

SSPC: The Society for Protective Coatings

Technology Guide No. 6

GUIDE FOR CONTAINING SURFACE PREPARATION DEBRIS GENERATED DURING PAINT REMOVAL OPERATIONS

1. SCOPE

1.1 This guide describes methods of paint removal, containment systems, and procedures for minimizing or preventing emissions from escaping the work area, and procedures for assessing the adequacy of the controls over emissions.

1.2 The containment systems are categorized in up to four classes per type of paint removal method, based on the extent to which emissions are controlled.

1.3 This guide is primarily intended for use with steel structures; however, some of the methods and materials may be suited for use on concrete, aluminum, wood, or other materials of construction.

1.4 This guide is intended for use by facility owners, specifiers, designers, and contractors. It may also be used by other interested parties.

1.5 A discussion of ventilation is included in the guide to assist users in both controlling emissions to the environment, and in enhancing worker protection and visibility within the containment. It is important to recognize that ventilation systems alone may or may not be sufficient to fully protect workers when the paint being removed contains lead or other toxic metals, and additional work practice and/or administrative controls and respiratory protection may be required to control worker exposures. Requirements or evaluation methods for worker health and safety are outside the scope of this guide.

Note: When toxic metals are referenced in the Guide, lead is often used as the example. This should not be construed to imply that lead is the only toxic metal contained in paints or abrasives, or that lead is the only toxic metal addressed in regulations. A number of toxic metals may be present in paint and abrasives, and regulations are available to address many of them.

2. DESCRIPTION AND DEFINITIONS

2.1 GENERAL: During surface preparation, airborne particulate and debris from the removal of paint (particularly paints containing lead, cadmium, and chromate pigments) can contaminate the air, soil, and water surrounding work sites. The potential environmental hazards are reduced by minimizing or eliminating the airborne particulate, and by containing and

collecting the debris. Controlling airborne particulate and other emissions may be necessary to comply with federal, state, and local regulations.

2.2 OUTLINE OF GUIDE

2.2.1 Procedures Included in this guide:

- Selecting Methods of Surface Preparation and Debris Collection (Section 4.1)
- Specifying Containment Systems (Section 4.2)
- Selecting Methods for Assessing the Quantity of Emissions (Section 4.3)
- Implementing Containment Project (Section 4.4)

2.2.2 The guide also includes descriptions and commentaries on:

- Methods of Coating Removal (Section 5.1)
- Methods of Collecting Debris (Section 5.2)
- Containment Enclosure Components (Section 5.3)
- Ventilation System Components (Section 5.4)
- Methods for Assessing Quantity of Emissions (Section 5.5)

2.3 DEFINITIONS

2.3.1 Action Level for Lead: Employee exposure, without regard to the use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air (30 $\mu\text{g}/\text{m}^3$) calculated as an eight-hour TWA per OSHA General Industry Standard 29 CFR 1910.1025 and OSHA Construction Industry Standard 29 CFR 1926.62.

2.3.2 Containment System: A containment system includes the cover panels, screens, tarps, scaffolds, supports, and shrouds used to enclose an entire work area or a paint removal tool. The purpose is to minimize or prevent the debris generated during surface preparation from entering into the environment, and to facilitate the controlled collection of the debris for disposal. Containment systems may also employ the use of ground covers or water booms.

2.3.3 Emissions: When used in this guide, emissions from the containment that require control include airborne plumes of material, as well as spills or leaks of water, abrasive, paint chips, and debris.

2.3.3 Ventilation System: Ventilation systems include both natural ventilation and mechanical ventilation (fans

hoods, and duct work), to provide air movement across the work area, and dust collectors to clean the discharged air.

2.3.4 PM-10: Particulate matter (dust) less than 10 micrometers (0.39 mils) in aerodynamic equivalent diameter. (Aerodynamic equivalent diameter is defined as the diameter of a unit density sphere having the same settling velocity as the particle in question, regardless of its shape and density.)

2.3.5 Permissible Exposure Limit (PEL) for Lead: Maximum allowable employee average exposure per OSHA General Industry Standard 29 CFR 1910.1025 and OSHA Construction Industry Standard 29 CFR 1926.62.

2.3.6 Time Weighted Average (TWA): Concentrations of airborne toxic materials that have been weighted for a certain time duration, usually eight hours.

