Example Alternatives Assessment Review

Green Ribbon Science Panel

February 12-13, 2018

ID	Product _chemical	Source	Date	Function	ID alternatives	ID relevant factors	Initial screening	Adverse impacts		Life cycle impacts	Economic impacts	Decision making
								Hazard	Exposure			
1	All-purpose cleaner NPE	BizNGO	Nov-13	+++	+	+++	+++	+		+++		+
2	Thermal paper Bisphenol A	US EPA Safer Choice	Sep-15	+	+++			+++	+	+		+++
3	Printed circuit boards Flame Retardants	US EPA Safer Choice	Aug-15	+++	+	+		+++	+++	+	+	+++
4	Electronic enclosures PBDE (DecaBDE)	Washington State DOE & DOH	Jan-06	+	+++		+	+++	+	+	+	
5	Antifouling paint Copper	ToxServices for Washington State	Mar-15	+	+		+++	+	+	+	+	+++
6	Paint stripper Methylene Chloride	UCSB (DTSC contract)	Feb-16	+	+++				+++	+++		
7	Multiple applications BPA	SUBSPORT	Mar-13		+		+++	+	+			

ID	Product _chemical	Source	Date	Function	ID alternatives	ID relevant factors	Initial screening	Adverse impacts (hazard)	Adverse impacts (exposure)	Life cycle impacts	Economic impacts	Decision making
8	Dry cleaning solvent Perchloroethylene	TURI	Jun-12	+++	+++			+			+	
9	Plasticizers in PVC Phthalates	HBN	Sep-14	+	+			+++	+			
10	NAS framework case study #2 Glitazone-T, Page 177-194	NAS	2014	+	+			+++	+			+++
11	Corrosion inhibitor in ammonia absorption deep cooling system Sodium dichromate	Lanxess Elastomers	Oct-15	+	+++						+++	
12	Solvent for textile TCE	Vlisco Netherlands BV	May-14	+++	+++	+	+++	+	+		+	
13	Antifouling paint Copper	Northwest Green Chemistry for Washington State	Aug-17	+	+++		+++	+	+		+	+

Note ---

+: indicate that the AA example addressed some aspects of the specific topic area.

+++: indicate that the AA example demonstrated strongly how to address the specific topic area and align with the SCP AA (article 5) requirements. This should not be considered as compliance with SCP AA (article 5) requirements. The review focused on transparency and documentation of the methodology and supporting information, rationale of results and justification, and relevance of the information provided in the documents. The review did not validate the information quality nor evaluate the adequacy of analysis presented by these AA examples.

Selection criteria:

AA examples selected in the Summary Table meet the following criteria:

- Represented a completed analysis of alternatives for a problematic chemical in specified products, including the identification of alternatives, evaluations comparisons of alternatives, and results/conclusions/recommendations from evaluations of alternatives.
- Were available in the public domain at no cost
- Included sufficient transparency of methodology and analysis
- (For GRSP meeting purpose) Had good coverage of manufacturers, NGOs, or government bodies who prepared the AA.
- (For GRSP meeting purpose) Had good coverage of topic areas addressed by these AA

#1:

Document Title: Final Alternatives Assessment Nonylphenol Ethoxylates (NPE) in All-Purpose Cleaners

Link to document:

http://www.bizngo.org/static/ee_images/uploads/resources/Final_text_for_CPA_review_Combined_NPE_STAGE_1_and_2_REPORT_20180116.pdf

Author: BizNGO

Purpose of the Report: This report used existing information to model a two-stage Alternatives Analysis in accordance with the Safer Consumer Product (SCP) regulations.

Report Summary: The proposed Priority Product analyzed in the report was all-purpose cleaners containing nonylphenol ethoxylates (NPE). The Chemical of Concern (CoC), nonylphenol ethoxylates, was the surfactant used in the formulation of an all-purpose cleaner. The report summarized the performance requirements for all-purpose cleaners and the surfactant's function in the Priority Product. Nine alternative surfactants were identified and analyzed as potential replacements for nonylphenol ethoxylates.

