

CERTIFICATION TRAINING FOR SAFE HANDLING  
AND USE OF ANTIFOULING PAINTS  
CONTAINING TRIBUTYL TIN (TBT)



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Prepared by the Members of the National Paint and Coatings Association

To assist in the certification of Applicators of TBT antifouling paint

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## INTRODUCTION

*Tributyltin* (TBT) compounds are registered for use in paint formulations as antifoulants on vessel hulls and other marine structures to inhibit the growth of aquatic organisms such as barnacles and algae. TBT antifouling paints are beneficial when used as coatings for underwater hulls of ships since they offer extended operating cycles over other antifoulants between dry-dockings and improve fuel efficiency by reducing resistance or drag.

The Environmental Protection Agency (EPA) has classified antifouling paint products containing *tributyltin* (TBT) as “restricted use pesticides” (except for products that are packaged in 16-ounce or less spray can containers and are labeled for use only on outboard motors, propellers and other non-hull underwater aluminum components). This classification limits the sale of the “restricted use” antifouling paints to certified applicators and application either by certified applicators or persons under the direct supervision of an on-site (at the work site) certified applicator. Users must adhere to prescribed safety and environmental precautions for application and disposal procedures in its handling.

The actual techniques required for applying TBT antifouling paints are similar to those required for other types of antifouling paints, or even conventional paints. However, because of its restricted use classification, a certified supervisor must be on-site and available while any activity involving TBT antifouling paints is in progress. Module I of this manual deals more specifically with supervisory responsibilities for restricted use applicators, and with the liabilities and penalties related to non-compliance.

This manual will outline suggested procedures to follow for the safe use and disposal of TBT antifouling paints. In addition, the applicator must comply with those methods and procedures outlined by the shipyard, the paint manufacturer and any applicable Federal, State and Local laws. This document cannot be more specific due to the diversity in size, location, and resources of particular application sites. Each State and EPA region, in certifying its applicators, must consider all of these variables. However, following the principles outlined here in addition to good painting practices should provide adequate protection of human/aquatic life and the environment.

### MODULE #1

#### LAWS AND REGULATIONS

##### A. Learning Objectives

After completion of the study of the laws and regulations, the trainee should be able to:

- Know which federal law applies to the use of TBT antifouling paint
- Know the difference between a “restricted use” and “general use” pesticide.
- Understand the responsibilities of a certified applicator.
- Know the penalties for violating the law.
- Understand the record-keeping requirements and be able to complete the form.

##### B. Discussion:

In order to protect the public health and welfare and to prevent adverse effects on the environment, it is essential that pesticides be regulated. The purpose of the federal and state

pesticide acts is to regulate the labeling, sale, storage, transportation, application and the disposal of pesticides. EPA has determined that TBT compounds used in antifouling paints exceed the risk criteria for exposure to non-target aquatic organisms to concentrations that are acutely or chronically toxic to such organisms. State restrictions on pesticides cannot be more liberal than those of FIFRA. Individual states may, however, impose stricter regulations on a pesticide, and applicators must comply with these requirements.

The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) regulates the registration, manufacture, transportation and use of pesticides. The law affects the applicator in many ways. Specifically, it provides that:

- All pesticides must be used only as directed on the label
- All pesticide uses must be classified as “restricted” or “general”. Restricted use pesticides are classified under Section 3(d) (1)(c) of FIFRA
- Persons who buy restricted-use pesticides must be certified pesticide applicators; persons who use restricted use pesticides must either be certified applicators or under the direct supervision of a certified applicator.
- Persons who do not obey the law will be subject to fines and jail terms.

### RESTRICTED AND GENERAL USE PESTICIDES

All pesticides are classified according to their potential hazards under those circumstances in which they are to be used. The two classifications are general use and restricted use. General use pesticides generally have lower toxicity with less potential hazard to humans and the environment than restricted use chemicals. They can be bought and used by the general public without special permit or restriction. They must, however, always be used according to label directions. Restricted use pesticides may be sold only to certified applicators and must be used only by those applicators or by persons working under their direct supervision. Restricted use pesticides and their uses could cause human injury or environmental damage unless they are applied by persons who have demonstrated their competency by obtaining their certification in the appropriate category as a pesticide applicator from an EPA approved State, Federal, or Tribal Certification Program.

TBT used as a component in antifoulant paint has been classified by the EPA as a restricted use pesticide. As a result, all commercial applicators of antifoulant paint must be certified by the applicable state programs or under the direct supervision of an on-site certified commercial applicator before performing any task associated with the TBT antifouling paint.

### CERTIFIED APPLICATORS

**From 40 CFR Part 171.2** the term “certified applicator” means any individual who is certified to use or supervise the use of any restricted use pesticides covered by his/her certification.

Persons who are not certified pesticide applicators may not purchase restricted use pesticides; non-certified persons may not apply restricted use pesticides unless they are under the direct supervision of a certified applicator. Certification requires testing for competency in the safe and effective handling and use of these pesticides. Your state or a federal agency will conduct the training and/or tests for certification. Certification is proof that you know the safe and correct way to carry out restricted uses. EPA has set minimum standards of competency for all commercial

applicators. Your state has developed a plan for competency certification that meets minimum national standards.

The term “under the direct supervision of” means the act or process whereby the application of a pesticide is made by a competent applicator working under the instructions and control of a certified applicator who is responsible for the actions of that person and who is available if and when needed, even though the certified applicator is not physically present at the time and place the pesticide is applied.

All commercial applicators shall demonstrate practical knowledge of the principles and practices of pest control and safe use of pesticides. Testing shall be based on examples of problems and situations appropriate to the particular category or subcategory of the applicator’s certification and the following areas of competency: label and labeling comprehension, safety, environment, pests, pesticides, equipment, and application techniques.

### PENALTIES

In general, any registrant, commercial applicator, wholesaler, dealer, retailer, or other distributor who violates any provision of the Federal Insecticide, Fungicide or Rodenticide Act (FIFRA) may be assessed either a criminal or a civil penalty by the EPA. A criminal penalty of not more than \$25,000 and /or 1year imprisonment may be assessed for knowingly violating any provision of the FIFRA. A civil penalty of not more than \$5,000 may be assessed for unknowingly violating any provision of the FIFRA. State restrictions on pesticides cannot be more liberal than those of FIFRA. Individual states may impose stricter regulations on a pesticide.

### RECORD-KEEPING

Certified commercial applicators or users or *tributyltin* will be required to maintain, at a minimum, for two years, records of the kinds of products, uses, dates and application sites of restricted use products containing TBT. “Uses” will include the disposal site of TBT containing dust, chips or other waste. Therefore the location and dates of disposal will be a record-keeping requirement. “Application site” is determined to be not only the geographic location of the application site, but also the identification of the vessel receiving the application. Below is a sample form for our record-keeping requirements.

**SAMPLE FORM**

1. Name of Certified Supervisor \_\_\_\_\_  
Name of Applicator User (if different): \_\_\_\_\_  
Address: \_\_\_\_\_  
Telephone No: \_\_\_\_\_

2. Application of TBT containing paint:  
Paint manufacturer: \_\_\_\_\_  
Trade name of paint: \_\_\_\_\_  
EPA registration number: \_\_\_\_\_  
Application date: \_\_\_\_\_  
Application Time: \_\_\_\_\_  
Amount of TBT paint applied: \_\_\_\_\_  
Application Site:  
    Geographic location: City: \_\_\_\_\_ State: \_\_\_\_\_  
    Vessel Identification: \_\_\_\_\_  
    Name of Vessel Owner: \_\_\_\_\_  
    Address of Vessel Owner: \_\_\_\_\_  
    \_\_\_\_\_  
    \_\_\_\_\_

3. Disposal dust, chips or other waste containing TBT:  
Amount or type of Paint waste disposed: \_\_\_\_\_  
    \_\_\_\_\_  
# and size of empty containers: \_\_\_\_\_  
Disposal date: \_\_\_\_\_  
Disposal location: \_\_\_\_\_  
How was the container disposed? \_\_\_\_\_



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### C. STUDY QUESTIONS

1. Does FIFRA regulate the maximum daily release rate of organotin from a painted surface? YES NO
2. Can a state law be less restrictive than FIFRA? YES NO
3. A pesticide or paint that is toxic to aquatic organisms, even when applied according to label directions, will be classified as a \_\_\_\_\_ use pesticide.
4. Pesticides, when applied according to label directions, which will not cause unreasonable adverse effects on the environment, are classified as \_\_\_\_\_ use pesticides.
5. A non-certified person will never be allowed to apply TBT paints. TRUE FALSE.
6. A person who is not a certified applicator can only buy \_\_\_\_\_ use pesticides.
7. When non-certified applicators are applying TBT paint the Certified applicator (supervisor) must be \_\_\_\_\_.
8. When a non-certified applicator applies TBT paint, who is responsible for that person's actions? "\_\_\_\_\_".
9. A certified applicator that allows his work crew to paint fiberglass boats (hulls), 35-50 feet in length, with TBT may be committing a \_\_\_\_\_ violation.
10. A fine of not more than \$5,000 may be assessed for a \_\_\_\_\_ violation.

