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Pollution Prevention at Shipyards

Pacific Northwest
Pollution Prevention Resource Center

September 1997

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Printed in the United States of America
Price: $15 U.S. dollars

The Pacific Northwest Pollution Prevention Resource Center (PPRC) is a public non-profit organization that promotes implementation of pollution prevention in the Pacific Northwest, and through its work in Alaska, Idaho, Oregon, Washington and British Columbia, contributes to our national understanding of pollution prevention. PPRC catalyzes research on pollution prevention, hosts forums, acts as an information clearinghouse, and serves as a link between public and private organizations.

PPRC
1326 5th Ave., Suite 650, Seattle, WA 98101
Telephone: 206-223-1151
Fax: 206-223-1165
E-mail: office@pprc.org
Web site: http://www.pprc.org/pprc

The PPRC wishes to extend its gratitude to the supporters who make PPRC's work possible:

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Acknowledgements

PPRC is grateful to the many individuals and organizations that provided assistance with this report and the Northwest Industry Roundtable on which it is based.

Special thanks go to Jerry McMahon of American Waterways Operators for providing project guidance and facilitating industry attendance; and to roundtable presenters: Barry Kellems and Rick Moore of Hart Crowser; Rob Reuter and Lisa Zinner of the Washington Department of Ecology; Al Rainsberger of Todd Pacific Shipyards Corporation; Bob Cipra of the Puget Sound Naval Shipyard; and Mike Shepherd of the Trident Refit Facility. Special thanks also go to the vendors that provided information displays and supported the roundtable: Filtration/Treatment Systems Ltd.; Flow International; Maritime Consulting, International; and Stormwater Management.

This report was peer-reviewed by Jerry McMahon, Rob Reuter, Lisa Zinner, Pam Elardo of the Department of Ecology, Al Rainsberger, Barry Kellems, Rick Moore, and David Leviten, formerly with the PPRC staff.

PPRC staff who helped in the organization of the roundtable and in the preparation of this report were David Leviten, Chris Montovino, Jim DiPeso, Chris Wiley, and Madeline Sten.

Above all, PPRC wishes to thank the roundtable attendees (listed in Appendix A) for their willingness to share information, ideas and recommendations that form the basis of this report.

The opinions, findings, conclusions or recommendations expressed in this report are those of roundtable attendees, and do not necessarily reflect the views of PPRC or its supporters.

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Pollution Prevention at Shipyards

A Northwest Industry Roundtable Report

Introduction

The Pacific Northwest Pollution Prevention Resource Center (PPRC) held a roundtable discussion on May 13, 1997 in Seattle, Washington, on pollution prevention issues facing the ship manufacturing and maintenance industry in the Pacific Northwest of the United States. Approximately 40 people representing military and commercial shipyards, ports, government agencies, consultants, vendors, and PPRC attended.

In organizing this roundtable, PPRC was assisted and guided by American Waterways Operators, a national trade association for inland and coastal tugboat and barge industries, and for "second-tier" shipyards, those of small and medium size.

Reasons for the Roundtable

The roundtable was held at this time for the following reasons:

- Ship manufacturing and maintenance is a major industry in the Pacific Northwest, supporting commercial shipping in the Puget Sound region; Portland, Ore.; Vancouver, BC; Anchorage and other Alaskan ports; commercial fishing vessels; and Department of Defense surface ships and submarines.

- The industry relies on processes, including painting and paint removal through abrasive dry grit blasting, that generate considerable releases to air and water, and generate solid and hazardous wastes. Among the pollutants of concern are heavy metals such as copper found in anti-fouling paints.

- The industry is working to comply with stormwater discharge regulations and with Clean Air Act requirements. The industry has been under close scrutiny, and several citizen lawsuits have been filed to compel compliance with regulations.

- Alternative paint removal methods and stormwater treatment technologies are being investigated by some of the region's shipyards, providing an opportunity for information sharing among industry peers on alternatives that reduce or eliminate releases.

The purpose of the roundtable was for participants to learn more about alternative pollution

prevention and treatment technologies, become familiar with tools to analyze alternatives, find out how to work productively with government agencies in complying with stormwater regulatory requirements, share experiences and ideas with industry peers, and generate ideas for future projects that will benefit the environment and the industry.

Washington Shipyard Industry

Background

Shipbuilding and ship repair are significant components of Washington's economy. Shipyards are located in many of the state's waterfront areas, from Bellingham to Vancouver, but the greatest activity takes place in Seattle, Tacoma, Bremerton, Everett and Bellingham. The ports of Seattle and Tacoma are the fifth and sixth largest container ports in the U.S. and the 20th and 25th largest in the world, respectively.

The commercial shipbuilding industry in Washington state consists of eight major shipyards and more than 20 smaller yards, and employs nearly 3,000 workers. The commercial industry works in niche markets building and repairing mid-sized vessels of more than 65 feet in length, including ferries, research and patrol boats, small to mid-size container ships, tugboats, fishing boats and luxury yachts.

Military facilities include the Puget Sound Naval Shipyard in Bremerton, which is the second largest industrial employer in the state and is capable of repairing and overhauling naval vessels of all sizes. Another large-scale military facility is the Trident Refit Facility, which repairs and maintains submarines.

Repair and maintenance activities commonly carried out at shipyards include hull cleaning, repair and painting; electrical and machine work; carpentry; steel fabrication; pipe-fitting; and sand blasting of parts. While smaller vessels can be worked on beneath shop roofs, larger vessels must be worked on outdoors in dry docks or hoisted out of the water on marine railways. In both cases, hulls are typically cleaned and stripped with high and low pressure water guns and/or dry, abrasive grit blasting. Painting of ship hulls is done mainly with spray guns.

Environmental Issues

Pollution Issues. Paint stripping and painting activities are significant sources of pollution from shipyards, and their waterfront locations increase the potential for pollutants to reach bodies of water. Many of the coatings used on hulls contain "anti-fouling" heavy metals, such as copper and zinc. The metals are toxins added to marine coatings to prevent marine organisms from building up on ship hulls, which reduces speed and fuel efficiency. When a ship's hull is prepared for painting, the first stage typically is pressure washing to remove any marine growth on the hull and/or to remove old paint. This washwater characteristically contains high levels of heavy metals from the removed paints.

Blasting with dry, abrasive grit typically is the second stage in the hull preparation process, which provides the final finished surface for painting. As a result of the anti-foulants removed during the blasting process, most of the spent grit, like the washwater generated in the first step, contains high concentrations of heavy metals. Contaminants can reach nearby waterways via stormwater drainage and air deposition, or when a marine railway is flooded.

Painting can result in solvents contaminating nearby waterways. Solvent-based paints also are sources of volatile organic compounds (VOCs), an ingredient in the formation of low-level ozone, and are sources of regulated hazardous air pollutants.

Regulatory Issues. Under the Clean Water Act, National Pollutant Discharge Elimination System (NPDES) permits issued to shipyards by the Washington Department of Ecology contain effluent limitations that restrict the volume and concentration of heavy metals and other pollutants that are discharged.

Conditions and requirements imposed by permits vary among shipyards, but in the last decade, NPDES permits have begun to place a stronger emphasis on the control of heavy metal discharges, sediments contamination, and the treatment of pressure washwater and stormwater. Recent permits require studies to develop site-specific programs of Best Management Practices (BMPs) and treatment systems to minimize discharge of heavy metals and other contaminants into waterways via stormwater. These studies are known as All Known, Available and Reasonable Methods of Prevention and Treatment Technology (AKART). After the BMP and treatment programs recommended through the AKART process are in operation for a period of time, site-specific discharge limits will be set.

Shipyard compliance with permit requirements has been a source of controversy. The Department of Ecology has fined a number of shipyards for permit violations. Shipyards also have paid penalties as a result of citizen lawsuits.

