

California's Green Chemistry Initiative at Age 10:

AN EVALUATION OF ITS PROGRESS AND PROMISE



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GLOSSARY OF ABBREVIATIONS

AA	Alternatives Analysis
A.B.	Assembly Bill
BCRC	Breast cancer-relevant chemicals
CalEPA	California Environmental Protection Agency
Cal/OSHA	California Division of Occupational Safety and Health
CBI	Confidential Business Information
CDPH	California Department of Public Health
DTSC	Department of Toxic Substances Control
EPA	United States Environmental Protection Agency
E.U.	European Union
NGO	Non-governmental organization
NPEs	Nonylphenol polyethoxylates
OECD	Organization for Economic Cooperation and Development
OEHHA	Office of Environmental Health Hazard Assessment
PFAS	Perfluoro/polyfluoroalkyl substances
REACH	E.U. Registration, Evaluation, Authorization and Restriction of Chemicals
S.B.	Senate Bill
SCP	Safer Consumer Products Program
TIC	Toxics Information Clearinghouse
TSCA	U.S. Toxic Substances Control Act
TURA	Massachusetts Toxics Use Reduction Act
TURI	Massachusetts Toxics Use Reduction Institute

The report, along with accompanying supplementary materials, is available online:

<http://bit.ly/CAGreenChemistry>

<http://www.phi.org/resources/?resource=california-green-chemistry-report>

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Executive Summary

In 2008, the California legislature enacted two groundbreaking laws collectively designed to protect Californians from toxic chemicals in products, and to provide the public with more information about chemical hazards. Assembly Bill 1879 created the Safer Consumer Products Program, requiring the Department of Toxic Substances Control (DTSC) to evaluate chemicals of concern in products and their potential alternatives, and to reduce the hazards of chemicals in products. Senate Bill 509 established a Toxics Information Clearinghouse (TIC) for data on chemical hazards. The Office of Environmental Health Hazard Assessment (OEHHA) was required to identify the hazard traits to be included in the TIC. A decade later, we critically review the progress made under these two laws, which collectively enacted the California Green Chemistry Initiative.

This policy research project included three overlapping phases of work: (1) A literature review to identify best practices in chemical policy; (2) Interviews with experts in green chemistry science and policy to evaluate the Green Chemistry Initiative; and (3) Evaluation of the degree to which breast cancer-relevant chemicals have been addressed to date. Experts from business, non-profit, academic, and government perspectives were interviewed to elicit strengths and challenges of the current laws and program. The interviews were transcribed and analyzed using qualitative research methods, and the draft findings were

reviewed by additional experts. Additional methods included a scoping review of the literature relevant to the program, and comparison of lists of breast cancer-relevant chemicals, to assess the degree to which these have been addressed or could be addressed through the existing program.

Ten ideal attributes of successful chemical policy emerged from the literature review and interviews:

Data—authority to obtain information on product ingredients, exposure, and chemical hazard

Information Flow—balancing protection of confidential business information while promoting the public right to know

Prioritization—selecting important issues and avoiding less important ones

Efficiency—moving to a conclusion within a reasonable time period

Transparency—incorporating adequate opportunities for public input

Protection—focusing on protecting the most vulnerable, and preventing regrettable substitutions

Authority—ability to take needed action to protect health and the environment

Burden—requiring the business to ensure the safety of their chemicals or products

Market Guidance—sending clear signals to drive businesses toward safer chemicals

Incentives—promoting education, technical assistance, research and development.

The California Green Chemistry Initiative is unique and innovative. It has the potential to drive the market for safer chemicals and products because the California market is so significant globally. The California laws and program include many of the ideal attributes of a successful chemical policy, particularly in the areas of information flow, transparency, and adequate authority to achieve public health protection. The Safer Consumer Products Program (SCP), in particular, has the authority to place the burden to evaluate chemical alternatives on the business, and is designed to provide market guidance. However, some experts

“Everybody cares about [the Program] because it’s about products sold in the State of California. And no ... product manufacturer, is going to avoid the California market.”

[BUSINESS EXPERT]

point out that the program has not fully utilized these strengths. Other experts contend that numerous toxic chemicals have been quietly and voluntarily removed from a variety of products in response to the SCP, making it difficult to gauge the impact based solely on regulatory actions. Experts also praised the OEHHA Hazard Traits regulation, and urged that the Hazard Traits be more actively used to predict the toxicity of poorly-tested and emerging chemicals.

