

November 1995  
NSRP 0458

SHIP PRODUCTION COMMITTEE  
FACILITIES AND ENVIRONMENTAL EFFECTS  
SURFACE PREPARATION AND COATINGS  
DESIGN/PRODUCTION INTEGRATION  
HUMAN RESOURCE INNOVATION  
MARINE INDUSTRY STANDARDS  
WELDING  
INDUSTRIAL ENGINEERING  
EDUCATION AND TRAINING

# **THE NATIONAL SHIPBUILDING RESEARCH PROGRAM**

## **Air Quality Best Management Prac- tice (AQBMP) Resource Document for Shipyards**

U.S. DEPARTMENT OF THE NAVY  
CARDEROCK DIVISION,  
NAVAL SURFACE WARFARE CENTER

in cooperation with  
National Steel and Shipbuilding Company  
San Diego, California

# Report Documentation Page

*Form Approved*  
*OMB No. 0704-0188*

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE <b>NOV 1995</b>	2. REPORT TYPE <b>N/A</b>	3. DATES COVERED <b>-</b>		
4. TITLE AND SUBTITLE <b>The National Shipbuilding Research Program, Air Quality Best Management Practice (AQBMP) Resource Document for Shipyards</b>		5a. CONTRACT NUMBER		
		5b. GRANT NUMBER		
		5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S)		5d. PROJECT NUMBER		
		5e. TASK NUMBER		
		5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>Naval Surface Warfare Center CD Code 2230-Design Integration Tower Bldg 192, Room 128 9500 MacArthur Blvd Bethesda, MD 20817-5700</b>		8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		10. SPONSOR/MONITOR'S ACRONYM(S)		
		11. SPONSOR/MONITOR'S REPORT NUMBER(S)		
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release, distribution unlimited</b>				
13. SUPPLEMENTARY NOTES				
14. ABSTRACT				
15. SUBJECT TERMS				
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT <b>SAR</b>	
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>		18. NUMBER OF PAGES <b>108</b>
				19a. NAME OF RESPONSIBLE PERSON

## DISCLAIMER

These reports were prepared as an account of government-sponsored work. Neither the United States, nor the United States Navy, nor any person acting on behalf of the United States Navy (A) makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness or usefulness of the information contained in this report/manual, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or (B) assumes any liabilities with respect to the use of or for damages resulting from the use of any information, apparatus, method, or process disclosed in the report. As used in the above, "Persons acting on behalf of the United States Navy" includes any employee, contractor, or subcontractor to the contractor of the United States Navy to the extent that such employee, contractor, or subcontractor to the contractor prepares, handles, or distributes, or provides access to any information pursuant to his employment or contract or subcontract to the contractor with the United States Navy. ANY POSSIBLE IMPLIED WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR PURPOSE ARE SPECIFICALLY DISCLAIMED.

November 1995  
NSRP 0458

**IN COMMITTEE  
PROVEMENTS  
PRODUCTION AIDS  
NG FOR SHIPBUILDERS  
TANDARDS THE NATIONAL  
TION INTEGRATION SHIPBUILDING  
FOR SHIPBUILDING RESEARCH  
ON AND COATINGS PROGRAM  
AL EFFECTS  
TRANSFER  
ING  
PS**

**Air Quality Best Management Practice (AQBMP)  
Resource Document For Shipyards**

**US. DEPARTMENT OF THE NAVY  
CARDEROCK DIVISION,  
NAVAL SURFACE WARFARE CENTER**

in cooperation with  
**National Steel and Shipbuilding Company  
San Diego, California**

**FINAL REPORT**

**AIR QUALITY BEST MANAGEMENT PRACTICE  
(AQBMP) RESOURCE DOCUMENT  
FOR SHIPYARDS**

Prepared by  
**NATIONAL STEEL AND SHIPBUILDING COMPANY**  
and  
**JACOBS ENVIRONMENTAL CONSULTING**

For

**NATIONAL STEEL AND SHIPBUILDING COMPANY**  
Harbor Drive and 28th Street  
Post Office Box 85278  
San Diego, CA 92186-5278

In Behalf Of  
SNAME SPC PANEL SP-1

FACILITIES AND ENVIRONMENTAL EFFECTS

Under the  
**NATIONAL SHIPBUILDING RESEARCH PROGRAM**

November 1995

Task N1-944

## Executive Summary

Air quality issues have gained much importance due to the promulgation of federal regulations such as the 1990 **Clean Air Act** Amendments (CAAA). As environmental regulations increase in rigidity and become more expansive, industry must continually evaluate their operations and focus on the potential for proactive pollution prevention. Industry has the greatest understanding of their processes, practices, and organization therefore, industry itself is best suited for determining cost effective methods for controlling air pollution. Industry realizes that it should take a proactive approach to reduce air pollution because of the importance of minimizing air pollution and reducing industrial impact on the environment and public health.

In many cases, Air Quality Best Management Practices (AQBMPs) are the most effective mechanism to minimize air pollution from shipbuilding and repair operations. For the purpose of this project, the NSRP defines AQBMPs as low cost, low technology, common sense measures and practices designed to reduce air pollution. AQBMPs are frequently the most cost effective method of pollution control and therefore, an area of research that the NSRP directed project finding. The goal of this project was to investigate shipyard operations and develop AQBMP ideas to be presented in a resource document. The resource document provides environmental and production personnel with suggestions for minimizing emissions from several production operations and equipment. The AQBMPs are designed to be flexible to be customized for a specific shipyard. A suggested AQBMP implementation strategy is also provided in the document for additional guidance.

Developing and implementing proactive AQBMPs will benefit shipyards and enhance their current environmental management efforts. Potential benefits include: reductions in violations, increased environmental compliance, reduced environmental liability, increased environmental awareness, and increased employee health and safety. In some cases, process evaluation and improvements during the analysis of AQBMPs may result in cost saving opportunities (e.g., waste minimization) and benefit production operations through continuous improvement. A proactive AQBMP strategy will also help prepare shipyards for future environmental and safety regulations. Similarly, developing and implementing AQBMPs will be viewed positively by local, state, and federal regulators and may help shape future regulations,

# Project Approach and Acknowledgments

## **A Team Approach**

To ensure the success of this project, a team approach was used to combine the talents and experience of four Environmental Engineers from diverse backgrounds. The AQBMP Project Team consisted of NASSCO Engineers; WUie Gaters (Project Lead), Ron Miller, Michelle Won and Zachary F. Jacobs P.E., *Jacobs Environmental Consulting*. The team would like to acknowledge Project Sponsor T. Michael Chee, NASSCO, for his support and guidance throughout the project and Thomas Bright, *Quality Training system*, for project planning and meeting facilitation.

## **Shipyard Survey**

The AQBMP Project Team would also like to acknowledge the many people who gave their support and assistance throughout this project. Severrd individuals from the SP-1 Panel participated in a written survey, phone interviews, a draft document review, and AQBMP presentations at panel meetings. The written survey was prepared at the beginning of the project to determine the overall level of interest in the AQBMP project and to determine areas in the shipyard where AQBMPs should be emphasized. A 67% response rate resulted with 21 out of 31 surveys returned. The results indicated that there was much support for the project and many individuals thought that implementing AQBMPs would enhance environmental compliance and reduce overall emissions. Specific results concerning individual process areas helped direct AQBMP research and development. A copy of the survey sent to the NSRP members is supplied as Attachment 1.

## **Project Organization**

The importance of project organization and planning cannot be overemphasized. A significant amount of time savings, budget management, and schedule adherence were achieved through up-front planning and organization. Once the AQBMP Project Team was assembled, a series of weekly meetings took place to identify the following: project mission, project objectives, objective sub-tasks, deliverables, time requirements, estimated start and completion dates, and team members assigned to sub-tasks. Once this was complete, a gantt chart was created to refine the timeline, identify needs, and track project progress. The AQBMP Project Team met weekly to perform project updates, submit sub-task deliverables, and discuss project items. During AQBMP research and development, another weekly meeting was added for brainstorming and information exchange on specific AQBMP topics.

## AQBMP Background

In recent years, the emphasis towards controlling air pollution has primarily been placed on the addition of pollution control equipment. Pollution control equipment has many drawbacks such as expensive purchase and maintenance costs and potential failure. Potential failure could result in excessive emissions causing potentially unhealthy conditions and production delays. In most cases, pollution control equipment is viewed as "end of the pipe" solutions to problems that may be solved "up-stream." Comprehensive process analysis with respect to up-stream pollution prevention material substitution and improved management practices can result in substantial reductions in air pollution and result in the most cost effective approach to controlling and minimizing pollution. Up-stream pollution prevention is most notably used for water pollution prevention and implemented in the form of Best Management Practices (BMPs).

BMPs are defined in the 1977 Clean Water Act (CWA). The CWA dictates that most shipyards obtain a National Pollutant Discharge Elimination System (NPDES) permit, which requires the development of facility specific BMPs, defined in a "*BMP Plan*." Shipyard specific BMPs identify how the shipyard will minimize water pollution and comply with provisions of the CWA. The process of investigating shipyard operations and developing BMPs, combined with employee education have resulted in up-stream control and pollution prevention. In recent years, shipyard releases to waterways have been significantly reduced by developing and implementing water quality BMPs. Because of the success of the water BMP program the NSRP SP-1 Panel decided to develop Air Quality Best Management Practices (AQBMPs) that emphasize up-stream analysis, common sense procedures, and low cost technology to minimize air pollution from shipyard operations.

This resource manual focuses on implementing pollution prevention AQBMPs directed at enhancing environmental regulatory compliance. It is intended that each shipyard will analyze the AQBMP ideas presented in this document and develop site specific measures to address related pollution prevention. The following is a listing of subjects emphasized in AQBMPs:

### ***AQBMP Criteria:***

Low Cost, Low Technology, and Common Sense

### ***AQBMPs Emphases:***

Improved Procedures and Practices, Housekeeping, Awareness Education Self Inspection, Preventative Maintenance, Containment, Recordkeeping and Minor Equipment Modifications



# Resource Document Overview

## **Section I. Compliance Benefits of Implementing AQBMPs**

This section identifies five major federal regulations that directly and indirectly require industry to develop and implement measures to minimize air pollution through management practices, procedures, and equipment modification. Much of the regulatory language suggests that industry should minimize pollution on their own accord. Therefore, increasing requirements for air permits and regulatory enforcement are driving the implementation of AQBMPs and are becoming extremely important for overall shipyard environmental compliance.

## **Section II. Potential Shipyard Emissions: Environmental and Health Concerns**

Shipyards employ a wide variety of production operations and equipment during ship construction and repair. Production processes include painting, decreasing, abrasive blasting, and several others. In addition production equipment, such as boilers, internal combustion engines, and furnaces are an integral part of shipyard operations. Many shipyard operations and equipment produce air emissions that may adversely affect public health employee health and/or the environment. This section briefly identifies potential health concerns and provides a description of seven major types of pollutants generally associated with shipyard production operations.

## **Section III. AQBMP Ideas For Shipyards**

This section of the resource manual is the thrust of AQBMP research and development presented. It contains AQBMPs developed for 22 shipyard production processes, support equipment, and management practices. Each AQBMP has a descriptive title followed by the three sections; 1) Objective, 2) Background, and 3) AQBMP Ideas section. The AQBMP Ideas section is where specific practices, process, and equipment modifications are suggested to minimize air emissions. Shipyards are encouraged to use the AQBMPs presented in this portion of the document to develop and implement site specific measures.

## **Section IV. Suggested AQBMP Implementation Strategy**

This section of the resource document is dedicated to increasing this project's overall benefit and usefulness by providing shipyards with some guidance, direction and strategies for developing and implementing shipyard specific AQBMPs. This section emphasizes that shipyard personnel (upper, middle, and production management) must understand potential benefits and needs. This section also suggests a three stage approach to help ensure AQBMP success: First, a preliminary investigation and analysis to evaluate existing processes and determine the need for AQBMPs; Second, development and implementation using a *team approach* combined with an *implementation plan*; Third, continuous evaluation refinement, and maintenance of AQBMPs to ensure continued success. Ideally, AQBMPs will be inexpensive to implement and maintain such an approach can be achieved through effective design development, and an organized implementation strategy.

## **Section V. Conclusion And Recommendations**

The resource manual is summarized and recommendations are made on how the document can be best utilized by shipyards.

# Table of Contents

<b>Executive Summary</b>	<i>i</i>
<b>Project Approach and Acknowledgments</b>	<i>ii</i>
<b>AQBMP Background</b>	<i>iii</i>
<b>Resource Document Overview</b>	<i>iv</i>
<b>I. Compliance Benefits of Implementing AQBMPs .....</b>	<b>1</b>
<b>II. Potential Shipyard Air Emissions: Environmental and Health Concerns ....</b>	<b>6</b>
<b>III. AQBMP Ideas for Shipyards .....</b>	<b>9</b>
<b>IIIa. Operational Support Equipment .....</b>	<b>10</b>
Water Treatment Units .....	11
Cooling Towers .....	12
Drying Ovens and Furnaces .....	13
Boiler Operations .....	15
Internal Combustion Engines .....	18
Painting Booth Operations .....	21
Solvent Distillation Units .....	24
Fuel Storage and Transfer Operations .....	26
<b>IIIb. Production Processes .....</b>	<b>29</b>
Welding Processes .....	30
Painting Operations .....	33
Degreasing .....	37
Abrasive Blasting Operations .....	40
Solvent Wiping .....	43
Varnish Insulation .....	45
Metal Finishing Operations .....	48
Composite Material Operations .....	50
<b>IIIc. Management Practices and Policies .....</b>	<b>53</b>
Hazardous Material/Waste Tracking and Recordkeeping Issues .....	54
Waste Management Operations .....	56
Periodic AQBMP Performance Evaluation .....	59
Preventative Maintenance (PM) .....	62
Internal Notification for Accidental Disturbances and Planned Removal of Asbestos Containing Material .....	64
Ozone Depleting Substance (ODS): Evaluation and Control .....	67
<b>IV. Suggested AQBMP Implementation Strategy .....</b>	<b>70</b>
<b>V. Conclusions and Recommendations .....</b>	<b>78</b>
<b>AQBMP Glossary .....</b>	<b>79</b>
<b>Attachment 1 - Sources of Information .....</b>	<b>86</b>
<b>Attachment 2 - Written AQBMP Survey .....</b>	<b>88</b>

## AQBMP Checklists and Recordkeeping Forms

Furnaces and Drying Oven Operation Checklist and Recordkeeping Form .....	14
Boiler Operations Checklist and Usage Recordkeeping Form .....	17
Internal Combustion Engine Operator Self Inspection Checklist .....	20
Paint Booth Usage and Inspection Form .....	23
New and Recycled Solvent Usage and Distillation Unit Recordkeeping Form .....	25
Gasoline and Diesel Pump Self Inspection Checklist .....	28
Welding Consumable Usage/Issues Tracking Form .....	32
Paint Associated Solvent and Coating Usage Log .....	36
Solvent Cleaning Operations Checklist and Usage Recordkeeping Form .....	39
Abrasive Blasting Self Inspection Checklist .....	42
Varnish Dipping Operations Checklist and Usage Recordkeeping .....	47
Metal Finishing Operations Checklist and Material Usage Recordkeeping .....	49
Composite Material Operations Self Inspection Checklist .....	52
Shipyard Hazardous Waste Transportation Form .....	58
AQBMP Performance Evaluation Form .....	61
Implementation Strategy Audit and Evaluation Forms .....	75

# Section I.

## Compliance Benefits of Developing and Implementing Proactive AQBMPs

### AQBMPs are Primarily Viewed as Proactive

Unlike the BMPs required by NPDES permits, no federal or state legislation specifically requires industry to develop and implement AQBMPs. Therefore, AQBMPs are viewed as proactive. However, many federal, state, and local rules and regulations directly and indirectly require industry to implement measures to minimize air pollution through management practices. Also, much of the environmental legislation suggests that industry should continuously develop procedures, practices, and equipment that minimize air pollution on their own accord and document these efforts. With increasing requirements for air permits and regulatory enforcement implementing AQBMPs is becoming extremely important for overall shipyard environmental compliance.

### AQBMPs and Federal Regulations

AQBMPs can be designed and implemented solely as proactive measures to minimize the likelihood for air pollution. On the other hand, shipyards can implement AQBMPs that are more specifically designed to maintain and enhance compliance with several federal regulations. Table 1 displays five (5) federal regulations that can be addressed by implementing AQBMPs. Following the brief introduction provided in Table 1 are introductory sections that provide more background on each regulation and its relation to AQBMPs.

**Table 1. Federal Regulations Addressed by Proactive AQBMPs**

Federal Regulations	AQBMP Application
<b>Clean Air Act Amendments (CAAA) of 1990</b>	Minimize releases of Volatile Organic Compounds (VOCs Title I), Minimize release; of hazardous air pollutants (HAPs Title HI), Implement Title V permit requirements, Reduce usage of ozone depleting substances (ODSs Title VI)
<b>Superfund Amendments and Reauthorization Act (SARA) Title III, Section 313</b>	Minimize usage, releases, and disposal of SARA Section 313 listed substances
<b>Pollution Prevention Act (PPA) of 1990</b>	Continuous pollution prevention multi-media approach continuous reduction in hazardous waste and air emissions
<b>Resource Conservation and Recovery Act (RCRA)</b>	Waste minimization reductions in use, proper handling and disposal of toxic chemicals
<b>Occupational Safety Health Act (OSHA)</b>	Indoor air quality concerns, employee air pollutant exposure levels & standards

## **AQBMPs and the Clean Air Act Amendments of 1990**

The signing of the Clean Air Act Amendments (CAAA) of 1990 led the way to some of the most significant regulatory legislation ever enacted. The CAAA of 1990 contains 11 new and amended titles, including enhanced non-attainment area provisions, additional conditions for controlling hazardous air pollutants (HAPs), expanded monitoring and recordkeeping, and increased enforcement authority. Under the 11 new and amended titles, the intent of Title I, Title III, Title V, and Title VI can be proactively addressed by implementing AQBMPs.

Title I focuses on achieving national ambient air quality goals and provides for an ambitious program to reduce ozone through a combination of measures including substantial reductions in emissions of Volatile Organic Compounds (VOCS). VOCS are mainly emitted from shipyard coating processes and other surface preparation and solvent cleaning operations. In some cases, industry may be required to install units that collect and destroy VOCS. Controlling and minimizing VOC emissions through implementation of AQBMPs is a positive step forward addressing Title I objectives.

