

NESDI Project Studies Pier Cleaning to Reduce Toxicity in Stormwater

Technique Combines Power Vacuuming & High-Pressure Washing

A RECENTLY-COMPLETED effort by Chuck Katz and Brandon Swope of the Space and Naval Warfare Systems Command (SPAWAR), Systems Center Pacific and sponsored by the Navy Environmental Sustainability Development to Integration (NESDI) program, studied the effectiveness of power vacuuming and high-pressure washing to reduce toxicity levels in stormwater.

Navy facilities have new challenges to comply with stricter limits on copper, zinc, and toxicity in stormwater

runoff. Although solutions for long-term compliance will require considerable time and/or expense, this NESDI project demonstrated that a low-tech pier surface cleaning procedure was effective at reducing metals in runoff.

The Compliance Issue

The Navy's National Pollutant Discharge Elimination System (NPDES) permits have benchmarks or numeric concentration limits for metals such as copper and zinc. These

limits are designed to ensure that water quality standards are met within the water bodies that receive the discharge. Over the past 10 years, these requirements have become more stringent across the country. Many Navy facilities are struggling to comply with these limits for a variety of reasons. These include the presence of condensed industrial operations, site materials containing metals, a high percentage of impervious surfaces, a considerable amount of



High-pressure washing technology at work.

This project demonstrated and validated one such BMP— a high-pressure wash-down and vacuuming regimen.

vehicular traffic, and the fact that these facilities have very short conveyance distances to reach receiving waters. These site conditions can and do lead to relatively high stormwater copper and zinc levels and associated failed acute toxicity testing (a measure of overall water toxicity).

While other efforts are studying long-term solutions to this complex problem, this NESDI project validated the effectiveness of a high-pressure wash down/vacuum system in meeting short-term compliance requirements.

Best Management Practices

There are a number of Best Management Practices (BMP) being utilized at Navy facilities that may be effective at reducing copper and zinc to levels to meet permit requirements. However, very few of these options have been tested and validated at Navy sites to determine if they meet site-specific requirements, long-term sustainability, and cost limitations.

This project team demonstrated and validated one such BMP—a high-pressure wash-down and vacuuming

regimen. This is a combination of routine power vacuuming and sweeping, and a high-pressure wash-down followed by a vacuum recovery system to remove contaminants from work areas before a rain event washes them into the water body. Various power vacuuming options using commercially available street sweepers have been utilized in the past; however no technique combining vacuuming with power washing has previously been studied.

Using commercially available equipment, the SPAWAR project team demonstrated the procedure on half of three piers at Naval Base San Diego between 2011 and 2013. The team measured the amounts of copper and zinc collected and composited from multiple random areas on the half of each pier where the cleaning was applied and compared them to the amounts collected on the other half of the pier where the BMP had not been applied. Particles were collected weekly or bi-weekly with a backpack style high-efficiency vacuum cleaner and evaluated for total particulate mass and copper and zinc concentration.

Stormwater samples were collected on both halves of the three piers to determine whether the surface cleaning was effective in reducing contaminant concentrations and toxicity below compliance requirements.

The Results

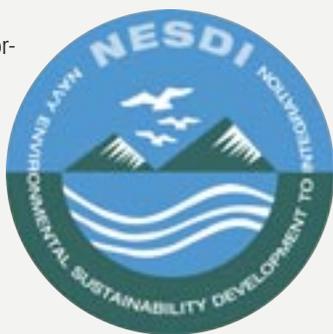
A post-demonstration analysis determined that the BMP procedure decreased the overall loading of parti-

The Basics About the NESDI Program

THE NESDI PROGRAM seeks to provide solutions by demonstrating, validating and integrating innovative technologies, processes, materials, and filling knowledge gaps to minimize operational environmental risks, constraints and costs while ensuring Fleet readiness. The program accomplishes this mission through the evaluation of cost-effective technologies, processes, materials and knowledge that enhance environmental readiness of naval shore activities and ensure they can be integrated into weapons system acquisition programs.

The NESDI program is the Navy's environmental shoreside (6.4) Research, Development, Test and Evaluation program. The program is sponsored by the Chief of Naval Operations Energy and Environmental Readiness Division and managed by the Naval Facilities Engineering Command out of the Naval Facilities Engineering and Expeditionary Warfare Center in Port Hueneme, California. The program is the Navy's complement to the Department of Defense's Environmental Security Technology Certification Program which conducts demonstration and validation of technologies important to the tri-Services, U.S. Environmental Protection Agency and Department of Energy.

For more information, visit the NESDI program web site at www.nesdi.navy.mil or contact Ken Kaempffe, the NESDI Program Manager at 805-982-4893, DSN: 551-4893 or ken.kaempffe@navy.mil.





High-pressure washing and vacuuming were conducted on one-half of the pier over a 2-year period.

The BMP procedure decreased the overall loading of particles, as well as copper and zinc levels on all three piers.

cles, as well as copper and zinc levels on all three piers under varying operational tempos. Total particulate mass was reduced between 32 and 72 percent compared to the non-BMP areas. Similarly, copper and zinc concentrations on the piers showed a reduction with the BMP implementation of between 60 and 84 percent compared to the untreated side. Copper and zinc concentrations in stormwater runoff samples collected from the BMP-treated side of the pier showed an average reduction of approximately 40 percent versus the non-BMP side.

Although a significant reduction was observed in particle, copper, and zinc loads on the piers, the reduction was not enough to consistently meet the current copper and zinc benchmarks in Naval Base San Diego's NPDES permits, nor the acute toxicity requirement.

However, the technology may be considered in conjunction with other strategies to reduce copper and zinc loading in stormwater runoff. Each facility needs to weigh the benefits for implementing this surface cleaning control practice against its cost and likelihood for gaining regulatory relief.

A technical report has been produced describing the results, costs, implementation strategies, and lessons learned for this project. It has been distributed to 29 potential end users, and is available at www.nesdi.navy.mil, or by contacting the Principal Investigator at the information provided below. [📎](#)

Chuck Katz
Space and Naval Warfare Systems Command,
Systems Center Pacific
619-553-5332
DSN: 553-5332
chuck.katz@navy.mil