Summary of Results & Lessons Learned from Demonstration Project

Summary of Results

This analysis found safer chemical alternatives to methylene chloride. Using GreenScreen® comparative hazard assessment method, only two of the eleven alternatives were screened-out—methanol and toluene—due to "high" hazard levels for developmental toxicity and/or reproductive toxicity. The remainder of alternatives (N=9) were safer, yet not free of hazards, as reflected in GreenScreen® Benchmarks.

For example, compared to methylene chloride, all of the alternatives ranked "low" regarding carcinogenicity. However of the nine safer alternatives, a majority (N=7) demonstrated high or very high hazard rankings for eye irritation. All but one alternative (dimethyl sulfoxide or DMSO), demonstrated at least one "high" hazard ranking for one human health endpoint, ecotoxicity endpoint, and/or physicochemical characteristic.

GreenScreen Benchmarks™ were developed to assist in decision-making about alternatives. The benchmark scoring process applies greater weight to human health endpoints versus ecotoxicity—with the exception of the prioritization of persistent, bioaccumulative, and toxic (PBT), very persistent and toxic (vPT), and very bioaccumulative and toxic (vBT) chemicals, where "toxicity" is a factor of either ecotoxicity or human health toxicity—and physicochemical characteristics. Among the human health endpoints, the scoring process applies greater weight to carcinogenicity, mutagenicity, reproductive toxicity, developmental toxicity, and endocrine activity versus other endpoints. Using these decision rules, nine alternatives were rated as a GreenScreen Benchmark™ 2 chemicals, "Use but search for safer substitutes." One alternative, DMSO was rated as a GreenScreen Benchmark™ 3 chemical, "Use but still opportunity for improvement."

While DMSO demonstrated the lowest hazard rating overall (highest benchmark score), DMSO can potentiate the hazards of other substances. It is well established that DMSO is a penetration enhancer of dermally applied/exposed substances. Given that the function of this chemical is to dissolve paints and varnishes, DMSO could potentiate the hazards of those substances (e.g., the hazards associated with lead in lead paint), and other substances in the paint stripper formulation. These results demonstrate that hazard ratings need to be considered with additional information about a substance—such as conditions of use—that help to inform the inherent hazards of that substance.

Lessons Learned

Lesson Learned #1

Information is readily available about functional requirements, performance requirements, and potential alternatives to methylene chloride based paint strippers —all Stage 1 analysis requirements under the California SCP regulations.

The Stage 1 analysis requires applicants to define a product's and chemical of concern's functional requirements, performance requirements, and to identify potential alternatives to methylene chloride in paint stripping products. Information relevant to all of these requirements was readily and publicly available.

With regards to functional requirements, the U.S. Department of Defense has sponsored a number of research projects examining alternatives to methylene chloride that have also served to enhance understanding about how methylene chloride functions in paint-stripping products. Research reports resulting from these grant-sponsored research programs are publicly available. While only a few of these reports are cited in this document, interested parties can search the Defense Technical Information Center (see: *http://www.dtic.mil/dtic*) for a number of related articles and papers on methylene chloride-based strippers and associated alternatives.

Performance standards are available for paint strippers through the American Society for Testing and Materials (ASTM). As paint strippers govern a wide range of applications, which include graffiti removal, other standards may be relevant, including those by Green Seal.

Recent regulatory actions significantly restricting the use of methylene chloride paint strippers in the European Union —including a consumer product ban—were supported by a number of research and market evaluation reports that examined the question of alternatives.[26] These papers contain lists and descriptions of potential alternatives. Seminal technical white papers published by research organizations and government agencies in the U.S. have also examined potential alternatives.[27] Many of the alternatives cited in the above documents can be found on home improvement store shelves today, based on a cursory review of available MSDSs.[28] Organizations such as the Massachusetts Toxics Use Reduction Institute are actively researching alternatives, including newer generation chemical alternatives in paint strippers.

Lesson Learned #2

Based on our assessment of the hazards of eleven chemical alternatives, safer alternatives to methylene chloride for use in chemical paint strippers are widely available.

As highlighted above, safer chemical alternatives to methylene chloride paint/varnish strippers are available. SCP regulations raise the question of how many alternatives must be assessed in order to be meet legal requirements. It is our viewpoint that it is sufficient to meet Stage 1 of the Safer Consumer Products regulations by identifying alternatives for the hazard under review and prioritizing those that appear from a market perspective to be economically viable and technically feasible. Of the alternatives assessed, many are known to be effective in paint and/or graffiti removal given that: (1) they are primary ingredients in paint stripping products on the market today based on a cursory review of MSDSs and/or (2) they have been shown in prior case studies to be safer and feasible —both technically and financially. While technical (performance) and economic feasibility assessments during Stage 2 are largely based on the question of feasibility from the perspective of the "responsible entity," the results of this assessment suggest that at least from a market perspective, feasible alternatives are available.

Lesson Learned #3

The action-orientation of alternatives analysis/alternatives assessment should guide the process from the beginning: the type and range of alternatives to consider should be informed by the capacity of business entities to adopt those alternatives.

Flexibility and an action orientation should guide the practice of alternatives assessments. For alternatives assessments to effectively guide the adoption of safer substitutes, the scope of the alternatives considered needs to reflect the capacity of firms to implement them. As one moves down the supply chain of participants required to comply with the SCP regulations, the capacity to adopt a broader range of alternatives increases. For a manufacturer of formulated chemical products, alternatives that are most feasible to adopt are limited (in most, but not all cases) to either process changes that eliminate the chemical of concern or chemical substitutes. For a retailer further down the supply chain, feasible alternatives are much broader, including chemical formulated products as well as a range of material substitutes, such as sand paper or metal scrapers (physical/mechanical alternatives) or heat guns (thermal alternative). Alternatives analyses need to allow for flexibility given differences in the types of alternatives that can be adopted by different participants in a supply chain.