Toxic air emissions or HAPs are addressed in Title III. The CAAA specifically directs the reduction of 189 of the most hazardous air pollutants through the issuance of maximum available control technology (MACT) standards for all major sources of these air toxics within ten years. The maximum degree of reduction in emissions can be achieved through a variety of process improvement measures and techniques including design and operational changes. AQBMPs can address HAP management efforts that reduce and/or minimize HAP usage and emissions, which addresses the main objectives outlined in Title III.

The cornerstone of the CAAA is the federal operating permits program depicted by Title V. The purpose of the program is to establish a central point for tracking all applicable air quality requirements and emissions for facilities required to obtain an operating permit. Under Title V, all facilities considered a "major" source of air pollution will need a Title V permit to operate. Many shipyards are considered "major" sources and will need a Title V permit. In the past many states have implemented regulations requiring operating permits similar to Title V, while other states have far less stringent air quality permitting requirements. This is the first time that a federally mandated uniform permit processing approach has been adopted throughout the nation. It is expected that within each facility's Title V permit operating procedures and practices that minimize the potential for fugitive releases will be addressed. In many cases, the implementation of management practices will be included as Title V permit conditions.

Title VI focuses on the control of substances that contribute to the depletion of the ozone concentrations in the protective layers of the stratosphere. The most important part of this title is the schedule for phasing out of production and consumption of ozone-depleting substances. Chemicals affected by this title include at a minimum, listed chlorofluorocarbons, listed hydrochlorofluorocarbons, listed halons, carbon tetrachloride, and methyl chloroform. The intent of this title is to address chemicals and chemical releases that can accelerate ozone depletion. The most effective way to address Title VI is through AQBMPs that address material substitution, process changes, and equipment modification.

### **AQBMPs and SARA Title III, Section 313**

Title III of the Superfund Amendments and Reauthorization Act (SARA) directs states, communities, and industry to work together to plan for chemical accidents, develop hazardous substance inventories, track toxic chemical releases, and provide release information to the public. SARA Title III is the beginning of what many consider to be "regulation by information." The simple fact that environmental groups, regulatory agencies, and the general public were made aware of toxic chemical usage, storage, and releases, has caused many industries to implement procedures and practices to minimize toxic material usage, storage, and releases.

Minimizing releases of substances on the Toxic Release Inventory (TN) reporting list is in the best interest of industry, and efforts can be addressed in the form of AQBMPs. Acetone, xylene, and n-butyl alcohol are a few SAM listed toxic chemicals reported by the shipbuilding and repair industry.

The majority of the TN listed substances reported are air releases from various shipyard operations. Many of the emissions reported can be addressed with management practice improvements as displayed in Table 2.

**Table 2 Potential Shipyard Processes Affected by SARA Title III**

<b>Process</b>	<b>Management Practice Improvements</b>
Solvent Decreasing and Surface Preparation	Material substitution% recycling, change cleaning process techniques
Painting Operations	Reformulation of paints, waste minimization, improved painting techniques
Abrasive Blasting Operations	Minimizing fugitive abrasives during blasting, storage, and transfer operations
Electroplating Operations	Process evaluation wasteminimizatio~ container covers, material segregation
Chemical paint Removal	Process evaluation and material substitution

### **AQBMPs and the Pollution Prevention Act of 1990**

With the Pollution Prevention Act (PPA) of 1990, the US Congress established pollution prevention as a "national objective" and the most important component of the environmental management hierarchy. This legislation emphasizes pollution prevention rather than treatment, as the preferred method for minimizing pollutants entering the environment. The PPA encourages "multimedia" pollution prevention emphasizing that it is not only important to minimize waste, but also to reduce air emissions, wastewater discharges, and solid wastes. The multimedia approach involves analyzing potential pollution of various media simultaneously and implementing measures to minimize, or prevent overall pollution. The PPA possesses the potential for facility-wide and multimedia permits that are designed to address all sources of potential pollution at a facility.

In most cases, state and federal initiatives on pollution prevention use the following hierarchy for evaluating the effectiveness of efforts to reduce the volume and the toxicity of toxic chemical releases:

- 1) Substitution of nontoxic inputs to the production process
- 2) Substitution of reduced toxic inputs to the production process
- 3) Modification of the production process, technologies, and/or equipment
- 4) Changes in material and waste handling and storage practices
- 5) Use of closed-loop reckunation, reuse, or recycling
- 6) Use of on-site recycling technologies and processes
- 7) Use of off-site recycling technologies and processes.

Portions of the PPA work in conjunction with the SARA Title III TRI reporting process and use the SARA listed toxic substances as a priority for reduction. The PPA requires accurate accounting and documentation of all TRI reporting issues and pollution minimization efforts. Therefore, many objectives of the PPA can be addressed with the development of proactive AQBMPs.

**AQBMPs and the Resource Conservation and Recovery Act (RCRA):**

The Resource Conservation and Recovery Act (RCRA) governs the transportation, storage, treatment, and disposal of hazardous wastes. In general RCRA requires hazardous waste transporters, generators, and disposal companies to manage waste within the rules and regulations of the act. The objectives are to minimize hazardous waste, increase stiety, and ensure that hazardous waste is disposed properly. Waste generators, transporters, and disposal sites address many of the objectives of RCRA through compliance with the "*manifest system*." The manifest system is used to track hazardous waste from "cradle-to-grave" for increased hazardous waste control. Under RCRA requirements and the manifest system all generators must certify that the facility has a waste minimization and toxic reduction program in-place.

Air emissions are usually wasteful therefore, efforts to reduce emissions will also reduce waste. Any substance that escapes through a smokestack containment system or is needlessly released into the atmosphere during manufacture, usage, transportation or storage can represent a loss of resources. Shipyards are required to manage and minimize all hazardous and toxic wastes. Minimizing and otherwise controlling hazardous and toxic wastes through improved procedures, management practices, and facilities have the potential to improve air quaky by reducing overall emissions and adding an extra element of control to potential emission sources.

Although RCIU does not directly regulate air quahy issues, many of its requirements potentially decrease the likelihood for air emissions through waste miinimization recordkeeping, and proper handling procedures. Therefore, AQBMPs can be developed to address the concerns of RCRA while emphasizing the need to manage potentially toxic or hazardous emissions, employee hazardous materials stiety and to properly package and transport hazardous wastes.

## **AQBMPs and OSHA Regulations**

Federal and State regulations affecting hazardous and potentially toxic air emissions are a main area where the Occupational Safety Health Agency (OSHA) and the Environmental Protection Agency (EPA) regulations and responsibilities tend to overlap. Employees have gained rights that ensure them a safe, healthy, and hazard-free breathing through OSHA, while the public outside seeks protection provided by EPA air quality regulations. Employee health and safety legislation, administered by the OSHA, has primary control of potentially toxic air emissions that are indoors and/or within the worker's breathing zone. Employers are required to reduce work-place hazards, implement programs aimed at promoting job safety and good health to meet all OSHA standards. Well written AQBMPs that address employee health and safety, as well as pollution prevention, should improve work-place conditions for employees as well as for the public and environment.

The shipbuilding industry has a wide variety of industrial settings including: ships, buildings, and work spaces where air quality must meet OSHA air quality standards to ensure a safe working environment. OSHA sets federal guidelines for, among other things, safe concentrations of various toxic substances, defining them as "threshold limit values" (TLVs) and "permissible exposure limits" (PELs) for over 500 regulated substances. Several of these substances are routinely found in shipyard industrial manufacturing operations that, through either short or long term exposure, can create unsafe working environments.

Concerns over clean air in the industrial work-place are common and a very important issue for shipyard management and shipyard unions. As exposure limits are reduced and the list of regulated substances increases, shipyards must implement measures to reduce employee exposure. In many cases, AQBMPs that address material Substitution employee education and work-practice modification will be the most cost effective method of compliance.

## **Summary**

Presently, no federal or state legislation specifically requires industry to develop AQBMPs. When shipyards choose to develop, implement, and maintain AQBMPs, they will be taking proactive measures to increase the effectiveness of their environmental pollution prevention program. Several federal rules and regulations directly and indirectly require industry to reduce air pollution through management practices and equipment modifications. Therefore, in some cases, AQBMP will be designed to directly address the intent of and/or requirements of certain regulations. Similarly, AQBMPs should always be designed to complement, enforce, and support other pollution prevention compliance efforts within the shipyard's environmental program.

AQBMPs are effective low cost measures and the most practical method for reducing shipyard's potential air pollution. Developing facility specific AQBMPs will require that shipyards evaluate their operations and equipment for emissions and potential methods to reduce pollution. Proactive measures can have the benefit of increased compliance with the intent of several federal regulations and provide support for maintaining good corporate citizenship. It is expected that proactive AQBMP methods will be less obtrusive and usually more effective than regulated requirements dictated by individuals uneducated about shipyard specific operations.



## **Section II.**

### **Potential Shipyard Emissions: Environmental and Health Concerns**

Shipyards utilize a wide variety of production operations and equipment for shipbuilding and repair. Production processes include welding, painting, decreasing, abrasive blasting, and several other ancillary operations. In addition production equipment such as boilers, internal combustion engines, and furnaces are an essential element of any shipyard. Many shipyard operations and equipment produce air emissions that may adversely affect employee health the public, and/or the environment. However, emissions produced by shipyard operations and equipment do not usually pose immediate health risks to employees, especially when proper safety equipment is used. Also, public exposure to shipyard emissions is primarily location specific and usually considered minimal. Even if the emissions have little effect on human health and the environment, it is still desirable to minimize air pollution due to compounding effects with outside emission sources such as other industries and automobiles.

It is commonly understood that prolonged exposure to air pollution can:

- \* Aggravate cardiovascular and respiratory illnesses,
- \* Add stress to the cardiovascular system forcing the heart and lungs to work harder in order to provide needed oxygen
- \* Speed up the natural aging process of the lungs and accelerate the loss of lung capacity
- \* Damage the cells in the airways of the respiratory system
- \* Damage the lungs even after symptoms of minor irritation disappear, and/or
- \* Contribute to the development of diseases including bronchitis, emphysema asthma and possibly cancer.

#### **Shipyard Emission Types**

Several types of emissions generated by shipyard operations potentially include criteria pollutants and hazardous air pollutants (HAPs). Criteria pollutants are a major category of air pollutants that include Oxides of Nitrogen (NOX), Carbon Monoxide (CO), Oxides of Sulfur (SOX), volatile organic compounds (VOC), Lead (Pb) and Particulate Matter (PM and P<sub>OM10</sub>). Ozone, a criteria pollutant, is formed from a photochemical reaction of VOC emissions and NOX emissions. Similarly, HAPs and other toxic/hazardous air contaminants are potentially released during shipyard operations. The following sections identify potential health problems resulting from various emissions and briefly explain their sources.

### **Nitrogen Oxide (NOX) Emissions**

Nitrogen dioxide is emitted from combustion sources powered by internal combustion engines equipment (i.e., cranes, forklifts, and generators) and natural gas or oil fired combustors and boilers. Nitrogen dioxide increases the severity of smog conditions in populated areas and basins. Nitrogen dioxide is an irritating gas that can damage the cells lining the respiratory system and can increase the susceptibility to infection.

### **Sulfur Oxides (SOX) Emissions**

Sulfur oxides are primarily produced during combustion of coal fuel oil, diesel, and/or natural gas. Sulfur emissions are proportional to the sulfur content in the fuel. Sulfur dioxide can cause constriction of airways and poses a particular problem for asthmatics. Shipyards usually do not produce significant quantities of sulfur dioxide emissions because of the low sulfur content fuels.

### **Carbon Monoxide (CO)Emissions**

Carbon monoxide is an odorless, colorless gas formed during the combustion process. About 85% of carbon monoxide is generated by internal combustion engine emissions. It is harmful when inhaled because it restricts the blood's ability to carry oxygen to the body's tissues. High concentrations of carbon monoxide are found in highly congested traffic areas.

### **Volatile Organic Compounds (VOCS)**

The vast majority of VOCS are released during painting, thinning, solvent clean-up, solvent decreasing, and trace preparation. When VOCS evaporate, they are emitted or released to the environment. Generally, lower vapor pressure solvents release less VOCS to the environment. In the presence of sunlight, VOCS participate in a photochemical reaction with oxides of nitrogen and other pollutants in the lower atmosphere to produce ozone. Ozone is a major component of smog. Ozone is a strong irritant that can attack the lungs and make breathing difficult. Ozone vapors can irritate eyes and cause them to hurt and water. Smog is especially irritating and unhealthy for individuals with respiratory illnesses, elderly people, and children.

### **Particulate Matter (PM) and PM<sub>10</sub>**

PM emissions are released from equipment and processes through exhaust stacks and ducting systems. They may also be emitted as fugitive emissions from processes such as material handling, transfer, or outdoor abrasive blasting. Particulate Matter (PM) can also consist of airborne plumes consisting of solid and/or liquid particles. The darker and/or denser a plume is indicates a higher concentration of PM in the air pollutant. PM emissions in shipbuilding are most commonly produced by the following three methods:

- 1) **Combustion or Burning:** Internal combustion engines, boilers, and welding operations are sources of PM emissions.
- 2) **Attrition:** Wearing or grinding down by friction. Industrial attrition in the shipbuilding processes that may release PM emissions include: milling, grinding, sanding, cutting, and abrasive blasting.

- 3) Windborne Dust: Trucks and other equipment movement over loose dirt or process materials can cause dust to become airborne. Process materials that become airborne may include fragments from wood cutting, composite operations, welding, and abrasive blasting.

Smoke, dusts, and other PM can contain inhalable PM<sub>10</sub>, which are microscopic solids or liquids that are smaller than ten microns in aerodynamic diameter (the average human hair is 70 microns in diameter). A significant percentage of smoke from combustion processes is in the PM<sub>10</sub> range and consists of condensed organic vapors (tars and gases), soot (unburned carbon), and ash (unburned minerals). When PM<sub>10</sub> is inhaled, the particles can travel deep into the lungs, causing irritation and coughing. PM<sub>10</sub> may become trapped in the lungs for several years, contributing to lung changes, chronic lung diseases, and possibly cancer.

### **Lead (Pb) Emissions**

Sources of lead pollutants from shipyard operations are usually associated with lead paint removal from older ships or combustion of leaded gasoline. During lead paint removal, shipyards take extreme efforts to contain fugitive dust and provide protection for employees. The major problem with lead occurs when small particles are inhaled, absorbed, or ingested into the body and circulated through the bloodstream. When ingested, lead affects the brain. It has been shown that even at relatively low levels, lead exposure can result in permanent decreases in the IQ of children. At higher levels, anemia can occur in both children and adults. Due to the toxicity of lead, it appears on several lists of toxic substances as well as on the criteria pollutants list.

### **Toxic Air Contaminants, Hazardous Air Pollutants, and SARA Listed Substances**

Air pollution and the potential for accidental and routine releases have come under regulatory scrutiny due to an increased emphasis on air pollution and pollution prevention. State and federal environmental and occupational health and safety regulations have identified toxic substances that may increase a person's risk of serious illness due to exposure. Toxic air contaminants include more than 500 chemical compounds, such as gasoline vapors, certain paint solvents and solids, chemical cleaners, and acids. The Clean Air Act Amendment of 1990 identifies 189 hazardous air pollutants (HAPs) that are potentially harmful to humans and identified for stricter environmental control requirements. Also, substances listed in the Superfund Amendments and Reauthorization Act (SARA), Title III, Section 313, are of environmental health and safety concern and a target for increased regulatory control. Many individual states also have an expanded list of toxic air contaminants regulated for tighter control, minimized releases, and public reporting and health risk assessments. Toxic air contaminants may cause either long or short-term health risks. Long-term exposure is commonly called chronic, and short-term exposure is referred to as acute.

### **Summary**

In summary, emissions potentially released from shipyards may adversely affect shipyard employees, the general public, and/or the environment. Shipyard management should continually make efforts to minimize the amount and impact of air emission. In many cases, emissions of air pollution from shipyard operations and equipment can be minimized through development and implementation of AQBMPs. AQBMPs are proactive steps taken to improve environmental, health, and safety effects resulting from shipyard processes and equipment emissions.

## Section III.

### AQBMP Ideas for Shipyards

This section of the resource manual is the thrust of AQBMP research and development presented. It contains AQBMPs developed for 22 shipyard Operational Support Equipment, Production Processes, and Management Practices and Policies. Each AQBMP has a descriptive title, followed by the three sections; 1) Objective, 2) Background, and 3) AQBMP Ideas section. The AQBMP Ideas section is where specific practices, process, and equipment modifications are suggested to minimize air emissions. Shipyards are encouraged to use the AQBMP Ideas presented in this portion of the document to develop and implement site specific measures directed at enhancing environmental regulatory compliance and minimizing the potential for air pollution.

#### AQBMP Table of Contents

	Page
<b>IIIa. Operational Support Equipment</b> . . . . .	<b>10</b>
Water Treatment Units . . . . .	11
Cooling Towers . . . . .	12
Drying Ovens and Furnaces . . . . .	13
Boiler Operations . . . . .	15
Internal Combustion Engines . . . . .	18
Painting Booth Operations . . . . .	21
Solvent Distillation Units . . . . .	24
Fuel Storage and Transfer Operations . . . . .	26
<b>IIIb. Production Processes</b> . . . . .	<b>29</b>
Welding Processes . . . . .	30
Painting Operations . . . . .	33
Decreasing . . . . .	37
Abrasive Blasting Operations . . . . .	40
Solvent Wiping . . . . .	43
Varnish Insulation . . . . .	45
Metal Finishing Operations . . . . .	48
Composite Material Operations . . . . .	50
<b>IIIc. Management Practices and Policies</b> . . . . .	<b>53</b>
Hazardous Material/Waste Tracking and Recordkeeping Issues . . . . .	54
Waste Management Operations . . . . .	56
Periodic AQBMP Performance Evaluation . . . . .	59
Preventative Maintenance (PM) . . . . .	62
Internal Notification for Accidental Disturbances and Planned Removal of Asbestos Containing Material . . . . .	64
Ozone Depleting Substance (ODS): Evaluation and Control . . . . .	67

**Section IIIa.  
AQBMP Ideas  
For Operational Support  
Equipment**

### **Objective**

To minimize the release of emissions from wastewater collection treatment, and storage through equipment modification preventative maintenance, and work practice modifications.

