VACUUM BLASTING
THE NEW AGE OF SURFACE PREPARATION

by

Raymond F. Williams

Vacuum blasting as a viable alternative to open abrasive blasting is gaining increasing acceptance as more productive, less expensive equipment becomes available. While abrasive blasting has always been the method of choice for producing a clean dry etched surface for coating, every other aspect of abrasive blasting is offensive.

Vacuum blasting is a means of overcoming the undesirable side effects of open blasting. These include:

A. High speed abrasive ricocheting

B. Poor visibility

C. Offensive and dangerous dust clouds

D. Operator exposure

E. Pulverized substrate containment

F. Extensive clean-up

Various methods over the years were tried to eliminate one or more of these negative aspects. All involved containment of the situation to some degree. The containment area took various forms from large enclosures which encapsulated the entire project in temporary buildings, to smaller rooms which could be moved about a large surface, to hand held recovery chambers.

All containment chambers include provision for vacuum to create a negative pressure within the chamber and air make up. In this way, the atmosphere can be changed continuously within. From the large rooms where the operator can move about inside and open blast in normal fashion, we move down to chambers the size of a large box. From these one-man , movable boxes the operator could stand outside, look inside, and abrasive blast with his arm in a rubber gauntlet within the box.

The methods thus far have only been usable on large flat surfaces and have involved extensive set-up costs. They also have used regular open blast equipment and operators to achieve their production rates. Another method adaptable to large flat surfaces, principally horizontal, involves the walk-behind wheel type unit such as Blastrac. These units do not involve open blasting equipment. Instead steel shot is propelled against the surface by wheels and then recovered by vacuum. This type vacuum blast equipment is very efficient, fast, and cost effective. The principal limitation is that applications are restricted to large open flat surfaces.

The next type of vacuum blasting equipment limited the containment chamber to the point of the blast. Here a recovery head having a blast nozzle and vacuum hose was moved by the operator over the surface to be blasted. Usually the blast head had an inner and outer chamber. The inner chamber protected the blast pattern against the degrading effects of the vacuum. The vacuum hose is attached to an annulus chamber surrounding the blast

cone.

This type of equipment originally developed by Vacu Blast incorporated an assembly with a vacuum recovery unit and cyclonic separator mounted to a small blast pot. This type unit is available from various sources. A different approach of the hand held type is the Blast N' Vac, which attached the recovery chamber on the contractor's existing production equipment. In this way, production rates, abrasives, and equipment on-site are not significantly affected. A final unit is a hand held unit, where the complete system is held in the operator's hand. While this is very handy, the rates limit the use to very small applications.

WHERE TO USE VACUUM BLASTING

The areas where vacuum blasting can be a solution to the numerous problems encountered in abrasive blasting can generally be put into one of three classifications: a) confined areas, b) areas where dust or abrasives are offensive, and c) areas where substrates are considered a contaminant or pollutant.

Typical confined areas would be tank car interiors, including rail cars, tanker trailers, storage tanks, and process tanks in manufacturing plants. They would also include rooms inside buildings on offshore rigs, inside ships, inside processing equipment, and even inside the Statue of Liberty.

Any time you are blasting in a confined area, you have an immediate problem with visibility. This is usually solved by blasting until you lose visibility, and then waiting a minute or so for the dust to be pulled from the area or settle so

that you can see what areas have been blasted in order to resume the process. This creates a great deal of wasted man hours and results in at best a hit and miss blast job. Usually elaborate equipment must be brought to the job site to exhaust the dusty air to another area. The abrasive built up in the confined area must ultimately be physically removed. The slowness, the mess, the poor safety, additional equipment requirements, and the difficulty in obtaining a good quality blast all make for a very unsatisfactory situation from the point of view of the contractor, the inspector, and the customer.

With the vacuum blasting process the operator is allowed to blast continuously and he never loses visibility. Even though the operator is now required to hold the tool in contact with the surface, which is more labor intensive, and slows his rate of cleaning, he is able to eliminate the waiting time which greatly reduces the total labor involved. Additional labor to be considered is the tremendous reduction in clean-up. Instead of having to remove the tons of abrasive in buckets or by vacuum, the accumulation of the abrasive has already been recovered into containers during the process. Because the blast nozzle was always in the same proximity to the surface, a very uniform blast is obtained as the operator overlaps his strokes achieving the same degree of etch uniformly throughout the surface. Simultaneously, the operator is vacuuming the surface while his blasting is minimizing the danger of intercoat contamination or the formation of a barrier of dust between the surface and the primer.

