The Consumer Impact of California's Green Chemistry Initiative

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The Consumer Impact of California's Green Chemistry Initiative
(Key Findings)

- Because the regulations are broadly crafted and highly uncertain, our high-level model assesses a broad range of potential impacts of the SCP. We find that the SCP has the potential to cost California businesses and consumers over $170 billion in the first 25 years of implementation in our Potential for Adversity Case. The total net costs to California businesses and consumers in the first 25 years of implementation could approach $150 billion. The SCP will directly affect 123,000 jobs in California at the peak of implementation in our Potential for Adversity Case.

- The timing of costs and benefits realization is critically important to understanding the regulation. Costs are certain and front-loaded while the full benefits from reduced medical spending and increased productivity will not be fully realized until several decades later.

- The Department of Toxic Substances Control (DTSC) failed to meet its obligations to provide a meaningful economic analysis of the Safer Consumer Products (SCP) regulations as required by the Administrative Procedure Act (APA). The "Preliminary" filing frequently contradicts itself and fails to leverage existing literature that may shed light in regards to the potential adverse effect on California's consumers, businesses, industries and economy. Specifically, the Department's submission fails on the following requirements:

  - Fails to provide analysis of "potential for adverse impact on California business," as required by the APA. DTSC, rather provides a descriptive analysis of the most "optimistic" scenario without discussion of risks and costs. DTSC ignores current literature available that quantifies the costs of similar initiatives;
  - Fails to provide an analysis of the impact of the SCP on the competitiveness of California's industries. DTSC ignores discussions regarding impact on ability of California firms to compete with other producers, particularly with to laxer jurisdictions such as China;
  - Fails to provide a meaningful cost analysis, either cost-benefit or cost-effectiveness. The Department submits a narrative cost-benefit analysis. No quantitative study is performed;
  - Fails to provide an impact on jobs. DTSC did not assess the impact on California employment;
  - Fails to provide an impact on key industries/businesses. DTSC fails to provide any assessment on key industries, such as manufacturing, retail and personal services;
  - Fails to provide an impact assessment on the housing market. DTSC did not make an effort to assess the impact of the proposed rulemaking on housing;
  - Fails to assess reporting burdens. Though the SCP will have significant reporting burdens, DTSC reports that there are no reporting burdens associated with the proposed rulemaking;
  - Fails to provide guidance on alternative means of applying the statute. DTSC does not asses any alternative framework or provide an assessment of performance based regulations as is required;
  - Provides incomplete state government fiscal impact. DTSC provides only cost estimates for a limited classification. No startup, IT infrastructure or contractor costs of implementing the regulations are specified; and
  - Fails to provide local government fiscal impact. DTSC fails to assess the impact of the regulations on local governments.

The Consumer Impact of California's Green Chemistry Initiative
Executive Summary

Governor Arnold Schwarzenegger signed two bills into law in 2008 that created the California Green Chemistry Initiative (GCI) with the goal of dramatically reducing or eliminating the use of toxic chemicals in products that are produced, distributed and sold in the state. Recently, the Department of Toxic Substances Control (DTSC) released its formal draft Safer Consumer Products (SCP) regulations to implement CGI for public review in July 2012. SCP identifies over 2,000 chemicals that could be subject to ban in the California marketplace and proposes to prioritize 85 chemicals that manufacturers, distributors and retailers must mitigate in the marketplace. However, the SCP provides little information on the potential for adverse impact on California's consumers, businesses, industries and economy and creates dramatic regulatory uncertainty for manufacturers and other stakeholders with billions of dollars of potential costs awaiting them.

Under the California's Administrative Procedures Act (APA), departments promulgating regulations are required to assess "the potential for adverse economic impact on California business enterprises and individuals" as part of the regulatory process. Specifically, promulgating departments are required to assess the impact of the proposed regulations on impacts to jobs, housing, industry competitiveness and costs. The purpose of this provision is to "provide the public with a meaningful opportunity to participate in the adoption of state regulations and to ensure that regulations are clear, necessary and legally valid."[1]

However, DTSC failed to meet its obligation to provide a meaningful fiscal and economic impact assessment. The analysis is more than just an academic exercise; a true fiscal and economic analysis must be complete and accurate to create the best regulatory program possible. Without a comprehensive analysis, we do not have the faith that DTSC developed the

[1] California Office of Administrative Law, "Administrative Procedure Act & APA Regulations," http://www.oal.ca.gov/administrative_procedure_act.htm, accessed in September 2012.

best possible regulatory scheme under the statute. As highlighted in Table ES.1, the analysis was structurally deficient in the numerous administrative and content issues.

Table ES.1
DTSC Analysis Deficiencies

Requirement	DTSC Form 399 Analysis	Comment
Potential "adverse" impact on CA business	▪ N.A.	▪ DTSC does not provide guidance. ▪ Contractor appears to report the most "optimistic" scenario. The contractor does not report potential risks or potential "adverse" effects on California businesses or industries.(1)
Impact on competitiveness	▪ N.A.	▪ DTSC does not provide guidance. ▪ Contractor assertions appear to be speculative, based on optimistic outlook and does not provide sufficient support.
Total cost analysis	▪ N.A.	▪ Neither DTSC nor its contractors provide quantitative cost analysis, either cost-benefit or cost-effectiveness. ▪ Contractor notes, "Our overall assessment, despite the fundamental uncertainties, is that these regulations will offer California significant net benefits."(1)
Impact on jobs	▪ N.A.	▪ DTSC does not assess impact on California jobs. ▪ Contractor speculates, "It is impossible to offer precise predictions concerning how California jobs will be affected."(1)
Impact on key industries / business	▪ N.A.	▪ DTSC does not assess impact on key industries.
Impact on housing	▪ N.A.	▪ DTSC does not assess impact on housing market.
Reporting burdens	▪ N.A.	▪ DTSC reports that there are no reporting burdens on its Form 399, directly contradicting their contractor's assessment.
Guidance on alternatives	▪ N.A.	▪ DTSC does not assess alternatives.
State government fiscal impact	▪ N.A.	▪ DTSC does not assess total state government fiscal impact. DTSC provides what appears to be a partial assessment of costs in its attachment.
Local government fiscal impact	▪ N.A.	▪ DTSC does not assess local government fiscal impact.

SOURCE: (1) Kahn, Matthew E., "Economic Analysis of California's Green Chemistry Regulations for Safer Consumer Products," Department of Toxic Substances Control, March 2012.

DTSC has failed to provide specificity to its SCP regulations, creating a vast amount of uncertainty for the fiscal and economic impact of the regulation, as well as its potential scope. Regardless of the uncertainty created by the broadly proposed regulations, a meaningful fiscal and economic analysis is not unachievable as suggested by DTSC. Our research indicates that fiscal and economic impact assessments have been conducted in other jurisdictions with similar programs. Though current literature indicates that California's program may be more far reaching than Europe's REACH program, and therefore more costly, a review of the literature

provides the basis for a high-level review of SCP regulations. Table ES.2 summarizes some of the key findings from current literature regarding the costs of REACH:

Table ES.2
Current Literature Regarding Similar Programs
(Partial List)

Study	Scope	Key Findings
Commission of the European Communities: "Regulation of the European Parliament and of the Council concerning [REACH]"	▪ REACH program ▪ Includes registration, testing, agency fees and administrative costs over 11-15 years	▪ €4.7 billion - €7.8 billion
Getzner: "Uncertainties and the precautionary principle in cost-benefit environmental policies"	▪ REACH program ▪ Tremendous uncertainty and vast unknowns ▪ Includes public sector implementation, direct private sector costs (registration and admitting newly developed chemicals), indirect private sector costs (competitive disadvantages and delayed market access) and costs of product and procedure changes	▪ A broad range of possible costs and benefits are possible ▪ €0.3 billion - €2.3 billion in total costs for implementation in Austria alone
Rovida: "Re-Evaluation of Animal Numbers and Costs for In Vivo Tests to Accomplish REACH Legislation Requirements for Chemicals"	▪ REACH program ▪ Includes testing costs only	▪ EU drastically underestimates costs ▪ May require as many as 54 million test animals ▪ Original assumptions drastically understated scope ▪ €9.5 billion, although this should be considered optimistic and the number of animals required may nearly triple
Vernon: "Revised Business Impact Assessment - Consultation Document"	▪ REACH program ▪ Full scope of the program, as laid out in the Consultation Document ▪ Includes registration, testing, reporting and other minor impacts	▪ Prior reports understate costs ▪ Preparing CSR will cost €2,500-€33,650 per substance ▪ €12.8 billion - €26.5 billion over 15 years, range due to uncertainty of number of polymers included
KPMG Business Advisory Services: "REACH - further work on impact assessment: A case study approach"	▪ REACH program ▪ Impact availability of substances and materials, the competitive position of EU companies in global supply chains, innovation, business benefits and recycling and recovery in the (in)organics sector ▪ Case study on automotive, inorganic, flexible packaging, and electronics sectors ▪ Includes registration and testing	▪ One time product costs increase of 6-20% passed on to consumers

The widely available literature on the impacts of REACH estimates the potential costs for testing and registration of between €4.7 billion and €26.5 billion based on just the selected literature. Additionally, case studies on chemical replacement are available and suggest switching costs of as low as 2/10th and as high as 10 times the original cost.

DTSC must analyze the entire regulation collectively rather than the fiscal and economic impacts of each individual product for some key reasons. Due to the uncertainty of the regulation and the products that could potentially be chosen, there is the potential for an overlap between affected products or an exponential increase between products. Overlapping costs could lead to smaller expenditures and thus reduce the potential impact of the regulation; however, affecting a product that feeds into the supply chain for other products could create exponential costs that would significantly increase the cost of the regulation. Individual fiscal and economic analyses would be inadequate to measure the interplay between regulated chemicals and products.

Building on the available research and utilizing generally accepted principles of policy and economic analysis, we assess DTSC's proposed SCP regulations. Our analysis uses widely available academic, agency and industry data and literature to estimate the potential costs and benefits under a wide range of policy scenarios. We rely on the experience of Europe's REACH program to draw meaningful analogies of costs and report on a range of potential outcomes. This calculation is consistent with public commentary on the similarities between the two programs with regards to the requirements of testing and alternative analyses. Because parts of California's program are viewed as more far reaching and more costly than Europe's, we believe that this approach tends to underestimate the true impact of SCP. Though we report a range, we emphasize the more expensive end of the range in our findings per California Government Code, Section 11346.3 which specifies that the analysis should focus on the "potential adverse" effects of the proposed regulations on California's consumers, businesses, industries and economy.

Key to our analysis is the consideration of timing of benefits and costs. We believe that any thoughtful analysis of the proposed regulations would need to consider the timing element. Namely, mainstream research indicates that costs would time with the implementation of the regulations and would likely be more immediate. However, benefits would not fully materialize

until later years as economic benefits from avoided healthcare costs and increased worker productivity are realized.

Our costs come from ranges based on literature available, including the administrative costs of managing existing products and analysis costs of existing and replacement chemicals, the costs associated with switching from current chemicals to alternatives, and the actual size of the market affected. These costs accumulate over the life of the regulation and our report reflects the total increase of these costs over what would have been the business-as-usual model without such a regulation.

The additional costs to final demand for goods in-state will ultimately be borne by the consumer, and as such will directly affect California jobs. Since the regulation affects chemicals, intermediate goods and final products within the state, the impacts will largely be felt in California as the final costs will be passed to end-user such as manufacturers, distributors, retailers and consumers. The increased costs of goods (or lack of goods, as the case could be) will directly affect consumer choice and spending.

Our range of impacts is also based, in part, on the uncertainty of the regulation. Since the size of the market could vary depending on the final regulation, we first estimate what the impact would be depending on what percentage of the California market would be affected. We then provide a range for that market size based on how the impact could shift between regulated industries in the state. Part of this range is based upon the expected reaction of consumers to costs and part is based upon how costs are potentially passed through the supply chain, from chemical manufacturer to manufacturer to distributor to retailer.

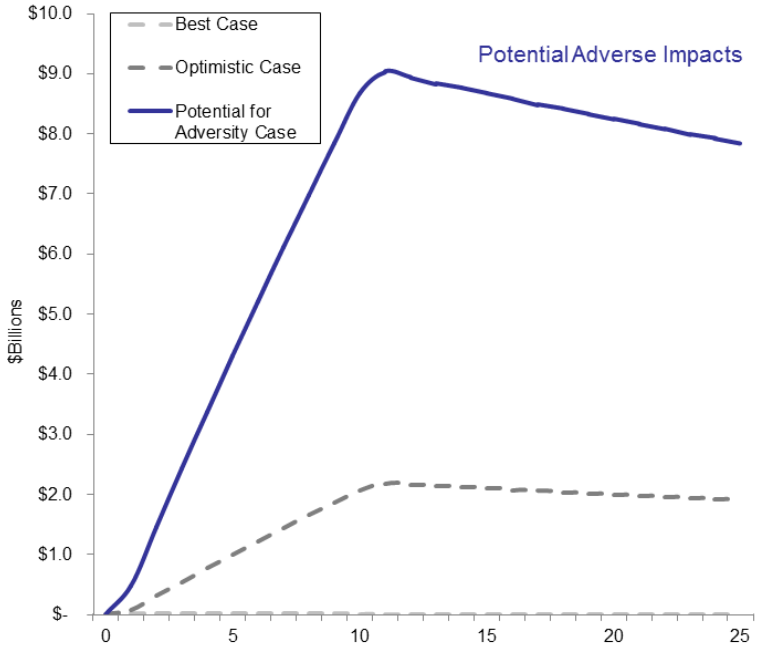
There is also the real potential for greater job losses outside of these sectors and outside of California due to the ripple effect of lost employment in other sectors and supporting industries. Since a potentially significant portion of the affected market lay outside of California, impacts to California consumers would ultimately affect out-of-state manufacturers and distributors. Costs that reduce consumer demand could have impacts to producers in states with heavy chemical

manufacturing such as Massachusetts, Texas, and Louisiana. These are impacts that occur along the existing supply chain of production. In addition, lost employment in any sector will naturally have some impact in other sectors of the economy. The lost salaries of those affected employees will not be spent on consumer goods and services, affecting a wider swath of the economies of California and the nation.

Consumer Impacts

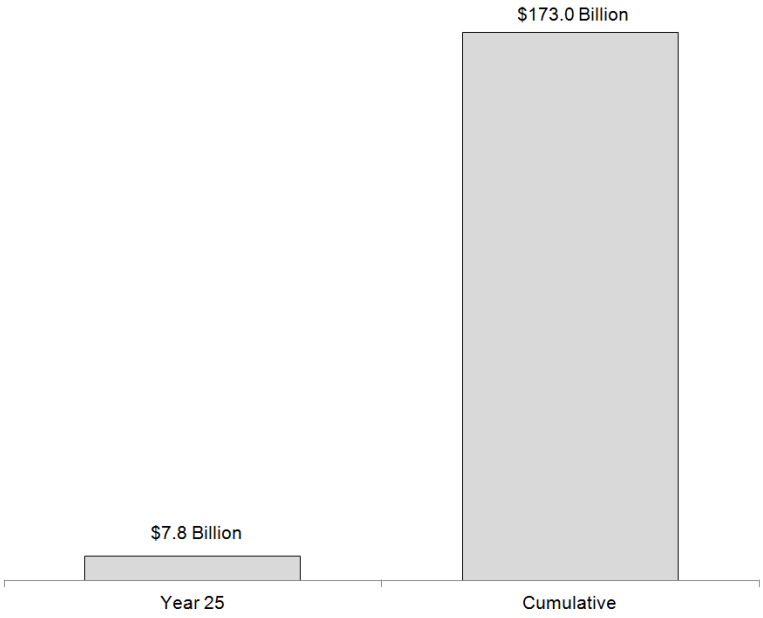
We considered implementation timeframes for both costs and benefits and modeled the impacts through the initial 25 years of the regulation. We found a range of significant impacts are possible under the rule; in all scenarios, costs were highest in early years, while benefits tend to accrue in later years. In all cases, costs are highest in years 1-10 as the program is being implemented, which includes significant testing and administrative costs, and decline over time as technology for alternatives improves. At no point during the timeframe we model do the potential benefits exceed the costs in the Optimistic or Potential for Adversity scenarios. In the Potential for Adversity Case, cumulative net costs could exceed $150 billion in year 25.