Key Findings:

Function and Performance: The report presented good examples that explained the function of the CoC in the Priority Product along with the function of the Priority Product as a cleaner. The report also provided a good discussion on the performance requirements for the Priority Product.

Identification of Relevant Factors: The report used qualitative discussions to justify the relevance of comparison factors contributing to adverse impacts, along with associated exposure pathways and life cycle segments. The report also demonstrated how to use a comparative hazard screening method, GreenScreen®, to determine the relevance of various hazard factors. It also tabulated the results for factors considered for relevance, methods used to determine relevance, and data gaps.

Initial Screening: The report clearly documented the initial screening rationale. Supporting information (including data sources with references) were included as a part of the preliminary screening of CoC and alternative surfactants using GreenScreen®.

Life Cycle Impacts: The report demonstrated the use of qualitative and quantitative analysis to evaluate multimedia life cycle impacts. It also discussed the data sources, limitations, and uncertainties.

#2:

Document Title: Bisphenol A Alternatives in Thermal Paper

Link to document: https://www.epa.gov/sites/production/files/2015-08/documents/bpa_final.pdf

Author: US EPA Safer Choice, Design for Environment (DfE)

Purpose of the Report: This report evaluated alternatives to BPA to assist in chemical substitution decisions concerning the selection and use of developers in thermal paper technologies and the disposal and recycling of thermal paper. It applied the DfE Alternative Assessment framework and focused on the hazard characteristics of chemical alternatives, providing information on the environmental and human health profiles of each chemical included.

Report Summary: This report summarized the outcomes of the alternatives assessment regarding the potential environmental and human health hazards of BPA and alternatives in thermal paper throughout their life cycles. It also described intrinsic properties that include concerns associated with chemical structure, absorption potential, persistence and bioaccumulation. Performance, economic, and social considerations were also briefly addressed along with interim risk management measures that may be relevant for alternatives associated with trade-offs.

Key Findings:

Identification of Alternatives: The report documented how nineteen alternatives with chemical identity information were selected for inclusion and assessment as potential functional substitutes based on conversations with technical experts and stakeholders. It also provided the rationale on why other chemicals were not selected and criteria used.

Adverse Impacts (hazard): The report adopted a semi-quantitative, screening-level comparison of the potential human health and environmental impacts of BPA chemical alternatives. The evaluation was conducted according to the DfE Alternatives Assessment Criteria for Hazard Evaluation. It evaluated human health effects, ecotoxicity, and environmental fate.

Decision Making: Chapter 6 described the five general attributes evaluated and discussed data gaps in the characterization of chemicals in this assessment. It provided a detailed discussion and presented trade-offs when considering selecting thermal paper developers.

#3:

Document Title: Flame Retardants in Printed Circuit Boards Final Report

Link to document: https://www.epa.gov/sites/production/files/2015-08/documents/pcb_final_report.pdf

Author: U.S. EPA, Safer Choice

Purpose of the Report: The EPA Design for the Environment (DfE) program and electronic industry convened a partnership to identify and evaluate flame retardants on their environmental, human health and safety, and environmental fate aspects in Flame Resistant 4 (FR-4) printed circuit boards (PCBs).

Report Summary: The report evaluated ten flame retardants and resins for FR-4 laminate materials used on printed circuit boards (PCBs) as potentially viable options. This report also helped the electronics industry consider human health and environmental impacts along with cost and performance of circuit boards when evaluating alternative flame retardants and technologies used in printed circuit board applications. It incorporated hazard assessment, consideration of exposure scenarios, and life-cycle thinking when evaluating the alternatives.

Key Findings (including brief descriptions of basis for our key findings):

Function and Performance: Chapters 2 and 3 contained a detailed discussion on the FR-4 Laminates and the flame-retardant chemicals used in FR-4 Laminates, including processes, general characteristics, classifications, and functions. It also discussed on the FR-4 Laminates market and the Halogen-Free Laminate market which addressed an exposure pathway required by the SCP regulations.

