

Product Stewardship Summary Formaldehyde

Formaldehyde is a colorless, flammable gas with a pungent odor which is used to make thousands of everyday products for home, school, and work. Formaldehyde is produced by the oxidation of methanol with air in the presence of a catalyst. Formaldehyde is also formed during the combustion of fuels and tobacco products, gas cookers and open fireplaces, as a by-product of manufacture and is naturally produced by plants and animals.

Exposure to the levels of formaldehyde typically found in the natural environment is not expected to be harmful to human health or the environment. Formaldehyde in work environments may cause adverse health effects in workers if exposure is not adequately controlled.

Chemical identity:

NAME: Formaldehyde

CAS#: 50-00-0

SYNONYMS: Formalin, formic aldehyde, methaldehyde, methanal, methyl aldehyde, methylene glycol and methylene oxide

TRADE NAMES OF ASHLAND PRODUCTS CONTAINING FORMALDEHYDE: Perform, Presstige, Arofene, Chem-Rez, Isocure, Novaset, Pepset, Pliobond

Uses:

Formaldehyde is used to produce chemical intermediates, formaldehyde containing resins and in the production of fertilizer, paper, plywood. It is also used in the production of cosmetics and sugar, in well drilling fluids, as a preservative for grains and seed dressings, in the production of latex, in leather tanning, in embalming fluids, tissue preservation, in wood preservation, and in photographic film production. Ashland uses formaldehyde to produce phenol formaldehyde and urea formaldehyde resins and manufactures certain resins by reacting formaldehyde with polyacrylamide and guanidine- cyano blends.

In the United States, Ashland obtains formaldehyde as a by-product of its manufacture of pentaerythritol and also purchases formaldehyde (primarily as paraformaldehyde) from both US and international manufacturers. Ashland's phenol formaldehyde resins are used in the manufacture of adhesives, resins and foundry binders used in:

- general purpose adhesive applications
- lamination
- imparting heat, friction and chemical resistance to equipment and parts
- making of molds/cores for the foundry industry.

Ashland also produces urea formaldehyde resins, used as fertilizers, and other formaldehyde resins used as cleaners and retention aides in paper manufacture.

Physical/chemical properties:

Formaldehyde:

- is a colorless gas
- is flammable (Flashpoint 50 °C).
- has a distinctive pungent aroma. The distinctive odor can be detected even when formaldehyde is present at extremely low levels. The odor threshold for formaldehyde ranges from to 0.5 to 1 ppm
- has a vapor density of 0.813 g/m³ (Air = 1).
- is soluble in a variety of solvents and is miscible in water.

Health Effects:

Exposure of humans to formaldehyde may result in eye, skin, nose, and throat irritation. Irritation is typically seen when formaldehyde exposure exceeds 0.4 to 3 ppm. Direct contact with formaldehyde and

formaldehyde solutions may also cause chemical burns and skin contact has resulted in allergic skin reactions. Air concentrations greater than 5 ppm of formaldehyde cause increasing irritation and tearing and quickly become intolerable above 10 ppm. Breathing of formaldehyde at these air concentrations may result in respiratory tract irritation with possible progression to bronchitis, pulmonary edema and pneumonia.

Because of the high metabolic production of formaldehyde in humans and the rapid breakdown of formaldehyde, it is expected that no long-term or carcinogenic effects will occur to organ systems.

The International Agency for Research on Cancer (IARC) has determined that formaldehyde is carcinogenic to humans. IARC found a causal relationship between formaldehyde exposure and leukemia and sinonasal cancer.

The following websites provide additional information on the potential health effects of formaldehyde:

- Agency for Toxic Substances and Disease Registry <http://www.atsdr.cdc.gov/toxprofiles/tp111.html>
- Formaldehyde Council <http://formaldehyde.org/>
- US EPA Integrated Research Information Center <http://www.epa.gov/ncea/iris/subst/0419.htm>
- International Agency for Research on Cancer (IARC) <http://www.iarc.fr/>

Environmental Effects:

Environmental fate information

Formaldehyde is biodegradable and is not expected to persist in the environment. Formaldehyde in the air is expected to photolyze and has a half-life of a few hours. The initial oxidation product of formaldehyde in the environment is formic acid which has a predicted removal half-life of between 19 and 50 hours.

Aquatic and/or terrestrial toxicity:

Formaldehyde was shown to have low to moderate toxicity to a variety of fish species. Formaldehyde's potential impact on aquatic and soil environments is significantly reduced by the rapid rate at which it biodegrades in the environment.

Formaldehyde was not bioconcentrated in a variety of fish and shrimp.

The following websites provide additional information on the potential environmental impacts of formaldehyde:

- Agency for Toxic Substances and Disease Registry <http://www.atsdr.cdc.gov/toxprofiles/tp111.html>
- Formaldehyde Council <http://formaldehyde.org/>

Exposure:

The principal route of formaldehyde exposure for the general population and workers is by breathing air containing formaldehyde. Ambient air levels of formaldehyde for the general public can be attributed to emissions from industrial activities, building materials, consumer products, vehicle exhaust, and tobacco smoke. Air contamination levels for workers are due to handling, storing and processing of formaldehyde and formaldehyde containing polymers. Formaldehyde concentrations in unpopulated areas are about 0.2 ppb, in suburban areas is about 2 – 6 ppb and in heavily populated areas can range up to 20 ppb. There is usually more formaldehyde in indoor air than outdoor air due to release of formaldehyde from many home products such as latex paint, fingernail hardeners and polish, plywood and particle board and furniture and cabinets, carpets, some permanent press fabrics and some paper products.

Exposure can also occur by eating foods containing formaldehyde. Low levels of formaldehyde occur naturally in fruits, vegetables, meats and fish. You are not likely to be exposed to formaldehyde in drinking water as it does not last a long time in water.

Workers may come in skin contact with formaldehyde during handling, storing and processing of formaldehyde and formaldehyde containing polymers

Risk Management Recommendations:

Exposure to formaldehyde in the workplace is covered by established exposure limits. The regulatory limit in the US, established by Occupational Safety and Health Administration (OSHA), is 0.75 ppm as a time weighted average (TWA) over an 8 hour workday and 2 ppm as a short term exposure limit. The American Conference of Governmental Industrial Hygienists recommends an occupational exposure limit of 0.3 ppm as a ceiling limit. European Union member states have varying occupational exposure limits for formaldehyde. A 2006 review indicates that inhalation exposures of less than 1 ppm are protective for the risk of respiratory tract cancer. Additionally, the latest formaldehyde risk assessment performed by the German Federal Institute for Risk Assessment found that 0.1 ppm is a safe indoor air concentration with respect to cancer risk for the general population.

Exposure to formaldehyde in the workplace can be controlled by sufficient ventilation and proper handling and storage techniques. Examples include: ventilation system, proper protective equipment such as eye protection (i.e., splash proof goggles), normal work clothing which covers arms and legs, formaldehyde resistant gloves, and NIOSH approved respirator in situations where exposure exceeds allowable exposure limits and/or ventilation alone is not sufficient. In addition, formaldehyde may be handled as paraformaldehyde which is a solid.

Federal, state and local governments regulate formaldehyde emissions from facilities. The regulatory emission limits for each facility are established to protect the health and environment of the community surrounding the facility and are written into the facility's operating permit.

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8. International Agency for Research on Cancer (IARC), Volume 88 (2006)
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