Figure ES.1
Annual Costs



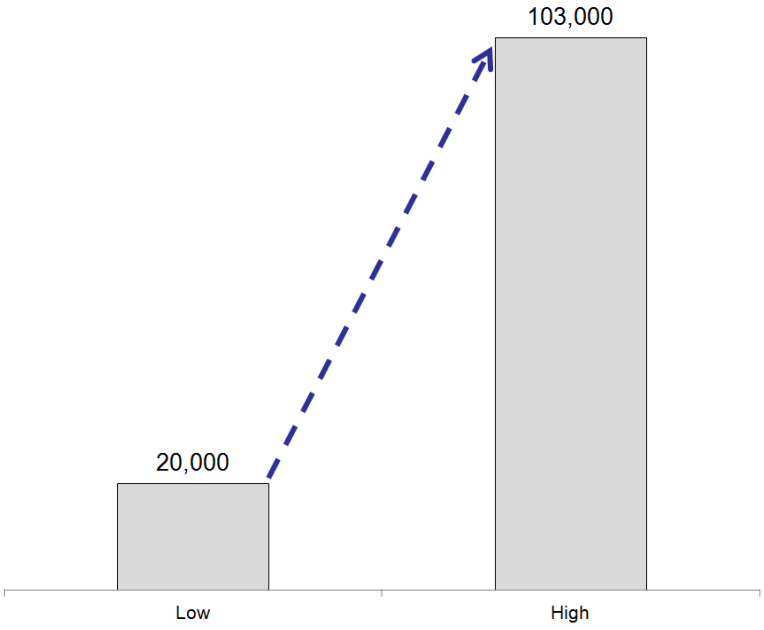
We focus on the Potential for Adversity Case as because the requirements of the state's fiscal and economic analysis indicate the target must be the potential adverse impact of the regulation. As highlighted in Figure ES.2, costs could reach $7.8 billion in Year 25 and cumulatively cost $173.0 billion in total. The direct cumulative cost over this period is multiple times larger than the General Fund of the entire state of California.

Figure ES.2
Potential for Adversity Case Consumer Impact



In this scenario, directly affected industries could lose as many as 103,000 jobs in Year 25 as seen in Figure ES.3. At the peak during this 25-year period, over 123,000 jobs could be lost before some are recovered in later years as costs decline. These could occur along the supply chain from the production of raw products to manufacturers to distributors and retailers. The point along the supply chain costs are absorbed determines how many jobs are lost.

Figure ES.3
Potential for Adversity Case Direct Employment Losses



Conclusion

In our judgment, DTSC did not meet its obligation to provide policy decision makers and the general public with the information specified in the APA and by the Department of Finance (DoF) to facilitate a meaningful discussion of the proposed rulemaking. DTSC is ambiguous and at times contradicts itself in its submission and fails to provide virtually any of the analysis specified by the APA and the DoF. Moreover, DTSC ignores relevant and widely available literature on similar initiatives.

Even with the considerable uncertainty, an assessment of the SCP proposed rulemaking is not impossible as DTSC would indicate. Other jurisdictions that have implemented similar programs have conducted assessments. Rather, the far reaching aspirations of the proposed rulemaking make it more imperative for a thorough analysis to be conducted. Our independent assessment indicates that costs to consumers could exceed $170 billion over the first 25 years of the program and that the job losses to impacted industries could reach 123,000 jobs. We

think that DTSC's self-labeled "Preliminary" assessment should be returned so that a more thorough and thoughtful analysis can be conducted.

The Consumer Impact of California's Green Chemistry Initiative

1. Background

In 2008, Governor Arnold Schwarzenegger signed two bills to create the California Green Chemistry Initiative (GCI), with the aim of reducing or eliminating the use of toxic chemicals in California's consumer products. The legislation designated the Department of Toxic Substances Control (DTSC) to establish a process to identify and evaluate "Chemicals of Concern" that could be used by policy makers and industry to find safer alternative chemicals for use in consumer products. The regulations propose to implement the statute by creating a large list of "Chemicals of Concern," and from that a smaller subset of "Priority Products" would be subject to regulatory mandates potentially including a ban in California and fines and levies against manufacturers. These are specific product-chemical combinations. For example, lead in batteries. In this case, all battery makers who sell in California would be required to test they products and, if they contain lead, begin the alternatives analysis process and be subject to regulations.

Though the law was scheduled to go into effect on January 1, 2011, the regulations to implement the law was delayed "to further vet the programmatic issues that have been brought to our attention via the public comment process," according to Linda Adams, CalEPA Secretary. During that period, DTSC has engaged in multiple public comment periods and several iterations of the proposed regulations. In July 2012, they released the latest proposed "Safer Consumer Products" (SCP) regulations to begin implementation of the GCI.

In the last few years, several domestic and international governments have instituted similar policies. The scope and approach of the programs vary widely, but California's program is widely considered the most far reaching program. The program that is closest in scope to California's, though arguably less onerous, is Europe's Registration, Evaluation, Authorization and Restriction of Chemical substances (REACH) program.

To date, no meaningful fiscal or economic analysis has been conducted to estimate the costs to California of SCP, despite the requirements of the California Administrative Procedure Act. DTSC cites too many unknowns in terms of the costs for firms to meet these regulations to allow for such analysis. DTSC fails to quantify the potential adverse impact on businesses and individuals, but list much of their information as unknown or measure their findings are preliminary, citing the need for implementation before more accurate assessments can be made. Unfortunately, the problems associated with this regulation require legitimate quantitative analysis before moving forward – analysis that the hired consultants indicated they were incapable of providing to the Department.

Like SCP, California does have another program for chemical compliance for in-state and out-of-state manufacturers. Proposition 65, a law passed by California voters in 1986, requires that all consumer products that contain any substances that could potentially cause cancer and birth defects must be labeled in advance. The law places the burden of evidence upon producers like SCP and requires testing for compliance, increasing consumer costs.

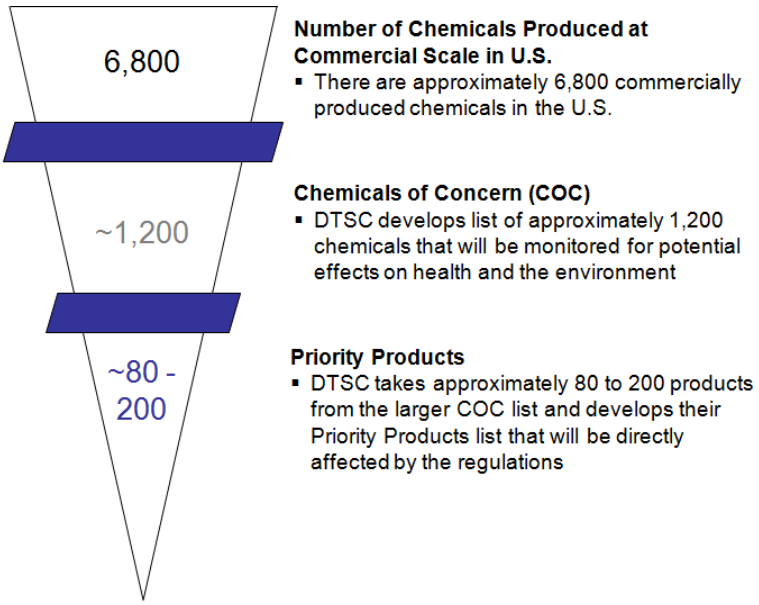
However, the scale of SCP is significantly larger than Proposition 65 and would likely increase costs further. Unlike the approximate 900 chemicals regulated by Proposition 65, the SCP could potentially regulate any of 100,000 chemicals.[2] In press during the release of the draft regulations, the acting director for DTSC even stated that the regulation is "the first of its kind in the nation."[3] The scale and scope of SCP translate into significant effects in the public and private sector – effect that must be addressed by DTSC.

The program itself will ultimately target between 80 and 200 products initially in the program's Priority Products (PP) list, as seen in Figure 1.1. This figure will be selected from the approximately 1,200 chemicals on the Department's Chemicals of Concern (COC) list. While the

[2] Lambert, Charles, "California's Sweeping Green Chemistry Initiative Gains Ground," TriplePundit, November 18th, 2010.
[3] Department of Toxic Substances Control, "DTSC Releases Draft Green Chemistry Regulation," June 23, 2010.

larger COC list is subject to some scrutiny, the smaller list of products will be heavily affected by the regulation, and the program has the potential for a significant increase because of a publicly-available petitioning process for the addition of chemicals and products.

Figure 1.1
Scale of California Program



SOURCE: Department of Toxic Substances Control, "Safer Consumer Products: Summary of Proposed Regulations," July 2012.

SCP places the primary responsibility of meeting the requirements of the regulation on manufacturers that have products and intermediate goods reaching the California market. Manufacturers will be responsible for notifying DTSC that its product is a Priority Product or alternatively submitting an Alternatives Analysis (AA) Threshold Exemption Notification or a Chemical of Concern Removal Notification to remove the good from scrutiny, performing an AA and submitting that report to DTSC for its product to meet the requirements of sale, and ultimately complying with regulatory responses applicable to the product should it not reach the requirements of the standard. The monitoring regulations outlined would apply to all consumer products that contain a Chemical of Concern and are sold, offered for sale, distributed, supplied, or manufactured in California, exempting medical and dental equipment, food and pesticides, or

products manufactured or stored in or transported through, California solely for use outside of the state.

Importers and distributors bare some role as well. They will be responsible for ensuring that manufacturer has fulfilled its compliance responsibilities, and if they have failed to do so, fulfilling the compliance responsibilities. Retailers too are responsible for monitoring DTSC listing of out of compliance products to remove from sale.

2. Approach

Our study was completed in two key phases: first, the review of current literature and a critique of DTSC's fiscal and economic analyses; and second, the development of a model to estimate the range of potential costs and benefits of the SCP regulation to California consumers.

Initially, we focused on reviewing the current literature surrounding green chemistry efforts around the country and internationally. We reviewed academic research, government reports and industry analyses, with an emphasis on any analysis which estimated costs for chemical switching or green chemistry program implementation. After completing a thorough literature search, we then looked at the analyses completed by DTSC. After having read through the existing literature on costs for analogous green chemistry efforts, we found there were significant reports that indicated costs for each aspect of California's SCP regulation. We also analyzed these reports through the requirements of the State Administrative Manual to determine if the state's standard for measuring potential fiscal and economic impacts were met.

The second phase of our analysis encompassed the development and refinement of our cost-benefit model. We identified the most credible sources of data currently available and relied exclusively on publicly available data. Unlike previous California analysis, we sought to develop a model that would accurately gauge the costs and benefits over a period of time to the all California consumers and manufacturers. Our model incorporates two primary models, a cost model that measures the primary costs to manufacturers, as is consistent under the regulation, and a benefit model that measures savings on medical spending, improved productivity and the decreased need for cleanup. For all of our modeling and key data, we have provided clear and concise data.

3. Review of Green Chemistry Programs

There are several other U.S. states and nations that have different programs that meet some aspect of “green chemistry,” all of them at least targeting the identification of harmful chemicals. As highlighted in Table 3.1, most of these programs are only slightly similar to California’s SCP regulations. California’s program is widely regarded as the most far reaching program both domestically and internationally.

The domestic programs, encompassing Connecticut, Maine, Minnesota and Washington, were all born out of programs that initially targeted the removal of certain chemicals from children’s products:

- Connecticut’s program offers education, training and research assistance to in-state businesses on the availability and use of safe and effective alternatives to traditional chemicals. It requires the state to identify "toxic substances" and recommend the maximum permitted levels of such substances, as well as safer alternatives and creates a Chemical Innovations Institute as a vehicle for advancing research and education.
- Washington State has focused on expanding education and working in-hand with industry. Though the state is still developing its roadmap, their goal is to create awareness of particular chemicals while also building an education system for industry and consumers to understand why such chemicals should be removed from production. In order to develop these goals, the state is funding research and enhancing research and educational opportunities, promoting safer chemicals and product innovation when applicable, and trying to accelerate economic development regarding the green chemicals sector. The program also suggests that their Legislature should consider green chemistry policy options to maintain state competitiveness and support economic development opportunities. Washington also

marries this effort with a regulation that affects lead and other chemical usage in children's products.

Table 3.1
Comparison of Other Green Chemistry Programs

Program	Private Reporting	Private Testing	Private Alternatives	Forced Phase Out	Fines & Penalties	Affects Products	Affects Chemicals
California	✔	✔	✔	✔	✔	✔	✔
Australia	—	—	—	—	—	—	✔
Japan	—	—	—	—	—	—	✔
U.S. EPA Toxic Substances Control Act	—	—	—	—	—	—	✔
U.S. EPA Design for the Environment	—	—	—	—	—	✔	✔
U.S. EPA Consumer Product Safety Commission	—	✔	—	—	—	✔	✔
Canada	—	—	—	—	—	✔	✔
Connecticut	—	—	✔	✔	—	—	✔
Minnesota	✔	—	—	✔	—	✔ (Children's products)	✔
Washington	✔	—	—	✔	—	✔ (Children's products)	✔
Maine	✔	—	✔	✔	—	✔ (Children's products)	✔
European Union	✔	✔	✔	✔	—	✔	✔

SOURCES: State of Connecticut, Public Act No. 08-106, "An Act Concerning Child Product Safety," October 1, 2008; Graham, Diana G., David J. Kent, Sheila A. Millar, Jean-Cyril Walker, "Green Chemistry Update: Maine Releases List of Chemicals of High Concern," Keller and Heckman LLP, July 31, 2012; Minnesota Pollution Control Agency, "Green Chemistry and Design," http://www.pca.state.mn.us/index.php/preventing-waste-and-pollution/index.html, accessed in September 2012; Washington Department of Ecology, "Sustainability," http://www.ecy.wa.gov/sustainability/greenchem.html, accessed in September 2012; U.S. Environmental Protection Agency, "Green Chemistry," http://www.epa.gov/greenchemistry, accessed in September 2012; U.S. Consumer Product Safety Commission, "The Consumer Product Safety Improvement Act (CPSIA) of 2008," http://www.cpsc.gov/about/cpsia/cpsia.html, accessed in September 2012; U.S. Environmental Protection Agency, "Summary of the Toxic Substances Control Act," http://www.epa.gov/lawsregs/laws/tsca.html, accessed in September 2012; U.S. Environmental Protection Agency, "Design for the Environment," http://www.epa.gov/dfe/, accessed in September 2012; Royal Australian Chemical Institute, "Green Chemistry Challenge Awards," http://www.raci.org.au/events-awards/national-awards-2012/green-chemistry-challenge-awards, accessed in September 2012; GreenCentre Canada, "Green Chemistry," http://www.greencentrecanada.com/green-chemistry, accessed in September 2012; European Commission, "REACH," http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm, accessed in September 2012; National Science Foundation, Tokyo Regional Office, "Green Chemistry in Japan," http://www.nsftokyo.org/ssr04-01.html, accessed in September 2012; Department of Toxic Substances Control, "Safer Consumer Products: Summary of Proposed Regulations," July 2012.

