

Hazards Associated with Spray Painting in Shipyard Employment

The construction and maintenance of vessels often involves spray painting, which can pose serious hazards to workers. The primary dangers include fires and explosions from flammable paints and coatings, as well as exposures to chemical hazards and toxic substances. The work is frequently conducted in confined spaces that, if not properly ventilated, can cause sickness or death for workers. Employers must take the necessary precautions to safeguard workers.

Exposure to Hazardous Substances

During spray painting operations, workers are at a greater risk of exposure to hazardous substances than when they are painting with a brush or roller. Paint particles are released into the atmosphere through the spray nozzle, which increases the release of hazardous vapors. While safer methods have been developed, such as using less volatile and less toxic paints and coatings, and low-flow airless spray nozzles, shipyard employers still need to take precautions to avoid hazardous exposures to workers. This is especially true in confined spaces.

Shipyard employers are responsible for identifying, evaluating, and protecting workers from exposure to respiratory and other hazards in the workplace. Where appropriate, employers must ensure chemical labels and safety data sheets are made available to exposed workers, and train them on the hazards and measures necessary to protect themselves.

For more information on hazard communication requirements specific to work performed in the maritime industry, see OSHA Fact Sheet — [Hazard Communication in the Maritime Industry](#).

OSHA's maritime standards specify permissible exposure limits (PELs) and other controls to protect workers from chemical hazards ([29 CFR Part 1915, Subpart Z](#)). However, based on more recent science, lower and more protective exposure limits have been recommended by many technical, professional, industrial, and government organizations, both inside and outside the United States. Details can be found at www.osha.gov under [Permissible Exposure Limits — Annotated Tables](#). OSHA's mandatory PELs in the Z-Tables

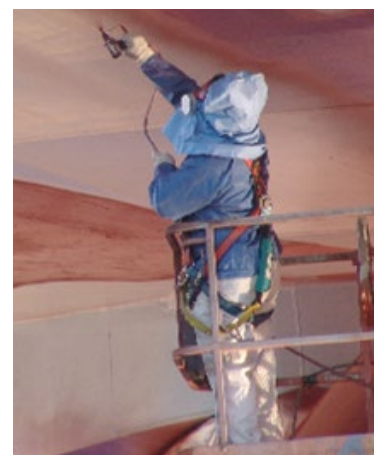
remain enforceable. However, the agency recommends that employers use the most protective occupational exposure limits to better protect their workers.

Fires or Explosions

Spray painting releases significant amounts of flammable and combustible vapors into the atmosphere, which increases the potential for fires or explosions. A spark from electrical equipment or static discharge can be enough to ignite volatile vapors. Employers must follow the safety precautions provided in [29 CFR 1915.36](#) and [1915.35\(b\)](#) when spray painting activities are capable of producing a flammable or combustible atmosphere.

Control Measures

Exposure to dangerous compounds can be prevented by using engineering controls and personal protective equipment (PPE). However, the use of engineering controls should be evaluated and implemented before relying exclusively on PPE for protection. Always review the manufacturer's safety data sheet (SDS) for all paints and coatings to determine flash points and if other volatile, toxic, or flammable substances are in the mixtures.



A worker involved in spray painting applications.

Photo: OSHA

Engineering Controls

Engineering controls, such as ventilation, are used to prevent worker exposure to hazardous atmospheric conditions and fires or explosions. During the spray application of paints or coatings where the potential for such hazards exists, a shipyard competent person must conduct frequent tests to verify that solvent vapors are at a concentration below 10% of the lower explosive limit (LEL). Additionally, when using paint mixtures containing highly toxic, flammable, and explosive solvents with flash points below 80°F, employers must:

- Stop painting operations and immediately evacuate exposed workers when atmospheric testing indicates that the concentration of solvent vapors reaches or exceeds 10% of the LEL.
- Use exhaust ventilation that is discharged away from working areas and potential ignition sources to keep concentrations of flammable vapors below 10% of the lower explosive limit and prevent fires or explosions.
- Continue using ventilation after the completion of paint or coating applications to dissipate excess vapor concentrations, keeping the compartment or space gas free.
- Retest the atmosphere 10 minutes after ventilation has been discontinued to confirm that atmospheric conditions remain at an acceptable level.

For additional information on the selection, installation and use of ventilation equipment, see OSHA guidance document 3639 — [Ventilation in Shipyard Employment](#).