### D. SELECTED REFERENCES

1. 40 CFR Part 171
2. Federal Register October 4, 1988 39022 to 39041
3. Federal Insecticide, fungicide and Rodenticide Act as amended of October, 1988

E. VISUAL AIDS None

F. HANDOUTS  
Federal Register Notice

## MODULE #2

### LABEL AND LABELING

#### A. LEARNING OBJECTIVES:

After completion of the study of the label and labeling, the trainee should be able to:

1. Understand what a label and labeling are.
2. Understand the contents of a pesticide label and be able to locate and interpret each part.
3. Understand the term “Use Inconsistent with Labeling”.
4. Understand the importance of reading labels and labeling before each use of the pesticide.

#### B. DISCUSSION

##### 1. Registration

Because antifouling paints prevent, destroy or repel the growth of aquatic plant and animal life on underwater surfaces, their sale and use is regulated by the Federal Insecticide, Fungicide, and Rodenticide Act, as amended, and in the code of Federal Regulations (40 CFR Parts 150-180). Every pesticide that is bought, sold or used in the United States must, by law, be registered by the US Environmental Protection Agency (EPA). EPA approves not only the product itself, but also each separate use, for which it is intended, and the product label and labeling.

##### a. Labels versus Labeling

Each pesticide you buy has instructions on how to use the product. The **label** is the information printed on or attached to the pesticide container. **Labeling** is all information that you receive from the manufacturer about the product. Labeling includes not only the label on the product container, but also any supplemental information accompanying the product. This may include such things as brochures, leaflets and information available from the paint dealer or manufacturer.

As the required user information becomes longer and more complex, some of the information is removed from the pesticide label itself and relocated onto the supplemental labeling.

Applicators must read the label and labeling, and understand all information, prior to using TBT antifouling paints. Both the information contained on the product label itself and on supplemental labeling is registered by EPA. You must comply with both.

##### b. Product Identification

1. Brand or Trade Name – Each manufacturer has a brand name for its products. Different manufacturers may use different brand names for the same pesticide active ingredient. Most companies register each brand name as a trademark and do not allow any other company to use that name. The brand or trade name is the one used in ads and by company salespersons. The brand name shows up plainly on the front panel of the label. Beware of choosing a

pesticide product brand name alone. Many companies use the same basic name with only minor variations to designate entirely different pesticide chemicals. For example:

**DePesto C**

Cuprous Oxide containing antifouling paint

**DePesto T**

Tributyltin and Cuprous Oxide containing antifouling paint.

2. Ingredient Statement – Each pesticide label must list what is in the product. The list is written so you can see quickly what the active ingredients are and the amount (in percentage) of each ingredient listed. The ingredient statement must list the official chemical names and/or common names for the active ingredients. Inert (inactive) ingredients usually are not named, but the label must show what percent of the total contents they comprise. If the inert ingredients are organic solvents such as xylene or petroleum distillates, the ingredient statement will so state.
3. Chemical Name – The chemical name is a complex name that identifies the chemical components and structure of the pesticide. The name is almost always listed in the ingredient statement of the label. An example of a chemical name is bis (tributyltin) oxide.
4. Common Name – Because some pesticide active ingredients have complex chemical names, many are given a shorter “common name”. Only common names that are officially accepted by EPA may be used in the ingredient statement on the pesticide label. The official common name may be followed by the chemical name in the list of active ingredients.
5. Type of Pesticide – The type of pesticide is usually listed on the front panel of the pesticide labeling. This short statement usually indicates, in general terms, what the product will control, such as **antifouling paint**.
6. Type of Formulation – The pesticide product you buy is rarely made up of only active ingredients. Usually, other chemicals are combined with the active ingredient before the product is offered for sale. The mixture of active and inert (inactive) ingredients is called a pesticide formulation.
7. Net Contents – The front panel of the pesticide label tells you how much is in the container. This can be expressed as gallons, quarts or pints, or in pounds or ounces.
8. Name and Address of the Manufacturer – The law requires the maker or distributor of a product to put the name and address of the company on labels and labeling. This is so you will know who to contact if you need additional information.
9. Registration and Establishment Numbers – These names are needed by the pesticide applicator in case of accidental poisoning, claims of misuse or liability claims.
10. Registration Numbers – An EPA registration number (for example EPA Reg. No. 3120-280-AA) appears on most pesticide labels. This indicates that the pesticide labeling has been approved by the federal government. In cases of special local needs, pesticide products may be approved by a state. These registrations are designated, for example as EPA SLN No. CA-770009. In this case SLN indicates “special local need” and CA means that the product is registered for use in California.
11. Establishment Numbers – The establishment number for example EPA Est. No. 5840-AZ-1) appears on either the pesticide labeling or the container. It identifies the facility that

produced the product. In case something goes wrong, the facility that produced the product can be traced.

c. Signal Words and Symbols

Every pesticide label contains a signal word that indicates how acutely toxic the pesticide product is to humans. The signal word is based on the acute (immediate) toxicity of the formulated product; therefore it reflects not only the acute toxicity of the active ingredient, but also the active toxicity of the solvents and inerts that constitute the product as sold.

The signal word represents the **highest** acute toxicity category out of five separate tests: oral toxicity, dermal toxicity, inhalation toxicity, eye irritation potential and skin irritation potential. If any one of the five tests results in a high acute toxicity rating, then the signal word for the pesticide product is **DANGER** – even if the other four test results indicate a moderate or slight acute toxicity rating.

Knowing the product's acute hazard helps you choose the proper precautionary measures for yourself, your workers, and other persons who may be exposed. The signal word must appear in large letters on the front panel of the pesticide label. It immediately follows the statement “Keep Out Of Reach Of Children”.

**DANGER** – This word signals you that the pesticide is highly toxic for one or more of the toxicity test categories. Any product that is highly toxic orally, dermally or through inhalation, or causes severe eye burning or severe skin burning will be labeled “DANGER”.

**POISON** and the skull and crossbones symbol – All pesticides that are highly toxic orally, dermally or through inhalation will also carry the word “POISON” (printed in red) and the skull and the crossbones symbol. Pesticides that have the signal word “DANGER” due to skin or eye irritation potential do not have the skull and crossbones signal or the word “POISON” printed in red.

**WARNING** - This word signals you that the product is moderately toxic. Any product whose highest acute toxicity (orally, dermally, through inhalation, or for eye or skin irritation potential) is rated as moderate will have the signal word “WARNING”.

**CAUTION** – This word signals you that the product is slightly toxic. Any product whose highest acute toxicity (orally, dermally, through inhalation, or for eye or skin irritation potential) is rated as slight will have the signal word “CAUTION”.

**THE SIGNAL WORD ON TBT ANTIFOULING PAINTS IS DANGER.**

d. Toxicity Statements

Some pesticides are toxic to humans. Accidental exposure to them without proper protection can sicken or kill humans. Other pesticides are much less toxic; large

exposures to these would be necessary to cause illness. Others can irritate the nose, eyes, throat and skin of some people. You should know how to protect yourself and your workers from unnecessary exposure to the pesticides you are handling. People may be poisoned without realizing the seriousness of the exposure, especially if the pesticide enters through the skin or the lungs. Pesticides can enter the body in three major ways:

- through the mouth (orally)
- through the skin and eyes (dermally)
- through the lungs (by inhalation)

1. Acute Toxicity Statement – The statement that immediately follow the signal word, either on the front or on the side of the pesticide label, indicate which route or routes of entry (mouth, eyes, skin, lungs) you must particularly protect. Many pesticide products are hazardous by more than one route, so study these statements carefully. A “DANGER” signal word followed by “May be fatal if swallowed or inhaled” gives you a far different warning than “DANGER: Corrosive. Causes skin burns and eye irritation.”
2. Oral Toxicity Statements – The pesticide label usually indicates how toxic a pesticide product if it is swallowed. If a pesticide were highly toxic (DANGER) orally, a typical label statement would be: “FATAL if swallowed” or “Can kill you if swallowed”. Some labels also specifically warn, “Do not swallow”, although this statement is often omitted. If the pesticide were moderately toxic (WARNING) orally, a typical label statement would be: “Harmful or fatal if swallowed” or “May be fatal if swallowed”. If the pesticide is slightly toxic (CAUTION) orally, a typical label statement would be “Harmful if swallowed” or “May be harmful if swallowed”.

**THE ORAL TOXICITY STATEMENT FOR TBT ANTIFOULING PAINT PRODUCTS IS: “MAY BE FATAL IF SWALLOWED”.**

3. Dermal (skin) Toxicity Statements – The pesticide label usually indicates how hazardous a pesticide product is if it enters the body through the skin. If the pesticide is highly toxic (DANGER) dermally, a typical label statement would be: “Fatal if absorbed through the skin” or “Can kill you by skin contact” combined with the statement “Do not get on skin or clothing”. If the pesticide were moderately toxic (WARNING) dermally, a typical label statement would be: “Harmful or fatal if absorbed through the skin” or “May be fatal by skin contact” followed by a statement such as: “Do not get on skin or clothing”. If the pesticide were slightly toxic (CAUTION) dermally, a typical label statement would be: “Harmful if absorbed through skin” or “May be harmful by skin contact” combined with the statement “Avoid contact with skin or clothing”.