Adverse Impacts (hazard): Chapter 4 discussed the methodology used to evaluate human health endpoints, environmental toxicity and fate endpoints, and endocrine activity. It discussed the hazard designations, the criteria used to assign hazard designations, endpoints and information characterized, data sources, physical and chemical properties, environmental transport, and biodegradation. The executive summary contained a good example of a table that summarized the screening level hazard for reactive flame-retardant chemicals and resins.

Adverse Impacts (Exposure): Guidance was provided regarding exposure assessment considerations for future follow-on analyses, but no quantitative estimates were provided in the report itself. For the incumbent flame retardant, TBBPA, readers were referred to the 2003 EU Risk Assessment Report for a quantitative exposure assessment. For the other 4 reactive flame retardants considered, exposure was anticipated during manufacture of the flame retardant or resin and, for resins only, during the manufacture of the laminate. For the 5 additive flame retardants, exposure was anticipated during all life-cycle stages. Qualitative exposure statements are provided for each flame retardant, indicating the relevant life stages, influence of functionality (mono, di, or tetra) and physicochemical properties (volatility, water solubility), and release mechanisms (fugitive dust, shredder dust, leaching, smelting). As a major complication, the report stated that “it is important to note that many of these flame-retardant chemicals must be used together in different combinations to meet the performance specifications.”

Decision Making: Chapter 7 outlined appropriate attributes for a decision maker to consider when determining trade-offs to select alternatives. It stated higher preference is given to human health and environmental hazards over the other considerations for the study. A detailed discussion to address data gaps and uncertainties is also included.

#4:

Document Title: Washington State Polybrominated Diphenyl Ether (PBDE) Chemical Action Plan: Final Plan

Link to document: https://fortress.wa.gov/ecy/publications/publications/0507048.pdf

Author: Washington State Department of Ecology and Washington State Department of Health

Purpose of the Report: This report was the final version of the Chemical Action Plan (CAP) for the class of flame retardants called polybrominated diphenyl ethers, or PBDEs. It was the second CAP done as part of the Department of Ecology (Ecology)'s *Proposed Strategy to Continually Reduce Persistent, Bioaccumulative Toxics (PBTs) in Washington State* (issued December 2000). In January 2004, Governor Locke directed Ecology, in consultation with the Department of Health (DOH), to investigate and recommend options to reduce the threat of PBDEs in the environment.

Report Summary: With production of Penta- and Octa-BDE discontinued, Deca-BDE became the focus of the study. Three new chapters were added to the CAP: 1) a review on studies of the degradation of Deca-BDE; 2) an alternatives assessment; and 3) a cost-benefit analysis.

Key Findings:

Identification of Alternatives: The sources used to identify Deca-BDE alternatives included a survey of electronics companies (telephone and email interviews), existing reports, and flame-retardant product information from chemical manufacturers (websites). The report provided a list of reports used to identify alternatives to Deca-BDE. A table presented production information and information related to tracking programs for Deca-BDE and alternatives. This table also illustrated other data gaps in information about alternatives, such as information on their production, use, and tracking mechanisms. DOH did an extensive review of existing literature and the rationale for the scope of alternatives was explained well in this report.

Adverse Impacts (Hazard): Human health impacts, ecotoxicity, and the evaluation of the persistence, bioaccumulation potential of Deca-BDE and Deca-BDE alternatives were presented in a table. A brief description of the toxicity, persistence, and bioaccumulation potential for each alternative and Deca-BDE was included in the report. Toxicity Profiles for each chemical were included in the Appendix as well.

In cases where there were no available toxicity studies for a health effect, NI (No/insufficient Information) is indicated instead of the L (low), M (medium), or H (high) rank in the comparison table. There was also a column in the table to rank the amount of toxicity information available.

#5:

Document Title: Assessing Alternatives to Copper Antifouling Paint: Piloting the Interstate Chemicals Clearinghouse (IC2) Alternatives Assessment Guide

Link to document: http://theic2.org/article/download-pdf/file_name/Assessing%20Alternatives%20to%20Copper%20Antifouling%20Paint%20-%20Piloting%20the%20IC2%20AA%20Guide.pdf

Author: ToxServices LLC

Purpose of the Report: This report was a case study completed under contract with Washington State Department of Ecology to develop a basis for a future alternative assessment to copper antifouling paints while testing the usability of the Interstate Chemical Clearinghouse Alternatives Assessment Guide Version 1.0 (IC2 Guide).

