Safer Alternatives: TSCA Case Study Examples
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IRTA had expertise in alternatives to five of the first 10 identified workplan chemicals

- Includes solvents trichloroethylene (TCE), perchloroethylene (PERC), methylene chloride (MC), n-propyl bromide (nPB) and N-methyl pyrrolidone (NMP)

EPA contractor subcontracted with IRTA to provide research/analysis on alternatives to TCE in three applications and MC and NMP in paint stripping as basis for four proposed regulations

Regulations were later delayed to comply with new TSCA deadlines
EPA is likely to eventually propose regulations on high exposure/high risk applications for solvents
  › Safer alternatives will need to be used
  › Important to evaluate effectiveness and cost
Information on alternatives is also useful for pollution prevention activities
Focus of presentation is on two case studies in applications of solvents that are likely to be regulated under TSCA in the future
  › Paint stripping boat hulls
  › Vapor degreasing of metal parts
IRTA work primarily in California and does not necessarily take into account local practices, regulations
Paint Stripping

- Large category that includes many different paint stripping subcategories
  - Aircraft stripping, art restoration and conservation, automotive refinishing, aftermarket refinishing, wheel stripping, ground vehicle repair and painting, bathtub refinishing, furniture refinishing, professional contractor operations, ship/boat paint stripping, graffiti management, consumer stripping, manufacturing/rebuild/rework stripping

- Alternatives are different depending on the application
  - Must evaluate/analyze each application separately
Work based on results of Department of Toxic Substances Control (DTSC) project on alternative boat paints

Paint used on boats is generally copper antifouling paint

In California, boat yards strip consumer owned boats which are about 25 to 65 feet
  - Boats are generally made of fiberglass
  - Stripping done infrequently, perhaps every five paint jobs
Boatyards use one of two methods to strip boat hull paint:
- MC chemical strippers
- Hand sanding

Generally purchase stripper at marine supply stores:
- Also available at Home Depot, hardware stores and online.

Chemical stripping involves placing tarp or cardboard below boat and applying stripper three to five times, waiting while stripper acts on paint, scraping it off, rinsing boat and sanding it lightly before applying new paint.

Hand sanding involves using sand paper applied with a DA sander or a vacuum sander.

In both cases, strip copper paint and leave primer (epoxy) on boat.
Tested/evaluated three alternative stripping methods, two of them based on use of abrasives

- Dry ice blasting, sodium bicarbonate blasting, volcanic rock blasting

Dry ice blasting attractive because it generates very little secondary waste because carbon dioxide sublimes

Must shroud certain operations and strip inside

Can rent or purchase systems or can use service provider
Testing and Cost Analysis

- Tested alternative methods on boat hull of boat ready to be demolished
- Based on results, made a variety of assumptions for cost analysis
- Cost of the three alternatives stripping methods was comparable
- A supplier in the area was offering service of stripping boats with sodium bicarbonate to boatyards
- Compared cost of using sodium bicarbonate blasting with service provider to cost of chemical and hand sanding stripping
- Full results of analysis in report at www.irta.us
## Cost Comparison of Stripping Technologies for 30 Foot Boat

<table>
<thead>
<tr>
<th>Stripping Method</th>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC Stripping</td>
<td>Baseline</td>
<td>$1,434</td>
</tr>
<tr>
<td>Hand Sanding</td>
<td>Baseline</td>
<td>$1,313</td>
</tr>
<tr>
<td>Sodium Bicarbonate Blasting</td>
<td>Alternative</td>
<td>$1,075 to $1,276</td>
</tr>
</tbody>
</table>
Perspective on Stripping Cost

- Boatyards charge average of about $1,038 for a copper paint job for a 30 foot boat.
- Boatyards charge boater between about $2,270 and $3,200 for a stripping job.
  - Actual cost of stripping ranges from about $1,100 to $1,400.
  - Markup by boatyards is substantial.
Best Options for Stripping Boats

- Avoid chemical stripping with MC
- Boatyards can use sodium bicarbonate blasting or hand sanding
- DIY stripping should be done by hand sanding
- Costs of all technologies are comparable
What is Vapor Degreasing?

