Safer Alternatives to Methylene Chloride Consumer Product Paint Strippers

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- Small nonprofit technical organization established in 1989
- Identifies, develops, tests and demonstrates safer alternatives in consumer product and industrial applications
- Projects have led to reduction in use of hazardous substances in California by more than 100 tons per day

Background on Consumer Product Paint Stripping

- Furniture stripping companies strip items for consumers
  - Some large strippers use equipment and buy stripper from suppliers
  - Smaller strippers purchase and use consumer product strippers from hardware and paint supply stores
  - IRTA estimated 80 facilities in California have equipment, 500 facilities do not

Background on Stripping Cont'd

- Other businesses use consumer product strippers
  - Contractors
  - Boatyards
  - Paint manufacturers
  - Aircraft maintenance companies
  - Other manufacturers/ small businesses with painting operations

Background on Stripping Cont'd

- Consumers strip wood and metal items

Characteristics of Methylene Chloride Paint Strippers

- Most effective paint strippers contain methylene chloride (METH) as active ingredient
  - Generally contain other components like methanol, rinse agents, thickeners and waxes, depending on application
- METH is a carcinogen
  - Chemical is a listed HAP and TAC, it is on California's Proposition 65 and it is a listed hazardous waste under RCRA
- METH has stringent OSHA level established in 1997
  - Very low exposure limit and action limit

Characteristics of One Major Alternative

- N-methyl pyrrolidone (NMP) marketed as "green" alternative
- Chemical is a reproductive and developmental toxin
  - NMP is listed on California's Proposition 65
  - May soon be regulated by Cal/OSHA
  - IRTA requested that the California Air Resources Board (CARB) add it to TAC list but CARB has not done so

Motivation for Investigating Alternatives

- IRTA worked on various projects over last 15 years to find alternatives in furniture stripping
  - Focused first on low METH content strippers and high air flow ventilation equipment
- Later worked on safer alternatives for furniture stripping and consumer product strippers
  - Had to solve both problems to include all furniture stripping
- Also worked on safer alternatives for various industrial applications over many year period
  - Aircraft stripping, metal stripping, boat hull stripping

More Recent Urgent Motivation

- Two worker deaths from use of methylene chloride consumer product paint strippers in California
- Paint manufacturing company in Orange County
  - Worker used paint stripper to strip paint production tank
- Church
  - Worker used paint stripper in baptismal font

Presentation Outline

- Present results for project focusing on alternatives used by furniture strippers, contractors and consumers
- Present results for project that included boat hull stripping alternatives
- Present alternatives approach for other applications
- Identify government agencies with ability to regulate/ban methylene chloride paint strippers

Furniture Stripper and Consumer Product Stripper Alternatives

- Project sponsored by DTSC
- Worked with paint stripper supplier called Benco Sales
- Focused on alternatives to methylene chloride and NMP
- Project aim
  - Identify, develop, test, demonstrate safer alternatives for furniture stripping and consumer product strippers used by furniture strippers, contractors and consumers

Testing With Furniture Strippers Using Equipment

- Worked with two stripping companies in Southern California
- Formulated different alternative strippers and compared their stripping effectiveness to baseline stripper
- B7 containing methylene chloride and methanol is baseline stripper
- Three alternative strippers based on benzyl alcohol were tested

Testing in Equipment Cont'd

- Stripping procedure in equipment
  - Use flow tray which is sloped tank with drain at lower end
  - Apply stripper using pump to items in flow tray
  - Wait for a period and pump more stripper on items to completely remove paint
  - Take items to water wash booth and rinse residue of coating and stripper
  - Let items dry prior to painting

Testing in Equipment Cont'd

- Stripped a variety of different items at Sunset Strip in flow tray
  - Chest of drawers with lacquer coating, mirror frame with shellac coating, door with shelac coating, chair with enamel coating

Testing in Equipment Cont'd

- Stripped several items at Strip Joint in flow tray
  - Mahogany drawer with lacquer coating, dental cabinet drawer with multiple layers of latex coating, mahogany door with several enamel coatings, oak drawer and door with varnish coating

