

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

April 1, 1997  
NSRP 0487  
N1-96-4, Subtask 12

# **THE NATIONAL SHIPBUILDING RESEARCH PROGRAM**

## **Develop Shipyard MACT Implementation Plan and Compliance Tools, Phase II**

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>01 APR 1997</b>		2. REPORT TYPE <b>N/A</b>		3. DATES COVERED <b>-</b>	
4. TITLE AND SUBTITLE <b>The National Shipbuilding Research Program, Develop Shipyard MACT Implementation Plan and Compliance Tools, Phase II</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 20817-5000</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>	18. NUMBER OF PAGES <b>54</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>			

## 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.

**NSRP Report # 0487**

**FINAL REPORT**

**DEVELOP SHIPYARD MACT IMPLEMENTATION  
PLAN AND COMPLIANCE TOOLS, PHASE II**

Prepared by  
**Austin Environmental, Inc.**  
2390 Shelter island Drive, #216  
San Diego, CA 92106

For

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

On Behalf Of  
SNAME SPC PANEL SP-1  
on  
FACILITIES AND ENVIRONMENTAL EFFECTS

Under the  
**NATIONAL SHIPBUILDING RESEARCH PROGRAM**

April 1997

Task #1-96-4, Subtask 12

**SHIPYARD MACT**  
**IMPLEMENTATION &**  
**TRAIN-THE-TRAINER**  
**WORKSHOP**

**UNDERSTANDING**

**THE**

**MACT RULE**

**MODULE I**

**SHIPYARD MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY  
(SURFACE COATINGS)**

**Understanding the Shipyard MACT Rule**

**Objective of this Training Session:** Provide the student with an overview understanding of the shipyard NESHAP and MACT standard.

**What are the Shipyard NESHAP and MACT standard?**

NESHAPs are "National Emission Standards for Hazardous Air Pollutants." They are standards applicable to many industry sources of Hazardous Air Pollutants, commonly referred to as "HAPs." Shipyards are one of the identified sources of HAPs for which a NESHAP has been established by the EPA. In most cases, the vast majority of HAP emissions from shipyards are derived from the application of marine coatings containing HAP solvents. These solvents are emitted to the air, as the coating dries or cures, and can cause or contribute to a variety of human and environmental health problems. To reduce the amount of HAPs being emitted into the atmosphere by marine coating operations, the NESHAP established a technical standard to which all major shipyard sources of HAP must conform. This standard is referred to as the Maximum Achievable Control Technology, or "MACT." It is this HAP control technology for marine coating operations which establishes the minimum acceptable level of HAP emissions reduction in the shipyard.

**Background**

In November of 1995, the U. S. Environmental Protection Agency (EPA) issued national regulations to control Hazardous Air Pollutant ("HAP") materials from shipbuilding and ship repair facilities designated as major sources. The regulation appeared in the December 15, 1995 edition of the Federal Register [volume 60, beginning on page 64330].

The regulation is applicable to all existing and new shipbuilding and ship repair facilities that are major sources of HAP or are located at plant sites that are major sources.

Overview  
understanding of  
the shipyard  
NESHAP and  
MACT standard

Notes:

**SHIPYARD MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY  
(SURFACE COATINGS)**

First Compliance Report Due: August 16, 1998

**NEW SOURCES:**

Initial Notification and Implementation

Plan Due: 6 months prior to start-up

Compliance Date: .....Date of start-up

First Reporting Period Ends: 6 months after start-up

First Compliance Report Due: 8 months after start-up

Summary

The MACT standard for shipyards controls which coatings may be applied to a ship during construction or repairs. It does this by requiring the shipyard to use only coatings that meet, or are lower than, the coating VOC limits for marine coatings established in the MACT. These VOC limits apply to all marine coating operations in the shipyard, no matter who conducts the work: shipyard personnel, subcontractors or ship's force. The VOC limits apply to all marine coatings, whatever their origin: shipyard supplied, customer supplied or government furnished. If a coating does not meet the MACT standard, it is illegal for the shipyard to allow it to be applied to a ship while the ship is in the shipyard. Any time a marine coating operation is conducted within the physical boundaries of the shipyard, it is subject to the MACT standards, and the shipyard is responsible for ensuring compliance.

**Overview  
understanding of  
the shipyard  
NESHAP and  
MACT standard**

**Notes:**

**SHIPYARD MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY  
(SURFACE COATINGS)**

**Understanding the Shipyard MACT Rule**

**Objective of this Training Session:** Explain the important compliance dates of the Shipyard MACT rule.

The Shipyard MACT rule establishes several important compliance dates for "existing" and "new" shipyards. An existing (major source) shipyard is a shipbuilding or repair facility which was operating and subject to the MACT requirements as of the rule's effective date of December 15, 1995. A new shipyard is a shipbuilding or repair facility which is constructed, reconstructed or becomes operational, after the effective date of the MACT rule.

Additionally, if a shipyard which is an area source<sup>1</sup> of HAPs and at some later time becomes a major source, the shipyard has one year from that date to comply with the MACT rule.

**Summary of Important Compliance Dates**

**EXISTING SOURCES:**

Effective Date: ..... **December 15, 1995**  
Initial Notification Due: ..... **June 13, 1996**  
Implementation Plan Due: **December 16, 1996**  
Compliance Date: ..... **December 16, 1997**  
First Reporting Period Ends: .... **June 16, 1998**  
First Compliance Report Due: **August 16, 1998**

**NEW SOURCES:**

Initial Notification and Implementation  
Plan Due: **6 months prior to start-up**  
Compliance Date: ..... **...Date of start-up**  
First Reporting Period Ends: **6 months after start-up**  
First Compliance Report Due: **8 months after start-up**

---

<sup>1</sup> An area source is a shipyard which has the potential to emit above the threshold levels of HAPs at the effective date of the MACT rule.

**Important compliance dates of the Shipyard MACT rule.**

**Notes:**

**SHIPYARD MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY  
(SURFACE COATINGS)**

Cure volatiles means reaction products which are emitted during the chemical reaction which takes place in some coating films at the cure temperature. These emissions are other than those from the solvents in the coating and may, in some cases, comprise a significant portion of total VOC and/or VOHAP emissions.

Exempt compounds means specified organic compounds that are not considered VOC due to negligible photochemical reactivity. Exempt compounds are specified in 40 CFR §51.100(s).

Facility means all contiguous or adjoining property that is under common ownership or control, including properties that are separated only by a road or other public right-of-way.

General use coating means any coating that is not a specialty coating.

Hazardous air pollutants (HAP) means any air pollutant listed in or pursuant to Section 112(b) of the CAA.

Major source means any source that emits or has the potential to emit, in the aggregate, 9.1 megagrams per year (10 tons per year) or more of any HAP or 22.7 megagrams per year (25 tons per year) or more of any combination of HAP.

Maximum allowable thinning ratio means the maximum volume of thinner that can be added per volume of coating without violating the standards of §63.783(a) of this subpart, as determined using Equation 1 of this subpart.

Nonvolatiles (or volume solids) means substances that do not evaporate readily. This term refers to the film-forming material of a coating.

Ship means any marine or fresh-water vessel used for military or commercial operations, including self-propelled vessels, those propelled by other craft (barges), and navigational aids (buoys). This definition includes,

**Definitions of important words and phases used in the MACT rule.**

**Notes:**

*SHIPYARD MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY  
(SURFACE COATINGS)*

**Understanding the Shipyard MACT Rule**

**Objective of this Training Session:** Explain the Notification and Implementation Plan requirements of the shipyard MACT rule.

Shipyards must notify the EPA that they are subject to the NESHAP. For existing shipyards that are subject to the MACT rule, the deadline to provide this notification was June 13, 1996. For new shipyards, notification is required six months prior to start up of operations.

Additionally, affected shipyards must prepare and submit to the EPA an implementation plan that describes how the shipyard will meet the requirements of the MACT rule. For existing shipyards this date was December 16, 1997. For new shipyards, the implementation plan is due with the initial notification, six months prior to start up of operations.

