Institute for Research and Technical Assistance

The Alternative

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IRTA Completes EPA Project With Port of San Diego

For the last three years, IRTA partnered on an EPA sponsored project with the Port of San Diego. The purpose of the project was to investigate safer alternatives to copper antifouling paints. Copper paints have been used on boat hulls for many years since the international community phased out tributyl tin (TBT). TBT, the commonly used biocide in hull paints, was found to have devastating effects on marine life.

Copper, like TBT, is a biocide. The hull coatings are designed to leach copper gradually over time keeping the boat hull free of fouling which can damage the hull and add weight to the boat. In southern California, it is customary for divers to clean the boat hulls every four weeks in the winter and every three weeks in the summer. Because of the passive copper leaching and the in-water hull cleaning, the copper from the paints has built up to high levels in many of the marinas and basins in California. Copper is considered a toxic pollutant and the copper levels exceed the water quality standard in many locations. The Shelter Island Yacht Basin, in particular, has been found to have high copper concentrations and water quality regulations require a 76 percent reduction in copper loading over 17 years to restore the condition of the Basin.

Over the last several years, a range of different alternatives have been and are being developed by suppliers because of the problems with copper paints. The EPA project involved conducting panel testing and boat testing of alternative paints and evaluating their performance and cost.

Several different types of alternative paints were investigated in the testing. These include:

- Zinc Biocide Paints
- Organic Biocide Paints
- Combination Zinc and Organic Biocide Paints
- Zinc Oxide Only Paints
- Nonbiocide Paints

Zinc biocide paints generally contain zinc pyrithione, a biocide. Although the concentration of the zinc pyrithione is generally lower than the concentration of the copper biocides in copper paints, the alternatives nearly always also contain high concentrations of zinc oxide. Although zinc oxide does not function as a biocide, it does add to the possible zinc loading from passive leaching and in-water hull cleaning of the paint.

A new organic biocide called Econea has recently been developed for use in boat hull coatings. This chemical contains halogens like fluorine, chlorine and bromine. Virtually all organic materials containing halogens pose health and/or environmental problems. Examples include ozone depleting substances, global warming substances, PCBs, dioxin, chlorinated solvents, n-propyl bromide and brominated fire retardants.

The zinc oxide only paints tested in the project are photoactive paints. Zinc oxide does not act as a biocide; it is present to catalyze the photoactive process. Use of these paints, however, could lead to a buildup of zinc.

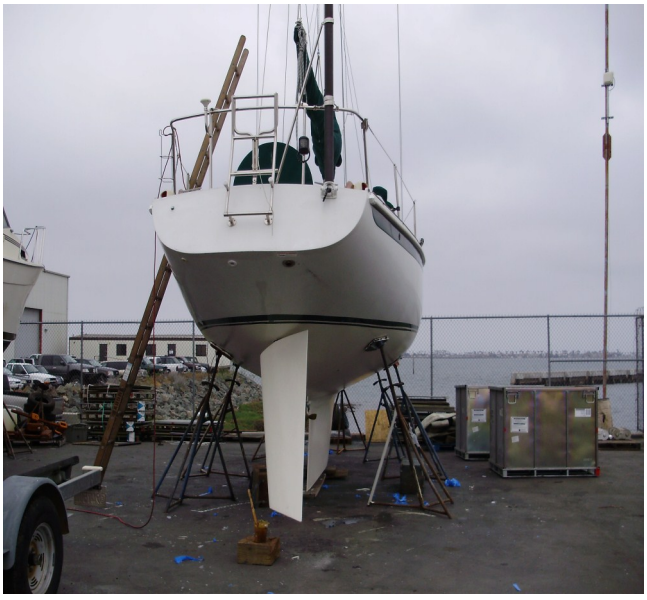
The alternative nonbiocide paints that were tested were of two types. The first type, called soft nonbiocide paints, generally contain silicon compounds and fluoropolymers. The second type, called hard nonbiocide paints, most often contain epoxy and/or ceramic.

(Continued from page 1)

The panel testing was conducted for four months during the high fouling period. Forty-six alternative paints were tested and 24 were nonbiocide paints. The results identified 21 coatings that performed well and five of them were nonbiocide paints. Eleven of the paints were tested on boats. Six were nonbiocide paints, two were zinc oxide only organic biocide paint. Two of the nonbiocide paints were the top performers in the boat testing. These were Intersleek 900 and Hempasil X3.

