

Vessel Maintenance and Repair

Environmental Concerns

Vessels require a great deal of attention. They must be scraped, painted, and cleaned. Their engines need to be lubricated and otherwise tended. They need to be prepared to withstand the cold of winter. Each of these activities has the potential to introduce pollutants into the environment.



Sanding, blasting, and pressure washing are meant to remove paint and marine growth. In the process, toxic heavy metals such as copper, lead and tin may be released. If heavy metals find their way into the water, they may be consumed by mussels, worms, and other bottom-dwelling creatures and passed up the food chain to fish, birds, and humans. Heavy metals that are not incorporated into living tissue will remain in the sediments where they will substantially increase the cost of dredge spoil disposal.

Paints, solvents, thinners, and brush cleaners generally are toxic and may cause cancer. If spilled, they may harm aquatic life and water quality. Additionally, the fumes, known as volatile organic compounds (VOCs), released by some paints and solvents contribute to air pollution. Likewise, oil and grease from maintenance areas threaten aquatic life.

Many of the cleaning products meant to be used in boat shops are also toxic. Many contain caustic or corrosive elements. They may also contain chlorine, phosphates, inorganic salts, and metals. Even non-toxic products are harmful to wildlife. For example, detergents found in many boat cleaning products will destroy the natural oils on fish gills, reducing their ability to breathe.

Legal Setting

Environmental Regulation

In Delaware, several types of pollution pertaining to boat maintenance facilities are regulated by the Department of Natural Resources and Environmental Control (DNREC) and include the following: boat maintenance facility construction and operation, hazardous and solid waste generation, accumulation, transportation and disposal, wastewater discharge, underground storage tanks (USTs) installation and operation, and management of stormwater runoff.

Vessel maintenance areas must be sited as far from the water as is practicable, and be designed so that all maintenance activities that are potential sources of water or air pollution can be accomplished over dry land and under roof, where practicable, as determined by the DNREC. Control of by-products, debris, residues, spills, and stormwater runoff shall comply with applicable DNREC regulations. All drains from maintenance areas must lead to a sump, holding tank, or pump out facility from which the wastes can later be extracted for treatment and/or disposal by approved methods. Drainage of maintenance areas directly into surface or groundwater is not permitted.

Call DNREC's Wetlands and Subaqueous Lands Section, (302) 739-9943 for a copy of their publication, *Best Management Practices for Delaware Boat Maintenance Facilities*, May 1997.

Critical Habitat Areas

Critical habitat areas are classified by DNREC and serve an essential role in the support of sensitive species. Critical habitat areas may include unique aquatic or terrestrial ecosystems that support rare, endangered, or threatened plants and animals. Rare, endangered, or threatened species are defined by both state and/or federal listings. For more information visit <http://www.dnrec.state.de.us/nhp/>

Best Management Practices to Control Pollution from Vessel Maintenance and Repair Activities

- Designate Work Areas.** One of the easiest ways to contain waste is to restrict the area where maintenance activities may be performed.
- ❖ All drains from maintenance areas lead to a sump, holding tank, or pump out facility from which the wastes can later be extracted for treatment and/or disposal by approved methods.
 - ❖ Locate maintenance areas as far from the water as possible.
 - ❖ Maintenance areas do not drain directly into surface or groundwater.
 - ❖ Perform all major repairs—such as stripping, fiberglassing, and spray painting—in designated areas.
 - ❖ Collect all maintenance debris. Clean work areas after completing each operation or at the end of the day—whichever comes first. Remove sandings, paint chips, fiberglass, trash, etc.
 - ❖ Vessel maintenance areas should have an impervious surface (e.g., asphalt or cement) and, where practical, a roof. Sheltering the area from rain will prevent stormwater from carrying debris and pollutants into surface waters.
 - ❖ If asphalt or cement is not practical, perform work over filter fabric or over canvas or plastic tarps. Filter fabric will retain paint chips and other debris yet—unlike plastic, or to a lesser extent, canvas—filter fabric will allow water to pass through. Tarps may potentially be re-used multiple times.
 - ❖ Surround the maintenance area with a berm, retaining wall, or vegetative buffer to control runoff.
 - ❖ Clearly mark the work area with signs, e.g., “Maintenance Area for Stripping, Fiberglassing, and Spray Painting.”
 - ❖ Post signs throughout the boatyard describing best management practices that boat owners and contractors must follow, e.g., “Use Tarps to Collect Debris.”
 - ❖ Develop procedures for managing requests to use the work space, to move boats to and from the site, and to insure the use of best management practices.

To collect maintenance debris, consider the purchase or rental of filter fabric to line the work area.

