In terms of environmental protection, at what percentage of lead in the paint must I be concerned with containment if abrasive blast cleaning is used as the method of surface preparation?

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The simple answer to the question “any level of lead.” There is a misconception amongst some people that containment is needed only when lead is present. This is not the case. Just take a look at the title of SSPC-Guide 6, which is “Guide for Containing Debris Generated During Paint Removal Operations.” Nowhere does the word "lead" appear in the title or even in the Scope.

When work began on development of the Guide in about 1987 or 1988, waste regulations had started to be enforced on painting projects in certain areas of the United States. The Resource Conservation and Recovery Act (RCRA), a law passed in 1976, required that waste be properly disposed of. RCRA regulates both hazardous and solid waste, and contains provisions for the landfills that can accept each classification of waste. Therefore, containment is necessary to collect the waste for proper disposal based on its classification. The early drafts of the Guide actually concentrated on full and partial containments for abrasive blasting, with attempts by the SSPC Task Group to come up with practical percentages of waste retention.

It wasn’t until about 1990 that the Task Group recognized that air quality also had to be considered. The Clean Air Act of 1970 (CAA) established criteria for six air pollutants. The goal of the CAA is to protect public health and welfare. Two of the six air pollutants are lead and PM-10 (Particulate Matter equal to or less than 10 microns in aerodynamic diameter). While the CAA requirements were not intended for point source emissions such as painting projects, the need still exists to protect public health and welfare. (Some states or local authorities do have regulations similar to the Clean Air Act requirements for projects such as painting. Always investigate state, area, county, and local regulations before starting a project.) Containment could be necessary regardless of the lead concentration because abrasive blasting generates dust that contains PM-10 size particles.

PM-10 size particles can be generated during abrasive blasting from breakdown of the paint and other materials on the surface being blasted, as well as breakdown of the abrasive particles, themselves. Guide 6 draft documents were then revamped in the 1990 time frame to include only full containments for abrasive blasting, with lower classes of containment loosening up on the sealing, the entryway, the need for negative pressure and regulated air flow, and even the need for air filtration (in Class 4A, only).

The important point to remember is that containment is required to collect the debris generated from the surface preparation activities and to control dust emissions that can impact public health and welfare.

The next obvious question is how does someone select the level of containment when abrasive blasting. I know of no information in the literature to assist in determining the level of containment for abrasive blasting based on the amount of lead in the paint film. Most guidance focuses on risk to the public, risk to the environment, and risk to adjacent workers based on the underlying premise that the paint system being removed contains a lead based primer. Usually, the choice is between Class 1A and 2A in this situation. There is no industry guidance on when a Class 3A or Class 4A containment will provide adequate environmental and public protection from lead or from PM-10 particles.

The main differences between Class 3A and Class 4A containment are:
- penetrability of the containment material (impervious or tightly woven for Class 3A vs. air penetrable (screen materials) for Class 4A);
- support structure (rigid or flexible for Class 3A vs. minimal for Class 4A); and
- exhaust dust filtration (air filtration for Class 3A vs. no controls on emissions for Class 4A).

Therefore, the cost for a Class 3A containment is significantly greater than a Class 4A containment. A Class 4A containment is essentially meant for projects where the aim is to collect the debris for disposal when there is no concern about the impact of the project on the environment and the public.
from lead or from the dust emissions. Class 3A would be appropriate for projects where lead levels are low, but the project still has an impact on the public and the environment.

One way of looking at determining the maximum amount of lead that can be present in the paint film to use a Class 3A or 4A containment is through the Lead in Construction Industry Standard (29 CFR 1926.62). This standard requires that engineering controls, i.e., ventilated containment for dry abrasive blasting, be implemented if a worker's exposure to lead is above the Permissible Exposure Limit (PEL). There has been one study that examined worker exposure as a function of lead concentration. Tinklenberg & Doezeama(1) determined that at the 95 percent confidence interval, the lead concentration in an inorganic zinc primer had to be below 280 parts per million to assure a worker's exposure was below the PEL when abrasive blasting is used. Recent re-calculation of these data shows that the lead level in the paint film has to be below 100 parts per million at 99 percent confidence interval. Therefore, a Class 1A or 2A containment would be needed if these levels were exceeded. These levels are based on the containment system design used in this test and the type of paint removed, and may not apply to all projects. As an industry, we need data from other projects using different containment/ventilation system designs. But the data do show that in certain situations it does not take a lot of lead in the paint film to require engineering controls to reduce lead exposure when abrasive blasting.

Current knowledge (or lack of knowledge!) precludes giving an exact concentration of lead in the paint film that separates the choice between a Class 1A or 2A containment versus a Class 3A or 4A containment. Each project has to be examined individually. But the important point to remember is that the days of open abrasive blasting are gone. We need containment for no other reason than to control the release of the debris into the environment, even if it contains essentially no lead.