**THE DERMAL TOXICITY STATEMENT ASSOCIATED WITH TBT ANTIFOULING PAINTS IS: “HARMFUL IF ABSORBED THROUGH SKIN. DO NOT GERT ON SKIN, CLOTHING OR EYES.”**

4. Inhalation Toxicity Statements – The pesticide label usually indicates how hazardous a pesticide product is if it enters the body through breathing. If the pesticide is highly toxic (DANGER) through inhalation, a typical label statement would be: “Poisonous if inhaled” or “Can kill you if breathed” combined with the statement “Do not breathe dusts, vapors or spray mist”. If the pesticide were moderately toxic (WARNING) through inhalation, a typical label statement would be: “Harmful or fatal if inhaled” or “May be fatal if breathed” followed by a statement such as: “Do not breathe dusts,

vapors or spray mist”. If the pesticide were slightly toxic (CAUTION) through inhalation, a typical label statement would be: “Harmful if inhaled” or “May be harmful if breathed” combined with the statement “Avoid breathing dusts, vapors or spray mists”.

5. Eye Irritation Statements - The pesticide label usually indicates how hazardous a pesticide product is if it gets into the eyes. If the pesticide were highly irritating or corrosive (DANGER) to the eyes, a typical label statement would be: “Corrosive. Causes severe eye burns or blindness” combined with the statement “Do not get in eyes”. If the pesticide were moderately irritating (WARNING) to the eyes, a typical label statement would be: “Causes eye irritation” or “Causes eye burns” followed by a statement such as: “Do not get in eyes”. If the pesticide were slightly irritating (CAUTION) to the eyes, a typical label statement would be: “May irritate eyes” combined with the statement “Avoid contact with eyes”.

**THE EYE IRRITATION STATEMENT FOR TBT ANTIFOULING PAINTS IS: CORROSIVE. CAUSES SKIN BURNS AND EYE IRRITATION. DO NOT GET ON SKIN, CLOTHING OR IN EYES.**

6. Skin Irritation Statements - The pesticide label usually indicates how irritating a pesticide product is to the skin. If the pesticide were highly irritating or corrosive (DANGER) to the skin, a typical label statement would be: “Corrosive. Causes severe skin burns” combined with the statement “Do not get on skin”. If the pesticide were moderately irritating (WARNING) to the skin, a typical label statement would be: “Causes skin irritation” or “Causes skin burns” followed by a statement such as: “Do not get on skin”. If the pesticide were slightly irritating (CAUTION) to the skin, a typical label statement would be: “May irritate skin” combined with the statement “Avoid contact with skin”.

**THE SKIN IRRITATION STATEMENT FOR TBT ANTIFOULING PAINTS IS: CORROSIVE. CAUSES SKIN BURNS AND EYE IRRITATION. DO NOT GET ON SKIN, CLOTHING OR IN EYES. MAY BE A DERMAL SENSITIZER.**

7. Chronic Toxicity Statements – Some pesticides have been identified as possible hazards to humans through chronic (long-term) toxicity. These statements typically cite evidence in laboratory animals as the source of possible risk from chronic effects. Typical statements include: “This product has been determined to cause birth defects in laboratory animals” and “This product has been determined to cause cancer in laboratory animals”. **No chronic toxicity statement appears on TBT antifouling paint products at this time.**

e. Precautionary Statements

Pesticide labeling contains statements to help you decide the proper precautions to take to protect yourself, your helpers and other persons (or domestic animals) that may be exposed. These statements are included under the heading “Hazards to Humans and Domestic Animals”.

Most pesticides are designed to poison pests. Unfortunately many pesticides are also poisonous to people. Therefore it is important to do everything possible to keep

your exposure to an absolute minimum. You also want to protect your workers and other people from pesticide injuries. Most pesticide accidents result from careless practices or lack of knowledge about safe handling of pesticides. The time you spend to learn about and to use safe procedures is an investment in the health and safety of yourself, your family, and others.

1. Special Hazard Precaution – The signal word is repeated at the beginning of the “Hazards to Human and Domestic Animals” section, unless that section follows immediately after the signal word section on the label. Sometimes the signal word will be followed by a special or specific precaution. This precaution often indicates the main hazard to the user and instructs how to avoid the hazard and/or what to do if you are exposed.
2. Hazards to Human and Domestic Animals statements for TBT antifouling paints are: “Corrosive. Causes skin burns and eye irritation. Harmful if absorbed through skin or inhaled. Do not get on skin, clothing or in eyes. May be a dermal sensitizer. Wear a face shield and rubber gloves when handling. Wear protective clothing such as long-sleeved cotton shirt, long pants and hat. Use in a well ventilated area. When used in confined areas or applied by spraying, wear protective clothing and a pesticide respirator jointly approved by the Mining Enforcement and Safety Administration (formerly the US Bureau of Mines) and by the National Institute for Occupational Safety and Health under the provisions of 30 CFR 11. May be fatal if swallowed. If swallowed promptly drink a large quantity of egg whites, gelatin solution or water. Avoid alcohol. Do not induce vomiting. Do not breathe vapors or spray mist”.
3. Wash Hands Precaution – Often pesticide product labeling will contain the statement: “Always wash hands before eating, drinking, chewing using tobacco or using the toilet.” This precaution is essential; while TBT antifouling paint pesticide labels do not contain this precaution, you should always heed it.
4. Ventilation – Pesticides that are hazardous if inhaled sometimes require ventilation during indoor use. TBT antifouling paint labels also list a precaution for outdoor uses of the product: “Use in a well ventilated area. When used in confined areas or applied by spraying, wear protective clothing and a pesticide respirator jointly approved by the Mining Enforcement and Safety Administration (formerly the US Bureau of Mines) and by the National Institute for Occupational Safety and Health under the provisions of 30 CFR 11.
5. Application precaution – Most pesticide labeling contains a statement prohibiting applicators from spraying or dusting workers or other persons. This prohibition applies to workers in the area that is to be coated and to workers and other persons in neighboring areas that may be subject to exposure. While TBT antifouling paint pesticide labels do not contain such a statement, care should always be taken that persons in neighboring areas are not exposed to and hazards caused by spray applications.
6. After-use Precautions – Pesticide labeling often instructs users to remove personal protective equipment and wash thoroughly after handling the pesticide product. TBT antifouling paint labeling does not contain a specific after-use precaution. However, workers should always wash with soap and water after handling TBT antifouling paints, and any contaminated clothing should be cleaned before reuse.

f. Protective Clothing and Equipment Statements

To prevent pesticides from entering the body, you must wear protective clothing and equipment. Follow all advice that appears on the label about protective clothing and equipment. However the lack of a statement or the mention of only one piece of equipment does not rule out the need for additional protection. No safety recommendations can cover all situations. Your common sense and knowledge of pesticide toxicity should help you assess the hazard and select the kind of protection you need.

While the pesticide label lists the clothing and equipment to wear when handling the pesticide, the best way to determine the correct protective clothing and equipment is to use the signal word, the toxicity statements and the precautionary statements along with the basic guidelines listed in the chapter on safety.

Protective clothing for use with TBT antifouling paints includes face shield, rubber gloves, long-sleeved cotton shirt, long pants and a hat. An approved pesticide respirator is required for spray applications or any application in confined areas.

g. Statement of Practical Treatment

Pesticides can poison humans as well as the target pests. Some pesticides are highly toxic to humans; only a few drops in the mouth or on the skin can cause severe injury. Other pesticides are less toxic but overexposure to them will cause injury. You should know the kinds of injury most likely to be caused by the pesticides you use. The TBT antifouling paint label gives first aid instructions in case of an accident or poisoning.

1. Signs and Symptoms of Poisoning – The most highly toxic pesticides (and some other pesticides) list the signs and symptoms of pesticide poisoning on the product labeling. There are no signs or symptoms of poisoning on TBT antifouling paint labeling.
2. First Aid – First aid statements tell you the first aid treatments recommended in case of poisoning by that product. The first aid statements on TBT antifouling paint labeling are: “ In case of skin contact, remove contaminated clothing and immediately wash skin with soap and water. Get medical attention wash contaminated clothing before reuse. If inhaled, remove to fresh air. Use artificial respiration if breathing has stopped. Get medical attention. If swallowed, do not induce vomiting. If in eyes, immediately flush with plenty of water. Get medical attention.
3. Antidote – An antidote is a medical treatment that will offset or counteract the effects of the pesticide poison. If an antidote is known, it is usually listed on the pesticide label. There is no antidote listed on TBT antifouling paint labels.
4. Note to Physician – All DANGER labeling and some WARNING and CAUTION labeling contain a note to physicians describing the appropriate medical procedures for poisoning emergencies and identifying an antidote, if one exists.



h. Environmental Hazards

Pesticides may be harmful to the environment. Some products are classified as RESTRICTED USE because of environmental hazards alone. Special warning statements are included on labeling concerning hazards to the environment.