Report Summary: This report identified both zinc and organic biocide paints to copper antifouling paints as well as nonbiocidal paints that create a slick surface. It chose six viable alternatives from two 2011-year U.S. EPA and CalEPA reports to fit for this study. Three independent teams completed alternatives assessments using three decision making frameworks described in the IC2 Guide and offered recommendations for improvement to the IC2 Guide.

Key Findings:

<u>Initial Screening:</u> The report applied the Greenscreen® method to calculate the percent of Benchmark 1 chemicals in each formulation for environmental and human health endpoints. The report also used the physical/chemical properties to make a qualitative comparative exposure assessment with respect to exposure potential, environmental fate and transport, and the release mechanism through various stages of the product's life cycle. An annualized cost of the paint application and maintenance was obtained from the existing CalEPA report.

<u>Decision-Making</u>: The report demonstrated and summarized three decision-making frameworks laid out by IC2 Guide; the sequential, simultaneous, and hybrid frameworks and their methodologies. Tasks 2 through 4 discussed the process used for each framework, respectively, and provided the weighting criteria and trade-offs in a matrix of findings.

In addition, the report presented the basic performance evaluation process suggested by the IC2 Guide based on the existing performance data. The report also demonstrated the basic materials management module and life cycle module suggested by the IC2 Guide for preliminary analysis.

#6:

Document Title: Pilot Study to Support Alternatives Analysis: Evaluating Alternatives to Methylene Chloride in Paint Stripper

Link to document: http://www.dtsc.ca.gov/SCP/upload/DTSC_Final_Quant_AA_pilot_UCSB-1.pdf

Author: Lilian Burns, Kristen Maguson, Roland Geyer, and Arturo A. Kelle, Bren School, University of California at Santa Barbara

Purpose of the Report: This report, prepared for Department of Toxic Substances Control, conducted a quantitative analysis of the exposure and life cycle impacts for a methylene chloride based paint stripper and its alternatives. The analysis was based on a previous qualitative analysis presented in Appendix B. It was not intended to be a complete and comprehensive Alternatives Analysis meeting the California Safer Consumer Products requirements.

Report Summary: This example used Life Cycle Assessment (LCA) approaches and exposure models to quantify upstream, use, and end-of-life impacts of the paint strippers using methylene chloride and other alternative chemicals, and sanding methods. It was a beneficial example for evaluating hazard and multimedia life cycle impacts of non-chemical drop-in substitution alternatives.

Key Findings:

Identification of Alternatives: The alternatives identified by this study included both chemical substitutes and non-chemical process changes.

Adverse Impacts (exposure): The study presented one simplified model approach to evaluate exposure for the use phase. This model then combined exposure data with the hazard information to compare alternatives for their adverse impacts. Sensitivity analysis was performed for several parameters in the exposure model to assess the significance of data gaps and uncertainties.

Life Cycle Impacts: The study presented examples using the Economic Input-Output (EIO-LCA) and the process Life Cycle Assessment (LCA) approaches to evaluate upstream phase impacts. It also applied two different fate-transport models to determine the downstream impacts of two chemical-based paint strippers in air and water. The limitations of different methodologies were discussed in the report.

#7:

Document Title: SUBSPORT Specific Substances Alternatives Assessment - Bisphenol A

Link to document: http://www.subsport.eu/wp-content/uploads/data/bisphenol_A.pdf

Author: SUBSPORT

Purpose of the Report: The SUBSPORT Case Story Database provided substitution examples as well as information on alternative substances and technologies from enterprises, published reports, and other sources. The case stories served to help companies or organizations searching for substitutes to hazardous chemicals. The report was conducted following the SUBSPORT Specific Substances Alternatives Assessments Methodology. The process laid out a series of steps, questions, data sources, and guidance for SUBSPORT assessors.

Report Summary: The focus of this alternatives assessment report was on BPA-free plastic bottles and containers for foods and drinks. The following alternatives were further assessed regarding hazard characteristics, and economical and technical feasibility: Polyethylene, Polyethylene terephthalate (PET), and Polypropylene (PP).