A shipyard's implementation plan must include information concerning the follow subjects:

- 1) Coating compliance procedures;
- 2) Recordkeeping procedures; and
- 3) VOC containing material transfer, handling and storage procedures.

The EPA reviews the submitted implementation plans and identifies deficiencies which require correcting by the shipyard. After correction of any problems, the EPA will approve the implementation plan for use at the shipyard. A copy of the approved implementation plan must be kept on file at the shipyard.

**Notification and Implementation Plan requirements of the shipyard MACT rule.**

**Notes:**

TABLE 2-1. VOLATILE ORGANIC HAP (VOHAP) LIMITS  
FOR MARINE COATINGS

Coating Category	VOHAP limits <sup>a,b,c</sup>		
	grams/liter coating (minus water and exempt compounds)	grams/liter solids <sup>d</sup>	
		t ≥ 4.5°C	t < 4.5°C <sup>e</sup>
General use	340	571	728
Specialty	—	—	—
Air flask	340	571	728
Antenna	530	1,439	—
Antifoulant	400	765	971
Heat resistant	420	841	1,069
High-gloss	420	841	1,069
High-temperature	500	1,237	1,597
Inorganic zinc high-build	340	571	728
Military exterior	340	571	728
Mist	610	2,235	—
Navigational aids	550	1,597	—
Nonskid	340	571	728
Nuclear	420	841	1,069
Organic zinc	360	630	802
Pretreatment wash primer	780	11,095	—
Repair and maint. of thermoplastics	550	1,597	—
Rubber camouflage	340	571	728
Sealant for thermal spray aluminum	610	2,235	—
Special marking	490	1,178	—
Specialty interior	340	571	728
Tack coat	610	2,235	—
Undersea weapons systems	340	571	728
Weld-through precon. primer	650	2,885	—

<sup>a</sup>The limits are expressed in two sets of equivalent units. Either set of limits may be used for the compliance procedure described in §63.785(c)(1), but only the limits expressed in units of g/L solids (nonvolatiles) shall be used for the compliance procedures described §63.785(c)(2)-(4).

<sup>b</sup>VOC (including exempt compounds listed as HAP) shall be used as a surrogate for VOHAP for those compliance procedures described in §63.785(c)(1)-(3).

<sup>c</sup>To convert from g/L to lb/gal, multiply by (3.785 L/gal)(1 lb/453.6 g) or 1/120. For compliance purposes, metric units define the standards.

<sup>d</sup>VOHAP limits expressed in units of mass of VOHAP per volume of solids (nonvolatiles) were derived from the VOHAP limits expressed in units of mass of VOHAP per volume of coating assuming the coatings contain no water or exempt compounds and that the volumes of all components within a coating are additive.

<sup>e</sup>These limits apply during cold-weather time periods, as defined in §63.782. Cold-weather allowances are not given to coatings in categories that permit less than 40 percent solids (nonvolatiles) content by volume. Such coatings are subject to the same limits regardless of weather conditions.

**SHIPYARD MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY  
(SURFACE COATINGS)**

designated thinner, up to the limit of the MACT VOC standards.

A "batch" of coating means a manufacturer's batch from a single production run. Each new type and batch of coating must be separately certified under this rule. Shipyards can rely on manufacturer certifications, or do their own testing. If the shipyard relies on the manufacturer's certification and later testing determines a coating batch was noncompliant, the EPA will consider the shipyard to be the liable party.

The record keeping and reporting requirements for both basic options are similar. The volume and type of coating used must be recorded, along with certifications and any test results. When thinning is allowed, data on the type and volume of thinner used with any batch of coating must also be recorded and used in calculations to determine compliance.

The shipyard is required to determine compliance monthly. Twice a year, the shipyard must demonstrate compliance via a report to EPA based on its testing and record keeping.

A third compliance option is conceptually more complex, but allows for simplified record keeping at some shipyards. Under this "group" option, the shipyard would set thinning ratios for several coatings that are thinned with a common thinner, and label the coating containers accordingly. It would then track the use of all coatings in that group, and the use of the common thinner, to determine compliance. This option does not allow coatings in a group to be above the MACT VOC standard so long as things average out at the end of the month: each coating as applied must still meet VOC limits for its coating category.

The fourth compliance option is to use VOC control equipment to prevent the release of HAPs to the air. This option requires EPA approval of a specific plan detailing the process and equipment the shipyard would use to destroy or capture the coating VOCs.

**What are the MACT standards and how is compliance determined?**

**Notes:**

**SHIPYARD MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY  
(SURFACE COATINGS)**

**Understanding the Shipyard MACT Rule**

**Objective of this Training Session:** Explain the “No Thinning” option (Option 1) for meeting the shipyard MACT requirements.

The No Thinning option of achieving compliance with the MACT rule requires the shipyard to only use VOC compliant coatings and never thin a marine coating which will be applied to a ship in the affected facility.

For each batch of coating received at the shipyard you must:

- 1) Determine the coating category;
- 2) Determine applicable VOC content limit for the category;
- 3) Certify the as-supplied VOC content of each coating batch, by:
  - a) Using certification supplied by manufacturer, or
  - b) Using certification testing (Method 24); and
- 4) Certify the as-applied VOC content of the coating batch, by:
  - a) Certify the VOC content (again) of each coating batch; and
  - b) Notify painters that no thinner may be added to the coating.

When determining if a coating batch is compliant as supplied, the shipyard may either test a sample of the batch using Method 24, or rely on batch test data supplied by the manufacturer of the coating. This same data is used again in certifying the as-applied VOC content of the coating prior to its application.

The recordkeeping requirements of the No Thinning option includes:

**The “No Thinning” option (Option 1) for meeting the shipyard MACT requirements.**

**Notes:**

**SHIPYARD MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY  
(SURFACE COATINGS)**

**Understanding the Shipyard MACT Rule**

**Objective of this Training Session:** Explain the “Thinning, Coating by Coating” compliance option (Option 2) for meeting the shipyard MACT requirements.

The “Thinning, Coating by Coating” compliance option allows the shipyard to thin batches of coating up to their applicable coating category VOHAP limit. The amount of any thinner which can be added to any coating is determined using the Maximum Allowable Thinning Ratio (“MATR”) value. This value is calculated for each batch of coating and each thinner which has been designated to be used with a coating. If coatings are never thinned in amounts greater than the calculated MATR, the coatings will never exceed their allowable VOHAP limit and the shipyard will achieve compliance with MACT standard.

To meet the requirements of Option 2, the following elements are required. For each batch of coating received at the shipyard:

- 1) Determine the coating category;
- 2) Determine applicable VOC content limit for the category;
- 3) Certify the as-supplied VOC content of each coating batch, by:
  - a) Using certification supplied by manufacturer; or
  - b) Using certification testing (Method 24).
- 4) Determine the density of designated thinner and the volume solids of each batch of coating;
- 5) Calculate the Maximum Allowable Thinning Ratio(s) for each batch of coating with its designated thinner; and
- 6) Notify the painters of the designated thinner to be used with each coating and the MATR value.

The “Thinning, Coating by Coating” compliance option (Option 2) for meeting the shipyard MACT requirements.

Notes:

**SHIPYARD MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY  
(SURFACE COATINGS)**

**Understanding the Shipyard MACT Rule**

**Objective of this Training Session:** Explain the “Thinning, Grouped by Thinner Type” compliance option (Option 3) for meeting the shipyard MACT requirements.

The “Thinning, Grouped by Thinner Type” compliance option allows the shipyard to thin batches of coating up to their applicable coating category VOHAP limit. The amount of any thinner which can be added to any coating is determined using the Maximum Allowable Thinning Ratio (“MATR”) value. This value is calculated for each batch of coating and each thinner which has been designated to be used with a group of coatings. If coatings are never thinned in amounts greater than the calculated MATR, the coatings will never exceed their allowable VOHAP limit, and the shipyard will achieve compliance with MACT standard.