### **Background**

Shipyards generate wastewater streams that can potentially contain organic compounds. Nearly all of these streams undergo collection containment, treatment, and storage operations before they are discharged into either a receiving body of water or a municipal treatment plant for further treatment. Wastewater treatment operations can range from oil/ water separation to full-scale chemical treatment processes. In a typical pretreatment facility, process water, sanitary wastewater, and storm water runoff is collected, equalized, and neutralized before it is discharged. Tanks are generally used for holding capacity when the chemical or physical properties of the wastewater are altered by neutralization biotreatment or other forms of treatment. During operations, wastewater is potentially exposed to the atmosphere and volatile organic compounds (VOCS) may be emitted. VOCS are emitted from wastewater through the volatilization of organic compounds at the liquid surface. Emissions can occur by diffusive and/or convective mechanisms. Diffusion occurs when organic concentrations at the water surface are much higher than ambient concentrations. Convection occurs when air flows over the water surface sweeping organic vapors from the water surface into the air. The rate of volatilization is related to the airflow over the water surface.

### **AQBMP Ideas**

#### **Equipment Modifications**

- \* Use covered tanks for the collection treatment, and storage of wastewater.
- \* Install air scrubbers on treatment systems whenever feasible.
- \* Install overfill protection mechanisms and alarms as a safeguard against spillage.

#### **Preventive Maintenance and Inspections**

- \* Develop a preventive maintenance program to ensure that all equipment is operating properly.
- \* Perform routine inspections of the treatment facility to check for leakage and other irregularities.

#### **Work Practice Changes**

- \* Keep chemicals in a contained storage area with lids closed.
- \* Use mechanical agitation rather than aeration to mix chemical treatment compounds.

### **Objective**

To minimize the potential for toxic emissions from shipyard cooling towers caused by chemical additives used in the prevention of corrosion scale, and bacterial growth.

### **Background**

A cooling tower is a device in which circulating water evaporates to remove heat from a process, a building or a refrigerator and transfers heat into the ambient air. The definition of a cooling tower includes, but is not limited to, evaporative condensers, quench towers, and cooling towers used in heating, ventilation cooling, or air conditioning processes. Cooling towers require a large volume of water due to the high rate of evaporation. Most cooling towers require frequent chemical treatment of the cooling water to prevent the buildup of corrosion scale, and bacterial growth. It is the high rate of evaporation combined with the chemical treatment that has the potential to cause potentially toxic air emissions. Hexavalent Chromium (Cr VI) has been widely used and has shown to be very effective in the elimination of corrosion scale build-up, and bacterial growth in cooling towers. Many state and local air pollution control agencies have developed regulations that prohibit the use of hexavalent chromium-containing compounds used in cooling tower circulating water.

### **AQBMP Ideas**

#### **Material Substitution**

- \* Investigate substitute corrosion inhibitors and anti-sealants for hexavalent chromium compounds that minimize potential environmental impacts.
- \* Since many substitutes are recommended for specific types of cooling towers, consult the manufacturer of the cooling tower prior to implementing substitute treatment compounds.

#### **Process Modification**

- \* Periodically test the circulating water to determine the concentration of hexavalent chromium. If hexavalent chromium compounds are to be used in cooling towers, keep the hexavalent concentration in the circulating water at less than 0.15 milligrams per liter.
- \* Hexavalent chromium should not be used in wooden cooling towers. The wood may cause the hexavalent chromium concentration to exceed the 0.15 milligrams per liter in the circulating water. Upgrade or replace wooden cooling towers whenever feasible.

#### **Preventive Maintenance**

- \* Implement a preventive maintenance program to ensure that all chemical levels are maintained and the cooling tower is operating as designed.
- \* Maintain monthly records of analytical results and maintenance for at least two years.

### **Objective**

To reduce the potential for emissions from drying ovens and furnaces through improved operational practices and procedures.

### **Background**

Furnaces and drying ovens are potential emission sources from shipyard operations. Furnaces are usually high temperature ovens used for foundry operations such as metal and plastic molding, metal heat treatment and forging. Furnaces are also used for material "bum-off" of motor varnish+ paints, and/or grease and dirt from parts. Drying ovens are usually lower temperature units used to accelerate drying of varnish for motors, adhesives, paints, and plastics. Both drying ovens and furnaces can range in size from very small to very large.

During furnace and drying oven operations, emissions are derived from either the combustion heat source or the part being processed within the oven. Ovens and furnaces of concern are heated by either fuel oil combustion or natural gas combustion. Both of these combustion processes produce NOX, VOC, and PM emissions. Combustion emissions can be minimized through proper operational performance. On the other hand, parts processed within the furnaces and ovens mainly produce VOC emissions and in some cases of material "bum-off" PM emissions can be released. A variety of measures can be taken to minimize releases caused by parts being processed which mainly include alternative part cleaning methods and VOC containing material substitution.

### **AQBMP Ideas**

#### **Preventive Maintenance**

- \* Include all drying ovens and furnaces in the shipyard preventative maintenance program.

#### **Work Practice Changes**

- \* Clean parts before furnace bum-off operations. Remove excess paint, varnish grease, and other petroleum products that can lead to reductions in VOC emissions.
- \* Maintain operational temperatures and other variables as recommended by the manufacturers' specifications for all ovens and furnaces to ensure proper combustion.
- \* Remove oils and other combustibles from products and parts prior to heating and eventual heat treatment.

#### **Equipment Modifications**

- \* When replacing existing ovens and furnaces, investigate the use of low NOX combustors.



## Furnace and Drying Oven Operation Checklist And Usage Recordkeeping

Inspect Furnace and Drying Oven Operations on a periodic basis identifying problems with an **X**, and no problems with an **OK**.

**Foreman:** \_\_\_\_\_

**Furnace or Oven Location:** \_\_\_\_\_

**Week of:** \_\_\_\_\_

Inspection Points	Mon	Tue	Wed	Thu	Fri	
Good Working Order						No Leaks, Working Gauges, Other Defects, Proper Ventilation
Proper Combustion Parameters						See Manufactures Recommendations
Part Cleaned						
Sootblowing Needed						Check For Excessive Soot or Ash
Excessive Smoke						Abnormal Emissions
<b>USAGE</b>						
Process Type						Heat Treat, Curing, Burn-off, Etc.
Hours of Operation (Meter Reading)						
Gas Usage (Meter Reading)						
Fuel Oil Usage						
<b>Inspector's Initials</b>						

OK = No Problems Identified

X = Problem Identified

NA = Use NA for areas that are Not Applicable to your operations

Comment of Problems Identified (Problem and Remedy to be Taken):

---



---



---



---

**Note:** Notify Department Supervisor of Problem Areas

### Objective

To minimize emissions generated by operating boilers through proper maintenance, fuel substitution, and improved management practices.

### Background

A boiler is a closed vessel containing water combined with a heat source. Water is changed into steam when heated under controlled conditions. Fuels most commonly used as the heat source for a boiler are natural gas, oil, and occasionally diesel. In a boiler, energy from fossil fuels are converted into thermal energy. Thermal energy heats water contained in the boiler tubes to make steam. Steam is used for many processes within a shipyard including supplying auxiliary power for a ship at berth generating electricity, and in some cases, powering heating and air conditioning systems.

The emissions from a boiler are mainly determined by the fuel type, the size and type of the boiler, loading practices, and the level of equipment maintenance. The most common emissions from boilers are Oxides of Nitrogen (NOX), Particulate Matter 10 (PM<sub>10</sub>), Oxygen Sulfides (SOX) and Carbon Monoxide (CO).

### AQBMP Ideas

#### Proper Operation and Maintenance

- \* Ensure that operating and maintenance procedures are followed as described in the manufacturer's specifications. It is essential that these instructions be carried out accordingly to ensure continuous, safe, and efficient operation.
- \* All boilers operate more efficiently and produce less air pollution when they are maintained properly. Set-up a preventive maintenance program for boilers, which will vary depending on the boiler components and their location.
- \* Water treatment must be performed on feed water before it can be used in the boiler.
- \* Blowdown is a procedure used to remove impurities in the water that can cause corrosion and scale and result in boiler tube failure.
- \* Sootblowing should be performed to remove soot and ash from the fire side of the boiler tubes and heat recovery equipment to achieve a higher combustion efficiency.

#### Fuel Substitution

- \* Emissions can be greatly reduced by choosing "cleaner" fuels. Natural gas is generally considered to be one of the cleanest fuels available.

- \* Reductions in NOX SOX and PM10 emissions can be achieved through combustion modifications such as low NOX burners, low excess air, staged combustion~ flue gas recirculation (FGR) systems, and/or the use of low sulfur fuels.

**Employee Education**

- \* Boilers can be complicated systems and operators and maintenance persons should be properly trained on all aspects of the boiler equipment that they will be operating or maintaining. A properly maintained boiler will ensure that air pollutants will be kept to a minimum.

## Boiler Operations Checklist And Usage Recordkeeping

Inspect Boiler Operations on a periodic basis identifying problems with an **X**, and no problems with an **OK**.

Foreman: \_\_\_\_\_  
 Shipyard Boiler Location: \_\_\_\_\_  
 Week of: \_\_\_\_\_

Inspection Points	Mon	Tue	Wed	Thu	Fri	
Good Working Order						No Leaks, Working Gauges, Other Defects, Proper Ventilation
Proper Combustion Parameters						See Manufacturer's Recommendations
Water Treatment on Feed Water						To Specifications
Sootblowing Needed						Check For Excessive Soot or Ash
Excessive Smoke						Abnormal Emissions
<b>USAGE</b>						
Hours of Operation (Meter Reading)						
Gas Usage (Meter Reading)						
Fuel Oil Usage						
<b>Inspectors Initials</b>						

OK = No Problems Identified  
 X = Problem Identified  
 NA = Use NA for areas that are Not Applicable to your operations

Comment of Problems Identified (Problem and Remedy to be Taken):

---



---



---

**Note:** Notify Department Supervisor of Problem Areas

### **Objective**

To reduce particulate matter, hydrocarbon sulfur oxides, and nitrogen oxides emissions from internal combustion engines (ICE) through implementation of work practice changes, management policies, and process modifications.

### **Background**

ICES are used to support a wide array of shipbuilding and repair operations in shipyards. ICES are used for emergency power generation for shipyard facilities such as buildings, fire pumps, graving docks, and floating drydocks. ICES are also used to provide electrical power to ships. ICES can also be found as integral components in support equipment such as forklifts, hydrocranes, cranes, trucks, cars, motorcycles, barges, and outboards. Lastly, ICES provide support functions for many shipyard processes which include: electric arc welders, vacuum systems, pumps, portable dust-fume collectors, and air compressors which provide air supply for breathing, grit blasting, and hydroblasting operations.

An ICE operates by burning an air/fuel mixture in a chamber or a cylinder. ICES operate on fuels such as compressed natural gas, propane, gasoline, and diesel oil. Power is generated when the heated air/fuel mixture expands pushing a piston down in the cylinder. The piston in turn drives a crankshaft to rotate. This rotation can generate electricity through a motor, mechanical movement, or both depending on the application.

ICES produce particulate matter ( $PM_{10}$ ), hydrocarbon sulfur oxides (SOX) and nitrogen oxides (NOX) emissions which are federally listed criteria pollutants.  $PM_{10}$  emissions are a result of incomplete combustion of fossil fuels, general road conditions, excessive vehicle speed and from tire pads wear and tear. Hydrocarbon emissions can come from fueling equipment, passive fuel evaporation from the fuel tanks and engine systems, and incomplete combustion of fossil fuel. SOX emissions result from combustion of sulfur containing fossil fuels. NOX emissions are generated from incomplete combustion of fossil fuels at high temperature.

### **AQBMP Ideas**

Steps taken to minimize emissions from ICES can result in reduced fuel consumption and increased operating life for ICES. A listing of AQBMP ideas and a self inspection checklist are presented below to assist shipyards minimize emissions from ICES:

### **Work Practice Changes**

- \* Establish an inspection checklist and inspect equipment routinely. (See Internal Combustion Engine Operator Self Inspection Checklist)
  
- \* Repair ICES with excessive visible emissions, noise, or leaks from operation.

- \* Establish and maintain a recordkeeping system of: operating hours, fuel consumption, and combustion parameters.
- \* Investigate modifying combustion parameters.
- \* Reduce vehicle traffic speed in the shipyard.

**Management Policies**

- \* Establish an on-going preventive maintenance program for all ICEs .
- \* Encourage use of bicycles or walking within the shipyard.

**Process Modifications**

- \* Evaluate fuel constituents.
- \* Examine the feasibility of using alternative "clean fuels."

## Internal Combustion Engine Operator Self Inspection Checklist

Equipment or Permit No. \_\_\_\_\_

Inspection Points		Sun	Mon	Tue	Wed	Thurs	Fri	Sat
Location (portable units)								
Purpose (test/emergency)								
Hours Meter Reading								
Fluid Levels	Oil							
	Coolant							
Visible Leaks	Oil							
	Coolant							
	Fuel							
Flow Meter Readings	Injection Water							
	Ammonia							
	Fuel							
Excess Smoke								
Other 1:								
Other 2:								
Operator's Initials	1st shift							
	2nd shift							
	3rd shift							

**NOTE:**      OK = No problems identified  
                   X = Problem identified

Notify the Maintenance Department of all identified problems.

### **Objective**

To reduce the potential for fugitive emissions from painting operations performed in booths through implementation of improved practices and procedures.

### **Background**

Many shipyards have spray painting booths where a variety of production painting is performed. Some booths are small and are primarily used for small part applications. On the other hand, some shipyards use large painting booths to provide indoor painting of large parts and plates. Painting booths are used for priming and coating pipe spools, ventilation system parts, metal fabricated parts, and flat plates. Some booths are automated, while the majority are hand operated. Conventional, airless, and high volume low pressure (HVLP) paint application equipment is predominantly used in spray booths.

Painting inside booths provides advantages such as increased environmental control, increased transfer efficiency, reduced dusts, and increased control of paint solids. Predominantly, spray booths are equipped with fabric filters that collect paint solid overspray. The filters are frequently cleaned and/or replaced to maintain air flow. Some booths are equipped with water curtain devices that collect paint solids as the air passes through the water. The paint solids can then be skimmed from the water surface for disposal.

Controlling emission from paint booths is very important for maintaining a quality painting environment as well as protecting employees and the public from potentially harmful emissions.

### **AQBMP Ideas**

#### **Preventative Maintenance**

- \* Replace fabric filters periodically to ensure proper booth operation. To be effective, most filters should be replaced when the pressure drop over the filter exceeds 0.25 inches of water. Include paint booths in the shipyard preventive maintenance program.
  
- \* Ensure that water curtain filters produce a steady curtain during operation. If open spots appear in the water curtain paint solid emissions can result. When open spots appear, correct the problem immediately. Also, periodically inspect and maintain the chemicals and additives in the water curtain for better performance and minimizing corrosion.

#### **Work Practice Changes**

- \* For automated paint booths, ensure that spray patterns continuously contact the product being painted. Spraying into empty spaces is wasteful and can result in filter clogging and excessive emissions.



- \* Ensure that fabric filters are installed properly and cover all openings. Spray booths should have all filters in-place during painting operations.
- \* Keep doors shut when painting and allow for settling prior to entry or exit. Also, maintain negative air pressure to minimize escape when doors are opened.

**Self Inspection and Recordkeeping**

- \* Setup a selfinspection checklist for painters who operate spray booths. The checklist should cover subjects such as proper mixing ratios, door seals, storage area filter status, and other items that are more specific to the booth and operational arrangement. (See Paint Booth Usage and Inspection Form)

## Paint Booth Usage And Inspection Form

Inspect Paint Booth Operations on a periodic basis identifying problems with an X and no problems with an OK.

Week of:

Inspection Points	Mon	Tue	Wed	Thu	Fri	
Using Compliant Coating Material						VOC limits and Other Constraints
Proper Thinning						Compliance
Proper Mixing Ratios						Compliance
Proper Mix Ratios Posted						Suggested Idea
Guns Cleaned Thoroughly and properly lubricated						Procedures In-Place and Followed
Minimize Solvent Surface Preparation						Improved Practices
Proper Cleaning Solvent						Environmental Approval and Compliant
Proper Clean-up Methods						Procedures In-Place and Followed
Filters Maintained and In-Place						Proper Condition
Closed Paint, Solvent and Associated Waste Cans						Lids Closed When Cans Are Not Directly In Use
Spray Equipment Cleaned in Closed Containers						Procedures In-Place and Followed
Proper Pressure Drop and Operational Manometer						Proper Condition
Water Curtain Operational						Proper Condition
Control Equipment Operational						Proper Condition
Exhaust Fan and Ducting						Operational and Sealed
Permits Displayed						In The Open
Secondary Containment and Clean-Up Equipment						In Place and Ready
Usage Recordkeeping						Keeping Track of Material Usage
Appropriate Safety Gear						Used and In-Place
Inspector's Initials						

OK = No Problems Identified

X = Problem Identified    NA = Use NA for areas that are Not Applicable to your operations

Note: Notify Department Supervisor of Problem Areas

### **Objective**

To implement and maintain practices that minimize VOC and other emissions from solvent distillation recycling units and associated operations.

### **Background**

Large volumes of chemical solvents are used for various production requirements in shipyards. The majority of solvent is used for paint surface preparation equipment cleaning, and paint thinning. A significant amount of solvents used in the shipyard can be recycled several times before being discarded. The most common technique used for solvent recycling is distillation. With this method, the solvent is heated to its boiling point and the resulting purified vapor is withdrawn, condensed, and collected for reuse. As the solvent boils, vapors form and pass through a series of piping, hoses, valves, and fittings before the vapor is condensed and stored in a holding tank. It is this cycle of turning the solvent into a vapor and back into a liquid that has the greatest potential of releasing VOCs. Caution must be used during the processing and recovery of used solvent to prevent the release of fugitive hazardous air contaminants.

### **AQBMP Ideas**

#### **Equipment Modification**

- \* Ensure that the unit has a vapor recovery/disposal system designed to minimize VOCs from exiting the unit and entering the atmosphere.

#### **Inspections, Maintenance, and Recordkeeping**

- \* Inspect all vapor transfer paths for leaks. Vapor transfer paths include the combination of piping, hoses, valves, fittings, storage tanks, and other devices through which VOC vapors are transferred.
- \* Maintain records of total recycled solvent throughput on the unit for every calendar month. Keep monthly records for at least two years. (See New And Recycled Solvent Usage And Distillation Unit Recordkeeping Form)
- \* Ensure that the seal on the unit's processing tank lid is not damaged. If it is damaged, it should be repaired immediately.
- \* Develop a preventive maintenance program designed to ensure that the vapor collection and/or vapor recovery/disposal systems are working properly.