IRTA performed cost analysis for the coatings that were applied to the boats and for a copper baseline paint. Two elements of the cost were considered. First, the cost of the paint job, a one-time cost over the life of the paint. Second, the on-going maintenance cost where divers regularly clean the hull. The costs were analyzed over the life of the paint which varied, depending on the paint. Copper paints generally last two years. The project findings indicated that the alternative biocide paints would have shorter lives than the copper paints. The nonbiocide paints, some of which have been on boats for many years, would have much longer lives, in some cases 10 years.

The paint job cost for the alternative paints is generally higher than the cost of a copper paint job. The paint is more expensive and the nonbiocide paints require the boat hull to be stripped the first time the paint is applied. In many cases, nonbiocide paints also need to be sprayed on whereas copper paints are rolled on. Stripping and spraying are expensive.



The results of the cost analysis indicate that the cost of using the alternative biocide paints is higher than the cost of using a copper paint over the life of the paint. This follows from the fact that the alternative biocide paints have shorter lives than copper paints. The results also indicate that the cost of using a soft nonbiocide paint are comparable to the cost of using a copper paint over the life of the paint. This is because the longer life of the soft nonbiocide paints offsets the higher paint job costs. The cost of using the hard nonbiocide paints is somewhat higher than the cost of using the copper paints because more frequent hull cleaning is required.

The best alternatives, from a health and environmental standpoint are the nonbiocide paints. When TBT paints were used, they caused a problem and they had to be phased out. TBT paints were replaced with copper and now copper is a problem. The alternative biocides are based on zinc and organic biocides that have unknown effects. Using these alternatives will result in an eventual buildup of zinc and other unforeseen consequences. It is simply not good public policy to replace one type of product that causes a problem with another that is likely to cause a problem down the line. The TBT to copper conversion illustrates the issue of a regrettable substitution and it would not be reasonable to repeat it now that the lesson has been learned.

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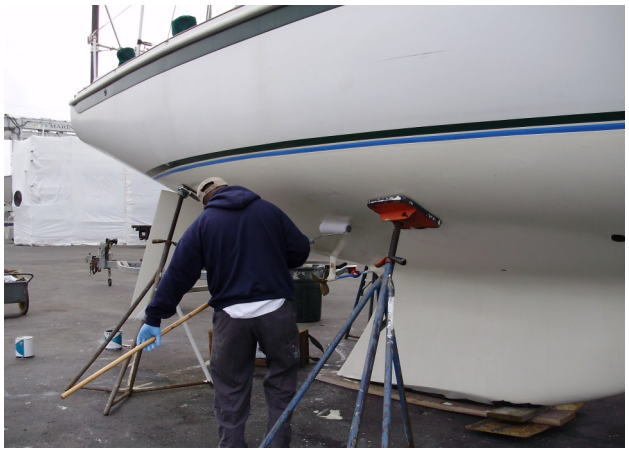
Suppliers of the alternative nonbiocide paints are working on methods of simplifying the application process so it is less costly (see article on IRTA's DTSC project in this issue). More alternative coatings are emerging regularly and these may offer even better properties and costs than those analyzed in the EPA project.

The report summarizing the results of the project is available on IRTA's website at www.irta.us. For more information, call Katy Wolf at IRTA at (323) 656-1121.



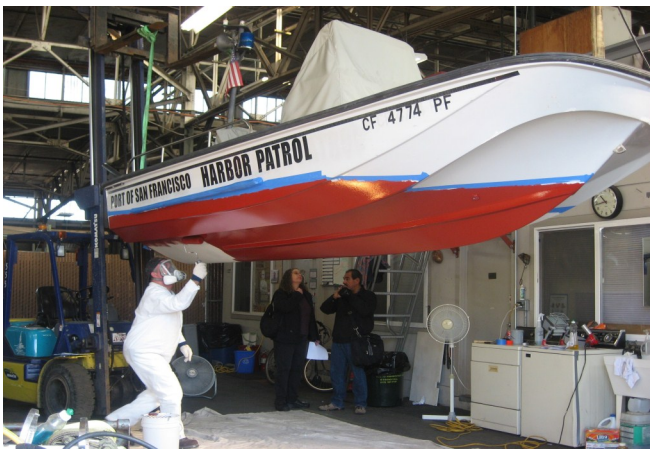
IRTA Paints Two Boats With Nonbiocide Hull Paints

