

Division 101 Appendix 1

Best Pollution Prevention Practices For Abrasive Blast Media Waste From Shipyard Repair Activities

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Based on Best Management Practices Manual for the Shipbuilding and Repair Industry, The Commonwealth of Virginia State Water Control Board.

FORWARD

There has been increasing concern in recent years about pollutants generated by the shipbuilding and repair industry. In particular, abrasive blast media, metals, metal related compounds, petroleum associated hydrocarbons and antifouling ingredients in paints have come under scrutiny. One reason for concern with pollutants generated by ship repair activities is the close proximity to water and the potential to pollute this resource. Technical inspections and toxics monitoring of shipyard effluent show that significant levels of pollutants are generated by shipbuilding, repair and maintenance operations. Inspections demonstrate a continuing effort by the DEQ to prevent shipyard-related pollutants from entering State waters, particularly to sensitive bays and estuaries.

As a result of these inspections, it was evident that Best Pollution Prevention Practices (BPP's) for the ship and boat repair industry were necessary. In 1993, the DEQ proceeded with the identification of general BPP's applicable to this industry. National Pollutant Discharge Elimination System (NPDES) permits were written to include BPP language, however, the permit wording was later determined to be too general. It was apparent that BPP's were needed that would contain practical hazardous sandblast grit containment methods .

This manual was developed through literature search, yard inspections and discussions between DEQ and the marine industry, and is designed to serve as an introduction to pollution prevention for repair facilities that do abrasive blasting. Implementation of BPP's described herein should provide significant and economical pollution control at boat yard and repair facilities.

Because the Department of Environmental Quality is not responsible for the implementation and maintenance of the BPP's described in this manual, and does not have daily control over each facility's particular use of the BPP's, the Department will not guarantee or warrant the performance or results that may be obtained by the implementation of the BPP's described herein; only that the BPP's will perform substantially in accordance with the specifications and constraints set forth in this manual, assuming they are properly installed and maintained.

BPP's are intended to complement, not substitute, existing Federal and State regulations.

INTRODUCTION

The shipbuilding and repair industry presents a unique problem in terms of applying pollution control techniques. Although a given facility may not compare exactly with another facility in terms of repair capabilities, type and size of docks, and so on, there are enough similarities between facilities to describe pollution control techniques that can be adapted to suit a specific site.

There are several different functions that occur at ship and boat repair facilities. Some facilities employ a few people, while others employ many people, including various

subcontractors, blacksmiths, boilermakers, chemists, carpenters, electricians, laborers, machinists, welders, painters, sandblasters, riggers, pipe fitters and a number of administrative and managerial staff.

Each of these facilities and associated shipyard services create their own unique set of potential environmental concerns. A tremendous amount of spent blast abrasive dust and grit is generated daily. Millions of gallons of vessel discharges are piped, collected, tested, treated, recycled or transported. Air pollution, noise pollution and water pollution can occur simultaneously with the variety of operations that take place.

There are hundreds of smaller shipyards and marinas which service small commercial and private boats, in addition to large shipyards which service everything from small vessels and marine equipment to super structures.

Abrasive blasting at repair facilities presents an especially challenging task in terms of pollution control because this activity results in a very fine airborne dust which is difficult to contain, it is generated in large volumes, and it takes place near water resources. Add to this complexity, antifouling ingredients which can be deadly to water organisms. Abrasive blasting clearly is what is known as a "cross media" pollutant which affects air, water and land.

While there are a variety of pollutants that may result from activities at repair facilities: abrasive blast and paint, lubricants and oils, solvents, vessel discharge, storm water runoff, etc., all of which need to be properly managed to insure protection of the environment, this manual focuses on one of the biggest problems in the shipyard industry: controlling the pollutants associated with paint removal operations.

SECTION ONE

ABRASIVE BLASTING AND ANTIFOULING PAINT

There are a variety of abrasive blast materials that can be used in air or water blasting processes used to remove paint from vessels and marine structures. Blast material particles, also referred to as "grit", are about 1/8" in diameter. These normally jagged, or sharp-edged particles become rounded and somewhat reduced in size after being blasted against a vessel's hull, for example, to remove paint.