To meet the requirements of Option 3, the following elements are required.:

For each batch of coating received at the shipyard you must:

- 1) Determine the coating category;
- 2) Determine applicable VOC content limit for the category;
- 3) Certify the as-supplied VOC content of each coating batch, by:
  - a) Using certification supplied by manufacturer, or
  - b) Using certification testing (Method 24);
- 4) Determine the density of designated thinner and the volume solids of each batch of coating;
- 5) Calculate the Maximum Allowable Thinning Ratio(s) for each batch of coating with its designated thinner; and
- 6) Notify the painters of the designated thinner to be used with each coating and the MATR value.

The “Thinning, Grouped by Thinner Type” compliance option (Option 3) for meeting the shipyard MACT requirements.

**Notes:**

**SHIPYARD MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY  
(SURFACE COATINGS)**

**Understanding the Shipyard MACT Rule**

**Objective of this Training Session:** To understand how the shipyard determines compliance with the MACT rule.

Shipyards are required to determine their compliance status with the MACT rule requirements on a monthly basis. Compliance is determined depending upon which compliance option(s) is used during that month. The "No Thinning" option is the least burdensome. The "Thinning, Coating by Coating" and the "Thinning, Grouped by Thinner Type" compliance determinations are essentially identical and require significantly greater effort to determine compliance.

**"No-Thinning Option" (Option 1):**

- 1) As-applied VOC content of each batch of coating used during a calendar month must be less than or equal to the applicable VOHAP limit. If this requirement is met, compliance has been demonstrated for that month, unless a violation is revealed using Method 24.

**"Thinning, Coating by Coating" (Option 2):**

- 1) By the 15th day of each calendar month, determine the volume of each batch of the coating used, as supplied, during the previous month.
- 2) By the 15th day of each calendar month, determine the volume of thinner actually used with the coating during the previous month.
- 3) If the volume of thinner actually used with the coating is less than or equal to the total allowable volume of thinner for that coating, then compliance is demonstrated, unless a violation is revealed using Method 24.

**Understanding  
how the  
shipyard  
determines  
compliance with  
the MACT rule**

**Notes**

**SHIPYARD MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY  
(SURFACE COATINGS)**

Compliance option dependent recordkeeping requirements are as follows:

Option 1 (No Thinning):

- 1) Certification of the as-applied VOC content of each batch of coating; and
- 2) Volume of each coating applied.

Option 2 (Thinning, Coating by Coating):

- 1) A record of the density of each thinner used at the facility;
- 2) A record of the volume solids of each batch of coating used at the facility;
- 3) The Maximum Allowable Thinning Ratio for each batch of coating and its designated thinner;
- 4) The volume used of each batch, as supplied;
- 5) A record of the calculation determining the total allowable volume of thinner that could have been used at the facility; and
- 6) A record of the actual volume of thinner used at the facility.

Option 3 (Thinning, Group by Thinner Type):

- 1) A record of the density of each thinner used at the facility;
- 2) A record of the volume solids of each batch of coating used at the facility;
- 3) The Maximum Allowable Thinning Ratio for each batch of coating and its designated thinner;
- 4) The volume used of each batch, as supplied;
- 5) A record of the calculation determining the total allowable volume of thinner that could have been used at the facility;
- 6) A record of the actual volume of thinner used at the facility; and
- 7) A record of the identification of each group of coatings and designated thinners.

**Explain the Recordkeeping requirements of the shipyard MACT rule.**

**Notes:**

**SHIPYARD MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY  
(SURFACE COATINGS)**

- a) Classified by reason for violation, including known causes for which a Federally approved or promulgated exemption from an emission limitation or standard may apply.
- 2) Identification of the data availability achieved during the reporting period; and
- 3) Identification of the compliance status as of the last day of the reporting period, and whether compliance was continuous or intermittent during the reporting period.

For violations for which no known Federally approved or promulgated exemption exists, the shipyard must additionally kept the following records for the report period:

- 1) All records that the shipyard is required to maintain that pertain to the periods during which the deviation occurred; and, the magnitude of each deviation, the reason for each deviation, a description of the corrective action for each deviation and all quality assurance activities taken for each deviation.

These records will be submitted to the EPA at the next semi-annual compliance demonstration report.

**Understanding  
how the  
shipyard  
determines  
compliance with  
the MACT rule**

**Notes**

**IMPLEMENTING**

**THE MACT**

**RULE IN THE**

**SHIPYARD**

**MODULE II**

*SHIPYARD MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY  
(SURFACE COATINGS)*

Implementing the MACT rule in the Shipyard

**Objective of this Training Session:** To Provide A Basic Primer on Marine Coatings.

Marine coatings are formulated to protect metals and other materials from one of the harshest environments on earth: sea water. To metals such as steel, sea water is highly corrosive and will result in their rapid destruction if not protected from exposure. Additionally, many marine coating are formulated to provide specific operational performance enhancements, such as preventing the growth of bio-fouling organisms or providing a non-skid surface for the deck of a ship.

The formulation of marine coatings varies tremendously, depending on the purpose of the coating. Generally speaking, however, marine coatings will be formulated using chemicals which fall into three groups:

- 1) Solids;
- 2) Volatile Organic Compounds; and
- 3) Water

The solids consist of materials which will form the coating that adheres to the surface of the metal or other materials to which the coating will be applied. The Volatile Organic Compounds ("VOC") are organic solvents which are used as a carrier for the solids in the coating. Water is also used as solvent and carrier for the coating solids.

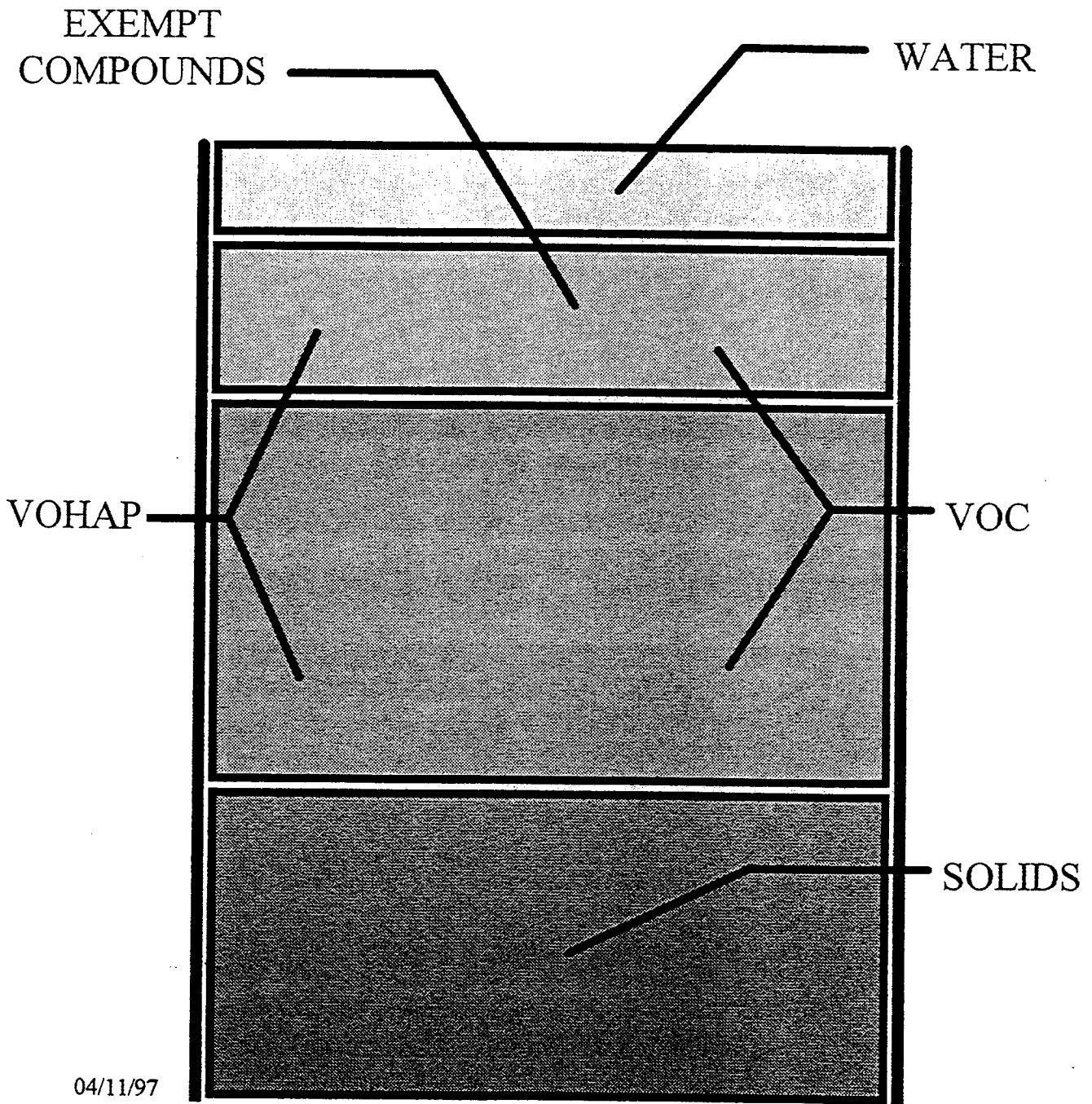
The type and amount of VOCs in marine coatings has been a concern due to the fact that VOCs, combined with another air pollutant called oxides of nitrogen ("NO<sub>x</sub>") and sunlight, result in the formation of ground level ozone, commonly called smog. Some VOCs used in marine coatings will not react with NO<sub>x</sub> and sunlight to produce smog. These compounds are referred to as "Exempt Compounds," because although they are VOCs they are exempt from regulations which control sources of smog.

