Pacific Northwest Pollution Prevention Resource Center (PPRC)
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## Material and Process Alternatives

**Sandblasting Alternatives** - Alternatives to silicon-based, 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. Additional alternatives include plastic or glass abrasives, sodium bicarbonate, sponge blasting, wheat starch blasting, and carbon dioxide pellets. Advantages and disadvantages of other alternative paint stripping media are outlined below:

**Plastic**
*Pros:* Media can be used 10 to 12 times, no wastewater to dispose of, and it does not contain respirable silica (a health concern).
*Cons:* Capital costs for blasting and media recycling equipment are high, spent media must be disposed of as hazardous waste; stripping quality depends on operator skill.

**Sponge Blasting**
*Pros:* Media can be used 10 to 15 times, media is safe and transportable.
*Cons:* Both capital and media costs are relatively high.

**Sodium Carbonate**
*Pros:* Less toxic than silicon-based, wastewater stream to be centrifuged to reduce waste volume.
*Cons:* Requires subsequent washing of the blasted part, may require containment.

**Recycled Glass**
*Pros:* Recycled content, no respirable silica or heavy metal content, and uses same equipment at sand and slags.
*Cons:* Product available in specific geographical areas, the Pacific Northwest and Ohio.

**Wheat Starch**
*Pros:* Media is plentiful, and waste totals only 5 percent of the input volume.
*Cons:* Initial capital costs are high, complex media recovery systems are necessary, media is moisture sensitive.

**Carbon Dioxide Pellets**
*Pros:* Blasting media vaporizes after use, provides excellent surface preparation.
*Cons:* Multiple passes may be needed to fully remove paint, capital costs can be high, system may cause worker fatigue.

**Antifoulant Coating Alternatives** - Effective substitutes for organotin (e.g., tributyltin) antifoulant coatings are continually being sought and researched. Copper-based compounds are used as an antifouling biocide but copper releases also cause detrimental environmental impacts. One copper ablative coating is available that binds the copper in the coating and greatly reduces the dispersion rate of the copper.

Another available coating acts to photochemically combine with sunlight and water to product hydrogen peroxide, which continually "bleaches" the hull and discourages antifouling. Finally, slick coatings have been used with some success, such as teflon-based or other non-stick, self-cleaning surface coatings.

Additional research includes a Navy project studying a polymer coating with a chemistry that prevents formation of the strong adhesive bonds marine organisms use to attach to hulls, and another organization is attempting to emulate the properties of seal skin, which naturally deters colonization of fouling organisms.

**Paint and Coating Alternatives** - Water-borne coatings, high-solids paints, and for smaller vessels and parts, powder and/or ultraviolet-cure coatings, contain less or no volatile organic compounds and hazardous air pollutants. Also, some non-pollutant bearing paints include hard epoxies, fluorinated polyurethanes, isothiazolone-based.

**Spray Painting Equipment** - Conventional air spray guns can result in 70 percent to 85 percent of the applied paint going to waste through overspray, which generates air emissions and hazardous waste. Alternatives that reduce paint waste include high-volume, low-pressure (HVLP) spray guns, airless guns, and air-assisted airless guns. HVLP guns

shoot paint at low velocities, which reduces overspray and results in 50 to 60 percent of the applied paint adhering to the work surface. Airless and air-assisted airless guns rely on hydraulic pressure. They are somewhat less efficient with paint than HVLP guns, but can cover work surfaces more quickly.

Some smaller vessels or components may lend themselves to electrostatic spraying where charged powder or paint particles adhere to the grounded workpiece. Electrostatic spraying achieves very high transfer efficiency.

**Spray Painting Techniques** - 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.

**Solid Waste Management** - Finding recyclers for packaging, plastics, metals, office and other grades of paper, cardboard, glass, wood, scrap tires or rubber, and construction and demolition debris, reduces volumes sent to landfills, and saves energy over production of new products with virgin material.

Implementing reuse opportunities, such as chipping scrap wood for landscaping, or recovering oil from oily wastes, and finding suppliers that will refurbish toner cartridges, pallets, packaging, compressed gas cylinders, etc., also helps reduce solid waste to landfills and reduces life cycle impacts of these goods and materials.

## Best Management Practices

| SURFACE PREPARATION, PAINT REMOVAL, SANDING AREAS |
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| 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, plastic, glass, carbon dioxide) |
| Cover drains, storm 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 dry-dock 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 |
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| 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 |

**Topic Hub: Ship Building & Repair Subsection : P2 Opportunities**

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| 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 for the most efficient painting and spraying techniques, and use effective spray equipment that delivers more paint to the target and less overspray |

| PRESSURE WASHING AREAS |
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| Perform pressure washing only in designated areas where wash water containment can be effectively achieved |
| Do not use detergents or additives in the pressure wash water |
| 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 wash water at marine railways |
| Use solid decking, gutters and sumps at lift platforms to contain and collect wash water |
| 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-DRY DOCK ACTIVITIES |
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| 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 |

| DRY DOCK MAINTENANCE AND ACTIVITIES |
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| Clean and maintain dry dock on a regular basis to minimize the potential for pollutants in the stormwater runoff |
| Vacuum or sweep accessible areas of the dry dock to remove debris and spent sandblasting material before flooding |
| If hosing must be used as a removal method, treat as pressure wash water 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) |
| Use plastic barriers beneath the hull, between the hull and dry dock walls for containment |
| Use plastic barriers hung from the flying bridge of the dry dock, 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 |

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| Install tie rings or cleats, cable suspension systems, or scaffolding to make implementation containment easier |

| ENGINE MAINTENANCE AND REPAIRS |
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| 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 |
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| 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 |
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| 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 |

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| 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 |

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The Topic Hub™ is a product of the Pollution Prevention Resource Exchange (P2RX™)

**The Ship Building & Repair Topic Hub™ was developed by:**

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