- Green chemistry efforts in Maine focus on children's products; the program regulates the manufacture, sale and distribution of various chemicals in those products. The state requires identification of "High Concern Chemicals" and a ban on children's products containing "Priority Chemicals" if safer alternatives exist and does contain some small fees for analysis and reporting, though official estimates expect a charge of less than $100 per product.
- Minnesota's program is also an effort at removing chemicals from children's products. The program recommends mechanisms to industry to reduce and phase out the use of identified "Priority Chemicals" in children's products and promote the use of safer alternatives. The state is required to identify and publish a list of these "High Concern Chemicals" and "Priority Chemicals" and submit a report to the state legislature that outlines ways to reduce and phase out the use of certain chemicals in children's products and promote the use of safer alternatives.

The U.S. Environmental Protection Agency (EPA) has no formal green chemistry program, but does have a series of programs that address chemical safety and consumer protection. The first program that most closely aligns with the traditional goals of green chemistry is the Design for the Environment program with the goals of promoting the research, development and implementation of chemical technologies that accomplish pollution prevention in a "scientifically sound and cost-effective manner." The EPA wants to recognize and support chemical technologies that reduce or eliminate the use or generation of hazardous substances during the design, manufacture and use of chemical products and processes. They also support research in the area of "environmentally benign" chemistry through voluntary partnerships with academia, industry, other government agencies and non-government organizations.

Two other EPA programs have been in existence since the 1970s to maintain consumer product safety and reduce chemical toxicity. Each of these programs deals with different facets

of what has become California's SCP. The Toxic Substances Control Act (TSCA) is specifically geared towards the control and understanding of new or emerging chemicals in the market and their potential for toxicity. However, the program itself treats existing chemicals on its larger list as otherwise normal. The Consumer Product Safety Commission (CPSC) has recently begun to examine chemicals used in the manufacture of children's products, in addition to its traditional role of monitoring the safety concerns regarding products. These new rules from 2008 placed the burden of some compliance on manufacturers to address potential concerns. Manufacturers are required to test their products at CPSC-approved laboratories before they can be cleared for the market.

Australia, Canada and Japan each have green chemistry programs that are largely directed at enhancing the collaboration between government, higher education and private industry. One of the goals of each of these programs is to find ways of enhancing the international competitiveness of their respective industries on green chemistry issues. These countries see grants and other investments into green chemistry fields, the setting of performance measures instead of prescriptive measures backed with government funding, as the best way to achieve the reduction of certain chemicals and shifting domestic industries towards green chemistry.

In contrast to the various states and nations described previously, the European Union (EU) has taken more aggressive steps to reach green chemistry targets through their REACH program. They are only other program than California's that targets the life-cycle of chemicals and products and uses government agencies to call for private industry to remove identified chemicals from the market or face a product or chemical ban. However, EU's program also seeks to enhance innovation and competitiveness of their domestic chemicals industry by the creation of information clearinghouses and the sharing of data. Their program requires manufacturers and importers of chemicals to obtain relevant information on their substances and to use that data to manage them safely as well as share data between each other. They also allow for analyses on alternative substances or technologies, as well as any relevant

substitution plans. It is also important to note that the EU's program is the only other program with a large estimated cost associated with implementation: official estimates peg the total cost at €5 billion over a decade of implementation, however other governmental, academic and industrial studies estimate the cost at several billion Euros annually.

California's SCP program is specifically designed to provide for a "continuous, science-based, iterative process" to identify consumer product alternatives to potentially harmful chemicals and products, as well as evaluate the availability of potential alternative chemicals and potential hazards posed by those alternatives. The state is also developing a life cycle assessment tool that would take several factors into account, greater than just chemical use and potential health hazards. They include: product function or performance, useful life, air and water conservation and quality impacts, energy efficiency and input, greenhouse gas emissions, waste and end-of-life disposal, public health impacts (including potential impacts to sensitive subpopulations, including infants and children), environmental impacts and economic impacts.

As we will show, the fiscal and economic impacts of this program are unknown based on current internal analyses.

4. Literature Review

As part of our assessment, we examined existing literature to find governmental, academic and industrial cost estimates on other analogous green chemistry measures and similar efforts. We discovered that there is limited literature discussing the potential costs or impacts from California's program. However, there is more literature available about other, more mature programs, particularly Europe's REACH program. Though California's program is regularly regarded as more far reaching and onerous to industry, we believe that REACH is the most analogous program currently in operation. This calculation is consistent with public commentary on the similarities between the two programs with regards to the requirements of testing and alternative analyses. For example, a scientific advisor for GCI indicated that REACH was "considered as a model" for chemical regulation in California and the development of the SCP.[4] Additional, articles from the American Bar Association[5] and regulatory specialists dealing with REACH[6] indicate that California's SCP is closely aligned with REACH on a number of regulatory factors.

We sought further literature about the program to find better analytical evaluations of the potential costs and benefits of the program. The literature we found about the REACH program suggests that the regulations may impose significant costs on California businesses and consumers as summarized in Table 4.1.

[4] Black, Harvey, "Chemical Reaction: The U.S. Response to REACH," Environmental Health Perspectives 116(3): A124–A127, March 2008.
[5] Chen, Patricia J., "Navigating California's REACH, aka, the Green Chemistry Initiative," Natural Resources & Environment 26:4, Spring 2012.
[6] EcoMundo, "Strategies for REACH Compliance," March 23, 2012.

Table 4.1
Partial List of Literature on REACH Program Costs

Study	Scope	Cost Findings
Commission of the European Communities	▪ Includes registration, testing, agency fees and administrative costs over 11-15 years	€4.7 billion - €7.8 billion
Getzner	▪ Includes public sector implementation, direct and indirect private sector costs and product and procedure changes	€0.3 billion - €2.3 billion (Austria alone)
KPMG Business Advisory Services	▪ Includes registration and testing ▪ Case study on automotive, inorganic, flexible packaging and electronics sectors	One time product costs increase of 6-20%
Rovida	▪ Includes testing costs only	€9.5 billion total
Vernon	▪ Includes registration, testing, reporting and other minor impacts over 15 years	€12.8 billion - €26.5 billion

SOURCES: Commission of the European Communities, "Regulation of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restrictions of Chemicals (REACH), establishing a European Chemicals Agency and amending Directive 1999/45/EC and Regulation (EC) {on Persistent Organic Pollutants}: Extended Impact Assessment," SEC (2003) 1171/3, October 29, 2003; Getzner, Michael, "Uncertainties and the precautionary principle in cost-benefit environmental policies," Journal of Policy Modeling, 30 (1): 1-17, 2008; KPMG Business Advisory Services, "REACH - further work on impact assessment: A case study approach," KPMG International, July 2005; Rovida, Costanza and Thomas Hartung, "Re-Evaluation of Animal Numbers and Costs for In Vivo Tests to Accomplish REACH Legislation Requirements for Chemicals," ALTEX 26 (3): 187-208, 2009; Vernon, Jan, Anthony Footitt, Tobe Nwaogu, "Revised Business Impact Assessment - Consultation Document," European Commission Enterprise Directorate-General, October 2003.

Costs to Industry

One of the key findings across the found literature is that implementing a similar system to the REACH program involving product registration and testing will have significant costs industry and consumers. One study found the REACH program distorted capital flows to and within Europe and created a "chilling effect" on chemical substance and product innovation.[7] Another study that examined the impact to one member nation of the EU estimated a broad range of possible costs and benefits are possible, with €0.3 billion to €2.3 billion in total costs for implementation in Austria alone, a nation approximately one-quarter the population of the whole of California.[8]

[7] Bergkamp, Lucas, Lawrence Kogan, and Nicolas Herbatschek, "Does REACH have a 'chilling effect' on trade and investment?" NewEurope Online, July 16, 2012.
[8] Getzner, Michael, "Uncertainties and the precautionary principle in cost-benefit environmental policies," Journal of Policy Modeling, 30 (1): 1-17, 2008.

An alternative analysis prepared for the EU stated that other reports on green chemistry efforts up to that point had understated costs, estimating that preparing chemical safety reports would cost between €2,500 and €33,650 per substance for a cost range of €12.8 billion to €26.5 billion over 15 years due to uncertainty of the number of polymers included in the regulations.[9] One academic study stated that the EU drastically underestimates costs required for the testing component alone. The analysis stated that the program would dramatically expand the need for live animal testing and may require at least 54 million test animals, noting that the original assumptions drastically understated the scope of REACH. They considered their cost estimate of €9.5 billion as optimistic since the number of animals required may nearly triple over the life of the program.[10]

A detailed case study completed on the automotive, inorganic, flexible packaging and electronics sectors found a number of issues that could contribute to significant costs for any industry involved in such a program. The study found that critical substances are not likely to disappear under REACH for economic reasons, but there are still serious concerns about the extent and timing of possible future restrictions under REACH related to adequate lead-in time and product cycles as well as reduced flexibility from the narrow definition of “identified use” for products. Companies also mentioned their concerns regarding lost confidential business information and that they would likely be unable to increase research and development budgets. These factors would contribute to one time product cost increases of 6 to 20 percent that would most likely be passed on to consumers.[11] Even Europe’s own internal analysis estimated costs

[9] Vernon, Jan, Anthony Footitt, Tobe Nwaogu, "Revised Business Impact Assessment - Consultation Document," European Commission Enterprise Directorate-General, October 2003.
[10] Rovida, Costanza and Thomas Hartung, "Re-Evaluation of Animal Numbers and Costs for In Vivo Tests to Accomplish REACH Legislation Requirements for Chemicals," ALTEX 26 (3): 187-208, 2009.
[11] KPMG Business Advisory Services, "REACH - further work on impact assessment: A case study approach," KPMG International, July 2005.

at anywhere between €4.7 billion - €7.8 billion in testing, registration and substitution costs over an 11 to 15 year period.[12]

Effects on Industry

The estimates on potential costs and benefits under the REACH program are matched along with analyses that also indicate California industries will face difficulties with implementation of their program. Both Europe and the United States have been losing ground to Asia in the chemical manufacturing industry. Increased regulations from green chemistry programs may have a significant impact on the domestic chemicals market and their ability to compete in the marketplace.[1314] Similarly, one study found that state and local policies that act independent of federal toxics policies could be economically damaging and impede innovation[15] and that green chemistry regulations that place a cost of compliance on companies will result in a net negative impact when exporting goods and chemicals outside of the market where the regulation takes place.[16]

Even the potential for economic growth as a result of such a program must also acknowledge the potential economic downsides. One particular study examined California's potential program and found that it may stimulate economic and technological development. However, the same program would, in effect, create a system of winners and losers. Certain industries and localities would stand to benefit from the regulation as the direct cost to other

[12] Commission of the European Communities, "Regulation of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restrictions of Chemicals (REACH), establishing a European Chemicals Agency and amending Directive 1999/45/EC and Regulation (EC) {on Persistent Organic Pollutants}: Extended Impact Assessment," SEC (2003) 1171/3, October 29, 2003.
[13] KPMG International, "The Future of the European Chemical Industry," January 2010.
[14] KPMG International, "The Outlook for the US Chemical Industry," October 2010.
[15] National Electrical Manufacturers Association, "EU REACH and U.S. Regulation of Chemicals and Chemical Users," White Paper, August 2007.
[16] Ackerman, Frank, Elizabeth Stanton, and Rachel Massey, "European Chemical Policy and the United States: The Impacts of REACH," Global Development and Environment Institute, Tufts University, September 2006.

industries and localities.[17] The very core of business operations must necessarily expand to meet the requirements of these new regulations, increasing costs and operations complexity over time. An analysis found that the program may have a significant and expanding impact on the way companies do business. Companies would be required companies to undertake a number of new processes and expand over time to address the naming of new chemicals and the administration required by alternative analyses.[18]

Analysis of Operations and Benefits

The very nature of how and why chemicals could be added to a list of concern or a suitable alternative is established will be influenced by policy, regulation and enforcement, technology development, economy and market, scientific finding and the public debate regarding chemicals. Both environmental legislation and public pressure will be relevant external factors in the discussion, and this substitution would require a number of tradeoffs and increase the complexity of the program.[19]

The very design of the program itself and its operations will have a significant impact on both the efficacy and the costs of the regulation. The methodology involved in the determination of the chemicals and AA process can have a significant impact on the results of an analysis, expanding or contracting the scope of the entire program. Recent findings also seem to indicate, according to one analysis of California's program, that additional development is required in a number of areas including the development of the AA process.[20]

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[17] Clean Water Fund and Lowell Center for Sustainable Production, "Safer Jobs And A Sustainable Economy Through Green Chemistry and Safer Alternatives to Toxic Chemicals In California: A Constituency Analysis," March 2007.

[18] Bergeson, Lynn L., "Dreaming no longer: California issues draft safer consumer products regulations," Environmental Quality Management, Volume 21, Issue 3, pages 81–91, Spring 2012.

[19] Lohse, Joachim, Martin Wirts, Andreas Ahrens, Kerstin Heitmann, Sven Lundie, Lothar Lißner, and Annette Wagner, "Substitution of Hazardous Chemicals in Products and Processes," Directorate General Environment, Nuclear Safety and Civil Protection of the Commission of the European Communities, March 2003.

[20] Malloy, Timothy F., Peter J. Sinsheimer, Ann Blake, Igor Linkov, "Developing Regulatory Alternatives Analysis Methodologies for the California Green Chemistry Initiative," UCLA Sustainable Technology & Policy Program, October 20, 2011.

The potential for medical benefits are significant. An analysis completed states that a significant portion of numerous childhood illnesses and occupational illnesses are linked to chemical exposure, and this occurs because federal regulations have shortcomings that can be addressed by an additional program.[21] The estimate used by DTSC for their annual costs identifies as much as $2.5 billion annually spent on health care or associated with lost worker productivity in California that could be saved by the implementation of green chemistry programs and regulations.[22]

[21] Wilson, Michael P., Daniel A. Chia, and Bryan C. Ehlers, "Green Chemistry in California: A Framework for Leadership in Chemicals Policy and Innovation," California Policy Research Center, 2006.
[22] Leigh, J. Paul, "Costs of Toxic Chemical-induced Occupational Diseases Among Adults and Environmental Diseases Among Children within California," California Department of Toxic Substances, April 25, 2008.

5. Review of DTSC's Fiscal and Economic Analyses

The existing literature indicates that California's program may result in significant costs with some benefits. However, analyses completed by both the DTSC result in ambiguous benefits, a lack of clearly-defined costs and reports that are occasionally contradictory and thoroughly incomplete. A thorough analysis of the fiscal and economic impact of a particular regulation is required under the California Administrative Procedure Act. As stated by the California Office of Administrative Law, the requirements of the set forth in the APA are designed to "provide the public with a meaningful opportunity to participate in the adoption of state regulations and to ensure that regulations are clear, necessary and legally valid."[23] The California Government Code highlights the need to assess the total adverse economic impact on California businesses and consumers, as seen in Figure 5.1 detailing the applicable code section.