**A Basic Primer on  
Marine Coatings**

**Notes**

# Figure One

## PRO-LINE F-124 EXTERIOR TOP COAT



**SHIPYARD MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY  
(SURFACE COATINGS)**

VOC Content =

$$\frac{\text{VOC} + \text{cure volatiles} + \text{Exempt Compounds on the HAP list}}{\text{liters of coating}}$$

Cure volatiles are VOCs which are released from the coating during the chemical reaction that takes place when plural component coating are mixed. This source of VOC is typically not accounted for when calculating VOC from formulation data, rather than measuring VOC using Method 24.

This method of calculating VOC content is used to ensure that all HAP from both the VOC and Exempt Compound portions of a coating and from cure volatiles are accounted for in the VOC content value.

It is important that the person in the shipyard with responsibility of calculating MATRs understands and uses the proper VOC content value, as it is defined in the MACT rule. As a matter of practicality however, if you use a VOC content value which includes all the exempt compounds, rather than only the portion of exempt compounds on the HAP list, your MATRs will also be equal to or less the allowable level.

**What is VOC content and how is it calculated?**

**Notes:**

*SHIPYARD MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY  
(SURFACE COATINGS)*

**Implementing the MACT rule in the Shipyard**

**Objective of this Training Session:** To understand the pre-purchase review requirements for coatings furnished by the shipyard.

When coatings are purchased for a job by the shipyard it is important that a pre-purchase review is performed to determine if the coating(s) will meet the MACT rule standards for as-supplied VOC content. This will help ensure that the coating(s) will meet spec when it is delivered to the shipyard and not result in work delays due to purchase of non-compliant materials.

Prior to ordering a coating, the Purchasing Department must forward the order information to the Environmental Department for review and approval (or rejection). The Environmental Department will require the following information:

- 1) Coating Identification;
- 2) Manufacturer;
- 3) Volume of coating being purchased;
- 4) MACT coating category of the material; and
- 5) VOC content of the as-supplied coating. (For plural component coatings, the VOC content of mixed final product.)

The coating manufacturer will be able to supply the information required for items 3 and 4 above. Note that both the product technical data sheet and Material Safety Data Sheet may not contain the required information for the Environmental Department personnel to make determination of as-supplied compliance. If necessary, the Purchasing or Environmental Department must contact the manufacturer's technical support representative to obtain the necessary information.

When a coating is approved for purchase, the Purchasing Department must require the coating manufacturer to supply the necessary "VOC Data Sheet" information as a

**Pre-purchase review requirements for coatings furnished by the shipyard**

**Notes:**

*SHIPYARD MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY  
(SURFACE COATINGS)*

**Implementing the MACT rule in the Shipyard**

**Objective of this Training Session:** How to properly receive coatings supplied by the customer or government, via land or ship delivery, to ensure compliance with the MACT rule.

Coatings supplied by the customer may be received into the shipyard via several routes. The owner/operator may purchase the materials directly from a coating manufacturer, in the U.S. or a foreign country, and arrange to have the coatings shipped directly to the shipyard. Alternatively, the customer may purchase the material and accept delivery of the coatings onboard the vessel prior to arriving at the shipyard. Ensuring the compliance of coatings which are furnished by the customer and delivered to the shipyard are best managed as a Quality Control/Quality Assurance issue. For this reason, the Production Department, through their QC/QA group, will typically take responsibility to determine as-supplied compliance of customer furnished coatings.

For customer furnished coatings received as ship's cargo onboard, or via overland delivery, the Production Department will have the responsibility to ensure the coating is compliant as received. These requirements include:

- 1) Assign QA/QC (or other) personnel to inspect material upon arrival of the ship into the shipyard. This person will ensure that a VOC Data Sheet for each batch (or other data appropriate for use to certify the material) was provided by coating manufacturer.
  
- 2) Determine if the VOC content of each batch of coating is equal to or less than its coating category limit. This task is accomplished by first determining the correct coating category for each batch of coating, (use manufacturer's determined category, from VOC Data Sheet, if available) and then determining the VOC content of each batch of coating. (Note: For plural

Ensuring compliance with customer furnished coatings

Notes:

***SHIPYARD MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY  
(SURFACE COATINGS)***

The above procedures also are applicable to coating furnished by the ship's owner/operator for use by ship's crew, while the ship is within the shipyard. Remember that the shipyard MACT rule applies to all coatings utilized within the physical boundaries of the shipyard, no matter who applies them, the shipyard, subcontractors or ship's crew.

**Ensuring  
compliance with  
customer  
furnished  
coatings**

**Notes:**

**SHIPYARD MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY  
(SURFACE COATINGS)**

3) Determine the VOC Content limit for the specified coating category and compare content to the applicable VOC content limit.

4) If coating VOC content is equal to or less than the VOC content limit, certify as-supplied compliance using the As-supplied/As-applied Certification form. Prepare one form for each batch received and certified as compliant as-supplied.

5) Forward the As-supplied certification forms, together with the VOC Data Sheets and/or appropriate data, with the material, to the Paint Department. This information will be required to identify the materials as-compliant as-supplied prior to application and compliant as-applied if the No-Thinning compliance option is being utilized.

If coating VOC content is greater than the coating category limit and cannot be certified as compliant as-supplied the Quality Control/Quality Assurance ("QA/QC") inspector must:

1) Reject the material and notify owner/operator that the coating cannot be applied while the ship is located in the shipyard,

or

2) Accept material conditionally and immediately notify the appropriate departments that non-compliant material has been delivered to the shipyard. The appropriate shipyard departments will include the Environmental Department, the Paint Department and the Production Department.

**Ensure compliance of coatings furnished by the shipyard**

**Notes:**

**SHIPYARD MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY  
(SURFACE COATINGS)**

5) The Paint Department Clerk will ensure that all Paint Crew Usage forms and As-applied certification forms are collected from all paint crews at the end of each work shift. Following collection of the forms, the clerk will transfer the data from the Paint Crew Usage forms to the Paint and Thinner Usage Log.

a) If a violation of the materials standard is identified, the clerk will immediately notify the appropriate Environmental Department personnel.

