

Evaluation and Control of Hazards from Preservative Coatings during Hot Work on Vessels

The construction and repair of vessels often involve the use of hot work processes that can pose serious hazards to workers. The presence of flammable or toxic preservative coatings creates serious hazards during hot work. The primary hazards include fire, explosion, and inhalation hazards, including gases, vapors, and aerosols that can result in damage to workers' neurological, reproductive or developmental, and respiratory systems. Employers must take the necessary precautions before and during hot work to reduce worker exposures to toxic substances and protect them from fire and explosion hazards.

Use of Preservative Coatings

Advances in technology have resulted in the elimination of preservative coatings containing lead, chromium, cadmium, zinc, or polychlorinated biphenyls (PCBs). However, despite the existence of safer alternatives, the potential for worker exposure to compounds at dangerous concentrations still exists. Applying heat to preservative coatings used on vessels, such as paint, can release gases, vapors, and aerosols that are flammable and harmful to workers. Exposures above OSHA's permissible exposure limit (PEL) may result from hot work being performed on surfaces containing preservative coatings, as well as during their removal. OSHA's Safety and Health Injury Prevention Sheets (SHIPS) on [Hot Work](#) and [Surface Preparation and Preservation](#) provide more in-depth discussion of potential overexposures and risks of fire or explosion associated with hot work and preservative coatings.

Employers must assess the workplace and associated operations to determine whether hazards are present, or likely to be present that require the use of personal protective equipment (PPE). Whenever possible, engineering controls (e.g., elimination or substitution), safe work practices, and administrative controls should be used to abate hazards before the use of PPE is implemented.

Hot Work Evaluation of Preservative Coatings

The following safety measures must be taken where preservative coatings are present before starting hot work:

- Evaluate work areas to identify potential hazards, including the atmospheric testing to ensure there are no concentrations of flammable vapors 10 percent or greater than the lower explosive limit.
- Sample and test preservative coatings with unknown flammability to determine if hot work can be safely performed. Preservative coatings must be considered to be highly flammable when scrapings burn with extreme rapidity.
- Remove highly flammable hardened preservative coatings from the location of intended heat application to prevent ignition. Verify that the method used for removing the flammable coating, such as chemical removers, will not cause a reaction, leading to fire or explosion.
- Strip toxic preservative coatings at least four inches on all sides surrounding the area of intended heat application, or provide workers with air line respirators in enclosed and confined spaces. Air purifying respirators must be worn by workers in open air operations during hot work on surfaces coated with toxic preservatives. Ensure filters, cartridges, or canisters used are appropriate for the specific air contaminant of exposure.

Toxicity Evaluation of Preservative Coatings

A toxic substance is defined as any chemical substance that has yielded evidence of an acute or chronic health hazard, or is the subject of a safety data sheet indicating that the material may pose a hazard to human health (see 29 CFR 1910.1020(c)(13)). OSHA standards outline potentially harmful substances and their corresponding PELs in [Table Z of 20 CFR 1915.1000](#). Additional guidance may be found at the [Permissible Exposure Limits – Annotated Tables](#). To better protect workers, OSHA recommends that employers follow the most protective occupational exposure limits. The sampling of such coatings and evaluation of the results by a competent person is necessary to make an accurate determination of the hazards present and associated strategy for ensuring worker protection. When evaluating test results, competent persons must determine whether further testing by a Certified Marine Chemist (CMC) or Certified Industrial Hygienist (CIH) is necessary.

Techniques for Preventing Exposures to Toxic Substances

Employers should use a systematic method for evaluating preservative coatings and implementing controls to protect workers from exposure to gases, vapors, or aerosols that can be released at harmful levels during removal and heating. Whenever possible, shipyard employers should explore whether an alternative method to hot work, such as cold work, is available. Where no such alternatives exist and coatings have been determined to be toxic, as prescribed in 29 CFR 1915.53(d), at least four inches on all sides surrounding the area of intended heat application must be removed in enclosed and confined spaces before hot work can be performed, unless workers are supplied with air line respirators. In open air, air purifying respirators are required.

However, the prescribed four inches is only a minimum distance, which is dependent on the expected temperature of the heat process and the surface area that the flame, arc, or other source of heat contacts. Therefore, the evaluation must take into account not only the immediate area where hot work is being performed, but the surrounding areas (e.g., adjacent locations and the reverse side of the material) as well. If surrounding surfaces are covered with a toxic preservative coating and have the potential to release harmful gases, vapors, or aerosols when heated, the coating must be removed or workers provided with the necessary respiratory protection. Where it is difficult to visually ascertain the edge of the area of heat application, the area can be marked with a 500°F temperature-indicating crayon (or temp-stick). If the crayon melts, it indicates insufficient coating removal. An infrared device is another alternative that can be used to measure surface temperatures. Additionally, as noted at 29 CFR 1915.53(e) (2), artificial cooling equipment can be used to cool the metal surrounding a heated area to limit the amount of preservative coating that must be removed. While this particular provision specifically addresses hot work performed in enclosed spaces on metals covered by soft and greasy preservatives, such cooling equipment is also suitable where there is the potential for preservative coatings on surrounding areas (e.g., backside of a bulkhead) to smolder or burn.

Use the [Process Flow Chart](#) for assistance in determining the steps and OSHA standards for safely dealing with preservative coatings where heat processes are necessary.