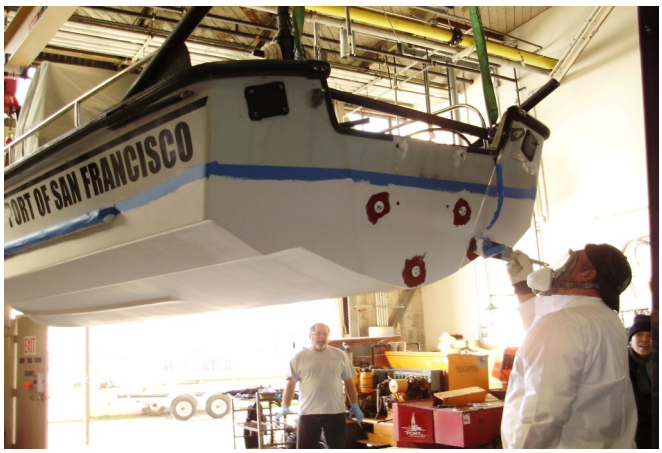
IRTA is conducting a project, sponsored by Cal/EPA's Department of Toxic Substances Control (DTSC) and EPA, that focuses on testing and optimizing the use of nonbiocide boat hull paints. Copper paints have been used for many years for this purpose and there has been a buildup of copper in a number of the basins and marinas in California. In many cases, the copper exceeds the water quality limit.

IRTA recently completed an EPA project with the Port of San Diego to test alternatives to copper antifouling paints (see article in this issue). That project involved investigating both biocide and nonbiocide alternatives. The DTSC project is investigating nonbiocide alternative paints exclusively. One of the aims of the project is to find methods of making it easier and less costly to use the nonbiocide paints.

The DTSC project involves conducting panel testing of emerging paints and IRTA has identified several promising nonbiocide paints from that effort. Over the last few months, IRTA has arranged for two different emerging nonbiocide paints to be applied to boats. Both of these paints are soft nonbiocide paints which are generally based on silicon compounds and fluoropolymers. One of the paints was applied to a boat operated by the Port of San Francisco. The other paint was applied to a diver's work boat in San Diego. Both boats were launched about one month ago.

The Port of San Francisco boat was stripped and a primer and the nonbiocide topcoat were applied by the Port painter. IRTA has conducted panel and boat testing in southern California and is very familiar with the fouling found in the warmer water there. IRTA, the Port and the supplier plan to inspect the Port boat shortly to determine the fouling pattern which should help in deciding on the best methods and frequency of in-water hull cleaning in the colder water in northern California.