Figure 5.1
Code Affecting Fiscal and Economic Analysis

(a) State agencies proposing to adopt, amend, or repeal any administrative regulation shall assess the potential for adverse economic impact on California business enterprises and individuals, avoiding the imposition of unnecessary or unreasonable regulations or reporting, recordkeeping, or compliance requirements. . . . (2) The state agency, prior to submitting a proposal to adopt, amend, or repeal a regulation to the office, shall consider the proposal's impact on business, with consideration of industries affected including the ability of California businesses to compete with businesses in other states. For purposes of evaluating the impact on the ability of California businesses to compete with businesses in other states, an agency shall consider, but not be limited to, information supplied by interested parties. All state agencies proposing to adopt, amend, or repeal a regulation that is not a major regulation or that is a major regulation proposed prior to November 1, 2013, shall prepare an economic impact analysis that assesses whether and to what extent it will affect the following:

(A) The creation or elimination of jobs within the State of California.

(B) The creation of new businesses or the elimination of existing businesses within the State of California.

(C) The expansion of businesses currently doing business within the State of California.

(D) The benefits of the regulation to the health and welfare of California residents, worker safety, and the state's environment.

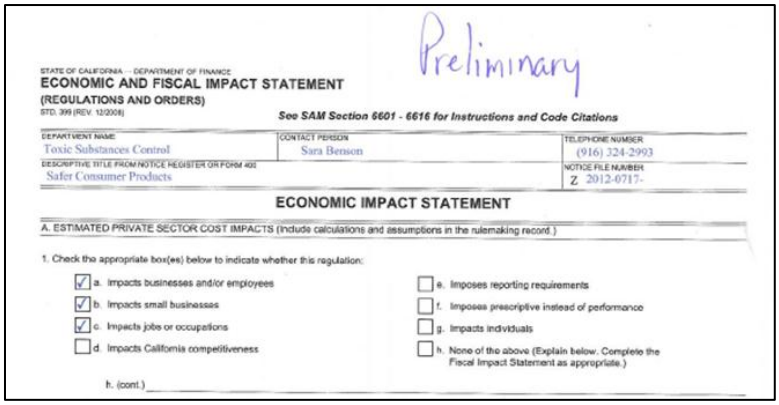
SOURCE: California Government Code Section 11346.3.

[23] California Office of Administrative Law, "Administrative Procedure Act & APA Regulations," http://www.oal.ca.gov/administrative_procedure_act.htm, accessed in September 2012.

The code section governing this analysis also includes a clause making it clear that any and all analyses assess how a regulation will affect the economic competitiveness of California businesses with interstate competitors. Explicitly, the code states that all state agencies "shall prepare" an economic impact analysis that assesses whether and to what extent the regulation will create or eliminate jobs; create new business or eliminate existing business; expand business currently within California; and benefit the health and welfare of California resident, worker safety and the state's environment.

DTSC must address these requirements through Form 399, the state's form for establishing a record of a policy's economic and fiscal impact. However, the Department's findings that were submitted in July 2012 appear to be a work in progress and has "Preliminary" written at the top of the analysis, highlighted in Figure 5.2.

Figure 5.2
DTSC Form 399 Highlight of "Preliminary" Findings


Preliminary

STATE OF CALIFORNIA -- DEPARTMENT OF FINANCE
ECONOMIC AND FISCAL IMPACT STATEMENT
(REGULATIONS AND ORDERS)
STD. 399 (REV. 12/2008)

See SAM Section 6601 - 6616 for Instructions and Code Citations

DEPARTMENT NAME	CONTACT PERSON	TELEPHONE NUMBER
Toxic Substances Control	Sara Benson	(916) 324-2993
DESCRIPTIVE TITLE FROM NOTICE REGISTER OR FORM 400		NOTICE FILE NUMBER
Safer Consumer Products		Z 2012-0717-

ECONOMIC IMPACT STATEMENT

A. ESTIMATED PRIVATE SECTOR COST IMPACTS (Include calculations and assumptions in the rulemaking record.)

1. Check the appropriate box(es) below to indicate whether this regulation:

- [x] a. Impacts businesses and/or employees
- [x] b. Impacts small businesses
- [x] c. Impacts jobs or occupations
- [ ] d. Impacts California competitiveness
- [ ] e. Imposes reporting requirements
- [ ] f. Imposes prescriptive instead of performance
- [ ] g. Impacts individuals
- [ ] h. None of the above (Explain below. Complete the Fiscal Impact Statement as appropriate.)

h. (cont.)

SOURCE: Benson, Sara, "Form 399: State Consumer Products," Department of Toxic Substances Control, July 17, 2012.

In their Form 399 filing, required by the previous Government Code, DTSC fails to include most reporting requirements. For the private sector, DTSC did not report that the regulation will impact California competitiveness; impose reporting requirements; impose prescriptive measures instead of performance measures; or impact individuals. Additionally, DTSC's analysis lists "Unknown" in other private sector data points, declining to measure how many

businesses would be impacted; jobs affected; or offer any kind of cost estimate for industry. The Congressional Budget Office regularly creates cost estimates for public regulations, and recently determined the approximate costs associated with a modification of the U.S. Toxic Substances Control Act.

DTSC also lists no fiscal impacts of any kind towards state or local governments, nor any possible alternative regulations or programs to achieve the regulation's goal. They also recognize that the benefits from this regulation may vary depending on which chemicals are affected. The form even fails to note the effect on state expenditures even though an attachment on required state personnel highlights that the regulation will require millions of dollars to implement.

Throughout their attachment to this form, DTSC also references their contractor-completed economic analysis as justification for the lack of clear analysis. However, the economic analysis completed by a contractor to the DTSC does little to add clarity or definition to these findings. In fact, the report occasionally contradicts information put forth by the Department in their Form 399. On Form 399, the state fails to note that this regulation will impact California's competitiveness or that the regulation will impose reporting requirements, contradicting the economic analysis completed by their contractor.[24]

In short, the contracted economic analysis did not provide the information required by statute and the State Administrative Manual. DTSC frequently glosses over particular requirements and provides very little in the way of detailed information on the potential costs and benefits as detailed in Table 5.1.

[24] Kahn, Matthew E., "Economic Analysis of California's Green Chemistry Regulations for Safer Consumer Products," Department of Toxic Substances Control, March 2012.

Table 5.1
Deficiencies in DTSC Analysis

Requirement	DTSC Form 399 Analysis	Comment
Potential "adverse" impact on CA business	▪ N.A.	▪ DTSC does not provide guidance. ▪ Contractor appears to report the most "optimistic" scenario. The contractor does not report potential risks or potential "adverse" effects on California businesses or industries.(1)
Impact on competitiveness	▪ N.A.	▪ DTSC does not provide guidance. ▪ Contractor assertions appear to be speculative, based on optimistic outlook and does not provide sufficient support.
Total cost analysis	▪ N.A.	▪ Neither DTSC nor its contractors provide quantitative cost analysis, either cost-benefit or cost-effectiveness. ▪ Contractor notes, "Our overall assessment, despite the fundamental uncertainties, is that these regulations will offer California significant net benefits."(1)
Impact on jobs	▪ N.A.	▪ DTSC does not assess impact on California jobs. ▪ Contractor speculates, "It is impossible to offer precise predictions concerning how California jobs will be affected."(1)
Impact on key industries / business	▪ N.A.	▪ DTSC does not assess impact on key industries.
Impact on housing	▪ N.A.	▪ DTSC does not assess impact on housing market.
Reporting burdens	▪ N.A.	▪ DTSC reports that there are no reporting burdens on its Form 399, directly contradicting their contractor's assessment.
Guidance on alternatives	▪ N.A.	▪ DTSC does not assess alternatives.
State government fiscal impact	▪ N.A.	▪ DTSC does not assess total state government fiscal impact. DTSC provides what appears to be a partial assessment of costs in its attachment.
Local government fiscal impact	▪ N.A.	▪ DTSC does not assess local government fiscal impact.

SOURCE: (1) Kahn, Matthew E., "Economic Analysis of California's Green Chemistry Regulations for Safer Consumer Products," Department of Toxic Substances Control, March 2012.

Risk and Uncertainty

As DTSC's economic contractor notes, these regulations produce a fundamentally new paradigm for manufacturers and consumers. There is substantial uncertainty as to how manufacturers will deal with the regulations and how this will impact the cost of goods and the productivity of the manufacturing sector. There are a number of unknowns. Some, like the number and identity of chemicals impacted and questions of compliance processes, will become known over time as DTSC better fleshes out the regulation. Others, such as the full costs and unintended impacts of reformulating products or the health and productivity benefits of doing so, may not be known with certainty for many years or even decades.

While these uncertainties make analysis challenging, they are challenges that occur in many projects and are overcome regularly by talented analysts in government, academia and the private sector. Furthermore, they do not remove the responsibility for agencies to conduct a full fiscal and economic analysis of the regulations they seek to implement. In fact, the uncertainty inherent in complex, cutting edge regulations makes such analysis all the more crucial.

DTSC have fallen short in this regard. DTSC's contractor, noting that he is "optimistic," outlines essentially a best case scenario in the economic report for DTSC, arriving at a single conclusion that the regulations will produce net benefits. DTSC simply says that the impacts are "unknown". In both cases this is inadequate. It is more appropriate, given the substantial uncertainty inherent in this regulation, to produce a range of possible outcomes, noting both the potential "optimistic" upside of the policy, as well as the risks, should such a rosy scenario not develop.

In our analysis, we have produced a range of possible outcomes. This range effectively represents the bounds of the possible upside and downside of the policy, given what is known and unknown about its impacts on California. We believe that this is the only appropriate, responsible strategy to undertake when analyzing a policy with as widespread of uncertainty as SCP presents.

One important caveat on the range that we have produced is that, in all scenarios, we assume that the full health and productivity benefits that a DTSC contractor calculated in a separate report[25] are realized. In this manner, we are extremely conservative. It is entirely possible and, in actuality, quite probable, that the full benefits will not be realized. If that were the case, all disease related to chemical exposure in the workplace or to children in California would be entirely eradicated, which may be unlikely. If only a portion of the benefits were realized, the total cost could be substantially worse.

[25] Leigh, J. Paul, "Costs of Toxic Chemical-induced Occupational Diseases Among Adults and Environmental Diseases Among Children within California," California Department of Toxic Substances, April 25, 2008.

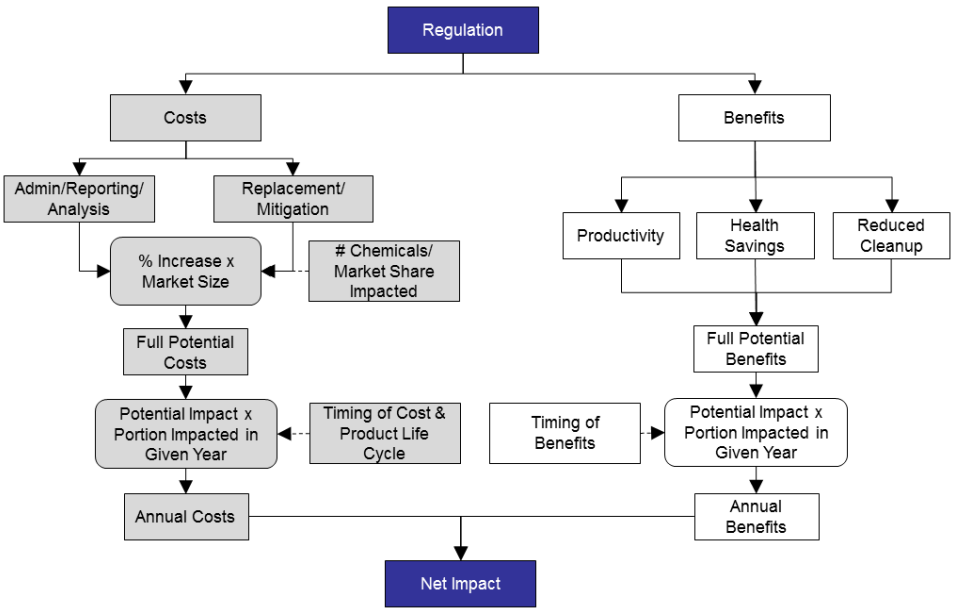
6. Independent Cost Analysis

When developing our approach on the consumer analysis, we took great care to complete a model that addressed the known cost impacts resulting from the regulation while also drawing a parallel between the amount of information that was readily accessible by DTSC. We believe that our analysis was inclusive of all major costs and benefits, leveraged existing literature and the best available data, and accounted for uncertainties and risks. We sought to include all of the major cost and benefit categories while also developing a conservative methodology applying those impacts. Where assumptions were made, we made every effort to be as generous to DTSC as possible, to ensure our results are conservative.

Model Structure

For costs, we included figures associated with regulatory compliance such as administrative/overhead costs and Alternatives Analysis and the direct manufacturing impacts from chemical switching, product reengineering and mitigation. Our benefits, consistent with DTSC's reports and methodology, include decreased medical spending, increased worker productivity and decreased spending on chemical cleanup. Figure 6.1 below highlights the structure of our model.

Figure 6.1
Cost-Benefit Model Structure



We use a summation equation to determine the annual net impacts and cumulative costs and benefits for the regulation. As show in Figure 6.2, we developed a calculation that would account for the cumulative costs in a given year, as well as calculating the total costs. These costs include spending on the difference in costs on alternatives selection and the costs associated with testing, reporting and administration.

Figure 6.2
Calculation of Cumulative Costs in Year X

$$\sum_{x}^{0} S \times P \times \Delta A + S \times P \times T$$

NOTES: S = Size of Market Impacted
P = Portion of Program Online
A = Costs/Savings of Alternatives
T = Costs for Testing/Reporting/Administration

We also developed a calculation for the gross benefits under the regulation as envisioned by the Department in their analysis. Figure 6.3 calculates the given benefits from decreased medical costs, increased productivity and cleanup costs avoided in each given year up to year

25 in a series, as well as the cumulative costs. Fuller line-by-line information is available in Appendix C.

Figure 6.3
Calculation of Cumulative Benefits in Year X

$$\sum_{x}^{0} P \times B \times (M + W) + C \times Y$$

NOTES: P = Portion of Program Online
B = Portion of Medical/Productivity Benefits Realized in Year X
M = Maximum Potential Medical Benefits
W = Maximum Potential Productivity Benefits
C = Maximum Potential Benefits from Cleanup Avoided
Y = Portion of Cleanup Costs Avoided in Year X

While our model includes the key costs and benefits of the program, it should be made clear that we have excluded some costs associated with the program. We do not include potential distributor and retailer impacts as we assume the manufacturer will bear the overwhelming costs (as the SCP program currently states). Additionally, since these costs are only realized if the manufacturer fails to comply, to a large extent, they are effectively included, since the model assumes all manufacturers fully comply. Additionally, we do not calculate the non-economic benefits of environmental improvements. The report utilizes the most reliable data available from government, academic and industry studies and literature. We also take advantage of the availability of existing literature in regards to the EU's REACH program as well as a few limited studies on the prospective California Green Chemistry regulations.

There are some uncertainties with how wide of an impact this will have, as well as how large the affected market would be for California. To address these concerns, we utilized a scenario analysis to account for that uncertainty. We included a range on the potential portion of the total chemicals goods market, excluding pharmaceuticals, as well as a range on the anticipated cost of compliance and the cost of chemical switching based on a percentage of the impacted chemicals. The scenarios as developed can be found on Table 6.1.