Summary of Pollution Prevention Opportunities

Pollution prevention measures can be implemented to minimize release of heavy metals and other contaminants during paint stripping, painting and other shipyard activities. Opportunities are described below:

- ***Best Management Practices.*** BMPs are a series of maintenance, housekeeping and materials management practices that minimize wastes from activities such as paint stripping and surface preparation, painting, dry dock maintenance, engine maintenance and materials handling. *(For a list of shipyard BMPs, refer to* ***Appendix C.****)*

- ***Sandblasting Alternatives.*** Alternatives to dry, abrasive grit blasting for removing marine coatings from ship hulls include high-pressure water blasting and blasting with wetted grit that is chemically treated to bind heavy metals and isolate them from aquatic life.

- ***Coating Alternatives.*** Alternative anti-fouling coatings are available which rely on surface

properties rather than toxicity to discourage buildup of marine organisms on hulls. Among the alternatives are slippery coatings based on Teflon and silicone. The Navy is studying a polymer coating with a chemistry that prevents formation of the strong adhesive bonds marine organisms use to attach themselves to hulls. Reducing emissions of volatile organic compounds and hazardous air pollutants can be achieved with coatings with reduced or no solvent content. Among the alternatives are water-borne coatings, high-solids paints and powder coatings.

- ***Training.*** More efficient painting techniques, properly maintained and cleaned spray guns, and high-efficiency application equipment also add to a shipyard's efforts for preventing pollution. These practices allow workers to apply coatings with less paint waste and consequent reductions in hazardous waste generation and air emissions.

- ***Total Cost Assessment.*** A more complete picture of the costs and benefits of pollution prevention strategies can be obtained through total cost assessment (TCA), an economic analysis tool which helps facilities make better informed investment choices.

Roundtable Agenda

- ***AKART.*** Roundtable attendees were briefed on the AKART process. The briefing included a summary of a joint AKART analysis in which 11 Puget Sound shipyards participated cooperatively. The briefing was provided by HartCrowser, an environmental consulting firm headquartered in Seattle, Wash., which conducted the joint AKART analysis.
- ***Total Cost Assessment.*** A briefing was provided on Total Cost Assessment by the Department of Ecology and PPRC.
- ***Alternatives to Abrasive Dry Grit Blasting.*** Shipyards that have used alternative paint removal methods gave presentations and responded to questions.
- ***BMPs, Barriers and Wrap-up.*** The roundtable concluded with a general discussion of BMPs, including opportunities for and barriers to implementing BMPs.

Four vendors had information displays outside the meeting room. Two of the vendors that supply products tested in the AKART analysis referred to above made presentations on their products.

AKART Study

Background

Pollutants of concern released in shipyard operations include total suspended solids and turbidity, total petroleum hydrocarbons, heavy metals, chlorinated compounds found in solvents, and acids and bases.

Of particular concern are pollutants that enter shipyards' stormwater and subsequently are

released to waterways. There are two approaches to complying with water quality regulations involving stormwater:

1) Source control and Best Management Practices;
2) Engineered treatment and controls.

The first line of defense for keeping pollutants out of receiving waters is source control and BMPs—minimizing waste, limiting or eliminating the use of toxic materials, and using alternatives to abrasive grit for paint removal. The more pollution is prevented through source control and BMPs, the less need there is for engineered treatment.

In the Department of Ecology's view, source controls and BMPs are not 100 percent effective in preventing release of significant quantities of pollutants via stormwater. To address the stormwater discharge problem, the department has required a number of Puget Sound-area shipyards to prepare site-specific All Known, Available and Reasonable Methods of Prevention and Treatment Technologies (AKART) reports. AKART is an engineering and economic decision-making process for identifying current, effective and economical pollution prevention and treatment technologies for protecting water quality.

In reports produced through the AKART process, shipyards are required to characterize their stormwater runoff, evaluate pollution prevention methods, review technologies for treating polluted stormwater, and make source reduction and treatment recommendations. Reports produced through the AKART process will be used to set site-specific source reduction and treatment plans for each shipyard. Once treatment methods are selected through the AKART process, shipyards will be required to prepare engineering design reports that describe the recommended treatment process, expected results and systematic maintenance. After construction, startup and a period of operation, "technology-based" discharge limits will be set based on experience with the installed treatment system. *(For a summary of regulations affecting the shipyard industry, refer to* ***Appendix B****.)*

The Department of Ecology suggested that Puget Sound-area shipyards cooperate to produce a shipyard AKART analysis. Accordingly, 11 shipyards jointly sponsored an AKART analysis to confirm whether filtration is the best known and available treatment technology for shipyard stormwater, and to evaluate costs, effectiveness and technical feasibility of three types of enhanced filtration media. The Department of Ecology's expectation of the final joint AKART analysis is a document that participating shipyards can use while preparing site-specific AKART reports.

The analysis examined treatment requirements for a "typical" shipyard with five acres of impervious surfaces, experiencing a six-month, 24-hour storm (1.35 inches) in the central Puget Sound area. (A six-month storm is a storm of an intensity statistically likely to occur every six months.)

Media Testing

Two test series were conducted on each of the three enhanced filtration media—a short-term test using two actual shipyard stormwater samples; and a long-term test using simulated stormwater samples over 10 time intervals. Media tested were:

- A proprietary peat-based medium produced by Aero-Terra-Aqua (ATA) Technologies of Cleveland, Ohio;
- CSF Humic Filter Media, a leaf-based compost product manufactured by Stormwater Management of Portland, Ore., and,
- MultiSorb 100, a peat-based compost product manufactured by Peat Technologies Corp. of Cook, Minn.

(For contact information on these companies, refer to ***Appendix A.****)*

The study's preliminary conclusions indicated that enhanced filtration media demonstrated good removal of dissolved heavy metals at relatively low costs. In the long-term test, all three filter media removed close to 100 percent of dissolved zinc early in the test. Removal of total suspended solids, however, was lower than expected.

Four treatment arrangements were evaluated in the joint AKART analysis for cost-effectiveness and feasibility. The first two processes employed the three tested enhanced filtration media, while the last two employed conventional treatment methods. The four treatment arrangements were:

- Individual catch basin filtration
- "End of pipe" collection sumps connecting a series of catch basins
- "End of pipe" sand filtration
- "End of pipe" sand filtration/chemical pre-treatment

Issues

Three issues arose in followup discussion:

- Managing stormwater to avoid unnecessary treatment
- Concentrating treatment on a storm's "first flush" of water
- Keeping shipyard discharges in perspective with other pollution sources

Managing Storm Water. Storing stormwater was suggested as a technique for reducing the amount of stormwater requiring treatment and ensuring that only stormwater from work areas are treated. Runoff from parking lots and rooftops is not considered industrial waste for purposes of meeting Clean Water Act requirements. Naval shipyards in California have established systems to catch process area runoff and allow heavy contaminants to settle, which is then followed by monitoring to determine whether the water requires treatment or if it can be discharged to Publicly Owned Treatment Works (POTW).

While stormwater storage may be viable for large shipyards, small yards may not have sufficient space on their properties to build storage facilities. Through the AKART process, Washington shipyards may evaluate and recommend runoff storage.

First Flush Treatment. Meeting participants questioned whether the AKART process can produce a time-sensitive characterization of pollutant concentrations. The questions were based on the theory that the "first flush" of runoff generated by a storm will have the highest pollutant concentrations. The Department of Ecology's view is that data do not support the "first flush" theory. In Western Washington, the six-month, 24-hour storm is the design event that is used to size appropriate stormwater treatment works.

Putting Shipyard Discharges into Perspective. Stormwater permits are required by the Clean Water Act. The Department of Ecology is working with shipyards, through the AKART process, to identify solutions that incorporate water quality protections and are economically feasible. Meeting participants raised concerns that the AKART process will result in technology-based requirements that are excessively stringent, considering shipyards' share of pollutant discharges into Puget Sound.