Tools and Equipment

Tools and equipment have the potential to be an ignition source in flammable and combustible atmospheres through an electrical spark or static discharge. Employers must:

- Confirm that, where paints or coatings in use have flash points below 80°F, all tools, equipment, and associated metallic parts (e.g., spray guns, paint pots, motors, fans, ventilators, and duct work) are electrically bonded and/or grounded to the vessel to prevent static discharge. Fan blades and portable air ducts must be made of nonferrous material, no ferrous materials may be taken into work areas, and all staging and scaffolds must be erected in a manner that ensures they are non-sparking.
- Make sure that where paints or coatings in use have flash points below 80°F, all motors and control equipment are classified as explosion-proof and are properly maintained and grounded.
- Ensure that the metallic parts of air moving devices, such as fans, blowers, and jet-type air movers, and all duct work are bonded to the vessel's structure where paints or coatings in use are mixed with toxic vehicles or solvents.
- Only permit explosion-proof lighting in work areas, approved by a Nationally Recognized Testing Laboratory for use in Class I, Group D atmospheres, or approved as permissible by the Mine Safety and Health Administration or the U.S. Coast Guard.

- Check that all power and lighting cables are inspected regularly by a competent person to verify that the insulation is free of cracks and worn spots, lines are not overloaded, and that cables are suspended with sufficient slack to prevent undue stress or chafing.
- Prohibit the use of objects or equipment that produce open flames or sparks, such as matches, lit cigarettes, cigars or pipes, cartridge-type stud guns, and tools used for hot work. Use only non-sparking paint buckets, spray guns, and tools.
- Keep electrical connections at least 50 feet or more from paint and tank coating operations.¹

Each connection within 50 feet of painting operations must be evaluated based on the class of the location in which they are intended to be used, in addition to the ignitable or combustible properties of the specific gas or vapor present (29 CFR 1910.307(c)(2)). The National Electrical Code, NFPA 70, which defines hazardous gases, vapors, and dusts by their ignitable or combustible properties, also contains guidelines for determining the type and design of equipment and installations approved for a specific hazardous (classified) location. Examples of such design principles and equipment characteristics may include the use of positive pressure ventilation, as well as explosion-proof, non-incendiary, intrinsically safe, and purged and pressurized equipment.

Personal Protective Equipment

Employers must assess work activities at their facility to determine if hazards are present or likely to be present that require worker use of PPE. [29 CFR Part 1915, Subpart I](#), specifies employer responsibilities to provide workers with and ensure the use of PPE that will adequately protect them from the hazards identified. To protect workers from hazards associated with spray painting operations, employers must make sure workers use:

- Airline respirators with auxiliary self-contained air supply for emergency escape when paint mixed with toxic solvents is being applied through spray application in confined spaces. During exterior spray painting operations, use of filter cartridge type respirators is required.
- The appropriate PPE, such as protective clothing, gloves, goggles, and face shields, that prevent air sprayed coatings from contacting the worker's face, eyes, head, hands, feet and other exposed skin.



Photo: OSHA

Airline respirator with personal protective equipment (PPE) to prevent skin contact.

¹ On vessels, [29 CFR Part 1910, Subpart S](#) is applied when shore-based electrical installations provide power for onboard use (e.g., the power from the electrical system comes from shore or from portable electrical generators), but does not apply to permanently installed electrical systems on vessels.

- Non-sparking footwear and gloves to prevent static electricity, as well as coveralls or outer clothing made of cotton, and rubber gloves, rather than plastic, where paints or coatings in use have flash points below 80°F.

For additional information on other hazards associated with surface preparation and preservation activities, including the application of paint and other protective coatings, see [Safety and Health Injury Prevention Sheet \(SHIPS\) on Surface Preparation and Preservation](#).

Disposal

- Employers must provide covered metal containers at worksites for the disposal of scrapings and rags soaked with flammable compounds.

Emergency Response

In case of a fire, response time is crucial. Employers must:

- Provide suitable fire extinguishing equipment for each work area that is immediately available in a state of readiness for instant use.
- Train workers to recognize unsafe conditions, including significant fire hazards, and procedures to follow in the event a fire occurs as outlined in the facility's fire safety plan.
- Ensure workers designated as fire watches are trained in accordance with [29 CFR 1915.508\(c\)](#).

State Plans

There are 28 OSHA-approved occupational safety and health state plans. State plans are required to have standards and enforcement programs that are at least as effective as Federal OSHA standards, which may be different or more stringent. More information is available at: www.osha.gov/dcsp/osp.

OSHA's On-site Consultation Program

OSHA's On-site Consultation Program offers free and confidential advice 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

Under federal law, workers are entitled to working conditions that do not pose a risk of serious harm.

For more information on how to assure a safe and healthful workplace, see [OSHA's Workers page](#).

How to Contact OSHA

For questions or to get information or advice, to report an emergency, fatality, inpatient hospitalization, amputation, or loss of an eye, or to file a confidential complaint, contact your nearest OSHA office, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

For assistance, contact us. We can help. It's confidential.



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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.