Table 6.1
Scenarios and Definitions

Scenario	Cost of Compliance	Cost of Switching	Portion of Market Impacted
Best Case	25th percentile of costs estimated in literature review of REACH related studies	25th percentile of costs estimated in literature review of case studies of chemical switching	The number of products DTSC estimates will be included (85) divided by the number of chemicals produced in the United States (6,759)
Optimistic Case	Median of costs estimated in literature review of REACH related studies	Median of costs estimated in literature review of case studies of chemical switching	The midpoint of the high and low
Potential for Adversity Case	75th percentile of costs estimated in literature review of REACH related studies	75th percentile of costs estimated in literature review of case studies of chemical switching	The number of products DTSC estimates will be included (85) divided by the number of chemicals produced in California (251)

We have developed these scenarios to address a range of uncertainties and build sensitivity into the analysis. Using existing reports on costs and impacts, we developed scenarios that would reflect reasonable expected highs and lows by removing outlier figures and focusing on the 25th percentile of costs for our low end and the 75th percentile of costs for our high end. Our Optimistic Case scenario uses median cost estimates and midpoints of available data.

The cost of compliance, as was previously mentioned, includes costs from administrative overhead, alternatives analysis for chemicals and products, and other costs associated with meeting the reporting requirements under the SCP regulation. Costs regarding chemical switching come from the costs needed for industry to develop replacement chemicals and reformulate products to meet DTSC regulations.

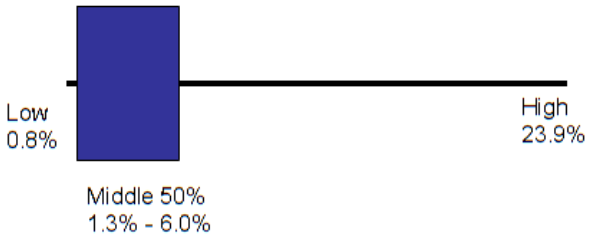
The portion of the market that will be impacted is necessarily a large range because the information required to make an accurate assessment of that figure, until a list of Priority Products is developed, remains elusive. The chemical product market includes raw chemicals, intermediate inputs and final products and are all impacted by the regulation.

Administrative and Analysis Costs

Companies that produce priority products will be required to undertake an alternatives analysis, which will include reporting costs as well as analysis costs, which will ultimately entail hiring an independent analyst. This is similar to the REACH program in Europe, where there is a reasonable volume of literature, which we have used as an analog.

We limit the possible range of costs to the middle 50%, with the Best Case at the 25th percentile, the Optimistic Case at the median and the Potential for Adversity Case at the 75th percentile. We assume that since California's program is generally considered more stringent than REACH, the low end is unlikely. Additionally, while it is possible that the high end could be an appropriate analog for California, to maintain our conservative approach, we assume that the highest cost alternatives, above the 75th percentile are outliers. As Figure 6.4 shows, the range that we have included in the analysis is at the low end of available literature.

Figure 6.4
Distribution of Literature on Administrative and Analytical Costs



Chemical Switching Costs

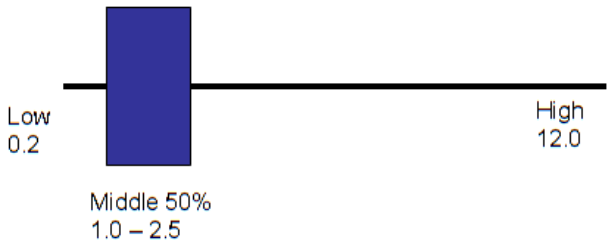
The alternatives analysis will sometimes result in a product being reformulated to limit or eliminate the chemical of concern. In other cases, there may not be alternatives or they may be cost prohibitive, so the company will engage in other mitigation or research efforts or the product may be banned outright, as would ultimately be imposed by DTSC.

While there is a wide range of possible outcomes, we focus on reformulation as the proxy for all outcomes. This maintains our conservative approach. As DTSC's economic contractor

wrote, “Alternatives that involve only switching of one chemical for another are likely to be among the least complex and perhaps the cheapest.”[26]

We limit the possible range of costs to the middle 50%, with the Best Case at the 25th percentile, which is cost neutral, the Optimistic Case at the median and the Potential for Adversity Case at the 75th percentile. We assume that options which lower costs have already been implemented or would be implemented in the near future at an efficient point in the firm’s business cycles. Additionally, we assume that the highest cost alternatives, above the 75th percentile would be considered cost prohibitive and, thus, would lead to alternate outcomes. As Figure 6.5 shows, the range that we have included in the analysis is at the low end of available literature.

Figure 6.5
Distribution of Literature on Switching Costs



Market Size

Chemicals play a role in virtually every product Californians buy as well as nearly every service provided in state. Regulation chemicals could potential significantly impact every sector of the economy. The true impacts will likely be more limited, but DTSC has chosen not to release the list of chemicals of concern or priority products. Additionally, the regulations as currently proposed would allow for the initial lists to be expanded greatly, so it is appropriate to

[26] Kahn, Matthew E., "Economic Analysis of California’s Green Chemistry Regulations for Safer Consumer Products," Department of Toxic Substances Control, March 2012.

focus on the potential high end because DTSC's regulations may allow for it to become a reality, even if they do not plan to do so.

We assume this policy will impact a portion of the overall chemicals market. In creating this fraction, our numerator is the number of priority products ultimately included. In maintaining our conservative approach, we assume that DTSC's estimated figure of 85 priority products is correct. As mentioned, this number could grow dramatically under the policies DTSC has laid out. Our denominator produces the range. The data is from the EPA's chemical reporting database.[27] At the low end, we assume the denominator is the total number of chemicals produced at volume in the United States, a total of 6,759 unique chemicals. Since a high portion of chemicals are produced and used in the same location, this number likely understates the impact. At the high end, we assume the denominator is the total number of chemicals produced in California, a total of 221 unique chemicals. Since many chemicals and products containing them are imported, this likely overstates the impact. It appears is safe to assume, however, that the reality falls within this range. As we discuss in section 5, the uncertainty of this and other factors is a key consideration in analyzing this policy. It is worth noting that the numerator is a number of products and the denominator is a number of chemicals. This is another area where DTSC lack of clarity leaves us with added uncertainty. This calculation may either understate or overstate the size of the market impacted, depending on the specific products DTSC chooses to regulate.

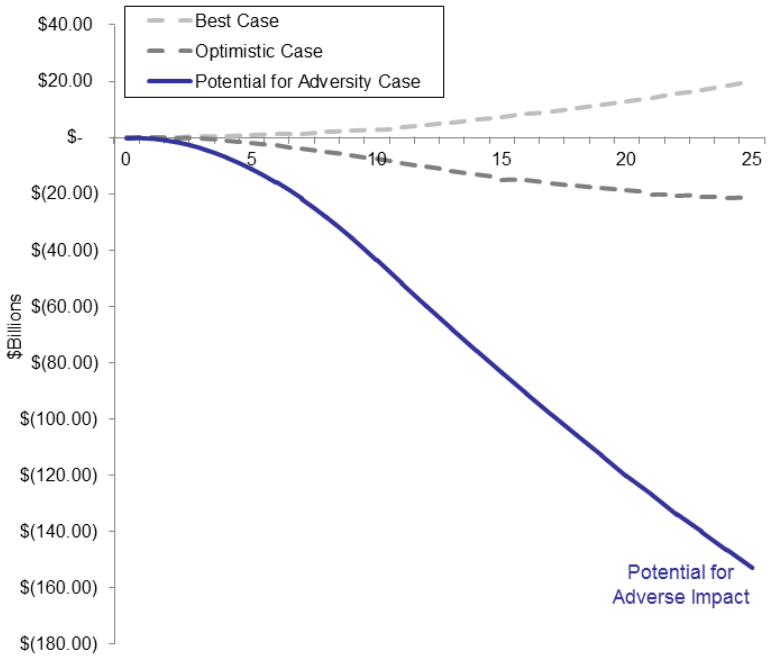
We assume that the total size of the potential market is California's share (12.4%) of the national chemical market, including both intermediate and final products, but not double counting chemicals that are intermediates for chemical final products, excluding pharmaceuticals.[28]

[27] U.S. Environmental Protection Agency, Chemical Data Reporting/Inventory Update Reporting, 2006.
[28] U.S. Bureau of Economic Analysis, "Interactive Access to Industry Economic Accounts Data, The Use of Commodities by Industries after Redefinitions (Producers' Prices)," 2010.

Timeline of Costs and Benefits

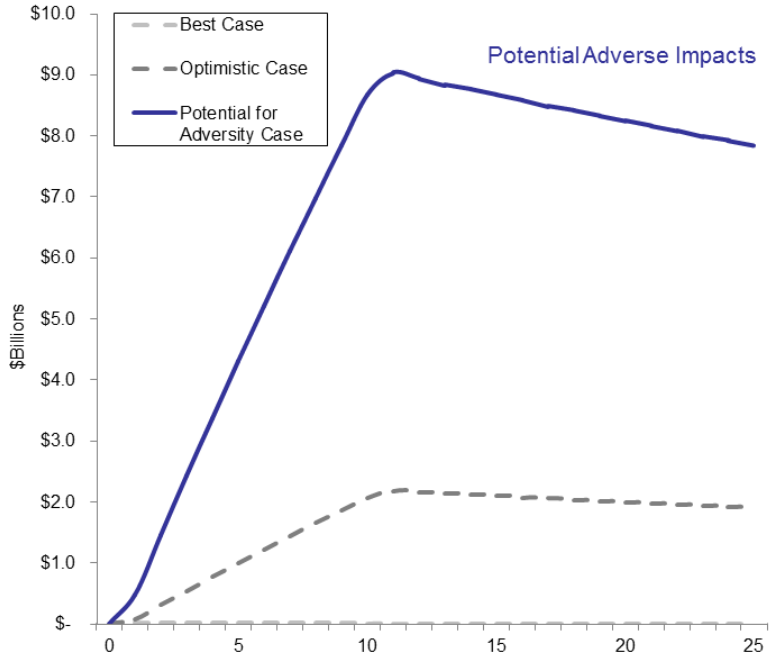
We estimated the first 25 years of the regulation beginning with the first year of implementation. We developed a timeline of costs and benefits for this model because it is important that impacts be phased in or out depending on what literature indicates is likely to occur. The costs under this regulation will be almost exclusively front-loaded within the first 10 years of implementation. Indeed, this phase-in period is approximately what DTSC expects will happen. We assume that the useful life of products using these chemicals is approximately 30 years and will ultimately be phased out after the last Priority Product is identified in Year 10. The net impact of the first 25 years can be seen in Figure 6.6.

Figure 6.6
Net Impact through Year 25



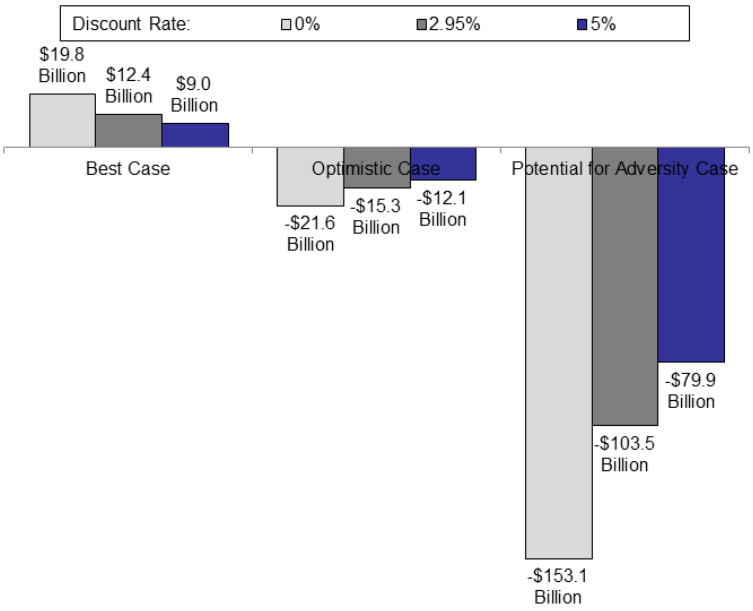
The reason the costs remain fairly consistent is that the benefits from decreased health care spending and increased worker productivity are not fully realized until much later in life. Decreased cleanup spending will see benefits initially in the front end but, like medical and productivity benefits, will not have those benefits fully realized until the end of the useful life of the products that use listed chemicals.

Figure 6.7
Annual Costs



In the interest of seeing how these costs and benefits will look in terms of present value in year 25 of implementation, we used several discount rates to estimate the net impact. The undiscounted rate indicates the potential for greater benefits in the Best Case and significantly higher costs in the Potential for Adversity Case. However, we also examine the net present values of these impacts using the 30-year Treasury bill rate of 2.95 percent and a 5 percent rate, as seen in Figure 6.8.

Figure 6.8
Net Present Value in Year 25



The significant potential for adverse effects that we find is concerning. This is despite the fact that we go out of our way to be generous to DTSC. While we assume that costs will fall within the middle 50% of the range suggested by the literature, we assume that the full range of benefits that DTSC's own study calculates is realized. While we do not question the credibility or accuracy of the study, it is unlikely that any program can successfully eliminate all of the relevant toxins and, thus, it is unlikely that 100% of the potential benefits will be realized. Furthermore, we assume that once the program is fully implemented, all health and productivity benefits are realized from this point forward, regardless of prior exposure. In reality, it would likely take a number of years and perhaps decades before any benefits would occur. Furthermore, logic suggests that many, if not all, of the cost neutral replacements that the Best Case assumes would be the average would occur over the next few years, on the most efficient business cycle, with or without this regulation. Additionally, given the higher level of complexity of California's regulation and its localized context, it is unlikely that the low range of results from Europe's REACH experience is the best analog for California. All told, there are numerous reasons to assume that the real cost will be closer to the worst case than the best case and if

the program expands beyond the 85 products targeted, even the worst case scenario may prove optimistic.

Consumer Impacts

We describe the potential range of impacts across the following three scenarios mentioned previously: Best Case, Optimistic Case and Potential for Adversity Case. However, it is important to note that these are still conservative estimates. The ranges we use to develop our scenarios were taken largely from reports based on Europe's REACH program, a regulatory scheme that is smaller in scope and impact than California's SCP regulations. Because of the uncertainty surrounding SCP and the larger available range of costs that manufacturers could bear, there is the potential for much greater impacts than are detailed here.

Our job impacts provide a range based upon estimated direct impacts to California businesses from the sectors affected by the regulation. The additional costs to final demand for goods in-state will ultimately be borne by the consumer, and as such will directly affect California jobs. However, we must note that we have only calculated the direct impacts within the state. Since the regulation affects chemicals, intermediate goods and final products within the state, the impacts will largely be felt in California. The increased costs of goods (or lack of goods, as the case could be) will directly affect consumer choice and spending. That decreased spending will affect the direct employment of impacted industries by reducing the workforce that can be supported.