#### **Work Practice Changes**

- \* Carefully transfer used (recyclable) solvent from the accumulation drums to the unit's processing tank. Avoid splashing solvent and do not overfill the tank.
- \* Keep lids on all solvent containers when not in direct use.

Date	New Inventory	New Service Usage	On Hand	Purchased	Issued	Thinning	Clean Up Equipment	Surface Preparation


**Objective**

To minimize the potential for VOC emissions caused by fueling operations and fuel storage by implementing proactive practices and procedures.

**Background**

Shipbuilding and repair facilities perform a wide range of fueling operations. Many facilities have underground or above-ground storage tanks used for supplying fuel to maintenance and production equipment. Similarly, some shipyards employ fuel tank trucks to supply equipment and ships. Fuel is transferred to cranes, transportation equipment (e.g. forklifts), automobiles, and ships. The frequency of fueling will be driven by production levels and varying maintenance requirements.

Shipyards generally store and/or transfer diesel gasoline, and jet fuel for shipbuilding and repair operations. Emissions from fueling and storage consist of VOCs such as benzene, hexane, toluene, and several others depending on the type of fuel. Emissions can occur from several types of fueling operations. The four fuel transfer configurations that are most widely used include splash filling, submerged falling, phase I vapor recovery, and phase II vapor recovery. Phase I vapor recovery involves recovering fuel vapors caused by tank trucks delivering fuel to shipyard storage tanks. On the other hand, phase II involves recovering fuel vapors at the pump while transferring fuel to shipyard equipment tanks. Many shipyards are not required to install and maintain phase I and/or phase II vapor recovery systems. Shipyards that are required to use phase I and II vapor recovery should review their permits and develop specific procedures to maintain compliance.

**AQBMP Ideas****Inspections and Recordkeeping**

- \* Periodically inspect and ensure that all seals and gaskets on fuel storage tanks are in good operating condition and that caps on the tanks are replaced and sealed properly. Replace gaskets and seals, when necessary. (See Gasoline/Diesel Pump Self Inspection Checklist)
- \* Track fuel usage quantities to cranes and other large and/or stationary engines.

**Work Practice Changes**

- \* Do not "Top-Off" fuel tanks. This can increase the risk of spillage and excessive vapors or cause a vapor recovery system to become blocked.
- \* When possible, perform submerged filling of fuel tanks as opposed to splash filling when no vapor recovery system is in use.

**Preventive Maintenance**

- \* For vapor recovery units, replace boots that have splits or tears.

**Spill Management**

- \* Use containment equipment (spill pans, buckets, etc.) in areas with the possibility for leakage.
- \* Clean-up all accidental spills rapidly to minimize fuel evaporation.

## Gasoline/Diesel Pump Self Inspection Checklist

Inspect Gasoline/Diesel Pumps on a periodic basis identifying problems with an **X** and no problems with an **OK**.

Week of:

Inspection Points	Mon	Tue	Wed	Thu	Fri	OK = No Problems Identified X = Problem Identified
Hoses						No Kinks, Flat Spots, or Blockages
Boots						No Triangular Tears, Cuts, or Slits
Faceplates and Flexible Cones						Good Seal, No Missing Seals or Gaskets
Nozzle Shut-Off						No Shut-off Malfunction
Connections in Good Condition						No Leaks or Potential Detachment
Check Valves						Properly Wired and Clamped
Certified Equipment						No Missing Seals, Gaskets, or Stickers
Vapor Recovery Unit						Power On, Compressor Working
Secondary Containment and Clean-up Equipment						Containment and Spill Equipment In-Place
No Topping Off						Signs or Procedures Followed
Submerged Filling						When Possible
Overflow Protection						Containment
Usage Accounting						Fuel Usage Accounting System In-Place and Operational
<b>Inspector's Initials</b>						

NA = Use NA for areas that are Not Applicable to your operations

Note: What to do if a serious problem (leakage, tear, etc.) is identified:

- 1.) Shut pump down and lock nozzle out of service
- 2.) Inform the Maintenance Department to repair the problem
- 3.) Inform the Environmental Department to follow up with Maintenance

Also, all minor problems should be reported to the Environmental Department.

**Section IIb.**  
**AQBMP Ideas For**  
**Production Processes**



### Objective

To implement and maintain procedures and practices that minimize the release of potentially toxic substances from shipyard welding operations.

### Background

Shipyards perform a variety of welding operations throughout the shipyard during ship construction and repair work. Welding is predominately used for pipe fitting, sheet metal ventilation% steel hull-structure joining, and shipyard maintenance. Welding occurs throughout shipbuilding and repair processes and at nearly all production shops, outdoor and indoor platens, on-board ships, and in confined spaces.

There are several different types of welding processes used for shipbuilding and repair. Each welding process has a unique set of advantages and disadvantages when applied to shipyards. The four main welding processes include the following: (1) Shielded Metal Arc Welding (SMAW), (2) Gas Metal Arc Welding (GMAW), (3) Flux Cored Arc Welding (FCAW) and (4) Submerged Arc welding (SAW). The majority of welding operations and materials are tightly regulated by Military Specifications (Navy) and the American Bureau of Shipping (ABS) for commercial vessels.

Welding processes utilize electrodes, filler metals, wire, coatings, and/or gases that may contain several potentially toxic substances. The high operating temperatures can cause hazardous fumes to be released. Fumes containing Hazardous Air Pollutants (HAPs) are a major concern with welding emissions. Potentially hazardous metals identified in welding fumes include: manganese (Mn), nickel (Ni), chromium (Cr), hexavalent chromium (Cr<sup>+6</sup>), cobalt (Co), and lead (Pb).

### AQBMP Ideas

#### Recordkeeping

- \* Keep records of welding rod consumption (lbs.) by shipyard location and weld rod type. (See Welding Consumable Usage/Issues Tracking Form)

#### Process Evaluation

- \* Investigate and evaluate switching to welding consumables and processes (rods, wires, electrodes, etc.) that produce less toxic emissions.
- \* Investigate and evaluate shipyard welding operations for potentially toxic welding emissions and analyze potential collection and control options.

#### Facility Modification

- \* Consider providing collection hoods in critical welding applications (i.e. indoors, confined spaces, and potentially high toxicity emissions).

**Education and Training**

- \* Educate welders about potentially toxic welding emissions and the importance of using exhaust hoods, respirators, and collection systems.

## Welding Consumables Usage/Issues Tracking Form

Date: \_\_\_\_\_

Foreman: \_\_\_\_\_

Shift: \_\_\_\_\_

Badge No.: \_\_\_\_\_

Shipyard Usage or Issue Location: \_\_\_\_\_

Rod/Wire Manufacturer	Rod/Wire Type ID No.	Rod, Wire, or Electrode Diameter	Shipyard Material Code	Welding Process (GMAW, SMAW, SAW, FCAW, Etc.)	Quantity Issued/Used (lbs.)

Welding consumable composition can be derived from AWS D1.1, AWS D1.6, and/or Material Certifications.

### Objective

To minimize the amount of fugitive VOC and HAP emissions from paint operations and paint particulate matter emissions through educational awareness, training, containment, and improved painting practices.

### Background

Surface coating generally involves the following sequence of operations: surface preparation, coating preparation, coating application, curing, and equipment clean-up. Surface preparation is performed with a variety of chemical and mechanical methods that include: solvent decreasing, alkaline/caustic cleaning, grinding, sanding, and grit blasting. Coating preparation involves mixing paints, catalysts, and sometimes thinning. Coatings are applied to products by either brushing, rolling, spraying, or dipping operations. The shipbuilding industry primarily relies on airless and conventional spray equipment for coating operations. Shipyard coatings are generally air dried, although in some cases, they are forced-air dried at elevated temperatures. Finally, organic solvents are generally used for clean-up operations for spray guns, lines, mixers, containers, brushes, and associated equipment.

Basically, coatings are made up of solvents and solid pigments. The solvent portion results in the majority of VOCs and HAPs released from shipyards. Emissions occur during evaporation of the paint thinner or solvent. Emissions can be emitted during storage, surface preparation, application, and clean-up operations. On the other hand the pigment portion of coating systems can contain toxic metals and resins, such as zinc, chromium, crystalline silica, copper, lead, and epoxy. Releases of coating pigments is a function of paint transfer efficiency and the quantity of airborne paint that becomes uncontrolled and carried off-site by wind.

### AQBMP Ideas

#### Develop Procedures For Improved Compliance

- \* Ensure use of VOC compliant coatings by employees, subcontractors, and customers.
- \* Ensure proper thinning and catalyst mixing in accordance with the manufacturer's instructions.
- \* Implement paint and associated solvent usage recordkeeping on a daily, monthly, and/or yearly basis. (See Paint Associated Solvent and Coating Usage Log)
- \* Develop and educate employees about "*GoodHousekeeping Practices*;" which could include
  - Neat and orderly work environment including storing hazardous materials and wastes in a manner that minimizes the potential for accidental releases.
  - Lids on liquid volatile material containers when not directly in use.
  - Practice clean-up procedures to ensure that accidentally spilled solvents and paints are cleaned-up immediately.

### **Increase Transfer and Solid Control Efficiency and Minimize Waste**

- \* Minimize over-spray through training on perpendicular painting techniques.
- \* Small parts should be painted with spray pattern appropriate for the size of the parts.
- \* Consider racking parts in a manner that allows over-spray to land and adhere to other parts.
- \* Reduce spray-gun air pressure to maximize transfer efficiency and reduce over-spray.
- \* Minimize painting performed in cross-draft wind, especially on large flat surface areas where wind velocities can severely reduce transfer efficiency.
- \* Install and utilize containment screening to contain fugitive paint in areas where over-spray can become uncontrolled and transferred off-site (See Abrasive Blasting AQBMP Ideas).
- \* Paint in enclosed areas to help contain paint over-spray whenever possible.
- \* Measure paint job sizes in order to mix the proper amount to ensure minimized emissions and waste.

### **Paint Associated Material and Waste Storage Improvements**

- \* Solvent contaminated rags, cloths, and materials should be stored in a covered container.
- \* Paint, solvent, and rag waste streams should be segregated and stored in separate containers.
- \* Drums should be equipped with tight fitting lids and should remain closed when not in use.
- \* Funnels should be used when filling and the cap should be replaced and the hole covered once filling is completed.

### **Solvent Surface Preparation**

- \* Used solvent-wipe rags should be disposed immediately in a covered container.
- \* Apply the volatile solvents directly to the rag and avoid spraying solvent directly on the surface.
- \* Avoid the use of VOCs for surface preparation whenever possible (i.e. aqueous cleaners).
- \* Investigate using non-VOC surface preparation techniques (i.e. grinding, sanding, blasting, steam cleaning).

### **Equipment Maintenance and Clean-up**

- \* Maintain paint guns and pots to minimize the potential for leaks and improper spraying.
- \* Never clean lines or paint guns by spraying solvents into the air.

- \* Direct spray gun cleaning solvent into a covered solvent pail using minimal pressure.
- \* Investigate using circulating paint gun solvent cleaning units.
- \* Soak spray guns in closed containers for added cleaning.
- \* Minimize using VOC containing materials for clean-up operations.

### **Policies and Investigations For Future Emission Reductions**

- \* Investigate the feasibility of more efficient and higher transfer efficiency equipment (i.e. Plural Component painting equipment, High Volume Low Pressure (HVLP), Airless, Electrostatic Spraying, Roll-coating, Dip-coating, Flow-coating, Brush-coating, etc.).
- \* Work with paint manufacturers and suppliers to develop paints with a lower percentage of VOCs, HAPs, ODSS, and SAWI listed substances.

### **Self-Inspection Procedures for Surface Coating Operations**

Develop a self-inspection program to maintain AQBMPs in the following areas:

- \* Proper storage (cover paint and solvent containers)
- \* Complete recordkeeping
- \* Product labels and MSDSS (easy access and legible)
- \* Equipment is in good operational condition (no leaks or poor spray patterns)
- \* Secondary containment and clean-up response equipment readiness
- \* Proper waste storage and segregation through the shipyard
- \* Containment curtains and screening are in-place in critical areas.

**Paint Associated Solvent  
and  
Coatings Usage Log**

Date: \_\_\_\_\_

Foreman: \_\_\_\_\_

Shift: \_\_\_\_\_

Badge No.: \_\_\_\_\_

Shipyards Usage Location: \_\_\_\_\_

Note: All usage should be identified in gallons and VOC should be identified in lbs/gallon.

Coating or Solvent Manufacturer	Coating Type	Paint or Solvent MFG. ID No.	VOC Content (lbs/gal)	Amount Used (Gal)	Amount Disposed (Gal)	Application Equipment (Airless, Brush, Conv. Etc.)	Solvent for Thinning, Surf/Prep or Clean-up (Gal)

**Note:** Maintain all current MSDSs for paint materials to identify components within the paint and respective concentrations, mixing ratios, VOC content, vapor pressure, and safety issues.

**Objective**

To reduce emissions from various decreasing operations through work practice changes and equipment modification.

**Background**

Decreasing is readily recognizable in many shipyard work areas. Machine shops, paint shops, maintenance shops, electrical shops, and pipe shops are a few areas where parts washers, vapor degreasers, or aqueous or semi-aqueous cleaning tanks are an integral part of operation processes.

Generally, decreasing is accomplished using a solvent with or without the aid of heat. Cold decreasing involves spraying, brushing, flushing, and immersing the parts in a dip tank. The solvent is occasionally heated, but always remains well below the solvent's boiling point temperature. The solvent is often agitated mechanically or ultrasonically to enhance the cleaning action. Mineral spirits, methyl ethyl ketone (MEK), and methylene chloride are a few of the commonly used solvents in cold decreasing.

Vapor decreasing is also found in shipyards. Generally, vapor decreasing starts with lowering parts into the vapor zone in vapor degreaser. In vapor degreaser, solvent vapors condense on the parts to dissolve and displace oily contaminants until the temperature of the parts approaches the boiling point of the solvent. When condensation ceases, the clean parts are slowly withdrawn from the degreaser. Trichloroethylene, 1-1-1 trichloroethane, perchloroethylene, and trichlorodifluoroethane (CFC 113) are widely used vapor decreasing solvents.

Aqueous and semi-aqueous cleaning tanks have replaced many of the traditional cold solvent degreasers and vapor degreasers in recent years. Generally, parts are immersed in a cleaning bath. The cleaning tank may be heated and/or mechanically or ultrasonically agitated for enhanced cleaning action. Parts are then rinsed with clean water to remove any residue. Terpenes, blends of alcohols, glycol ethers, and surfactants are widely used in aqueous and semi-aqueous cleaning. Most solvent emissions occur during removal of parts from decreasing equipment. Pollutants emitted from decreasing operations include VOCs, HAPs, and ODSS.

**AQBMP Ideas****Work Practice Changes**

- \* Keep covers closed when the degreaser is not being used.
- \* Discourage spraying or agitating solvents using air. Use a steady liquid stream or brush cleaning.
- \* In vapor degreaser, only work in or below the vapor zone.
- \* Do not degrease porous or absorbent materials such as rags and wood products.
- \* Rack parts in a manner to allow for maximum drainage and do not overload degreasers.



- \* Tip out any pools of solvent on the cleaned parts before removing from the degreaser.
- \* Remove parts from degreaser slowly. For a solvent degreaser, ensure all parts appear dry before removing from the degreaser.
- \* Dispose of the used solvent in accordance with the local regulations.

### **Personnel Training**

- \* Train operators on proper decreasing techniques as recommended in this document.

### **Inspections and Recordkeeping**

- \* Keep records of solvent usage and used solvent disposal and perform self-inspection of degreasers for leaks and other anomalies regularly. (See Solvent Cleaning Operations Checklist and Usage Recordkeeping Form)

### **Management Policies**

- \* Scrutinize the processes for possible modifications: What are the requirements? Is cleaning a necessary step in the whole process? How clean is clean? Investigate an alternate solvent. Replace high VOC, ODS, HAP, or toxic solvents.

### **Facility Modifications**

- \* Install covers. The cover is the single most important control device for open top degreasers. A tight fitting cover on the degreaser prevents evaporation and saves solvent.
- \* For vapor degreasers, ensure that the covers open and close in a horizontal motion to minimize the air/vapor interface disturbance when removing and inserting parts.
- \* For aqueous cleaning tanks, consider covering the surface of the liquid with commercially available plastic balls to minimize evaporation.
- \* Increase the freeboard distance. The freeboard is the distance from the top of the solvent (for cold degreasers) or vapor (for vapor degreasers) to the top of the tank. The freeboard serves to reduce drafts near the air/solvent interface. An acceptable freeboard height is usually determined by the freeboard ratio, the freeboard height divided by the width of the degreaser's air/solvent area. The minimum freeboard ratio of 0.75 is recommended by the American Society for Testing and Materials (ASTM).
- \* Consider installing a hoist or conveyor to lower and raise parts into and out of degreaser to prevent solvent drag out.
- \* Keep equipment in good condition. Fix leaks, ill fitting covers, or inefficient chillers immediately.

## Solvent Cleaning Operations Checklist And Usage Recordkeeping Form

Inspect Solvent Cleaning Operations on a periodic basis identifying problems with an **X**, and no problems with an **OK**.

Foreman \_\_\_\_\_  
 Shipyard Usage Location \_\_\_\_\_  
 Solvent Type (Manufacture and ID No.) \_\_\_\_\_  
 VOC (Lbs/Gal) \_\_\_\_\_  
 MSDS Readably Accessible \_\_\_\_\_

**Week of:**

Inspection Points	Mon	Tue	Wed	Thu	Fri	
Good Working Order						No Leaks, No excessive spraying, Working Gauges
Containers Closed						Portable Containers and Drum Bung Holes Should Be Closed When Not In Direct Use
Cover Closed						Solvent Tank Lids Should Fit Tight And Have No Leaks
Solvent Spray and Agitation						No Air Agitation, No excessive Splashing
Drying Parts						Remove Parts and Part Racks Slowly, Shake Excess Solvent Over the Solvent Tank
Freeboard Ratio						Should Be 0.75 or More
Hoist Speed						Should Be 11 Ft/Min Or Less
Check and Replace Filter						Check Solvent Cleaning Filter and Replace When Necessary
<b>USAGE</b>						
Solvent Added to Tanks						Gallons of Solvent Added
Solvent Taken from the Tank for Portable Usage						Gallons of Solvent Removed for Usage
Solvent and Sludge Disposed						Gallons of Solvent Removed for Disposal or Recycling
<b>Inspector's Initials</b>						

OK = No Problems Identified

X = Problem Identified

NA = Use NA for areas that are Not Applicable to your operations

**Note:** Notify Department Supervisor of Problem Areas

### **Objective**

To reduce particulate matter and hazardous air pollutant emissions from abrasive blasting operations in shipyards through the implementation of work practice modifications, personnel training, establishing a preventative maintenance program developing management policies, and facility modifications.