Note

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In terms of federal regulations, there are no specific Environmental Protection Agency (EPA) rules that require containment at or above a given level of lead content. Unlike standards from the Occupational Safety and Health Administration (OSHA), EPA standards are written from a proscriptive point-of-view. This is, EPA regs tell you what you cannot do, not what you should do. For example, the Clean Air Act (CAA), Clean Water Act (CWA), and Storm Water Management standards prohibit the release of the lead into the air, water, or soil (where it may be carried into waterways or enter the ground water table).

Interpretations of the EPA's Resource Conservation and Recovery Act or RCRA (i.e., hazardous waste standards) have indicated that the uncontrolled release of lead from a paint removal project could be regulated as illegal disposal of hazardous waste. Historically, this has caused most owners and contractors with the potential for pollution liability to require some level of containment to prevent releases of lead into the air, water, or soil.

Perhaps more important than the lead content is the potential of the method of surface preparation to produce emissions. Nearly every state and many local municipalities (such as Allegheny County, PA) have established

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regulations regarding airborne emissions. These are typically referred to as "visible emissions," "fugitive emissions," or "fugitive particulate emissions standards." Standards about such emissions are typically used to regulate "non-specific" sources such as material piles, roadway operations such as paving, dirt roads, and, in many cases, abrasive blasting are included by reference.

Regulations on emissions typically prohibit the release of any fugitive particulate matter beyond the property line, the opacity (based on 40 CFR 60, Appendix A, Method 9) to some percentage (i.e., 20%), or both particulate matter and opacity. Method 9 or opacity observations are the most common tool used by environmental regulators to assess the severity of emissions.

When abrasive blast cleaning is referenced, the regulations typically require installation and use of hoods, scrubbers, fabric filters, or other dust cleaning devices where they are feasible to capture and contain fugitive particulate matter while handling dusty materials. Adequate containment methods are typically required during blast cleaning or other similar operations.

In summary, on the federal level, the prevailing EPA regulations prohibit the release of lead into the air, soil, and water. On a state and local level, regulations are focused on the release of any emissions beyond the property line or above a specified opacity. The combination of these requirements would dictate that containment should be provided during abrasive blast cleaning (or other surface preparation methods with the potential to generate emissions) on paint removal projects, whether or not lead is in the paint.

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As Mr. Bartlett also states, some passivating agents do indeed change the colour of the steel, giving the user the impression that something is happening. Tannic acid solution, for instance, will give a black colouration on rusty steel, but the colour change is merely a cosmetic effect offering no long-term protection. Moreover, tannic acid is water-soluble, so any un-reacted tannic will cause hydrophilic sites on the surface, which will lead to water ingress into the film formed on the steel and premature failure.

In fact, a converter that contains hydrophilic materials, such as some acids, cannot be fully effective because these will form sites for water penetration. It would be impossible to remove these soluble sites from some coatings without completely removing the paint, which tends to defeat the object.

Hydrophilic organic solvents will also give an opportunity for water ingress until they evaporate. This is a bigger problem in colder climates, where the solvent may take months to evaporate.

Performance of the rust converters depends also on the generic type of binder used. Binders with high water and oxygen permeability lead to poor performance.

As with any paint system, correct surface preparation is imperative. Of course, blast cleaning is still the preferred method of surface preparation. But when blast cleaning is not possible, because of cost or safety, then proper use of a good rust converter is an effective approach to preparing previously coated surfaces.

A successful high-performance water-borne rust converter can be developed by following the general formulation parameters below.

• Passivating agents selected should have a strong affinity to chelate with reactive iron corrosion products. The chelating component of a rust converter chemically changes reactive rust to a stable complex. (Red oxide, which could
be described as a stable form of iron oxide, has been used in primers for a number of years.)

- Passivating agents also must be insoluble or have very low solubility in water. The complexes formed should be stable and insoluble in water. Residual, un-reacted agent should not cause any side effects on over coating with either water-borne or solvent-borne coatings. As noted above, passivating agents such as phosphoric acid or tannic acid should be avoided. The complexes that these form are partially soluble in water. Any of these agents remaining will cause problems if over coating, particularly with water-borne paints and, because of their water-solubility, accelerate further corrosion. Tannic acid in particular can also give severe discolouration of water-borne topcoats.

- A hydrophobic coalescing solvent should be carefully selected so that it dries fairly rapidly but ensures that the converter has time to fully penetrate the rust. Formulators should avoid hydrophilic components at all cost. They are sure to provide sites for water penetration.

- A binder should be selected that will enhance the protection of the surface. I know of one proprietary binder with extremely low water and oxygen permeability that will protect the steel from further corrosion.

- Correct surface preparation is very important. Before the rust converter is applied, excess rust should be removed with a chipping hammer/wire brush to ensure full penetration through to the metal. If thick rust is not removed, then the rust converter coating could dry before fully penetrating, particularly on a hot day. In addition, the substrate should be washed with clean water to remove soluble salts, such as chlorides, prior to application of the converter.

- For optimum performance and cosmetic appearance, a rust converter, properly applied and dried, should be overcoated with a high-quality coating system to ensure long life of the substrate.

An effective rust converter can be produced if it adheres to the guidelines above.

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