Safer Alternatives To Copper Antifouling Paint Project
Stakeholder Work Group Meeting Summary
12/10/08

I. Introduction & General Information

There were 35 participants in attendance and 9 participants contributing via conference call.

II. Overview of Panel Testing Phase

The panel phase occurred over a four month period from June through October of 2008. The panels were placed on south facing docks at the San Diego Yacht Club and the Southwestern Yacht Club. Placement occurred at a constant depth of one foot below the surface of the water. This follows the industry standard protocol for panel testing.

The Project Team evaluated the coating performance by assessing: 1) fouling growth, 2) the level of effort required to clean, and 3) the coating condition. By evaluating these three criteria, the Project Team was able to identify coatings that are effective in repelling or preventing growth and are relatively easy to clean. The primary discussion points are identified below.

Test Coating Categories

46 Alternative Coatings

- 18 Zinc coatings
- 4 Non-Zinc Organic Biocide
- 24 Non-biocide

QA/QC Controls

Copper Reference Coatings

- AF-33
- Super KL

Negative Controls

- 4 PVC frames with blank fiberglass panels with no gel or test coating
- 3 PVC frames of blank fiberglass panels with gel coat only

Cleaning Controls

- 1 no clean panel for each test coating

Application of Paints

- Paints were applied to both sides of panels at one of the participating boatyards (Nielsen Beaumont, Koehler Kraft, Knight and Carver, or Marine Group) per manufacturer's instructions during the last two weeks of May, 2008 Suppliers were encouraged to be present.

Fouling Assessment

- ASTM D3623-78a standard method for static immersion panel testing
- Evaluated percent cover of categories of fouling (pre-clean and post-clean)
- Assessed percent cover of fouling growth using a scale from 1-5 (no fouling to heavy fouling)

Cleaning Assessment

- Panel A = No Clean
- Panel B = 3 week cleaning with carpet
- Panel C = supplier recommended cleaning method and frequency
- Cleaned panel while rinsing with bay water using a peristaltic pump
- Used a rating scale from 1-5 (light to hard effort)

Coating Condition Assessment

- Evaluated if the paint was removed from panel (physical failure)
- Used a rating scale from 1-5

Comments/Concerns

Clarification was requested on the types of rating scales that were used during the panel testing. The Project Team followed the fouling rating scale provided by the ASTM 3623-78a method. The Project Team developed the cleaning and coating condition rating scales but utilized information from the scales developed through the UC SeaGrant studies.

Clarification was also provided regarding the cleaning tool that was used for the standard cleaning panel. Discussions at previous stakeholder workgroup meetings concluded that the Project Team should use a soft carpet instead of the originally proposed green pad.

III. Results of Panel Testing Phase

Using the panel testing protocol, the Project Team evaluated the fouling, cleaning, and coating condition ratings for each panel. Those that met the criteria (indicated by low ratings numbers) were assigned a "plus" for the respective category. Those that did not meet the criteria (high ratings numbers) were assigned a "minus". The Project Team then evaluated the entire panel series to determine those coatings that would be passed on to the hull testing phase. The following are general findings relating to each assessment:

Fouling Results

- Copper baseline, zinc biocide, and organic biocides paint = low fouling
- Zinc Oxide = low fouling
- Some non-biocide = substantial hard fouling

Cleaning Results

- Zinc biocide, organic biocide, and zinc oxide = easy to clean on standard and supplier schedules
- Zinc metal paints = hard to clean

- Zinc oxide = behaved like biocide paints
- Non-biocide = some hard to clean (ceramic, epoxy)
- Non-biocide = some easy to clean (silicon compounds)

It was noted that a few zinc oxide coatings were initially categorized as non-biocide but were re-categorized to the zinc category because they contain a zinc compound. Additionally, some coatings had a combination of active ingredients (see *"Paint Results Tables"*). In most cases, these active combinations contained some zinc-based compound. As such any coating containing a zinc compound was categorized into the zinc paint category.

There was a wide range of growth patterns during the study time period. The Project Team noticed significantly more fouling on back of panel (shading effect). They also observed more algae (green, brown, or red) on the front (sun facing) rather than on the back (shaded). The reference copper coatings also had growth on the front and back but the growth was limited to algae/slime. The organic biocide and zinc oxide paints performed similar to copper as they were easy to clean and typically had only algae slime growth.

