

HAZARD ALERT

Methylene Chloride Hazards for Bathtub Refinishers

In February 2012, a worker using a product containing methylene chloride to refinish a bathtub was found dead, slumped over a bathtub in an unventilated bathroom.

In September 2011, a worker using a product containing methylene chloride to strip the glaze from a bathtub collapsed in the bathtub and later died.

The cases described above are just two of many similar cases. The Occupational Safety and Health Administration (OSHA) and the National Institute for Occupational Safety and Health (NIOSH)-supported Fatality Assessment and Control Evaluation (FACE) Program have identified at least 14 worker deaths since 2000 related to bathtub refinishing with stripping agents containing methylene chloride.

These types of deaths can be prevented by using alternative, less hazardous chemicals or methods that eliminate the use of methylene chloride. If this is not possible, employers can still prevent deaths and illnesses by using safe work practices, such as using adequate ventilation, supplying workers with respiratory protection as well as protective clothing and equipment, and providing workers with training in accord with OSHA's Methylene Chloride standard ([29 CFR 1910.1052](#)) and other applicable standards, such as the Hazard Communication standard ([29 CFR 1910.1200](#)) and the Personal Protective Equipment standard ([29 CFR 1910.132](#)).

What is bathtub refinishing?

Bathtub refinishing is the process of restoring the surface of an old bathtub to improve the bathtub's appearance and repair surface damage. The process commonly involves removing the bathtub's existing finish before applying a new coating, usually a synthetic finish such as polyurethane or epoxy. Refinishing a bathtub is a less costly alternative to full replacement of the fixture; however, the process often involves the use of hazardous chemicals including methylene chloride, acids and isocyanates.

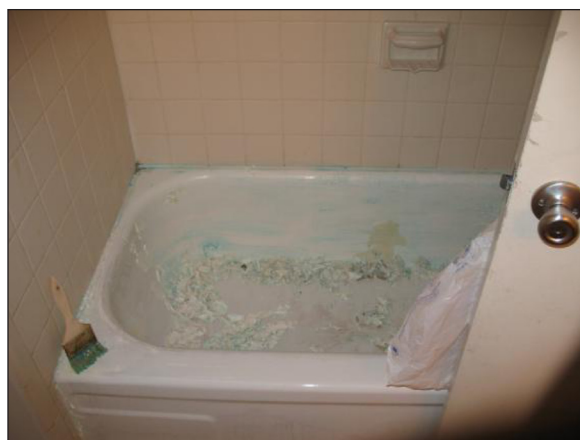
What is methylene chloride?

Methylene chloride, a chlorinated solvent, is a volatile, colorless liquid with a sweet-smelling odor. It is often referred to as dichloromethane. Methylene chloride has many industrial uses, such as paint stripping, metal cleaning and degreasing.



Workers use a methylene-based stripper to remove paint from a bathtub prior to refinishing.

Photo courtesy of California Department of Public Health



A bathtub painted with a stripping chemical used during the reglazing process.

Photo courtesy of Michigan Fatality Assessment and Control Evaluation Program

How are workers exposed to methylene chloride?

Workers are exposed to methylene chloride by breathing it in and by absorbing it through their skin. If workers smell methylene chloride, they are being overexposed because methylene chloride cannot be smelled until the level in the air is higher than OSHA's permissible exposure limits (PELs). However, the human body can quickly become desensitized to the smell of methylene chloride, and a worker may be overexposed even if he or she can no longer smell it.

Why is methylene chloride a hazard for bathroom refinishers?

When workers use methylene chloride to strip coatings from bathtubs, they often spray or pour a bathtub stripping product into the basin of the bathtub and then brush the product onto the tub surface. Many stripping products (including those that may also be available to consumers), such as the one shown in the picture at right, contain high percentages of methylene chloride. Use of these chemicals in bathrooms is extremely dangerous, particularly because bathrooms are often small, enclosed spaces with little or no ventilation. Since methylene chloride is a volatile organic compound that will evaporate faster when sprayed, brushed, or poured, the chemical vapors can quickly build up in small spaces. Moreover, because methylene chloride evaporates quickly (it has a high vapor pressure), vapors can collect in the bottom of a bathtub and in the worker's breathing zone when working in the bathtub. This situation creates dangerously high concentrations of methylene chloride and even replaces the breathable air. Exposure to as little as six ounces of methylene chloride-based material has been enough to cause death.