Key Findings:

Initial Screening:

To eliminate any alternatives that would pose a high risk to the environment or human health, SUBSPORT developed a database containing substances that are not acceptable as alternatives due to their hazards. All alternatives were screened against the SUBSPORT Database Screening Criteria (SDSC). Hazard characteristics (physical, human health, and environmental perspective) of alternatives were presented in a table format. A characterization of BPA based on its inherent hazards was also included.

#8:

Document Title: Assessment of Alternatives to Perchloroethylene for the Dry-Cleaning Industry

Link to document:
http://www.turi.org/content/download/7399/134622/file/2012%20M&P%20Report%2027%20Assessment%20of%20Safer%20Alternatives%20to%20Perchloroethylene.pdf

Author: Toxics Use Reduction Institute (TURI)

Purpose of the Report: This alternatives assessment case study follows the TURI Alternatives Assessment Process. The goal of the project was to assist dry cleaners to identify which alternatives offer the best fit for their facility. It also aimed to collect and provide background information about the use of perchloroethylene in dry cleaning.

Report Summary: Perchloroethylene is a solvent used for cleaning garments. The report evaluated technical, financial, environmental, health and safety, and regulatory information about alternatives to perchloroethylene dry cleaning systems. Overall, the alternative solvents assessed in this report, with the exception of nPB, exhibited less persistence, potential to bioaccumulate, or aquatic toxicity than perchloroethylene.

Key Findings:

Function and Performance: TURI compared the technical performance of the alternatives to that of perchloroethylene. It also compared the key technical parameters, regulatory and safety information that applicable to small dry-cleaning businesses in a table format.

Identification of Alternatives: TURI used the Massachusetts Department of Environmental Protection Environmental Results Program data to identify several alternative dry-cleaning solvents and alternative garment cleaning technologies. It provided the information source, brief data analysis and uncertainties on national and Massachusetts trends to replace perchloroethylene.

#9:

Document Title: Phthalate-free Plasticizers in PVC

Link to document: http://healthybuilding.net/uploads/files/phthalate-free-plasticizers-in-pvc.pdf

Author: Sarah Lott (Healthy Building Network)

Purpose of the Report: This Healthy Building Network (HBN) Research Brief examined replacements for phthalate plasticizers in Polyvinyl Chloride (PVC) building materials. The Healthy Building Network was founded in 2000 to reduce the use of hazardous chemicals in building products as a means of improving human health and the environment.

Report Summary: This paper took a detailed look at six phthalate-free plasticizer alternatives, three synthetic alternatives, and three bio-based alternatives, used in PVC building products. It detailed what was known and unknown about these substances' human health and environmental impacts, and compared them to the known effects of a standard phthalate used in PVC building products, diisononyl phthalates (DINP).

Key Findings:

Adverse Impacts (hazards):

HBN compared the manufacturing raw materials use and toxicity, human health toxicity, and ecotoxicity of the alternatives using the Chemical and Material Library (CML) in HBN's Pharos Project, European Chemicals Agency (ECHA) REACH registration dossiers and reports, GreenScreen® hazard assessments, U.S. Environmental Protection Agency (EPA) High Production Volume Challenge (HPV) chemical hazard characterizations, and previously conducted journal research. The results of their comparison of the alternatives and DINP were presented in a table format.

HBN indicated the data gaps in the table with question marks and discussed the source of data gaps and how it may impact the conclusion. The report included a brief discussion of the migration/exposure data gaps that cause difficulty in justifying claims that the plasticizers were of no concern to building occupants and PVC product users.

#10:

Document Title: Case Study 2: Chemical Substitution of a Hazardous Biologically Active Compound (Glitazone)

Link to document: https://www.nap.edu/catalog/18872/a-framework-to-guide-selection-of-chemical-alternatives (free PDF version - Page 177-194)

Author: National Academy of Sciences (NAS)

Purpose of the Report: This example demonstrated the steps of NAS Alternatives Assessment framework. It was specially designed to illustrate that how in-silico and in-vitro high throughput screening (HTS) data, animal toxicity data, and human health outcome data could be used to assess potential hazards associated with a chemical substitution.