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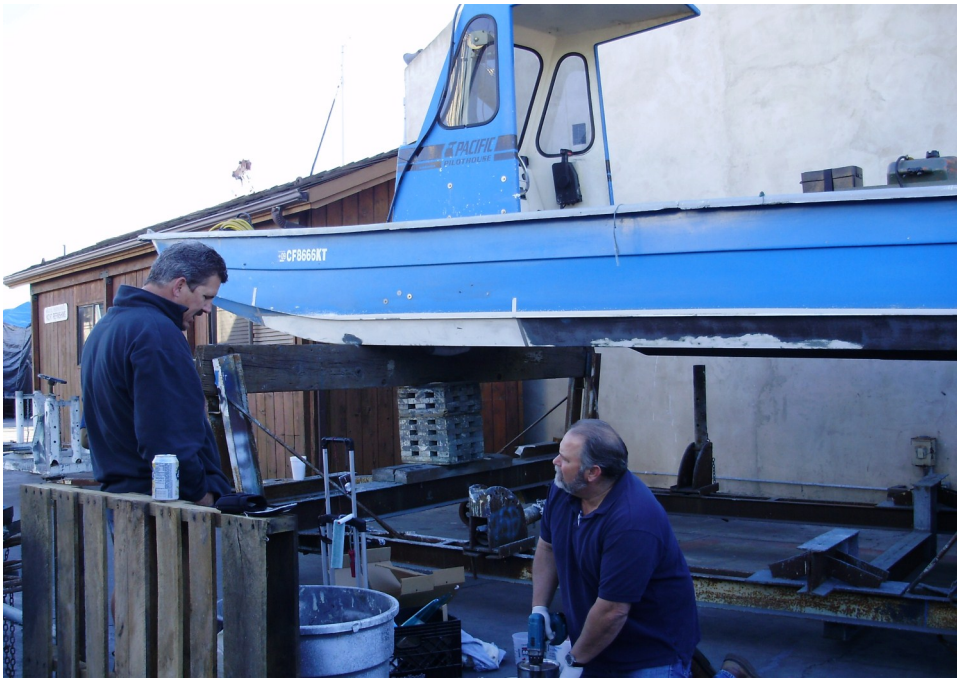
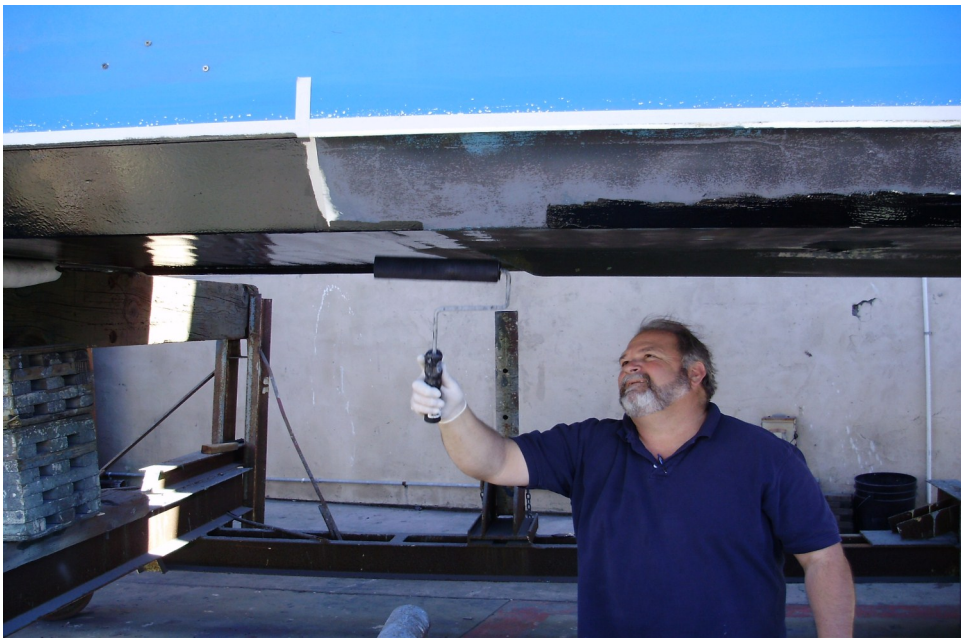
IRTA, the supplier and the diver who owns the boat wanted to experiment with the boat in San Diego. One of the most expensive parts of the application process is stripping the boat hull. Most of the nonbiocide paints require a stripped hull for the first application of the paint. Suppliers are exploring methods of avoiding the stripping process which generally involves using a tie coat or sealer between the old copper paint on the hull and the nonbiocide paint. For this boat, half the boat was stripped and the paint was applied to the stripped hull.

For the other half of the boat, the hull was prepared in the normal way for a copper paint job and a tie coat was used below the nonbiocide topcoat. The diver is monitoring the condition of the coating and is performing regular cleaning.

There are a number of new and emerging soft and hard nonbiocide paints IRTA is interested in testing on boats. IRTA has plans to apply these additional paints to boats over the next three months. If boaters need a paint job and are interested in participating in the project, contact Katy Wolf at IRTA at (323) 656-1121.