2.3.7 Impenetrable: Impervious to dust and wind.

2.3.8 Impermeable: Impervious to water.

3. REFERENCED DOCUMENTS

3.1 The latest issue, revision, or amendment of the referenced standards in effect on the date of invitation to bid shall govern, unless otherwise specified. Standards marked with an asterisk (*) are referenced only in the Notes, which are not requirements of this specification.

3.2 If there is a conflict between the requirements of any of the cited referenced standards and this specification, the requirements of this specification shall prevail.

NOTE: New governmental regulations or amendments to existing ones become effective as scheduled by the governmental agency, independent of the date of bid.

3.3 SSPC: THE SOCIETY FOR PROTECTIVE COATINGS

AB 2	Specification for Cleanliness of Recycled Ferrous Metallic Abrasives
Guide 7	Guide for the Disposal of Lead-Contaminated Surface Preparation Debris
Guide 16	Guide to Selection of Dust Collectors
Guide 18	Specifier's Guide for Determining Containment Class and Environmental Monitoring Strategies for Lead-Paint Removal Projects
TU 7	Conducting Ambient Air, Soil, and Water Sampling During Surface Preparation and Paint Disturbance Activities

3.4 U.S. CODE OF FEDERAL REGULATIONS:¹

29 CFR 1926.57	Safety and Health Regulations for Construction, Subpart D – Occupational Health and Environmental Controls (Ventilation)
29 CFR 1926.62	Safety and Health Regulations for Construction, Subpart D – Occupational Health and Environmental Controls (Lead)
29 CFR 910.1025	Occupational Safety and Health Standards Subpart Z – Toxic and Hazardous Substances (Lead)

3.5 AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS:²

- * Industrial Ventilation – A Manual of Recommended Practice

3.6 AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI):³

- * ANSI Z9.2 (1979) Fundamentals Governing the Design and Operation of Local Exhaust Systems
- * ANSI Z9.2 (2001) Fundamentals Governing the Design and Operation of Exhaust Systems
- * ANSI/AIHA Z9.4 (1997) Exhaust Systems - Abrasive Blasting Operations – Ventilation and Safe Practice

3.7 NATIONAL FIRE PROTECTION ASSOCIATION⁴

NFPA 701	Standard Methods of Fire Tests for Flame Propagation of Textiles and Films
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4. PROCEDURES

4.1 SELECTING METHODS OF SURFACE PREPARATION AND DEBRIS COLLECTION

4.1.1 Surface Preparation Method: Prior to selecting and specifying a containment system, it is necessary to determine the method to be used for surface preparation of the steel. Considerations for selecting surface preparation follow.

4.1.1.1 Coatings can be removed from the surface by a variety of techniques. These include:

- Abrasive blasting (e.g. open blasting with expendable abrasives, open blasting with

¹ Downloads from the Code of Federal Regulations are available at <<http://www.ecfr.gov>>

² American Conference of Governmental Industrial Hygienists, 1330 Kemper Meadow Drive, Cincinnati, OH 45240, phone 513-742-2020 <<http://www.acgih.org>>

³ American National Standards Institute, 1819 L Street, NW, Suite 600, Washington DC 036. Standards available online from <<http://www.ansi.org>>

⁴ National Fire Protection Association, 1 Battery March Park, Quincy, MA 02269. Standards available from <<http://www.nfpa.org>>

reusable abrasives, vacuum [closed] blasting with reusable abrasives, nonrecirculating closed blast systems).

- Water blasting and pressurized waterjetting (with or without abrasives).
- Chemical stripping.
- Hand and power tool cleaning (with and without localized exhaust).

4.1.1.2 Methods vary significantly in their productivity, degree of cleanliness and surface profile achieved, utility and support requirements, dust and waste produced, clean-up required, and costs. For example, open abrasive blasting with expendable abrasives requires the greatest quantity of abrasive and produces the greatest quantity of dust and debris. Methods that do not utilize abrasive generally produce the least amount of dust and debris.

NOTE: The toxicity characteristic of the waste is independent of the volume of the waste generated (e.g., paint chips alone or paint chips combined with abrasive). It should also be noted that the abrasive used for abrasive blast cleaning might contain toxic components.

4.1.1.3 Before specifying a method of surface preparation, the manufacturer of the coating to be applied should be consulted to assure that the degree of cleaning and surface profile produced will be satisfactory for coating system performance.

