

Evaluating Spray Painting of Submarine Ballast Tanks

New Pollution Prevention Equipment Meets Operational and Maintenance Requirements

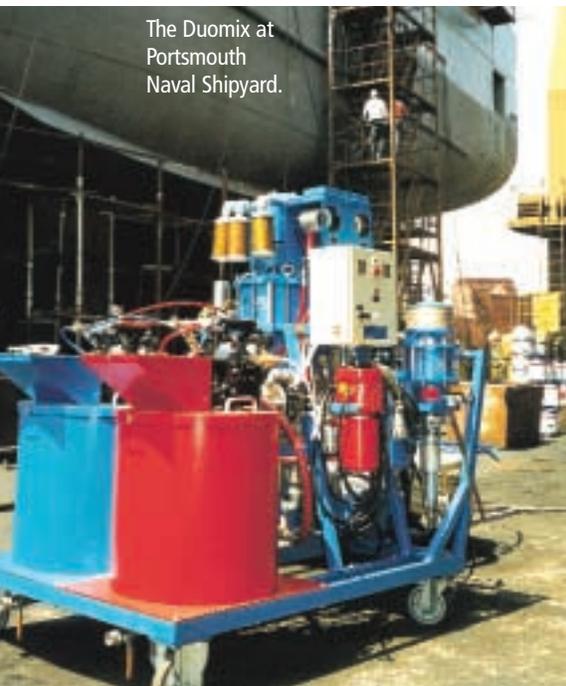
The Chief of Naval Operations established the Pollution Prevention Equipment Program (PPEP) with the overall goal of reducing hazardous material usage and hazardous waste genera-

tion. Pollution prevention (P2) equipment with favorable environmental and cost effective benefits is approved for inclusion into the P2 Equipment Handbook and for widespread implementation. However in the early years of the program, unique characteristics of submarines had not been considered in the evaluations of the P2 equipment. Atmospheric controls, confined and limited space, hull shape, and submarine safety (SUBSAFE) requirements are some of the characteristics unique to submarines that need to be considered for implementing P2 equipment in submarine operation and maintenance functions. The Submarine Maintenance, Engineering, Planning, and Procurement Activity (SUBMEPP) managed a study in the spring of 1999 to evaluate selected P2 equipment for meeting the needs of the submarine community. Naval Sea Systems Command (NAVSEA) 92T and Portsmouth Naval Shipyard (PNS) agreed to provide assistance in demonstrating and evaluating P2 equipment for the unique requirements of submarine operation and maintenance functions.

One of the first functions to be evaluated was spray painting of the main ballast tanks (MBT) of 688-Class submarines. The objective of this demonstration and evaluation for this process is to quantify the technical, environmental, and economic benefits of using a plural component paint sprayer (PCP sprayer) for painting submarine MBTs. Two PCP sprayers were demonstrated at PNS on the submarine USS San Juan (SSN 751) over the time period from October 1999 to December 2000. The evaluation approach was to gather and compare data for the existing paint spraying process and the two new PCP sprayers. Evaluation criteria included quantity of paint and solvent usage, material, waste, maintenance and labor costs, in addition to quality and thickness of the applied paint.

Painting the MBTs of a 688-Class submarine during an overhaul requires application of three two-component epoxy coatings (primer, stripe, and topcoat). Each epoxy coating type is made up of two components or parts—part A is the base (resin) and part B is the hardener. Once the two parts have been mixed, the pot life of the paint is approximately 15-20 minutes.

The existing application process requires the two-part epoxy coating be pre-mixed manually and then applied with a spray rig consisting of a paint material



The Duomix at Portsmouth Naval Shipyard.

supply bucket, supply hoses, a pump, spray hoses and spray guns. One spray rig pump can supply two sets of spray hoses and guns. The typical spray rig operation requires four people to mix the paint and keep a constant supply to the spray rig pump, one person to operate the pump, and for each spray line one person to spray the paint and two people to assist the painter with maneuvering the hoses, priming the system, and collecting the cleaning solvent for a total of ten people per rig. When the spraying is complete or if a gun or hose becomes clogged, the paint in the system (pump, hoses and guns) is flushed out with solvent such as methyl amyl ketone or thinner and collected for proper disposal. The paint must be completely purged from the system or the paint will harden and render the system unusable.

PCP spraying systems pump both components in a pre-selected mix ratio at a continuous rate through separate hoses to a mixing block where the two parts are combined into a homogenous mixture before being supplied to the spray gun. The advantages of PCP sprayers are elimination of mixed paint passing through the pumps, reduction of mixing errors by accurate mixing control, reduction of mixed paint waste and solvent waste, and reduction of personnel exposure to paint/solvent vapors. PCP sprayers consist of paint material supply drums or pails, proportioning pumps for each component, supply hoses, mixing block, spray hoses, and spray guns as well as a solvent flush system (pump and hoses) for cleaning of the mixing block, spray hoses, and spray guns. PCP spraying equipment from two manufacturers were demonstrated and evaluated, the Graco Supercat and the WIWA Duomix Series 333. Both manufacturers provided free training on the operation and maintenance of their equipment to the PNS painters. The typical PCP sprayer operation requires two people to maintain a constant supply of each component, one person to operate the pumps, and one person to spray the paint and two people to assist the painter with maneuvering the hoses for a total of six people per unit.

Paint quality and thickness were not adversely affected by use of the PCP sprayers. Labor required by the PCP sprayers decreased by about 40 percent due mainly to the reduction of personnel to mix paint. Paint usage for the PCP sprayers (1390 gallons) remained about the same as for the standard spray rig (1413 gallons). Solvent use increased by 368 percent because only two PCP sprayers were used and a complete flushing and clean out of the system was required each time a paint type was changed. Hazardous waste decreased overall by 12 percent. Paint waste decreased by 87 percent due to eliminating the premixing. Solvent waste increased by 86 percent, again because only two PCP sprayers were used. An economic analysis showed the PCP sprayer could save at least \$47,000 each year in operating



The Duomix.

costs compared to the cost to operate the standard spray rig. These annual cost savings provide a capital cost pay back period for two PCP sprayers of about 3.5 years.

PNS found that the amount of solvent waste increased because only two units were tested. PNS recommended that using additional units for each job could significantly reduce the solvent waste. PNS also determined that the portability of the units enhanced the painting process.

SUBMEPP plans to institutionalize the use of plural component painting throughout Navy submarine maintenance activities. ⚓

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