Overall, five non-biocide coatings, 14 zinc-based coatings and two organic biocide coatings were identified as meeting criteria and able to move through to the hull testing phase. Tables containing the results for each coating (identified by number only) were handed out at the meeting. They are also posted on the website, *"Paint Results Tables"* and are located under the Alternative Hull Paints downloads.

Questions/Comments/Concerns

The Project Team was asked if they observed any variation in the fouling species between yacht club locations. While overall, the fouling species were similar, there was some degree of variation observed between the two yacht club locations, such as the amount and type of bryozoans and tunicates. There was also some variation observed as the summer months progressed.

An audience member asked the Project Team what they knew about the behavior of the organic biocides. The Project Team noted the organic biocides tended to be ablative and display bubble characteristics.

Clarification was provided regarding the Project Team's observations that hard growth had grown in the paint matrix. A coating manufacturer described the difference between a marine growth foot print and etching. The difference was that hard marine growth footprint may not necessarily be embedded into the paint, as with etching, but just be on top of it.

Clarification was requested on the rating system used for passing coatings through to the next phase. It was stated that the "no clean" panel assessment was based on the fouling rating. The standard and manufacturer's recommended panels were based primarily on the cleaning criteria.

A stakeholder inquired if the data analysis considered performance variations throughout the summer. This had not been done as of the meeting. It was suggested to analyze how the paints were performing at various stages and identify when a particular paint began to fail. The Project Team may be able to work with the individual suppliers to assess their coating's performance.

IV. Hull Testing

The Project Team presented a draft approach for the hull testing phase of the project. This included identifying the hull testing objectives, presenting a draft study design, and discussing an approach to ensure there were adequate boater volunteers to meet the study needs. The Project Team identified the following objectives for the hull testing phase:

1) Evaluate different coating application methods
2) Evaluate performance in terms of maintenance and longevity
3) Consider environmental impacts
4) Evaluate costs of alternative coatings

The Project Team further suggested including coatings in the hull testing using a tiered approach, as follows:

Tier 1 = Non-biocides (5)
Tier 2 = ZnO only or Organic only (4)
Tier 3 = Remaining active ingredient combinations (10)

This tiered approach would place more weight on the non-biocides, thereby providing an inherent safety margin for environmental impacts. The Project Team also recognized that there may be different questions necessary to evaluate environmental impacts and, as such, they may require a different study design. Additionally, the Project Team acknowledged that all coatings need to meet the APCD VOC limit

Draft Conceptual Approach

The Project Team presented the following conceptual approach to meet the objectives and answer the following study related questions for each tier.

1) Coating Application (Tier 1 only)

-How can costs be controlled when applying non-biocide paints?
-Do different application methods impact non-biocide coating performance?

The application of coatings can be evaluated by considering different methods to apply the coatings. Coatings could be sprayed, rolled, or applied over copper to see if there are reductions in cost and to evaluate whether the performance is impacted by the application method.

2) Coating Performance (Tier 1, 2, & 3)
-How frequently do coatings need to be cleaned to remain effective?
-What is the longevity of the test coatings?

Coating performance can be evaluated by assessing all boats at the same frequency and identifying the number of times cleaning is required and the efforts needed to clean the hull. Additionally, the performance evaluation will also identify whether any physical failures occur in the coating.

3) Environmental Considerations (Tier 2 & 3)
What are the environmental impacts from Zn products or Organic biocides?

Environmental impacts may be assessed by evaluating leach rates of zinc and organic biocide products and/or evaluating their toxicity. Most likely this could occur as a panel test study as it is not necessary to conduct these evaluations on boat hulls. Using panels would reduce project costs significantly. Further research is needed to determine the final study design and proper analytical efforts necessary to answer the environmental impact question.

The Project Team asked for input from the stakeholders on the draft conceptual approach, how to keep the number of boats to a reasonable number, and how to leverage existing resources (data/boats) for portions of the study.

Questions/Comments/Concerns

Overall, stakeholders indicated that the tiered approach was a good direction to take. The workgroup further agreed that the focus should remain on bringing out the best non biocide paints for the consumer. The general consensus was to move forward with the Tier 1 study design and focus the hull testing on the five non-biocide paints.

