Institute for Research and Technical Assistance

The Alternative

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IRTA Completes Project on Alternative Boat Hull Paints

Copper antifouling paints have been used for many years on boat hulls to prevent attachment of marine growth which can slow boat progress, increase fuel consumption and, in extreme cases, damage the hull. These paints are designed to leach copper and the hulls are also generally cleaned in the water by divers. As a result of the leaching and hull cleaning, copper loading in several basins and marinas in California has built up to toxic levels.

IRTA partnered on an EPA sponsored project with the Port of San Diego to test alternatives to copper antifouling paints some years ago. The landmark project involved testing 46 alternative biocide and nonbiocide paints on panels and selecting some of the best performing paints for testing on boats in San Diego. Two of the best performing paints on the boats were soft nonbiocide paints called Intersleek 900 and Hempasil X3. These paints are based on silicon compounds and fluropolymers. The analysis indicated that the cost of using the nonbiocide paints over the life of the paint is roughly equivalent to the cost of using copper paint. The soft nonbiocide paints have much longer lives than copper paints which last two or three years. Because the boats need to be stripped before these alternative paints can be applied and because they require spraying rather than rolling, boatyards charge much more for a paint job for the nonbiocide paints. The cost of a typical copper paint job for a 30 foot boat is about $1,040. The cost of a paint job for a soft nonbiocide paint for a similar boat is much higher at $5,500 to $6,400 if stripping and spraying are required. Even though it is cost effective to use the paints over their life, the high cost of the paint job deters boaters from using the nonbiocide paints.

Over the last few years, IRTA worked on a project sponsored by EPA Region IX and Cal/EPA's Department of Toxic Substances Control (DTSC) to test additional emerging boat hull paints and to find methods of making it easier and less costly for boaters to use the alternative nonbiocide paints. During the project, IRTA conducted panel testing of additional nonbiocide paints and several of them performed well. IRTA also examined alternative stripping methods and alternative paint application methods. As part of the project, IRTA painted 10 boats, some with the new and emerging paints and/or some with promising alternative application methods. Finally, IRTA examined the possibility for boatyards to recycle the copper waste streams they generate.

The panel testing indicated that four of the new and emerging paints were likely to perform well on boats. IRTA applied these four paints and one paint that was modified from an earlier tested paint on boats.

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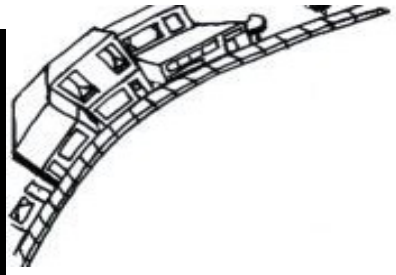

Small Business Corner

Should Methylene Chloride Be Banned in Consumer Product Paint Strippers?

In 2006, IRTA completed a project that focused on finding safer alternatives for methylene chloride consumer product paint strippers. The project was sponsored by Cal/EPA's Department of Toxic Substances Control. The project final report, entitled "Methylene Chloride Consumer Product Paint Strippers: Low-VOC, Low Toxicity Alternatives," is on IRTA's website at www.irta.us. The work involved testing alternatives in the applications where consumer product paint strippers would be used. These included traditional consumer stripping tasks that would be performed by homeowners, on-site cabinet stripping which is conducted by contractors and stripping performed by small furniture stripping companies. Methylene chloride stripping formulations are generally purchased from hardware and home improvement stores for these activities.

The Orange County Register recently reported a worker had died while using a methylene chloride consumer product paint stripper for removing the cured paint from a paint manufacturing tank at a paint manufacturing company in Orange County (see article in this issue on paint tank cleaning). The worker or the company had purchased the stripping formulation, called Jasco Premium Paint & Epoxy Remover. This stripping formulation is widely available in quart and gallon containers in home improvement stores. In this case, the workers were apparently not trained to observe the procedures required for working in confined spaces. Even so, consumers could just as easily purchase the same paint stripper and strip items at home in basements or rooms without ventilation. Consumers are not trained in confined space procedures either. They could just as easily be overcome and be injured or die from exposure to the stripping formulation just as the worker was.

IRTA undertook the project on alternatives to consumer product paint strippers to find safer alternatives that could be used for all applications where methylene chloride formulations are used today. When consumers purchase paint strippers, there is no need for the strippers to perform effectively over a short period of time. Consumers stripping items can use strippers that require a longer time to work. In contrast, contractors who strip on-site and small furniture stripping companies offer a service to their customers and they must have a formulation that will work in a reasonably short period of time. IRTA worked with Benco Sales on the project and the alternatives that worked most effectively were based on benzyl alcohol. This chemical has been tested for chronic toxicity and it did not cause cancer. It did perform reasonably well for stripping items furniture strippers commonly encounter. The cost analysis indicated it was cost effective to use.