### **Background**

Shipyards abrasive blasting operations can be performed in a cabinet, in enclosures, or outdoors in open air. Abrasive blasting is a gross mechanical surface preparation method performed to remove contaminants and provide enhanced coating adhesion on metal substrates. Common contaminants can include mill scaling, rusting, salting, dirt, or old paint.

In a shipyard, cabinet or booth blasting is typically conducted by support organizations such as maintenance, machine, and pipe shops. Cabinet or booth blasting equipment is used to prepare small parts, beams, or plates prior to assembly for machining or for subsequent coating application.

Open air blasting is used on larger structures prior to the application of coatings. This step is typically done outdoors in a designated open air area in a shipyard for blasting miscellaneous parts, a floating drydock and graving dock for blasting ship hulls, and overwater to blast superstructures.

Blasting operations are carried out using equipment such as cabinets or booths equipped with a compressor which supply air, a hopper for blast media storage, a pot for blast media containment, and a nozzle to manipulate the blast media stream fan and speed. Compressed air is used to propel blast media at high speeds toward a surface. This action results in breaking up loose contaminants and, if intended, in creating an anchor pattern for application of subsequent coatings.

The primary emission from grit blasting operations is particulate matter which can be listed HAPs. This can include respirable emissions such as particulate matter under ten microns (PM<sub>10</sub>) which is a listed criteria pollutant and HAPs depending on the blasting media and substrate blasted. Fugitive emissions from grit blasting operations can travel to other parts of the shipyard or outside of the shipyard. Fugitive emissions within the shipyard can end up in other production areas leading to unnecessary worker exposure and potential contamination of other shipyard production activities such as painting. It can end up in or around storm drains which impact stormwater quality. Fugitive emissions can also travel outside of the shipyard and impact the general public. The general public can include industrial, commercial, and residential neighbors. Fugitive emissions which impact these neighbors can potentially result in public nuisance complaints which require a lot of time and money to resolve.

## **AQBMP Ideas**

**Minizing** fugitive emissions from abrasive blasting operations will provide environmental, health stiety, and production benefits for a shipyard. A listing of AQBMP ideas and an inspection checklist are presented below which may lead to cleaner and improved blasting operations:

### **Work Practice Modifications**

- \* Use localized surface preparation methods for small jobs such as a needle gun, grinding, or sanding.
- \* Encourage blasting of small parts in a booth.

### **Personnel Training**

- \* Provide training to workers to blast with the media stream perpendicular to the stiaeces.

### **Preventive Maintenance Program**

- \* Inspect abrasive blast equipment including pots, hoses, and baghouses for breaks, holes, and leaks regularly. (See Abrasive Blasting Self Inspection Checklist)
- \* Ensure cabinet and booth filters are installed and are free of blockage.

### **Management Policies**

- \* Establish a policy to curtail blasting operations during high wind conditions and during erratic wind directions.
- \* Establish a preventive maintenance program for blasting equipment.

### **Process Modifications**

- \* Investigate use of certified abrasive blast media. Certified blast media will lower visible emissions from outdoor blasting operations and fugitive emissions outside the shipyard (CalKornia has a program to evaluate abrasive blast media. Through this program, abrasive blast media that meet stringent opacity standards are certified for outdoor use.).
- \* Investigate alternative surface preparation methods such as hydro-blasting or slurry blasting.
- \* Investigate process changes to eliminate or reduce abrasive blasting surface preparation requirements.

### **Facility Modifications**

- \* Evaluate use of containment methods such as shrink wrapping, shrouding, or screening when blasting operations are conducted in areas above boot tops, on-block or in other designated shipyard areas.
- \* Evaluate use of containment structures such as curtains, sally port screening, or taping when blasting operations are conducted in areas such dry docks, graving docks, or building ways.

**Abrasive Blasting  
Self Inspection Checklist**

**Equipment or Permit No.** \_\_\_\_\_

**Week of:** \_\_\_\_\_

Inspection Points		Sun	Mon	Tue	Wed	Thu	Fri	Sat
Containment in Place								
Manometer Reading								
Filters in Place								
No Holes or Leaks								
No Fugitive Emissions								
Part Size								
Type of Media								
Amount of Media								
Operator's Initials	1st shift							
	2nd shift							
	3rd shift							

OK = No problem Identified

X = Problem Identified

Notify the Maintenance Department of all equipment problems.

### **Objective**

To reduce fugitive emissions from solvent wiping operations through process modification material substitution work practice changes, and equipment modification.

### **Background**

Solvent wiping is an integral part of surface preparation prior to various shipyard operations such as plating, painting, bonding, welding, etc. Also, many maintenance operations require wipe cleaning with solvent.

Generally, solvent wiping is a production cleaning process employing solvent(s) to dissolve or displace contaminants from part surfaces. An operator accomplishes cleaning by wiping the contaminated surface with a solvent dampened wiper (rag, paper, etc.). Chlorinated solvents, alcohols, aromatic solvents, and texpenes are widely used for solvent wiping.

Solvent wiping is a labor intensive task that has a significant potential for unwanted emissions of VOCs, ODSS, SARA listed substances, and HAPs. The type of solvent used for cleaning and the operators' cleaning practices can mandate the emission levels.

### **AQBMP Ideas**

#### **Material Substitution**

- \* Consider an alternate solvent. Replace high VOC, ODSS, and other toxic solvents with more benign solvents.

#### **Process Modification and Work Practice Changes**

- \* Evaluate the processes for possible modifications: What are the requirements? Is cleaning a necessary step in the whole process? How clean is clean? Can different methods of cleaning such as dip cleaning replace wipe cleaning?
- \* Use plungers and squeeze bottles to transfer solvent to a wiper. Discourage direct transferring of solvent from drums or large containers to the wiper material to prevent spills and over saturating the wiper material.
- \* Discourage use of spray bottles for high VOC solvents such as MEK and alcohols.
- \* Encourage proper cleaning techniques: Discourage pouring solvent directly onto the part. Dampen do not saturate, the wiper with solvent. Clean a small area at a time.
- \* Provide containers with covers at or near the work area. Line the container with plastic liier for better retention of solvent and its vapors.

- \* Encourage disposal of dirty rags in a closed container immediately upon completion of solvent wiping.
- \* Empty the job site containers daily into a storage drum with a lid.
- \* Encourage and reward operators for employing cleaning practices that curtail unnecessary emissions from solvent wiping operations.

### **Objective**

To reduce fugitive emissions from varnish dipping processes through work practice modification, equipment modification and employee awareness.

### **Background**

Electrical insulating varnish is an integral part of power equipment construction and operation. Varnishes offer resistance to vibration and wire separation~ and protect the winding and coil from moisture and airborne impurities.

Varnish is generally applied through a dip coating process. The winding, core, stator, and armature of motors are submerged in tanks filled with varnish until bubbles no longer rise to the surface. Depending on the type of varnish used, the components are air cured or forced air cured in a drying oven.

Most common varnishes used in electrical insulation include synthetic resins mixed with solvent carriers such as xylene or toluene. Generally, solvent and thinners comprise up to 50% of most varnishes. Therefore, varnish dipping operation can result in VOC and HAP emissions depending on varnish material composition.

### **AQBMP Ideas**

#### **Work Practice Changes**

- \* Keep varnish dip tank covers closed when not in use. As much as five gallons of solvent vapor per day can evaporate from an open tank of solvent mixed varnish.
- \* Ensure parts are clean prior to varnish coating.
- \* Keep varnish free of scraps and dirt to prolong its pot life and ensure varnish performance.
- \* Keep varnish temperature as cool as possible to prolong its pot life.
- \* Drain and clean dip tanks yearly and filter the varnish before refilling.
- \* Agitate varnish only when necessary. Use mechanical agitation and avoid air agitation of varnish.

#### **Recordkeeping and Inspections**

- \* Keep records of varnish and solvent usage and disposal.
- \* Perform self-inspection of varnish tanks for leaks and other defects regularly. (See Varnish Dipping Operations Checklist and Usage Recordkeeping)



**Personnel Training**

- \* Train operators on proper varnish dipping techniques as recommended by the manufacturer and as specified in this document.

**Management Policies**

- \* Consider replacing high solvent requiring varnish with no-solvent or water-base varnishes

**Facility Modifications**

- \* Consider reducing the size of the varnish dip tank if the size of the tank is much greater in comparison to the parts being varnish dipped.
- \* Install covers, if not already installed. The cover is the most important control device for varnish tanks. A tight fitting cover will prevent evaporation of solvent and excessive emission.
- \* Consider installing a small opening in the cover for dipping small components.
- \* Keep the equipment in good working condition. Fix leaks or ill fitting covers.

## Varnish Dipping Operations Checklist and Usage Recordkeeping

Inspect Varnish Dipping Operations on a periodic basis identifying problems with an **X**, and no problems with an **OK**.

Foreman: \_\_\_\_\_

Shipyards Usage Location: \_\_\_\_\_

Varnish Type (Manufacture and ID No.): \_\_\_\_\_

VOC (Lbs/Gal) \_\_\_\_\_ MSDS Readably Accessible \_\_\_\_\_

Week of: \_\_\_\_\_

Inspection Points	Mon	Tue	Wed	Thu	Fri	
Good Working Order						No Leaks, Working Gauges, Other Defects, Proper Ventilation
Cover Closed						Varnish Tank Lids Should fit Tight and Have No Leaks
Varnish Mixing and Agitation						No Air Agitation, No Excessive Splashing
Parts Cleaned Prior To Dipping						Ensure Proper Surface Preparation
Part Removal						Remove Parts and Part Racks Slowly, Shake Excess Varnish Over the Tank
Varnish Temperature						Keep Varnish Cool to Avoid Evaporation
<b>USAGE</b>						
Make-Up Varnish Added						Gallons of Make-Up Varnish Added
Make-Up Solvent Added						Gallons of Make-Up Solvent Added
Varnish Removed For Portable Usage						Gallons of Varnish Removed for Usage
Varnish and Sludge Disposed						Gallons Removed for Disposal
<b>Inspector's Initials</b>						

OK = No Problems Identified

X = Problem Identified

NA = Use NA for areas that are Not Applicable to your operations

Note: Notify Department Supervisor of Problem Areas

Comment on Problems Identified: \_\_\_\_\_

---



---



---

### **Objective**

To reduce fugitive emissions from metal finishing operations such as plating and pickling processes through work practice changes and equipment modification.

### **Background**

Metal finishing is an integral process to shipbuilding and repair operations. Metal finishing operation is found in various locations within a shipyard including pipe shop, electrical motor shop, machine shop, etc. Metal parts are pickled or plated to prepare for painting or to provide for conductive property, decorative look and/or corrosion resistance.

Pickling steel parts is accomplished by immersing steel parts in a series of corrosive baths, generally caustic soda and sulfuric acid tanks. Ferrous and nonferrous metal parts are plated in a copper, cadmium-silver, or chromium bath or may be brush plated. Generally parts are cleaned with a solvent before being plated. Potential pollutants from metal finishing include volatile organic compounds (VOCs) from cleaning operation and hazardous air pollutants (HAPs) from plating and pickling bath solutions.

### **AQBMP Ideas**

#### **Material Substitution**

- \* Consider choosing less harmful chemicals for metal finishing processes. Replace high VOC, ozone depleting, or toxic chemicals with less environmentally hazardous chemicals.

#### **Facility Modification**

- \* Consider installing covers over plating baths if the configuration of the tanks allow. Covers help minimize plating solution evaporation and keep the plating bath clean.
- \* Consider using floating balls in pickling baths. The balls provide the same effect as covers.
- \* Consider installing an air curtain and scrubber to pickling and plating tanks.

#### **Maintain Operational Constraints**

- \* Maintain the temperature, concentration% and cleanliness of plating and pickling baths to your yard's specification or the manufacturers' recommendations.

#### **Inspections and Recordkeeping**

- \* Regularly perform inspection of pickling and plating tanks for leaks and other irregularities.
- \* Maintain records of chemical usage and tank inspection. (See Metal Finishing Operations Checklist And Material Usage Recordkeeping)

## Metal Finishing Operations Checklist And Material Usage Recordkeeping

Inspect Metal Finishing Operations on a periodic basis identifying problems with an **X**, and no problems with an **OK**.

Foreman: \_\_\_\_\_

Shipyards Location and Tank ID No.: \_\_\_\_\_

Material Inside Tank (Chemical, Manufacture and ID No.) \_\_\_\_\_

MSDS' Readably Accessible \_\_\_\_\_

Week of:

Inspection Points	Mon	Tue	Wed	Thu	Fri	
Good Working Order						No Leaks, Working Gauges, Other Defects, Proper Ventilation
Cover Closed						Tank Lids Fit Tight and Have No Leaks, Floating Balls In-Place
Mixing and Agitation						No Air Agitation, No Excessive Splashing
Parts Cleaned Prior To Dipping						Ensure Proper Surface Preparation
Part Removal						Remove Parts and Part Racks Slowly, Shake Excess Material Over the Tank
Bath Temperature						Keep Tanks at Proper Operational Temperatures
<b>USAGE</b>						
Amount of Make-Up Material Added						Gallons of Make-Up Material Added
Amount of Material and Sludge Disposed						Gallons Removed for Disposal
<b>Inspector's Initials</b>						

OK = No Problems Identified

X = Problem Identified

NA = Use NA for areas that are Not Applicable to your operations

Comments on Problems Identified: \_\_\_\_\_

\_\_\_\_\_

Note: Notify Department Supervisor of Problem Areas

### Objective

To reduce particulate matter (PM<sub>10</sub>) and volatile organic compound (VOC) emissions from composite material operations through changes in work practices, processes, and through implementation of training and management policies.

### Background

Because composite materials are lightweight, possess tensile strength and provide corrosion protection their use in industry is steadily increasing. Although the application of composites in steel shipbuilding is currently limited and very specialized it is expanding as new uses are proven. Composite materials can be found in superstructure components such as railings, antennae, radar dishes, and weapon systems. Composite materials are also found in the construction and repair of propeller shafts and other ship components such as insulation material furniture, fixtures, and various types of equipment.

Composite materials are basically plastic reinforced with fiber. The common types of plastic used include epoxy, polyester, and silicone. The common types of fibers used include glass, carbon polyester, cotton or nylon.

The basic steps in manufacturing composite material parts are: tool manufacturing, surface preparation of tool (mold), gel coat application polyester resin lay-up, fiber material lay-up, polyester resin lay-up, cutting, grinding, sanding, curing, painting, clean-up, and curing.

Composite material operations can generate PM<sub>10</sub> emissions from the cutting, grinding and sanding of the tool and fiber components. PM<sub>10</sub> is a federally listed criteria pollutant. Surface preparation gel coat application polyester resin lay-up, painting, clean-up, and curing activities involved in composite material operations result in VOC emissions. VOC is a precursor to ozone. Ozone is also a federally listed criteria pollutant.

### AQBMP Ideas

PM<sub>10</sub> and VOC emissions can be minimized from composite material operations by following simple housekeeping procedures and by implementing work practices and process changes along with implementing training and management policies. A listing of AQBMP ideas and a sample self inspection checklist are presented below:

### Work Practice Changes

- \* Encourage use of drip pans for hand lay-up work.
- \* Place covers on VOC containers when not in use.
- \* Vacuum work areas.

- \* Replace booth filters with significant drops in air flow when applicable.
- \* Use booths or containment equipped with an air collection and filtration systems when possible for sanding, grinding, or cutting operations.

### **Inspections and Personnel Training**

- \* Encourage craftsmen to cover all VOC containers not being actively handled.
- \* Discourage painting in cross draft areas.
- \* Encourage self inspection of air collection and filtration systems of booths and work areas when applicable. (See Composite Material Operations Self Inspection Checklist)

### **Management Policies**

- \* Encourage review of hazardous material constituents.
- \* Establish and maintain a recordkeeping system for using VOC materials.
- \* Establish a preventive maintenance schedule for booth or containment air collection and filtration systems.

### **Process Modifications**

- \* Evaluate the use of low monomer content resins.
- \* Evaluate the use of low VOC cleanup solvents.
- \* Evaluate use of preimpregnated composite materials.

## Composite Material Operations Self Inspection Checklist

Equipment or Permit No. \_\_\_\_\_

Week of \_\_\_\_\_

Inspection Points		Sun	Mon	Tue	Wed	Thu	Fri	Sat
Housekeeping Practices	Containers Closed							
	Drip Pans Used							
	Work Area Clean							
Recordkeeping	Mix Ratios Followed							
	Material Usage Logged							
Equipment Operation	Oven Temperature Range							
	Filters in Place							
	Air Flow Readings							
Other:								
Operator's Initials	shift No. _____							

OK = No problems Identified

X = Problem Identified

Notify the Maintenance Department of all air handling system problems.

**Section IIIc.**  
**AQBMP Ideas For**  
**Management Practices**  
**and**  
**Policies**



## **Hazardous Materials/Waste Tracking And Recordkeeping**

### **Objective**

To enhance shipyard environmental air quality management program through hazardous materials/waste tracking and accurate recordkeeping.

### **Background**

Many process variables, maintenance operations, and self inspections should be documented through the use of recordkeeping. Recordkeeping is a very important issue with respect to the Clean Air Act as well as local rules and regulations. Process and operational records are used for maintaining compliance with permit conditions and are a key element in establishing a hazardous material/waste tracking system.

Hazardous materials/waste tracking provides for mass balance relationships through material usage, waste generation and other process documentation. Accurate hazardous materials/waste tracking through recordkeeping is essential when collecting and reporting usage and release information for various federal and state environmental reporting purposes. Similarly, records of material usage and disposal are necessary to measure the effectiveness of waste minimization efforts in the shipyard.