6) At the end of each calendar month the clerk will forward the current Paint and Thinner Usage Log to the Environmental Department.

Thinning, coating by coating compliance determination  
(Option 2)

1) Prior to actual coating application operations, the paint issues clerk or paint crew leadman will determine the coating category, the category VOC Content limit, and the VOC content of each batch of coating to be issued or applied and the thinner to be used with each coating batch. (Note: For plural component coatings, compliance is determined using the calculated VOC content of the mixed product and using the mixing ratio specified by the manufacturer, not the VOC content of the individual coating components.)

2) Using the equations provided in the MACT rule, the clerk or leadman will calculate the Maximum Allowable Thinning Ratio(s) ("MATR") for each coating batch, for its designated thinner, using the Thinning Ratio Calculation Form. One calculation form must be used for each batch of coating which will be applied.

3) Inform the painters of the MATR for each batch by labeling each container of coating issued with a "Maximum Allowable Thinning Ratio" label, or by informing paint crew members

**Ensuring compliance with the As-applied VOHAP limits of MACT rule.**

**Notes:**

**SHIPYARD MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY  
(SURFACE COATINGS)**

Allowable Thinning Ratio(s) for each coating batch, for its designated thinner, using the Thinning Ratio Calculation Form. One calculation form must be used for each batch of coating which will be applied.

3) Inform painters of the MATR of each batch by labeling each container of coating issued with a "Maximum Allowable Thinning Ratio" label, or by informing paint crew members of designated thinners and maximum thinning ratios for each coating at the gang box meeting prior to starting the job.

4) After coating application is completed, or at the end of each work shift, the paint crew leadman will record the volume of each batch of coating and each thinner applied, using the Paint Crew Usage form. These forms will be forwarded to the Paint Department clerk at the end of the work shift.

5) The Paint Department Clerk will ensure all Paint Crew Usage forms have been received from all paint crews by the end of each work shift, after collecting all forms, the clerk will transfer the paint and thinner usage data to the Paint and Thinner Usage Log.

a) If a violation of the materials standard is identified, the clerk will immediately notify the appropriate Environmental Department personnel.

6) At the end of each calendar month, the clerk will forward the current Paint and Thinner Usage Log to the Environmental Department.

**Ensuring compliance with the As-applied VOHAP limits of MACT rule.**

**Notes**

TABLE 2-1. VOLATILE ORGANIC HAP (VOHAP) LIMITS  
FOR MARINE COATINGS

Coating Category	VOHAP limits <sup>a,b,c</sup>		
	grams/liter coating (minus water and exempt compounds)	grams/liter solids <sup>d</sup>	
		t ≥ 4.5°C	t < 4.5°C <sup>e</sup>
General use	340	571	728
Specialty	—	—	—
Air flask	340	571	728
Antenna	530	1,439	—
Antifoulant	400	765	971
Heat resistant	420	841	1,069
High-gloss	420	841	1,069
High-temperature	500	1,237	1,597
Inorganic zinc high-build	340	571	728
Military exterior	340	571	728
Mist	610	2,235	—
Navigational aids	550	1,597	—
Nonskid	340	571	728
Nuclear	420	841	1,069
Organic zinc	360	630	802
Pretreatment wash primer	780	11,095	—
Repair and maint. of thermoplastics	550	1,597	—
Rubber camouflage	340	571	728
Sealant for thermal spray aluminum	610	2,235	—
Special marking	490	1,178	—
Specialty interior	340	571	728
Tack coat	610	2,235	—
Undersea weapons systems	340	571	728
Weld-through precon. primer	650	2,885	—

<sup>a</sup>The limits are expressed in two sets of equivalent units. Either set of limits may be used for the compliance procedure described in §63.785(c)(1), but only the limits expressed in units of g/L solids (nonvolatiles) shall be used for the compliance procedures described §63.785(c)(2)-(4).

<sup>b</sup>VOC (including exempt compounds listed as HAP) shall be used as a surrogate for VOHAP for those compliance procedures described in §63.785(c)(1)-(3).

<sup>c</sup>To convert from g/L to lb/gal, multiply by (3.785 L/gal)(1 lb/453.6 g) or 1/120. For compliance purposes, metric units define the standards.

<sup>d</sup>VOHAP limits expressed in units of mass of VOHAP per volume of solids (nonvolatiles) were derived from the VOHAP limits expressed in units of mass of VOHAP per volume of coating assuming the coatings contain no water or exempt compounds and that the volumes of all components within a coating are additive.

<sup>e</sup>These limits apply during cold-weather time periods, as defined in §63.782. Cold-weather allowances are not given to coatings in categories that permit less than 40 percent solids (nonvolatiles) content by volume. Such coatings are subject to the same limits regardless of weather conditions.

# VOC DATA SHEET

## PROPERTIES OF THE MARINE COATING OR THINNER "AS SUPPLIED" BY THE MANUFACTURER

Manufacturer: SIGMA COATINGS Product Identification: 2135

Is this product a coating or thinner? COATING  THINNER

MACT Coating Category: General Use  or Specialty Coating

If Coating is a Specialty Coating please list the specific Category type(s) below. (Use attached list of marine coating specialty categories):

ANTIFOULANT

If product is a coating or paint please provide the information in the box below and provide all information for Items A through J below:

If the product is thinner or reducer, please provide the information requested in Items D through J below:

Properties of the coating or thinner as supplied to the customer:

- A. Coating Density: ( $D_c$ ) 2324 g/l 19.4 lbs/gal [ ] ASTM D1475-90 [ ] Other
- B. Total Volatiles: ( $M_T$ ) 14.22 Mass Percent [ ] ASTM D2369-93 [ ] Other
- C. Cure Volatiles Content: ( $C_{CV}$ ) \_\_\_\_\_ g/L or \_\_\_\_\_ lbs/gal [ ] Calculated [ ] Other
- D. Organic Volatiles: ( $M_O$ ) 14.22 Mass Percent [ ] Calculated [ ] Other
- E. Water Content:
1. ( $M_W$ ) 0% Mass Percent [ ] ASTM D3792-91 [ ] ASTM D4017-90 [ ] Other
2. ( $V_W$ ) 0% Volume Percent [ ] Calculated [ ] Other
- F. Exempt Compounds Content: ( $C_{ex}$ ) \_\_\_\_\_ g/L or \_\_\_\_\_ lbs/gal [ ] Calculated [ ] Other
- G. Nonvolatiles: ( $V_S$ ) 59.87 Volume Percent [ ] Calculated [ ] Other
- H. VOC Content (VOC):
1. 552 g/L or 4.61 lbs/gal solids (nonvolatiles)
2. 331 g/L or 2.76 lbs/gal coating (less water and exempt compounds)
- I. Thinner Density: ( $D_{th}$ ) 831 g/L or 6.94 lbs/gal ASTM \_\_\_\_\_ [ ] Other