Vessels, depending on the size, can use an enormous amount of grit for both interior and exterior blasting. One large supertanker, for example, may require up to 40,000 tons of grit just to do interior blasting. The amount of grit needed to remove paint from a vessel's exterior depends on the surface condition of the hull (i.e., was the previous paint put on bare metal, or over existing paint), the nozzle diameter of the hose used in abrasive blasting, and the number of coats to be removed and other contract specifications.

Some of the brand names of abrasive blast material include: Black Blast, Black Beauty, Fines Blast and Green Diamond. The constituents of abrasive blast varies somewhat, but in general the primary components with approximate percentages are:

Silicon Dioxide	20-50%
Iron Oxide	15-40%
Aluminum Oxide	0-25%
Calcium Oxide	0-25%

These four components comprise up to 90 percent of the abrasive grit composition. Other abrasive grits may contain as much as 10-15 percent zinc oxide or 20-25 percent magnesium oxide. Trace elements in these abrasive grits include: potassium oxide, sodium oxide, copper, titanium and sulfur.

Spent abrasive blast material may contain a variety of pollutants. Fresh, or unused abrasive blast media is even considered a "dangerous" or "special" waste in some states due to gill abrasion which can be fatal to some fish; therefore, abrasive blast media, used or unused, should not be discharged into State waters.

When hydroblasting, rust inhibitors such as sodium nitrite or diamonium phosphate may be used. In certain situations, antifreeze may also be part of the water jet to reduce ice formations.

Antifouling paints are used on vessels and marine structures to control the growth and attachment of "fouling" organisms such as barnacles, seaweed and algae. This is the intended effect of antifouling ingredients in paint. However, some antifouling ingredients, such as Tributyltin (TBT) can have a deadly effect on species other than fouling organisms. TBT is highly toxic in small concentrations to fish, oysters, clams and other forms of water life, so proper management of TBT-containing paint, and while blasting vessels that have been painted with TBT paint, is extremely important.

How does Tributyltin, and other antifoulants get into the environment?

Here are some of the most common ways:

- External blasting out of dry docks or contained areas
- Uncovered or loosely covered sandblast waste piles where grit blows away, or rainwater leaches antifoulant into nearby surface water or groundwater
- Sweeping or hosing sandblast grit waste into water
- Submerging dry docks with grit waste on them
- Overspray of TBT or other antifouling paints

Not only can mismanagement of waste containing antifoulants kill water organisms, but mismanagement of antifouling paints is a violation of hazardous and solid waste regulations.

The following section provides suggested Best Pollution Prevention Practices that are intended to be used as general guidelines to achieve the underlying objective of protecting the air, water and land from abrasive blast media, which may or may not contain antifouling ingredients.

SECTION TWO

ABRASIVE BLASTING: BEST POLLUTION PREVENTION PRACTICES

It is easy to understand the magnitude of controlling the pollutants associated with paint removal operations when the multitude of marine paints, which contain hazardous and toxic chemicals, is considered. And this is just one aspect of the activities that go on in ship repair. Besides blasting operations which are ongoing, there is the potential for large quantities of paints, thinners and solvents to enter State waters, either by accidental spills, poor cleaning procedures or improper disposal. When these paints are blasted off of vessels and marine structures, thousands of tons of grit waste are generated. The following Best Pollution Prevention Practices describe various methods of containing abrasive blasting:

BPP ONE: SHROUDING

Vessel maintenance generally involves some amount of abrasive blasting with copper, nickel or some other type of slag, or steel shot. These operations may be carried out on the ship's interior tanks and compartments or on the exterior hull and upper decks. The use of blast abrasive or paint represents a major pollutant source which may be lost, directly or indirectly to the water during the repair work.