1. Special Toxicity Statements – If a particular pesticide is especially hazardous to wildlife that is stated on the label. TBT antifouling paint labeling includes the statement: “This product is toxic to fish”. This statement alerts you to the special hazards that the use of these products may pose. It should help you choose the safest product for the job and remind you to take extra precautions.
2. General Environmental Statements – Some of these statements appear on nearly all pesticide labeling. They are reminders of common sense actions to follow to avoid contaminating the environment. Adequate precautions must always be taken to protect the environment. Environmental statements are included on TBT antifouling paint labeling in the sections on Environmental Hazards, Directions for Use and Storage and Disposal:

“Do not apply directly to water”.

“Do not contaminate water by cleaning of equipment or disposal of wastes”.

“Do not allow chips and dust generated during paint removal to enter water”.

“During and after paint removal and/or application of new TBT paint, methods must be employed which are designed to prevent release of TBT paints into the aquatic environment”.

“Do not contaminate water, food or feed by storage or disposal”.

i. Physical or Chemical Hazards

This section of labeling tells you of any special fire, explosion or chemical hazards the product may pose. For example:

“Flammable – Do not use, pour, spill, or store near heat or open flame.”

“Do not weld or cut container.”

**NOTE:** Hazard statements (Hazards to Humans and Domestic Animals, Environmental Hazards, and Physical/Chemical Hazards) are not located in the same place on all pesticide labeling. Some labeling group them in a box under the headings listed above. Other labeling may list them on the front panel beneath the signal word. Still other labeling lists the hazards in paragraph form under headings such as “Note” or “Important”. Search the labeling for statements that will help you apply the pesticide more safely and knowledgeably.

j. Classification Statements

Every use of every pesticide product is classified by the US Environmental Protection Agency (EPA) as either “General Use” or “Restricted Use”. If EPA determines that the pesticide, utilized for the purposes for which it is registered, will not generally cause unreasonable adverse effects on the environment when applied in accordance with its directions for use, warnings and cautions, and for the uses for which it is registered, EPA will classify that pesticide, or that particular use of the

pesticide, for “general use”. When a pesticide is classified for general use, the words “General Classification” will appear immediately below the heading “Directions for Use”.

Based on laboratory and field studies, EPA has determined that adverse acute and chronic effects to non-target aquatic organisms may result from the use of TBT antifouling paints. This determination is based on high levels of TBT in the water column in adjacent to marinas, dry-docks and poorly flushed harbors.

For this reason, EPA has determined that unrestricted use of TBT antifouling paints will result in unreasonable adverse effects on the environment, and these products are classified as “Restricted Use Pesticides”. As such, they must carry the following statement in a prominent place at the top of the front panel of the pesticide labeling:

**“Restricted Use pesticide** due to toxicity to aquatic organisms, including shellfish: For sale only to certified commercial applicators and for use only by persons under the direct supervision of an on-site (at the work site) certified commercial applicator. These restrictions become effective on March 1, 1900”.

TBT containing antifouling paints may be applied only by a certified applicator or persons under the direct supervision of an on-site (at the work site) certified applicator and subject to such other restrictions as EPA may provide by regulation.

k. Storage, Disposal Spill Cleanup, Transportation and Handling Containers

One section of the pesticide label usually states specific directions for the storage and disposal of the pesticide product. Often there are also instructions for appropriate cleanup of spills, safe transportation of the product, and directions for the appropriate handling of the pesticide containers.

One or more statements may appear in a special section of labeling titled “Storage and Disposal”.

**Storage statement** – “Do not contaminate water, food or feed by storage or disposal”.

**Disposal statement** – “Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal Law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance”.

**Container disposal statement** – “Dispose of empty container in a sanitary landfill, or by other approved state and local procedures. Dispose of product that cannot be used in accordance with its labeling directions following federal, state, or local procedures under the Resource Conservation and Recovery Act (RCRA)”.

This section of the pesticide labeling may also include statements addressing spill cleanup, transportation of the pesticide product and handling of the pesticide containers.

l. Directions for Use

The instructions on how to use a pesticide are an important part of labeling. They provide the applicator with information on where the product may be used and the right way to apply it. The use and application directions will tell you:

- the pests which the manufacturer claims the product will control
  - the surface the product is intended to protect
  - the proper equipment to be used to apply the product
1. Inconsistent with labeling – A statement must appear on all pesticide products to indicate that the pesticide must be used as specified and directed on the product label and accompanying labeling information. The statement is: “It is a violation of Federal law to use this product in a manner inconsistent with its labeling”.
  2. Consistent with labeling – “Consistent with labeling” has been indicated by EPA to mean:
    - No less personal protective equipment or other label-specific attire than stated; however, more protective attire is allowable.
    - No applications to non-aluminum hulled vessels less than 82 feet (25 meters) in length (on deck) except for the outboard motor or lower drive unit of such vessel.
    - Cleaning of equipment and disposal of wastes in a manner that will contaminate water.
    - Prevention of chips and dust generated during paint removal from entering water.

Pesticide product labeling, regardless of the manufacturer or supplier, will follow a general format. A sample generic label is enclosed as **Appendix A**.

m. Reading Labeling

Before you buy a pesticide, read the labeling to determine:

- whether it is the pesticide you need for the job and
- whether the pesticide can be used safely under the application conditions.

Before you apply the pesticide, read the labeling to determine:

- what protective equipment you should use
- what safety measures you should follow

- where the pesticide can be used
- how to apply the pesticide and
- whether there are any restrictions for use of the product (it is unlawful to use this product on non-aluminum hulled vessels less than 82 feet (25 meters) in length (on deck) except for the outboard or lower drive unit of such vessels).

Before you store or dispose of the pesticide or pesticide container, read the labeling to determine:

- how to decontaminate and dispose of the pesticide container and
- where to dispose of excess pesticide

### C. STUDY QUESTIONS

1. A label is the information printed on or attached to a pesticide container.  
TRUE or FALSE
2. Regardless of the SIGNAL word(s) on a label all pesticide labels must carry the statement “\_\_\_\_\_”.
3. All formulations and containers of TBT antifouling products will carry the same signal word. TRUE or FALSE
4. Always remove the label from a pesticide container and place it in the file for safekeeping. TRUE or FALSE
5. The Skull and Crossbones will appear on TBT products packaged in 16 ounce or less spray can containers, labeled for use on outboard motors and propellers.
6. The label should be read before:
  - a. buying a TBT product
  - b. applying a TBT product
  - c. storing or disposing a TBT product container
  - d. All of the above
7. Use of a TBT product to protect lobster pots is considered a violation because its use is inconsistent with its labeling. TRUE or FALSE

#### USE THE ATTACHED LABEL FOR THE FOLLOWING:

8. The SIGNAL word on this label indicates that the product is “\_\_\_\_\_” toxic.
9. If this product is accidentally swallowed you should induce vomiting to prevent further intestinal damage. TRUE or FALSE

11. The EPA Registration No. of the product is “\_\_\_\_\_”.
12. When applying this product it is necessary to follow OSHA requirements.  
TRUE or FALSE
13. The best method of disposing all paint, TBT paint chips, spent and unused abrasives is to dump them into the water because “dilution is the solution to pollution”.  
TRUE or FALSE
14. While spraying this product the applicator should wear a “\_\_\_\_\_” approved respirator.
15. If a respirator is worn when applying this product it is not necessary to wear eye protection. TRUE or FALSE

## MODULE #3

### SAFETY

#### A. LEARNING OBJECTIVES

After the completion of study of safety the trainee should be able to:

- Know the difference between acute and chronic effects of overexposure to TBT products.
- Know common types of exposure and accidents that may be expected when using TBT paint products.
- Know precautions, protective clothing and equipment to avoid overexposure to TBT paint products.
- Know the symptoms of overexposure/poisoning.
- Know emergency procedures and practical treatment

#### B. DISCUSSION

##### 1. Introduction

Pesticides, by their inherent nature, have properties that make them toxic to animals and the environment. The degree of hazard, or “risk”, is inversely proportional to the amount necessary to cause an adverse effect. In order to minimize the potential for employee or environmental exposure to all paints, including TBT antifouling paint, the following recommendations should be considered:

- a) Engineering controls and safe work practices should be utilized in order to keep airborne concentrations of TBT, or other hazardous substances, as far below the Permissible Exposure Limit (PEL) as is technically feasible.
- b) When practicable, remove all non-essential personnel, equipment and materials from the spraying area.
- c) Use airless spray equipment to minimize over spray and the potential for exposure.

##### 2. Specific information for the specific use of TBT antifouling paints:

###### Hazards:

The following effects may occur as a result of exposure to TBT antifouling paints. They are grouped according to route of exposure.

Eye Contact: May cause immediate or delayed severe eye irritation. The onset of irritation may not occur until several hours after exposure. Exposure through eyes is caused primarily by the chemical being splashed into the eye.