Shipyards face a practical problem, in that implementing a Department of Ecology-approved stormwater plan developed through the AKART process may not necessarily bring them into compliance with water quality standards, leaving shipyards open to citizen lawsuits. One of the reasons for this problem is complexities associated with stormwater regulation. There are two kinds of effluent limits that govern discharges to receiving waters: water quality-based limits and technology-based limits. Water quality-based limits are designed to protect aquatic life and require permittees to comply with numerical limits for specific pollutants such as heavy metals. There are two sets of standards: one for fresh water, the other for salt water, and they include acute and chronic exposure limits.

Technology-based limits are based on the performance of treatment technologies. The stricter of the two types of limits must be applied as permit conditions, but the point of contention is that the technology-based limits cannot exceed economic reasonableness. Conversely, the water quality-based limits do not have an economic reasonableness component.

An alternative approach would be setting a Total Maximum Daily Load (TMDL), a carrying capacity for each pollutant in a body of water, then allocating each permittee a share of that capacity. TMDLs are required by the Clean Water Act for any body of water that does not meet water quality standards.

Total Cost Assessment

Total Cost Assessment (TCA) is an economic analysis tool for comparing all the costs and benefits of two or more environmental investment alternatives. TCA exposes "hidden" costs that conventional economic analysis often overlooks and which can be reduced or avoided through pollution prevention. Among the tangible "hidden" costs are permitting fees,

environmental testing, hazard and workers' compensation insurance, workplace injury, future liability and remedial action. Intangible "hidden" costs include employee relations and corporate image. Using the time value of money, TCA extends the horizon of the analysis in order to account for the longer-term savings typical of pollution prevention investments. TCA can be carried out by hand or by using *P2/Finance* software developed by the Tellus Institute.

*(To obtain a free copy of P2/Finance, contact PPRC or Rob Reuter at the Department of Ecology, listed in **Appendix A**.)*

Alternatives to Abrasive Dry Grit Blasting

Abrasive dry grit used in sandblasting operations to remove paint from ship hulls is a significant source of pollutants entering waterways from shipyards' stormwater. Spent sandblast grit is contaminated with hull paint, which contains toxic heavy metals, such as copper and zinc, that are used as anti-fouling agents.

Three Puget Sound shipyards—Todd Pacific Shipyard Corporation, Puget Sound Naval Shipyard and Trident Refit Facility—gave presentations on alternatives to abrasive dry grit blasting they are using to strip paint from hulls. The alternatives are:

- ❑ Ultra-high-pressure water blasting with hand-held units, used by Todd Pacific;
- ❑ High-pressure water blasting with a robotically driven unit, used by Puget Sound Naval Shipyard;
- ❑ Wetted grit blasting with an additive to chemically bind lead to silica particles, used by Trident Refit Facility.

Ultra High-Pressure Water Blasting With Hand-Held Units

How the Operation Works. Operators use hand-held units to blast water at a pressure of 40,000 pounds per square inch. The hand-held units are connected to a central control mechanism. Water used for paint removal is collected for treatment and disposal.

Pollution Prevention Benefits. The use of water rather than dry grit for paint removal avoids dust emissions and the need to dispose of large quantities of spent grit contaminated with paint particles containing heavy metals.

Technical and Cost Issues. Wastewater can be filtered with media such as diatomaceous earth, then disposed of in Publicly Owned Treatment Works. Paint chips can be gathered with a wet vacuum for disposal as hazardous waste.

Ultra high-pressure water blasting projects do not require the complex containment necessary for dry grit blasting. Elimination of dust emissions also permits more flexible scheduling of maintenance projects on dust-sensitive components, such as propeller shafts and hydraulic equipment. Operating costs are comparable to dry grit blasting. While the "production rate" (square feet of painted surface stripped per hour) is lower with ultra high-pressure blasting, containment and cleanup costs are lower. For gummy coatings such as vinyl, the production rate for ultra high-pressure water blasting exceeds that of dry grit blasting.

Coating manufacturers have developed paints that can be applied to surfaces prepared with ultra high-pressure water blasting. Paint can be applied directly over "flash rust"—surface areas which rust when bare metal is exposed to the elements between removal of old coating and application of new coating.

Safety is a concern. Water blasted at 40,000 pounds per square inch can sever operators' limbs.

Another operational issue is the strenuous nature of the work. Frequent rotation of workers is necessary to prevent fatigue.

High-Pressure Water Blasting with Robotically Driven Unit

How the Operation Works. A robotically driven unit applies water under high pressure to the ship hull, and filters and reuses the water in a closed loop.

Pollution Prevention Benefits. The use of water rather than dry grit for paint removal avoids dust emissions and the need to dispose of large quantities of spent grit contaminated with paint particles containing heavy metals. Because water is reused in a closed loop, there is little danger of heavy metals being released via wastewater.

Technical and Cost Issues. The complex containment required for dry grit blasting is avoided with robotically driven, high-pressure water blasting. Scheduling other overhaul jobs, such as propeller shaft maintenance, is more flexible, because there is no danger of blasting grit contaminating dust-sensitive equipment. Blast jobs can be carried out in drydock or over water.

The unit's production rate of 240 square feet per hour exceeds that of dry grit blasting by 60 percent. The cost of the unit, manufactured by Pratt & Whitney, is $1.4 million. The estimated operating costs are half the costs of dry grit blasting, when avoided cleanup costs are taken into account.

Wetted Grit Blasting

How the Operation Works. A garnet grit is mixed with water inside the pressure chamber of an air-driven blasting unit. The wetted grit is then mixed with Blastox, an additive which

bonds with lead and copper to form silicates. Hand-held spray guns are used to blast the wetted grit.

Pollution Prevention Benefits. Worker and environmental exposure to lead and copper is prevented, because bonding the metals into silicates formed through the Blastox process makes the metals biologically unavailable. Spent grit falls dry after blasting and is collected for use in cement kilns or sent to a landfill. Wetting the grit avoids dust emissions.

Technical and Cost Issues. Reduction in dust emissions lessens the amount of containment required and there are no hazardous waste disposal costs. The system has saved the Trident Refit Facility $50,000 in hazardous waste disposal costs and 1,200 person-days of labor per vessel. The facility has worked on three ships with the process, and four more jobs are scheduled during the next three years.

The blasting units are available for demonstration at Puget Sound-area shipyards. The units cost $35,000 each.

Best Management Practices

Best Management Practices (BMPs) are maintenance, housekeeping and materials management practices that prevent or reduce pollution. Other benefits of BMPs include reduced costs and reduced workplace exposure to hazardous materials. The concluding discussion explored opportunities for implementing BMPs and barriers to implementation.

BMP Opportunities

Roundtable participants discussed issues associated with a number of the BMPs that can prevent or reduce pollution from shipyards. Discussions for three of the opportunities are described below. *(For a list of shipyard BMPs, refer to* ***Appendix C.****)*

Materials Management. Instituting controls over the purchase, storage and distribution of work chemicals is a recommended source reduction method for minimizing waste, reducing workplace exposure to hazardous materials, and cutting costs. Trident Refit Facility routinely uses 2,000 chemicals in 66 shop buildings, one drydock and two piers for its submarine maintenance and overhaul projects. Before each shift, each shop receives a job box with measured quantities of chemicals for the shift's work. Unused materials are picked up at the end of the shifts. The controls were implemented to better manage hazardous wastes and reduce workers' compensation costs. Estimated savings: $250,000 per year.

Alternative Coating Materials and Tools. The use of alternative anti-fouling coatings can reduce the release of copper and other toxic heavy metals. The use of alternative coatings with few or no volatile solvents can reduce generation of hazardous wastes and emissions of VOCs and hazardous air pollutants. Using alternative coating materials can help a facility avoid the more complex Clean Air Act compliance requirements for emissions of hazardous air pollutants that exceed certain thresholds. Alternative spray guns can reduce paint waste

by increasing "transfer efficiency," the ratio of paint deposited on a work surface to the total amount of paint sprayed.

