Unique Containment Systems

by

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Because steel structures come in many shapes and sizes, a single type of containment does not fit every situation.

Abstract: The containment of debris during the abrasive blasting of steel structures has become a mandated portion of nearly all cleaning and painting projects. This presentation will discuss a number of unique containment systems, innovative techniques, and proven designs for containment screening for a wide variety of steel structures. Various degrees of containment--from 100% containment to lesser, more localized containment--will be featured. Emphasis will be placed on the role variables such as structure location, type, and age play in the design of a successful containment system.

Although this paper addresses containment during a water tank rehabilitation project, the ideas discussed here are applicable to many different types of steel structures.

Increased regulation and public awareness of environmental concerns has drastically affected the coatings industry. Whether painting a water tank or a bridge, an industrial structure or an oil rig--the owner, the contractor, the specifier, the supplier and everyone else who is even remotely involved in the project can and will be scrutinized and subject to many environmental codes and regulations.

Background

The use of containment to limit the discharge of spent cleaning debris during coating removal projects has become standard practice in the steel structures painting industry. Early, more primitive methods of containment often consisted of nothing more than canvas tarps thrown over fencing to help prevent coating overspray from damaging surrounding property. The limitations and folly of such containment "systems" is now obvious to not only the coatings industry, but also to the public. But--it was a start.

Today, the containment industry is undergoing rapid change and development. Special materials for use in shrouding have been developed. Mechanized means of raising, lowering, or moving containment shrouding have been improved. Now, the goal of containment design is not only to protect the public from harmful emissions and nuisance dust, but also to protect the workers who must access the contained area.

Designing Containment Systems

Although many of the containment systems used today have many similar features, each containment system is unique to the structure for which it is designed. When designing a containment system, the specifying engineer--whether a consultant or an employee of the tank owner--needs to know certain specific characteristics of the structure to be rehabilitated prior to deciding upon a method of containment.

One of the most important factors to evaluate prior to specifying a method of containment is the location of the tank. What other types of structures surround the tank site? A site surrounded by residences or a school will probably require more stringent containment criterion than an area with low-occupancy industrial buildings might. Parking lots, busy roads, bodies of water, schoolyards, and public areas such as shopping centers and parks are of great concern. The specifying engineer must also take into consideration how far away these public areas and buildings are, and even such factors as hours of business or times when the buildings will be occupied can play an important part in the preparation of a good containment specification.

The type of steel structure to be rehabilitated also needs to be evaluated. An elevated water storage tank presents a totally different set of requirements than a ground level water storage tank does, and an elevated-legged tank poses a different set of containment requirements than an elevated single pedestal tank does. The type of construction, for example riveted or

welded steel construction, can affect the method of containment. The age of the structure can have a direct bearing on the type of construction and therefore the containment specified. A tank constructed prior to the mid to late 40's is most likely of riveted field construction and will have special containment requirements that might not affect a newer tank of welded steel construction. For instance, on riveted tanks, welding of attachments near riveted seams could cause the tank to leak.

The mode of coating removal and surface preparation that will be specified for the rehabilitation project must be determined prior to deciding on a method of containment. Complete coating removal by abrasive blast cleaning will require a completely different method of containment than a spot cleaning operation using power tools with vacuum attachments. The debris and slurry generated during a water blasting operation must be contained and handled in a different fashion than would the abrasive and coating debris from a more traditional dry abrasive blasting operation.

Structural Evaluation

Prior to the attachment of any containment screening or shrouding, a structural evaluation must be performed to determine the loadings resulting from containment the structure can withstand. When utilizing a containment system, of utmost importance is a determination of the structure's ability to withstand the weight and wind loadings imposed on it by the containment system. An analysis of the structural stability of the structure must take into account the containment bracing, containment-to-structure attachment points, other coating removal accessories attached to the structure, the weight of the personnel, and the weight of the abrasive/residue supported by containment. It must be determined that under high-wind loadings, the containment connections would fail or structural members would fail prior to the structure overturning. It is recommended that the proposed containment system be designed and stamped by a registered professional engineer.

Current Regulations

No regulations exist that precisely define how much pollutant can be emitted into the atmosphere during a portable or temporary abrasive blast cleaning operation. Therefore, the coatings removal industry has adopted the Clean Air Act as a qualifier for critical locations. Bear in mind, however, that a multitude of factors such as atmospheric conditions, the environment surrounding the structure, and the location of the testing can affect atmospheric monitoring. The Clean Air Act and the National Primary and Secondary Ambient Air Quality Standards (NAAQS), which are a part of the Clean Air Act and define allowable levels of a number of substances including particulate matter and lead, addresses continuous long-term emission rather than short-term, localized emissions such as would be associated with abrasive blast cleaning. The Clean Air Act currently sets forth as its compliance level that not more than an average of 1.5 micro grams per cubic meter (æg/m3) of lead may exist in the atmosphere averaged over a 90-day period. The National Ambient Air Quality Standard further sets forth a compliance level that not more than 150 æg/m3 of particulate matter less than 10 microns (PM 10) in size (dust small enough to be inhaled into the deepest portion of the lungs) can be present in the atmosphere averaged during a twenty-four-hour period. Based on this criteria, dust emissions on projects where so called "lead-free" coatings are being removed--and even projects involving the field blasting of uncoated or shop primed steel for new structures--could be deemed to be polluting the atmosphere and fines imposed and/or the project shut down.