Photo courtesy of Iowa Fatality Assessment and Control Evaluation Program

One type of stripping product used for refinishing that contains methylene chloride.

What have investigations found?

Investigations of bathroom refinisher fatalities by Federal OSHA, OSHA-approved State plans,¹ and the NIOSH-supported FACE program revealed common elements that led to dangerous working conditions. Workers were:

- Using methylene chloride-based stripping agents to remove bathtub coatings.
- Working alone.
- Working in small, windowless and poorly ventilated bathrooms.
- Wearing no or inadequate respiratory protective equipment.
- Wearing the wrong type of or no skin protection.
- Working without being trained on the hazards of exposure to methylene chloride.



Photo courtesy of Maryland Occupational Safety and Health

A small, poorly ventilated bathroom with no windows.

How can methylene chloride affect workers' health?

When methylene chloride enters the human body, it affects brain function, such as not being able to concentrate. At high enough levels, it can stop breathing. At lower levels, methylene chloride exposure causes dizziness, fatigue, headaches, and nausea. Methylene chloride breaks down into other chemicals in the body, such as carbon monoxide. In addition, methylene chloride can displace the oxygen in a worker's environment because of its high vapor pressure.

¹ Currently there are 27 OSHA-approved state occupational safety and health plans. Twenty-one states and Puerto Rico operate complete state plans covering the private sector and state and local government employers and employees. Four states and the Virgin Islands operate state plans which cover only state and local government employers and employees. For additional information about state plans, see: www.osha.gov/dcsp/osp/index.html.

The specific effects of methylene chloride exposure will vary depending on several factors, such as the amount of methylene chloride the worker is exposed to, how long the exposure lasts, and whether the worker has a higher susceptibility (for example, having a pre-existing heart condition).

- Workers exposed to methylene chloride may experience headaches, dizziness, nausea, a “feeling of intoxication,” and eye, nose and throat irritation.
- Prolonged skin contact may cause irritation and even chemical burns.
- As exposure increases so do the health effects, with the potential for suffocation, loss of consciousness, coma and sudden death.
- Long-term exposure may cause cancer in humans. Animal studies have shown that exposure to methylene chloride may lead to liver and lung cancer, as well as tumors in the breast and salivary glands. Like many cancer-causing agents, any level of exposure, even concentrations below applicable occupational exposure limits, may increase the risk of cancer.

In workers with heart disease, an increase in carbon monoxide may lead to early onset heart attacks and arrhythmias (irregular heartbeats). Heart attacks may occur even before any other symptoms of methylene chloride exposure occur.

WARNING: Methylene Chloride and Stripping Products

- **Methylene chloride-based stripping agents are EXTREMELY DANGEROUS if OSHA and state requirements are not followed.**
- **The best way to prevent exposure is to use products that DO NOT contain methylene chloride.**
- **Consider using alternative methods, such as sanding. Care must be taken to ensure that workers are not overexposed to particulates being generated during sanding operations.**
- **Be aware that substitute stripping products and methods may include other harmful chemicals or hazards, so use substitutes safely.**
- **Check product labels and safety data sheets to understand the recommended and required precautions. Stripping products may also contain flammable solvents and flammability may be a concern.**
- **If methylene chloride is used, follow the applicable requirements in OSHA’s Methylene Chloride standard (29 CFR 1910.1052) and other applicable OSHA standards.**

How can employers reduce hazards and protect bathroom refinishing workers?

Under the [Occupational Safety and Health Act of 1970](#), employers are responsible for providing safe and healthy working conditions for their workers.