Longer-lasting coatings reduce the frequency that ships need to be stripped and repainted, as long as the coatings are applied with high quality control, such as avoiding painting in wet weather. Concerns were raised about the performance of alternative anti-foulants and spray guns with high transfer efficiency. Trident Refit Facility is experimenting with a high-solids coating that does not contain solvents.

Work Area Cleanup. In a test, the Puget Sound Naval Shipyard compared the results of sweeping versus vacuuming drydock work areas. The test area was first swept, then vacuumed. The result was that the vacuuming picked up a significant quantity of copper-laden paint chips that sweeping had failed to remove. A concern was raised about the labor costs of vacuuming.

Barriers to Implementation

Roundtable participants discussed financial, institutional and information barriers to implementing BMPs that prevent or reduce pollution. Discussions for four of the barriers are described below.

Costs. Many shipyard representatives, both commercial and military, said financial pressures preclude investment in pollution prevention technologies and practices. For example, the commercial fishing fleet is suffering revenue losses as a result of declining catches and stricter harvest regulations. As a result, fishing vessel owners are reducing their spending on vessel maintenance, which in return reduces shipyard revenues.

Cooperative projects, such as the joint sponsorship of the AKART analysis discussed above, were suggested as a means of encouraging implementation of pollution prevention. Economic analysis tools that provide a more complete picture of the costs and benefits of alternative prevention and treatment strategies would lead to better-informed decision-making. *(For details on Total Cost Assessment, refer to* ***Page 4****.)*

Customer Specifications. Shipyards often are required by their customers to use paint stripping methods and coatings that generate pollution. A solution is specifications that are less prescriptive and more performance-based. The U.S. Department of Defense is examining contract policies that will reduce hazardous wastes by employing commercial instead of traditional military specifications.

Policing Work Practices. Among the more vexing issues raised at the roundtable was policing work practices at shipyards where docks are rented and work is performed either by subcontractors or by ship crews themselves. While the owners of such shipyards ultimately are responsible for activities performed at their facilities, they lack the ability to monitor customers continuously. Even more problematic is communicating pollution concerns with foreign ship personnel and/or subcontractor employees who do not understand English.

Regulatory Requirements. Concerns were raised that the prospect of citizen lawsuits could force shipyards into end-of-pipe pollution treatment rather than long-term pollution prevention strategies. One suggested solution would be setting pollution caps that allow facilities operational flexibility in their work practices and processes, as long as their releases stay below the caps. This approach would avoid the regulatory burden of re-opening permits whenever a process change is planned.

Recommendations

As part of all industry roundtables, PPRC identifies projects or activities that could address needs or problems identified during the roundtable discussions. As a result of the shipyards roundtable, possible follow-up activities with the potential to help the industry in future pollution prevention and compliance efforts were identified by PPRC. They include:

❑ Provide cost assessments of shipyard pollution prevention projects and make them available to the industry

Because industry funds are limited, especially on the commercial side, it is important to show decision-makers at shipyards the true costs and benefits of potential pollution prevention projects. This will help encourage investment in projects that might otherwise be overlooked. A good candidate for a Total Cost Assessment (TCA) demonstration would be one of the alternative technologies that replace dry grit blasting. Several roundtable participants expressed an interest in a TCA demonstration. One possible way to make such a project happen would be to have a volunteer shipyard perform the analysis by using free consulting services provided by the University of Washington Environmental MBA program. Students from the program perform consulting projects with local companies each spring as part of their graduation requirements. Application to participate in the program could be done by an individual shipyard, the American Waterways Operators, PPRC, or others.

❑ Facilitate technology transfer between the military and commercial shipyards

It was clear during the roundtable that many of the lessons the military shipyards learned from their testing and evaluation of alternative technologies are very useful to the commercial yards as well. The reason the Navy and commercial yards have not had contact on environmental issues very often is because the commercial yards are regulated by the state, while the military yards are regulated by the federal government. While it is true that some of the projects the Navy implements are not feasible for the commercial yards because of their high capital cost, many others have potential transferability.

❑ Continue good-faith efforts to ensure that water quality standards are met with due consideration for economic impacts

As discussed earlier, shipyards face a practical problem in implementing stormwater

prevention and treatment projects that may not necessarily bring them into compliance with water quality standards. Shipyards and the Department of Ecology should continue working together in good faith to:

- ❑ Characterize the extent and nature of stormwater-related water quality problems,
- ❑ Identify prevention and treatment projects that will incorporate water quality protections into stormwater permits with due consideration for economic impacts.

Appendix A:
Shipyard Roundtable Attendees

Name	Company/Agency	Address	Telephone	FAX	E-mail
Arnie Arstad	Lake Union Drydock	1515 Fairview Ave. E Seattle, WA 98102	206-364-7002	206-324-0124	
Bob Benze	Puget Sound Naval Shipyard	1400 Farragut, Code 106.3, Bremerton, WA 98314-5001	360-476-0118	360-476-8550	benzer@ psns.navy.mil
Cherie Berg	Marco Seattle Shipyard	2300 W. Commodore Seattle, WA 98199	206-285-3200	206-285-8486	
Dale Bonar	Aquatic Environmental Sciences	2730-C Washington St. Port Townsend, WA 98368	360-385-7976	360-379-9705	dbonar@ olympus.net
Tom Boucher	WA Dept. of Ecology	3190 160th Ave. SE Bellevue, WA 98008	425-649-7180	425-649-7098	tbou461@ ecy.wa.gov
Dave Cheramy	Maritime Consulting, International	3003 NE 149th Ave. Portland, OR 97231	503-256-5535	503-256-4535	cheramy.mci@ worldnet.att.net
Bob Cipra	Puget Sound Naval Shipyard	1400 Farragut, Code 106.3, Bremerton, WA 98314-5001	360-476-6009	360-476-8550	ciprar@ psns.navy.mil
Jim DiPeso	PPRC	1326 5th Ave., #650 Seattle, WA 98101	206-223-1151	206-223-1165	jdipeso@ pprc.org
Pam Elardo	WA Dept. of Ecology	3190 160th Ave. SE Bellevue, WA 98008	425-649-7126	425-649-7098	pela461@ ecy.wa.gov
Peter Giles	Northlake Shipyard	1441 N. Northlake Way Seattle, WA 98103	206-632-1441	206-632-8628	
Jim Gleason	Treatment Equipment	PO Box 6743 Bellevue, WA 98008	425-641-4306	425-641-9270	tec.jimgleason@ halcyon.com
Nathan Graves	Kennedy/Jenks Consultants	530 S. 336th St. Federal Way, WA 98003	253-874-0555	253-952-3435	nathangraves@ kennedyjenks. com
Barry Kellems	HartCrowser	1910 Fairview Ave. E Seattle, WA 98102	206-324-9530	206-328-5581	blk@ hartcrowser.com
John Killingsworth	Dakota Creek Industries	PO Box 218 Anacortes, WA 98221	360-299-0971		