Recordkeeping responsibilities and procedures are generally decentralized throughout the shipyard. In many cases, recordkeeping information is forwarded to the shipyard's environmental department for material tracking analysis, regulatory reporting, and archiving. A variety of methods exist for maintaining records and tracking hazardous material usage and disposal. Depending on the complexity and quantity of information being recorded, computer data-bases or hand written information combined with customized forms is effective. Data-base systems are excellent for recordkeeping and material tracking, and offer retrieval and data-manipulation capabilities for reporting. The important factor is that the recorded information is complete, accurate, accounts for process materials and waste, and information is readily accessible.

### **AQBMP Ideas**

#### **Screening Hazardous Materials**

- \* Screen all hazardous material MSDSS prior to material purchase and entry into the shipyard. Screening procedures should be established for environmental and safety review of hazardous materials prior to purchase. Establishing an "approved" hazardous products list is often desirable.

#### **Inventory Control and Recordkeeping**

- \* Develop inventory control practices to minimize the amount of hazardous materials on-site at one time and maintain procedures to minimize hazardous material spills. Hazardous material purchase and distribution should apply just-in-time (JIT) principals.

- \* Develop a system of procedures, forms, and computer interface to account for material mass balance relationships. For example, track site or job specific paint usage and correlate this with the specific waste generation.
- \* Maintain a current inventory file of equipment and process air permits.
- \* Maintain accurate and consistent records of self inspections, regulatory inspections, maintenance functions, and material usage/disposal (hours, gallons, etc.) regularly.

### **Recordkeeping Evaluation**

- \* Frequently provide for evaluation of recordkeeping and hazardous materials tracking. Encourage self inspections to ensure that responsible individuals are maintaining complete and accurate records.

### **Education and Training**

- \* Educate individuals involved with processes that accurate record-keeping is critical for a variety of reasons (i.e., waste minimization process control and regulatory compliance).

### **Objective**

To minimize particulate and VOC emissions through environmental awareness and increased control of waste management operations.

### **Background**

Shipyards potentially generate large quantities of hazardous and nonhazardous waste. Nonhazardous waste may include a wide variety of packaging materials, construction debris, and several recyclable materials. On the other hand hazardous waste is generated from painting, pickling, plating, and other production and maintenance operations that utilize hazardous materials.

Some shipyards collect nonhazardous waste throughout the shipyard in large containers. These containers are frequently dumped out and the waste is segregated in the waste operations area. Devices, such as magnetic cranes remove any steel scrap from the piles. Waste operations personnel may remove aluminum and other recyclable materials from the piles. Waste operations personnel also ensure that hazardous waste is not disposed with non-hazardous waste. This process of segregation can frequently cause dust which is referred to as Particulate Matter (PM). Similarly, PM emissions generally result from waste abrasive transfer operations and handling.

On-site satellite generators of hazardous waste (e.g., painters) accumulate waste in their area and, once waste containers are full, send the waste for on-site waste processing and disposal. In some cases, on-site waste processing includes consolidating waste streams and packaging hazardous waste properly for off-site disposal. The process of segregation and consolidation can result in minor VOC emissions.

### **AQBMP Ideas**

#### **Employee Awareness**

- \* Institute employee awareness education to ensure understanding of waste operations and the potential for emissions.

#### **Recordkeeping**

- \* It is important keep records of wastes that are processed and disposed. Internal tracking of waste to on-site satellite generators can result in greater process awareness and ideas for waste minimization and emission control. (See Shipyard Hazardous Waste Transportation Form)

#### **Operational Analysis**

- \* Perform an up-stream analysis of waste operations. Up-stream segregation can save time, money, and eliminate the need for emissions to occur. For example, if paint waste is properly segregated into accumulation drums, there is essentially no need to open the drum and release VOCs.

**Work Practice Modification**

- \* Set up practices to perform dust containment. PM emission can result when segregating nonhazardous waste or transferring used abrasive blast. Investigate dust containment screens and process modifications that will reduce fugitive dusts.
  
- \* Ensure that hazardous waste is segregated from nonhazardous waste. Frequent inspections of nonhazardous trash is desirable for up-stream control of potential emissions.

## Shipyard Hazardous Waste Transportation Form

### Section 1) To be Completed by Waste Generation Department (Only):

**Destination** (Circle One): (Waste-Area) (Paint Storage Solvent Still) (Sand Blast) (Treatment)

**Date:**(Also Put Date On Outside of Packing Slip): \_\_\_\_\_

**From** (Shop, Area, Ship, etc.): \_\_\_\_\_, **Department Name:** \_\_\_\_\_

**Responsible Supervisor:** \_\_\_\_\_, **Badge #:** \_\_\_\_\_, **Phone:** \_\_\_\_\_

**Waste Information:** Fill rows A, B, & C for each waste type shipped to Waste Area on this pallet.

<b>Description of Waste:</b> (Paint Sludge, Acid, Solvent, Oil, Absorbent, Rags, Aerosol Cans, etc.)	<b>Volume of Waste:</b> (Gallons, Lbs, etc.)	<b>Container Type:</b> (1 gal can, 55 gal drum, etc.)	<b>Number of Containers</b>	<b>Waste State:</b> (Solid, liquid, Sludge, gas)	<b>Hazardous Properties:</b> Flammable, Corrosive, Explosive, Etc.)
A)					
B)					
C)					

"I certify that the materials described above are no longer of use in my area of responsibility"

Name \_\_\_\_\_, \_\_\_\_\_ Badge #: \_\_\_\_\_  
 (Print) (Signature)

### Section 2) To be Completed by the Waste Area (only):

**Date Received by Waste Area:** \_\_\_\_\_ **Date Processed by Waste Area:** \_\_\_\_\_

<b>Waste Description:</b> (Actual Waste Description)	<b>Actual Quantity Of Waste:</b>	<b>Comments:</b>	<b>Employee Badge #</b>	<b>Waste Profile #</b>
A)				
B)				
C)				

### **Objective**

To minimize the potential for excess emissions through periodic facility AQBMP evaluations, which will help to ensure that shipyard workers preserve AQBMPs.

### **Background**

The process of AQBMP performance evaluation is crucial to the success of any environmental program. Evaluation for the purpose of this AQBMP, is the process of periodic potentially unannounced internal inspections to ensure that departments are taking proper measures to minimize air pollution. This internal evaluation is an excellent tool that companies can use to measure the performance of air quality pollution prevention practices. The intent is to provide an objective point of view about how well the shipyard is performing AQBMPs before potential violations and/or unnecessary releases occur. The evaluations are meant to complement the self-inspection and preventive maintenance programs. All AQBMP evaluations should be reviewed with and provided to the responsible department personnel for evaluation and improvements.

### **AQBMP Ideas**

#### **Inspections and Recordkeeping**

- \* Develop an inspection checklist for AQBMP performance evaluation.
- \* Develop evaluation forms that contain date, time, results of inspection and proposed follow-up. A follow-up procedure should be instituted to ensure that adequate response and corrective actions are taken. (See AQBMP Performance Evaluation Checklist Form)
- \* A typical evaluation will include an examination of pipes/pumps, containers (open lids), tanks, leaks/seepage, material and wastes transfer processes, baghouses, ducting systems, containment curtains, procedural compliance, and other potential release points identified.
- \* Assess areas identified for evaluation on the basis of potential for accidents and risk of releases. Evaluate AQBMP performance at potentially high risk areas and practices such as:
  - Hazardous materials and waste storage areas
  - Transfer areas and operations
  - Loading and unloading of grit materials and waste
  - Internal and external tank corrosion (toxic tanks)
  - Baghouses and associated procedures
  - Containment screening
  - Proper housekeeping practices and other AQBMPs

### **Procedure Development**

- \* Identify procedures with optimal time intervals between evaluations. It is sometimes desirable to include air quality concerns in an existing program. It is also a good idea to form an evaluation team depending on the size of the facility and complexity of operations. In some cases the evaluation team may include facility environmental engineers, department managers, and/or environmental consultants.

### **Training and Education**

- \* Individuals performing the AQBMI evaluations should have proper training, education and experience in environmental management and company-specific operations.

## AQBMP Performance Evaluation Checklist Form

Evaluate various AQBMP subject areas on a periodic basis to ensure proper operation and adherence to procedures. Evaluations should be conducted by environmental personnel or a designated AQBMP Coordinator.

**Date:** \_\_\_\_\_ **AQBMP AREA:** \_\_\_\_\_

**Time:** \_\_\_\_\_ **Evaluator:** \_\_\_\_\_

**Responsible Area Employee or Department:** \_\_\_\_\_

Evaluate the Following:	Evaluator Comments	Remedy and Follow-up Items
AQBMP Procedures Followed		
Containers Covered in the Area		
Consistent, Accurate, and Easily Accessible Recordkeeping Information		
Proper Installation and Usage of Air Emission Containment Systems		
Good Housekeeping followed in the Area		
Preventive Maintenance System in-place		
Equipment in Good Operational Order		
Employee Awareness of AQBMPs in the Area		
Others		
Others		
Others		



### **Objective**

To implement preventive maintenance measures that reduce the potential for accidental or excessive emissions while increasing equipment life and operating efficiency.

### **Background**

Most shipyards have a maintenance program to maintain production support equipment and systems. In some cases, the maintenance program may only consist of repairing or replacing broken and/or worn out equipment. This breakdown maintenance is not considered a good practice, especially if broken or improperly operated equipment results in fugitive air releases or other potential environmental and safety hazards. Effective preventive maintenance programs contain proactive procedures and practices that extend equipment life through proper operation periodic maintenance inspections, corrective actions, and performance testing. Preventive maintenance will generally reduce breakdown frequency, increase equipment life, and reduce the overall cost of equipment maintenance. An environmentally conscious preventive maintenance program will also include practices and procedures designed to minimize the potential for excessive emissions and accidental environmental releases.

Shipyards preventive maintenance programs should address equipment and process including but not limited to the following:

- Refrigeration and Air Conditioning Systems,
- Plating Tanks (e.g., Cyanide Plating Solution),
- Internal Combustion Engines and Boilers,
- Halon Fire Systems,
- Dust Collection Systems and Baghouses,
- Paint and Grit Blasting Booths and Containment Systems, and
- Solvent Stills.

### **AQBMP Ideas**

#### **Process and Equipment Analysis**

- \* Identify all equipment, systems, and processes that have potential for excess emission due to improper operation and/or breakdown.

#### **Develop Procedures**

- \* Determine and develop procedures and practices to maintain appropriate equipment adjustment, operational condition required repair, and replacement of parts. Include inspections and testing of plant equipment and systems that could break down go out of adjustment, or fail and result in substantial quantities of environmental releases.
- \* Integrate any existing preventive maintenance procedures with environmental concerns.

- \* Integrate any existing preventive maintenance procedures with environmental concerns.
- \* Set-up a system of forms and records for inspections and tests to be maintained in an organized manner. Consistently store and retrieve all maintenance records including repairs, new parts, equipment change-out and all corrective actions for each equipment and/or system.

## **Internal Notification for Accidental Disturbances and Planned Removal of Asbestos Containing Material**

### **Objective**

To ensure that shipyard personnel are aware of accidental disturbances and planned removal of asbestos containing material in shipyard facilities and on ships.

### **Background**

Because asbestos has low electrical conductivity and the ability to resist heat and chemicals, it has a wide variety of industrial and commercial applications. These applications include using asbestos as insulation reinforcement of construction materials, and use in friction products. These materials can be found in construction materials used for shipyard facilities. In the past, asbestos was extensively used as gasket and insulation material for steam pipes and boilers in ships. With the exception of United States (U. S.) based shipyards, these materials are still used in shipbuilding and repair operations throughout the world for both military and commercial vessels.

Asbestos is typically removed prior to renovation or demolition of shipyard facilities. On ships, asbestos removal is typically done before repair of heating, ventilation and air conditioning systems, boilers, and power generation equipment. Asbestos removal practices in shipyard facilities and on ships follow similar practices. In areas where asbestos cannot be removed, the asbestos along with the substrate is typically removed and disposed of as hazardous waste.

Asbestos on piping is commonly removed using the glove bag method. This method involves isolating a section of a pipe with a plastic bag equipped with arm/hand gloves. For flat Mace areas, a plastic containment area with a negative air pressure ventilation system is set up to remove asbestos. The asbestos is usually wet down before it is removed.

Since the late 1970's the use of asbestos in building construction and U.S. shipbuilding and repair operations has declined primarily because of health concerns and regulations adopted and promulgated by U.S. federal agencies such as the Environmental Protection Agency (EPA) and Occupational Safety and Health Agency (OSHA) from the mid to the late 1980s. Emission from asbestos removal operations is particulate matter. Asbestos is a federally classified hazardous air pollutant (HAP). Asbestos particulate matter is respirable and has been known to cause lung cancer and other related lung illnesses. Because asbestos is known to lead to lung cancer and other lung related illnesses it is important to prevent unnecessary exposure to shipyard personnel. Shipyards can help prevent exposure by establishing an internal notification system to keep shipyard workers including subcontractors and government personnel aware of accidental disturbances of asbestos and asbestos removal activities. These notifications can be done through signs in work areas, on bulletin boards, or through announcements at work group meetings.

### **AQBMP Ideas**

A brief listing of AQBMP ideas are presented below which can lead to increased employee awareness about asbestos activity. An example of an internal notification procedure is included to assist shipyards monitor accidental disturbances and planned removal of asbestos containing material in shipyard facilities and on ships.

### **Personnel Training**

- \* Ensure that training is provided to all shipyard personnel and subcontractors to recognize asbestos removal work areas.
  
- \* Ensure that training is provided to shipyard personnel and subcontractors to report any accidental disturbance of facilities containing asbestos in the shipyard.

### **Management Policies**

- \* Ensure all facilities containing asbestos in the shipyard are clearly identified.
  
- \* Establish an internal notification procedure to report any accidental disturbances and planned removal of asbestos containing material in shipyard facilities and on ships.

**Internal Notification Procedures  
for Accidental Disturbances and Planned Removal  
of Asbestos Containing Material**

**Purpose:** To prevent unnecessary asbestos exposure to shipyard personnel.

**Policy:** Shipyard personnel will be informed of accidental disturbances and planned removal of asbestos containing material in shipyard facilities and on ships.

**Procedures:**

	<b>Responsible Parties</b>	<b>Action</b>
1.0	Shipyard Personnel, Maintenance, Facilities Engineer, or Ship Manager	Notify Environmental Engineering or Safety about accidental disturbances or planned removal of asbestos containing material.
2.0	Environmental Engineering  safety	Post areas where accidental disturbances of asbestos containing material has occurred or where planned removal of asbestos containing material will occur as off limits to unauthorized personnel.
2.1	Environmental Engineering  Safety	Notify all supervisors about any accidental disturbances or planned removal of asbestos containing material. This notification will include the location of accidental disturbances or planned removal of asbestos containing material and the time frame for the removal work.
3.0	Supervisor	Announce specifics of internal asbestos notification to employees
4.0	Maintenance, Ship Manager, or Facilities Engineer	Notify Environmental Engineering or Safety of any changes in location or time frame of planned asbestos containing material removal.
5.0	Environmental Engineering or Safety	Release notification to all supervisors on any changes.

NOTE: Environmental Engineering or Safety: mail stop  
fax

### **Objective**

To reduce depletion of the stratospheric ozone layer by evaluating and minimizing usage and releases of Ozone Depleting Substances (ODSS).

### **Background**

ODSS have a wide array of uses in the shipbuilding industry. In recent years, it has been determined that they are damaging the ozone layer and potentially causing global warming. Therefore, shipyards are taking steps to reduce the use of ODS materials. ODSS are generally used in refrigeration and air conditioning plants, fire suppression systems and as a blowing agent for thermal insulation materials. During construction and repair, shipyards may use ODSS in one or more of the following five areas:

- 1) Industrial solvent cleaning for a variety of electrical and non-electrical surface cleaning applications
- 2) Fire extinguishing and suppression systems including: Halon 1211, primarily used for applications in handheld extinguishers and Halon 1301, used for total flooding and explosion protection
- 3) Refrigeration systems for food storage, cold storage warehouse refrigeration air conditioning systems and chillers removed, rebuilt, and otherwise recharged by shipyards personnel
- 4) Paints, adhesives, aerosols, and inks used for a variety of shipbuilding needs
- 5) Insulation materials on-board ships

Chlorofluorocarbons (CFCs) are a major ODS concern because of their ozone-depleting potential. Methyl Chloroform, a CFC, otherwise known as 1-1-1 trichloroethane and CFC-113 are being phased out of production by January 1, 1996. To ensure and support the elimination of ODSS, the DOD has required that "... no DOD contract awarded after June 1, 1993, may include a specification or standard that requires the use of a class I (CFC) ozone deplete..." This requirement also includes modification of previous repair and new construction contracts.

### **AQBMP Ideas**

#### **Evaluate Current ODS Usage in the Shipyard**

\* Analyze shipyard operation to determine when where, why, and how much ODSS are used at the shipyard through the following techniques:

- Inspection of purchase records and MSDSS (incoming materials)
- Physical inspections of the facility and associated processes
- Interview with production managers and staff
- Inventory ODS related equipment and substances

## **Develop an ODS "Management Strategy" Addressing the Following Four (4) Issues**

### **1) Refrigeration and Air Conditioning Operations**

Proper maintenance of facility as well as shipboard systems  
Proper refrigerant recycling and venting procedures  
Proper disposal of refrigeration and other ODS containing equipment  
Outline efforts to recycle refrigerants, retrofit to new alternative refrigerants, or replace old and potentially inefficient equipment with HCFCs or HFCS.

Venting CFCs (Class I substances) and HCFCs (Class II substances) to the atmosphere is prohibited by law. Therefore, shipyards must ensure the following:

- A) Only certified technicians are allowed to maintain, service, and repair air conditioning and refrigeration systems
- B) Only certified technicians are legally authorized to purchase refrigerants
- C) All Class I and II substances must be recycled by a certified reclaimer using EPA certified recovery equipment.

### **2) Fire Extinguishing and Suppression Operations**

Setup procedures to ensure that fire extinguishing systems on-board ships and within the shipyard facility are repaired, tested, and/or dismantled properly to prevent accidental releases into the atmosphere.

### **3) Solvent Cleaning Operations**

Investigate and implement alternative cleaning techniques and chemicals to eliminate ODS containing cleaning solutions. Aqueous, semi-aqueous (including those based on terpenes or petroleum based hydrocarbons), and many options are available to replace ODS substances.

