



RESEARCH BRIEF

Research Request:

Painting Aircraft in Hangars

Research Response:

Some aviation operators paint aircraft in their hangar. This research brief provides references to published requirements and an OSHA interpretation of appropriate requirements.

Definitions

A “*spray booth*” is defined as: A power-ventilated structure provided to enclose or accommodate a spraying operation to confine and limit the escape of spray, vapor, and residue, and to safely conduct or direct them to an exhaust system. 29CFR 1910.107 (a)(3).

A “*spray room*” is defined as a room in which spray-finishing operations not conducted in a spray booth are performed separately from other areas. 29CFR 1910.107(c)(iii)

[Link to CFRs](#)

Key Takeaways

1. For purposes of OSHA's standard at 29 CFR 1910.94(c), which addresses ventilation requirements for spray finishing operations, **the determination of whether such activities must be conducted in a spray booth or spray room is based on the presence of a hazardous chemical in the paint** (see OSHA Case Study on page 4)
2. It is essential that the organization obtain the services of an Industrial Hygienist (IH) to help evaluate requirements. (See Industrial Hygiene section on page 3)

Published Requirements**Regulations:**

- **29 CFR 1910.107 Occupational Safety and Health Standards: Occupational Health and Environmental Control—Spray Finishing Using Flammable and Combustible Materials**

General. All spraying areas shall be provided with mechanical ventilation adequate to remove flammable vapors, mists, or powders to a safe location and to confine and control combustible residues so that life is not endangered. Mechanical ventilation shall be kept in operation at all times while spraying operations are being conducted and for a sufficient time thereafter to allow vapors from drying coated articles and drying finishing material residue to be exhausted.

- **29 CFR 1910.94 Occupational Safety and Health Standards: Occupational Health and Environmental Control—Ventilation**

Spray-finishing operations are employment of methods wherein organic or inorganic materials are utilized in dispersed form for deposit on surfaces to be coated, treated, or cleaned. Such methods of deposit may involve either automatic, manual, or electrostatic deposition but do not include metal spraying or metallizing, dipping, flow coating, roller coating, tumbling, centrifuging, or spray washing and degreasing as conducted in self-contained washing and degreasing machines or systems.

- **29 CFR 1910.134 Occupational Safety and Health Standards: Personal Protective Equipment—Respiratory Protection.**

In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective shall be to prevent atmospheric contamination. This shall be accomplished as far as feasible by accepted engineering control measures (for example, enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials). When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators shall be used pursuant to this section

- **29 CFR 1910.1026 Occupational Safety and Health Standards: Toxic and Hazardous Substances—Cromium (VI).**

Hexavalent chromium or Cr(VI) is a toxic form of chromium which can cause severe health effects to workers, including lung cancer. Chromium compounds are added to paints and primers to provide corrosion protection and to create specific colors. Painting operations in the **aerospace and air transportation industries** can expose workers to hazardous levels of Cr(VI). The OSHA Permissible Exposure Limit (PEL) for worker exposure to Cr(VI) is 5 µg/m³ [as an 8-hour-time weighted average (TWA)] and OSHA regulates worker exposure to this hazardous substance under its Chromium (VI) standard.

[OSHA Fact Sheet—Controlling Exposure to Hexavalent Chromium in Aerospace and Air Transport Painting](#)

Published Requirements Cont...**Standards:**

IBAC: IS-BAO and IS-BAH require an organization to have a process to identify and comply with all national and local occupational health and safety laws and requirements applicable to its operations. Additionally the organization is required to ensure that all company personnel, passengers, and visitors accessing ramp or hangar areas comply with the occupational health and safety requirements.

Industrial Hygiene

Vapors and chemicals from paint can cause health hazards which vary greatly depending on the chemical composition of the paint, the application method (spray or brush) and the amount of exposure to it. Additionally non-water based paint vapors and aerosols are flammable. A good place for any aviation operator to start is to read the Safety Data Sheet (SDS) of all the paints that are used in painting their aircraft.

Next, it is essential that the organization obtain the services of an Industrial Hygienist (IH) to help evaluate requirements. Industrial hygienists use environmental monitoring and analytical methods to detect the extent of worker exposure and employ engineering, work practice controls, and other methods to control potential health hazards.

Industrial hygienists recognize that engineering, work practice, and administrative controls (in that order of priority) are the primary means of reducing employee exposure to occupational hazards.

Engineering controls minimize employee exposure by either reducing or removing the hazard at the source or isolating the worker from the hazard. Engineering controls include eliminating toxic chemicals and substituting non-toxic chemicals, enclosing work processes or confining work operations, and the installation of general and local ventilation systems.

Work practice controls alter the manner in which a task is performed. Some fundamental and easily implemented work practice controls include (1) changing existing work practices to follow proper procedures that minimize exposures while operating production and control equipment; (2) inspecting and maintaining process and control equipment on a regular basis; (3) implementing good housekeeping procedures; (4) providing good supervision; and (5) mandating that eating, drinking, smoking, chewing tobacco or gum, and applying cosmetics in regulated areas be prohibited.