Dave Gohsman, former manager of Port Annapolis, in Annapolis, Maryland, and now Marina Management Consultant at Gangplank Marina in Washington DC, states: "My experience with (manmade) filter cloth is that the customer loved it! Once they saw another customer with it under their boat - they wanted it too. The cost was a low per foot fee and in most cases we used the same piece of cloth for several boats by leaving it in one place and putting successive boats on that spot for a set fee. We accomplished the two basic business prerequisites - to make the customer happy and to make money. Some boats did not contaminate it even a little; others a lot. In addition, the cloth had other uses. We used it to line drains and vaults where we were sure to have run off. This way we caught the particulates. The cloth used this way can be vacuumed once dirty or simply thrown into the dumpster. Wherever you have need of the filter cloth, you also have the opportunity to sell Tyvek suits, hats and shoe covers, face masks and other similar products. The filter cloth starts the package."

Contain Dust from Sanding.

- ◆ Collect debris. Have your waste characterized; if hazardous, you must manage it according to the Delaware Regulations Governing Hazardous Waste (DRGHW).
- ❖ Invest in vacuum sanders and grinders. These tools collect dust as soon as it is removed from the hull. Vacuum sanders allow workers to sand a hull more quickly than with conventional sanders. Additionally, because paint is collected as it is removed from the hull, health risks to workers are reduced.
- ❖ Require tenants and contractors to use vacuum sanders. Rent or loan the equipment to tenants and contractors.
- ◇ Post signs indicating the availability of vacuum sanders and grinders.
- ◇ Bring vacuum sanders to tenants if you see them working with non-vacuum equipment.
- ❖ Conduct sanding in the vessel maintenance area or over a drop cloth.
- ❖ Restrict or prohibit sanding on the water to the greatest extent practical.
- ❖ When sanding on the water is unavoidable, use a vacuum sander and keep dust out of the water.
- ❖ Use a damp cloth to wipe off small amounts of sanding dust.

Contain Debris from Blasting.

- ◆ Collect debris. Have your waste characterized; if hazardous, you must manage it according to the Delaware Regulations Governing Hazardous Waste (DRGHW).
- ❖ Prohibit uncontained blasting.
- ❖ Perform abrasive blasting in the vessel maintenance area within a structure or under a plastic tarp enclosure. Do not allow debris to escape from the enclosure.
- ◇ Investigate alternatives to traditional media blasting. Hydroblasting and mechanical peeling essentially eliminate air quality problems. Debris must still be collected, however. Consider using a filter cloth ground cover.
- ◇ Avoid dust by using strippers that allow the paint to be peeled off. These products are applied like large bandages, allowed to set, and are then stripped off. When the strips are removed, the paint is lifted from the surface. Dust and toxic fumes are minimized.
- ◇ Consider using a closed, plastic medium blast (PMB) system. These systems blast with small plastic bits. Once the blasting is completed, the spent material and the paint chips are vacuumed into a machine that separates the plastic from the paint dust. The plastic is cleaned and may be reused. The paint dust is collected for disposal. A 50-foot vessel will produce about a gallon of paint dust; substantially less than the many barrels full of sand and paint that must be disposed of with traditional media blasting methods.

Minimize Impacts of Pressure Washing.

- ◆ Collect debris (pressure washing solids). Have your waste hauler characterize the waste and bring it to a facility authorized to manage such waste.
- ❖ Visible solids must be removed from wash water before it may be discharged. At a minimum, allow large particles to settle out. More thorough treatment involves filtration or chemical or physical techniques to treat the rinse water:
 - *filtration* uses devices such as screens, filter fabrics, oil/water separators, sand filters, and hay bales to remove particles;
 - *chemical treatment* relies upon the addition of some type of catalyst to cause the heavy metals and paint solids to settle out of the water; and
 - swirl concentrators are examples of *physical structures* that can be used to concentrate pollutants. They are small, compact soil separation devices with no moving parts. Water flowing into a concentrator creates a vortex that centralizes the pollutants. Clean water is then discharged.
- ❖ Pressure wash over a bermed, impermeable surface that allows the waste water to be contained and filtered to remove particulates and solids.
- ❖ When pressure washing ablative paint, use the least amount of pressure necessary to remove the growth but leave the paint intact. Where practical, use a regular garden-type hose and a soft cloth.
- ❖ Reuse the wash water. For example, recycle it through the power washing system (a closed water recycling operation).

Bottom Paints

Currently there are 3 main options for recreational boat owners to think about for slowing the growth of organisms on their boat's bottom.

1. Keep the boat out of the water, and wax the bottom of the boat.
2. Use copper based anti-fouling paints.
3. Use alternative bottom coatings.

