

**EPA Pollution Prevention Grant Program  
“Safer Alternatives to Copper Antifouling Paints  
for Marine Vessels”  
Annotated Outline  
July 20, 2010**

## **1 Introduction**

This section provides an overview of the project and its goals and objectives, how the project will build on previous research by investigating, testing, and providing information on newly emerging, and recently developed non-copper hull coatings, and the partnership between the Port of San Diego and the Institute for Research and Technical Assistance (IRTA).

### **1.1 Background**

This subsection summarizes the historical and current issues with fouling and antifouling coatings, water quality issues resulting from copper loading by copper-based antifouling coatings locally and globally, and regulations to reduce copper loading in SIYB (TMDL) and other San Diego Bay marinas (303(d) listed). This section will also provide a synopsis of previous research on alternative coatings from which this project builds from.

### **1.2 Study Participants**

This sub-section provides background information on the Port of San Diego and IRTA. This sub-section will also describe the process by which stakeholder workgroup involvement was utilized throughout the project term and will list the different stakeholders that participated in the project.

### **1.3 Study Overview/Goals**

This sub-section will discuss the goal of the grant, to identify and promote the use of effective non-copper antifouling coatings, and the objectives established to do so. This sub-section will discuss how this comprehensive report will provide the results of this technical demonstration of the various types of alternative antifouling coatings that are, or may become available to the boating community, and a comparative evaluation on their effectiveness in terms of cost, application efficiency, maintenance, and antifouling properties. This sub-section will also describe how these findings will be distributed (i.e., via EPA and pollution prevention websites) and how the findings of this project will have potential implications for other marinas in California and throughout the U.S.

## **2 General Methodology**

This section will provide information on: 1) the study design and the rationale for selecting the design (i.e., to identify those coatings that are viable for practical

field use); and 2) the general methodology used to evaluate the alternative coatings.

### **2.1 Key Issues to Address**

This sub-section will describe common key issues to be addressed in the report relating to the viability of the alternative coatings, such as performance, cost, and longevity. This sub-section will also provide information on how the coatings were divided into categories according to presence or absence of active ingredients (i.e., zinc containing, non-zinc organic biocide, and non-biocide).

### **2.2 Current Coating Practices**

This sub-section will describe efforts to investigate and analyze current coating practices (including stripping, application methods and maintenance strategies) and efforts to investigate alternative non-copper coatings including the optimal stripping, application, and cleaning methods for each.

## **3 Project Phase One: Panel Testing**

This section will describe the approach taken to evaluate alternative coatings in a static immersion testing process.

### **3.1 Procedural Issues**

This sub-section will discuss the efforts taken to identify alternative coatings. It will also discuss the collaboration between the Project Team, coating manufacturers, boatyards, and yacht clubs to apply the alternative coatings and place them in the water. The design and construction of fiberglass panels and PVC frames will also be presented here.

### **3.2 Protocol Development and Implementation**

This sub-section will describe the process that was used to develop the panel testing protocol, and discuss the objective of the panel testing, to provide a routine panel inspection process. The protocol was developed with input from experts in the field of biofouling and antifouling technology and stakeholder workgroup members. This sub-section will discuss how industry standard ASTM methodologies and techniques used in previous efforts were integrated into the panel testing phase protocol. Information will also be provided on mechanisms that were employed to account for environmental variability. QA/QC mechanisms to provide quantitative measures of test conditions and ensure accuracy and precision throughout the panel test phase will also be described.

### **3.3 List of Alternative Coatings**

This sub-section will provide information on the alternative coatings that were included in the study. A list of coatings will be provided in tabular format, with additional information identifying the coating suppliers and coating type categories (as described in section 2.1) for each coating.

### ***3.4 Panel Testing Phase Coating Assessment***

This sub-section will provide information on how the data was analyzed in order to assess the overall performance of each coating during the panel testing phase. The information will describe the assessment used for evaluating: 1) fouling, 2) the level of effort required to clean, and 3) the coating condition. This sub-section will describe the tiered approach used to determine which of the top performing alternative coatings will be applied to boat hulls in the second phase of the study.

## **4 Phase Two: Boat Hull Testing**

This section will describe the field testing approach used to objectively evaluate alternative coatings on boat hulls in a real world, dynamic testing situation.

### ***4.1 Procedural Issues***

This sub-section summarizes efforts to identify key parties to participate in the boat hull testing phase. It will discuss coordinating the coating application (e.g. boat owner, boat yard, and coating manufacturer), inspections and boater use schedules and identifying the different participants involved. General information on agreements between the Port and the other parties involved (Boaters, boat yards, and hull cleaner) will also be provided.

### ***4.2 Protocol Development and Implementation***

This sub-section discusses the Standard Operating Procedures (SOP) developed for the field assessment of coatings on boat hulls. The development of a field testing SOP was necessary to document the project's procedures and ensure consistency throughout the timeframe of the boat hull testing phase, which will ensure that the end results can be reproduced. This sub-section will discuss how the stakeholder workgroup participated in the development of the boat hull testing protocol. Information will also be provided on mechanisms employed to account for environmental variability, as well as QA/QC mechanisms to ensure accuracy and precision throughout the boat hull testing phase.