Three significant areas of weakness have impaired the ability of the California Green Chemistry Initiative to live up to its potential:

- 1 The pace of implementation of the SCP has been slow, with relatively few chemical-product combinations identified for action so far.
- 2 The SCP suffers from unclear authority to collect data on chemicals in products, and struggles with broader data gaps on exposure and toxicity, impairing its ability to identify priorities and take subsequent regulatory action.
- 3 California's overall efforts and investment have so far not been sufficient to foster robust research and development of safer product chemistry.

The interviewees described multiple reasons for these lagging areas, including the lack of a dedicated funding stream, insufficient staffing, limited clarity and flexibility in some aspects of the law, and a deliberative pace of implementation. Some experts predicted that some lagging areas would improve with time, whereas most recommended adjustments to the law, the funding structure, and the implementation to ensure success.

The experts also criticized other areas. The Toxics Information Clearinghouse was universally seen as a disappointment, providing little or no useful information. Within the SCP, experts noted some lack of clarity around how chemical-product combinations are prioritized, and a very complex structure for the chemical Alternatives Analyses (AAs) required under the SCP regulations. Finally, the experts universally expressed disappointment that some of the original goals of the California

Green Chemistry Initiative, such as fostering innovation in product chemistry, have not been acted upon over the past decade.

Based on the findings, we recommend enhancements to strengthen and streamline the statutory authority and allow the SCP to be more effective; improvements to the California scientific programs related to exposure monitoring, chemical hazard identification, and public information on toxic chemicals; enhanced commitment to fostering a robust green chemistry industry through public-private-academic partnerships; and development of a sustainable long-term funding strategy to ensure California's future environment and people are safe from toxic chemicals. The specific recommendations include:

A.B. 1879 and Safer Consumer Products Program Enhancements

→ Amend the legislation to allow expedited action on certain product-chemical combinations

Expedited action should occur when DTSC or the legislature finds that a product-chemical combination meets one of three criteria: (1) the chemical is not necessary for the function of the product; (2) a safer alternative is already in use by major manufacturers; or (3) a satisfactory Alternatives Analysis has already been performed.

→ Clarify and strengthen data call-in authority

DTSC needs clear statutory authority to require manufacturers to disclose the function and use of chemicals in products. Appropriate protections for confidential business information (CBI) must be maintained.

→ Evaluate the SCP prioritization process

DTSC should evaluate the scientific and procedural foundation of its prioritization process to ensure that it is as efficient as possible and that the prioritization strategy is clearly articulated and appropriately transparent. This evaluation should be done in consultation with the Green Ribbon Science Panel.

→ **Streamline and support Alternatives Analysis**

Some flexibility in the statutory criteria would allow DTSC to streamline its regulations and guidance and utilize existing high-quality Alternatives Analyses more easily. DTSC also needs authority to assess a fee for reviewing Alternatives Analyses, or to hire a third-party if the regulated business does not produce an adequate one.

S.B. 509 and Scientific Enhancements

→ **Enhance exposure monitoring**

The California Environmental Protection Agency (CalEPA) should enhance human and environmental monitoring of toxic chemicals in air, water, soil, and food; integrate data across programs and environmental media where possible; and seek increased support for new monitoring methods and biomonitoring of chemicals in people.

→ **Update and utilize the Hazard Traits**
OEHHA should reevaluate the Hazard Traits regulation to ensure that it accounts for new scientific methods; and use the Hazard Traits to compile a “Watch List” of emerging chemicals, using predictive toxicology techniques

→ **Re-structure the Toxics Information Clearinghouse (TIC)**

The TIC could be integrated with DTSC’s existing CalSAFER website, to display public data from data call-ins. Alternatively, the responsibility for the TIC could be transferred to OEHHA to house and display the chemical Watch List, including Hazard Trait information. The Green Ribbon Science Panel should review existing online resources and advise DTSC on how to re-purpose the TIC.

Green Chemistry and Safer Product Advancements

→ **Support academic centers for green chemistry**

One or more state-supported centers for education and research in California is needed to integrate and propel forward the science of chemistry, predictive toxicology, and alternatives assessment. California must train the next generation of chemists in multidisciplinary approaches that include health and environmental responsibility.

→ **Partner with leading businesses to advance safer chemistry**

DTSC should more actively engage with companies that are leaders in advancing product chemistry. Jointly funding challenge grants, awards, or other strategies to spark innovation would be an effective way to leverage state resources.