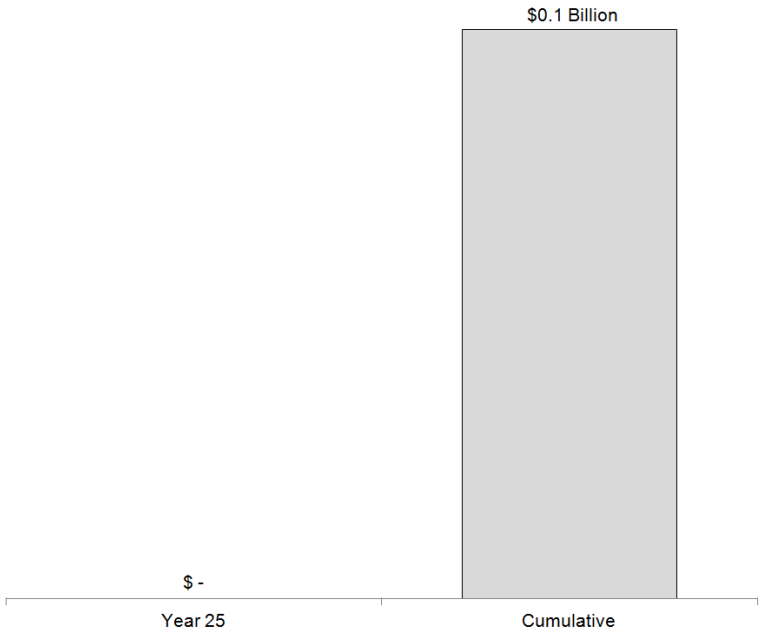
Our range of employment impacts is also based, in part, on the uncertainty of the regulation. Since the size of the market could vary depending on the final regulation (as mentioned earlier), we first estimate what the impact would be depending on what percentage of the California market would be affected. We then provide a range for that market size based on how the impact could shift between regulated industries in the state. Part of this range is based upon the expected reaction of consumers to costs and part is based upon how costs are potentially

passed through the supply chain, from chemical manufacturer to manufacturer to distributor to retailer.

There is also the real potential for greater job losses outside of these sectors and outside of California due to the ripple effect of lost employment in other sectors and supporting industries. Since a potentially significant portion of the affected market lay outside of California, impacts to California consumers would ultimately affect out-of-state manufacturers and distributors. Costs that reduce consumer demand could have impacts to producers in states with heavy chemical manufacturing such as Massachusetts, Texas and Louisiana. These are impacts that occur along the existing supply chain of production. In addition, lost employment in any sector will naturally have some impact in other sectors of the economy. The lost salaries of those affected employees will not be spent on consumer goods and services, affecting a wider swath of the economies of California and the nation.

Our Best Case scenario estimates that there will be approximately $1.5 billion in benefits in Year 25, or approximately $0.1 billion in cumulative costs by that point in addition to $21.1 billion in benefits. As shown in Figure 6.9, this particular scenario benefits from an implementation costs that are relatively small but are far outpaced by the benefits from health savings, productivity gains and cleanup costs avoided. The estimates for these figures are on the far positive end of the impact spectrum and assume an extremely positive implementation phase. This scenario assumes that switching and mitigation can be achieved in a cost-neutral manner and that administrative costs are at the low range of the literature.

Figure 6.9
Best Case Consumer Impact

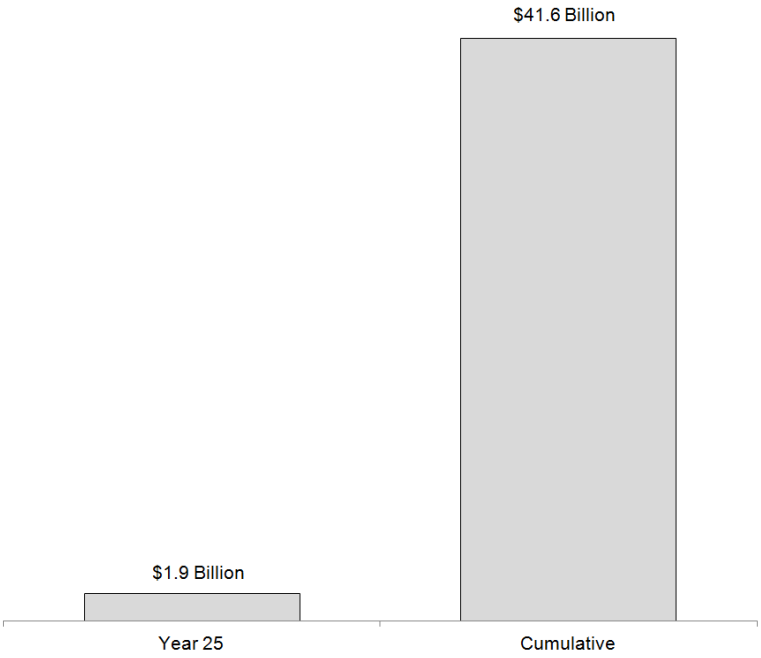


In this Best Case, the job losses in affected industries will be less than 1,000 total jobs as seen in Figure 6.10.

Figure 6.10
Best Case Direct Employment Losses

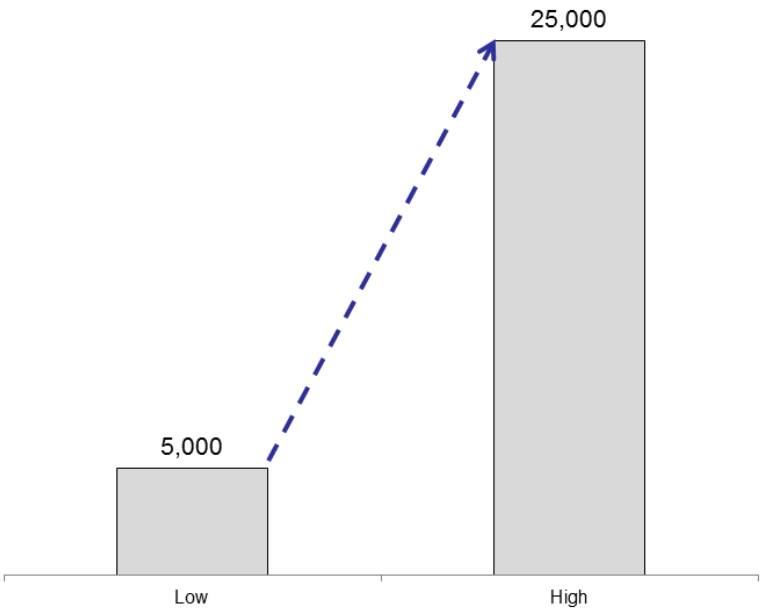
Our Optimistic Case scenario is closer to what we believe to be the likely outcome. We estimate costs of $2.1 billion in Year 25. From Years 1 through 25, the cumulative cost impact will be $46.1 billion in total, offset by the $21.1 billion in benefits. As shown in Figure 6.11, the cumulative costs will more than double the estimated consumer benefits.

Figure 6.11
Optimistic Case Consumer Impact



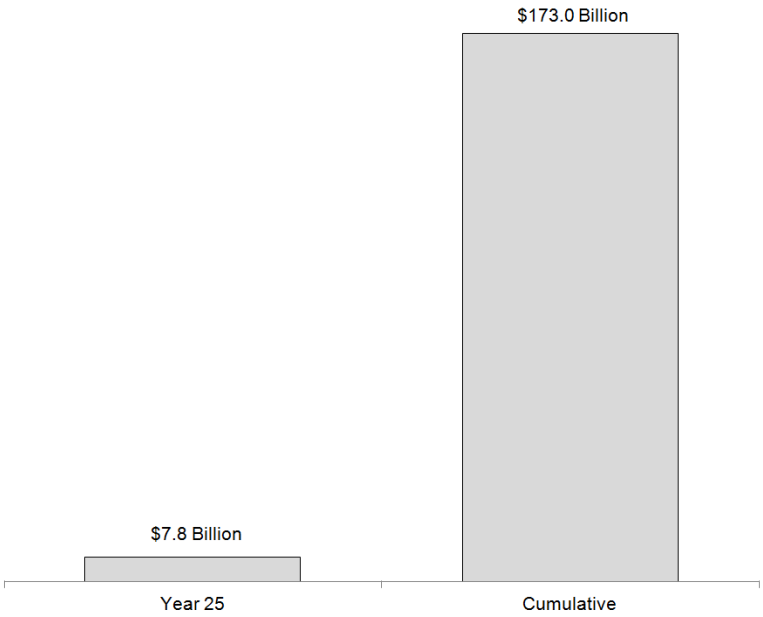
In the Optimistic Case scenario, directly affected industries could lose as many as 28,000 jobs in Year 25 as seen in Figure 6.12. At the peak during this 25-year period, over 32,000 jobs could be lost before some are recovered in later years as costs decline. These could occur along the supply chain from the production of raw products to manufacturers to distributors and retailers, and where along the supply chain costs are absorbed determines how many jobs are lost.

Figure 6.12
Optimistic Case Direct Employment Losses



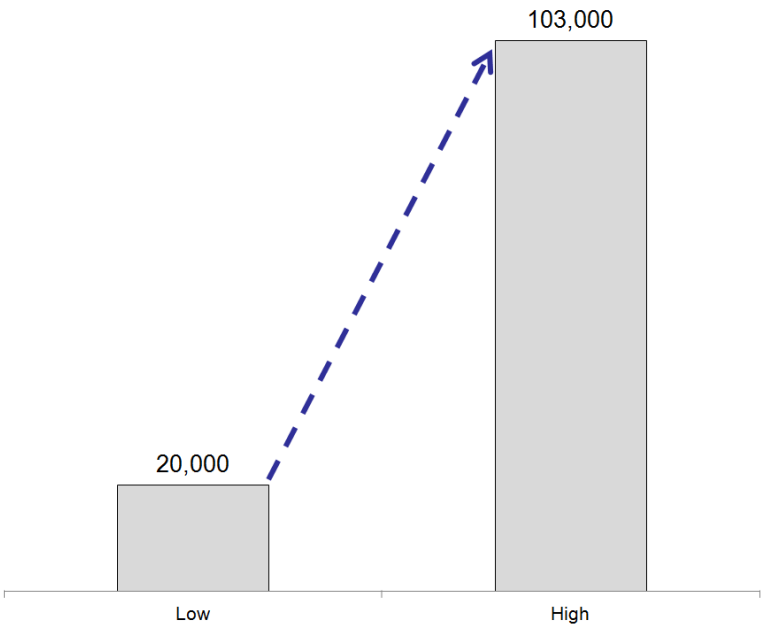
Our Potential for Adversity Case creates the potential for significant trouble and could make operation within the state difficult for manufacturers. As highlighted in Figure 6.13, this case will cost $4.5 billion in Year 25 and cumulatively cost $101.6 billion in total offset by the $21.1 billion in cumulative benefits. The direct cumulative cost over this period is larger than the General Fund of the entire state of California. Based upon the language in the State Administrative Manual on potential impacts, we use our Potential for Adversity Case as the base case for potential adverse economic effects.

Figure 6.13
Potential for Adversity Case Consumer Impact



In the Potential for Adversity Case, directly affected industries could lose as many as 103,000 jobs in Year 25 as seen in Figure 6.14. At the peak during this 25-year period, over 123,000 jobs could be lost before some are recovered in later years as costs decline. These could occur along the supply chain from the production of raw products to manufacturers to distributors and retailers, and where along the supply chain costs are absorbed determines how many jobs are lost.

Figure 6.14
Potential for Adversity Case Direct Employment Losses



Case Studies

Since DTSC refuses to disclose either the list of Chemicals of Concern or, more importantly, the Priority Products that will be immediately impacted, it is impossible to calculate or discuss impacts on specific industries or products. Some Priority Products would certainly have significantly more impact than others. Until DTSC discloses the list of Chemicals and Products impacted, any discussion of 'potential adverse impacts' should assume that DTSC could potentially selected the most significant products.

Alternative Energy

California is aggressively pushing policies to expand the use of alternative energy. AB 32, along with the closely related 33% Renewable Portfolio Standard, mandates significant expansion of alternative energy sources. Programs like the PUC's Energy Efficiency Finance program, ABX1 14 and the New Solar Home Partnership seek to dramatically expand the use of solar technologies as well. Expanding the use of these new technologies is focused on lowering emissions from energy consumption, especially carbon emissions related to climate change.

There is substantial evidence, though, that these emerging technologies will bring with them health and environmental tradeoffs.

Solar technology may be the most closely watched technology. The Silicon Valley Toxics Coalition's groundbreaking 2009 report exposed the numerous issues with toxic chemical exposure related to the solar technology.[29] Following the report's release, an editorial appeared in the Journal of Information, Communication & Ethics in Society, writing, "consideration of green concerns beyond GHG emissions shows why use even of photovoltaic (PV) generated solar electricity may be deprecated according to green thinking. PV panels comprise numerous hazardous chemicals, and thus pose a danger if waste is not disposed of properly."

Solar panel manufacturing uses highly toxic chemicals such as cadmium telluride (CdTe), copper indium selenide (CIS), copper indium gallium selenide (CIGS)[30], lead, brominated flame retardants (BFRs) and hexavalent chromium (Cr(VI)).[31] CDTE, for instance, is extremely toxic, even at trace exposure levels. The United States Agency for Toxic Substances & Disease Registry ranks it as the chemical of 7th highest concern (out of a list of 275 substances).[32] The Occupational Safety & Health Administration (OSHA) describes it as "extremely toxic" and warns that it causes cancer (lung and prostate), metal fume fever and kidney damage and has been linked to pulmonary emphysema and bone disease.[33] It is also the fastest growing solar PV technology globally.[34]

If DTSC chose to apply its regulations to solar technology, or if interested members of the public were to petition DTSC to do so, the potential for economic harm caused by the interaction of California's environmental regulations is tremendous. While the specifics of the protocols for

[29] Silicon Valley Toxics Coalition, "Toward a Just and Sustainable Solar Energy Industry," January 2009.
[30] Bradbrook, Sam, Peter Ellwood, Elizabeth Hoult, and Richard Snodgrass, "Emerging Energy Technologies Programme: Background Report," Risk Science Unit, Health & Safety Laboratory, May 2010.
[31] Silicon Valley Toxics Coalition, "Toward a Just and Sustainable Solar Energy Industry," January 2009.
[32] Agency for Toxic Substances & Disease Registry, "Priority List of Hazardous Substances," Centers for Disease Control and Prevention, http://www.atsdr.cdc.gov/SPL/index.html, accessed September 2012.
[33] Occupational Safety & Health Administration, "Safety and Health Topics, Cadmium," United States Department of Labor, http://www.osha.gov/SLTC/cadmium/index.html, accessed September 2012.
[34] Silicon Valley Toxics Coalition, "Toward a Just and Sustainable Solar Energy Industry," January 2009.

selection may or may not protect against such calamity, it is impossible to know until DTSC fully releases its regulations for public consideration and comment.

European Automobile Regulations

The European Union issued a directive (ELV Directive 2000/53/EC) targeting the end of life impacts of automobiles, which caused automakers to replace a number of components in the vehicles they produced with similar components that did not contain specific heavy metals. While well intentioned, the program proved extremely difficult to implement and costly to industry and, ultimately, consumers.

The EU's research showed that, "Many [countries], however, have experienced significant difficulties, delays and setbacks in implementing the Directive." Regulations drafted by the EU proved inadequately detailed on a number of key issues. Diverse and varying regulations of the various members states made it difficult for companies to comply. Administrative burdens proved more costly than was anticipated. The EU even noted that the Directive incentivized illegal activities, "There are a number of routes to the disposal of a vehicle, some legal, and some not. Where the Directive requires extra procedures and incurs extra costs in disposal, there is an obvious disincentive for full compliance …"[35]

Moreover, the program proved costly to automakers. The Öko-Institut conducted case studies on a number of components and found that the cost of most increased significantly due to the Directive. The cost impact varied significantly from one component to the next. At the low end of the spectrum, newer plastic fuel tanks are more cost effective than lead coated tanks. This substation had been occurring, driven by the cost savings, since the 1970s. One other component, mercury free headlamps, saw negligible cost increases. It is worth noting that this sift was already beginning to occur as well, although not to the extent of fuel tanks. Other components were significantly more expensive. The cost of substitute bearing shells and

[35] Fergusson, Malcolm, "End of Life Vehicles (ELV) Directive: An Assessment of the Current State of Implementation by Member States," European Union, Policy Department Economy and Science, March 2007.

bushes were ten times higher than the original components. The reason is the original version, which contained lead, performed at a far greater level than replacement versions. Additionally, the manner in which it is used requires significant testing on any new component.[36]

[36] Groß, Rita, Dirk Bunke, Marion Drut, Carl-Otto Gensch, Martin Hendel, Stéphanie Zangl, and Dieter Seifried, "End-of-Life vehicle directive 2000/53/EC Annex II: Study on analysis of costs and environmental benefits of heavy metal ban, and proposal for better regulation," Öko-Institut e.V., December 2010.