Report Summary: This was a hypothetical study to find a substitution for a biologically active ingredient that has been identified to cause liver injury. The ingredient was commonly referred by its abbreviated trade name, Glitazone-T. Each of the alternatives had one or more human health or ecological hazards that were categorized as moderate to high.

Key Findings:

Adverse Impacts (hazards):

The study examined various data streams for hazard assessment by looking at in-silico, in-vitro, and in-vivo data. Computational Assessment of safety using QSAR models, in-vitro ADME assessments, in-vitro assays, Tomcat™ data, and the GreenScreen® classification system were used to compare the chemical and alternatives. The methods, information sources, and the data gaps were well documented. Detailed discussion on ecotoxicity evaluation was included (page 187-189).

Decision-Making:

The case study illustrated the effects of relative weighting on the overall ranking. Depending on the entity performing the Alternatives Assessment, subtle differences in a chemical's attributes and rankings might lead to selection (or deselection) of an alternative. Rationale, tools, and references were well documented. It also briefly discussed how uncertainty and data gaps were addressed.

#11:

Document Title: Socio-Economic Analysis (non-confidential version) Use of sodium dichromate as corrosion inhibitor in ammonia absorption deep cooling systems

Link to document: https://echa.europa.eu/documents/10162/18584504/afa_sd-0042-01-sea_en.pdf/64219392-e0cd-47a8-beaa-2c2745e3322f

Author: LANXESS Elastomers B.V.

Purpose of the Report: This socio-economic assessment (SEA) was part of the Application of Authorization (the application) submitted by LANXESS Elastomers B.V. The application was to use sodium dichromate as a corrosion inhibitor in the Ammonia Absorption Deep Cooling (AADC) systems. The AADC systems were part of the process used to produce ethylene-propylene diene m-rubber (EPDM). The aim of this SEA was to demonstrate that the socio-economic benefits associated with the continued use of sodium dichromate at the LANXESS facility outweighed the remaining risks to human health and the environment associated with prevalent use conditions.

The ECHA SEA guidance recommended setting up an iterative process where a qualitative assessment was conducted based on readily available data. In additional iterations, a more detailed and quantitative assessment is used until all key impacts are covered in a sufficiently robust way to draw a conclusion.

Report Summary: The SEA analyzed economic impacts over a 20-year timeframe. The methodology used was described in the ECHA guidance on the preparation of socio-economic analysis as part of an application of authorization, version 1, January 2011. The reference dose response relationship used for carcinogenicity of hexavalent chromium substances was agreed on at a 22nd meeting of the Committee for Risk Assessment (RAC) in September 2012. Exposure data were taken from the Chemical Safety report that was part of the application. The outcomes of the Analysis of Alternatives report for sodium dichromate corrosion inhibitor were considered when defining the Non-Use Scenarios (NUSs), Replacement (change) of the cooling system, and Replacement of the corrosion prone parts.

Key Findings:

<u>Identification of Alternatives</u>: Section 3.6 discussed past research regarding alternatives for the current technology. This section summarized the applicant's attempts to identify alternatives to sodium dichromate. Scientific literature was reviewed and experts at other companies and institutions were contacted regarding possible corrosion inhibitor alternatives. A water technology/treatment company was also contacted regarding possible alternatives. The Analysis of Alternatives report contained more information on these research efforts. Section 4 discussed the different cooling technologies that might be used to remove the heat generated during the production of EPDM. This section also briefly discussed considerations of changing the current cooling system to a different cooling system such as a vapor compression system and replacing the corrosion prone parts made of carbon steel with stainless steel or surface coated materials.