Over-Archiving Recommendation to Support California’s Commitment to a Safe Future

Substantially increase funding for California’s Green Chemistry Initiative

California programs cannot meet the public’s expectations, and protect health and ecosystems, without a substantial increase in funding. CalEPA should:

- Conduct a funding study to identify appropriate funding source(s) and document the necessary funding level.
- Develop a funding proposal to enhance environmental monitoring and biomonitoring; sustainably support the Safer Consumer Products Program; enable OEHHA to track the Hazard Traits of chemicals; adequately support the TIC; and allow the State to support and incentivize safer chemistry.
- Seek legislative approval for permanent Green Chemistry funding.

Introduction

In 2008, California policymakers enacted Assembly Bill (A.B.) 1879 (Feuer) and Senate Bill (S.B.) 509 (Simitian). Signed into law by Governor Schwarzenegger, these laws established the California Safer Consumer Products Program and the Toxics Information Clearinghouse. The laws, often described collectively as the enactment of the “California Green Chemistry Initiative”, are designed to reduce toxic chemicals, promote greener chemistry in products, and provide information to the public.

The new legislation built on a foundation of other unique California chemical laws, including the Safe Drinking Water and Toxic Enforcement Act (established by referendum in 1986 as Proposition 65); the Children’s Environmental Health Protection Act (established in 1999 in S.B. 25 (Escutia)); the California Environmental Contaminant Biomonitoring Program (established in 2006 in S.B. 1379 (Ortiz)); and numerous other laws on toxic air contaminants and specific pollutants. The intention of these laws is to protect the California environment, and the health of Californians, with an emphasis on susceptible groups, from toxic chemicals that could cause cancer or other serious diseases (Geiser, 2009). Many of these laws also responded to gaps in federal laws, such as in the Toxic Substances Control Act (TSCA) of 1976 (Applegate, 2008). Californians have long recognized that federal laws are not always adequate to protect health (Malloy, 2015). Despite a 2016 overhaul of TSCA, implementation at the federal level suggests that California laws and regulations remain essential for protecting our health and the environment.

The scientific literature strongly suggests that

environmental chemicals and other stressors, are contributing to numerous health conditions, including cancer. Some chemicals cause mutations, directly initiating a process that can lead to cancer. Other chemicals promote cell proliferation, inhibit immune response, or cause other cellular alterations, thereby also increasing cancer risk (Schwarzman, 2015; Smith, 2016). Hundreds of chemicals in current use today are linked to increased risk of cancer, including chemicals in pesticides, plastics, foods, smoke, and gasoline (Gray, 2017; Brody, 2010). Although the causes of observed increases in breast cancer and certain other cancers are multi-factorial and not fully understood, it is likely that environmental carcinogens play a significant role (Nudelman, 2009). Despite this information, many chemicals that are linked to cancer, reproductive toxicity, neurotoxicity, and other serious health effects are still in widespread use in our environment and in consumer products. It is therefore imperative to analyze the effectiveness of public policies in California to ensure that they protect public health from toxic and carcinogenic chemicals.

Background: California Green Chemistry and the Safer Consumer Products Program

In 2006, a report to the legislature from the University of California (Wilson et al. 2006b) identified major deficiencies in U.S. federal regulation of chemicals: The Data Gap, the Safety Gap, and the Technology Gap. The report authors argued that those deficiencies adversely affect states including California; pointed to leadership by some major California companies to promote

“I think California is trying to do things that nobody’s done before.”

[BUSINESS SCIENTIST]

green chemistry; and called for adoption of a comprehensive chemical policy in California to address the three gaps. The Data Gap referred to insufficient information on toxicity, use, or exposure to new and existing chemicals. The Safety Gap described limits on regulatory authority that curb government's ability to protect the public from hazardous chemicals in multiple media and in products. The Technology Gap reflected the lack of green chemistry education and the need for businesses and governments to prioritize research and development of safer chemicals.

In 2007, the Secretary for Environmental Protection directed the Department of Toxic Substances Control (DTSC) to launch a Green Chemistry Initiative. The first phase involved compilation of over 800 policy options submitted by more than 600 participants in an open call to the public (CalEPA 2008b). DTSC assembled a Green Chemistry Science Advisory Panel consisting of 21 scientists and engineers charged with providing the technical basis for the Green Chemistry Initiative. In June 2008 the panel reported 38 options to advance green chemistry (GCI SAP, 2008).