Skin Contact: May produce irritation of contact dermatitis, which may be delayed several hours. Prompt and thorough washing with soap and water will minimize eliminate any potential dermal effects. TBT may be absorbed through the skin. Dermal exposure is usually caused by chemicals being splashed on the skin.

Inhalation: Inhalation of particles or vapors of TBT may irritate the upper respiratory tract. Overexposure may be also produce coughing, headache and nausea. The onset of these symptoms may be delayed until several hours after exposure. This route of exposure is primarily from inappropriate respiratory protection.

Oral Toxicity: Acute oral LD<sub>50</sub> (rat) = 170-500 mg/kg (approx. 350 mg/kg) – (moderately toxic) liver and kidney pathology was observed at all doses in the acute feeding study. The LD<sub>50</sub> refers to that dosage of the substance that is likely to kill one-half of a group of test animals using a specified test procedure. This dose is expressed as the amount per unit of body weight, the most common expression being milligrams of material per kilogram of body weight.

### 3. Effects of Overexposure:

Acute effects of overexposure refer to the adverse effects that normally are evident immediately or shortly after the exposure to hazardous material without implying a degree of severity. Acute effects from exposure to *tributyl* tins are reversible. Chronic effects of overexposure refer to the adverse effects that develop as a result of repeated prolonged exposure to a hazardous material without implying a degree of severity.

Effects of overexposure to TBT antifouling paints include skin burns, sore throat coughing, vomiting, persistent headache followed by dizziness, abdominal pain, and urinary retention. Avoid contact with wet or dry paint, overspray or contaminated sandblasting residue.

In order to avoid accidental ingestion or dermal exposure, the applicator should wash before eating, drinking or using gum or tobacco products. Accidental ingestion can occur if the pesticide is mistaken for food or drink, the pesticide accidentally contaminates food, or the pesticide is splashed into one's mouth. Proper respiratory protection should be worn in or near the spraying area to avoid accidental inhalation.

### 4. Precautions:

Use respiratory protection in accordance with 29 CFR 1910.134 (NIOSH/MSHA approved respirator). For spray painters, full coverage supplied air hood shall be used. Workers should be trained in the proper use of respirators.

Wear protective clothing (disposable coveralls and shoe covers) and plastic or rubber gloves and hoods to avoid skin contact. Shower with soap and water immediately after removing protective equipment contaminated with TBT antifouling paint.

Discarded disposable clothing and materials should be disposed of in a sanitary landfill.

Wear goggles and face shield to protect eyes from dust, mist or spray.

Avoid eating and drinking in work areas.

Monitor workplace and workers regularly by using a qualified professional, such as a certified hygienist, physician, plant nurse, etc

Do not use TBT antifouling paint in ship's interior.

Do not have open flames or sparks near the spraying or storing of TBT antifouling paint.

Always follow any additional precautionary statements on the product label.

5. Exposure Limits:

Permissible Exposure Limit: (OSHA's designation for air contaminant exposure)

0.1 mg/m<sup>3</sup> as tin for 8-hour time weighted average.

6. In case of emergency:

Eyes: In case of contact, immediately flush eyes with flowing water for at least 15 minutes. Get medical attention.

Skin: Remove contaminated clothing and flush skin with water. Then wash with soap and water. (Never use solvents to remove TBT antifouling paint from the skin). Get medical attention. Note to physician: Application of a corticosteroid cream has been effective in treating severe skin irritation. If blisters develop, they may require abrasion to promote healing.

Inhalation: Move exposed individual to fresh air. If not breathing, give mouth-to-mouth respiration. Get medical attention.

Ingestion: If swallowed, promptly drink a large quantity of milk, egg whites, gelatin solution or, if not available, drink large quantities of water. Avoid alcohol. Do not induce vomiting. Get medical attention.

These safety precautions are relevant to TBT antifouling paint. The paint may also contain other hazardous ingredients. Precautions should be taken on the entire paint product following the manufacturer's label and material safety data sheet. In case of an emergency involving an individual exposed to TBT, the product label and material safety data sheet should be made available to medical professionals.

C. STUDY QUESTIONS



1. Four common routes of TBT entry into the human body are \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.
2. A respirator should be worn to prevent TBT entry by \_\_\_\_\_.
3. Adverse effects of a pesticide that become visible soon after exposure are called “\_\_\_\_\_” effects.
4. Adverse effects of overexposure such as a birth defect or cancer are called “\_\_\_\_\_” effects.
5. Skin contact with TBT paint can be prevented by coating the skin with “Skin So Soft”.  
TRUE or FALSE
6. It is not permissible to eat or smoke in the area where TBT paint is being applied.  
TRUE or FALSE
7. Four symptoms of overexposure to TBT paints are “\_\_\_\_\_”, “\_\_\_\_\_”, “\_\_\_\_\_”, and “\_\_\_\_\_”.
8. Emergency treatment for an eye that was splashed with TBT paint is to “\_\_\_\_\_”.
9. Skin irritation as a result of exposure to TBT may be delayed or reduced by “\_\_\_\_\_”.

D. SELECTED REFERENCES

1. NCPA’s Hazardous Materials Identification System (HMIS) Implementation Manual
  2. Dangerous Properties of Industrial Materials, N. Irving Sax, Reinhold Publishing Corporation
  3. Documentation of TLV’s, American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio
- E. VISUAL AIDS: Slides from HMIS program.
- F. HANDOUTS: HMIS wallet cards

## STORAGE, HANDLING AND DISPOSAL

### A. LEARNING OBJECTIVES

After completion of the study of storage, handling and disposal, the trainee should be able to:

- Know how to store, handle and mix.
- Know how to dispose of chips and dust.
- Know how to dispose of unused material and containers.
- Know Federal, State and Local laws and regulations affecting storage and disposal.

### B. DISCUSSION

#### 1. Storage and Handling of TBT Antifouling Paints

Storage and disposal must be done in accordance with the product's label directions. Additional storage and handling precautions include the following:

- Follow normal warehouse handling and store on a cool, dry area.
- Do not contaminate water, food or feed by storage or disposal.
- Pesticides should be stored in their original containers. If the original container is unavailable, the pesticide should be stored in a fully labeled chemical resistant container.
- Pesticides should be stored away from food, feed, seed, humans and animals.
- Pesticides should be stored in fully closed containers
- Pesticides should never be stored in food or drink containers.
- Check state and local regulations requiring pesticide storage area, which may require locked storage areas and posted warning signs on all entry points.
- Transportation, mixing and handling of restricted use pesticides must be done by or under direct supervision of a certified applicator.

#### 2. Disposal of TBT Antifouling Paint

Emptied TBT antifoulant containers must be disposed of in a sanitary landfill, or by other approved State and local procedures. Open burning and dumping is prohibited. TBT antifouling paint that cannot be used according to the product's label directions must be disposed of according to Federal, state or local procedures under the Resource Conservation and Recovery Act (RCRA). Disposal regulations vary from state to state. Be sure that you follow appropriate disposal methods for your particular state or locality.

Equipment that is worn and used during the application removal of TBT antifouling paints must be carefully cleaned according to the equipment manufacturer's instructions. The contaminated wastewater from this cleaning process should then be disposed of within the parameters of the Clean Water Act in conjunction with any state or local regulations.

The dry dock and equipment surfaces should be swept or vacuumed to gather paint overspray and other paint waste, such as paint chips, dust and spent sand-blasting grit which accumulate in the drydock for disposal. These wastes along with any equipment that cannot be economically cleaned should be disposed of in accordance with local, state and federal requirements under the Resource Conservation and Recovery Act (RCRA) and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

### 3. Spillage

Adequate supplies of a suitable absorbent to deal with accidental spillage of paint should be available around the work area. Any absorbent that has been used must be treated as solid toxic waste and disposed of as such.

Use protective coverings, such as plastic, canvas, etc. in the immediate work areas where TBT antifouling paints are going to be used. TBT paint spills can be further contained by covering the entire spill area with absorbent materials such as sand, kitty liter or pads. Every effort should be made to ensure that there is adequate containment in the event of a spill. In the case of a spill, apply absorbent material to the spill area, collect, identify and dispose of contaminated absorbent material in accordance with local, state and federal requirements. Contain the spilled material in as small an area as possible. Do everything possible to keep it from spreading or getting worse. Use a hand tool such as a shovel or rake to construct a dam of soil or sod. If the spilled material is flowing into a ditch or depression, the flow should be blocked on all sides to reduce further movement. The important thing to remember is do not allow the spilled material to enter any body of water.

### C. STUDY QUESTIONS

1. TBT antifouling paint should be stored in the “\_\_\_\_\_” container.
2. Transportation of TBT products must be done under the supervision of a certified applicator. TRUE or FALSE
3. To determine if a pesticide storage area must be locked and posted you should check “\_\_\_\_\_” and “\_\_\_\_\_” laws.
4. Mixing and handling of TBT paints should never be done by non-certified persons. TRUE or FALSE
5. Empty TBT paint containers must be disposed of in a “\_\_\_\_\_” or by other approved State and local procedures.
6. A suitable method of disposing unused TBT paint is by burning. TRUE or FALSE

7. TBT paint that cannot be used and wastes that cannot be economically cleaned are to be disposed of in accordance with local, State and Federal requirements under the “\_\_\_\_\_” Act and the “\_\_\_\_\_” Act.

