# Health & Safety

## Paint Strippers: Evaluating available chemicals and their hazards

Conservators may be panicking to find out that their favorite methylene chloride-based paint strippers will no longer be found at large retail stores including Lowe's, Home Depot, and Sherwin-Williams—all of which have announced that they will stop carrying these products by the end of 2018. Smaller chains and local stores may soon follow. Currently the Environmental Protection Agency (EPA) is deciding whether to ban methylene chloride paint strippers following an initial review under the Toxic Substances Control Act (TSCA); in January 2017, the EPA issued a plan to prohibit the manufacture and import, processing, and distribution in commerce of methylene chloride for consumer paint and coating removal. However, the EPA has walked back the plan in the past year.

### What is Methylene Chloride?

CAS# 75-09-2

International Chemical Safety Card

Common Paint Strippers: ZipStrip (SDS); KleanStrip (SDS)

For decades, methylene chloride (dichloromethane or DCM) could be found in common household items from hairspray to Christmas tree bubble lights. Proprietary paint strippers containing methylene chloride are extremely effective for removing paints, varnishes, and adhesives and continue to be sold even after methylene chloride (long known to be a serious health hazard) was eliminated from most other consumer products. The European Union banned methylene chloride paint strippers from general use in 2011. And while use in occupational setting is regulated (OSHA Standard 1910.1052), these regulations do not apply to home use or to those who are self-employed.

Exposure from paint strippers is largely through vapor inhalation, although absorption through skin or eye contact and accidental ingestion are also of concern. Because of its high vapor pressure, methylene chloride can displace the oxygen in a worker's environment and quickly reach harmful concentrations, making working in small, unventilated spaces particularly hazardous.

The American Congress of Governmental Industrial Hygienists (ACGIH) assigns methylene chloride a threshold limit value (TLV)—an air concentration exposure limit—of 50ppm time weighted average (TWA). For comparison acetone is 750ppm TWA and ethanol is 1000ppm TWA.

Once it enters the body, methylene chloride affects the central nervous and cardiovascular systems along with other organs such as the liver. Those exposed may find it difficult to concentrate and experience dizziness, fatigue, headaches, and nausea. At higher concentrations, the solvent can arrest breathing and cause heart attacks as it breaks down into carbon monoxide. Prolonged exposure eventually causes death. It is a considered a possible carcinogen (Group 2B) by the International Agency for Research on Cancer (IARC).

Conservators can safely use methylene chloride by working in a conservation laboratory equipped with proper engineering controls and ventilation (i.e., fume hood) as well as personal protective equipment (i.e., goggles and gloves). Air purifying respirators (APRs)--such as cartridge filtered half face respirators--are not acceptable for working with methylene chloride because once breakthrough occurs the exposure limit is reached extremely quickly. Worth noting, studies showing 56 confirmed deaths associated with methylene paint strippers since 1980, and 2700 calls to poison control in the five-year period from 2008-2013 indicate the risk associated with not following or not having safety protocols in place (Smith Hopkins 2015).

While methylene chloride is the main ingredient, strippers containing this ingredient usually include other hazardous chemicals such as mineral spirits, methanol, toluene, and acetone, and the Safety Data Sheet (SDS) for the specific product should be consulted (See Box 1). Appropriate protective gear should be selected for the specific chemicals listed in the SDS. For example, gloves made from polyethylene vinyl alcohol and ethylene vinyl alcohol are resistant to methylene chloride while those made from latex, nitrile, neoprene, polyethylene, and butyl rubber should not be used. For more information on selecting materials for chemical exposure see the Health & Safety Committee's PPE Chemical Protective Material Selection Guide.

### Need help?

Have a question about health and safety in your conservation work? Send it to us at health-safety@conservation-us.org.

## Safer Alternatives?

A conservator looking to find safer and equally effective alternatives will encounter a variety of options on store shelves. As part of a "Public Workshop on the Use of Methylene Chloride in Furniture Refinishing," the EPA and Small Business Association (SBA) have posted several presentations evaluating the efficacy of alternative paint strippers (EPA, 2017). While many of these products are marketed as being "non-toxic," "safer," having "no harsh fumes," or as "eco-alternatives," users should more closely evaluate the health hazards and look past consumer labels to SDSs and other sources (see box 1).

### Box 1. Other sources for safety information about paint stripper ingredients

- The EPA's Chemicals and Toxics Topics
- The National Institute for Occupational Safety and Health's (NIOSH) Directory of Chemical Safety Resources
- International Chemical Safety Cards.

When used for marketing, the term "non-toxic" is not defined by the Consumer Product Safety Commission (CPSC) and can be used if there is no information that proves a substance is toxic according to the Federal Hazardous Substances Act (FHSA); that can include chemicals for which there have been no health studies conducted. In addition, compared to the high toxicity of methylene chloride, many chemicals would be considered "safer" even if they have significant health effects.

Solvent-based commercial alternatives to methylene chloride-based paint strippers will generally contain one of three main ingredients:

- N-methyl-2-pyrrolidione (NMP)
- benzyl alcohol
- dibasic esters (DBE)

The following discussion focuses on the health hazards associated with these main ingredients, but consumers should consult the SDS for their specific product particularly for other known hazards such as flammability.