The final "Phase 2" report of the California Green Chemistry Initiative presented six recommendations: "(1) Expand pollution prevention and product stewardship programs to more business sectors; (2) Develop green chemistry workforce education and training, research and development and technology transfer; (3) Create an online product ingredient network; (4) Create an online clearinghouse of chemical toxicity and hazards with the guidance of a Green Ribbon Science Panel to help prioritize chemicals of concern and data needs; (5) Create a systematic, science-based process to evaluate chemicals of concern and alternatives; and (6) Move toward a Cradle-to-Cradle economy by establishing a California Green Products Registry to develop green metrics and tools and encourage their use by businesses." (CalEPA 2008a)

Some of these recommendations were signed into law as Assembly Bill (A.B.) 1879 (Feuer) by Governor Schwarzenegger, entering into effect on

RECOMMENDATIONS FROM THE CALIFORNIA GREEN CHEMISTRY INITIATIVE

- 1 Expand pollution prevention and product stewardship programs to more business sectors;
- 2 Develop green chemistry workforce education and training, research and development and technology transfer;
- 3 Create an online product ingredient network;
- 4 Create an online clearinghouse of chemical toxicity and hazards with the guidance of a Green Ribbon Science Panel to help prioritize chemicals of concern and data needs;
- 5 Create a systematic, science-based process to evaluate chemicals of concern and alternatives; and
- 6 Move toward a Cradle-to-Cradle economy by establishing a California Green Products Registry to develop green metrics and tools and encourage their use by businesses.

January 1, 2009. A.B. 1879 required the state to "establish a process by which chemicals of concern in products, and their potential alternatives, are evaluated to determine how best to limit exposure or to reduce the level of hazard posed by a chemical of concern." This law was designed primarily to address the "Safety Gap" identified by Wilson et al. (2006b), and recommendation #5 from the Phase 2 report.

A second law, Senate Bill (S.B.) 509 (Simitian), was signed as part of the same legislative package. It attempted to address some aspects of the "Data Gap" and recommendation #4 of the Phase 2 report. S.B. 509 established a Toxics Information Clearinghouse (TIC) for the "collection, maintenance, and distribution of specific chemical hazard trait and environmental and toxicological end-point data." The Office of Environmental

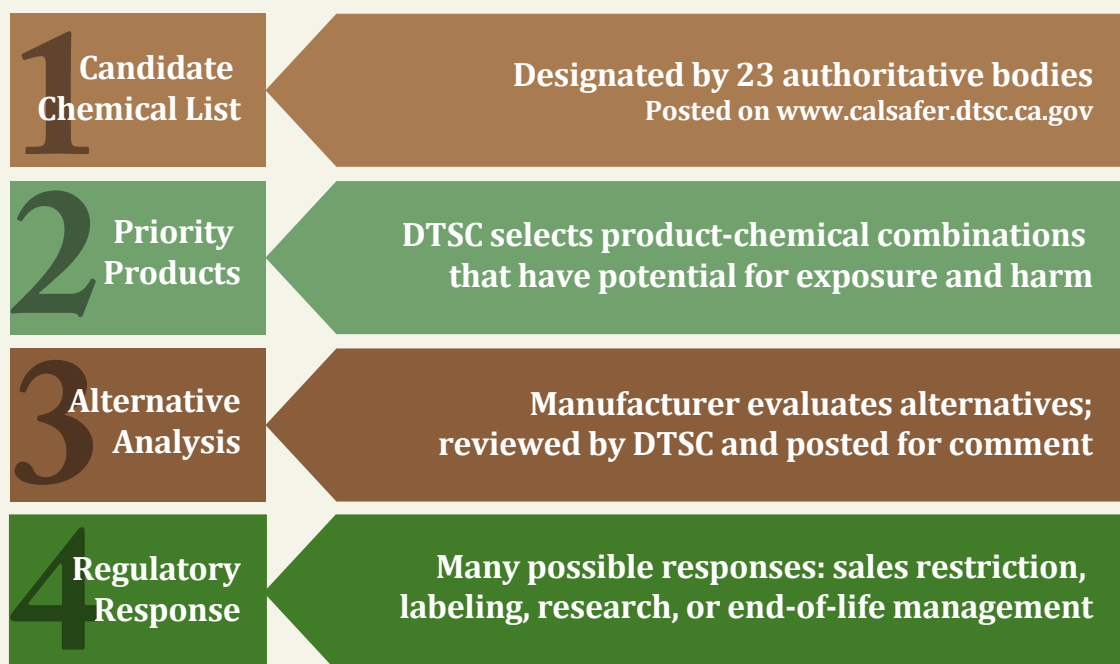
Health Hazard Assessment (OEHHA) was required to “evaluate and specify the hazard traits and environmental and toxicological end-points and other relevant data that are to be included in the clearinghouse.” OEHHA adopted a regulation defining hazard traits in December of 2011 (22 CCR § 69401-69407.2 2012).