D. SELECTED REFERENCES

1. Federal Register, October 4, 1988, pp. 39022 to 39041.
2. Uniform Industrial Process Instruction, Naval Sea Systems Command, Department of the Navy.

E. VISUAL AIDS:           None

F. HANDOUTS:             None

## MODULE #5

### ENVIRONMENT

#### A. OBJECTIVES:

Trainees should be able to:

- Understand why there are restrictions on this product.
- Understand the effect of TBT antifouling paint on non-target organisms.
- Know the concepts of spill management.

#### B. DISCUSSION:

##### 1. WHY RESTRICTIONS:

Laboratory testing and field trials have established that *tributyltin* (TBT) can be toxic at low levels to fish, bivalves (such as oysters), gastropods (such as marine snails), crustaceans (such as shrimp and crab) and algae.

TBT concentrations in some US waters have been found to exceed levels that cause toxic effects in oysters, clams, fish and other aquatic life.

In 1988, to protect the aquatic environment by reducing the quantities of TBT entering the waters of the US, the President signed the Organotin Antifouling Paint Control Act of 1988 (OAPCA). This legislation is independent of FIFRA and has interim and permanent use restrictions such as prohibiting the use of TBT antifouling paints with high release rates. The term “release rate” means the rate at which the TBT is released from the antifouling paint. The act also prohibits the use of TBT products on vessels less than 82 feet except for vessels with aluminum hulls. Aluminum hulls are excluded because of corrosion, which can occur if painted with copper-based paints, which at this time are the only available alternative.

In October 1988, based on a Special Review of TBT paints conducted over the previous two years, PEA determined that the use of TBT products could result in unreasonable adverse effects on the environment unless that use complied with the requirements promulgated in the Federal Register of October 4, 1988. These requirements include classification of these paints as restricted use pesticides, which require that applicators or their supervisors are properly trained and that proper procedures are followed to reduce the risk from inadvertent aquatic contamination.

##### 2. EFFECT OF TBT ANTIFOULING PAINT ON NON-TARGET ORGANISMS:

TBT compounds have the ability to penetrate biological membranes and produce toxic effects.

**Acute toxicity** where the organisms may be killed after exposure for a relatively short period of time (less than one week); or

**Chronic toxicity** due to long-term exposure affecting such functions as growth, reproduction and normal physiological processes.

Most aquatic organisms appear to be extremely sensitive to TBT toxicity during the time of development from fertilize eggs through various larval stages.

### 3. CONCEPTS OF SPILL MANAGEMENT

Antifouling paint should be applied and disposed of in accordance with generally acceptable practices with the intent to minimize contact with the soil, water and aquatic life and to avoid contamination, which could result in damage to non-target organisms. Since climatic factors such as type of terrain, drainage and soil, could increase the potential of environmental harm of a spill, leak or run-off, extreme care should be used by the applicator in all aspects of handling TBT antifouling paint.

If proper procedures as prescribed by the manufacturer are followed during application and disposal, no hazard should be present to any non-target animal species or the environment. Some basic points include:

- Use floor coverings
- Be sure that there is sufficient containment to prevent spills from reaching the water
- Collect used wiping materials, waste paint, empty cans and other contaminated materials in approved containers
- Do not flush out the dock to remove spillage
- Ensure that wind conditions do not cause overspray to drift into dockside areas and adjacent waters.

### C. STUDY QUESTIONS

1. Laboratory tests and field trials established that TBT products could be toxic to fish, bivalves (clams), gastropods (snails), crustaceans (shrimp and crabs), and algae. TRUE or FALSE
2. A pesticide such as TBT that can adversely affect aquatic organisms will be classified as a “\_\_\_\_\_” use pesticide.
3. To reduce the quantity of TBT entering US waters, release rates were limited to 4.0 ug organotin/cm<sup>2</sup>/day by the “\_\_\_\_\_” Act.
4. TBT paints are prohibited on the hulls of vessels less than “\_\_\_\_\_” feet except for those with “\_\_\_\_\_” hulls.
5. In case of a TBT paint spill it will be necessary to contain the spill to prevent it from reaching the “\_\_\_\_\_”

6. Spills on docks may be flushed into the water in non-coastal states.  
TRUE or FALSE
7. TBT restrictions do not apply in the Great Lakes. TRUE or FALSE
8. Wind speeds over 25 mph are of no concern when spraying TBT paints on hulls.  
TRUE or FALSE

D. SELECTED REFERENCES

1. Federal Register, Oct. 4, 1988, pp. 39022 to 39041
2. EPA Tributyltin Technical Support Document 2/3 dated October 1987
3. Organotin Antifouling Paint Control Act of 1988, HR 2210

E. VISUAL AIDS: None

F. HANDOUTS:

Organotin Antifouling Paint Control Act of 1988, HR 2210 (can be obtained from Congress) – Clerk of House of Representatives

## MODULE #6

### PESTS AND PESTICIDAL PROPERTIES

#### A. OBJECTIVES

Trainee should be able to:

- Know why antifouling paints are used
- Know what groups of marine organisms are controlled by antifouling paints
- Know the fouling control mechanism of antifouling paints, why TBT compounds were used in the antifouling paints, categories of TBT antifouling paints and the various factors that can affect antifouling performance

#### B. DISCUSSION

##### 1. WHY ANTIFOULING PAINTS ARE USED:

The growth of plant and animal organisms such as barnacles, seaweeds or tubeworms on the hulls of ships and other structures submerged in seawater is referred to as “fouling”.

Fouling in the hull of the ship decreases the speed and increases fuel consumption. Fouling can result in enormous penalties. For example an aircraft carrier must maintain a speed of 40 knots to launch and land aircraft. The 1985-1986 fuel bill of the “QE-II” was 17 million dollars. Fouling also increases the weight of buoys and other navigational equipment, interferences with moving equipment and underwater sound devices, clogs underwater pipes and promotes corrosion of underwater surfaces. Fouling also increases time out of services and cost for hull cleaning and painting.

##### 2. MARINE FOULING ORGANISMS:

Woods Hole Oceanographic Institution in 1952 listed about 2000 species as being found in the fouling community consisting of marine plants and animals. Marine plants include bacteria and diatoms, which form a slime film. A wide variety of algae are found such as seaweeds, which live in large colonies. Larger animal foulers primarily consist of barnacles, mussels, bryozoans, hydroids, tunicates and tubeworms. Every member of the fouling community goes through its own life cycle, all of which contribute to the development of the fouling community.

The life cycles of such sea animals and plants depend upon permanent anchorage.

##### 3. DEFINITIONS:

The term “pesticide” means any substance or mixture of substances intended for preventing, destroying, repelling or mitigating any pest. There are different types of pesticide products formulated for different classes of pests. The following are examples of classes of pesticides:



<u>Biocide:</u>	Chemical which has a wide range of toxic properties, usually to members of both the plant and animal kingdoms.
<u>Herbicide:</u>	Pesticide for killing or inhibiting plant growth.
<u>Mildewcide:</u>	Pesticide that inhibits the growth of mildew.
<u>Fungicide:</u>	Pesticide intended for preventing or inhibiting the growth of, or destroying any fungi declared to be pests.
<u>Insecticide:</u>	Pesticide intended for preventing or inhibiting the establishment, reproduction, development or growth of, destroying or repelling insects or allied organisms declared to be pests.
<u>Nematicide:</u>	Pesticide intended for preventing or inhibiting the multiplication or establishment of, preventing or mitigating the adverse effects of, repelling or destroying any members of the Class Nematoda declared to be pests.
<u>Invertebrate animal poisons and repellents:</u>	Pesticides intended for preventing the establishment of, destroying, repelling or mitigating invertebrate animals declared to be pests except insecticides or nematicides. This category includes antifouling paints intended for use on boat and ship bottoms, pier and deck pilings and similar submerged structures to prevent attachment or damage and destruction by marine invertebrates.

#### 4. ANTIFOULING AGENTS:

In the early 1950s, three agents served as the primary toxic control agents. They were compounds of copper, mercury and arsenic. These compounds were physically incorporated into the paints, which controlled fouling by leaching a high level of biocide into the water from the paint film when immersed. Federal and state regulations have eliminated the use of mercury and arsenic as antifouling agents in the US.

Organotin compounds were first evaluated as antifouling agents in the 1950s and 1960s. They were very rapidly accepted and used by the paint industry for the following reasons:

- 1) They exhibit no galvanic corrosion, which can occur when dissimilar metals are in contact with each other and seawater, as in the case of an aluminum hull painted with a copper base paint.
- 2) A wide spectrum of biological activity.
- 3) A lower order of mammalian toxicity than organic mercury and arsenic compounds.
- 4) They require a significantly lower level of biocide compared to copper compounds for effective fouling control.