There were several general statements regarding the proposed hull testing approach. The use of controls such as a copper paint standard (AF-33 or Super KL) should be considered. Additionally, there was concern that applying only one paint to each boat could result in lost information if the boat owner opted out of the study. Therefore, it was recommended that several paints be applied to each boat as a preventative measure. Another concern was that the Project Team should consider shading effects during hull testing as there was a shading effect noted during the panel phase.

Many agreed that evaluating leach rates and toxicity for the biocide paints strays from the purpose of the project and is not the best use of resources. It was also suggested that the organic biocides be excluded due to the lack of information on their environmental impact. There was agreement that repeating leaching/loading and toxicity testing that may have already been done on the zinc coatings would not be the best use of resources. Many coating manufacturers with biocide paints may have already tested the paints for registration purposes. The Project Team could use this data to evaluate those coatings. It was also suggested to use a hydrodynamic model to obtain more information on the fate and transport of zinc. The Project Team will take these suggestions into consideration when determining the environmental impact design approach.

The workgroup discussed several options to control costs of the hull testing. A workgroup member suggested using only the manufacturer's top paint in cases where a coating manufacturer has several coatings still in the study. Others felt that the project should focus on those coatings that offer the safest and most effective options. Overall, there was agreement that the hull testing should focus on the alternatives not currently being applied on boat hulls. It was stated that many zinc based paints and some non-biocides are already being used on boats. As such, the Project Team should consider ways to work with boat owners and incorporate data from these boats. One suggestion was to contact UC SeaGrant and gather information about the boats they have been observing in their studies. Another suggestion was to contact boatyards to see if any boats are already scheduled be repainted with an alternative product. The Project Team will take all of these suggestions into consideration.

Currently all of the top performing non-biocides are silicone based to varying degrees. Stakeholders raised concern about the lack of a hard non-biocide coating making it into the hull testing phase. Part of the concern was that silicone coatings may not be durable enough to withstand boat use. Furthermore, to fully evaluate non-biocide products, both types of coatings (hard and soft) should be included. There was a suggestion and general agreement by the stakeholders to incorporate at least one hard, epoxy coating to round out the testing. The Project Team will take this into consideration.

An audience member noted that the color of the coating may influence its performance. Black coatings may attract more heat and more growth than lighter colored coatings. Some suggestions were to consider reanalyzing coating performance based on color, or conduct further studies using multiple colors of a particular coating to assess color related performance differences. The issue of coating color will be considered for the hull testing to the degree possible.

Cost is one of the primary concerns of using the non-biocide paints. The application of non-biocides generally entails more hull preparation than the

standard copper coatings, and different application methods vary in cost. One suggestion was to apply non-biocide coatings over copper, thereby eliminating the stripping costs. Several were concerned that delaminating will likely occur as a result. The Project Team will contact the coating suppliers to better understand which non-biocide coatings may be able to be applied over copper, if any. During the hull testing, the Project Team will work with the coating suppliers and the boatyards to identify potential ways to lower the cost of applying non-biocides.

There was general agreement that the activity of boats should be documented to account for the variability in paint performance due to differences in speed and amount of use. The Project Team presented the idea of requiring a boat log so that each boater would record their boat use. This will assist in normalizing the data when comparing results.

There was general consensus that the study should keep the average boater in mind when evaluating the cost of the coatings and transitioning to non-copper paints. Increases in cost make it more difficult for the average boater to make the transition. However, there were some in the audience that pointed out that boaters are willing to pay more for environmentally friendly options, as long as the increase is not too considerable. Furthermore, there were recommendations to ensure that the test coatings moving forward be commercially available or at least in the process of being registered. This would ensure that the coatings are available to the consumer and that a transition to alternative paints could occur in the near future.

Next Steps:
The Project Team will continue to refine the study design, identify hull testing costs and discuss cost options with all parties involved, and continue efforts to find volunteer boaters.

V. Other Items (Meetings/Deadlines):

January 21, 2009: Stakeholder work group meeting (discuss study design, cost options)

February – March, 2009: Apply coatings to boat hulls

March 11, 2009: Stakeholder work group meeting (finalize hull testing protocol)

April, 2009: Begin testing phase