Administrative controls include controlling employees' exposure by scheduling production and tasks, or both, in ways that minimize exposure levels. For example, the employer might schedule operations with the highest exposure potential during periods when the fewest employees are present.

Industrial Hygiene Cont...

When effective work practices or engineering controls are not feasible or while such controls are being instituted, appropriate **personal protective equipment** must be used. Examples of personal protective equipment are gloves, safety goggles, helmets, safety shoes, protective clothing, and respirators. To be effective, personal protective equipment must be individually selected, properly fitted and periodically refitted; conscientiously and properly worn; regularly maintained; and replaced, as necessary.

OSHA Case Study—Spraying Water Based Paint

In 2008 OSHA provided a Standards Interpretation for an organization that asked the question “**Is a spray booth required when the substance is water based paint?**”

That scenario, the questions, and OSHA’s responses have been paraphrased below:

Scenario: Your client has a spray finishing operation that is performed periodically and uses fewer than 18 gallons of chemical product per week. The product being used is a water-based (non-flammable) liquid and has some toxic properties. The employer has performed air monitoring and no employee overexposures to the chemicals were obtained. Currently, this operation is not performed within the confines of a spray booth or a spray area (as defined by 29 CFR 1910.107, *Spray Finishing Using Flammable and Combustible Materials*), and no overspray accumulation has been detected in the work area in which the operation is performed.

Question 1: Should the determination whether to perform the spray operation in a booth be based on the employee's level of exposure to the hazardous chemicals in the paint or the mere presence of a hazardous chemical in the paint?

Answer 1: For purposes of OSHA's standard at 29 CFR 1910.94(c), which addresses ventilation requirements for spray finishing operations, **the determination of whether such activities must be conducted in a spray booth or spray room is based on the presence of a hazardous chemical in the paint.** Section 1910.94(c)(2) provides:

(2) *Location and Application.* Spray booths or spray rooms are to be used to enclose or confine all operations. Spray-finishing operations shall be located as provided in section 201 through 206 of the Standard for Spray Finishing Using Flammable and Combustible Materials, NFPA No. 33-1969.

Also, Section 1910.94(c)(8), *Scope*, provides:

(8) *Scope.* Spray booths or spray finishing rooms are to be used to enclose or confine all spray finishing operations covered by this paragraph (c). This

OSHA Case Study—Spraying Water Based Paint Cont...

paragraph does not apply to the spraying of the exteriors of buildings, fixed tanks, or similar structures, nor to small portable spraying apparatus not used repeatedly in the same location.

Although OSHA routinely requires ventilation when employees are exposed to chemicals at levels that exceed established permissible exposure limits (PELs), **the known presence of a health hazard during spray finishing operations is also indicative of the need for spray booth ventilation** as required by 29 CFR 1910.94(c)(2). Paragraph 1910.94(c)(2) states that "spray booths or spray rooms are to be used to enclose or confine all operations." The source of the spray-finishing portion of the ventilation standard is the *American Standard Safety Code for the Design, Construction, and Ventilation of Spray Finishing Operations*, ANSI Z9.3-1971 which states, "this standard is intended to protect the health of personnel from injurious effects of *contact* with gases, vapors, mists, dusts, or solvents used in, created, released, or disseminated by spray-finishing operations." According to this source standard, it is the presence of a toxic chemical which creates the possibility of injurious effects on employees from contact, thus triggering the requirements for spray booth ventilation.

When employees are exposed to chemicals at levels in excess of any of the established standards under 29 CFR 1910.1000(e), *Air Contaminants*, ". . . administrative or engineering controls must first be determined and implemented whenever feasible." The primary method used to control employee exposures to inhalation hazards is an adequate ventilation system.

Question 2: Is the employer required to use a spray booth when performing the spray-finishing operation described in the scenario?

Answer 2: There are many chemicals, that while not flammable, may still possess harmful properties that can result in occupational illnesses when inhaled or contacted. Water-based paints and other substances that are not considered flammable are applied in occupational settings through the use of spray application techniques and may present potential health hazards. **Therefore, as explained in your scenario, if an employer is performing spray-finishing operations using chemicals that are not flammable, but possess possible inhalation health hazards, then the ventilation requirements of 1910.94(c), *Ventilation*, would apply.**

Your email references an existing memorandum of interpretation by OSHA dated June 9, 1978 identifying the requirement to have a spray booth when water-based paints that contain toxic substances are sprayed. Our answer to your inquiry above is consistent with that interpretation. Your client has made an assessment that no hazardous conditions exist during the spraying of their water-based chemicals. It is imperative the employer document that, during any expected conditions of use (of the water-based chemical) at the worksite, no adverse health effects have been, or could be, experienced by employees. Although the employer would be considered to be in violation of 29 CFR 1910.94(c) for failing to perform painting operations in a spray booth when using paint containing toxic substances, such a violation would be considered *de mini-*

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mis, provided that the hazard assessment has in fact demonstrated that no hazardous health effects could result during the application. *De minimis* violations are those which have no direct or immediate relationship to safety or health. In such instances, OSHA does not issue citations, but rather a notice that does not require abatement.