While performing abrasive blasting or painting operations in floating dry docks, wet slips and marine railways, or other areas where blast material may reach State water, shroud material should be erected to prevent the loss or scattering of these potential pollutants. Shroud material should be used in graving docks as well, particularly extending from the ship sides to the top of the graving dock walls. In addition, shrouding should be incorporated with all blasting or painting performed on super structures.

BPP OBJECTIVE:

The use of shrouds can reduce or prevent the loss of abrasive blast grit and paint to the water surface. Shrouding can also reduce the scattering effects of wind and localize the area needing cleanup.

CRITERIA:

The shroud must be large enough to adequately enclose or segregate the working area. The bottom of the shroud should be fastened to the dock floor.

The shroud must be sufficiently supported to withstand minor wind stress. Support structures should be used in conjunction with the shroud.

With the shrouding in place the drydock space beneath the shrouding would be considered a confined space. To comply with OSHA 1915 standards, fresh air respirators for all personnel is required and proper ventilation, blowers, fans and all electrical equipment must be intrinsically safe.

Floating Drydocks

It is recommended that lightweight, polyethylene shroud be used for vertical hanging. Small sections of the material can be tied together to form larger shrouds for hanging at the aft and bow sections of the dock. The shroud may have screened flaps or openings to lessen wind stresses. The material can also be manufactured with grommets and securing (spring type) hooks which are used to hang the shroud. Typically the shroud can be fastened to cables connected to dock wing walls or cables which are strung from the top of one wing wall to the other wing wall. Ropes or cables can be fastened to grommets on the center of the shrouds to enhance vertical hanging stability.

The material can also be used to shroud the larger sally ports of some docks. For work on upper sides of vessels, the shroud should be fastened from the ship decks to the dock wing walls. The bottom of the shroud should hang sufficiently upon the dock floor to allow it to be weighted down or fastened. Straw bales should be placed on the floor behind the bottom of the shroud. Periodically, scattered abrasive will be blown and trapped under the shroud. This material needs to be swept up daily to prevent it from escaping into the water. Shrouding, combined with other Best Pollution Prevention Practices should provide an effective method for controlling blast abrasive and paint overspray on floating dry docks.

Graving Docks

The primary concern at these facilities involves using shrouds to prevent blast abrasives and paint overspray from exiting the top of the dock. Therefore, shrouds should be erected between the vessel deck to the dock walls. Vessel deck abrasive blasting and painting activities should be shrouded in a dome-like fashion to prevent the scatter and loss of pollutants.

Marine Railways

Marine railways present a different problem in controlling spent abrasive blast material. These are areas that are essentially uncontained and open to the effects of the wind. Two methods are suggested to control abrasive scatter at railways. The first technique involves erecting poles or masts at each end of the railway in a semicircular fashion. The poles can hold rolled-up shrouds that are lowered when needed. Shroud is also hung vertically from the railway wing wall scaffold to prevent abrasive loss on the railway sides. The top is then protected by stringing shroud from the vessel deck to the side wall scaffolds. Some railways may not have side wall scaffolds, It is then necessary to erect masts which encircle the entire railway work area.

Another acceptable technique involves segregating the water surface from the railway work area. Masts are erected along the shoreline which hold the shrouds. The vessel is raised and the shrouds are strung to form a barrier between the water surface and the work area. A portable scaffold is then placed around the immediate work area of the vessel. The scaffold is covered with shroud material. The workman is required to work within the shroud scaffold, which must be moved as the workman moves along the length of the vessel. Abrasive material that escapes the shrouding scaffold will be further confined to the work area by the shoreline shrouding. Timely cleanup and railway underpaving play an important and equal role in ensuring that the pollutants will not enter State waters. A lighter may be required in conjunction with shrouding for ships that overhang a marine railway, or on the pier side of a vessel in a wet slip.