Results of Testing in Equipment

- The baseline stripper stripped all items except the dental cabinet drawer with the latex coating
- Two of the alternative benzyl alcohol stripping formulations performed reasonably well
- One formulation performed best and it also stripped the latex coating
- About half as much of the alternative strippers were required but double the amount of hazardous waste was generated

Annualized Cost Comparison for Furniture Stripping in Equipment

	METH Stripper	Benzyl Alcohol Stripper
Capital Cost	-	$217
Stripper Cost	$4,790	$4,250
Rinse Agent Cost	$55	$124
Disposal Cost	$300	$350
Total Cost	$5,145	$4,941

Furniture Stripping Without Equipment (Hand Stripping)

- Meant to represent majority of furniture stripping companies who purchase consumer product strippers
- Used baseline stripper called B4 as control
  - Contains methylene chloride and methanol
- Formulated and tested four alternative strippers
  - Two strippers contained benzyl alcohol and acetone
  - Two strippers contained benzyl alcohol and no acetone

Hand Stripping Cont'd

- Variety of items stripped at Sunset Strip
  - Bed rail with shellac coating, chair with two coats of enamel, bookcase shelf with lacquer coating

Hand Stripping Cont'd

- Several items stripped at Strip Joint
  - Panel with lacquer coating, dental drawer with three coats of latex, panel with five coats of enamel, mirror frame with varnish coating

Results of Hand Stripping at Furniture Stripping Companies

- General results indicated that B4 was the most effective stripper
- One of the alternative benzyl alcohol strippers was almost as good as the B4 stripper

Contractor On-Site Stripping Tests

- Contractors strip items in houses and offices
- Items include cabinets, molding, frames
- Doors and drawers often removed and stripped off-site
- IRTA and Benco Sales conducted tests of alternative strippers for cabinet stripping at Palos Verdes home

Contractor Alternative Strippers

- Baseline stripper is called Lifteeze
  - Contains methylene chloride, methanol, acetone and toluene
- Tested two alternative strippers based on benzyl alcohol
- Procedure involved applying three strippers to a panel, letting the strippers act for a time and then scraping off the residual stripper and coating residue

Results of Contractor On-Site Stripping Tests

- Baseline stripper Lifteeze was best overall stripper
- One of the alternative benzyl alcohol strippers was nearly as effective as the Lifteeze

Consumer Stripping Tests

- Items most often stripped by consumers are made of wood
  - Includes doors, door jambs, cabinetry, chairs, bed frames and tables
  - Most common coating encountered is lacquer
- Consumers also strip metal patio furniture
  - Would likely be painted with a primer and topcoat

Consumer Stripping Tests Cont'd

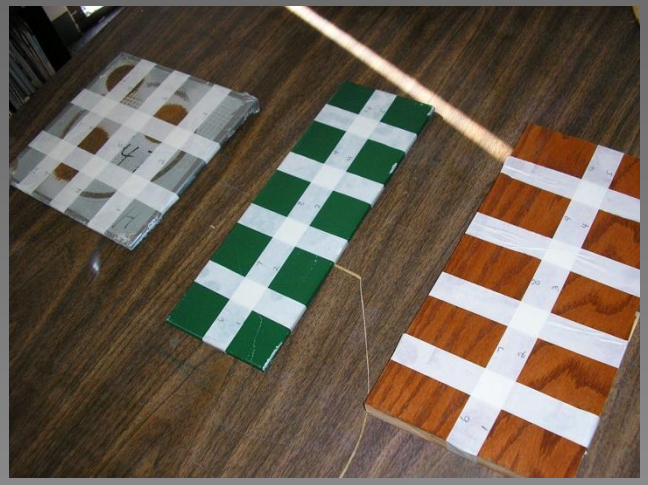
- For consumer stripping tests, constructed three panels
  - Wood panel with a nitrocellulose lacquer to represent the majority of wood items
  - Metal panel with an epoxy primer and cross-linked polyurethane topcoat to represent the majority of metal patio items
  - Metal panel with an epoxy primer and a UV cured topcoat to represent the coatings of the future