## A-OK SHIPYARDS COATING COMPLIANCE CERTIFICATION

AS-SUPPLIED

AS-APPLIED

ID	Item	Description	Data
A.	Coating	Name/ Identification	
B.	Coating Manufacturer	Name	
C.	Batch Identification	Count/Volume	
D.	Supplied By	Source (check one)	<input type="checkbox"/> Customer <input type="checkbox"/> Manufacturer <input type="checkbox"/> Government
E.	VOC Content	Concentration, g/L	
		Source (check one)	<input type="checkbox"/> Batch test data (M-24) <input type="checkbox"/> VOC Data Sheet
F.	Coating Category (check one below)	Code    Description	VOC Limit, grams/liter coating
	General	<input type="checkbox"/> G1    General use	340
	Specialty	<input type="checkbox"/> S1    Air flask	340
		<input type="checkbox"/> S2    Antenna	530
		<input type="checkbox"/> S3    Antifoulant	400
		<input type="checkbox"/> S4    Heat resistant	420
		<input type="checkbox"/> S5    High-gloss	420
		<input type="checkbox"/> S6    High-temperature	500
		<input type="checkbox"/> S7    Inorganic zinc high-build	340
		<input type="checkbox"/> S8    Military exterior	340
		<input type="checkbox"/> S9    Mist	610
		<input type="checkbox"/> S10    Navigational aids	550
		<input type="checkbox"/> S11    Nonskid	340
		<input type="checkbox"/> S12    Nuclear	420
		<input type="checkbox"/> S13    Organic zinc	360
		<input type="checkbox"/> S14    Pretreatment wash primer	780
		<input type="checkbox"/> S15    Repair/ maintenance of thermoplastics	550
		<input type="checkbox"/> S16    Rubber camouflage	340
		<input type="checkbox"/> S17    Sealant for thermal spray aluminum	610
		<input type="checkbox"/> S18    Special marking	490
		<input type="checkbox"/> S19    Specialty interior	340
		<input type="checkbox"/> S20    Tack coat	610
		<input type="checkbox"/> S21    Undersea weapons systems	340
		<input type="checkbox"/> S22    Weld-through precon. primer	650
G.	I certify that the VOC content of this product is less than or equal to the allowable federal VOC content for its applicable coating category. Signed _____ Date _____		

## A-OK SHIPYARDS COATING COMPLIANCE CERTIFICATION

AS-SUPPLIED       AS-APPLIED

ID	Item	Description	Data
A.	Coating	Name/ Identification	
B.	Coating Manufacturer	Name	
C.	Batch Identification	Count/Volume	
D.	Supplied By	Source (check one)	<input type="checkbox"/> Customer <input type="checkbox"/> Manufacturer <input type="checkbox"/> Government
E.	VOC Content	Concentration, g/L	
		Source (check one)	<input type="checkbox"/> Batch test data (M-24) <input type="checkbox"/> VOC Data Sheet
F.	Coating Category (check one below)	Code    Description	VOC Limit, grams/liter coating
	General	<input type="checkbox"/> G1    General use	340
	Specialty	<input type="checkbox"/> S1    Air flask	340
		<input type="checkbox"/> S2    Antenna	530
		<input type="checkbox"/> S3    Antifoulant	400
		<input type="checkbox"/> S4    Heat resistant	420
		<input type="checkbox"/> S5    High-gloss	420
		<input type="checkbox"/> S6    High-temperature	500
		<input type="checkbox"/> S7    Inorganic zinc high-build	340
		<input type="checkbox"/> S8    Military exterior	340
		<input type="checkbox"/> S9    Mist	610
		<input type="checkbox"/> S10    Navigational aids	550
		<input type="checkbox"/> S11    Nonskid	340
		<input type="checkbox"/> S12    Nuclear	420
		<input type="checkbox"/> S13    Organic zinc	360
		<input type="checkbox"/> S14    Pretreatment wash primer	780
		<input type="checkbox"/> S15    Repair/ maintenance of thermoplastics	550
		<input type="checkbox"/> S16    Rubber camouflage	340
		<input type="checkbox"/> S17    Sealant for thermal spray aluminum	610
		<input type="checkbox"/> S18    Special marking	490
		<input type="checkbox"/> S19    Specialty interior	340
		<input type="checkbox"/> S20    Tack coat	610
		<input type="checkbox"/> S21    Undersea weapons systems	340
		<input type="checkbox"/> S22    Weld-through precon. primer	650
G.	I certify that the VOC content of this product is less than or equal to the allowable federal VOC content for its applicable coating category. Signed _____ Date _____		

**SHIPYARD MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY  
(SURFACE COATINGS)**

where:

$m_{volatiles}$  = Total volatiles in the batch, including VOC, water, and exempt compounds (g/L coating);  
and  
 $D_{avg}$  = Average density of volatiles in the batch.

Using the above formulas, calculate the Maximum Allowable Thinning Ratios for the following coatings and designated thinners.

Coating	Thinner
Ameron 21-4	Amercoat 930
Sigma 2135	Thinner # 91-90
Never Thin	HI-VOC

- 1) Determine the values for volume solids, VOHAP limit and VOC content for each coating.
- 2) Determine the density of each thinner to be used for each coating.
- 3) Calculate the MATR for each coating and thinner combination.

**Hands on training using the Maximum Allowable Thinning Ratio Calculation Sheet.**

**Notes**

# VOC DATA SHEET

## PROPERTIES OF THE MARINE COATING OR THINNER "AS SUPPLIED" BY THE MANUFACTURER

Manufacturer: AMERON Product Identification: 21-4

Is this product a coating or thinner? COATING X THINNER \_\_\_\_\_

MACT Coating Category: General Use \_\_\_\_\_ or Specialty Coating X

If Coating is a Specialty Coating please list the specific Category type(s) below. (Use attached list of marine coating specialty categories):

INORGANIC ZINC, HIGH BUILD

If product is a coating or paint please provide the information in the box below and provide all information for Items A through J below:

If the product is thinner or reducer, please provide the information requested in Items D through J below:

Properties of the coating or thinner as supplied to the customer:

A. Coating Density: ( $D_c$ ) \_\_\_\_\_ g/L or \_\_\_\_\_ lbs/gal [ ] ASTM D1475-90 [ ] Other

B. Total Volatiles: ( $M_t$ ) \_\_\_\_\_ Mass Percent [ ] ASTM D2369-93 [ ] Other

C. Cure Volatiles Content: ( $C_{cv}$ ) \_\_\_\_\_ g/L or \_\_\_\_\_ lbs/gal [ ] Calculated [ ] Other

D. Organic Volatiles: ( $M_o$ ) \_\_\_\_\_ Mass Percent [ ] Calculated [ ] Other

E. Water Content:

1. ( $M_w$ ) 0% Mass Percent [ ] ASTM D3792-91 [ ] ASTM D4017-90 [ ] Other

2. ( $V_w$ ) 0% Volume Percent [ ] Calculated [ ] Other

F. Exempt Compounds Content: ( $C_{ex}$ ) \_\_\_\_\_ g/L or \_\_\_\_\_ lbs/gal [ ] Calculated [ ] Other

G. Nonvolatiles: ( $V_s$ ) 80% Volume Percent [ ] Calculated [ ] Other

H. VOC Content (VOC):

1. 366.3 g/L or 3.05 lbs/gal solids (nonvolatiles)

2. 293.0 g/L or 2.44 lbs/gal coating (less water and exempt compounds)

I. Thinner Density: ( $D_{th}$ ) \_\_\_\_\_ g/L or 7.9 lbs/gal ASTM \_\_\_\_\_ [ ] Other (Amercoat 930)

# VOC DATA SHEET

## PROPERTIES OF THE MARINE COATING OR THINNER "AS SUPPLIED" BY THE MANUFACTURER

Manufacturer: NEVER-Thin Product Identification: 43210

Is this product a coating or thinner? COATING  THINNER

MACT Coating Category: General Use  or Specialty Coating

If Coating is a Specialty Coating please list the specific Category type(s) below. (Use attached list of marine coating specialty categories):

GENERAL USE

If product is a coating or paint please provide the information in the box below and provide all information for Items A through J below:

If the product is thinner or reducer, please provide the information requested in Items D through J below:

Properties of the coating or thinner as supplied to the customer:

- A. Coating Density: ( $D_c$ )            g/l            lb/gal [ ] ASTM D1475-90 [ ] Other
- B. Total Volatiles: ( $M_T$ )            Mass Percent [ ] ASTM D2369-93 [ ] Other
- C. Cure Volatiles Content: ( $C_{CV}$ )            g/L or            lbs/gal [ ] Calculated [ ] Other
- D. Organic Volatiles: ( $M_O$ )            Mass Percent [ ] Calculated [ ] Other
- E. Water Content:
1. ( $M_W$ ) 0% Mass Percent [ ] ASTM D3792-91 [ ] ASTM D4017-90 [ ] Other
2. ( $V_W$ ) 0% Volume Percent [ ] Calculated [ ] Other
- F. Exempt Compounds Content: ( $C_{ex}$ )            g/L or            lbs/gal [ ] Calculated [ ] Other
- G. Nonvolatiles: ( $V_S$ ) 31.3 Volume Percent [ ] Calculated [ ] Other
- H. VOC Content (VOC):
1. 1.022 g/L or            lbs/gal solids (nonvolatiles)
2. 320 g/L or            lbs/gal coating (less water and exempt compounds)
- I. Thinner Density: ( $D_{th}$ ) 831 g/L or            lbs/gal ASTM            [ ] Other



**CUSTOMIZING  
THE TRAINING  
MATERIAL**

**MODULE III**

*SHIPYARD MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY  
(SURFACE COATINGS)*

**Customizing the Shipyard MACT Implementation  
Workshop materials**

Both the student manual and presentation materials can be modified to meet the requirements of your facility and its specific implementation plan. This is easy to accomplish using the hardware and software tools identified in this section.

