A Case Study:
Ultrahigh Pressure Water Stripping versus Soda Abrasive Blasting for Paint Removal on Military Ground Vehicles

Introduction

The Combined Support Maintenance Shop (CSMS) at Camp Dodge in Johnston, Iowa previously conducted paint stripping of tactical vehicles and other equipment using abrasive blasting with sodium bicarbonate (baking soda) as the medium. This system consisted of two 250-pound medium storage/feed hoppers, a 520 CFM (ft^3 per minute) air compressor and a recirculating air filtration system within the 1500 ft^2 enclosed blasting area.

During September 2003, the facility's soda blast system was replaced with a Lancorp ASI, Model 4075E Closed Loop Advanced Water Jet System (CLAWS). This system consists of a low volume/high pressure water pump capable of producing 40,000 psi of water pressure at a 3-gallon per minute flow rate. Pressurized water is applied to the substrate to be stripped using a hand-held lance fitted with a rotary nozzle. The resulting water is collected in a sump and pumped into the water reclamation portion of the system which consists of oil, solids and organics removal, disinfection (ozone) and deionization. Reclaimed water is directly reused for subsequent paint stripping. The recovered paint residual, oil and dirt are collected for off-site disposal as either hazardous or nonhazardous waste as determined through EPA-prescribed laboratory analysis.

Environmental Implications

Solid/Hazardous Waste

The CSMS reported the generation of between 100 and 150 pounds of waste media using the soda blast system to prepare a standard M-977 Heavy Expanded Mobility Tactical Truck (HEMTT) for painting. Solid/hazardous waste generated for similar vehicles using CLAWS is essentially zero since the blasting media (i.e., water) is reused and the only disposable material consists of the relatively small amount of paint solids removed from the treated substrate. Operation of the soda blast system generated more than 5,000 pounds of waste media during a period of time when 70 pieces of equipment where stripped. Essentially no solid/hazardous waste was generated from use of CLAWS for stripping 70 pieces of similar equipment during a subsequent deployment mission.

Wastewater

While the soda blast system is a dry operation, extensive washing of the equipment being soda blasted is necessary to remove media from the surfaces of the equipment, and in particular recessed areas of the equipment. Actual water usage rates are not available, but CSMS reported as many as 3 to 5 complete washings were necessary to remove the necessary residual soda blast medium to allow application of an acceptable finish. All wash water was discharged to the facility sanitary sewer system.

No wastewater is generated using CLAWS because of 100% collection, reclamation and reuse.

Stripping Rate

Again using the HEMTT for comparison, CSMS testing showed a maximum soda blast stripping rate of 74 ft^2 per hour, while the maximum rate obtained using CLAWS was reported at 184 ft^2 per hour. It was also reported that stripping time required for a HEMTT was reduced from a range of 8 to 20 hours using soda blast to a comparative range of 5 to 8 hours using CLAWS.

Cost/Benefit

A comparison of soda blast and CLAWS paint stripping methods was conducted in 1996 using the Pollution Prevention Financial Analysis and Cost Evaluation System (P2/FINANCE) Version 3.0. Given available baseline and predictive information, an inflation rate of 3.5percent and a discount rate of 12.0 percent, P2/FINANCE calculated a Discounted Payback of 2.36 years.

Conclusions

Tangible benefits have been clearly demonstrated for CLAWS in use at the Camp Dodge Combined Support Maintenance Shop in terms of reduced solid/hazardous waste generation, wastewater generation and labor time necessary to perform equipment paint stripping as compared to that experienced using a conventional soda blast system. Benefits associated with reduced air emission, worker exposure and regulatory requirements, while not quantified, would likely favor CLAWS versus soda blast as well. Payback calculations also appear to support CLAWS as a preferred paint removal technology for this type of application.

This case study was prepared by Spray Technique Analysis and Research for Defense (STAR4D®) staff in conjunction with the Camp Dodge National Guard base in Johnston, Iowa. STAR4D® operates as part of the Iowa Waste Reduction Center at the University of Northern Iowa, Cedar Falls, Iowa and was established to improve the technique of spray technicians at military bases throughout the country. The primary goal of the STAR4D® program is to identify issues concerning military paint refinishing operations and train spray technicians to utilize strategies and techniques that will enable them to use less material, generate less waste, and improve finish quality.

For more information, contact the Iowa Waste Reduction Center at www.iwrc.org or STAR4D® www.star4d.org.