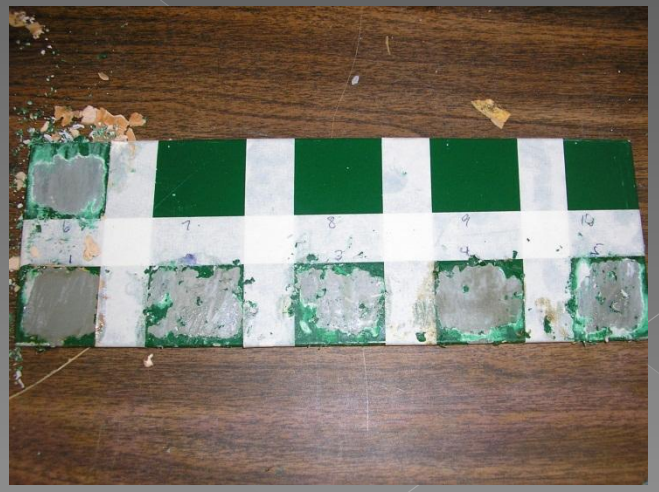
Alternative Strippers Used in Consumer Product Tests

- IRTA investigated alternative consumer product strippers on the market
- Tested and compared five alternative strippers
  - KS Brushable Stripper containing METH and methanol (high METH content stripper)
  - BIX Stripper containing METH and methanol (low METH content stripper)
  - CS Stripping Gel containing NMP (NMP stripper)
  - Ready-Strip Pro containing NMP and benzyl alcohol (NMP stripper)
  - Ben's Nu-Tech Stripper containing benzyl alcohol (formulated by Benco for testing)

Panel Testing Procedure

- Panels were masked off
- The five stripping formulations and B4, the high METH content hand stripper, tested at the furniture stripping companies, were applied to the panels
- The panels were inspected at various intervals to determine if strippers had stripped the paint





Results of Panel Stripping Tests

- Four of the strippers stripped the coating on the wood panel within 10 minutes
  - Bix Stripper took 20 minutes to strip and Ready Strip Pro took one hour to strip
- Four of the strippers stripped the primer and topcoat from the green metal panel in 5.5 hours
  - CS Stripping Gel and KS Brushable Stripper took about 20 hours to strip
- After 20 hours, only two strippers, Ben's Nu-Tech Stripper and Ready-Strip Pro, both containing benzyl alcohol, were beginning to work on the gray metal panel

Cost Comparison of Consumer Hand Strippers

Stripper	Type	Stripper Cost Per Quart	Amount Used	Total Cost
KS Brushable Stripper	METH	$7.47	2 quarts	$14.94
BIX Stripper	METH	$5.97	2 quarts	$11.94
CS Stripping Gel	NMP	$10.99	1 quart	$10.99
Ready-Strip Pro	NMP, benzyl alcohol	$17.69	1 quart	$17.69
Ben's Nu-Tech	benzyl alcohol	$7.95	1 quart	$7.95

Boat Hull Paint Stripping Alternatives

- Boat hull stripping alternatives work performed as part of project sponsored by EPA and DTSC
- Boat hull paints containing copper are used to protect hulls from attachment by marine life
- Paint needs to be stripped periodically
- Boatyards strip paint using one of two methods
  - Chemical stripping
  - Abrasive hand stripping

Characteristics of Chemical Stripping

- Chemical strippers contain methylene chloride
  - Purchase stripper at hardware or marine supply stores
  - Commonly used formulation called Klean-Strip Aircraft Remover
  - Contains 60 to 100 percent methylene chloride
- Stripping procedure
  - Lay down tarp or cardboard
  - Formulation applied three to five times
  - Paint bubbles up and workers use scraper to remove coating residue
  - Boat is rinsed down with water and lightly sanded

Chemical Stripping Cont'd

- Waste disposal
  - Tarp/cardboard with coating residue and stripper waste is classified as hazardous waste
  - Many boatyards throw waste in garbage
    - Believe that if it is dry, it is not hazardous

Hand Sanding/Stripping

- Use DA or vacuum sander to abrade paint from surface of boat
- May have to shroud boat with plastic so particulate matter does not affect other boatyard paint jobs
- Sanding dust generated in process is hazardous waste because of copper
  - If dry, must handle as hazardous waste
  - If wet, will enter the clarifier or become airborne