### ***4.3 Boat Hull Testing Coating Assessment***

This sub-section will present the data gathered during the boat hull testing phase and describe how the data was analyzed to evaluate the overall performance and maintenance strategy of 1) each coating, and 2) for overall coating categories. This sub-section will describe the process to determine whether the coatings and cleaning procedures were effective in repelling fouling or preventing fouling attachment. Maintenance requirements to be described include: inspection schedule, cleaning tools used, cleaning frequency and the level of effort required for cleaning, and any physical deterioration of the coatings themselves. Understanding these factors will enable a comparison of the effectiveness of alternative coatings to commonly used copper coatings.

## **5 Cost Assessment**

This section will present information on the cost of painting and maintaining boats with copper and non-copper hull coatings. It will describe the current practices of painting and maintaining boats with copper antifouling coatings. It will also describe the requirements for painting and maintaining boats with non-copper antifouling coatings and non-biocide coatings. The section will provide estimates of the costs of painting and maintaining typical 30 foot and 40 foot power and sail boats with copper and non-copper hull coatings. The cost data will be developed from discussions with boatyards, divers and suppliers and they will be presented in ranges. The section will include a table of the cost comparisons for easy reference by the reader.

### **5.1. Current and New Practices**

This sub-section will discuss the current paint application and maintenance practices for copper coatings. It will also discuss the alternative application and maintenance practices that are necessary for the non-copper alternative coatings. Two categories of alternatives, non-copper biocide and non-biocide coatings, will be presented separately to account for their different requirements for application and maintenance.

### **5.2. Approach to Cost Analysis and Comparison**

This sub-section will describe the factors that will be considered in the cost analysis for the copper and non-copper coatings and the cost comparison for the types of coatings. Cost ranges will be developed for each of the factors. The ranges are meant to capture differences in the cost of a haul out by boatyards, the prices charged by divers and the costs and types of alternative coatings. The factors that will be described include haul out procedures like surface preparation and application methods, maintenance of the coatings by divers and estimates of the life of the copper and alternative coatings and estimates of the useful life of a boat or a specific timeframe. It is important to consider the life of the boat or a timeframe longer than the life of the paint because many of the alternative biocide coatings may have a shorter life than copper coatings and some of the alternative non-biocide coatings may have a longer life than copper coatings.

### **5.3. Cost Analysis and Comparison**

This sub-section will present and discuss the costs of painting and maintaining a 30 foot and a 40 foot boat with a copper coating over the life of the coating and over the life of the boat or a specific timeframe. It will also present and discuss the costs of painting and maintaining a 30 foot and a 40 foot boat with a non-copper biocide coating and a non-biocide coating. A distinction will be made for power and sail boats if it is warranted once the cost information is developed.

The sub-section will provide a comparison of the costs and will discuss the results of the analysis and comparison. Finally, the sub-section will present a table summarizing the cost comparison for the different coating types for easy reference.

## **6 Results and Findings**

This section will present results for individual alternative coatings and for overall coating categories, discuss appropriate maintenance strategies for overall coating categories and individual coatings, describe costs and key issues which create barriers to transition, and will discuss the results of outreach efforts during the grant term. This section may also discuss if any worker exposure or cross media issues were identified during coating application and/or routine cleaning operations.

### **6.1 Overall Coating Category Results**

This subsection will summarize the results for overall coating categories. As with Section 6.1, detailed results will be provided in an appendix in the final report. Information to be provided will include the general maintenance strategies identified for the coating categories through the evaluation process and any key observations.

### **6.2 Individual Coating Results**

This subsection will summarize the results for each of the alternative coatings evaluated in the project. More detailed results will be provided in an appendix in the final report. Information to be provided will include the appropriate maintenance strategies identified through the evaluation process and any key observations.

### **6.3 Barriers to Transition**

This subsection will discuss key issues which create barriers that may prohibit boat owners from transitioning from copper coatings to non-copper alternative coatings. Factors to be discussed include: Costs, appropriateness of coatings for particular boat uses; VOC; and, EPA and DPR registration requirements for biocide containing coatings.

### **6.4 Outreach Efforts**

This subsection will describe literature developed and the outreach efforts undertaken during the course of the project and the materials developed for boaters, marinas, and boatyards. The sub-section will also discuss how the outreach material will be distributed to local boaters and boatyards, as well as nation-wide via websites (i.e., Port of San Diego, IRTA, and EPA websites).

## **7 Conclusions and Recommendations**

This section will present the list of preferred alternative coatings. In addition, a matrix will be presented that relates how coating performance is dependent on various factors (i.e., type/frequency of boat use, boat type or environmental conditions such as water temperatures, species of fouling growth, tidal flushing in the marina, and other condition). The goal of the matrix is to aid boaters in the selection of a suitable alternative coating for their boats.

DRAFT