If the boat is kept out of the water, whether it be on a trailer, an electric hoist at the slip, or in a dry-stack storage facility, the boater may prefer to avoid the hassles of painting the bottom of the boat. With a sturdy Teflon wax on top of the gelcoat, the boater will be ready for daytrips, and can wash the boat bottom on it's way out of the water each night.

The second, more traditional option, is to use some type of anti-fouling paint. Through the centuries, copper has been the preferred coating for boats. (Some even say Columbus had sheets of copper attached to the bottom of some of his boats but it's hard to find photographs of that.) The same copper that keeps a boat bottom clean of barnacles has also been shown to be toxic to other marine life. Copper in the bottom paint or hull sheathing enters the water and sediments, where it can be accumulated by marine life, and has been linked to impaired growth in clams, mussels, and other shellfish (Sobral & Widdows 1997).

These days you can buy paints that contain the biocide cuprous oxide (Cu_2O) copper bottom paints with between 20% and 76% cuprous oxide, depending on the brand and formulation.

Pressure washing wastewater should not be discharged directly to septic tanks or surface waters. It may contain both the organic material off the bottom of the boat as well as flakes or small bits of toxic paint.

A list of vendors of pressure wash recovery systems can be obtained from DNREC's Pollution Prevention Program at (302) 739-9909.



See also the Clean Boating Tip Sheet, "Selecting a Bottom Paint", at the end of Chapter 11

Antifouling paints can be separated into three general categories:

Leaching (Hard) Paints. Water soluble portions of leaching antifouling paints dissolve slowly in water, releasing the pesticide. The insoluble portion of the paint film remains on the hull. The depleted paint film must be removed before the boat is repainted. Most leaching paints are solvent based. Consequently, fumes are a concern.

Ablative (Soft) Paints. Ablative antifouling paints also leach some toxicant into the water. The major difference is that as the active ingredient is leached out, the underlying film weakens and is polished off as the boat moves through the water. As the depleted film is removed, fresh antifouling paint is exposed. There are several water-based ablative paints on the market that are up to 97% solvent free. As a result, levels of volatile organic compounds are substantially reduced as compared to solvent-based paints. Ease of clean up is another advantage of water-based paints.

Non-toxic Coatings. Teflon polyurethane, and silicone paints are nontoxic options. With hard, slick surfaces, natural foulants find it more difficult to adhere.

Antifouling coatings are designed to release copper through passive leaching (hard paints) and ablation (soft paints). One thing to know is that you don't need the highest amount of copper content to do a good job in preventing growth. Paint distributors in the mid-Atlantic area generally recommend something like Micron CSC, with 37% copper content, or Pettit Trinidad with 65-76% copper content, since they provide enough toxicity to prevent the major anti-fouling problems. Most recently some "slime inhibitors" have also been added to these paintings, to try to address other bottom maintenance concerns.

Other metals have been tried in bottom paints, including the tributyltin (TBT), seen on race boats and ships up through the early 1990s. While TBT created a very nice smooth finish, it was also found to be a major environmental problem. Studies showed that TBT altered the development and reproductive success in oysters, clams and snails (EPA 1993). As a result, the Organotin Antifoulant Paint Control Act of 1988 restricted the use of tributyl tin based paints. This law restricts use of TBT paints to aluminum hulled vessels, on boats larger than 82 feet (25 meters) and on outboard motors and lower drive units. Any boatyard operator wishing to apply TBT paints must obtain a TBT/pesticide applicator's license from the DE Department of Agriculture. Contact them at (800) 282-8685 for more information.

Looking towards the future, and analyzing international trends with TBT, experts predict a total ban on TBT coming to the United States, via federal legislation in the next few years. While nothing is yet firm, marina operators should be aware that:

Boats painted with TBT may not be welcomed into US waters after January 1, 2008. This alert should help alert both marinas and boat owners that alternatives to TBT should be sought out and used on recreational boats, so as not to create a problem later.

Finally, because of rising concerns about the long-term toxicity of the copper bottom paints, there are alternative non toxic bottom coatings being developed, and on the market. They are being created primarily in the European and commercial shipping market, but recreational boating will see a trickle down effect.

Some of these products, the silicone based or ceramic based paints are not anti-fouling. Instead, they are extremely slick and they work because they are too slick for the fouling organisms to adhere. This is great news, but they will take a very different application and maintenance scenario than most of us are used to. Studies have shown that if a boat is used once a week, and goes faster than 15 knots, that most of the fouling from the week slides off these bottoms. However, for the average boat owner who leaves their slip far less often, and perhaps has a sailboat that can't go 15 knots, the coatings may not be a real viable solution. They will require more maintenance, perhaps twice as much in-water scraping, and they will require some very different application methods and haul out methods. Time will tell – pilot tests are being conducted on these products in the California market now.