<u>Economic Impacts</u>: The SEA used the approach set out in the ECHA guidance on the preparation of socio-economic analysis as part of an application for authorization. Specific data used for this analysis were based on information gathered from questionnaires sent to the responsible staff in the company and site visits. Estimates of the cost of health impacts were based on the ECHA methodology and a worst-case approach. Human health impacts were monetized using exposure data from the applicant's Chemical Safety Report, using dose-response relationships from an ECHA study, and using the willingness to pay (WTP) value from an ECHA study. Internal economic impacts were estimated for scenarios where the company stopped using sodium dichromate in their cooling system. These impacts included the costs associated with installing, operating, and maintaining a new cooling system, investment costs, downtime costs, and loss of production capacity.

#12:

Document Title: Use of trichloroethylene as a solvent for the removal and recovery of resin from dyed cloth; Use of trichloroethylene as a solvent in a process to recover and purify resin from process water

Link to document:

https://echa.europa.eu/documents/10162/18584504/afa_tce-0014-01-aa_en.pdf/961d7630-6e20-4a73-9d9d-135113d81b4d

https://echa.europa.eu/documents/10162/18584504/afa_tce-0014-02-aa_en.pdf/9640ee7e-422c-489f-9827-3f3987c56d8f

Author: Vlisco Netherlands BV

Purpose of the Report: This report is one of the examples compiled by the European Chemicals Agency (ECHA) to demonstrate how applications for the requirements under the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) have been prepared.

Report Summary: This report presented an example of a downstream user requesting to use trichloroethylene as a solvent to remove and recover a synthetic resin from cotton cloth, as part of a textile dyeing process.

Key Findings:

Generally, the report was clearly written. Tables and diagrams were used to illustrate processes and other key information. Additional information was provided in appendices.

Performance and Function: The report used detailed description and process diagrams to explain the process steps, process conditions, and the function of tricholoethylene in the processes. It summarized the critical properties and quality criteria that the substance must fulfill, function conditions, process and performance constraints, customer requirements as well as industry/sector requirement sin a table.

Identification of Alternatives: This report considered not only switch-out solvents, but also other resists, alternative techniques, and the relocation of the production site.

Initial Screening: This report tabulated non-suitability for each identified alternative based on technical feasibility of the final product and the process, economic feasibility, availability, and the overall reduction of risk. The rationale was well justified.

#13:

Document Title: Washington State Antifouling Boat Paint Alternatives Assessment Report

Link to document:
https://static1.squarespace.com/static/5841d4bf2994cab7bda01dca/t/59a99c0403596e26c0ca8f6b/1504287758401/CuBP+AA+draft+final+report_2017_08_29_WMv2.pdf

Author: TechLaw and Northwest Green Chemistry

Purpose of the Report: This report presented an alternative assessment prepared for Washing State Department of Ecology for copper-based antifouling boat paint. This report followed the Washington State Alternative Assessment Guide for Small and Medium Businesses (WA Guide), which is based on the Interstate Chemicals Clearinghouse Alternatives Assessment Guide. Relevant endpoints considered included hazard, exposure, performance, and cost and availability.

Report Summary: The report assessed alternatives to copper-based antifouling paint following WA Guide through formal open stakeholder engagement. The results suggested that cost-effective copper-free antifouling alternatives were currently available on the market and that several of them were likely to meet performance expectations with reduced impact to human and marine health.

Key Findings:

<u>Identification of Alternatives</u>: The study identified both chemical alternatives including biocidal paints, non-biocidal paints, and non-chemical alternative technology based on different antifouling mechanisms.

<u>Initial Screening</u>: In this report, hazard assessment considered human and environmental health by focusing on particular toxicological endpoints associated with antifouling paints, such as chronic human health hazards including carcinogens, mutagens, reproductive/developmental toxicants and endocrine disruptors, neurotoxic or respiratory sensitizers, and persistent, bioaccumulative, aquatic toxicants. The underlying hazard assessment method is GreenScreen® methodology. An overall summary of results of alternatives assessment was available in the Selection Guide (Section 1.1) as well as a supplemental Excel worksheet. This was a format designed to inform decision-making with consideration of multiple endpoints combined with boaters' needs and preferences.

In addition, the study considered the exposure to workers and to the marine environment separately with qualitative and semi-quantitative metrics. The total amount of product applied over time and the release of volatile organic compounds served as proxies for exposure. There was also a discussion on how the use of PPE and the application methods can affect exposure.