Name	CompanyAgency	Address	Telephone	FAX	E-mail
John Knutson	Stormwater Management	2035 NE Columbia Portland, OR 97211	503-240-3393	503-240-9553	johnk@ stormwatermgt.com
Dean Kohn	NUWC	c/1433 610 Dowell St., B.95 Keyport, WA 98345	360-396-5665	360-396-7683	dkohn@kpt.nuwc. navy.mil
Lincoln Loehr	Heller, Ehrman, et.al.	6100 Columbia Center 701 5th Ave. Seattle, WA 98104	206-389-6219	206-447-0849	LLOEHR@ hewm.com
Joe Martinac	J.M. Martinac Shipbuilding	401 E. 15th St. Tacoma, WA 98421	253-572-4005	253-627-2816	martinac@ nwrain.com
Kyle McCleary	Duwamish Shipyard	5658 W. Marginal Way SW Seattle, WA 98106	206-767-4880	206-767-5867	
Jerry McMahon	American Waterways Operators	5615 W. Marginal Way SW Seattle, WA 98106	206-768-3538	206-764-1323	
Gary Minton	Resource Planning Associates	311 W. McGraw Seattle, WA 98119	206-282-1681		
Bob Miulli	Port of Port Townsend	PO Box 1180 Port Townsend, WA 98368	360-385-0656	360-385-3988	bob@portofport townsend.dst.wa.us
Chris Montovino	PPRC	1326 5th Ave., #650 Seattle, WA 98101	206-223-1151	206-223-1165	cmontovino@ pprc.org
Rick Moore	HartCrowser	1910 Fairview Ave. E Seattle, WA 98102	206-324-9530	206-328-5581	rfm@ hartcrowser.com
Bob Morris	Maritime Industries Northwest, Inc.	313 E 'F' St. Tacoma, WA 98401	253-627-9136	253-627-1094	
Jeffrey Pettey	Filtration/Treatment Systems	7118 S. 220th St. Kent, WA 98032	253-872-9007	253-872-9004	
Holly Pettit	Oregon DEQ	811 SW 6th Portland, OR 97204	503-229-5672	503-229-5850	pettit.holly@ deq.state.or.us
Ken Radon	Port of Port Townsend	PO Box 1180 Port Townsend, WA 98368	360-385-2355	360-385-3988	ken@portofport townsend.dst.wa.us

Name	Company/Agency	Address	Telephone	FAX	E-mail
Al Rainsberger	Todd Pacific Shipyards	PO Box 3806 Seattle, WA 98124	206-623-1635	206-442-8519	
Rob Reuter	WA Dept. of Ecology	3190 160th Ave. SE Bellevue, WA 98008	425-649-7086	425-649-7098	rreu461@ ecy.wa.gov
Mike Rogers	Maritime Contractors	201 Harris Ave. Bellingham,WA 98225	360-647-0080	360-671-3563	mrogers@ mari.com
Scott Rossiter	Pacific Fisherman	5351 24th Ave. NW Seattle, WA 98107	206-784-2562	206-784-1986	
Rick Schmid	Flow International	23500 64th Ave. S Kent, WA 98032	253-813-9370	253-813-3295	RSCHMIDY@ aol.com
Lynn Schroeder	NW Marine Trade Association	1900 N. Northlake, #233 Seattle, WA 98103	206-634-0911	206-632-0078	
Mike Shepherd	Trident Refit Facility	7000 Finback Circle Silverdale, WA 98315	360-315-1971	360-396-6185	Mike_Shepherd@ trfb.navy.mil
Paul Stash	WA Dept. of Ecology	PO Box 47600 Olympia, WA 98504	360-407-6446	360-407-6426	psta461@ ecy.wa.gov
Reinout Vanbeynum	NUWC Div. Keyport	610 Dowell St. NUWC, Code 143, RVD Keyport, WA 98345	360-396-5435	360-396-7839	vanbeynu@ kpt.nuwc.navy.mil
Anne Weiner	Johannessen & Associates, P.S.	PO Box 70605 Seattle, WA 98107	206-706-8148	206-706-8248	envirolaw@ johanassocs.com
Cynthia Wellner	King County Industrial Waste	130 Nickerson St., #200 Seattle, WA 98109	206-689-3001	206-689-3001	
Chris Wiley	PPRC	1326 5th Ave., #650 Seattle, WA 98101	206-223-1151	206-223-1165	cwiley@ pprc.org
Frank Williamson	Foss Shipyard	660 W. Ewing St. Seattle, WA 98119	206-270-4888	206-281-4702	
Lisa Zinner	WA Dept. of Ecology	3190 160th Ave. SE Bellevue, WA 98008	425-649-7276	425-649-7098	lzin461@ ecy.wa.gov

Vendor Information for Enhanced Filtration Tests

Medium	Company	Name	Phone
ATA Aqua-Fix Media	Aero-Terra-Aqua (ATA) Technologies 1240 Valley Belt Road Cleveland, OH 44131	Jim Larson ATA Contact Jim Gleason Local ATA Rep.	216-459-1930 425-641-4306
CSF Humic Filter Media	Storm Water Management 2036 NE Columbia Blvd Portland, OR 97211	John Knutson	503-240-3393
MultiSorb 100 Media	Peat Technologies 9076 Little Sweden Rd. Cook, MN 55723	Tim Hagen	218-666-2962

Appendix B:

Summary of Environmental Regulations Affecting Shipyards

Water Pollution Regulations

Shipyards are regulated by the Clean Water Act and in Washington by the State Water Pollution Control Act, both of which are carried out by the state Department of Ecology. The department operates a waste discharge permit program for discharges to surface and groundwater, sewers and storm drains, and issues both state permits and National Pollutant Discharge Elimination System (NPDES) permits. Facilities that discharge directly to surface water are called direct dischargers, and must obtain NPDES permits.

Facilities that discharge to a Publicly Owned Treatment Works (POTW) are called indirect dischargers, and their discharge permits come from the POTW to which they discharge. Indirect dischargers must meet the following requirements:

The discharge cannot:

- ❑ Create fire or explosion
- ❑ Have a pH less than 5.0 or greater than 12.0
- ❑ Obstruct the flow of wastewater through the system
- ❑ Interfere with the sewage plant operations
- ❑ Contain excessive heat
- ❑ Contain excessive petroleum, mineral, or non-biodegradable oils

Indirect dischargers also must comply with metals and toxic organics concentration limits that are the same as or more strict than those prescribed for direct dischargers.

Submission of Plans and Reports for Construction of Wastewater Facilities

Chapter 173-240 of the Washington Administrative Code provides direction to shipyards for submission of plans and reports for the construction of wastewater facilities as determined from the facility-specific AKART process. Shipyards may submit engineering reports, plans and specifications, and an operation and maintenance manual to the Department of Ecology either in stages or all at once for review. The department will approve, conditionally approve, comment on, or disapprove the documents.

The purpose of this process is to ensure that the proposed facilities will: 1) be designed, constructed, operated and maintained to meet effluent limitations and other requirements of an NPDES or state waste discharge permit, 2) meet policies and requirements of regulations pertaining to preventing and controlling water pollution, and 3) be consistent with good

engineering practices. All documents must be prepared under supervision of a professional engineer, and bear the engineer's seal.

Guidelines for submitting the engineering report are included in Section 173-240-130. The list should be treated as a checklist to ensure that the report fulfills all department requirements. The checklist includes: specific business information, industrial processes, wastewater generation, wastewater treatment options, construction/installation plans, and cost analysis. Two copies of the engineering report must be submitted to the department.

Section 173-240-140 provides the guidelines for submitting plans and specifications as noted in the engineering report. The plans and specifications section must include drawings of major components such as the treatment units, pump stations, flow measuring devices, sludge handling equipment, and influent and effluent piping. Two copies of plans and specifications also must be submitted to the department for approval.

The final requirement involves the submission of operation and maintenance manuals, as detailed in Section 173-240-150. The purpose of the manual is to present technical guidance and regulatory requirements to the operator for both normal and emergency conditions.

Air Pollution Regulations

The 1990 Clean Air Act directs the U.S. Environmental Protection Agency (EPA) to regulate airborne emissions of 189 toxic chemicals. To control emissions of these chemicals, the EPA issues National Emission Standards for Hazardous Air Pollutants (NESHAPs).

On Dec. 15, 1995, EPA finalized a rule covering air emissions of Hazardous Air Pollutants (HAPs) from shipbuilding and ship repair surface coating operations. If a facility has the potential to emit 10 tons of any one hazardous air pollutant or 25 tons of any combination of such pollutants, then it is considered a major source, and is responsible for controlling emissions under this standard.