Wet Slip

Wet slips are the most difficult locations to attempt to control abrasive scatter and paint overspray. Such work in this area will most likely result in the loss of pollutants to the water surface. To properly conduct blasting and painting operations at wet slips, it will be necessary to use the pier, scaffolding, lighters and the vessel to erect shrouds. Only small sections of a vessel should generally be worked on at any time. Protecting surface waters from wet slip blasting and painting is a time consuming and difficult task which must conform to the varying size and shape of each vessel. This task can be made more efficient by erecting masts along the pier and by using magnets against the vessel hull to hold the shroud in place. The lighters and the pier should be cleaned up at the end of each work shift.

CONCERNS

To be effective, the shrouding must be properly designed, constructed positioned and erected.

The use of magnets to hold shrouding may be acceptable if sensitive electronic equipment is on board the vessel. Enhance lighting outline in OSHA 1915.92 standards and forced supply and exhaust ventilation may be required for the shrouded work areas.

While certain concentrations of blast dust are airborne and during all painting evolutions, the concentrations of fumes and dust will require continuous monitoring for the LEL and O₂ contents by a Marine Chemist or OSHA Certified Competent Person.

BPP TWO: OVERWATER PROTECTION

General work and repairs are continually being performed around or adjacent to wet slip piers, floating dry docks, marine railways and the exterior and interior sides and the upper decks of ships. Much of this work generates trash and pollutants of various forms which potentially may fall onto the water surface below. The use and proper positioning of lighters (pontoons, small floating decks or barges, etc.) can enhance the ability to retrieve pollutants prior to inadvertent loss to surface waters.

BPP:

Provide and position a lighter adjacent to ships, floating dry docks, piers and marine railways. These work platforms provide a catch surface for trash, paint spray, grit, paint slop, oil slop, etc.

Lighters should be used to protect the water surface underneath and adjacent to vessels in wet slips and vessels which overhang marine railways and floating dry docks.

BPP OBJECTIVE:

The primary objective is to catch the waste pollutant material prior to being lost to the water surface where cleanup becomes more difficult. The lighters need not necessarily be used primarily for workmen or machinery support but rather to catch discarded materials and pollutants.

Lighters also provide a surface for performing work related operations. The lighter should carry a drip pan in which all fluids (paints, solvents, oils, etc.) are contained. A drop cloth should be placed under the drip pan to catch fluid "slosh" over the pan rim due to wave action or transport. Following use of the drip pan, it must be removed from the lighter and cleaned. The waste fluids should be placed in proper storage containers for subsequent disposal.

For abrasive blasting and painting operations, lighters are to be used in conjunction with shrouding. Booms and/or absorbent devices are to be placed around the lighter to contain contaminants which reach the water surface.

CRITERIA:

Proper positioning of the lighter is of utmost importance to prevent pollutants from reaching surface waters. The lighter must be large enough to catch falling pollutants and stable enough to support workmen and required equipment. A tarpaulin or other protective coverings should be employed if the spacing between flooring boards is great enough to allow pollutants to fall through. The mixing of paints, solvents, or other hazardous materials should not be permitted on the lighter. This should be performed at a designated mixing area.

CONCERNS:

Use of a lighter requires that cleanup operations are periodically performed. Cleanup of the lighter should occur daily, and if, possibly, after every work shift. Cleanup procedures include sweeping or vacuuming spent abrasive and trash and placing the debris into designated disposal containers.

BPP THREE: WATER BLASTING, HYDROBLASTING, WATER-CONE BLASTING AND SLURRY BLASTING

Water blasting, hydroblasting, water-cone blasting and slurry blasting is performed to either clean sediment and marine growth from vessel hulls or to remove the top layers of

hull paint. These techniques will generate large volumes of water with the potential of transporting existing pollutants to surface water.

BPP:

Water blasting, hydroblasting, slurry blasting and/or water-cone blasting should not be conducted unless prior cleanup of the dry dock or marine railway floor is complete.

Water blasting runoff should be channeled into floor sumps where the wastewater will be pumped to grit removal basins/sedimentation tanks for settling treatment. The effluent discharge from the sedimentation treatment must be NPDES permitted.

Prior to entering floor drains and sumps, water blasting runoff may also be channeled through straw bales and/or sand bags which will catch most of the particles of paint and marine growth. Once the floor is dry the collected particles may be removed employing graving dock and floating dry dock clean-up methods.