4.1.2 Methods for Collecting Debris: Debris may be collected from the surface at the point of cleaning (e.g., with vacuum) or from the general work area. The collection method should be selected in conjunction with the paint removal method and the containment system design to assure a completely integrated operation. The debris should be collected on a regular basis and not left to accumulate over the course of a job. Methods of collecting debris are described in Section 5.2.

In addition to collecting debris within containment, debris that escapes the contained area should be removed on a routine basis (e.g., end of work day, or as specified) to prevent winds or rain from carrying it onto surrounding property, into soil, ground, or storm sewers, or into bodies of water.

4.2 SPECIFYING CONTAINMENT SYSTEMS

4.2.1 The facility owner or representative should specify the class of containment required and/or the environmental monitoring criteria that will be used to verify the containment's effectiveness. The specified containment should be maintained in accordance with the approved design throughout the course of surface preparation. Because of uncertainties in the measurement and significance of containment efficiencies, it is not a good practice to simply specify a level or percent of containment. Methods for specifying containment systems and items that should be considered are found in Sections 4.2.2 and 4.2.3. Containment for paint application is beyond the scope of this guide. SSPC Guide 18 provides additional information about selecting and specifying containment

classes. SSPC-TU 7 provides additional information about selecting and specifying monitoring requirements,

4.2.2 Containment System Classes: The classifications described below vary in the degree to which the containment design can be effective in controlling emissions of dust and debris into the environment. Note that emissions requiring control include spills and leaks of material in addition to plumes of airborne dust and debris.

The degree of emissions control is greatest for Class 1 and least for Class 4. Selection of a containment system with greater emission control capability is required for surface preparation methods that produce the greatest quantity of dust and debris. Containments with lesser emissions control capability are required for surface preparation methods that produce lesser quantities of dust and debris. For each containment system described in this Guide, the Class designation (Class 1, 2, 3, or 4) is provided first, followed by a letter. The letter represents the method of preparation (A – abrasive blast cleaning, W – wet methods of preparation, C – chemical stripping, and P – hand and power tool cleaning). For example, a Class 1 containment for abrasive blast cleaning (designated 1A) involves the use of more elaborate containment components than Class 1 for power tool cleaning (designated 1P). For this reason, individual tables have been prepared to identify the containment components for each of the classes according to the type of removal method.

When vacuum shrouding is employed around the removal tool, controls equivalent to Class 1 may be achieved through the use of ground covers or free hanging tarpaulins.

4.2.2.1 Class 1: This system provides the highest level of emissions control.

For abrasive blast cleaning, Class 1A normally requires air-impenetrable walls, ceiling, and floors as applicable; with rigid or flexible framing, fully sealed joints, airlock or resealable entryways, negative air pressure achieved by forced or natural air flow (verified by instrument or visual monitoring), and exhaust air filtration.

For wet methods of preparation, Class 1W normally requires water-impermeable walls, ceiling, and floors with rigid or flexible framing; fully sealed joints, resealable entryways, negative air pressure achieved by forced or natural air flow (verified visually), and exhaust air filtration.

For chemical stripping, Class 1C normally requires water-impermeable and chemical-resistant walls, ceiling, and floors, as applicable; and floors with rigid or flexible framing, fully sealed joints and overlapping entryways, and forced or natural air flow with exhaust air filtration. When pressure washing is used to remove the dislodged paint, it may be necessary to specify one of the containments from Table W for the control of the water and waste.

For hand or power tool cleaning, Class 1P normally requires air-impenetrable walls with rigid or flexible framing, fully sealed joints, resealable entryways, negative air pressure achieved through forced or natural air flow (verified visually) and exhaust air filtration.

4.2.2.2 Class 2: This system provides a high level of emissions control.

For abrasive blast cleaning, Class 2A normally utilizes air-impenetrable walls, ceiling, and floors, as applicable; with rigid or flexible framing, fully sealed joints, partially sealed entryways, negative air pressure achieved by forced or natural air flow (verified visually), and exhaust air filtration.

For wet methods of preparation, Class 2W normally requires water-impermeable walls, ceiling, and floors, as applicable; rigid or flexible framing, fully sealed joints, overlapping entryways, and natural air flow.

For chemical stripping, Class 2C normally requires water-impermeable and chemical-resistant walls, ceiling, and floors, as applicable; and floors with rigid or flexible framing, fully sealed joints, overlapping entryways, and natural air flow. When pressure washing is used to remove the dislodged paint, it may be necessary to specify one of the containments from Table W for the control of the water and waste.