OSHA’s Methylene Chloride standard ([29 CFR 1910.1052](#)) requires employers using methylene chloride to protect and train workers exposed to its hazards. States that operate their own occupational safety and health programs approved by Federal OSHA enforce similar standards but may have different or additional requirements. A list of state plans is available at www.osha.gov/dcsp/osp/index.html.

Control Measures

Engineering Controls:

- OSHA requires that employers test the air for methylene chloride (see the next section on Exposure Levels and Air Monitoring).
- Use a qualified occupational safety and health specialist to assist in the design and installation of local exhaust ventilation (LEV) to effectively control vapors to below applicable PELs.

- **Bathroom fans or open windows do NOT provide adequate ventilation.**
- **Ensure that the room is adequately ventilated during the entire refinishing process.**
- **Follow all applicable OSHA standards, including the Methylene Chloride standard (29 CFR 1910.1052), as well as other applicable safety and health standards and codes during bathtub stripping.**

- Provide local exhaust ventilation (LEV) and fresh makeup air to exhaust vapors released from the stripping agents in the bathtub. Specifically, typical mobile LEV units have a fan, flexible ductwork, and a hood near the tub that exhausts hazardous vapors to the outdoors.
- Ensure that the fresh make up air is fresh – not contaminated with exhausted methylene chloride vapors or other contaminants, such as car exhaust.

Work Practice Controls:

- Avoid use of methylene chloride or minimize the amount of methylene chloride used at each site.
- Avoid or minimize spraying methylene chloride.
- Follow good housekeeping measures, including spill and leak control and appropriate personal hygiene practices (such as making skin washing areas available to workers).
- Use long-handled tools (e.g., scrapers, brushes) to avoid leaning into the bathtub.
- Leave the room immediately after applying the methylene chloride-based stripping agent to limit exposure to methylene chloride vapors. Use full-face supplied-air respirators, protective gloves, and other appropriate personal protective equipment (PPE) that is resistant to methylene chloride during the entire refinishing process.

Exposure Levels and Air Monitoring

OSHA's Methylene Chloride standard (29 CFR 1910.1052) requires employers to test the air to determine the concentration of methylene chloride present in the air when a product containing methylene chloride is used (29 CFR 1910.1052(d)). Employers must ensure that workers are not exposed to levels above OSHA's permissible exposure limits (PELs) of 25 parts per million (ppm) over an 8-hour time-weighted average (TWA) and 125 ppm over any 15-minute period (short-term exposure limit or STEL) (29 CFR 1910.1052(c)). The standard also sets a 12.5 ppm action level (AL) which triggers periodic monitoring and medical surveillance provisions. Lowering exposures, even below the permissible exposure limit (PEL), is considered to be good industrial hygiene practice.

Personal Protective Equipment (PPE)

Respirators:

When engineering and work practice controls cannot decrease methylene chloride levels below OSHA's PELs (25 ppm over an 8-hour TWA or 125 ppm over a 15-minute period), employers must provide their workers with full-face atmosphere-supplying respirators. Air-purifying respirators are not permitted due to the short service life of chemical cartridges when used for methylene chloride exposure. Half-mask respirators may NOT be used because methylene chloride may cause eye irritation or damage. Whenever respirators are required to be worn, the employer must establish and implement a complete respiratory protection program that meets the requirements of OSHA's Respiratory Protection standard (29 CFR 1910.134), including proper selection, usage, training and medical surveillance.



Two examples of full-face atmosphere-supplying respirators. The system on the left is a full-face, pressure demand respirator with a self-contained breathing apparatus. The system on the right is a combination full face piece, pressure demand atmosphere-supplying respirator with an auxiliary self-contained air supply.