Additional Resources:

- OSHA Shipyard Employment eTool
- National Institute for Occupational Safety and Health (NIOSH) [Registry of Toxic Effects of Chemical Substances](#) (RTECS)
- NIOSH Pocket Guide to Chemical Hazards
- OSHA Maritime Resource Webpage

For More Information

Your nearest OSHA office can provide more information. Also, OSHA's On-Site Consultation Program offers no-cost and confidential occupational safety and health services to small and medium-sized businesses in all states, with priority given to high-hazard worksites. On-Site consultation services are separate from enforcement and do not result in penalties or citations. For more information or to find the local On-Site Consultation office in your state, visit www.osha.gov/consultation, or call 1-800-321-OSHA (6742).

Workers' Rights

Workers have the right to:

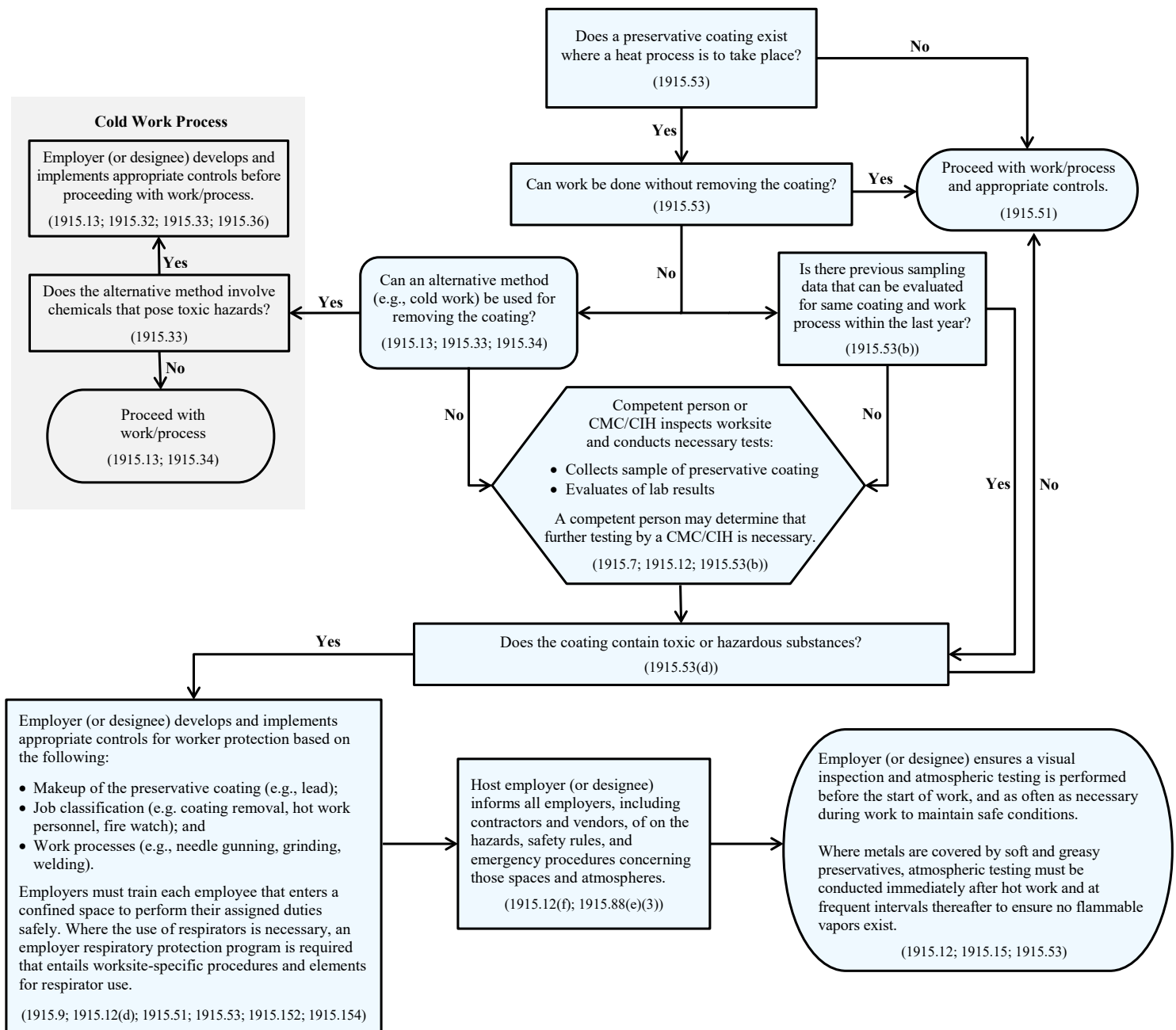
- Working conditions that do not pose a risk of serious harm.
- Receive information and training (in a language and vocabulary the worker understands) about workplace hazards, methods to prevent them, and the OSHA standards that apply to their workplace.
- Review records of work-related injuries and illnesses.
- 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. OSHA will keep all identities confidential.
- Exercise their rights under the law without retaliation, including reporting an injury or raising health and safety concerns with their employer or OSHA. If a worker has been retaliated against for using their rights, they must file a complaint with OSHA as soon as possible, but no later than 30 days.

For additional information, see OSHA's Workers page (www.osha.gov/workers).

How to Contact OSHA

Under the Occupational Safety and Health Act of 1970, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to help ensure these conditions for America's workers by setting and enforcing standards, and providing training, education and assistance. For more information, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

Process Flow Chart: Evaluation and Control of Preservative Coatings during Hot Work



This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: 1-877-889-5627.



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