Reducing emissions below these levels can eliminate the need to comply with this standard. However, if compliance with this emissions standard is unavoidable, then all affected shipyards were required to submit an implementation plan by Dec. 16, 1996 and must use coatings that meet the emissions limits by Dec. 16, 1997.

This emissions standard has other requirements covering implementation plans, work practices, record-keeping and reporting. More information on these requirements is available through state Small Business Assistance Program representatives or local air quality authorities.

Hazardous and Toxic Materials Regulations

The Resource Conservation and Recovery Act (RCRA), enacted in 1976, put in place a national hazardous waste management system that tracks waste from "cradle to grave." Amendments

enacted in 1984 brought small generators into the system and put into place other requirements, including restrictions on land disposal of hazardous waste, guidelines for underground storage tanks, and waste minimization requirements for hazardous waste generators. Examples of regulated waste streams include copper, zinc, cadmium and other heavy metals.

Wastes are determined to be hazardous if they contain any of the items listed on the U.S. EPA's list of hazardous wastes or if they have any one of four hazardous properties: ignitability, corrosivity, reactivity or toxicity.

Certain other wastes are automatically defined as hazardous unless they are proved not to be. Wastes in this category that pertain to the ship building and repair industry include wastewater treatment sludges, spent grit from dry sandblasting operations, waste paint chips and dust from hull stripping processes, and spent stripping and cleaning solutions.

Each facility that generates or accumulates hazardous waste is designated as a large quantity generator (LQG), a small quantity generator (SQG) or a conditionally exempt small quantity generator (CEG) based on the monthly quantity of generation and accumulation. (In Washington, different terms are used: the corresponding category names are large quantity generator [LQG], medium quantity generator [MQG], and small quantity generator [SQG].) The greater the quantity generated, the more requirements a facility must adhere to.

Superfund and Emergency Planning, Community Right-to-Know Regulations

Regulations related to cleanup of contaminated sites, emergency planning, and community right-to-know come from the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, and the subsequent Superfund Amendments and Reauthorization Act of 1986 (SARA). SARA includes the Emergency Planning and Community Right-to-Know Act (EPCRA). These laws require reporting of spills that exceed a specified amount, which varies depending on the substance, and reporting on the use, storage and disposal of hazardous materials. Reporting requirements include submitting Material Safety Data Sheets for chemicals used, inventories of chemicals stored on-site, and filing a toxics release inventory report for facilities that meet certain criteria.

The toxics release inventory (TRI) is a compilation of information contained in the reports submitted to EPA by companies which are in SIC codes 20-39, have 10 or more full-time employees, and use or process any of the more than 650 chemicals on the toxics chemicals list above specified threshold levels. Large federal shipyards have been among the facilities required to file TRI reports.

Pollution Prevention Planning Regulations

In Washington, the Hazardous Waste Reduction Act of 1989 requires pollution prevention plans from facilities that file TRI reports or whose hazardous waste generation exceeds a

specified threshold. In Oregon, the Toxics Use Reduction and Hazardous Waste Reduction Act of 1990 requires pollution prevention plans from facilities that are large toxics users as defined in the state law, or are LQGs or SQGs as defined in federal hazardous waste regulations.

While facilities covered by the laws are required to write a plan and report progress toward reaching plan goals, there is no regulatory requirement for implementing identified pollution prevention opportunities or for reducing chemical usage or releases by a specified amount.

Other Regulatory Requirements

In addition to the environmental regulations described above, shipyards are affected by a number of occupational safety and health regulations. These include requirements for hazards communication in the workplace, emergency response planning, electrical safety, respiratory protection, flammables storage, and noise protection.

Appendix C:
Shipyard Best Management Practices

Compiled by the Washington Department of Ecology

SURFACE PREPARATION, PAINT REMOVAL, SANDING AREAS
Enclose, cover, or contain blasting and sanding areas to the maximum extent practical to prevent abrasives, dust and paint chips from reaching storm sewers or receiving water
Use shrouded or vacuum-assisted tools that prevent abrasives, dust and paint chips from leaving immediate area being worked on (dustless sanders, vacuum blasting robots)
Use blast media that does not contain pollutants (examples: garnet, steel, ultra-high-pressure water)
Cover drains, trenches, and drainage channels to prevent entry of blasting debris to the system
Prohibit uncontained blasting or sanding activities over open water
Prohibit blasting or sanding activities during windy conditions that render containment ineffective
Inspect and clean sediment traps to ensure the interception and retention of solids before entering the drainage system
Vacuum or sweep accessible areas of the drydock to remove debris and spent sandblasting material before flooding
Improve work area to reduce areas which are hard to clean: alter keel support layout, seal crevices, make surfaces smoother
Segregate water that has come into contact with abrasives and paint chips from water that has not; treat separately
Collect spent abrasives frequently and store in an enclosed, covered area from which it cannot escape or be rained upon
Consider testing paint before removal to establish potential pollutant levels
Establish objective measures of cleanliness that will need to be met before proceeding to next work process

PAINTING
Enclose, cover or contain painting activities to the maximum extent practical to prevent overspray from reaching the receiving water
Prohibit uncontained spray painting activities over open water
Prohibit spray painting activities during windy conditions that render containment ineffective
Mix paints and solvents in designated areas away from drains, ditches, piers and surface waters, preferably indoors or under a shed
When painting from floats, paint should be in cans five gallons or smaller, with drip pans and drop cloths underneath
Have absorbent and other cleanup items readily available for immediate cleanup of spills
Allow empty paint cans to dry before disposal
Keep paint and paint thinner away from traffic areas to avoid spills
Recycle paint, paint thinner and solvents
Train employees on proper painting and spraying techniques, and use effective spray equipment that delivers more paint to the target and less overspray
Investigate and use non-pollutant bearing paints (hard epoxies, fluorinated polyurethanes, isothiazolone-containing)

PRESSURE WASHING AREAS
Perform pressure washing only in designated areas where washwater containment can be effectively achieved
Do not use detergents or additives in the pressure washwater
Direct deck drainage to a collection system sump for settling and/or additional treatment
Install diagonal trenches, or berms and sumps to contain and collect washwater at marine railways
Use solid decking, gutters and sumps at lift platforms to contain and collect washwater
Segregate stormwater from process water; consider using stormwater for applications that do not demand high cleanliness
Educate the customer about the environmental consequences of paint choice

NON-DRYDOCK ACTIVITIES
Hang tarpaulin from the boat, and/or from fixed or floating platforms to reduce pollutants transported by wind
Pave or tarp surfaces under marine railways
Clean railways before the incoming tide
Haul vessels beyond the high tide zone before work begins or halt work during high tide
Place plastic sheeting or tarpaulin underneath boats to contain and collect waste and spent materials, and clean and sweep regularly to remove debris
Use appropriate plastic or tarpaulin barriers for containment when work is performed on a vessel in the water to prevent paint overspray from contacting stormwater or the receiving water
Vacuum or sweep rather than hose debris from the dock

DRYDOCK MAINTENANCE
Clean and maintain drydock on a regular basis to minimize the potential for pollutants in the stormwater runoff
Vacuum or sweep accessible areas of the drydock to remove debris and spent sandblasting matenal before flooding
If hosing must be used as a removal method, treat as pressure washwater
Clean the remaining areas of the dock after a vessel has been removed and the dock raised
Remove and properly dispose of floatable and other low-density waste (wood, plastic, insulations)
DRYDOCK ACTIVITIES
Use plastic barriers beneath the hull, between the hull and drydock walls for containment
Use plastic barriers hung from the flying bridge of the drydock, from the bow or stem of the vessel, or from temporary structures for containment
Weight the bottom edge of the containment tarpaulins or plastic sheeting during a light breeze
Use plywood and/or plastic sheeting to cover open areas between decks when sandblasting
Install tie rings or cleats, cable suspension systems, or scaffolding to make implementation containment easier