Photo courtesy of Construction Safety Council/elcosh.org
www.cpwrr.com and www.elcosh.org

Protective Clothing, Gloves and Eyewear

Regardless of the airborne exposure levels of methylene chloride, the employer must provide each worker using methylene chloride with, and ensure the use of, appropriate PPE to protect the worker's eyes and skin from exposure to methylene chloride. This includes, but is not limited to:

METHYLENE CHLORIDE-RESISTANT GLOVES

- Gloves made of polyethylene (PE)/ethylene vinyl alcohol (EVOH), or other laminate materials that are resistant to methylene chloride are recommended to meet the requirements of the standard. (Contact the glove manufacturer or supplier for recommendations). Based on work activities, outer gloves are also recommended to prevent cuts and tears to the inner methylene chloride-resistant gloves.
- Latex, nitrile, neoprene and polyethylene gloves do NOT protect against methylene chloride. Butyl rubber gloves are not recommended to meet the requirements of the OSHA Methylene Chloride standard because they typically degrade in less than 1 hour.
- Employers should ensure that workers frequently check gloves for cracks, pinholes and defects, and change gloves before breakthrough occurs.



Laminate gloves resist methylene chloride from coming through.

METHYLENE CHLORIDE-RESISTANT CLOTHING

- Methylene chloride-resistant aprons, sleeves and boots or shoe covers are recommended to meet the requirements of the OSHA Methylene Chloride standard to prevent methylene chloride from getting on clothing and skin.
- Employers must ensure that workers remove any clothing contaminated with methylene chloride. Contaminated clothing and equipment need to remain in a regulated area (a demarcated area where exposures to methylene chloride are expected to exceed OSHA's PELs).
- Employers must then launder or dispose of the clothing and equipment appropriately, as outlined in [Appendix A of the Methylene Chloride standard](#).



Images from left to right: methylene chloride-resistant boots, face shield, and worker wearing a methylene chloride-resistant apron, safety goggles and a face shield.

EYE PROTECTION

- Eye protection, such as goggles or a face shield, is recommended to meet the requirements of the OSHA Methylene Chloride standard in operations where respiratory protection is not required.

Worker Training

Both OSHA's [Methylene Chloride](#) and [Hazard Communication](#) standards² require employers to provide health and safety information and training to their employees. **Employers must provide training to workers in a manner and language that the worker understands.** The training and information must include but is not limited to:

- Routes of exposure and personal protective equipment (PPE).
- Physical and health hazards of methylene chloride.
- Any operations in the work area where methylene chloride is present.
- Methods to detect the presence or release of methylene chloride in the work area.

² OSHA revised its Hazard Communication standard on March 26, 2012 (see 77 FR 17574). Although this Hazard Alert references the revised standard (for example, by referring to "safety data sheets" instead of "material safety data sheets"), the regulated community should refer to the revised standard to determine the effective dates of the revised standard.

- Specific procedures implemented by the employer so that workers can protect themselves from methylene chloride exposure, such as appropriate work practices and emergency procedures to follow, and personal protective work clothing and equipment to use.
- An explanation of labels, pictograms, hazard statements and safety data sheets, and how employees can obtain and use the appropriate hazard information.
- The quantity, location, manner of use, characteristics, release and storage of methylene chloride and the specific operations that could result in methylene chloride exposure.

In addition, employers must:

- Provide **retraining** to ensure that each worker exposed at or above the action level (AL) of 12.5 ppm (which is half of the OSHA PEL of 25 ppm TWA) or 15-minute short-term exposure limit (STEL) of 125 ppm maintains an understanding of the principles of safe use and handling of methylene chloride in the workplace; and
- Provide **updated information and training** whenever there are workplace changes, such as modifications to existing tasks or procedures or the institution of new tasks or procedures that increase employee exposure to above the AL.

MULTI-EMPLOYER WORKSITES

Employers who produce, use, or store methylene chloride in such a way that employees of other employers may be exposed must:

- Provide the other employers on-site access to safety data sheets for methylene chloride;
- Inform the other employers of any precautionary measures that need to be taken to protect workers during the workplace's normal operating conditions and in foreseeable emergencies; and
- Inform the other employers of the labeling system used in the workplace.