Worker safety on lead-paint removal projects is also an area of concern. OSHA has released its lead standard for worker safety entitled the "Interim Final Rule on Lead Exposure in Construction." The new rule was published in the May 4, 1993 Federal Register. The worker protection standards contained within the Rule became effective August 2, 1993, except those provisions for engineering controls which went into effect October 1, 1993. Prior to the Interim Final Rule, there was no OSHA standard for construction workers exposed to lead. However, for a number of years certain contractors and owners used as a reference OSHA Regulation for General Industry 1910.1025 which details precautions the contractor must take to protect worker health.

Common Safeguards

In addition to lead in the air, there is also concern for the amount of lead or other metals permissible in soil and water. Steps must be taken to protect the project site and neighboring property or waterways during lead-paint abatement projects.

Air monitoring may be required if local air quality regulators deem it necessary; if the renovation site is residential or near a school, hospital, playground, other area readily accessible to the public; if complaints over visible emissions or questions about the seriousness of emissions are raised; or in cases of litigation. In such cases, extensive background data is required to successfully determine the lead abatement project's impact

on air quality. However, more and more frequently, prudent owners and specifying engineers are establishing air monitoring programs as a safeguard, even when not required.

The sampling of the soil surrounding the job site prior to the initiation of rehabilitation activities and after the completion of the project offers the owner an additional method of assuring that the area surrounding the structure has not been contaminated by the Contractor's activities. Soil samples should be collected from predetermined locations and tested by atomic absorption analysis to determine the total lead content. The location from which these samples were taken should be documented, and additional samples from these same sites should be collected and tested following the substantial completion of the project. The EPA has issued a revised lead in soils guidance which has established 400 ppm was the level above which there is sufficient concern to warrant further study of the site. If the results of the total lead tests reveal that the lead levels in the soil have increased by more than allowable limits, then the contractor should be responsible for cleaning up the site and returning it to its original (or lower) lead levels.

Containment Specification

The containment specification should, at a minimum, address:

- the intent of containment (or what containment is supposed to mean)
- the specific distance that cleaning/blasting debris, overspray or coating droplets can travel from the base of the structure
- what other specific areas are to be protected (e.g., the ground surrounding the structure, electrical cabinets on the site near the base of the structure, a utility building directly under or adjacent to the structure, etc.)
- what generic types of tarps are desired (impervious vs. some percentage of opacity, flame resistant, reinforced, etc.)
- how the cost of the containment is to be included in the bidder's proposal.

Since every structure is different and every containment design is unique to a particular structure, the effects and limitations of the containment system on the structural capability of the structure can only be addressed by the containment contractor. The specifying engineer and the owner cannot accept the liability for the structural capability of a structure to withstand any loadings resulting from a containment system which the owner and specifying engineer have not designed. Additionally, the owner and specifying engineer do not want to be held liable for any field modifications made by the contractor. This situation is probably best handled by writing the specification to require the contractor to be solely responsible for any tarping material, additional bracing, and other apparatus used for the containment system, as well as the effects of the loadings that system places on the structure. The containment system should be designed by a registered professional engineer, and the plans signed and stamped. The owner or the owner's consultant should review the containment system submittals only to verify it complies with the intent of the specifications.

The Future of Containment Design

Today, many new application and removal techniques are being experimented with in the blasting and painting industry. Some of the new techniques utilize mini enclosures with negative air ventilation, dry-fall coatings, and recycled abrasive. While these are effective means of meeting OSHA's requirements for proper ventilation, these methods are expensive and cost prohibitive in most instances.

With the ever-changing rules and regulations, new methods for the removal of lead-based coatings are being researched and developed. In the future, such methods as chemical stripping, vacuum blasting, or power tool cleaning on elevated water storage tanks may become feasible, but appears that some means of containment will likely be required even when using what are now considered to be "non-traditional" methods of coating removal.

CONCLUSION

Twenty, maybe even fifteen, years ago, who would have predicted that containment screening would be required on nearly all steel structure cleaning and painting projects? Knowledge of the health risks involved in the removal of lead-based paints from elevated steel structures has caused a public outcry that has been answered by the development of containment systems that will protect them from these health risks. It is now up the steel structure painting industry to continue refining these methods to assure economically viable methods of protecting the environment and public health.