Based on the results of this project, IRTA assumed that, because effective safer stripping formulations had been demonstrated, that the California Air Resources Board (CARB) would develop a consumer product regulation that phased out methylene chloride. CARB, the agency with jurisdiction over air emissions from consumer products in California, had been prohibiting the use of chlorinated solvents in many consumer product categories as they moved forward to regulate them. The agency did begin developing a regulation by taking the first step and conducting a survey on consumer product paint strippers. CARB signaled their intention to develop a regulation for the category but the agency has not yet taken the next step.

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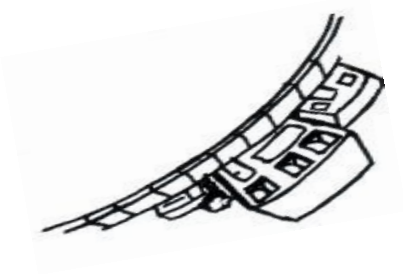

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Boatyards currently use hand sanding or chemical stripping with methylene chloride stripping formulations to strip the boats. IRTA investigated three alternative stripping methods including sodium bicarbonate blasting, volcanic rock blasting and dry ice blasting. IRTA worked with Marine Group, a boatyard that had a boat destined to be demolished, to demonstrate the three alternative methods. All of them seemed to perform well on the test boat and sodium bicarbonate blasting is used, to some extent, for stripping boats today. IRTA's analysis indicated that using the three technologies is slightly less costly than using hand sanding or chemical stripping for stripping boats. Although using these technologies is much better from an overall health and environmental standpoint, their use does not reduce the cost of stripping a boat substantially.

IRTA examined two other application methods for reducing the cost of a paint job. These include rolling the paint on rather than spraying it and applying the alternative nonbiocide paint over copper paint using a sealer in between. Boatyards charge as much as $1,000 for spraying paint on a 30 foot boat instead of rolling the paint on. They charge as much as $3,000 for stripping a 30 foot boat. IRTA worked with suppliers to test rolling and using sealers and applying the paint over copper paint for four boats. The findings indicate that these methods can reduce the cost of a paint job for a nonbiocide paint to about $2,200, roughly twice the cost of a paint job for a copper paint. In addition, the nonbiocide paints should have a much longer life than the copper paint so these methods are promising.

IRTA worked with a copper recycler to investigate the feasibility of recycling the copper waste streams from boatyards. Three streams generated by boatyards contain copper. These include hand sanding dust from surface preparation or stripping boats, spent material from stripping boats with blasting media and clarifier waste from high pressure water spray and wet sanding. IRTA arranged for several streams from different boatyards to be analyzed. In particular, it is likely to be cost effective to recycle the hand sanding dust. Two boatyards contracted with the recycler to recycle these streams during the project.

IRTA arranged for 10 boats to be painted with nonbiocide paints during the project. Eight of the boats were painted with five new and emerging paints. The paint was rolled on eight of the boats. Paints were applied over copper paint on four of the boats. Four of the five emerging paints seemed to perform well by the end of the project. Initial results indicate that rolling the paint on and applying it over copper using sealers are promising methods for reducing the cost of the paint job.

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Methylene chloride stripping formulations are dangerous not only because the chemical is a carcinogen but because it can cause carboxyhemoglobin. Methylene chloride metabolizes to carbon monoxide in the body and the, carbon monoxide replaces oxygen in the blood. Although the paint tank incident was an industrial application of the stripper, the same situation could arise at other small industrial plants and in consumers' homes. Methylene chloride consumer product strippers are a very dangerous product and they should be prohibited.

There are alternatives to methylene chloride strippers on the market today. Many of them are based on N-methyl pyrrolidone (NMP). This chemical is a reproductive and developmental toxin and is not necessarily safer than methylene chloride. If CARB regulated consumer product strippers, it would be possible to establish a VOC limit for the category that would also prohibit the use of NMP. This example points up the importance of regrettable substitutions.

CARB has the authority to prohibit methylene chloride consumer product paint strippers. Another agency that should have the authority to act is DTSC, once the Green Chemistry regulation is finalized. The draft regulation focuses on consumer products and this consumer product is certainly dangerous and of high priority. DTSC could prioritize methylene chloride as a chemical of concern and move forward to prohibit its use in consumer product paint strippers as soon as the Green Chemistry regulation is adopted.

For more information on methylene chloride and alternatives strippers, call Katy Wolf at IRTA at (323) 656-1121.