Medical Surveillance, Emergency Treatment and Medical Removal

- Employers must make medical surveillance available for workers who are or may be exposed to concentrations at or above the Methylene Chloride standard's 12.5 ppm action level (AL) for 30 or more days per year, or above the standard's 8-hour TWA 25 ppm PEL or 15-minute 125 ppm STEL for 10 or more days in a year ([29 CFR 1910.1052\(j\)\(1\)\(i\)](#)).
 - o [Appendix B](#) of the standard describes the toxicology of methylene chloride and provides clinicians with useful information on medical evaluation.
- Employers must ensure the availability of appropriate emergency medical treatment and decontamination ([29 CFR 1910.1052\(j\)\(6\)\(i\)](#)).
- Employers must provide medical removal protection benefits when a medical determination recommends removal because the worker's exposure to methylene chloride may contribute to or aggravate the worker's existing cardiac, hepatic, neurological (including stroke) or skin disease ([29 CFR 1910.1052\(j\)\(11\)](#)).

How can OSHA and NIOSH help?

OSHA Consultations: OSHA provides free [On-Site Consultation](#) safety and health services for small businesses with fewer than 250 workers at a site (and no more than 500 employees nationwide). This program provides on-site compliance assistance to help employers identify and correct job hazards as well as improve injury and illness prevention programs. On-site consultation services are separate from enforcement and do not result in penalties or citations. To locate the OSHA Consultation office nearest you, visit www.osha.gov/consultation or call 1-800-321-OSHA (6742).

OSHA Compliance Assistance: OSHA also has [compliance assistance specialists](#) throughout the nation who can provide general information about OSHA standards and compliance assistance resources. Contact your [local OSHA office](#) for more information by calling 1-800-321-OSHA (6742) or visit OSHA's webpage at www.osha.gov.

NIOSH FACE Program: Through the FACE Program, NIOSH and state partners investigate selected work-related fatalities to identify work situations at high risk for injury and then formulate and disseminate prevention strategies. NIOSH and state partner FACE investigation reports and related NIOSH worker safety and health documents can be accessed at the NIOSH FACE webpage at www.cdc.gov/niosh/face.

NIOSH HHE Program: Employees, employee representatives, or employers can ask NIOSH to conduct Health Hazard Evaluations (HHEs) at their workplace. NIOSH may provide assistance and information by phone and in writing, or may visit the workplace to assess employee exposure and health. Based on their findings, NIOSH will recommend ways to reduce hazards and prevent work-related illness. The evaluation is done at no cost to the employees, employee representatives, or employers. For more information about the HHE Program, visit the NIOSH HHE webpage at <http://www.cdc.gov/niosh/hhe/default.html> or contact the HHE program by phone at 513-841-4383. For general information or questions about any hazard or illness, call the **NIOSH Toll-Free Information Service: 1-800-CDC-INFO (1-800-232-4636)**.

What rights do workers have?

Workers have the right to:

- A safe and healthful workplace.
- Receive information and training (in a language and vocabulary they can understand) about workplace hazards, methods to prevent them, and the OSHA standards that apply to their workplace.
- Review records of work-related injuries and illnesses.
- Get copies of test results that find and measure hazards.
- [File a complaint](#) asking OSHA to inspect their workplace if they believe there is a serious hazard or that their employer is not following OSHA's rules. When requested, OSHA will keep all identities confidential.
- Exercise their rights under the law without retaliation or discrimination.

Federal resources with more information:

- Safety and Health Topics: Methylene Chloride, **OSHA**, <http://www.osha.gov/SLTC/methylenechloride/index.html>. This webpage describes methylene chloride hazards and OSHA's standard for methylene chloride.
- Methylene Chloride, **OSHA**, <http://www.osha.gov/Publications/osha3144.pdf>. This 2003 informational booklet provides comprehensive guidance on the Methylene Chloride standard.
- Methylene Chloride Small Entity Compliance Guide Fact Sheets, **OSHA**, http://www.osha.gov/SLTC/methylenechloride/factsheets/meth_facts.html. These fact sheets assist in the understanding of and compliance with the provisions of the Methylene Chloride standard.
- OSHA Methylene Chloride standard, 29 CFR 1910.1052, **OSHA**, http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10094. This standard covers requirements for employers to control occupational exposures to methylene chloride.
- NIOSH's Workplace Safety and Health Topics: Methylene Chloride, **NIOSH**, <http://www.cdc.gov/niosh/topics/methylenechloride>. This webpage identifies different methylene chloride informational resources.
- Morbidity and Mortality Weekly Report: Fatal Exposure to Methylene Chloride Among Bathtub Refinishers – United States, 2000-2011, **Centers for Disease Control and Prevention (CDC)**, http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6107a2.htm?s_cid=mm6107a2_e. This February 24, 2012, report evaluates deaths among methylene-chloride-exposed bathtub refinishers in the United States from 2000 to 2011.
- What You Should Know about Paint Strippers, **Consumer Product Safety Commission and the Environmental Protection Agency**, 1997 (expected to be revised in 2012-2013). <http://www.cpsc.gov/CPSCPUB/PUBS/423.html>. This publication provides consumers and do-it-yourself workers with information and safety measures relating to paint stripper usage, including products containing methylene chloride.

State resources with more information:

- 2011 Bathtub Refinish Hazard Alert, **Michigan** Fatality Assessment & Control Evaluation (MIFACE) Program, <http://www.oem.msu.edu/userfiles/BathtubRefinishingHA14.pdf>. This alert summarizes worker fatalities using methylene chloride-based stripping agents in bathtub refinishing operations observed in Michigan and nationwide.
- 2011 Investigation Report, **Michigan** Fatality Assessment & Control Evaluation (MIFACE), <http://www.cdc.gov/niosh/face/stateface/mi/10MI013.html>. This report summarizes the agency's investigation of a tub refinisher who died from methylene chloride.
- **California** Department of Public Health webpage: [Preventing Worker Deaths from Pain Strippers Containing Methylene Chloride](#). The webpage includes investigative reports on worker deaths in California, an easy-to-use [guide on choosing the safest paint stripping agent](#), and fact sheets in both [English](#) and [Spanish](#).
- 2012 Bathtub Refinisher Safety Alert, **Massachusetts** Fatality Assessment and Control Evaluation (MA FACE) Program, <http://www.mass.gov/eohhs/docs/dph/occupational-health/bathtub-refinisher.pdf>. This alert summarizes a bathtub refinisher death that occurred in Massachusetts and provides a list of state and national informational resources for preventing hazards related to methylene chloride exposure at worksites.
- 2012 Methylene Chloride Hazard Alert, **Washington** State Department of Labor & Industries' Safety & Health Assessment & Research for Prevention (SHARP) Program, <http://www.lni.wa.gov/Safety/Research/Files/MethChlorideHazardAlert.pdf>. This alert summarizes bathtub refinisher deaths from methylene chloride nationwide and provides recommendations for its discontinuing its use, as well as suggestions to follow if methylene chloride use continues.

Contacts

OSHA:

For questions or to get information or advice, to report an emergency, fatality or catastrophe, to order publications, to file a confidential complaint, or to request OSHA's free on-site Consultation service, contact your nearest OSHA office, visit www.osha.gov, or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

NIOSH:

To receive documents or more information about occupational safety and health topics, please contact NIOSH at 1-800-CDC-INFO (1-800-232-4636), TTY 1-888-232-6348, email: cdcinfo@cdc.gov or visit the NIOSH website.

Disclaimer

This Hazard Alert is not a standard or regulation, and it creates no new legal obligations. It contains recommendations as well as descriptions of mandatory safety and health standards. The recommendations are advisory in nature, informational in content, and are intended to assist employers in providing a safe and healthful workplace. The Occupational Safety and Health Act requires employers to comply with safety and health standards and regulations promulgated by OSHA or by a state with an OSHA-approved state plan. In addition, the Act's General Duty Clause, Section 5(a)(1), requires employers to provide their employees with a workplace free from recognized hazards likely to cause death or serious physical harm.



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