7. Key Considerations and Assumptions

After analyzing the range of consumer impacts to California under the SCP regulations, there are some key considerations that should be discussed. Each of these considerations could dramatically affect the cost-benefits of the regulation as well as how it would be implemented.

Additionally, in order to complete our analysis, certain assumptions needed to be made. In many cases, we include a range of possibilities, driven by the best available literature and federal economic data. In other cases, we chose to make the assumptions that are most favorable to DTSC to maintain a conservative approach and/or will maximize the range, both in terms of high and low to ensure that it is comprehensive.

In addition to the assumptions that drive our scenarios, which are detailed in Section 6, there are a number of assumptions that are common to all scenarios. We summarize the assumptions here and discuss the rationale behind these decisions over the course of the section:

- Priority products selected will not overlap with any current industry efforts;
- Policies will be implemented over the course of ten years, as DTSC has indicated is likely;
- The chemicals industry switch to will be the ideal alternatives and there will be no further costs from switching or mitigation of imperfect; and
- All potential health and productivity benefits will be realized.

Business-as-Usual

To some extent, firms are already engaging in green chemistry initiatives. In some cases they are seeking to get ahead of anticipated regulatory action, but in many others they simply see it as a good decision for their business in terms of enhancing company image, maintaining product stability or creating marketing opportunities. To the extent that it makes economic sense

to do so, companies are likely to be engaging in the desired behaviors even in the absence of regulatory action.

To the extent that companies are already implementing these changes it causes both the costs and the benefits of the policy to shrink. The companies would already be conducting the analysis to find better alternatives and paying the costs of implementing these alternatives absent regulations. Additionally, since the alternatives would be implemented without regulations, the benefits that accrue would also do so with or without the regulation.

There is one significant caveat, however. For companies that are already engaging in the desired behaviors, the benefits will entirely shift to the baseline. It is likely that they will still bear some costs, however, at the very least including administrative costs to show their compliance. At this point, it is unclear how significant of costs these companies will have to bear under the regulations.

One very real question is, in the event that a company has internally conducted significant, appropriate alternative analyses, would simply providing DTSC with the documents be adequate for compliance or would the companies be required to repeat the analysis within the DTSC framework? The former would significantly limit the costs to companies that are independently engaging in the desired behaviors. In either case, however, the framework DTSC has proposed would likely exact some administrative related compliance costs on these companies, despite not creating any societal benefit.

For the purpose of our model, we have implicitly assumed that no companies are currently engaging in these activities for priority products. This may not be completely true, however it is an appropriate assumption given the nature of our model. Our model is designed to produce a broad range of possible results. This assumption maximizes both potential costs and potential benefits, so it is necessary to create true outer high and low bounds on the projected range.

Implementation Timeline

One key consideration is the timeline for implementation. For simplicity, our model assumes that implementation for any given priority product will happen over the course of a single year. In reality, based on the timeline indicated by DTSC, this will vary from product to product, but will generally occur over approximately two to three years. While the timeline for implementation is of little consequence within the parameters of our model, it could have profound impacts on the economy in practice.

There are a number of reasons for this distinction. Our model produces a wide range of results. The results are driven by three variables. The size of the market impacted is uncertain because it has not yet been decided by DTSC what products will be included and so it is uncertain what total portion of state product that will represent. While this factor is very much impacted by DTSC's regulatory decisions, the timeline of implementation will cause little change. The other two factors could be significantly impacted by implementation timelines.

The administrative and analytical costs of compliance represent significant one-time costs to the impacted company. These costs include significant unknowns. This includes the ability of companies to form industry consortiums to undertake combined alternatives analyses, potentially resulting in significant savings. One industry study of REACH, for example, found that costs would be cut by 70% if companies were able to form consortia.[37] Longer implementation timelines could make it more likely that companies are able to successfully form consortia. Doing so may require overcoming significant logistical and technological hurdles, including effectively dealing with intellectual property protection among competing companies.

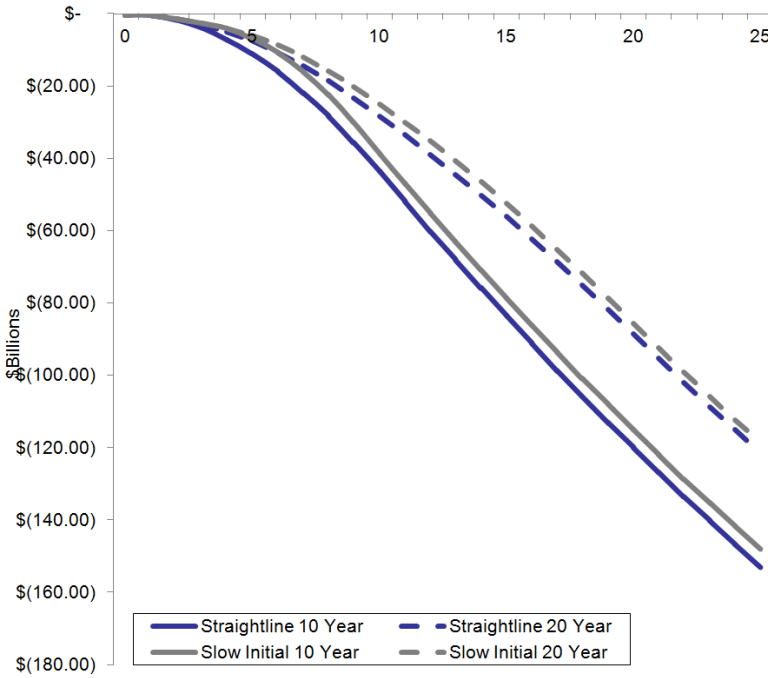
Similarly, the switching and mitigation costs could be significantly impacted by implementation timelines. Under a shorter timeline, such as DTSC proposes, companies will likely be limited to current technologies as their alternatives. Because fewer alternatives are

[37] KPMG Business Advisory Services, "REACH - further work on impact assessment: A case study approach," KPMG International, July 2005.

available under the shorter timeline, costs will likely be higher on average, since better alternatives may not be available.

The potential to alleviate impacts to consumers and manufacturers can vary widely based upon the chose timelines. As seen in Figure 7.1, net costs for the program are expected to be potentially significant regardless of timeline, but extending full implementation by a decade has the potential to delay $30 billion in costs.

Figure 7.1
Net Costs by Implementation Timeline



We included two basic implementation paths to illustrate this point: a straight-line path in which implementation increases uniformly over time and a slow initial path where implementation starts slowly, with five Priority Products initially and no additional products until Year 5.

Additionally, each implementation path is phased in over both 10 and 20 years and does not include potentially significant benefits due to R&D or administrative efficiency that may occur do to delay. Analysis from DTSC indicates that there could be benefits from innovation in the industry as a response to the regulation. Indeed, the Department indicates that this benefit could

lead to significant savings in the both the short and long-term of SCP. However, it is unclear exactly how crucial a role research and innovation will play in the on-going implementation of SCP and, more importantly, when will those technological advancements would occur along the implementation timeline.

Front-Loaded Costs

We assume that over time, the cost of chemical switching will decline as technology and experience improves and any front-loaded costs are paid for. This is consistent with DTSC's economic contractor's analysis, "In the medium term, each of these costs will decline due to market forces."[38] Our assumption is that the average cost, in real dollars, will decrease at a steady rate by 1% annually. This may be high or low depending on a number of unknown factors. Technological development could occur faster or slower than anticipated. Additional regulations in other states or nations may drive up costs due to increased demand or drive down costs due to economies of scale.

Realization of Potential Benefits

Whenever any analysis of green chemistry programs is undertaken, there is some possible benefit assumed for reduced medical expenditures and improvements in the workforce. DTSC itself commissioned a study by a widely respected expert on such benefits that could possibly be realized.[39] The analysis found that a percentage of certain widespread diseases could be directly attributable to chemical exposure in juveniles and adults, specifically cancer, Chronic Obstructive Pulmonary Disease (COPD), asthma, pneumoconioses, chronic and fatal renal failure, Parkinson's disease and mental retardation and cerebral palsy in infants.

Collectively, he estimates that these diseases are responsible for billions of dollars in annual medical spending and lost productivity. We use these estimates to determine part of our

[38] Kahn, Matthew E., "Economic Analysis of California's Green Chemistry Regulations for Safer Consumer Products," Department of Toxic Substances Control, March 2012.
[39] Leigh, J. Paul, "Costs of Toxic Chemical-induced Occupational Diseases Among Adults and Environmental Diseases Among Children within California," California Department of Toxic Substances, April 25, 2008.

estimated benefits. However, these benefits will not be fully realized immediately. They do have initial impacts, especially on reduced spending for childhood juvenile illnesses and lost parental/caregiver productivity, but the majority of these benefits are typically not realized until after age 40[40] and won't be fully realized until there are no individuals alive that would have been exposed to a listed chemical. The phase-in on health and productivity benefits therefore would phase in over the lifetime of a human being.

Similarly, DTSC's reports expect savings from decreased chemical cleanup costs thanks to the regulation. Like all of our impacts, we estimate that there will be a phasing period for savings from decreased chemical cleanup. However, these savings will ultimately be phased out. Industry estimates that spending on chemical mitigation and cleanup exceeds approximately $10.5 billion annually in California alone.[41] These benefits would be realized almost immediately, however these benefits would also decrease as the regulation takes hold and the industry begins producing less and less chemicals that need expensive mitigation or removal.

Switching Tradeoffs

In many instances, the alternative substance, even if seemingly preferable, will have negative traits of its own. For example, the GreenScreen program developed by Clean Production Action divides chemicals into four benchmark categories, as seen in Figure 7.2. They only suggest that a very small percentage, in Benchmark 4, can be used without looking for improved alternatives. The remaining three benchmarks, which encompass the vast majority of chemicals, have potentially significant negative traits.

[40] Alemayehu, Berhanu and Kenneth E. Warner, "The Lifetime Distribution of Health Care Costs," Health Services Research 39: 3, June 2004.
[41] Wilson, Michael P., Daniel A. Chia, and Bryan C. Ehlers, "Green Chemistry in California: A Framework for Leadership in Chemicals Policy and Innovation," California Policy Research Center, 2006.

Figure 7.2
GreenScreen Benchmarks

SOURCE: GreenScreen for Safer Chemicals, Clean Production Action.

This is important because switching is expensive. A potential reformulation will likely entail significant costs in terms of safety testing, performance testing and market testing, as well as a wide variety of possible investments required to change processes. Ensuring that the first switch is the final switch will significantly mitigate direct costs and risks to manufacturers. Conversely, switching to an imperfect alternative may lead to wasted infrastructure spending and significant costs down the road if required to switch again.

One example of this, which California has long struggled with, is gasoline blend. For years, California and many other states blended their gasoline with methyl tert-butyl ether (MTBE). MTBE improves the performance of gasoline and limits tailpipe emissions. Refiners began mixing it with gasoline in the 1970s to phase out leaded gasoline, which had significant negative health and environmental issues.

MTBE, however, proved an imperfect replacement. It resulted in significant environmental consequences, damaging potable water supplies and may be linked to cancer as well. In 2004, MTBE was banned in California and its use has subsequently been phased out nationwide. Ethanol has been the primary replacement for MTBE. American firms have invested significantly

in plants to produce corn-based ethanol, driven by demand for the fuel as a blend stock. Since 2003 when MTBE laws began being passed, the number of Ethanol plants has more than tripled and total production capacity has increased more than five-fold.[42]

But ethanol also proved to be an imperfect alternative. It is significantly more costly than MTBE and poses logistical challenges, especially as it relates to transport. It also leads to lower fuel efficiency, with about 20% less energy per gallon. Worse, it has significant environmental consequences, including greater greenhouse gas emission levels than gasoline itself. It also has potentially severe impacts on food chain issues and, as our country is currently experiencing, is highly susceptible to drought. Under the California Air Resources Board's Low Carbon Fuel Standard, California will need to switch again, over the next few years, to a new blend stock. It is not entirely clear what that switch will look like. What we can surmise, though, is that each step to this point has dealt with a specific harm only to bring about new ones.

In cases where there is an unequivocally superior alternative, it is likely that the alternative has already been implemented, or soon would be, with or without regulation. In cases where there are only imperfect alternatives, negative consequences could likely be lowered significantly with regulations that allow the time, rigor and flexibility to ensure that the regulations do not effectively mandate regrettable alternatives that will be need to be replaced within a short time frame.

Our model assumes that the replacement chemicals are maintained throughout the period considered. In this way it is conservative, since it is possible, and seemingly rather likely, that some imperfect alternatives will need to be replaced a second time over the life of the program, adding to the total costs. Since we assume that all benefits are realized in the first instance, the model would already give credit for the benefits of any subsequent improvements, adding to its conservative nature.

[42] Renewable Fuels Association, "Historic U.S. fuel Ethanol Production," http://www.ethanolrfa.org/pages/statistics, accessed on September 2012.

Winners and Losers

By enacting regulations of this sort, the government is implicitly picking winners and losers, creating markets for certain industries by enacting barriers to others. A critical concern, though, is whether mitigation occurs only in the macro-economic sense. Eliminating jobs in certain industries will directly harm the employees who are laid off, lose hours or lose wages and their families. Creating additional jobs in other industries only mitigates that harm if they require comparable skill sets and are created in a location that is accessible to displaced workers. A middle age factory worker will derive little benefits from jobs created in the chemical engineering field that require graduate degrees. Worse yet, California may cause jobs to effectively be exported out of the state or even out of the country. As DTSC's economic contractor writes, "In an extreme case in which entire product lines are banned, then retailers can import products designed in other countries such as Europe that are likely to meet DTSC's regulatory requirements."[43]

[43] Kahn, Matthew E., "Economic Analysis of California's Green Chemistry Regulations for Safer Consumer Products," Department of Toxic Substances Control, March 2012.

8. Conclusion

The SCP regulation being developed by DTSC has the potential to create significant impacts on consumers and manufacturers. The DTSC and their contractor provided poor analysis of the fiscal and economic impact the regulations would have on California. Information that is required by the state is left listed as “unknown” or in direct contradiction to other stated information throughout their analyses. Further exacerbating the problem is that literature on the projected costs of such a program, currently being undertaken in Europe, clearly indicates that there will be some significant costs from any similar green chemistry program. In addition, the regulation has the potential to pick winners and losers in industries.

After completing our analysis, we have determined that there will likely be some cost associated with the program and could reach as high as $100 billion by Year 25. We acknowledge the expected medical and productivity benefits, but our analysis makes it clear that there is still a great deal more information that needs to be understood about implementation before DTSC should move forward. Costs of the SCP are overwhelmingly front-loaded within the first few decades, with cost savings and other benefits not being realized until much later, and the manufacturing sector will bear the overwhelming costs of the regulation. It is unclear whether or not industries would even choose to participate in the California market or instead refuse to avoid compliance with the regulation.