- Solvent heated to its boiling point in a vapor degreaser
  - stainless steel tank with a heater in the bottom and cooling coils around the inside perimeter
  - Liquid and vapor zone

- Parts lowered into degreaser in basket
  - Hot solvent in vapor zone condenses on part carrying contaminants into liquid

- Many types of vapor degreasers
  - Batch open top
  - Conveyorized
  - Airless/Airtight (Vacuum)
Solvents Used in Open Top Vapor Degreasing

- Must have no flashpoint
  - Limits candidates to halogenated solvents
- Four of solvents listed as first ten workplan chemicals are used in vapor degreasing
  - TCE, PERC, MC, nPB
- EPA passed NESHAP regulation on halogenated solvents in early 1990s
  - Affected TCE, PERC, MC
  - Many users converted to nPB to avoid compliance
  - Some users converted to “designer” halogenated solvents
- Tens of thousands of vapor degreasers used in the country
Analysis for TSCA Regulation on Vapor Degreasing

- Evaluated three different case studies meant to represent possible users of TCE
- Potential alternatives to TCE
  - Drop-In alternatives like PERC, MC and nPB where the same equipment can be used
  - Use of a vacuum degreaser with TCE or alternative
  - Other halogenated solvents (HFCs, HFEs, HFOs)
  - Not-In-Kind solvents like mineral spirits or terpenes
  - Cold cleaning with TCE
  - Water-Based cleaners
Vapor Degreasing Case Study

- Based on company IRTA worked with in California called Nelson Nameplate
  - 90% of stock made of aluminum, rest made of stainless steel and brass
  - Most sheets are 18 by 24 inches, some are 12 by 40 inches
- Contaminants are oils
- Open top degreaser with capacity of 50 gallons, operated eight hours per day, used 1,500 gallons of TCE per year
- Processes 1,000 sheets per day through degreaser
Included drop-in alternatives
Did not include “designer” halogenated solvents
  > These solvents are very expensive and a large operation like this would likely not use them
Included not-in-kind alternative
  > Might not be allowed in California
Included water-based cleaning
Did not include TCE cold cleaning
  > Large operations would not likely use TCE this way because of high losses
Costs Included in Analysis

- Cost of purchasing solvent
- Cost of electricity for operating the system
- Labor cost of loading machine/cleaning
- Cost of waste disposal
- Other costs depending on the alternative
- Did not include certain other costs
  - Complying with the NESHAP
  - Local air district fees
## Annual Cost Comparison

<table>
<thead>
<tr>
<th>Cleaning Agent</th>
<th>Equipment</th>
<th>Cleaner</th>
<th>3% Annualized Over 10 Years</th>
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</thead>
<tbody>
<tr>
<td>TCE Baseline</td>
<td>-</td>
<td>$36,000</td>
<td>$85,093</td>
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<tr>
<td>PERC</td>
<td>-</td>
<td>$36,975</td>
<td>$85,965</td>
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<tr>
<td>MC</td>
<td>-</td>
<td>$23,400</td>
<td>$73,815</td>
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<tr>
<td>nPB</td>
<td>-</td>
<td>$81,075</td>
<td>$125,438</td>
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<tr>
<td>Water-Based</td>
<td>$150,000</td>
<td>$2,280</td>
<td>$66,282</td>
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<tr>
<td>Mineral Spirits</td>
<td>$5,656</td>
<td>$24,700</td>
<td>$73,900</td>
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</tbody>
</table>
Nelson Nameplate Conversion

- Company converted to conveyorized water-based cleaning system
Many different types of systems depending on specific case and preferences

Most companies in California have converted to water-based systems

Water-Based cleaning is often least costly alternative

Energy costs higher for Nelson Nameplate but this is not always the case
Many Other Types of Water-Based Cleaning Systems
Conclusions

- Safer alternatives available for all applications of solvents included in first ten workplan chemicals
- Different alternatives suitable for different applications and different subapplications
  - Must understand applications in depth
- Cost of safer alternatives is generally reasonable and is often lower cost
- Region 10 can work with users to assist them in converting if TSCA regulations are adopted or for providing pollution prevention assistance
Materials

- IRTA website can be accessed at www.irta.us
- Two reports available
  - DTSC/IRTA final report
  - IRTA analysis for Abt Associates
    - Request a copy
    - Available in EPA’s TCE vapor degreasing proposed regulation docket
- Fact sheet available
  - Alternative stripping methods fact sheet on IRTA website
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