For hand or power tool cleaning, Class 2P normally requires air-penetrable or -impenetrable walls, ceiling, and floors, as applicable; rigid or flexible framing, fully sealed joints, overlapping or open seam entryways, and natural air flow.

4.2.2.3 Class 3: This system provides a moderate level of emissions control.

For abrasive blast cleaning, Class 3A normally utilizes air-penetrable walls, ceiling, and floors, as applicable; with rigid or flexible framing, partially sealed joints and entryways, and exhaust air filtration.

For wet methods of preparation, Class 3W normally requires water-impermeable walls, ceiling and floors, as applicable; minimal framing, partially sealed joints, open seam entryways, and natural airflow.

For chemical stripping, Class 3C normally requires water-impermeable and chemical-resistant walls, ceiling, and floors, as applicable; minimal framing, partially sealed joints, open seam entryways and natural airflow. When pressure washing is used to remove the dislodged paint, it may be necessary to specify one of the containments from Table W for the control of the water and waste.

For hand or power tool cleaning, Class 3P normally requires air-penetrable walls, ceiling, and floors, as applicable; minimal framing, partially sealed joints, open seam entryways, and natural air flow.

4.2.2.4 Class 4: This system provides a minimal level of emissions control.

For abrasive blast cleaning, Class 4A normally utilizes air-penetrable walls, ceiling, and floors, as applicable, with flexible framing, open seams and entryways, and natural airflow.

For wet methods of preparation, Class 4W utilizes water-permeable walls, ceiling, and floors, as applicable; with flexible framing and natural air flow to collect dislodged debris while allowing the water to pass through. For chemical stripping, this class is not applicable.

For hand or power tool cleaning, this class is not applicable.

4.2.2.5 Containment Class Tables: Tables A, W, C, and P list various containment and ventilation components that can be utilized to achieve these different classes. Table A is used for abrasive blast cleaning, Table W for water blasting/waterjetting, Table C for chemical stripping, and Table P for hand or power tool cleaning. The components are described in Sections 5.3 and 5.4. Note that other combinations of containment and ventilation components may provide dust and debris control similar to those suggested in the tables.

4.2.3 Other Considerations in Specifying and Selecting Containment Systems:

- Type of structure (simple flat plate or beams versus complex trusses and joists).
- Load-bearing capacity (live, dead) and integrity of the containment system, attachments, and of the structure. **NOTE:** Containment systems may need to be reviewed by a registered professional engineer prior to erection and use to confirm the structural adequacy of the containment and the effect of various loads imposed.
- Size and elevation of structure (e.g., elevated water tank, small secondary bridge, etc.).
- Location of structure (e.g., rural, urban, over water, etc.).
- Proximity to other buildings, structures, operating equipment, and traffic. Tight confines may not permit the construction of certain containment devices.
- Local climate (e.g., heavy winds, rain, snow, etc.).
- Permitting. The construction of containment devices may be regulated by codes.
- Construction of structure (such as riveted or welded). On certain structures, the welding of containment system brackets adjacent to riveted seams should be avoided.
- Additional work to be performed inside containment (e.g., the control of paint overspray).

4.3 SELECTING METHODS FOR ASSESSING THE QUANTITY OF EMISSIONS

4.3.1 The specifier should select one or more of the following methods for monitoring the amount of dust or debris that escapes the work area. These methods are described in SSPC-TU 7.

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| Method A: | Visible Emissions |
| Method B: | Ambient Air Monitoring for PM-10 |
| Method C: | Occupational Monitoring of Area Emissions of Lead |
| Method D: | Ambient Air Monitoring for Toxic Metals (TSP Lead) |
| Method E: | Soil Analysis for Toxic Metals |
| Method F: | Water and Sediment Analysis for Toxic Metals |

4.3.2 If one or more of the methods is specified, the specification should identify the method selected, the frequency,

and duration of the tests that will be employed, the location of the monitors (in the case of instrument monitoring), and the acceptance criteria.

4.4 IMPLEMENTING CONTAINMENT PROJECT

4.4.1 Preparation of Written Specification: The specifier should incorporate the information derived in 4.1 through 4.3 in a written document that clearly defines what is required of the contractor, what is to be furnished by the owner, and how the work will be evaluated. It is also recommended that the specifier identify applicable regulations, codes, ordinances, etc., and the associated enforcement agencies. In addition, the document should include names of key contacts and provisions for resolving disputes.