There are opportunities to mitigate the cost to industry by increasing the phase-in time period to extend implementation costs over a longer period, but DTSC must take a step back from the regulation and consider serious alternatives.

Appendix A:
Literature Review

Study	Key Findings	Implication for California
Ackerman, Frank, Elizabeth Stanton and Rachel Massey, "European Chemical Policy and the United States: The Impacts of REACH," Global Development and Environment Institute, Tufts University, September 2006.	▪ $14 million in chemical products compliance costs annually for EU REACH program. Approximately 0.1% compliance cost-per-value of chemical products ▪ REACH will impact approximately 54,000 U.S. jobs at a cost of $250 per affected job per year	▪ REACH will impact California manufacturers that export to Europe
Bergeson, Lynn L., "Dreaming no longer: California issues draft safer consumer products regulations," Environmental Quality Management, Volume 21, Issue 3, pages 81–91, Spring 2012.	▪ These rules may have a significant and expanding impact on the way companies do business, requiring companies to undertake a number of new processes and expanding over time	▪ The regulations could potentially have significant costs for California industry and will likely expand significantly in the future
Bergkamp, Lucas, Lawrence Kogan and Nicolas Herbatschek, "Does REACH have a 'chilling effect' on trade and investment?" NewEurope Online, July 16, 2012.	▪ Distortion of capital flows to and within Europe ▪ "Chilling effect" on chemical substance and product innovation ▪ Industry costs of €2.1 billion	▪ Implementing a similar system involving product registration and testing will have costs to California industry and consumers
Clean Water Fund and Lowell Center for Sustainable Production, "Safer Jobs And A Sustainable Economy Through Green Chemistry and Safer Alternatives to Toxic Chemicals In California: A Constituency Analysis," March 2007.	▪ May stimulate economic and technological development ▪ May threaten the economic well being of Californians in particular localities and industries that make extensive use of chemicals included in the regulation	▪ There are potential benefits, in terms of growing new industries and developing new technologies as well as potential threats, in terms of undercutting current industries

Study	Key Findings	Implication for California
Commission of the European Communities, "Regulation of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restrictions of Chemicals (REACH), establishing a European Chemicals Agency and amending Directive 1999/45/EC and Regulation (EC) {on Persistent Organic Pollutants}: Extended Impact Assessment," SEC (2003) 1171/3, October 29, 2003.	▪ €4.7 billion - €7.8 billion in testing, registration and substitution costs over 11-15 years	▪ Implementing a similar system involving product registration and testing will have costs to California industry and consumers
Getzner, Michael, "Uncertainties and the precautionary principle in cost-benefit environmental policies," Journal of Policy Modeling, 30 (1): 1-17, 2008.	▪ A broad range of possible costs and benefits are possible ▪ €0.3 billion - €2.3 billion in total costs for implementation in Austria alone	▪ Implementing a similar system involving product registration and testing will have costs to California industry and consumers
Kahn, Matthew E., "Economic Analysis of California's Green Chemistry Regulations for Safer Consumer Products," Department of Toxic Substances Control, March 2012.	▪ Uncertain fiscal impacts ▪ Net economic benefits	▪ DTSC commissioned analysis
KPMG Business Advisory Services, "REACH - further work on impact assessment: A case study approach," KPMG International, July 2005.	▪ Critical substances are not likely to disappear under REACH for economic reasons ▪ Concerns about the extent and timing of possible future restrictions under REACH as they relate to adequate lead-in time and product cycles ▪ Companies do not plan to increase R&D budgets ▪ Narrowly defined 'identified use' may reduce business flexibility ▪ Loss of confidential business information is a threat for enterprises ▪ One time product costs increase of 6-20% passed on to consumers	▪ Implementing a similar system involving product registration and testing will have costs to California industry and consumers
KPMG International, "The Future of the European Chemical Industry," January 2010.	▪ Europe was seeing a decline in chemical manufacturing before the recession, largely due to increasing competition from Asia	▪ There are significant preexisting threats to California's chemical industry

Study	Key Findings	Implication for California
KPMG International, "The Outlook for the US Chemical Industry," October 2010.	▪ The U.S. has been quickly losing ground to Asia ▪ Tougher regulations may have a significant impact	▪ There are significant preexisting threats to California's chemical industry ▪ Current regulations may already be contributing to this
Lohse, Joachim, Martin Wirts, Andreas Ahrens, Kerstin Heitmann, Sven Lundie, Lothar Lißner and Annette Wagner, "Substitution of Hazardous Chemicals in Products and Processes," Directorate General Environment, Nuclear Safety and Civil Protection of the Commission of the European Communities, March 2003.	▪ Decisions to substitute substances taken in enterprises are influenced by policy, regulation and enforcement, technology development, economy and market, scientific finding and the public debate ▪ Both environmental legislation and public pressure are relevant external factors	▪ Substituting substances for less toxic substances or processes involves significant tradeoffs
Malloy, Timothy F., Peter J. Sinsheimer, Ann Blake, Igor Linkov, "Developing Regulatory Alternatives Analysis Methodologies for the California Green Chemistry Initiative," UCLA Sustainable Technology & Policy Program, October 20, 2011.	▪ Methodology can have a significant impact on the results of an analysis ▪ Additional development is required in a number of areas	▪ The design of the program will have a significant impact on both the efficacy and the costs of the regulation
National Electrical Manufacturers Association, "EU REACH and U.S. Regulation of Chemicals and Chemical Users," White Paper, August 2007.	▪ State and local policies that go beyond federal toxics policies are economically damaging and impede innovation	▪ These regulations will make California's industries less competitive with national and international firms
Rovida, Costanza and Thomas Hartung, "Re-Evaluation of Animal Numbers and Costs for In Vivo Tests to Accomplish REACH Legislation Requirements for Chemicals," ALTEX 26 (3): 187-208, 2009.	▪ EU drastically underestimates costs ▪ May require as many as 54 million test animals ▪ Original assumptions drastically understated scope ▪ €9.5 billion, although this should be considered optimistic and the number of animals required may nearly triple	▪ Implementing a similar system involving product registration and testing will have costs to California industry and consumers

Study	Key Findings	Implication for California
Vernon, Jan, Anthony Footitt, Tobe Nwaogu, "Revised Business Impact Assessment - Consultation Document," European Commission Enterprise Directorate-General, October 2003.	▪ Prior reports understate costs ▪ Preparing CSR will cost €2,500-€33,650 per substance ▪ €12.8 billion - €26.5 billion over 15 years, range due to uncertainty of number of polymers included	▪ Implementing a similar system involving product registration and testing will have costs to California industry and consumers
Wilson, Michael P., Daniel A. Chia and Bryan C. Ehlers, "Green Chemistry in California: A Framework for Leadership in Chemicals Policy and Innovation," California Policy Research Center, 2006.	▪ A significant portion of numerous childhood illnesses and occupational illnesses are linked to chemical exposure ▪ Federal regulations have numerous shortcomings	▪ There are potential health savings available to California due to shortcomings in Federal regulations

Appendix B:
Assumptions

Policy Assumption	Explanation	Source
Timelines for Costs and Benefits	▪ For each of the costs and benefits, we estimate a total phase-in (or phase-out, as necessary) to determine how much of an impact that cost or benefit would have in a given year	Existing literature on product life cycles and DTSC implementation timeframes
Switching Costs for Existing Chemicals	▪ Using literature from various analogous but limited switching case studies, we have determined a range of possible cost impacts to the industry	Existing literature on case studies of chemical switching and product life cycles
Compliance Costs, Including Alternatives Analysis	▪ Using literature from Europe's REACH program, we have determined a range of possible cost impacts to the industry	Existing literature on compliance costs
Cost Savings on Medical Spending and Increased Worker Productivity	▪ We use the Department's own analysis of annual spending on medical visits and lost worker productivity related to chemical-caused illness and disabilities	Analysis completed for Department of Toxic Substances Control
Cost Savings on Waste Mitigation and Cleanup	▪ The chemical manufacturing industry puts out regular reports on in-industry spending on chemical cleanup as a share of expenditures annually	Industry reports on annual spending towards chemical waste cleanup
Realization of Health Benefits	▪ Prior exposure has no impact, once a chemical is eliminated, all health and productivity gains will be realized, regardless of prior exposure	Limited literature highlighting medical impacts from switching chemicals; analysis on medical spending occurring later in life
Size of the Market Impacted	▪ DTSC has not released the list of chemicals of concern or the specific priority products and has indicated that it will not do so until the regulation has been finalized and chemicals are used in virtually every consumer product, so the range of products impacted could be immense	DTSC's indication on the estimated number of priority products and federal data on the number of chemicals produced in the U.S. and California specifically

Appendix C:
Impact Model

(All Dollars in $2010 and $Millions, Unless Otherwise Stated)

Appendix C-1
Direct Replacement Costs

	Year 1	Year 10	Year 20	Year 25
Total CA Chemical Value[44]	$43,895	$43,895	$43,895	$43,895
CA Pharmaceuticals[45]	$28,819	$28,819	$28,819	$28,819
Subtract pharmaceutical from chemical value	-			
Remaining Chemicals	$15,076	$15,076	$15,076	$15,076
Portion Impacted[46]	33.9%	33.9%	33.9%	33.9%
Multiply remaining chemicals by portion impacted	x			
Total Cost of Chemicals Impacted	$5,105	$5,105	$5,105	$5,105
Portion Online[47]	0.0%	90.0%	100.0%	100.0%
Product Life[48]	100.0%	100.0%	100.0%	100.0%
Multiply total costs of chemicals impacted by portion online and product life	x			
Total Impacted This Year	$-	$4,595	$5,105	$5,105

[44] BEA, Regional Data, GDP by State, 2010
[45] BEA, Regional Data, GDP by State, 2010
[46] Total Priority Products included divided by unique chemicals in CA
[47] Assumed, see sensitivity analysis in Section 7
[48] Assumed based on standard product life

Replacement Multiplier[49]	(1.50)	(1.50)	(1.50)	(1.50)
Annual Reduction[50]	100.0%	91.4%	82.6%	78.6%
Multiply total impacted by replacement multiplier and annual reduction	x			
Replacement Chemical Additional Costs – CA	**$-**	**$(6,296)**	**$(6,327)**	**$(6,017)**
Nat'l Retail/Wholesale[51]	$1,701,937	$1,701,937	$1,701,937	$1,701,937
Nat'l Pharmaceuticals[52]	$201,836	$201,836	$201,836	$201,836
Subtract pharmaceutical from retail/wholesale value	-			
Remaining Retail/Wholesale	$1,500,101	$1,500,101	$1,500,101	$1,500,101
CA Retail/Wholesale[53]	$214,340	$214,340	$214,340	$214,340
CA Pharmaceuticals[54]	$28,819	$28,819	$28,819	$28,819
Subtract pharmaceutical from retail/wholesale value	-			
Remaining Retail/Wholesale	$185,521	$185,521	$185,521	$185,521
Divide California Retail/Wholesale by Nat'l	÷			
CA Share of Nat'l	12.4%	12.4%	12.4%	12.4%
Nat'l MFG Chems[55]	$245,493	$245,493	$245,493	$245,493
Multiply CA Share by National Chems	x			

[49] Assume for this case, 75th percentile of literature review
[50] Assumed 1% annual reduction in real dollars
[51] BEA, Regional Data, GDP by State, 2010
[52] BEA, Regional Data, GDP by State, 2010
[53] BEA, Regional Data, GDP by State, 2010
[54] BEA, Regional Data, GDP by State, 2010
[55] BEA, Regional Data, GDP by State, 2010

CA Share of Nat'l Total	$30,361	$30,361	$30,361	$30,361
CA MFG Chems	$25,802	$25,802	$25,802	$25,802
Subtract CA MFG from CA Share	-			
Net Imports	$4,558	$4,558	$4,558	$4,558
Portion Impacted[56]	33.9%	33.9%	33.9%	33.9%
Multiply net imports by portion impacted	x			
Total Cost of Chemicals Impacted	$1,544	$1,544	$1,544	$1,544
Portion Online[57]	0.0%	90.0%	100.0%	100.0%
Product Life[58]	100.0%	100.0%	100.0%	100.0%
Multiply total cost by portion online and product life	x			
Total Impacted This Year	$-	$1,389	$1,544	$1,544
Replacement Multiplier[59]	(1.50)	(1.50)	(1.50)	(1.50)
Annual Reduction[60]	100.0%	91.4%	82.6%	78.6%
Multiply total impacted by replacement multiplier and annual reduction	x			
Replacement Chemical Additional Costs – Net Imports	**$-**	**$(1,904)**	**$(1,913)**	**$(1,819)**
Add California Replacement and Net Imports	+			
Total Additional Replacement	**$(469)**	**$(8,669)**	**$(8,240)**	**$(7,836)**

[56] Total Priority Products included divided by Unique chemicals in CA
[57] Assumed, see sensitivity analysis in Section 7
[58] Assumed based on standard product life
[59] Assume for this case, 75th percentile of literature review
[60] Assumed 1% annual reduction in real dollars

Appendix C-2
Direct Administrative/Analytical Costs

	Year 1	Year 10	Year 20	Year 25
Total CA Chemical Value[61]	$19,634	$19,634	$19,634	$19,634
Portion Online[62]	10.0%	10.0%	0.0%	0.0%
Multiply total value by portion online	x			
Total Impacted This Year	$1,963	$1,963	$-	$-
Cost Increase for Testing/Registration[63]	-23.9%	-23.9%	-23.9%	-23.9%
Multiply total impacted by cost increase	x			
Additional Administrative Costs	**$(469)**	**$(469)**	**$-**	**$-**

Appendix C-3
Direct Benefits

	Year 1	Year 10	Year 20	Year 25
Potential Medical Spending Avoided[64]	$-	$231	$408	$522
Portion Online[65]	0.0%	90.0%	100.0%	100.0%
Multiply medical spending avoided by portion online	x			

[61] Appendix C-1
[62] Assumed, see sensitivity analysis in Section 7
[63] Assume for this case, 75th percentile of literature review
[64] Leigh, J. Paul, "Costs of Toxic Chemical-induced Occupational Diseases Among Adults and Environmental Diseases Among Children within California," California Department of Toxic Substances, April 25, 2008.
[65] Assumed, see sensitivity analysis in Section 7

Medical Spending Avoided	**$-**	**$208**	**$408**	**$522**
Potential Worker Productivity Gained[66]	$-	$335	$708	$894
Portion Online[67]	0.0%	90.0%	100.0%	100.0%
Multiply productivity gained by portion online	x			
Worker Productivity Gained	**$-**	**$302**	**$708**	**$894**
Annual Cleanup Spending in CA[68]	$151	$151	$151	$151
Portion of Savings Realized	0.0%	86.7%	70.0%	61.7%
Multiply annual spending by portion realized	x			
Cleanup Costs Avoided	**$-**	**$131**	**$106**	**$93**
Add medical spending avoided, productivity gained and cleanup costs avoided	+			
Total Savings	**$-**	**$641**	**$1,221**	**$1,509**

[66] Leigh, J. Paul, "Costs of Toxic Chemical-induced Occupational Diseases Among Adults and Environmental Diseases Among Children within California," California Department of Toxic Substances, April 25, 2008.
[67] Assumed, see sensitivity analysis in Section 7
[68] Wilson, Michael P., Daniel A. Chia, and Bryan C. Ehlers, "Green Chemistry in California: A Framework for Leadership in Chemicals Policy and Innovation," California Policy Research Center, 2006.

Appendix D:
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