### **4) Paints, Adhesives, Aerosols, and Inks**

Paints, aerosols, adhesives, and inks used in the shipyard environment should be ODS free. Ensure that ODS are not contained within these production materials when feasible.

## **Phasing Out ODS Usage In The Shipyard**

### **Phaseout Team**

- \* Setup a phaseout team consisting of environmental management, production personnel, and equipment & chemical vendors. Develop an action plan to investigate alternative processes and materials and establish an implementation schedule.

### **Potential Substitutes**

- \* Significant New Alternative Policy (SNAP) substitutes are published in the Federal Register March 18, 1994 (59 FR 13044). Consult the EPA SNAP substitutes prior to implementing substitutes for industrial cleaning, aerosols, adhesives, coating, and inks.

- \* Perchloroethylene, Methylene Chloride and Trichloroethylene are not part of the phaseout because they are not regulated ODSS under the Clean Air Act, although they are regulated substances that are potentially toxic to human health and the environment. These substances are regulated as Hazardous Air Pollutants (HAPs) under Title III of the 1990 CAAA.
- \* Ensure that all substitutes are compliant with the specific state and local environmental regulations and permits: Similarly-all OSHA regulations concerning substitute materials should be evaluated.
- \* Investigate using low VOC plastics and coatings for products cured in drying ovens.



## **Section IV.**

### **Suggested AQBMP Implementation Strategy**

#### **Objective/Purpose**

In recent years, the National Shipbuilding Research Program (NSRP) has placed increased emphasis on implementation and utilization of funded projects. This section of the resource document is dedicated to increasing this project's overall benefit and usefulness by providing shipyards with some guidance, direction, and strategies for developing and implementing shipyard specific AQBMPs. It is not intended to be a step-by-step process that shipyards must follow to make use of this resource manual or implement AQBMPs. In fact, there are a number of ways shipyards can research, develop, implement, and maintain AQBMPs. Shipyards should approach implementation with methods that best fit their environmental program and shipyard organization. It is expected that this section will merely be used as a guide of suggested ideas.

#### **The Need for Effective AQBMP Development**

Shipyards personnel must understand the importance and potential benefits of developing and implementing proactive AQBMPs. Environmental managers will want to communicate the importance of implementing AQBMPs to upper management, middle management, and everybody that will have a part in development and implementation. It should always be stressed that AQBMPs are designed to be low cost, common sense procedures and practices that should have very little (if any) impact on production operations. In some cases, production improvements and cost saving opportunities may result from process evaluation during AQBMP analysis and implementation. Ideally, AQBMPs will be inexpensive to implement and maintain. This may be achieved through up-front effective AQBMP development, combined with a well thought-out and organized implementation strategy.

#### **Ideas for Implementing and Maintaining AQBMPs: A Three Stage Approach**

Three main stages should take place to help ensure AQBMP success. First, a preliminary investigation should be performed that evaluates existing processes and determines the need for implementing AQBMPs. Once the needs are defined, development and implementation of AQBMPs will be enhanced using a team effort combined with an implementation plan. Finally, once AQBMPs are implemented, they will need continuous evaluation, refinement, and maintenance to ensure continued success. The three stage approach outlined in the following sub-sections suggests a progression of events that could take place for a comprehensive evaluation, implementation, and continuation of an AQBMP program.

#### **Stage 1. AQBMP Preliminary Analysis and Assessment**

This stage involves analyzing the shipyard's current operations and associated AQBMP needs. This stage is highly shipyard-specific and requires a hands-on approach. The shipyard should perform a preliminary analysis of their processes, equipment, and the potential sources of air

emission that can be mitigated using AQBMPs. This stage generally involves facility-wide inspections, personnel interviews, and preliminary remedy evaluation. Once this stage is completed, the shipyard should determine if there is a current need for implementing AQBMPs and develop a rough outline of AQBMPs that should be implemented.

The following five steps can be used for AQBMP preliminary analysis and assessment:

- 1) Determine which AQBMP Ideas presented in this resource document apply to the specific shipyard. Some AQBMP Ideas developed in this document can be directly applied to the shipyard operations. This step may involve the following functions:
  - Perform site investigations of the current practices, processes, and equipment.
  - Investigate specific shipyard air permit conditions, if any.
  - Investigate specific state and local regulations for AQBMP requirements.
  - Integrate shipyard-specific regulatory requirements into the process.
  - Solicit input from yard personnel in each AQBMP area.

AQBMP Audit Forms developed for this task are supplied at the end of this section. The Audit Forms will help provide an organized approach to the preliminary site investigations and analysis.

- 2) Identify potential sources of fugitive air emissions that are not identified and presented in this resource document. Other potential sources should be noted on the Audit Forms. When other sources are identified, shipyards should analyze potential methods to minimize and/or control emissions.
- 3) Assemble a list of preliminary AQBMP ideas that apply to the specific shipyard. This list of AQBMP ideas could be in a condensed form that may be presented to company management and used for cost/benefit evaluation.
- 4) Determine how implementing AQBMPs will benefit the shipyard and enhance current environmental management efforts. The following items are frequently considered potential benefits:
  - Reduced health and environmental liability.
  - Increased compliance and reduced potential for penalties.
  - Increased yard-wide environmental awareness, commitment, and involvement.
  - Increased employee health and safety.
  - Reduced potential for public exposure to emissions.
  - Establish a positive approach toward pollution prevention.
  - Time savings achieved from process analysis and modification.
  - Increased overall environmental awareness and waste minimization.

- 5) Present results of the preliminary evacuation and analysis to individuals who could be involved with developing and implementing the AQBMP program. It is generally appropriate to solicit and gain upper management support for implementing proactive AQBMPs at this time. It may be appropriate to present the following ideas:
- List of preliminary AQBMP Ideas
  - AQBMP associated costs and benefits (Cost/Benefit Analysis)
  - Estimated level of effort involved for development and implementation
  - Preliminary plan of action (i.e., draft implementation plan).

## **Stage 2. AQBMP Planning, Development, and Implementation**

Upon completion of the preliminary investigations and solidifying agreement to implement AQBMPs, the planning, development, and implementation stage can begin. Proper planning and implementation are very important and essential for success. This stage can be accomplished with a variety of approaches, depending on the shipyard organization and level of effort. The suggested approach advocates the use of an *AQBM Team* and an associated *Implementation Plan*. An AQBMP Team could be assembled to provide comprehensive AQBMP development, management support, and facility-wide buy-in for initial and continued cooperation. The Implementation Plan is a tool developed by the AQBMP Team to define common objectives, identify responsibilities, plan action items, and coordinate effective implementation.

A team approach is highly recommended for a projects that have the potential to affect a wide variety of shipyard departments. Shipyards should assemble an AQBMP Team which could consist of department representatives from environmental production management, facilities, maintenance, and safety. The team should have a leader who has primary control and responsibility for the project. Each team member must understand their responsibility to ensure a successful team effort. In smaller shipyards, the team may consist of one manager or engineer that is assigned to communicate individually with different departments. In general, anyone tasked with implementing AQBMPs is considered apart of the team.

The AQBMP Team should:

- Customize AQBMPs to the specific shipyard facilities and processes.
- Identify equipment specific or expanded AQBMPs.
- Evaluate AQBMPs and implementation issues.
- Access, develop, and implement employee education and awareness.
- Develop an AQBMP implementation plan.

As mentioned above, the shipyard AQBMP Team should develop an implementation plan. In most cases, efforts to prepare a complete and comprehensive implementation plan will lead to fewer problems throughout the program. A generic implementation plan outline follows.

## ***"AQBMP Implementation Plan" (A Suggested Outline)***

### **I. Management Policy Statement: (Project Vision/Mission)**

Provide a clear statement of management's commitment to the policies and responsibilities depicted in the Plan to encourage company-wide AQBMP support.

### **II. Goals and Objectives**

The team should set clear goals and objectives that are written into the Plan and addressed by the work breakdown. Goals should be more global and the objectives should be obtainable milestones.

### **III. AQBMP Ideas to be Implemented**

Identify specific AQBMPs that will be implemented in the shipyard. In some cases, this part of the Plan may be presented in a similar format as the AQBMP Ideas provided in this resource. The shipyard can simply use the AQBMP Ideas provided in this resource document, make modifications, or create their own.

### **IV. Task and Work Breakdown Structure with Time-line**

Specific tasks must be accomplished in order to complete the project objectives and implement AQBMPs. Tasks need to be broken down into manageable work packages, responsibilities assigned to the tasks, and time allotments determined. A Gantt Chart that displays the project's time-line is helpful to visualize project progress and the overall plan.

### **V. Team Involvement and Responsibilities**

A list of individuals on the Implementation Team responsible coordinators, and ancillary help should be identified in the Plan. The list would include titles of individuals and their area of responsibility. This section should contain some type of organizational chart to help visualize the chain of command and responsibility structure.

### **VI. AQBMP Refinement and Preservation**

This section of the plan will identify how to ensure that the AQBMPs continue working. This is generally accomplished through a AQBMP Committee or Coordinator as described in Stage 3.

## **Stage 3. AQBMP Refinement and Preservation**

AQBMPs must be a continuous and integral part of everyday operations. AQBMPs that do not integrate well with operations can fail to gain support from individuals involved and discontinue. A mechanism should exist which provides for periodic AQBMP improvements, modifications, and refinement to encourage support while maintaining environmental objectives.

Refinement and preservation can be accomplished through the use of a shipyard AQBMP Committee or a designated AQBMP Coordinator. The Committee or Coordinator can be used to monitor AQBMP status and effectiveness through inspections, incident reports, departmental complaints, and/or status meetings. An AQBMP Committee could be composed of members from

the implementation team upper management and/or production. Similarly, an AQBMP Coordinator could be a member of the AQBMP Team or another responsible individual.

The Committee or Coordinator will generally perform the following:

- Regularly discuss AQBMP status and potential problems.
- Evaluate the effectiveness of the current AQBMPs and make recommendations.
- Evaluate employee AQBMP awareness and education.
- Discuss and address needs for future AQBMP improvements and updates.
- Assess how the AQBMPs are received by the workers.

Through inspections and interdepartmental communication the shipyard can make a determination as to the overall effectiveness of implementing AQBMPs. Some success factors may include: reduction in violations, penalties, more efficient running equipment, increases in employee health and safety, increased overall awareness, and interest in AQBMP ideas.

## **Summary**

There are many ways that a shipyard can approach analyzing and implementing AQBMPs. This section of the AQBMP resource document has identified a three stage approach that addressed analysis and assessment, planning and implementation and AQBMP refinement and preservation. Specific shipyard implementation strategies will vary greatly and be a function of its size, complexity, organizational structure, and the configuration of current environmental programs. It is important that the implementation strategy integrates with shipyard operations and does not cause significant additional effort.

A team approach is always recommended for a project that has the potential to affect a wide variety of shipyard departments. Similarly, preparing an implementation plan will improve the efficiency of the implementation effort by clearly identifying objectives, AQBMPs, assigning responsibilities, and assembling an implementation schedule. Once the AQBMPs are implemented, continuous refinement and maintenance of AQBMPs should be addressed to increase overall effectiveness and make improvements to the program.

Most shipyards will benefit from implementing AQBMPs. Benefits can be realized through reduced liabilities and penalties, increased employee health and safety, and decreased effects to the environment and public at large. Also, through the AQBMP process analysis, shipyard personnel will gain a greater understanding of operations that present potential air pollution problems and, in some cases, identify cost saving opportunities.

## AQBMP Implementation Facility Analysis Check-List Forms

<b>Operational Support Equipment</b>	<b>No. of Units On-Site</b>	<b>Practices Currently <u>In Place</u></b>	<b>AQBMPs Needed (Write out)</b>	<b>Est. Cost to Implement (Dollar Amount and Time)</b>	<b>Possible Benefits</b>	<b>Possible Roadblocks</b>
<b>Water Treatment Units</b>						
<b>Cooling Towers</b>						
<b>Drying Ovens and Furnaces</b>						
<b>Boilers Operations</b>						
<b>Internal Combustion Engines</b>						
<b>Paint Spraying Booths</b>						
<b>Solvent Distillation Units</b>						
<b>Fuel Storage And Transfer Operations</b>						

<b>Production Processes</b>	<b>Practices Currently <u>In</u> Place</b>	<b>What AQBMP Needs to be Implemented (write out)</b>	<b>Est. Cost to Implement (Dollar Amount and Time)</b>	<b>Potential Benefits</b>	<b>Possible Roadblocks</b>
<b>Welding Processes</b>					
<b>Painting Operations</b>					
<b>Degreasing</b>					
<b>Abrasive Blasting Operations</b>					
<b>Solvent Wiping</b>					
<b>Varnish Insulation</b>					
<b>Metal Finishing</b>					
<b>Composite Material Operations</b>					

<b>Management Practices and Policies</b>	<b>Practices Currently <u>In</u> Place</b>	<b>What AQBMP Need to be Implemented (write out)</b>	<b>Est. Cost to Implement (Dollar Amount and Time)</b>	<b>Potential Benefits</b>	<b>Possible Roadblocks</b>
<b>Hazardous Material-Waste Tracking and Recordkeeping</b>					
<b>Waste Operations</b>					
<b>Periodic AQBMP Evaluations</b>					
<b>Preventive Maintenance</b>					
<b>Internal Notification of Asbestos Disturbances</b>					
<b>ODS Evaluation and Control</b>					



## **Section V.**

### **Conclusions and Recommendations**

#### **Conclusions:**

Implementing AQBMPs within the shipyard production environment will benefit shipyards in many ways when implemented and maintained properly. AQBMP development and implementation will enhance environmental and safety compliance and reduce liability. In some cases, AQBMPs offer a method of compliance with the intent of several federal environmental and safety regulations. Also, many individual state requirements can be addressed using AQBMPs. Emissions associated with shipyard operations are potentially unhealthy for the employees and public alike, and AQBMPs are low-cost solutions for minimizing releases.

The suggested AQBMPs listed in this document are an excellent source of information that can be directly applied to many shipyards. A significant amount of up-front research and shipyard personnel interviews went into developing each AQBMP idea. The AQBMPs are written to be flexible to enable each shipyard to customize the AQBMP to better fit their operations. It is expected that each shipyard will analyze their specific operations and customize AQBMPs that apply, or simply use the AQBMPs as written. The list of AQBMPs in this document is not exhaustive, but should serve as an excellent guide for developing AQBMPs for specific shipyard operations.

#### **Recommendations:**

Controlling and minimizing pollution through the use of management practices and low technology facility improvements is a proven technique throughout industry. In many cases, practices implemented to minimize waste or reduce water pollution can also reduce air pollution. For example, water quality BMPs were originally intended to compliment other regulatory requirements and pollution prevention efforts imposed by RCRA OSHA the Clean Air Act and other regulations and requirements. Thus using a multi media approach toward pollution prevention should always be emphasized when developing and implementing AQBMPs.

Seriously consider using the Suggested Implementation Strategy outlined in Section IV. It is a well thought out strategy that will help ensure that AQBMP efforts are more effective. The implementation phase of any project is usually more complex than realized and the historical project implementation pitfalls can be avoided by using the suggested implementation strategy. In essence, remain organized by forming a team and developing a plan. Get buy-in and up-front involvement from all individuals who will be affected. Also, assign a project leader to follow through organize regular meetings, and develop progress reports. Finally, organize a process to ensure that AQBMPs continue and are modified as processes change and new equipment is added.

## **AQBMP Glossary**

**ABS (American Bureau of Shipping):**

The has authority of American commercial ship construction and operations standards.

**Air Pollutants:**

Amounts of foreign and/or natural substances occurring in the atmosphere that may result in adverse effects on humans, animals, vegetation and/or materials.

**Alternative Fuels:**

Fuels such as methanol ethanol natural gas, and liquid propane gas that are cleaner burning.

**Ambient &**

The air occurring at a particular time and place outside of structures. Often used interchangeably with outdoor air.

**AAQS (Ambient Air Quality Standards):**

Health and welfare based standards for clean outdoor air which identify the maximum acceptable average concentrations of air pollutants during a specified period of time.

**AQBMPs (Air Quality Best Management Practices):**

The use of materials, processes, or practices to reduce, minimize, or eliminate the creation of pollutants or wastes. It includes practices that reduce the use of toxic or hazardous materials, energy, water, and/or other resources.

**Atmosphere**

The gaseous mass or envelope surrounding the earth.

**BMPs:**

Best Management Practices are defined in the CWA as practices, procedures, policies and minor facility improvements that minimize the potential for pollution of state and federal surface waters.

**CAAA**

Clean Air Act Amendments of 1990; expand EPA's enforcement powers and place restrictions on air toxics, ozone-depleting substances (ODSS), stationary and mobile emission sources, and substances implicated in global warming acid rain formation.

**Cancer:**

A group of diseases characterized by uncontrolled growth of body cells leading to the formation of malignant tumors that tend to grow rapidly and spread (metastasize).

### Catalytic Converter

A motor vehicle pollution control device designed to reduce emissions such as oxides of nitrogen hydrocarbons, and carbon monoxide. Catalytic converters have been required equipment on all new motor vehicles sold in California since 1976.

### CERCLA:

Comprehensive Environmental Response, Compensation, and liability Act; also known as Superfund; federal law authorizing identification and remediation of unsupervised hazardous waste sites.

### Certified Abrasive Blast Media

Abrasive blast media certified to generate low opacity visible emissions.

### CFCS (Chlorofluorocarbons):

Any of a number of substances consisting of chlorine, fluorine, and carbon. CFCS are used for refrigeration, foam packaging, solvents, and propellants. They are proven to cause depletion of the atmosphere's ozone layer. HCFC are hydrochlorofluorocarbons, which are any of several temporary alternatives to CFCS.

### Chrome VI.:

Chrome VI is a valence state of chrome that occurs during welding operations and may be found in some cooling tower water. Chrome VI is toxic and carcinogenic.

### CWA:

Clean Water Act federal law regulating the discharge to surface waters and publicly owned treatment units (POTWS). The original version was passed in 1972 and updated in 1987.

### CO (Carbon Monoxide):

A colorless, odorless gas resulting from the incomplete combustion of fossil fuels. Over 80% of the CO emitted in urban areas is contributed by motor vehicles. CO interferes with the blood's ability to carry oxygen to the body's tissues and results in numerous adverse health effects. CO is a criteria air pollutant.

### CO (Carbon Dioxide):

A colorless, odorless, gas that occurs naturally in the earth's atmosphere. Significant quantities are also emitted into the air by fossil fuel combustion. Emissions of CO have been implicated with increasing the greenhouse effect.