The most commonly used organotins for antifouling paint formulations are in the *tributyltin* family, with some *tripenyltin* formulations also being used. Organotin copolymers were at first developed in the 1960s but it was not until the 1970s that their superior antifouling properties were recognized and they were fully marketed.

#### 5. PAINT PROPERTIES:

The properties required for satisfactory performance of antifouling paints include fouling resistance, durability and adhesion. The paint should be easily applied, should dry or harden in a relatively short period and should have good film build (desired film thickness with two or four coats of paint).

Sufficient levels of the active ingredients should be released over an extended period of time to provide fouling control as long as possible without requiring removal and/or repainting.

In addition, paint, properly applied should not adversely affect health, safety and the environment.

#### 6. MECHANISM:

The principal function of an antifouling paint is to interrupt the life cycle of marine organisms by preventing or eliminating the settlement and growth of fouling organisms. *Tributyltin* (TBT) antifouling paints release TBT ions (an electrically charged group of atoms), which act on the early life stages of the fouling organisms from anchoring and growing on the protected surface.

Like antifouling paints containing copper compounds, release rates of antifouling paints containing organotin compounds into seawater (which is mildly alkaline) can vary depending on the formulation and the environment.

Differences in berthing locations, operating schedules, length of service, condition of paint film surface, temperature, pH (measure of acidity or alkalinity), and salinity can affect results.

Low concentrations of TBT ions transported beyond the painted surface have been shown to have adverse effects on non-target aquatic organisms. EPA has classified TBT paint as a restricted use pesticide as one means of reducing environmental contamination with TBT.

#### 7. FORMUALTIONS AND CATEGORIES:

A TBT antifouling paint formulation can have a single TBT active ingredient, can be combined with one or more of the other TBT antifoulants, can be combined alone with copper compounds (especially cuprous oxide), can be combined with *tripenyltin fluoride* or can be combined with copper and other organotin compounds. Current TBT products are formulated with 0.5 to 41 percent active ingredient TBT. TBT compounds registered for use as antifoulants are bis (*tributyltin*) oxide, bis (*tributyltin*) adipate, bis (*tributyltin*

*dodecyl succinate*), bis (*tributyltin*) sulfide, *tributyltin acetate*, *tributyltin acrylate*, *tributyltin resinate*, *tributyltin fluoride*, and *tributyltin methacrylate*. Depending on the specific formulation, these paints cover from 150 to 400 square feet per gallon.

TBT antifouling paints may be classified into three categories according to the way the TBT component is incorporated into the paint coatings and subsequently released.

Free association paints: In this category the TBT component is chemically bonded to a polymer (resin molecules which consist of structural units repeated a number of times). The biocide is released by the action of seawater on the TBT bond. These paints are characterized by the slow dissolution from ship hulls and thus achieve a constant but prolonged release of antifoulant toxicant. The micro layer of the hydrolyzed polymer is polished away as the ship moves through the water similar to what occurs with a cake of soap. Service life depends on the dry film thickness (number of coats applied).

Ablative paints: These paints have the characteristics of both the free association and copolymer paints. The TBT is not bound to a polymer, but may be incorporated into the paint matrix. Ablative paints are soft paint films with the resin portion of the paint slightly water-soluble so that the surface slowly sloughs or ablates away as the painted vessel moves through the water. This exposes a fresh layer of antifouling paint and prevents the buildup of insoluble materials.

These products are specifically formulated and should be applied according to the manufacturer's instructions to achieve optimum effectiveness. Because the product's effectiveness is directly proportional to the amount applied, it is important not to underdose or apply in an uneven deposit pattern.

#### D. STUDY QUESTIONS:

1. Growth of barnacles, seaweed or tubeworms on the hulls of ships and other submerged structures is called “\_\_\_\_\_”
2. Growth of these hull-attaching organisms does not affect that vessel's speed or fuel consumption. TRUE or FALSE
3. Marine organisms attaching themselves to vessel hulls are from the PLANT and ANIMAL kingdoms. TRUE or FALSE
4. The two major toxic metallic compounds currently used in antifouling paints are “\_\_\_\_\_” and “\_\_\_\_\_”.
5. TBT compounds are incorporated into paint coating. Their effectiveness is derived when the TBT is “\_\_\_\_\_”.
6. TBT antifouling paint interrupts the life cycle of marine organisms by preventing or eliminating the settlement and growth of fouling organisms. TRUE or FALSE

D. SELECTED REFERENCES:

- 1) Becka A., Castelli V, and Fischer E, “Bibliography on Fouling, Biodeterioration and their Control”, David W. Taylor Naval Ship Research & Development Center Report DTNSRDC/SME-81/43, June 1981
- 2) Birnbaum LS, “The Technology of Antifouling Coatings, Journal of Protective Coatings and Linings, April 1987, pp 39-46
- 3) CFR, Title 40, Subchapter E, Section 162.3
- 4) Fischer EC, et al, “Technology for Control of Marine Biofouling – A Review”, Marine Biodegradation – An Interdisciplinary Study, ed. JD Costlow and RC Tipper, Naval Institute Press, Annapolis, MD, 1981, pp 261-299
- 5) “Marine Fouling and Its Prevention”, Woods Hole Oceanographic Institute, Annapolis, MD, 1952
- 6) Military Specification DOD-P-24647A, “Paint, Antifouling, Ship Hull w/Amdt 2 dated August 1989

F. VISUAL AIDS:

Fouling on ship hull with conventional copper paint after 30 months.

Ship hull with TBT copolymer antifouling paint after 30 days in same service as above.

Fouling organisms (to be obtained).

G. HANDOUT MATERIAL:

Military Specification DOD-P-24647A, Antifouling Paint

## MODULE #7

### **APPLICATION TECHNIQUES**

#### A. LEARNING OBJECTIVES:

After completion of the study of application techniques, the trainee should be able to:

- Understand the different methods of application
- Know how to clean and maintain spray equipment
- Identify the proper personnel protective equipment to wear while applying the antifouling paint
- Know what to do in the event of a paint spill

#### B. DISCUSSION:

Paint is not a finished product until it has been applied to the substrate. Proper application of the paint, therefore, is a critical part of the complete paint system. High performance coating systems are especially sensitive to misapplication and may fail drastically, even more than conventional paint systems, which are less sensitive to application variables.

The application techniques described in this section are primarily intended to minimize the potential hazards associated with the use of TBT antifouling paints. Basically, these procedures are identical to the techniques to be used for other antifoulants and coatings applied in shipyards and drydocks. Wetdocks are not applicable because TBT antifouling paints are not applied to submerged vessels. The primary difference between working with TBT antifouling paints and conventional coatings is that the antifouling paints are restricted use pesticides. Therefore, they are different safety precautions and clean-up procedures required. Knowledge of special application practices and understanding of the effects of improper or unnecessary use of TBT antifouling paints are essential for the protection of the applicators and the environment.

#### Paint Preparation

Organotin antifouling paints are typically proprietary and are to be used only for over the manufacturer's recommended anticorrosion coating system. Proprietary solvents and/or other materials may be recommended or required by the manufacturer. Paint preparation and application must also be in accordance with the manufacturer's specifications.

Mixing is generally required to make the paint homogenous and uniform before use by stirring the vehicle, dispersing the settled supernatant liquid, and removing all skins, lumps and other large particles, if any. The paint, if stored at hot or cold temperatures, should be brought to a moderate temperature for application. Two and three component paints must be carefully mixed just prior to use. Check seals to be sure there is no leakage. Check dated products and replace outdated materials.

## Literature

Prior to each use, before opening cans, pails or drums containing TBT antifouling paints, carefully read the entire label, the product data sheet and material safety data sheet supplied by the manufacturer. Ask your supervisor or contact the supplier of the antifouling paint to clarify any statements that you may not understand.

TBT antifouling paints have been formulated to meet EPA's release rate standard of not more than 4 ug (millionths of a gram) per square centimeter of painted surface per day. Products registered by the EPA leach the lowest level of TBT compounds into the environment while still providing adequate fouling protection. Along with the release rate restriction and classification of TBT antifouling paints as restricted use pesticides, additional labeling and restrictions on the size of the vessels, which may be coated with TBT antifouling paints, provide further protection to the environment. Such additional labeling may refer to compliance with applicable OSHA regulations and with directions for work practices for the application, removal and disposal of TBT paint wastes into the environment.

## Preparation for Application

Surface preparation is the same for TBT antifouling paints and conventional paints. Always follow the directions on the product label. Follow good painting procedures on any policies specific to your location. In addition, these points should be noted:

1. Keep all cans, pails or drums tightly closed when not being used. Place them in an area protected by barriers to prevent damage by vehicles, cranes or other plant movement or place them well away from these activities.
2. The content of leaking cans, pails or drums shall immediately be transferred to suitable containers and the spillage absorbed with sand or sawdust. If pesticides are transferred to new containers, those containers must be relabeled with the original label or a facsimile.
3. Place warning signs or placards in and around the area where the TBT antifouling paint is going to be used to inform the other workers of the nature of the hazard and whether personal protective equipment is needed.
4. Use protective coverings, such as plastic, canvas, etc. in the immediate work areas where TBT antifouling paints are going to be used. TBT paint spills can be further contained by covering the entire spill area with absorbent materials such as sand, kitty litter or pads. Every effort should be made to ensure that there is adequate containment in the event of spills.