ENGINE MAINTENANCE AND REPAIRS
Maintain an organized inventory of materials used in the maintenance shop
Dispose of greasy rags, oil filters, air filters, batteries, spent coolant and degreasers properly
Label and track the recycling of waste material (e.g., used oil, spent solvents, batteries)
Drain oil filters before disposal or recycling
Store cracked batteries in a non-leaking secondary container
Promptly transfer used fluids to the proper container; do not leave full drip pans or other open containers around the shop. Empty and clean drip pans and containers
Do not pour liquid waste down floor drains, sinks, or outdoor storm drain inlets
Plug floor drains that are connected to the storm or sanitary sewer; if necessary, install a sump that is pumped regularly
Inspect the maintenance area regularly for proper implementation of control measures
Train employees on proper waste control and disposal procedures

SHIPBOARD WATER HANDLING
Keep cooling water used aboard ships separate from sanitary wastes to minimize disposal costs for the sanitary wastes
Keep cooling water from contact with spent abrasives and paint to avoid pollution of the receiving water
Inspect connecting hoses for leaks
Discharge sanitary wastes from the ship being repaired to the yard's sanitary system or dispose of by a commercial waste disposal company

MATERIALS HANDLING
Store permanent tanks in a paved area surrounded by a dike system that provides sufficient containment for the larger of either 10 percent of the volume of all containers or 110 percent of the volume of the largest tank
Maintain good integrity of all storage tanks
Inspect storage tanks to detect potential leaks and perform preventive maintenance
Inspect piping systems (pipes, pumps, flanges, couplings, hoses, valves) for failures or leaks
Train employees on proper filling and transfer procedures
Store containerized materials (fuels, paints, solvents) in a protected, secure location and away from drains
Store reactive, ignitable, or flammable liquids in compliance with the local fire code
Identify potentially hazardous materials, characteristics and use
Control excessive purchasing, storage and handling of potentially hazardous materials
Keep records to identify quantity, receipt date, service life, users, and disposal routes
Secure and carefully monitor hazardous materials to prevent theft, vandalism and misuse of materials
Train employees on proper storage, use, cleanup and disposal of materials
Provide sufficient containment for outdoor storage areas for the larger of either 10 percent of the volume of all containers or 110 percent of the volume of the largest tank
Use temporary containment where required by portable drip pans
Use spill troughs for drums with taps
Mix paints and solvents in designated areas away from drains, ditches, piers and surface waters

IF SPILLS OCCUR ...
■ Stop the source of the spill immediately ■ Contain the liquid until cleanup is complete ■ Deploy oil containment booms if the spill may reach the water ■ Cover the spill with absorbent material ■ Keep the area well ventilated ■ Dispose of cleanup materials properly ■ Do not use emulsifier or dispersant

TRAINING
Establish training progams for practices that prevent stormwater pollution
Include stormwater pollution prevention training in new employee orientations
Establish incentive programs of material rewards to encourage stormwater pollution prevention ideas and implementation. Provide prompt feedback
Recognize successful practices and publicize them intemally (newsletters, posters, plaques) and externally (speaking engagements, press releases to industry journals and local media)
Appoint a specific stormwater pollution prevention coordinator and task force to develop and implement a stormwater pollution prevention program. Keep records
Conduct an annual program evaluation at the corporate level
Establish quantifiable goals. Chart progress by individual, by unit and overall
Incorporate stormwater pollution prevention accomplishments into annual job performance evaluations

Appendix D:

Contacts and Information Resources

Manuals and Reports

Maritime Industrial Waste Project: Reduction of Toxicant Pollution from the Maritime Industry in Puget Sound. King County, March 1992. (Being catalogued into the Department of Ecology resource center system; also available from King County at 206-689-3051.) Includes pressure-washing, bottom paints, stormwater, bilge and ballast water treatment, hazardous materials from boatyards, shipyards, and repair facilities. Provides waste characterization, review of treatment systems, vendors, cost analysis, and Best Management Practices (BMPs).

Boatyard Wastewater Treatment Guidelines—Seattle, Wash. Municipality of Metropolitan, Seattle, 1991. (In Ecology library.)

A Hazardous Waste Resource Manual for the Marine Service Industry. Puget Sound Alliance, August 1993. (In Ecology resource center system.) Includes BMPs, pollution prevention opportunities, case studies, and an overview of applicable regulations.

Best Management Practices for Ship and Boat Building and Repair Yards. Puget Sound Shipbuilders Association. Undated. (In Ecology resource center system.) Lists of vendors and services, and BMPs.

Best Management Practices for Small Boatyards. Department of Ecology, 1990. (In Ecology library.)

Pollution Prevention Opportunities—Reducing Hazardous Waste and Chemical Use in the Marine Industry. Puget Sound Alliance, 1993. (In Ecology library.)

Clean Marinas—Clear Value: Environmental and Business Success Stories. U.S. EPA (EPA 841-R-96-003). August 1996. (Being catalogued into Ecology resource center system)

Guides to Pollution Prevention: The Marine Maintenance and Repair Industry. U.S. EPA (EPA/625/7-91/015), 1991. Includes pollution prevention opportunity assessments, machine shop and engine repair wastes, paint and solvent wastes, chemical stripping and abrasive blast wastes, vessel cleaning, and spill control.

NPDES Handbook for Compliance with Washington State Department of Ecology NPDES Boatyard Permits. Northwest Marine Trades Association, 1992. (In Ecology library.)

Survey of Contaminants in Two Puget Sound Marinas. U.S. EPA, 1989. (In Ecology library.)

Waste Audit Study—Marineyards for Maintenance and Repair. California Department of Health Services, 1989. (In Ecology library.)

Commercial Fishing Vessel Waste Assessment, Squalicum Harbor, Bellingham, Wash. Cassandra Karuza, Huxley College of Environmental Studies, 1994. (Contact Tom Boucher, Department of Ecology Northwest Regional Office, 425-649-7180 or tbou461@ecy.wa.gov).

Sound Information: A Boaters Guide. Puget Soundkeeper Alliance, 1996. (Being catalogued into Ecology resource center system.) Covers bilge, sewage, oil and fuel, trash, cleaning products, hull maintenance, services and vendors.

Washington State Marina Directory. Robert Goodwin and Tim Farrell, University of Washington, 1991. (In Ecology library.)

Marine Maintenance and Repair: Waste Reduction and Safety Manual. North Carolina Department of Natural Resources and Community Development, 1991. (In Ecology library.) Includes derelict vessels, hazardous materials, engine servicing, paints, solvents, cleaners, caulks and adhesives, and fueling.

Underwater Hull Cleaning Guidelines. Department of Ecology, 1995 (Pub. # WQ-BR-95-79). A small brochure for boaters.

Practices and Products For Clean Marinas: A Best Management Practices Handbook. Paul E. Dodson, International Marina Institute, 1994. Emphasizes BMPs. (In King County Library, 206-689-3051)

Pollution Prevention for Marinas and Boat Yards: Best Management Practices for Wisconsin Operators. David S. Liebl, University of Wisconsin Extension, December 1994. (In King County Library, 206-689-3051)

Companion Report on Shipyards Roundtable Briefing. Covers briefing PPRC provided to public-interest organizations on the Shipyards Roundtable. Includes organizations' recommendations for future action. Available from PPRC (206-223-1151 or office@pprc.org)

Department of Ecology Contacts

Greg Cloud (360-407-6291 or gclo461@ecy.wa.gov) for information on boatyard permits, BMPs, vacuum sanders and anti-fouling paints.

Paul Stasch (360-407-6446 or psta461@ecy.wa.gov) for information on a general permit for boatyard discharges, bottom paints and marinas.

Rob Reuter (425-649-7086 or rreu461@ecy.wa.gov) and ***Tom Boucher*** (425-649-7180 or tbou461@ecy.wa.gov) for information on boatyard wastes and pollution prevention.