**Modifying the Student's Manual**

Customizing the student's manual merely requires modifying the appropriate training "session" to meet your requirements. All the training sessions are prepared in Microsoft Word for Windows version 7.0. The session pages are in a column format with a single line between the columns. When modifying the document, you may find it easier to change the column format to "one column" prior to making changes, then return the format to "two columns, right" with a line between the columns.

**Modifying the training presentation material**

The presentation material is prepared in Microsoft Power Point 4.0 and can be modified by using either Power Point for Windows version 3.1 or Power Point for Windows for Window 95. There is a set of presentation materials for each training session in the student manual. Ensure that the presentation is updated to be consistent with the student's manual if the training sessions are modified.

The presentations include photo and/or video images taken from actual shipyard operations. This is done to increase training comprehension and retention by providing the student with a familiar frame of context for specific training sessions. These photos and/or video images can be customized for your facility and personnel by using the the following step by step procedure:

**Customizing the  
Shipyard MACT  
Implementation  
Workshop materials**

**Notes:**

**SHIPYARD MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY  
(SURFACE COATINGS)**

- 2) To add a picture to a presentation, Insert an Object. Double Click on the Object box. The computer will ask from what application (Corel Photo-Paint) you want to create the object. Select Photo-Paint.
- 3) The first screen asks for the size and resolution of the photo. For a typical horizontal slide, set parameters to (Width = 378 Pixels, Height = 256 Pixels, Resolution 300, Color Mode = 256). Experiment with these settings to match your picture requirements.
- 4) Once in Photo-Paint, input "Edit" - "Paste From File". Now, if you have the photo on CD, identify the drive and the picture desired. Click "OK."
- 5) It is a good idea to perform some picture enhancements prior to fully importing the photo into Photo-Paint. When the first window comes up, click on "Image Enhancement". The Kodak color corrections functions are the best. Try to enhance the photo by adding green, red, blue, brightness, and/or sharpness with the provided functions. Once the picture looks acceptable, click, "OK".
- 6) Now, the picture is on the screen inside the dimensions that you set in the parameters. The picture should be close to the size identified. Only the picture inside the dimensions specified will be transferred to Microsoft Power Point or Word.
- 7) Now, click on "File" - "Close and Update", this closes Corel Photo-Paint and return you back to Power Point. The picture will show up on the screen as a very small image. Click on the picture and **drag a corner**. This will increase the picture size without distorting the picture.
- 8) Cropping the picture is frequently helpful. Click on the picture and then pull down the TOOLS menu and CROP PICTURE. The Crop function allows you to cut the picture and focus into a particular area. Once the picture is cropped, click on the Arrow and then click on the picture to enlarge and position it properly. Remember, always enlarge the photo by dragging from the corner.

**Customizing the  
Shipyard MACT  
Implementation  
Workshop materials**

**Notes:**

# **FORMS**

## **APPENDIX A**

TABLE 2-1. VOLATILE ORGANIC HAP (VOHAP) LIMITS  
FOR MARINE COATINGS

Coating Category	VOHAP limits <sup>a,b,c</sup>		
	grams/liter coating (minus water and exempt compounds)	grams/liter solids <sup>d</sup>	
		t ≥ 4.5°C	t < 4.5°C <sup>e</sup>
General use	340	571	728
Specialty	—	—	—
Air flask	340	571	728
Antenna	530	1,439	—
Antifoulant	400	765	971
Heat resistant	420	841	1,069
High-gloss	420	841	1,069
High-temperature	500	1,237	1,597
Inorganic zinc high-build	340	571	728
Military exterior	340	571	728
Mist	610	2,235	—
Navigational aids	550	1,597	—
Nonskid	340	571	728
Nuclear	420	841	1,069
Organic zinc	360	630	802
Pretreatment wash primer	780	11,095	—
Repair and maint of thermoplastics	550	1,597	—
Rubber camouflage	340	571	728
Sealant for thermal spray aluminum	610	2,235	—
Special marking	490	1,178	—
Specialty interior	340	571	728
Tack coat	610	2,235	—
Undersea weapons systems	340	571	728
Weld-through precon. primer	650	2,885	—

<sup>a</sup>The limits are expressed in two sets of equivalent units. Either set of limits may be used for the compliance procedure described in §63.785(c)(1), but only the limits expressed in units of g/L solids (nonvolatiles) shall be used for the compliance procedures described §63.785(c)(2)-(4).

<sup>b</sup>VOC (including exempt compounds listed as HAP) shall be used as a surrogate for VOHAP for those compliance procedures described in §63.785(c)(1)-(3).

<sup>c</sup>To convert from g/L to lb/gal, multiply by (3.785 L/gal)(1 lb/453.6 g) or 1/120. For compliance purposes, metric units define the standards.

<sup>d</sup>VOHAP limits expressed in units of mass of VOHAP per volume of solids (nonvolatiles) were derived from the VOHAP limits expressed in units of mass of VOHAP per volume of coating assuming the coatings contain no water or exempt compounds and that the volumes of all components within a coating are additive.

<sup>e</sup>These limits apply during cold-weather time periods, as defined in §63.782. Cold-weather allowances are not given to coatings in categories that permit less than 40 percent solids (nonvolatiles) content by volume. Such coatings are subject to the same limits regardless of weather conditions.

# VOC DATA SHEET

## PROPERTIES OF THE MARINE COATING OR THINNER "AS SUPPLIED" BY THE MANUFACTURER

Manufacturer: \_\_\_\_\_ Product Identification: \_\_\_\_\_

MACT Coating Category: General Use \_\_\_\_\_ or Specialty Coating \_\_\_\_\_

If Coating is a Specialty Coating please list the specific Category type(s) below. (Use attached list of marine coating specialty categories):

Is this product a coating or thinner? COATING \_\_\_\_\_ THINNER \_\_\_\_\_

If product is a coating or paint please provide the information in the box below and provide all information for Items A through J below:

If the product is thinner or reducer, please provide the information requested in Items D through J below:

---

Properties of the coating or thinner as supplied to the customer:

- A. Coating Density: ( $D_c$ ) \_\_\_\_\_ g/L or \_\_\_\_\_ lbs/gal [ ] ASTM D1475-90 [ ] Other
- B. Total Volatiles: ( $M_T$ ) \_\_\_\_\_ Mass Percent [ ] ASTM D2369-93 [ ] Other
- C. Cure Volatiles Content: ( $C_{CV}$ ) \_\_\_\_\_ g/L or \_\_\_\_\_ lbs/gal [ ] Calculated [ ] Other
- D. Organic Volatiles: ( $M_O$ ) \_\_\_\_\_ Mass Percent [ ] Calculated [ ] Other
- E. Water Content:
1. ( $M_W$ ) \_\_\_\_\_ Mass Percent [ ] ASTM D3792-91 [ ] ASTM D4017-90 [ ] Other
2. ( $V_W$ ) \_\_\_\_\_ Volume Percent [ ] Calculated [ ] Other
- F. Exempt Compounds Content: ( $C_{ex}$ ) \_\_\_\_\_ g/L or \_\_\_\_\_ lbs/gal [ ] Calculated [ ] Other
- G. Nonvolatiles: ( $V_g$ ) \_\_\_\_\_ Volume Percent [ ] Calculated [ ] Other
- H. VOC Content (VOC):
1. \_\_\_\_\_ g/L or \_\_\_\_\_ lbs/gal solids (nonvolatiles)
2. \_\_\_\_\_ g/L or \_\_\_\_\_ lbs/gal coating (less water and exempt compounds)
- I. Thinner Density: ( $D_{th}$ ) \_\_\_\_\_ g/L or \_\_\_\_\_ lbs/gal ASTM \_\_\_\_\_ [ ] Other