## N-Methyl-2-Pyrrolidione (N-Methylpyrrolidone, 1-Methyl-2-Pyrrolidinone, or NMP)

CAS# 872-50-4

International Chemical Safety Card

Common Paint Strippers: CitriStrip (SDS); ReadyStrip (SDS); Back to Nature Multi Strip (SDS)

Although marketed as safer than methylene chloride-based strippers, the EPA (under TSCA) identified significant risks posed by NMP when used in paint removers, particularly for pregnant women and women of childbearing age. Additionally, they found that when using NMP for more than four hours per day (in one day or over a succession of days), gloves and respirators do not adequately reduce the health risks. The EPA is considering similar limitations on its use in commercial paint strippers as those for methylene chloride-based strippers. Compared to methylene chloride, a harmful concentration in the air will not or will only very slowly be reached. Note that there are no US exposure limits for air concentrations, but European exposure limits (MAK) are listed as 20ppm (lower than for methylene chloride). In addition, NMP is readily absorbed through skin, so NMP-resistant gloves such as butyl rubber or laminated polyethylene/EVOH should be used.

## Benzyl Alcohol

CAS# 100-51-6

International Chemical Safety Card

Common Paint Strippers: SmartStrip (SDS); NPS Rx (SDS)

Benzyl alcohol-based paint strippers as a group are marketed as both natural and safer alternatives. They often include another chemical commonly found in "natural" cleaners: D-limonene (the chemical often responsible for a citrus smell in many cleaners). Although used as an ingredient in numerous consumer products, there is little information on inhalation exposure for either of these chemicals. For example, there are no established US exposure limit values, while European values (MAK) are listed for both at 5ppm and both receive a yellow warning on the EPA's Safer Chemical Ingredients List. In

addition to skin irritation and reports of temporary headaches, dizziness, and nausea from exposure, recent studies have shown that benzyl alcohol can be fatal to neonates (TOXNET, 2018). Benzyl alcohol and D-limonene are examples of how "natural" should not be a substitute for safe.

## Dibasic Esters (DBE)

CAS# 1119-40-0 (Dimethyl glutarate ester)

International Chemical Safety Card—None available

Common Paint Strippers: EZ Strip (SDS); CitriStrip (SDS)

Dibasic esters can be found as the main ingredient or as a secondary ingredient in NMP-based strippers. There is little information on the possible health effects of dibasic esters, including those found in paint strippers that contain dimethyl adipate ester, dimethyl succinate ester, and dimethyl glutarate. None have International Chemical Safety Cards, although dimethyl glutarate ester is listed as a safer chemical alternative on the EPA's Safer Chemical Ingredients List; however, there is no supporting data on how this classification was determined. Blurred vision has been reported with use of strippers in unventilated areas and repeatedly breathing DBE has damaged the cells lining the nose of laboratory animals (CPSC 2013).

## Resources (All accessed on December 10, 2018)


Occupational Safety and Health Administration (OSHA). OSHA Standard: 1910.1052 - Methylene Chloride. https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1052.

Smith Hopkins, J. 2015. Common Solvent Keeps Killing Workers, Consumers. The Center for Public Integrity. Updated December 10, 2018. https://www.publicintegrity.org/2015/09/21/17991/common-solvent-keeps-killing-workers-consumers.

United States Consumer Product Safety Commission (CPSC). 2013. What You Should Know About Using Paint Strippers. https://www.cpsc.gov/Global/Safety%20Education/Home-Appliances-Maintenance-Structure/423%20Paint%20Stripper%20Publication.pdf.

United States Environmental Protection Agency (EPA). n.d. Risk Management for Methylene Chloride. https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/risk-management-methylene-chloride.

United States Environmental Protection Agency (EPA). Risk Management for N-Methylpyrrolidone (NMP). https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/risk-management-n-methylpyrrolidone-nmp.

United States Environmental Protection Agency (EPA). Safer Chemical Ingredients List. https://www.epa.gov/saferchoice/safer-ingredients.

United States Environmental Protection Agency (EPA). 2015. Fact Sheet: Methylene Chloride or Dichloromethane (DCM). https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/fact-sheet-methylene-chloride-or-dichloromethane-dcm-0.

United States Environmental Protection Agency (EPA). 2015. Fact Sheet: N-Methylpyrrolidone (NMP) https://www.epa.gov/sites/production/files/2015-09/documents/nmpfaq.pdf.

United States Environmental Protection Agency (EPA). 2017. Agenda and Presentations for September 12, 2017 Public Workshop on the Use of Methylene Chloride in Furniture Refinishing. https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/agenda-and-presentations-september-12-2017-public

United States National Institutes of Health (NIH), National Library of Medicine, TOXNET. 2018. Benzyl Alcohol. http://toxnet.nlm.nih.gov/cgi-bin/sis/search2/r?dbs+hsdb:@term+@DOCNO+46.


### Keep Your Safety Information Current

It is important to keep your Safety Data Sheets (SDS) current. If you have any discontinued or soon-to-be discontinued products in your laboratory, make sure to get the most current version of your SDS and the one that is specific to your product. If these materials are obtained from a hardware store or online vendor, you will probably not have the SDS provided to you at the time of purchase and it is your responsibility to get them from the store or manufacturer. As suppliers and manufacturers remove or discontinue these products, they may not continue to update SDS or provide them at all. This means that an outdated SDS will not reflect the current understanding of the toxicology of a chemical. Therefore, it important for you to stay up-to-date on the chemicals contained in products that are discontinued but remain in your lab. TOXNET and Pubchem are two sites that can provide the current toxicology research for any chemical.