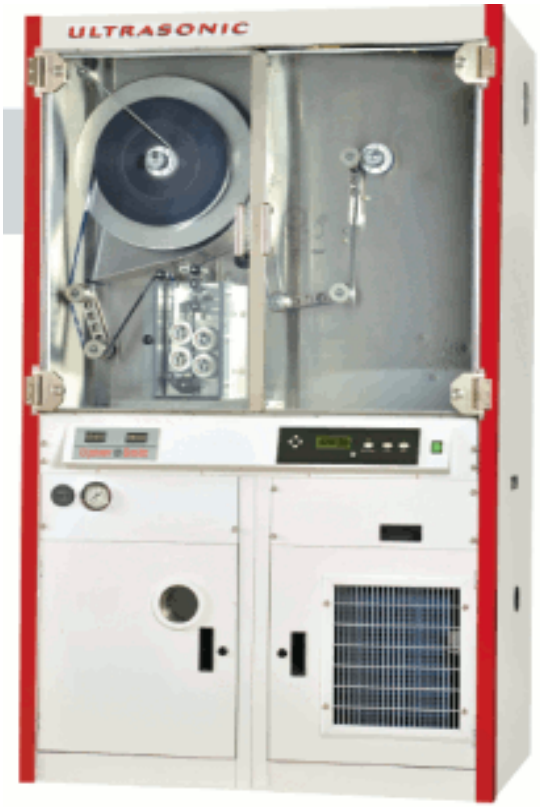


IRTA Submits Draft Report on Greenhouse Gases to CARB

In 2006, the California Legislature passed AB 32, which charges the California Air Resources Board (CARB) with developing and implementing a plan for the state to reduce emissions of greenhouse gases (GHGs) to 1990 levels by 2020. Part of CARB's work in developing the plan involves determining the inventory of many different types of GHGs in California. Over the last few years, IRTA has been conducting research on certain applications of GHGs as part of the CARB effort. IRTA has submitted a draft report to CARB's Research Division and the agency will review the document over the next several months. A final report will be available when the review is complete.

The focus of IRTA's research is two applications where GHGs are used. These include solvents and fire protection agents. The GHGs used in these applications are hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), hydrofluoroethers (HFEs) and various ozone depleting substances like hydrochlorofluorocarbons (HCFCs) and halons. Emissions of these GHGs are much lower than overall carbon dioxide emissions but they are much more portent GHGs on a pound for pound basis than carbon dioxide. For instance, carbon dioxide has a global warming potential (GWP) of 1 and HCFC - 225, which is used in solvent applications, has a GWP of 370. Halon 1301, which is still in many fire protection systems, has a GWP of 6,900. This means that the global warming potential of one pound of HCFC-225 is the same as the global warming potential of 370 pounds of carbon dioxide. The global warming potential of one pound of Halon 1301 is equivalent to the global warming potential of 6,900 pounds of carbon dioxide.

The project involved estimating emissions of GHGs from three solvent applications including film cleaning, vapor degreasing and disk lubing. The movie industry uses various HFEs and HCFC-225 to clean different types of film like original negative and archived film when it is being processed. In vapor degreasing, the solvent is heated to its boiling point and used to remove contaminants from metal, plastic and precision parts during manufacture or assembly; the GHGs used in vapor degreasing are HCFC-225, HFC-4310, various HFEs and blends of these materials with other solvents. In disk lubing, PFCs and HFEs are used as a carrier medium to deposit a lubricant on computer hard disks.



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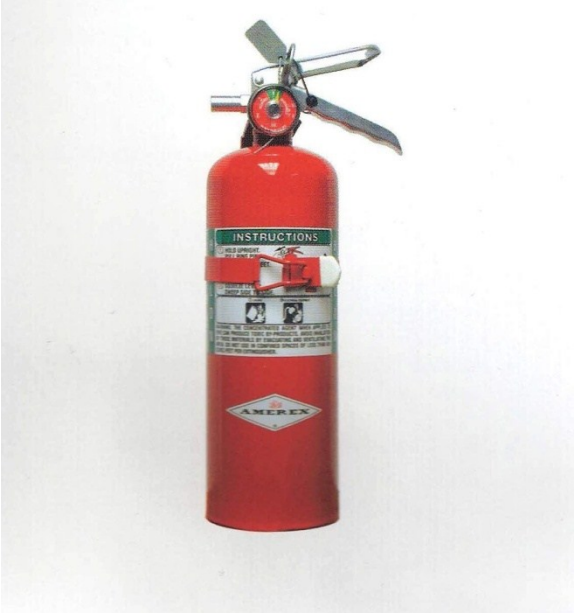
The project also involved estimating emissions of GHGs from two fire protection applications including total flooding systems and portable fire extinguishers. Total flooding systems are used to protect data centers, electronic equipment, telecommunications equipment and medical facilities. In a fire, the extinguishing agent is released and achieves a concentration in the enclosed space that will extinguish the fire. Production of Halon 1301 was banned in 1994 under the Montreal Protocol but there is still a large "bank" of the chemical in many total flooding systems. Other agents in total flooding systems are PFCs, HFCs, inert gases which are not GHGs, and the newest agent, a fluoroketone which has a very low GWP. Portable fire extinguishers are used for local fire protection. GHG agents are used in portable extinguishers at data centers, communication facilities, marine, utility and rail industry facilities. Halon 1211 is still in many portable extinguishers even though its production was banned in 1994. Other agents include one HCFC and an HFC.

Production of the HCFCs used in solvent and portable fire extinguisher applications will be phased out beginning in 2015 because HCFCs contribute to ozone depletion. In both these applications, alternatives will be required. There is research ongoing to find new in-kind materials that have very low GWPs that could be possible replacements.