In the case of a spill, apply absorbent material to the spill area, collect, identify and dispose of contaminated absorbent material in accordance with local, state and federal requirements. Contain the spilled material in as small area as possible. Do everything possible to keep it from spreading or getting worse. Use a hand tool such as a shovel or rake to construct a dam or soil or sod.

5. Only protected personnel shall remain in the exposure zone of the 'TBT' antifouling application. The exposure zone is the area in which the Permissible Exposure Limit may be surpassed.
6. Remove all unnecessary equipment from the immediate work area to a place where it cannot be contaminated by overspray. Cover all exposed equipment with material that does not allow the liquid paint to pass through and contaminate the equipment. Such material includes rubber, canvas or plastic coverings.
7. Use screens and canopies to prevent overspray from reaching areas that are not to be painted. This method of containment is standard practice for applying paint in a shipyard.
8. Install emergency eyewashes and showers in drydock at 'TBT' antifouling paint work and mixing areas.
9. Contain the spraying area so that the wind will not cause the overspray to drift into dockside areas and adjacent waters.

#### Protective Equipment

1. Use disposable coveralls, disposable shoe covers, and plastic or rubber gloves. Full coverage supplied air hoods shall be worn by all personnel working within a 25-foot radius of spray painting. Tape the protective clothing at the wrists, ankles and zippers. All discarded disposable items should be accumulated in a closed container and disposed of in a sanitary landfill or by other approved State or local procedures after use.
2. Disposable coveralls, disposable shoe covers and hoods shall be worn by all persons working within a 10-foot radius of paint mixing, handling and cleanup. Tape the protective clothing at the wrists, ankles and zippers. The paint mixing area shall not be located downwind of the spraying area. For non-disposable clothing, the following rules apply:
  - Wear clean clothing every day. If clothing gets wet, change clothes immediately.
  - Do not store or wash contaminated clothing with other laundry.
  - Wash gloves daily, inside and out, and hang them to dry.
  - Test gloves for leaks by filling them with water and gently squeezing. Discard damaged gloves.
  - Wash goggles or face shields daily.
3. Personnel who must enter the dry-dock during applications but who are beyond the work area distances specified in the above paragraphs, shall wear protective eyewear

and respirators as specified on posted signs or as specified by an Industrial Hygienist or Safety Engineer.

4. Spray painters, mixing personnel, open bucket handling personnel, cleaners, and brush or roller painters inside the TBT antifouling paint work area exposure zone shall wear approved supplied air hoods. Only NIOSH/MSHA-approved respirators shall be used. Painter's respirator air lines shall be covered with disposable sleeves.

Application:

1. When practicable, apply TBT antifouling paints by airless (pressurized) spray to minimize overspray. Localized touch-up may be done with brush or roller. See pictures of application equipment at the end of this chapter.
2. Do not perform work of any kind that produces flames or sparks within a minimum of 35 feet of the work area during application.
3. Carefully follow the application instructions mentioned on the label, the product data sheets and the material safety data sheets of the manufacturer. In particular use the specified amount and type of thinner during mixing and follow the spray equipment guidelines for type of pump, type and length of hoses, pressure, tip size and fan width.
4. Choose the distance between spray tip and surface to be painted in such a way that a full wet layer of paint is obtained with no overspray or dry spray. To do the job correctly is necessary to apply each coating at the wet film thickness recommended by the paint manufacturer. Measure the film thickness as the job progresses using a wet film thickness gauge as illustrated at the end of this chapter.
5. During spraying, keep the gun perpendicular to the surface and make passes parallel to the surface. Avoid any spraying under angles greater than 45 degrees with the horizontal plane and vertical plane to avoid overspray and spray mist.
6. Release the trigger in time to end the pass before overspray occurs. Do not open the nozzle starting a new pass before the correct angle is reached. The maximum allowable angle will differ with the wind conditions in the drydock.
7. Clean tip, gun, hoses and pump with the specified cleaning thinner. During the cleaning of equipment, the same protective equipment must be used as for spraying. Used cleaning thinner has to be treated as TBT containing waste and disposed of properly.
8. After the application is completed move all contaminated equipment, tools, tarpaulins, coverings, etc. to the designated area for further treatment (i.e., for disposal in a sanitary landfill). Spray equipment should be flushed with solvent, which is then treated in accordance with procedures under RCRA.



9. Do not flush out the dock to remove spillages since these may cause adverse effects to the environment (either land, water, or non-target organisms).
10. For small spillages during TBT antifouling paint application, immediately apply absorbent material to the spill area. For large spills, (more than one gallon of paint) stop spillage and contain spilled material if this can be done without risk of injury. Keep others out of the spill area. As a protection measure, place a disposable drop cloth or plastic sheeting that is impermeable to the liquid paint under each location where an open container of paint is present. Contaminated rugs from clean-up operations must be collected, identified and disposed of in a manner specified in the Disposal chapter of this document.

### C. STUDY QUESTIONS

1. TBT antifouling paints develop high performance coatings; therefore they will not be affected by mis-applications. TRUE or FALSE
2. A primary difference between TBT paints and conventional coatings is that the TBT paints are restricted use pesticides. TRUE or FALSE
3. Warning signs should be posted where TBT paint will be used to inform other workers of possible hazards and the need for special protective equipment. TRUE or FALSE
4. Only “\_\_\_\_\_” people shall remain in the exposure zone of a TBT paint application.
5. A TBT paint spill in the work area should be covered with “\_\_\_\_\_” to prevent spreading.
6. All contaminated material collected from a TBT paint spill should be disposed in accordance with state, local and federal requirements. TRUE or FALSE
7. Where practicable, apply TBT paints by “\_\_\_\_\_” (pressurized) spray.
8. The application of TBT paint should not be made within “\_\_\_\_\_” feet of any type of work that may produce flames or sparks.
9. It is not necessary to wear protective equipment when cleaning spray equipment. TRUE or FALSE
10. Used cleaning solvent must be treated as a “\_\_\_\_\_” waste and disposed of in accordance with the “\_\_\_\_\_” Act.

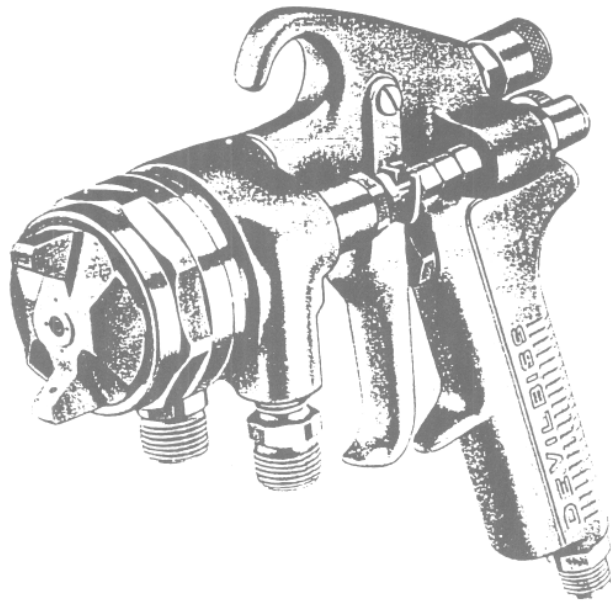
### D. REFERENCES:

1. Uniform Industrial Process Instruction, Naval Sea Systems Command, Department of the Navy.

2. Good Painting Practices, Volume 1, Second Edition, Steel Structures Painting Council, Pittsburgh, PA.

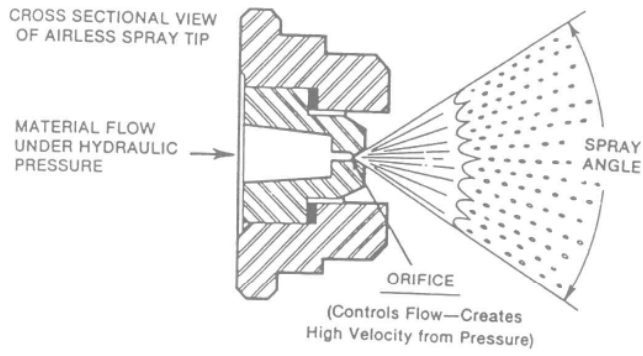
E. VISUAL AIDS: NONE

F. HANDOUTS: Binks, DeVilbiss, Graco application handout material.



Two – Component Spray Gun Internal Mix

Courtesy of DeVilbiss Company



Airless Spray Action

Courtesy of the Aro Corporation



Wet Film Thickness Gage  
Courtesy of Gardner Laboratory, Inc.