BPP OBJECTIVE:

Water blasting techniques produce a scattered water pattern which is difficult to control or immediately contain. Unless prior cleanup of the dock or marine railway floor has been conducted, it is difficult to prevent water blast from contacting pollutants.

CRITERIA:

Runoff generated from water blasting, hydroblasting, slurry blasting and/or water-cone blasting should not be allowed to discharge directly into surface waters from graving docks, floating dry docks, or marine railway work areas.

The design flow of the collection and treatment system must be adequate to receive the water blasting runoff flow rates. Special consideration should be given to pumping and treatment of slurry blast runoff.

CONCERNS:

All pump connections, valves, meters and couplings must be watertight. Leaks must be immediately repaired when discovered.

BPP FOUR: ABRASIVE BLAST MATERIAL CONTAINMENT

Abrasive blasting is generally one of the preliminary tasks performed when a vessel is docked for repairs and maintenance. The task typically involves blasting the vessel hull or upper decks with nickel, copper or some other type of slag or steel shot to remove layers of old paint. Blasting generates a tremendous volume of spent abrasive which must be cleaned up and contained on a frequent basis.

BPP:

Spent abrasive blast must be stored in proper containment vessels or structures while on the shipyard site. Containment bins, tanks or hoppers must have covers to prevent rainwater from entering the structure and percolating through the stored abrasive.

BPP OBJECTIVE:

The objective is to store all spent abrasive in appropriate containment vessels until ultimate disposal off site. Proper containment involves not allowing any stormwater runoff or accidental discharges to come into contact with the abrasive. This method eliminates the typical procedure of storing voluminous piles of spent abrasive on bare ground. Storing the abrasive in yard stockpiles promotes pollutant runoff.

CRITERIA:

The containment structures may consist of specifically designated hoppers for holding abrasive; metal bins with covers, or a concrete containment pit or slab (three-walled) with runoff channels to sedimentation treatment units.

CONCERNS:

Treatment units which provide a discharge must be NPDES permitted. The NPDES permit may require more advanced treatment than sedimentation.

There must be an appropriate storage volume available on site to contain all spent abrasive.

BPP FIVE: RECORD KEEPING

Due to the nature of the shipyard repair business, BPP installations are in constant need of repair, replacement, inspection and cleanup. Records indicating a history of maintenance should be kept to provide a good indication of the current reliability of existing BPP's.

BPP:

Records should be maintained to document BPP's at the facility. The type of records which should be maintained include, but are not limited to, the following:

1. Quantities of abrasive which are used for blasting and quantities which are retrieved through cleanup.
2. Date of installation of a BPP control, inspections and subsequent repairs or replacements to the BPP including such items as how often straw bales, absorbent booms and other filtering devices are replaced and/or cleaned.
3. A listing of BPP equipment, and supplies.
4. Date, time, description and action taken for any chemical spills.
5. The location, quantities, destination and hauler of vessel discharge waters and spent abrasive material.

6. Waste inventory records.

CRITERIA:

Record keeping should be maintained by designated individuals responsible for the task. The records should be kept at a specified location for review upon request.

BPP SIX: BPP TRAINING

BPP:

Shipyards management should provide all employees with regularly scheduled Best Pollution Prevention Practices seminars and discussions related to shipyard pollutants and pollutant runoff. The training should emphasize procedure, BPP techniques and supervisory responsibility and accountability. Subcontracting firms in the shipyard should be strongly encouraged to participate in the BPP program.

BPP OBJECTIVE:

Training each employee about the fundamentals of BPP control lessens the chance of recurrent pollutant discharges. Providing each officer, manager, supervisor, dock master, etc., with a strong sense of BPP commitment ensures solutions for recurring problems.

CONCERNS:

The primary concern is that not enough emphasis is given to teaching employees about the rudimentary aspects of Best Pollution Prevention Practices. Each new employee should be made aware of the BPP's as part of new employee training.