Alternative Stripping Methods

- Examined and tested three alternative stripping methods to see if using them is less costly
  - All abrasive blasting methods
- Dry sodium bicarbonate stripping
  - Uses media to abrade paint
  - Called soda blasting

Alternative Methods Cont'd

- Wet volcanic rock stripping
  - Uses volcanic rock/water media to abrade paint
- Dry ice blasting
  - Uses carbon dioxide pellets to abrade paint
  - Advantage is that there is no secondary media

Alternative Methods Cont'd

- Marine Group, a boatyard in San Diego, had boat destined for demolition
- Conducted tests of all three technologies at the same time on the boat
- One aim was to determine whether technologies could strip paint from a boat
  - Rough idea of efficiency
- Another aim was to collect residue and determine whether residue was hazardous waste

Alternative Stripping Methods Cont'd

- Conducted cost analysis/comparison
- Determined that waste is hazardous waste

Results of Stripping Tests

- All three alternative technologies could effectively strip boat hull paint
- Compared cost of using methylene chloride stripper, hand sanding and sodium bicarbonate blasting
- Cost to boatyards for renting equipment for sodium bicarbonate blasting, volcanic rock blasting and dry ice blasting is roughly comparable

Cost Comparison of Alternative Stripping Technologies

Cost Comparison for 30 Foot Boat		
System	**Description**	**Cost**
METH Stripping	Baseline	$1,434.00
Hand Sanding	Hand Abrasion	$1,313.00
Sodium Bicarb	Abrasive Blasting	$1,075 to $1,276

Alternative Stripping Methods for Other Applications

- Aircraft stripping can be performed with alternative benzyl alcohol strippers and/or abrasive methods like PMB, sodium bicarbonate blasting and wheat starch blasting
- Paint tank stripping can be performed with hand sanding or abrasive blasting methods. Can also strip paint directly after manufacture and before it is cured
- Companies with painting operations can strip paint for rework before paint has cured

General Alternatives Approach

- Metal stripping like aircraft stripping and fiberglass boat hull stripping can be performed by hand sanding or with abrasive methods
- Paint tank stripping and manufactured parts stripping can be performed before curing or by hand sanding or with abrasive methods
- Fixtures from paint conveyor lines can be stripped cryogenically or with benzyl alcohol or hot alkaline strippers
- Wood stripping by furniture strippers generally requires a chemical stripper and can use benzyl alcohol strippers
- Consumers can use any benign stripper because the time for stripper to work does not matter

Agencies With Authority to Ban Methylene Chloride Strippers

- EPA identifying chemicals for review under TSCA
  - Has developed risk assessments for methylene chloride and NMP in paint stripping for review
  - Used IRTA study in risk assessments
  - Could ban both chemicals but rarely takes action
- California Air Resources Board regulates toxic and VOC emissions from consumer products in California
  - Has banned methylene chloride in many other product categories
  - Could ban methylene chloride and restrict NMP as VOC in consumer product paint strippers
  - Does not believe there are alternatives in spite of evidence to the contrary

Agencies Cont'd

- California Department of Toxic Substances Control is developing a "Green Chemistry" regulation
  - Could ban methylene chloride as one of first chemicals of concern in product combinations
  - Current version of regulation would not catch NMP
  - Process likely to be substantially delayed
- South Coast Air Quality Management District
  - Methylene chloride is TAC so air districts have authority to regulate it
  - Can ban methylene chloride use at stationary sources (industrial operations) and can likely ban methylene chloride use in consumer products sold in Southern California
  - More difficult to ban NMP

Conclusions

- There are demonstrated safer alternatives to methylene chloride consumer product strippers
- There have been two deaths associated with methylene chloride strippers in California in the last few years
  - Likely to be consumer deaths in years ahead
- Government agencies with the authority to regulate strippers have not stepped forward to do so
- Must regulate methylene chloride and NMP in concert

Materials

- IRTA website can be accessed at www.irta.us
- Two reports and fact sheet available
  - "Methylene Chloride Consumer Product Paint Strippers: Low-VOC, Low Toxicity Alternatives"
  - "Safer Alternatives to Copper Antifouling Paints: Nonbiocide Paint Options"
  - "Alternative Boat Hull Paint Stripping Methods"

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