the manufacture of chemicals commonly added to many consumer products, including cosmetics, soaps, shampoo and bubble bath.

Low levels of 1,4-dioxane exist in ambient air; but it is degraded within a few days. 1,4-Dioxane is resistant to degradation in soil and binds only weakly to it. 1,4-Dioxane will readily migrate to groundwater where it is likely to persist. It is completely soluble in water. 1,4-Dioxane does not accumulate in plants or animals. Therefore, consuming home produced vegetables, fruit, or meat is not likely to be a significant source of exposure.

1,4-Dioxane is an "emerging contaminant," meaning it has recently been recognized as a potential or actual threat to the environment and human health. Until fairly recently, it was not possible to detect it at the low concentrations usually present in the environment. Because of the improved ability to detect 1,4-dioxane at lower levels, environmental officials have increased sampling efforts to determine how widespread its presence is in soil and groundwater.

Health Effects

Exposure and Metabolism

In human and animal studies of how 1,4-dioxane is absorbed into the body, almost all of 1,4-dioxane that is ingested is absorbed. Approximately 80 percent of what is breathed in is absorbed and less than one percent of what comes in contact with the skin is absorbed. Both human and animal studies indicate that after exposure, 1,4-dioxane and its metabolites rapidly leave the body, with almost all of it eliminated within one day after exposure ceases.

Short-Term (Acute) Effects

There are few studies available that provide information about the health effects of 1,4-dioxane in humans. Accidental exposure to extremely high levels of 1,4-dioxane in the workplace has resulted in deaths due to liver and kidney damage. Studies on animals have shown that exposures

to 1,4-dioxane affects the liver and kidneys. It should be noted that levels of 1,4-dioxane that are normally found in the environment or in consumer products are generally much lower than levels used in laboratory studies of animals.

Long-Term (Chronic) Effects
Exposure to 1,4-dioxane in animals for the majority of their lifespan has caused toxic effects to the liver and kidney such as swelling, degenerative changes, cell death, and lesions. The lowest concentration in animals that caused any of these toxic effects would be equivalent to a human exposed to 1,4-dioxane in drinking water at a concentration of approximately 3 million parts per billion (ppb, which is equal to micrograms per liter of water or ug/l).

Carcinogenic (Cancer-Causing) Effects
There are limited studies of humans exposed to 1,4-dioxane in the workplace relative to its ability to cause cancer. Several kinds of animals exposed to 1,4-dioxane in drinking water had increases in liver cancer. The U.S. Environmental Protection Agency (EPA) has classified 1,4-dioxane as likely to be carcinogenic to humans based on the evidence from animal studies.

Reproductive/Developmental Effects
No studies are known regarding reproductive or developmental effects in humans. In the only known study specifically conducted to assess the reproductive and developmental effects of 1,4-dioxane, pregnant rats given very large amounts of the compound had some offspring with reduced body weight and minor bone malformations.

Health Standards and Criteria
Based on revised toxicity values for 1,4-dioxane developed by the EPA, the state of New Hampshire is evaluating 1,4-dioxane in groundwater with an interim drinking water standard of 0.35 ug/l, the concentration at which there is a one in one million increase in the cancer risk for a 70 year exposure period.. No non-cancer health effects are expected at 1,4-dioxane drinking water concentrations below 200 ug/l.

The Occupational Safety and Health Administration has developed a permissible exposure limit or PEL for 1,4-dioxane in workplace air of 100 parts per million (ppm) averaged over eight hours.

The Food and Drug Administration allows up to 10 ppm of 1,4-dioxane in the food supply for specific purposes where exposure is likely to be minimal, such as in some components of dietary supplement tablets and for adhesives used in food packaging.

For more information, please contact the DES Environmental Health Program, PO Box 95, Concord, NH 03302-0095; (603) 271-4608.

Suggested Reading and References

Casarett and Doull's Toxicology: The Basic Science of Poisons, Sixth Edition. Klaassen, C.D., ed. McGraw-Hill Publishing Co., Inc., New York, 2001.

ToxFAQs for 1,4-Dioxane. Agency for Toxic Substances and Disease Registry (ATSDR). Atlanta, GA. September, 2007. At: http://www.atsdr.cdc.gov/tfacts187.html.

Toxicological Profile for 1,4-Dioxane (Draft Update). Agency for Toxic Substances and Disease Registry (ATSDR). Atlanta, GA. September, 2007. At: http://www.atsdr.cdc.gov/toxprofiles/tp187.html

Toxicological information for 1,4-dioxane. Integrated Risk Information System (IRIS). U.S. EPA, Office of Health and Environmental Assessment. Last revision : August, 2010. At: http://www.epa.gov/iris/subst/0326.htm

Voluntary Children's Chemical Evaluation Program (VCCEP). Tiers 1, 2 and 3. Pilot Submission for 1,4-Dioxane. Sponsor: Ferro Corporation. Cleveland, OH. Author: The Sapphire Group, Inc. March, 2007. At: http://www.epa.gov/oppt/vccep/pubs/chem16.htm