### Criteria Air Pollutant:

An air pollutant for which acceptable levels of exposure can be determined and for which an ambient air quality standard has been set. Examples include: ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, and PM-10 (see individual pollutant definitions).

EPA (Environmental Protection Agency):

The United States agency charged with setting policy and guidelines, and carrying out legal mandates for the protection of national interests in environmental resources.

FCAA (Federal Clean Air Act):

A federal law passed in 1970 and amended in 1977 and 1990 which forms the basis for the national air pollution control effort. Basic elements of the act include national ambient air quality standards for major air pollutants, air toxics standards, acid rain control measures, and enforcement provisions.

Emission Inventory:

An estimate of the amount of pollutants emitted from mobile and stationary sources into the atmosphere over a specific period such as a day or a year.

Fugitive Dust:

Dust particles which are introduced into the air through certain activities such as soil cultivation, off-road vehicles, or any vehicles operating on open fields or dirt roadways.

Greenhouse Effect

The warming effect of the earth's atmosphere on the earth. Light energy from the sun which passes through the earth's atmosphere is absorbed by the earth's surface and re-radiated into the atmosphere as heat energy. The heat energy is then trapped by the atmosphere, creating a situation similar to that which occurs in a greenhouse or a car with its windows rolled up. Many scientists believe that the emission of CO and other gases into the atmosphere may increase the greenhouse effect and contribute to global warming.

Hazardous Air Pollutant (HAP):

An air pollutant considered by EPA to be particularly hazardous to health. Emission sources of hazardous air pollutants are identified by EPA, and emission standards are set accordingly.

HVLP:

High Volume Low Pressure; this identifies paint application equipment that has excellent transfer efficiency due to low pressure requirements.

Hydrocarbon:

Any of a large number of compounds containing various combinations of hydrogen and carbon atoms. They may be emitted into the air as a result of fossil fuel combustion, fuel volatilization, and solvent use, and are a major contributor to smog.

ICE (Internal Combustion Engine):

ICES operate by burning an air/fuel source within a cylinder causing a motion that becomes rotational and used for a variety of purposes. ICES operation on compressed natural gas, gasoline, diesel, and propane. Several types of emissions are released from ICES.

Inspection Checklist Form:

A form designed and used to track and maintain information on material consumption, equipment operating parameter or operating practices.

Indoor Air Pollution

Air pollutants that occur within buildings or other enclosed spaces, as opposed to those occurring in outdoor, or ambient air. Some examples of indoor air pollutants are tobacco smoke, asbestos, formaldehyde, and radon.

JIT (Just-in-time):

A method of material acquisition and usage which increases manufacturing efficiency and reducing the need for storing material prior to use (i.e., material is delivered when it is needed).

MACT (Maximum Achievable Control Technology):

Maximum achievable control technology standards are required for certain types of pollutants identified in the CAAA of 1990.

Mobile Sources:

Sources of air pollution such as automobiles, motorcycles, trucks, off-road vehicles, boats, and airplanes.

NAAQS (National Ambient Air Quality Standards):

Standards set by the federal EPA for the maximum levels of air pollutants which can exist in the outdoor air without unacceptable effects on human health or the public welfare.

Nitrogen Oxides (Oxides of Nitrogen, NO<sub>x</sub>):

A general term pertaining to compounds of nitric oxide (NO), nitrogen dioxide (NO<sub>2</sub>), and other oxides of nitrogen. Nitrogen oxides are typically created during combustion processes, and are major contributors to smog formation and acid deposition. NO<sub>x</sub> is a criteria air pollutant, and may result numerous adverse health effects.

NPDES:

National Pollutant Discharge Elimination System; a CWA program requiring facility permits that outline water discharges and identify methods to minimize the potential for water pollution.

ODS (Ozone Depleting Substances):

Substances identified that are potentially depleting the stratospheric ozone layer which is predicted to add to global warming and the greenhouse effect. Several ODS have are being phased out of production and substitute materials are under development.

**OSHA:**

Occupational Safety and Health Administration federal agency responsible workplace health and safety and governing the Occupational Safety and Health Act.; federal law passed in 1970 establish the administrative OSHA body.

**Ozone:**

A strong smelling, pale blue, reactive toxic chemical gas consisting of three oxygen atoms. It is a product of the photochemical process involving the sun's energy. Ozone exists in the upper atmosphere ozone layer as well as at the earth's surface. Ozone at the earth's surface causes numerous adverse health effects and is a criteria air pollutant. It is a major component of smog.

**Ozone Layer:**

A layer of ozone 12 to 15 miles above the earth's surface which helps to filter out harmful ultraviolet rays from the sun. It may be contrasted with ground-level ozone, which exists at the earth's surface and is a harmful component of photochemical smog. A primary concern is that compounds such as chlorofluorocarbons (CFCs), used in air conditioning systems, are depleting the ozone layer. Stringent federal requirements will phase out production of chlorofluorocarbons in the U.S. by the year 2000.

**Ozone Precursors:**

Chemicals such as hydrocarbons and oxides of nitrogen occurring either naturally or as a result of human activities, which contribute to the formation of ozone, a major component of smog.

**Permit:**

Written authorization from a government agency (e.g., an air quality management district) that allows for the construction and/or operation of an emissions generating facility or its equipment within certain specified limits.

**PELs:**

OSHA sets federal guidelines for Permissible Exposure Limits (PELs) for over 500 toxic substances found in the industrial work-place.

**PM-10 (Particulate Matter):**

A major air pollutant consisting of tiny solid or liquid particles of soot, dust, smoke, fumes, and mists. The size of the particles (10 microns or smaller, about 0.0004 inches or less) allows them to easily enter the air sacs deep in the lungs where they maybe deposited to result in adverse health effects. PM-10 also causes visibility reduction and is a criteria air pollutant.

**Photochemical Reaction**

A term referring to chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with oxygen in the presence of sunlight to form ozone is an example of a photochemical reaction.

PPA:

Pollution Prevention Act; a federal act established in 1990 that identified pollution prevention as a "National Objective" and the most important component of the environmental management hierarchy.

Preventive Maintenance:

Preventive maintenance is a system of scheduled inspections, replacement, and repair of equipment. A preventive maintenance program will ensure equipment is operating correctly and help to avoid unexpected breakdown or inefficient operation.

RCLA:

Resource Conservation and Recovery Act; federal law passed in 1976 and amended in 1986; regulates the management and disposal of solid and hazardous wastes.

SARA Section 313:

Superfund Amendments and Reauthorization Act federal law passed in 1986 reauthorizing and expanding CERCLA. Section 313 outlines reporting requirements under SARA Section III, also known as the Emergency Planning and Community Right to Know Act. This Act requires public disclosure of Toxic Release Inventory (TRI) information and development of emergency response plans.

Smog:

A combination of smoke, ozone, hydrocarbons, nitrogen oxides, and other chemically reactive compounds which, under certain conditions of weather and sunligh, may result in a murky brown haze that causes adverse health effects. The primary source of smog is motor vehicles.

SNAP (Significant New Alternative Program):

The SNAP list of materials identifies acceptable substitutes for Ozone Depleting Substances. The list is published in the March 18, 1994 Federal Register.

SO (Sulfur Dioxide):

A strong smelling, colorless gas that is formed by the combustion of fossil fuels. Power plants, which may use coal or oil high in sulfur content can be major sources of SO. SO and other sulfur oxides contribute to the problem of acid deposition. SO is a criteria pollutant.

Stationary Sources:

Non-mobile sources such as power plants, refineries, and manufacturing facilities which emit air pollutants. (Contrast with mobile sources).

TLVs:

OSHA sets federal guidelines for Threshold Limit Values (TLVs) for over 500 toxic substances found in the industrial work-place.

#### Vapor Recovery Systems:

Mechanical systems that collect and recover chemical vapors resulting from transfer of gasoline from operations such as tank-to-truck systems at refineries, tanker-to-pipeline systems at offshore oil operations, and pump-to-vehicle systems at gasoline stations.

#### Visibility:

The distance that atmospheric conditions allow a person to see at a given time and location. Visibility reduction from air pollution is often due to the presence of sulfur and nitrogen oxides, as well as particulate matter.

#### VOCS (Volatile Organic Compounds):

Hydrocarbon compounds which exist in the ambient air. VOCS contribute to the formation of smog and/or may themselves be toxic. VOCS often have an odor, and some examples include gasoline, alcohol, and the solvents used in paints.



## **Attachment 1. Source of Information**

*Air Pollution Glossary*, Bruce Oulrey, California Air Resources Board March 1993

*Asbestos Waste Management Guidance, Generator \* Transportation \*Disposal*, USEPA Office of Solid Waste, EPA/530-SW-85-009, May 1985

*Arresting Runaway Fugitive Emissions*, Pollution Engineering, May 15,1993

*Developing a Refrigerant Management Plan*, Robert Johnson, Plant Engineering, April 10,1995

*Electroplating, Case Studies from the Pollution Prevention Information Clearinghouse (PPIC)*, USEPA Office of Environmental Engineering and Technology Demonstration and the Office of Pollution Prevention November 1989

*Environmental Technology For Preventing Air Pollution in the Aerospace Electronics Industry, Volume II Low Cost, Transfer Efficient Paint Spray Equipment*, Southbay Air Quality District and Hughes Aircraft, Corporate Environmental Technology Office, Los Angeles, Cal 90045-0069, June 1991

*Facility Pollution Prevention Guide*, USEPA, Office of Research and Development EPA/600/R-92/088, May 1992

*Guide to Solvent Waste Reduction Alternatives*, California Department of Health Services, ICF Consulting, October 1986

*Hazardous Waste Minimization Guide, NSRP*, Document # 0418, January 1994

*Introduction to Boiler Operations*, USEPA Air Pollution Training Institute, December 1984

*Local Government Commission, Reducing Industrial and Commercial Toxic Air Emissions By Minimizing Waste: The Role of Air Districts*, (916) 448-1198, November 1990

*Metal Finishing, Case Studies from the Minnesota Technical Assistance Program and the Hazardous Waste Reduction Program of Oregon*, USEPA Office of Environmental Engineering and Technology Demonstration and the Office of Pollution Prevention, November 1990

*Metal Waste Management Alternatives; Minimizing, Recycling, and Treating Hazardous Metal Wastes*, 1989 Symposium Proceedings, California Department of Toxic Substance Control Office of Pollution Prevention and Technology Development Document #51 1

*Ozone Depleter Compliance Guide*, July 1993

*Pollution Prevention Directory*, USEPA Office of Pollution Prevention and Toxics, EPA 742-B-94-005, September 1994

*Refrigerants and Regulations... the Latest from EPA*, Professional Tool & Equipment News, March./April 1995

*Self Inspection Handbook Solvent Cleaners*, California Air Resources Board, 1989

*Seminary Proceedings, Metal Cleaning Alternatives to 1,1,1-Trichloroethane and CFC-113*, U.S. EPA and Center for Emissions Control, November 1993

*Solvent Cleaning Decreasing Operations*, California Air Resources Board, July 1989

*Stationary Internal Combustion Engines*, California Air Resources Board, August 1990

*Stratospheric Ozone Information Hot-line 1-800-296-1996*

*Understanding Small Quantity Generator Hazardous Waste Rules*, USEPA, Office of Solid Waste and Emergency Response, EPA/530-SW-86-O19, September 1986

*Varnish: The invisible Insulator*, Al Tamburo, Electrical Design and Manufacturing, Nov/Dec 1994

*Waste Audit Study, Automotive Repairs*, California Department of Toxic Substances Control, Wesley M. Toy, P.E., May 1987

*Waste Audit Study Fiberglass and Plastic Composite Products*, California Department of Health Services, Woodward-Clyde Consultants, April 1989

*Waste Audit Study, Mechanical Equipment Repair Shops*, California Department of Health Services, Ralph Stone and Company, Inc., May 1990

## Attachment 2. Shipyard AQBMP Survey Questionnaire

**Cover Letter:**

**Subject: Air Quality Best Management Practices Survey**

Dear Colleague:

In 1991, the NSRP developed standardized Best Management Practices (BMPs) for water pollution prevention. The Water Quality BMPs were well received and area helpful tool being used throughout the Shipbuilding and Repair Industry. Encouraged by the success of the Water Quality BMP Document, the NSRP funded a project to develop a standardized and consensus driven Air Quality BMP Guidance Document. The final document will help shipyards develop site specific air quality management practices.

BMPs are widely accepted, low technology, common sense measures, designed to minimize potential pollution. It is envisioned that Air Quality BMPs will include small facility improvement items and management practices and procedures that emphasis preventative maintenance, self inspections, housekeeping, and educational awareness.

I am enclosing an Air Quality Best Management Practices Survey for your comments. This survey will provide us with direction on current BMP development and on future research.

The Air Quality Project Team is evaluating and characterizing various emissions from shipbuilding and repair operations to assess low technology pollution prevention ideas that will result in Air Quality BMPs. The results of this project will help shipyards understand their air emission sources and help develop proactive air quality management programs and practices to reduce liabilities and increase overall environmental compliance.

**Please take a few minutes to fill out the survey and send or FAX (619) 232-6411 it back.** Should you have any questions concerning this project or the enclosed survey, please feel free to call.

Thank you,

**Air Quality Project Team**  
NASSCO - Mail Stop 22A  
P.O. Box 85278, Harbor Drive & 28<sup>th</sup> Street  
San Diego, CA 92186-5278  
(619) 544-8882

## Air Quality BMP Survey #1

Responding Shipyard (Name): \_\_\_\_\_

Individual Responding (Name): \_\_\_\_\_

### Would Your Shipyard Be Supportive of AQBMPs on the Following Subject Areas?

**- Please "X" Your Response in the Appropriate Column -**

Your Response	*0	1	2	3
<b>*0 = Not Supportive</b>				
<b>1 = Somewhat Supportive</b>				
<b>2 = Supportive</b>				
<b>3 = Very Supportive</b>				

**\* Please provide an explanation for all areas that you are "Not Supportive" in the comments section following this series of questions**

<b>A) Procedures and Practices:</b>	<b>*0</b>	<b>1</b>	<b>2</b>	<b>3</b>
1) Implementing Preventative Maintenance and Self Inspection Programs for Air Emission Sources (i.e. for baghouses, IC engines, Boilers, Water Treatment Units, etc.)				
2) Implementing and maintaining procedures and practices to ensure proper asbestos demolition and removal				
3) Developing practices for shipyard painters to reduce fugitive VOC emissions				
4) Developing practices to minimize vapor releases during fueling operations				
5) Forming an Air Quality BMP Committee to facilitate action on air quality issues				
<b>B) Containing Emissions:</b>	<b>*0</b>	<b>1</b>	<b>2</b>	<b>3</b>
6) Containing fugitive dusts generated during grinding of composites and plastics				
7) Containing or otherwise controlling fugitive blast materials from blasting operations				
8) Covering or otherwise containing process tanks when not in use to minimize the release VOCs and other Toxics				
9) Storing waste rags laden with solvent in a covered containers				
10) Cover solvent containers when not in use to minimize VOC emissions				

<b>C) Source Reduction Analysis and Recycling</b>	<b>*0</b>	<b>1</b>	<b>2</b>	<b>3</b>
11) Analyze and implement recycling of solvents used for clean-up, surface preparation, and degreasing				
12) Process improvements to minimize potential air emissions from degreasing operations				
13) Analyzing the facility for actual and potential fugitive emissions sources similar to what is required by SARA Title III and 1990 CAAA.				
14) Implementing procurement screening of hazardous materials with potentially toxic emission before they are bought				
15) Developing and maintaining procedures and practices that ensure proper lead paint removal and disposal				
16) Analyzing potential alternative and substitute materials to replace chlorinated solvents				
17) Continued analysis of water-based and low VOC coating systems for marine and metal parts priming and painting				
18) Continued analysis of high transfer efficiency painting to increase productivity and reduce pollution				
19) Continued investigation to minimize the use of chemical paint removers with other paint removal techniques				
20) Continued investigation to minimize the use of solvent wipe-down as a surface preparation technique				
<b>D) Record-Keeping, Equipment Modifications, and Education:</b>	<b>*0</b>	<b>1</b>	<b>2</b>	<b>3</b>
21) Record-keeping of material and equipment usage schedules				
22) Maintaining a hazardous waste and material management program that accounts for the amount and type of materials used and disposed of at the shipyard facility (mass balance accountability)				
23) Collection and ventilating indoor welding emissions (especially high toxicity emissions)				
24) Filtration of exit air on blasting booths				
25) Educating workers about air quality issues and what they can do to help (i.e. keeping lids on cans and spill prevention)				
26) Educating Painters and Hazardous Waste Personnel on practices to reduce emissions from their operations				
27) Repairing leaks and maintaining systems to reduce potential fugitive emissions				
28) House-keeping practices to ensure that potential pollutants are disposed of properly and do not become airborne				

\* Comments on Issues you are "Not Supportive (\*0)" (supply question #)

---



---



---



---

---

---

Other Subject areas that you would like to see AQBMPs \_\_\_\_\_

---

---

**General Air Quality BMP Questions:**

**A)** Do you believe that the deliverable of this project (Air Quality BMP Guidance Document) will be of use to your shipyard?

Yes / No (Explain) \_\_\_\_\_

---

---

**B)** Would an implementation Section in the final report help your shipyard implement Air Quality BMPs?

Yes / No (Explain) \_\_\_\_\_

---

---

**C)** Is there anything that you would like to be included in this document to be more useful to shipyard?

Yes / No (Explain) \_\_\_\_\_

---

---

**D)** Do you agree that current regulations (i.e. CAAA of 1990, SARA Section 313 Title III, Pollution Prevention Act of 1990, EPCRA, etc.) point towards the reduction of air pollution through the development of BMPs?

Yes / No (Explain) \_\_\_\_\_

---

---

**E)** Does your shipyard perform any practices other than those mentioned in the survey to reduce or prevent air pollution?

Yes / No If yes, Describe and provide any supporting information \_\_\_\_\_

---

---

---

---

Additional copies of this report can be obtained from the  
National Shipbuilding Research and Documentation Center:

**<http://www.nsnet.com/docctr/>**

Documentation Center  
The University of Michigan  
Transportation Research Institute  
Marine Systems Division  
2901 Baxter Road  
Ann Arbor, MI 48109-2150

Phone: 734-763-2465  
Fax: 734-936-1081  
E-mail: [Doc.Center@umich.edu](mailto:Doc.Center@umich.edu)