The environment the operator is exposed to is safer in a number of respects. First, he is not exposed to the tremendous amount of dust which permeates even the best safety equipment. Second, because he has full visibility, he has greatly reduced the risk of falling down or blasting himself or another operator.

The add-on type systems, such as Blast N'Vac, utilize contractor's existing blasting equipment including his compressor, blast pot, blast hose, and venturi style nozzles. As a consequence, the contractor can use the air pressures and abrasives best suited to meeting the specifications and obtaining typical results from his regular blasting equipment. The Blast N' Vac equipment is involved only in the recovery aspect of the process and as a consequence, the production rates and results are similar to those which the contractor is used to.

An example of vacuum blasting in the confined area was the recent renovation project of the Statue of Liberty. As a part of the renovation, the structural steel which was coated with roughly five coats of material, including red lead primers, chlorinated rubbers, and coal tar, had to be removed from the complicated maze of structural steel which supports the copper. Adding further complexity to this project was the large rivet construction of the malleable iron from 100 years ago. The considerations were: The confined area with poor ventilation capabilities was going to pose serious safety hazards for the operator and other trades working in the Statue; poor visibility would greatly

slow the production process; any over blast or abrasive over spray would damage the sensitive copper skin; pulverized red lead being removed would endanger both operators and the environment; and the tremendous clean-up requirement and rain of abrasive down over other areas would halt other types of work for months. In this situation, vacuum blasting solved all of the problems at once. The vacuum blasting process not only contained all the dust and abrasive, allowing for normal visibility, but also contained the red lead and protected the copper skin from any damage.

Another example of use in a confined area is the blasting of Union Carbide tanker trailers by Tank Services. The method normally utilized was to pull a vacuum on the tanker trailers with Super Sucker trucks at $70 per hour for 12 hours while the surface inside was blasted to SSPC-SP5 white metal. Because of the need for absolute cleanliness in the cryogenic gas hauling tankers, which would remain unlined, the surface needed not only to be blasted to white metal but needed also to be dust-free. By utilizing the vacuum blasting process the blasting time was reduced to six hours and the need for clean-up and the Super Sucker truck was eliminated. The surface was vacuumed while it was blasted and any fall out was easily cleaned up by the operator with the vacuum he already had in his hands.

The second major area for use of vacuum blasting equipment is where dust and abrasive are offensive. Examples are residential areas, swimming pools, public areas, highway bridges,

bridges over waterways, offshore rigs, ships, power plants, paper plants, and manufacturing facilities.

Dust and abrasive can be offensive in a number of differnt ways. In some areas the presence of the abrasive endangers sensitive equipment such as electronic equipment, moving parts, and engines.

In other areas the abrasive and dust are offensive to passers-by, vehicles, and traffic in the area. Many jobs are simply never done because owners cannot afford the risk of uncontrolled abrasive and dust flying around. Inside manufacturing plants the on-going process workmen and batches of material cannot tolerate exposure to abrasive and dust. We have all experienced driving past an area where abrasive blasting was going on resulting in our cars being sprayed with dust and abrasive.

By using the vacuum blasting process, the operator not only eliminates the dust but also recovers the abrasive for recycle, cleaning, and/or disposal. The abrasive can be recovered into drums or other containers condusive to dumping, or proper disposal under EPA guidelines.

The elimination of the dust and abrasive also greatly improves the operator's safety. As the operator is no longer being sprayed with the abrasive and has the blast under his control, the risk of accidential injury is greatly reduced. In addition the exposure to silicosis or other respiratory problems caused by inhaling dust and pulverized paint is eliminated.

One of the greatest benefits of recovering the dust and abrasive is the corresponding reduction in the amount of clean-

up at the end of the job. Since the abrasive and dust has been recovered during the blasting process, the clean-up is generally reduced by about 95 percent. In most areas and in most jobs, the clean-up after abrasive blasting is a major portion of the expense of doing business.

The third major area where vacuum blasting is used is where the substrate being blasted off is considered a contaminant or pollutant. The most typical situation which comes to mind is the removal of red lead from bridges. Other applications include blasting toxic coatings from ship hulls, removing contaminated linings from tanks or process equipment, blasting off built up residue in industrial process equipment, and blasting off contaminated coatings within nuclear power plants.

Not only does the vacuum blasting process protect the operator and those in the area from exposure to the pollutant material being removed, but also automatically recovers this material into disposal containers. In this way, the operator's safety is provided for, proper disposal of the material is provided for, and the liability exposure of the contractor is greatly reduced. It is not uncommon today to see class action suits brought against contractors by neighborhoods or towns for exposure to red lead and silica. By making this provision in this way to fully contain the dust and abrasive and other materials removed, the contractor not only protects the environment and his workmen but also himself.