This demonstration project was undertaken from the perspective of a company that manufactures chemical formulations. While the regulations require consideration of all types of viable alternative products (formulated chemicals, physical, mechanical), from the perspective of a formulated products manufacturer the only viable alternative is another formulated product, given pre-existing investments and knowledge. While this report acknowledges a broader range of paint stripping alternatives and cites sources of additional information about those alternatives, only chemical alternatives are examined in the hazard assessment step.

It is important to recognize that a consideration of exclusively chemical alternatives could limit the SCP regulations' goal of creating safer substitutes to toxic chemicals in consumer products. It is plausible that for a given application, and from a consumer perspective, the safest and best performing substitute for the money is a non-chemical paint stripper. However, for DTSC to identify safer consumer products, the Department needs entities across the supply chain to provide information about the hazards, life cycle impacts, technical and economic feasibility of all potential options—chemical and non-chemical alternatives. It remains to be seen if regulatory compliance alone will be enough to showcase the full range of alternatives. It is essential that research institutions, public health and environmental advocacy organizations, and others be prepared to provide additional information and support to DTSC during public comment periods to ensure that the SCP regulations can reach their potential of identifying safer consumer products.

Lesson Learned #4

Whether or not GreenScreen® is sufficient to meet the requirements of the California SCP regulations concerning hazard assessment criteria remains to be determined.

For the hazard screening step, this demonstration project used GreenScreen®, which assesses chemicals on the basis of 18 hazard endpoints. This project demonstrated the utility of using GreenScreen® for the hazard assessment of a chemical and its alternatives. It remains to be determined whether GreenScreen® alone is sufficient for the hazard assessment stage of the SCP regulations. Additional analysis beyond GreenScreen® assessments may be warranted for a hazard assessment depending on the priority product and its alternatives. Note that performing GreenScreen assessments is an intensive process that requires technical expertise that only the largest

of corporations typically have in-house. If GreenScreen assessments prove to be insufficient to meet the requirements of the SCP regulations, the costs to companies could be significant. In general the data requirements of the SCP regulations on the surface seem to be quite burdensome. For this project, BizNGO had access to experts in the field of alternatives assessment, and even under what could be considered best circumstances, we confronted questions about the sufficiency of our hazard assessments to meet the SCP regulations.

Lesson Learned #5

When conducting an alternatives assessment on formulated chemical products, the hazards of other chemicals in the formulation should also be considered.

The majority of chemical alternatives assessed in this demonstration project are those that function as a solvent —the same function as methylene chloride in a paint stripper. However, it is unlikely the alternative solvents can replace methylene chloride without any other reformulation to the product. Replacing the solvent will require reformulating the product to meet performance metrics. For the regulations to advance the goal of safer consumer products and to protect against regrettable substitutions, an additional assessment of hazards (or at minimum, a screen against authoritative hazard lists) should be performed on other chemicals above a threshold percent concentration in the formulation. For example, the U.S. EPA's Safer Choice program uses a cut-off of 0.01% (i.e., if a chemical is less than 100 ppm in a product, a hazard assessment does not need to be conducted in order for the product to qualify for the Safer Choice label).[29] This particular cut-off threshold is useful for many endpoints, but not for all. For example, for impacts such as endocrine disruption, a lower threshold is more appropriate given the extremely low concentrations that can activate/disrupt hormonal pathways. In addition, if products contain nanomaterials, lower thresholds may also be warranted given that the hazards of nanomaterials are better informed by particle counts contained in the product, rather than mass-based concentration measures.[30]

Additional Recommended Actions Not Undertaken in this Demonstration Project

Resource limitations, of the kind that most responsibility entities will also confront, constrained the scope of this demonstration project. For those using this report as a guide to compliance with California SCP regulations' Stage 1 requirements for methylene chloride-based paint strippers, we recommend:

- Considering a broader range of chemical alternatives. New bio-based solvents such as methyl soyate or ethyl lactate should be explored and tools such as the Hansen Solubility Parameters (HSP)31 may help identify a range of additional chemical solvents worth considering.
- Data permitting, considering a broader range of eco-toxicity endpoints. Hazard assessment tools such as the GreenScreen® assess chronic and acute ecotoxicity, which are the most widely available ecotoxicity data. However, additional eco-toxicity endpoints such as effects on organisms necessary for waste water treatment or terrestrial toxicity may be relevant for specific use scenarios of paint strippers. Information on these additional hazard endpoints should be considered wherever possible. The challenge, of course, is finding this data; which is typically not available for most chemical substances.
- Evaluating the hazards associated with all chemical ingredients in a formulated chemical product above 0.01%. As described in Lesson 4, it is important to consider the hazards of all chemicals in a formulated chemical product as the goal of an alternatives assessment is to ensure the final product is safer overall.

The use of alternatives analysis as being advanced by the California SCP regulations is one of the most important developments in recent years to advance the supply of safer chemicals and products. The regulations provide a framework for firms to identify that safer alternatives are available and are viable from a business perspective. The BizNGO Alternatives Assessment Work Group looks forward to working with multiple sectors as they begin the process of assessing their options for safer, feasible substitutes.