IRTA Completes Report on Paint Manufacturing Tank Cleaning

Over the last few years, IRTA worked on a project sponsored by EPA and Cal/EPA's Department of Toxic Substances Control (DTSC) that addresses safer alternatives for reactor tank and associated equipment cleaning for the chemical industry (see companion article in this issue on process hose cleaning). The chemical industry comprises a range of diverse companies including pharmaceutical and biotechnology companies, plastic and resin manufacturing, paint manufacturing and lacquer manufacturing. As part of the project, IRTA investigated cleaning alternatives for a hypothetical waterborne paint manufacturing company.

IRTA was interested in focusing on this application because of a very serious accident that occurred in October 2011 at a waterborne paint manufacturing company in Orange County, California. The Orange County Register reported that a worker died while he was using a paint stripping formulation inside a tank at a paint manufacturing facility. A co-worker also entered the tank when he saw the first worker unconscious at the bottom of the tank. The co-worker also passed out; he was hospitalized but he did survive. The Occupational Health Branch of the California Department of Public Health issued a Worker Fatality Alert for this case. The alert can be accessed at www.cdph.ca.gov/programs/ohb. The worker was using a stripping formulation based on methylene chloride to remove the cured paint from a tank used to produce the paint. Methylene chloride is a carcinogen and it also causes a condition called carboxyhemoglobin where carbon monoxide displaces oxygen in the blood. IRTA used this actual unfortunate case to construct a hypothetical tank cleaning operation for a paint manufacturing facility.

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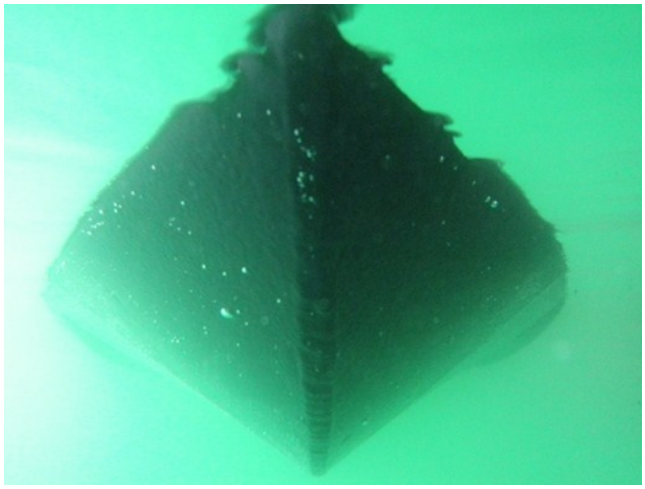
IRTA worked with San Diego Diving Service during the project. The company painted one of their boats with an emerging paint and it was applied with a sealer over copper paint. The company also maintained some of the other test boats that were painted. IRTA and the company deliberately did not clean two of the boats with different emerging paints for five to six months after the paint was applied. Although the fouling was heavy on the boats when they were cleaned, it was easy to remove. This indicates that the cleaning frequency for soft nonbiocide paints may be able to be extended significantly and this holds promise for reducing the cost of using the alternative paints.

The final report summarizing the results of the project is on IRTA's website www.irta.us. IRTA prepared five fact sheets which are also on the website. These fact sheets focused on:

- alternative nonbiocide paints
- alternative stripping methods
- alternative application methods
- boatyard copper recycling
- diver maintenance practices for nonbiocide paints



For more information on alternative nonbiocide paints and the results of the project, call Katy Wolf at IRTA at (323) 656-1121.

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

IRTA Completes Report on Process Hose Cleaning Alternatives

For the last few years, IRTA worked on a research project sponsored by U.S. EPA and Cal/EPA's Department of Toxic Substances Control (DTSC) that focuses on safer alternatives for reactor tank and associated equipment cleaning. One of the final reports, entitled "Safer Alternatives for the Chemical, Pharmaceutical and Biotechnology Industries: Process Hose Cleaning" can be accessed on IRTA's website at www.irta.us.

There are more than 1,200 chemical manufacturing facilities in California and they rely on cleaning solvents in their manufacturing operations when they are changing products that require different input chemicals. IRTA analyzed the cost of adopting options for reducing or eliminating the use of a mix of halogenated and non-halogenated solvents used for cleaning process hoses in a hypothetical chemical, pharmaceutical or biotechnology manufacturing plant. Process hoses are used to transfer intermediates or products to and from reactors during manufacturing. Two sizes of operations, a small operation cleaning 10 process hoses per day and a large operation cleaning 20 process hoses per day, were considered.