## A-OK SHIPYARDS COATING COMPLIANCE CERTIFICATION

AS-SUPPLIED       AS-APPLIED

ID	Item	Description	Data
A.	Coating	Name/ Identification	
B.	Coating Manufacturer	Name	
C.	Batch Identification	Count/Volume	
D.	Supplied By	Source (check one)	<input type="checkbox"/> Customer <input type="checkbox"/> Manufacturer <input type="checkbox"/> Government
E.	VOC Content	Concentration, g/L	
		Source (check one)	<input type="checkbox"/> Batch test data (M-24) <input type="checkbox"/> VOC Data Sheet
F.	Coating Category (check one below)	Code    Description	VOC Limit, grams/liter coating
	General	<input type="checkbox"/> G1    General use	340
	Specialty	<input type="checkbox"/> S1    Air flask	340
		<input type="checkbox"/> S2    Antenna	530
		<input type="checkbox"/> S3    Antifoulant	400
		<input type="checkbox"/> S4    Heat resistant	420
		<input type="checkbox"/> S5    High-gloss	420
		<input type="checkbox"/> S6    High-temperature	500
		<input type="checkbox"/> S7    Inorganic zinc high-build	340
		<input type="checkbox"/> S8    Military exterior	340
		<input type="checkbox"/> S9    Mist	610
		<input type="checkbox"/> S10    Navigational aids	550
		<input type="checkbox"/> S11    Nonskid	340
		<input type="checkbox"/> S12    Nuclear	420
		<input type="checkbox"/> S13    Organic zinc	360
		<input type="checkbox"/> S14    Pretreatment wash primer	780
		<input type="checkbox"/> S15    Repair/ maintenance of thermoplastics	550
		<input type="checkbox"/> S16    Rubber camouflage	340
		<input type="checkbox"/> S17    Sealant for thermal spray aluminum	610
		<input type="checkbox"/> S18    Special marking	490
		<input type="checkbox"/> S19    Specialty interior	340
		<input type="checkbox"/> S20    Tack coat	610
		<input type="checkbox"/> S21    Undersea weapons systems	340
		<input type="checkbox"/> S22    Weld-through precon. primer	650
G.	I certify that the VOC content of this product is less than or equal to the allowable federal VOC content for its applicable coating category. Signed _____ Date _____		



**MARINE COATING ALLOWABLE THINNING RATIO  
CALCULATION SHEET (SIDE 2)**

Coating Category:		VOHAP limits grams/liter solids	
		t ≥ 4.5°C	t < 4.5°C
General	G1 General use	571	728
Specialty	S1 Air flask	571	728
	S2 Antenna	1,439	--
	S3 Antifoulant	765	971
	S4 Heat resistant	841	1,069
	S5 High-gloss	841	1,069
	S6 High-temperature	1,237	1,597
	S7 Inorganic zinc high-build	571	728
	S8 Military exterior	571	728
	S9 Mist	2,235	--
	S10 Navigational aids	1,597	--
	S11 Nonskid	571	728
	S12 Nuclear	841	1,069
	S13 Organic zinc	630	802
	S14 Pretreatment wash primer	11,095	--
	S15 Repair and maintenance of thermoplastics	1,597	--
	S16 Rubber camouflage	571	728
	S17 Sealant for thermal spray aluminum	2,235	--
	S18 Special marking	1,178	--
	S19 Specialty interior	571	728
	S20 Tack coat	2,235	--
	S21 Undersea weapons systems	571	728
	S22 Weld-through precon. primer	2,885	--

Note: To convert from g/L to lb/gal, multiply by (3.785 L/gal)(1/453.6 lb/g) or 1/120. For compliance purposes, metric units define the standards.

Note: Cold-weather allowances are not given to coatings in categories that permit over a 40 percent VOHAP content by volume. Such coatings are subject to the same limits regardless of weather conditions.

## Plural Component Coatings VOC Content and Volume Solids Calculation Sheet

	Column One			Column Two		
	VOC Content			Volume Solids		
Step 1 - Identify Components	A	B	C	A	B	C
Step 2 - Record the mix ratio value for each component of the coating (mix ratio values will be the same for both VOC Content and Volume Solids columns).	_____	_____	_____	_____	_____	_____
Step 3 - Sum the mix ratio values from Step 2 above, for each column, and record the values	_____			_____		
Step 4 - Record the VOC Content and Volume Solids for each Component	_____	_____	_____	_____%	_____%	_____%
Step 5 - Sum the VOC Content values from Step 4 above and record in column one. Sum the Volume Solid values from Step 4 above and record in column two.	_____			_____%		
Step 6 - Divide the VOC Content value from Step 5 above by the sum of the mix ratio value from Step 3 and record in column one. Divide the Volume Solids value from Step 5 above by the sum of the mix ratio value from Step 3 and record in column one.	_____			_____%		
Step 7 - Record values obtained from Step 6 above in each column. These values are the VOC Content and Volume Solids values for Plural Component coating, after it is mixed. Use these values to determine as-supplied compliance with the applicable coating category and, if the coating is thinned, the Maximum Allowable Thinning Ratio.	_____			_____%		
	VOC Content			Volume Solids		

## Maximum Allowable Thinning Ratio

<b>Ratio</b>	Normal ( $\geq 40$ °F) _____ Cold ( $< 40$ °F) _____
<b>Thinner</b>	<i>USE NO SUBSTITUTES</i> <sup>(1)</sup> Mfg. Name _____ Product ID _____ Use no more than _____ gal thinner per gallon paint.
<sup>(1)</sup> In compliance with 40 CFR Part 63.785. Contact Paint Foreman or _____.	

# **NO THINNING**

**In compliance with 40CFR Part 63.785.  
Contact Paint Foreman or \_\_\_\_\_.**





# A-OK SHIPYARDS

## RECORDKEEPING COMPLIANCE FORM

<b>BASIC CHECKLIST</b>
------------------------

- Initial Notification Documentation \*
- Approved Implementation Plan \*
- Volume of Low-Usage -Exempt Coatings by Month
- Identification of coatings used, EPA categories, and VOHAP limits
- Certification of As-Supplied VOC Content for each Batch of Coating
- Determination whether containers meet standard §63.783(b)(2)
- Results of Method 24 or other approved measurements on individual containers

OPTIONS	Opt 1	Opt 2	Opt 3
<input type="checkbox"/> Certification of As-Applied VOC content by Batch	X		
<input type="checkbox"/> Volume of each coating applied	X		
<input type="checkbox"/> Thinner density and Vol fraction solids for each Batch		X	X
<input type="checkbox"/> Maximum Allowable thinner ratio for each Batch		X	X
<input type="checkbox"/> Volume Used of each Batch, (As-Supplied)		X	X
<input type="checkbox"/> Cold weather dates and times		X	X
<input type="checkbox"/> Total Allowable Volume of thinner		X	X
<input type="checkbox"/> Actual Volume of thinner		X	X
<input type="checkbox"/> ID of coating groups/Thinner			X

\* Maintained on site but not reported.

---

<sup>(1)</sup> In compliance with 40 CFR Part 63.788(b)(2).





For more information about the  
National Shipbuilding Research Program  
please visit:

**<http://www.nsrp.org/>**

or

**<http://www.USAShipbuilding.com/>**