In vapor degreasing applications, HCFC-225 is used more widely than any other GHG solvent in California. The ban will force users to evaluate other options. Many of the HCFC-225 users can convert to water-based cleaners but they are not convinced such cleaners will work for them. Some users are not even willing to test water-based cleaners though that option is the best from a health and environmental standpoint.



The other GHG solvents that are used today in vapor degreasing are less aggressive than HCFC-225 and they are generally used in blends with 1,2-trans-dichloroethylene (DCE) and/or alcohols to make them clean better. DCE and the alcohols are VOCs and these blends cannot be used in the South Coast Air Quality Management District (SCAQMD) in open top vapor degreasers. SCAQMD Rule 1122 requires solvents used in open top vapor degreasers to have a VOC content of 25 grams per liter or less and the blends generally do not meet this limit. Rule 1122 allows the use the higher VOC content blends in airless/airtight degreasers which have lower emissions than open top degreasers and are very expensive.

The full report, which includes more extensive discussions of the uses and the GHGs, will be on IRTA's website after CARB has completed their review. For more information on solvent or fire protection applications, call Katy Wolf at IRTA at (323) 656-1121.

Visit our website: www.irta.us

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and recently completed reports.

Senate Bill Would Ban Copper in Marine Paints

On February 18, California State Senator Kehoe introduced a bill that would affect copper in marine paint. SB 623 would make it illegal to manufacture, sell or distribute in commerce in California marine antifouling paints that contain copper. The effective date of the ban is January 1, 2015.

Copper antifouling paint has been used to protect boat hulls from fouling for many years (see articles in this issue). Copper is toxic to many aquatic organisms and plants and there has been a buildup of the metal in numerous California basins and marinas over the last several years. In many cases, the copper levels exceed allowed water quality standards.

The state of Washington has introduced a bill SB 5436 that proposes to ban copper bottom paint and that state may be the first to implement a ban. SB 5436 would ban copper paint on recreational boats 65 feet and under. No new boats with copper bottom paint could be sold after January 1, 2017. The bill does not restrict the sale of used boats because it would be difficult to enforce. By 2020, no antifouling paint containing more than 0.5 percent copper could be sold in Washington. Violators could face fines of $10,000. The bill has been passed by the state senate and now will be sent to the House of Representatives for approval. Some of the provisions may change prior to adoption.

The California copper bill, SB 623, states that manufacturers shall use the least toxic alternative when replacing copper in marine antifouling hull paint. This statement will require clarification before the bill is passed. The alternative biocide paints that are available have shorter lives than the copper paints and, as a result, they are more expensive to use over the paint life (see two other articles in this issue for more detail). Even though the cost of applying the alternative nonbiocide paint is higher, they have longer lives than the copper paint. The cost of using certain nonbiocide paints is comparable to the cost of using copper paints. Allowing use of alternative biocide paints just guarantees they will cause a problem over the next several years and they, like the copper paints, will have to be restricted. The best strategy would be for the bill to ban alternative biocide paints as well as copper paints.

The California bill may change over the next few months. It is a spot bill which means it is a placeholder and the language in the final bill is likely to be very different from the language of the bill that was first introduced.

Need help finding an alternative?
IRTA assists firms in converting to suitable alternatives in cleaning, paint stripping, coating, thinning, dry cleaning and other applications.

Calendar

April 4
Cal/EPA Department of Toxic Substances Control, Green Ribbon Science Panel, Subcommittee Teleconference Meeting, Subcommittee I: Chemical Identification and Prioritization, 9:30 AM to 12:00 noon. Phone number: (800) 857-9659; pass code: 4363475#. For information, call Kathy Barwick at (916) 323-3381.

April 14
"Safer Alternatives to Copper Antifouling Paints for Marine Vessels," Dr. Katy Wolf, IRTA, Brown Bag Presentation, U.S. EPA, 75 Hawthorne Street, San Francisco, CA. For information, contact Andre Villasenor at (213) 244-1813 villasenor.andre@epa.gov.

April 22
Earth Day
Many activities planned

May 5 and 6
Cal/EPA's Department of Toxic Substances Control, Green Ribbon Science Panel, full meeting of panel. For information, contact Kathy Barwick at (916) 323-3381.

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IRTA is working together with industry and government towards a common goal, implementing sensible environmental policies which allow businesses to remain competitive while protecting and improving our environment. IRTA depends on grants and donations from individuals, companies, organizations , and foundations to accomplish this goal. We appreciate your comments and contributions!

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