Minimize Impacts of Paints.

- ❖ Recommend antifouling paints which contain the minimum amount of toxin necessary for the expected conditions to your customers.
- ❖ Avoid soft ablative paints.
- ❖ Use water-based paints whenever practical. Touch up areas under jack stands with quick-drying, solvent-based paints. Ask your sales representative to recommend compatible paints.
- ❖ Store boats out of the water, where feasible, to eliminate the need for antifouling paints.
- ❖ Stay informed about alternative bottom coatings, like Teflon, silicone, polyurethane, and wax, that have limited negative impacts. Pass the information along to your customers.

Minimize Impacts of Painting Operations.

- ❖ Use brushes and rollers whenever possible.
- ❖ Reduce paint overspray and solvent emissions by minimizing the use of spray equipment.
- ❖ Prohibit spray painting on the water.
- ❖ Conduct all spray painting on land, in a spray booth, or under a tarp.
- ❖ Use equipment with high transfer efficiency. Tools such as high-volume, low-pressure (HVLP) spray guns direct more paint onto the work surface than conventional spray guns. As a result, less paint is in the air, less volatile organic compounds are released, less paint is used, and clean up costs are reduced. Air-atomizer spray guns and gravity-feed guns are other types of highly efficient spray equipment.
- ❖ Train staff to use spray painting equipment properly in order to reduce overspray and minimize the amount of paint per job.
- ❖ Limit in-water painting to small jobs. Any substantial painting should be done on land, in the vessel maintenance area, and/or over a ground cloth.
- ❖ If painting with brush or roller on the water, transfer the paint to the vessel in a small (less than one gallon), tightly covered container. Small containers mean small spills.
- ❖ Mix only as much paint as is needed for a given job.
- ❖ Mix paints, solvents, and reducers in a designated area. It should be indoors or under a shed and should be far from the shore.
- ❖ Keep records of paint use to show where too much paint was mixed for a job. Use the information to prevent over-mixing in the future.

Handle Solvents Carefully. Refer to Chapter Waste Containment and Disposal for further information about requirements for handling, storing, and transporting hazardous wastes.

- ◆ Store open containers of usable solvents as well as waste solvents, rags, and paints in covered, UL-listed, or Factory Mutual approved containers.
- ◆ Hire a licensed waste hauler to recycle or dispose of used solvents.
- ❖ Direct solvent used to clean spray equipment into containers to prevent evaporation of volatile organic compounds. A closed gun cleaning system will save you money on cleaning materials.

To operate a permanent paint spray booth, you must obtain an air permit from the Air Quality Management Section, DNREC at (302) 793-9402 or DNREC's Clean Air Act Ombudsman at (302) 739-9909.





The Marina Operations and Maintenance (O&M) Plan requires that marinas address the storage and handling of all materials used in maintenance, as well as storage, handling, and disposal of wastes, with the goal of minimizing the discharge of pollutants to surface waters.

- ❖ Use only one cleaning solvent to simplify disposal.
- ❖ Use only the minimal amount of solvent (stripper, thinner, etc.) needed for a given job.
- ❖ For small jobs, pour the needed solvent into a small container in order not to contaminate a large amount of solvent.
- ❖ Use soy-based solvents and other similar products with no or low volatility.
- ❖ Order your spray painting jobs to minimize coating changes. Fewer changes mean less frequent purging of the spray system. Order your work light to dark.
- ❖ Allow solids to settle out of used strippers and thinners so you can reuse solvents.
- ❖ Keep records of solvent and paint usage so you have a handle on the amount of hazardous waste generated on site.

Repair and Maintain Engines with Care.

- ❖ Do not wash engine parts over the bare ground or water.
- ❖ Adopt alternatives to solvent-based parts washers such as water-based and/or bioremediating systems that take advantage of microbes to digest petroleum. Bioremediating systems are self-contained; there is no effluent. The cleaning fluid is a mixture of detergent and water. Microbes are added periodically to “eat” the hydrocarbons.
- ❖ Store engines and engine parts under cover on an impervious surface like asphalt or concrete.
- ❖ Use dry pre-cleaning methods, such as wire brushing.
- ❖ Avoid unnecessary parts cleaning.
- ❖ If you use a solvent to clean engine parts, do so in a container or parts washer with a lid to prevent evaporation of volatile organic compounds. Reuse the solvent. Once the solvent is totally spent, recycle it.
- ❖ Water-soluble engine washing fluids should be treated in the same manner as other industrial wastewaters.
- ❖ Use drip pans when handling any type of liquid. Use separate drip pans for each fluid to avoid mixing. Recycle the collected fluid.
- ❖ Use funnels to transfer fluids.
- ❖ Drain all parts of fluids prior to disposal.
- ❖ Clean engine repair areas regularly using dry cleanup methods, e.g., capture petroleum spills with oil absorbent pads.
- ❖ Prohibit the practice of hosing down the shop floor.