Six options for reducing solvent use that were analyzed included:

- using acetone exclusively;
- eliminating one of the solvent hose flushing operations;
- using a lower volume of solvent for the flushing operation;
- sending the spent acetone off-site for reutilization or reuse by another company;
- sending the spent solvent off-site for recycling; and
- recycling the spent solvent on-site for reuse back in the same process.

The results of the analysis demonstrate that the biggest cost savings can be achieved by using a lower volume of solvent for flushing and recycling the acetone on-site.

Four options for eliminating solvent use were analyzed. They included converting to one of two alternative water-based cleaners for the flushing operation and reducing the flushing volume of the water-based cleaners. Substituting the water-based cleaners with either a high or low volume for flushing resulted in the largest cost savings for the hypothetical companies.

The findings should be useful to chemical, pharmaceutical or biotechnology companies with batch production operations and require hose flushing to be performed routinely. For more information on the report, access IRTA's website at www.irta.us or call Katy Wolf at IRTA at (323) 656-1121.

Visit our website: www.irta.us

Read back issues of The Alternative and

recently completed reports.

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The major problem with the case study where the worker died is that the workers apparently were not trained in the procedures required for working in confined spaces like small paint tanks. Whenever a worker enters a tank for any purpose, which may not be related to tank cleaning, they should exercise these procedures. They include use of proper ventilation, supplied air respiratory protection, air monitoring, communications and proper rescue and retrieval procedures. These procedures would apply no matter what methods are used to clean the tanks.

Many manufacturers produce small amounts of a number of different paints on a regular or as-needed schedule. After a run of one type of paint, which is produced in a batch operation, the paint tank is cleaned so the new ingredients can be introduced for the next paint batch. The paint tank in the hypothetical facility is the same size as the actual tank. The dimensions are seven feet by seven feet by nine feet deep. The top of the paint tank is a hinged cover and the tank opening is two feet wide by seven feet long. The tank includes a ladder for workers to descend to the bottom of the tank. It has a center rod mixer for mixing the ingredients when a production run is underway.

The project involved investigating several alternatives to using a methylene chloride stripping formulation for cleaning the tank. The hypothetical company manufactures water-borne paint. If the paint is cleaned shortly after it is manufactured and before it is cured, plain water or water and detergent can be used to clean the tank. Three options using water were examined. First, the company could use plain water to flush the tank using the mixer at the bottom of the tank to circulate the water. Second the company could use water with a small amount of detergent added to flush the tank. Third, the company could use a pressure washer to clean the tank with plain water. The higher pressure cleaning may be more thorough than the other two options.

If the company does not clean the tank before the paint is cured, other more aggressive methods must be used to clean the tank. IRTA examined two additional options that can be used for the cured paint. First, workers can physically abrade the cured paint from the tank surface with sanding discs and collect the material in a vacuum sander. Second, workers can use an alternative safer stripping formulation. In an earlier project that focused on consumer product and furniture stripping alternatives to methylene chloride, IRTA tested formulations based on benzyl alcohol. This chemical is safer than methylene chloride; it has been tested for carcinogenicity and it did not cause cancer. The benzyl alcohol formulations were able to strip the cured paint effectively.

IRTA evaluated the cost of using the five alternative options. It is obviously best to clean the tank before the paint is cured. The lowest cost alternative option of the five that were analyzed is to purchase and use a pressure washer to clean the tank before the paint is cured. Using sanding for the cured paint is the next lowest cost option. This is the best option if the paint is cured since it does not rely on chemicals for the cleaning. Although this method does generate dust, the dust is vacuumed up so it does not expose the worker. In all cases, it was assumed that confined space procedures would also be followed. Using the benzyl alcohol formulation for cleaning the cured paint is slightly less costly than using the methylene chloride formulation.

The final report that analyzes and compares the methylene chloride and alternative options is available on IRTA's website at www.irta.us. For more information on the alternatives, call Katy Wolf at IRTA at (323) 656-1121.

Calendar

April 19

South Coast Air Quality Management District Rule 1107 "Coating of Metal Parts and Products" working group meeting, SCAQMD Headquarters, Room CC2, 9:00 AM. For information, call Mike Morris at (909) 396 -3282.

May 15 - 17

2012 Used Oil + HHW + Western Sustainability and Pollution Prevention Network Training & Conference, Sheraton Grand Hotel, Sacramento, CA. For information, access www.wsppn.org.

June 19 - 22

"Leading Environmental Frontiers," Air & Waste Management Association 2012 conference, Henry B. Gonzalez Convention Center, San Antonio, TX. For information access www.awma.org.

June 24 - 28

16th International Congress of Marine Corrosion and Fouling (ICMCF), Washington State Conference Center, Seattle, WA. For information, contact icmcf@onr.navy.mil.

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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