4.4.2 Implementation of Containment and Monitoring: A high level of involvement by the owner either directly or through knowledgeable designates should be maintained throughout the course of the project, should it become necessary to modify the specific terms of the specification, such as the paint removal methods employed, the design and construction of the containment, or the methods for monitoring the emissions.

4.4.3 Project Documentation: It is vital that the facility owner be provided with accurate and complete records of all the documents and activities; including specifications, inspection and work reports, change orders, weather conditions, various mitigating factors, contractor suppliers, activities by regulatory agencies in monitoring or guiding the work, disposal records and test results and data derived from containment, ventilation, air, soil, and other monitoring. These records and data are invaluable in evaluating the quality of the work and in determining conformance with the specifications. In addition, they can be added to the database being developed by the protective coatings industry on the most cost-effective and efficient means of debris containment.

4.4.4 Disposal of Debris: Surface preparation debris (e.g., spent abrasives and containment materials that cannot be reused), must be disposed of in accordance with Federal and state regulations on solid and hazardous waste. For more information, see SSPC-Guide 7.

4.4.5 Cleaning of Reusable Equipment and Materials: Loose surface lead dust should be removed from equipment, containment materials, and other reusable items prior to transportation off-site.

5. DESCRIPTIONS OF METHODS AND SYSTEMS

5.1 METHODS OF COATING REMOVAL: The following is a list of methods that can be used successfully to remove coatings and to collect the debris. Mists, dusts, and debris created may or may not contain toxic metals. All waste discharges should be tested for hazardous waste characteristics. The list is not considered to be all-inclusive, as new and innovative methods are continually being developed.

5.1.1 Hand Tool Cleaning: Include chipping hammers, scrapers, wire brushes, and sandpaper.

5.1.2 Power Tool Cleaning: Power tools are of two general types:

5.2.1.1 Grinding Tools: Any rotary or reciprocating hand-held tool that uses bonded abrasives as the cutting media. Examples include but are not limited to reciprocating sanders, orbital sanders, or any grinding device, whether right angle or straight shaft, that utilizes abrasive cloths, discs, wheels, or flaps.

5.2.1.2 Impact tools: Any rotary or reciprocating hand-held tool that uses repetitious impact to create the specified surface cleanliness. Examples include but are not limited to rotary flap, cutter bundle, needle gun, wire bristle impact, and hammer flail assemblies.

5.1.3 Power Tool Cleaning with Localized Exhaust: Includes power tools that contain integral vacuum-equipped shrouding. A brush or rubber sleeve on the shrouding conforms to the surface to enhance the control of dust and debris collection.

5.1.4 Waterjetting Without Abrasive: Includes all types of pressurized waterjetting systems. The action of the water with or without cleaning solutions or rust inhibitors provides the cleaning. Pressures are as stated by the manufacturer of the equipment. Note that when removing hazardous paints, high pressures and certain cleaning solutions may cause the hazardous substances to be carried with the water. This water should be recycled or collected and disposed of properly. Waterjetting at pressures from 70 to 210 MPa (10,000 to 30,000 psi) is often called high-pressure waterjetting, and, at pressures over 210 MPa (30,000 psi), ultra high-pressure waterjetting.

5.1.5 Waterjetting With Abrasive: Includes pressurized waterjetting systems with abrasive injection. Variations may mix abrasive and water in a separate tank or at the nozzle, or inject abrasive into the water stream. Pressures required as stated by the manufacturer of the equipment. Note that when removing hazardous paints, high pressures and certain cleaning solutions or rust inhibitors may cause the hazardous substances to be carried with the water. This water should be recycled or collected and disposed of properly. Waterjetting at pressures from 70 to 210 MPa (10,000 to 30,000 psi) is often called high-pressure waterjetting, and, at pressures over 210 MPa (30,000 psi), ultra high-pressure waterjetting.

5.1.6 Wet Abrasive Blast Cleaning: Includes compressed air blasting systems that incorporate water into the blast stream. Variations may mix abrasive and water in a separate tank or at the nozzle, or apply the water to the abrasive as it exits the nozzle. Pressures are required as stated by the manufacturer of the equipment. Note that when removing hazardous paints