Winterize Safely.

- ❖ Use propylene glycol antifreeze for all systems. It is much less toxic than ethylene glycol antifreeze.
- ❖ Use the minimum amount of antifreeze necessary for the job.
- ❖ For health reasons, ethylene glycol should never be used in potable water systems; it is highly toxic and cannot be reliably purged come springtime.
- ❖ Add stabilizers to fuel to prevent degradation. Stabilizers are available for gasoline and diesel fuels and for crankcase oil. These products protect engines by preventing corrosion and the formation of sludge, gum, and varnish. Also, the problem of disposing of stale fuel in spring is eliminated.

- ❖ Be sure fuel tanks are 85-90% full to prevent flammable fumes from accumulating and to minimize the possibility of condensation leading to corrosion. Do not fill the tank more than 90% full. The fuel will expand as it warms in the springtime; fuel will spill out the vent line of a full inboard tank.
- ❖ Use the highest rated octane recommended by the engine manufacturer; premium fuels are more stable than regular.
- ❖ Be sure the gas cap seals tightly.
- ❖ Promote reusable canvas or recyclable plastic covers. Some manufacturers will clean and store canvas covers during the boating season.
- ❖ Recycle used plastic covers (Shrink Wrap) whenever possible.

Help Your Customers and Contractors to Conduct Maintenance Wisely by Encouraging the Following Practices:

- ◆ Only biodegradable detergents are allowed for vessel washing and cleaning within Delaware waters. Discharge treated wash water to surface water if no detergents or other chemical cleaning agents were used.
- ❖ If the impacts of cleaning or maintenance activities (regardless of area involved) cannot be contained or mitigated against, remove the boat from the water. No debris should be allowed to fall into the water.
- ❖ Keep containers of cleaning and maintenance products closed.
- ❖ Restrict or prohibit sanding on the water. When it is absolutely necessary to sand on the water, use vacuum sanders to prevent dust from falling into the water. Do not sand in a heavy breeze.
- ❖ Plug scuppers to contain dust and debris when the boat is in the water.
- ❖ Do not spray paint on the water.
- ❖ Discourage underwater hull cleaning of anti-fouling paints in your facility. Given the concentration of boats, underwater cleaning is dangerous to divers and the heavy metals that are released are harmful to aquatic life. Insurance to cover divers is also expensive.
- ❖ Educate your customers about the difference between ablative and hard paints and their maintenance, as well as alternative bottom coatings. See pages 5-4 and 5-5 for a discussion on bottom paint.
- ❖ Incorporate guidelines for boat maintenance into slip leasing agreements.
- ❖ Require maintenance contractors to register at the marina office and obtain and follow your guidelines for appropriate maintenance practices.
- ❖ Perform all major repairs at designated maintenance areas (and help customers know where they are).
- ❖ Make use of dustless sanders and ground tarps.
- ❖ Fill fuel tanks only 90% full – for winter or summer – to prevent overflow when fuel expands.
- ❖ Copy the Vessel Cleaning and Maintenance, Selecting a Bottom Paint, and Underwater Hull Cleaning tip sheets from the back of this book (after Chapter 11) and distribute them to your customers. There is room on each sheet to add your marina's name and logo.
- ❖ Find out about local hazardous waste collection days. Check your local phone book, or call the Delaware Solid Waste Authority Recycling Manager at (800) 404-7080, or visit www.dswa.org for local recycling contacts. Post notices informing your tenants when and where they can take their hazardous wastes.
- ❖ Offer incentives, like reduced mid-season haul out rates, so that boaters can have their hulls cleaned on land where contaminants may be contained.

Information Sources

Department of Natural Resources and Environmental Control (DNREC)

- Marina Regulations Wetlands and Subaqueous Lands Section (302) 739-9943
- Solid and Hazardous Waste Hazardous Waste Management Branch (302) 739-9403
- Surface Water Discharge Section (302) 739- 9946
- Underground and Aboveground Storage Tanks Tank Management Branch (302) 395-2500
- Watershed Assessment Section (302) 739-9939
- Air Quality Management Section (302) 739-9402

Delaware Department of Agriculture (800) 282-8685

Delaware Solid Waste Authority (800) 404-7080