Bernard Brady (360-407-6803 or bbra461@ecy.wa.gov) for information about the Maximum Achievable Control Technology (MACT) rule for air emissions control at boat manufacturing facilities and marine vessel loading operations scheduled to take effect on Nov. 15, 2000.

Other Northwest Regional Office contacts are:
John Drabeck (425-649-7293 or jdra461@ecy.wa.gov)
Bob Newman (425-649-7046 or bnew461@ecy.wa.gov)
Ron Devitt (425-649-7028 or rdev461@ecy.wa.gov)
Bob Wright (425-649-7060 or rowr461@ecy.wa.gov)

Internet Resources

The Naval Research Laboratory, Environmental Effects Branch
The Naval Research Laboratory (NRL) is the Navy's corporate research and development laboratory, which conducts research and engineering projects with the goal of preventing material degradation and failure in naval environments.
http://thor.nrl.navy.mil/mstd/6310.html

Enviroene
Enviroene, part of the U.S. Environmental Protection Agency's Web site, is a repository for pollution prevention, compliance assurance, and enforcement information and databases. Included are pollution prevention case studies, technologies, points of contact, environmental statutes, executive orders, regulations, and compliance and enforcement policies and guidelines. The site includes a search engine. Two publications of interest to shipyards that can be found on the site are *Waste Reduction Guide: Shipyards* and *Guides to Pollution Prevention: The Marine Maintenance and Repair Industry.*
http://es.inel.gov/

Tri-Services' Pollution Prevention Technical Library
Maintained by the Naval Facilities Engineering Service Center (NFESC), this Web site contains process data sheets including information on technology, materials compatibility, safety and health, benefits, disadvantages, economic analysis, points of contact and vendors.
http://enviro.nfesc.navy.mil/p2library/paint.htm

Available topics include:

- ***Painting***
  - Dry filter booth paint conversion
  - High volume low pressure paint spray system
  - Plural component proportioning system for epoxy paints
  - Powder coating painting system
  - Unicoat paint technology
  - Water-borne paint
  - Bulk paint storage
  - Electrostatic paint spray system
- ***Paint Removal***
  - Automatic paint gun washer
  - Paint stripping using sodium bicarbonate (baking soda) medium
  - Carbon dioxide blasting operations
  - Fluidized bed paint stripper

High and medium pressure water paint stripping processes
Plastic media blasting (PMB) paint stripping
Degreasing and paint stripping using sponge blasting
Paint stripping wheat starch blasting
Vacuum sanding system paint stripping process

- ❑ *Stormwater*
  Sand filters for treating stormwater runoff
  Vortex solids separators for treating stormwater runoff
  Water quality inlets to control stormwater runoff
  Wet detention ponds to treat stormwater runoff

Research Triangle Institute: Abrasive Blasting Operations
This site provides information on alternative blasting technologies such as wheat starch blasting, and includes case studies, economics data, and environmental requirements.
http://clean.rti.org/ab_gen.htm

SAGE
SAGE is an expert system software used to determine solvent/process alternatives most likely to work in a given case.
http://clean.rti.org/frm_test.htm

Environmental Resources & Information Center (ERIC)
Division of the Gulf Coast Region Maritime Technology Center
This site contains a list of pollution prevention measures dealing with paint management, solvent usage, machine shop wastes and spill cleanup.
http://www.uno.edu/~engr/eric/techbriefs/brief1.html

Tacoma-Pierce County Health Department Boating Page
This site contains pollution prevention ideas, boat maintenance tips, and a list of alternative boat maintenance products.
http://www.healthdept.co.pierce.wa.us/water/boat/res.html

Trade Associations, Organizations

Puget Sound Shipbuilders Association
1515 Fairview Ave. E
Seattle, WA 98102

Puget Sound Alliance
1415 W. Dravus
Seattle, WA 98119
206-286-1309

Northwest Marine Trade Association
1900 N. Northlake Way
Seattle, WA 98103
206-634-0911

American Waterways Operators
5615 W. Marginal Way SW
Seattle, WA 98106
206-768-3538

International Marina Institute
PO Box 284
Wickford, RI 02852
401-294-9558

National Marine Manufacturers Association
200 E. Randolph Drive, #5100
Chicago, IL 60601
312-946-6200

Marine Technology Society
1828 'L' St., NW
Washington, DC 20036
202-775-5966
206-523-4680 (Puget Sound Section)

Appendix E:
Glossary

AKART: An acronym for "All Known, Available, and Reasonable methods of prevention and treatment Technology." AKART shall represent the most current methodology that can be reasonably required for preventing, controlling, or abating the pollutants associated with a discharge. The concept of AKART applies to both point and non-point sources of pollution. The term "best management practices," typically applied to non-point source pollution controls, is considered a subset of the AKART requirement. "The Stormwater Management Manual for the Puget Sound Basin" (1992) may be used as a guideline, to the extent appropriate, for developing best management practices to apply AKART for stormwater discharges.

Best Management Practices (BMPs): Physical, structural, and/or managerial practices approved by the Department of Ecology that, when used singularly or in combination, prevent or reduce pollutant discharges.

Engineering report: A document that examines the engineering and administrative aspects of a domestic or industrial wastewater facility. The report shall contain the appropriate information required in WAC 173-240-060 or 173-240-130.

Hardness: A measure of the calcium and magnesium salts present in water. Hardness is measured in milligrams per liter and expressed as calcium carbonate (CaCO3).

Industrial wastewater: The water or liquid-carried waste from industrial or commercial processes, as distinct from domestic wastewater. These wastes may result from any process or activity of industry, manufacturing, trade or business, from the development of any natural resource, or from animal operations such as feedlots, poultry houses, or dairies. The term includes contaminated stormwater and also leachate from solid waste facilities.

Industrial wastewater facility: All structures, equipment, or processes required to collect, carry away, treat, reclaim or dispose of industrial wastewater.

Mixing zone: That portion of a water body adjacent to an effluent outfall where mixing results in the dilution of the effluent with the receiving water. Water quality criteria may be exceeded in a mixing zone as conditioned and provided for in WAC 173-201A-100.

Non-point source: Pollution that enters any waters of the state from any dispersed land-based or water-based activities, including but not limited to atmospheric deposition; surface water runoff from agricultural lands, urban areas or forest lands; subsurface or underground sources; or discharges from boats or marine vessels not otherwise regulated under the National Pollutant Discharge Elimination System program.

Permit: A document issued pursuant to RCW 90.48.160 et seq., RCW 90.48.260 or both, specifying waste treatment and control requirements, and waste discharge conditions.

pH: A numerical measure of a liquid's acidity or alkalinity, expressed on a scale of 0-14, in which small numbers signify acidity, large numbers signify alkalinity, and 7 signifies a neutral liquid.

Plans and specifications: The detailed drawings and specifications used in the construction or modification of domestic or industrial wastewater facilities. Except as otherwise allowed, plans and specifications are preceded by an approved engineering report. For some industrial facilities, final conceptual drawings for all or parts of the system may be substituted for plans and specifications with the Department of Ecology's permission.

Pollution: Such contamination, or other alteration of the physical, chemical or biological properties, of any waters of the state, including changes in temperature, taste, color, turbidity, or odor of the waters, or such discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters of the state as will or is likely to create a nuisance or render such waters harmful, detrimental, or injurious to the public health, safety or welfare, or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish or other aquatic life.

Stormwater: That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes, and other features of a stormwater drainage system into a defined surface water body, or a constructed infiltration facility.

Surface waters of the state: Includes lakes, rivers, ponds, streams, inland waters, saltwaters, and all other surface waters and water courses within the jurisdiction of the state of Washington.

Turbidity: Clarity of water expressed as nephelometric turbidity units (NTU) and measured with a calibrated turbidimeter.

Waters of the state: All surface waters and ground waters within the jurisdiction of the state of Washington.