Recommendations #1-3 and #6 of the Phase 2 report were never adopted in California. In fact, the pollution prevention program at DTSC was eliminated in order to fund and staff the new Safer Consumer Products Program (SCP) established under A.B. 1879. A Center for Green Chemistry was established at U.C. Berkeley, but it has remained very small and has not had the capacity to engage in broad workforce education, training, research and development, and technology transfer. No “online product ingredient network” was created, although recent legislation did create ingredients disclosure for cleaning products (S.B. 258 (Lara), 2017).

Implementation of A.B. 1879 was given to DTSC, which was required to adopt regulations defining

the process by January 1, 2011. DTSC ultimately adopted implementing regulations that came into effect on October 1, 2013 (DTSC, 2013). The regulations contain a four-step process to implement the law (Figure 1). Step 1 is creation of a Candidate Chemicals list based on numerous existing authoritative lists; the list currently contains nearly 2,400 individual chemicals and several broad chemical classes (CalSAFER, 2018; Cowan et al. 2014; Krowech et al. 2016). Step 2 is identification by DTSC, in a rulemaking, of a Priority Product that contains one or more of the chemicals on the Candidate Chemicals list. DTSC is required to show that there is “potential exposure to the Candidate Chemical in the product” and that there is “potential for one or more exposures to contribute to or cause significant or widespread adverse public health and/or environmental impacts.” This process includes a pre-regulatory workshop, notice and comment, and a public hearing. Promulgating a regulation is often a multi-year process; thus considerable time elapses during the identification of each chemical-product

FIGURE 1: Structure of the Safer Consumer Products Program



California Code of Regulations, title 22, Chapter 55. Safer Consumer Products. Sections 69501-69510.

combination. Once a product is listed in regulation, in Step 3, a responsible entity, usually the product manufacturer, must conduct an Alternatives Analysis (AA) for the product within a specified timeframe. The preliminary and final AA reports are reviewed by DTSC and redacted versions are posted for public review. At that point, DTSC determines whether to move to Step 4—the regulatory response. DTSC has very broad authorities in Step 4, including banning or restricting the chemical in the product, requiring product labeling or end-of-life management, or requiring funding of research into safer alternatives.

A business may choose to take quicker action in several ways, such as by removing the product from sale in California, removing the chemical from the product, or concluding that “a functionally acceptable and technically feasible alternative”

does not exist. In the latter case, the business may submit an abridged AA report. To date the Safer Consumer Products Program has moved very deliberately, with two product-chemical combinations currently finalized and four more in various stages of Step 2 (Table 1). No products have yet undergone AA under this program and no regulatory responses have yet occurred.

ALTERNATIVES ASSESSMENT is a process for systematically identifying, comparing, and selecting safer alternatives to chemicals of concern on the basis of hazards, performance, and economic viability. The term “Alternatives Analysis” specifically refers to the alternatives assessment process laid out in the DTSC Safer Consumer Product regulations.

TABLE 1: Chemicals and Products Identified by the Safer Consumer Products Program

CHEMICAL	PRODUCT	STATUS	BREAST CANCER-RELEVANT?
Tris(1,3-dichloro-2-propyl)phosphate (TDCPP) and Tris(2-carboxyethyl) phosphine (TCEP)	Children’s Foam Padded Sleeping Products	Listing finalized 7/1/17	No*
Methylene diphenyl diisocyanates (MDI)	Spray polyurethane foam systems	Listing finalized 7/1/18	No
Methylene chloride	Paint or varnish strippers	Listing proposed 11/17/17	Yes
Perfluoro/polyfluoro alkyl substances (PFAS)	Carpets and rugs	Pre-regulatory proposal	Yes
Nonylphenol ethoxylates (NPEs)	Laundry detergents	Pre-regulatory proposal	Yes
1-methyl-2-pyrrolidone (NMP)	Paint and varnish strippers and graffiti removers	Pre-regulatory proposal	No**

* TDCPP and TCEP are carcinogens, but do not appear on the list of Breast Cancer-Relevant Chemicals.

** NMP is a developmental toxicant

Approach

Other researchers have published evaluations of various chemical policy models, ranging from REACH in the European Union, to the newly-enacted federal Lautenberg Chemical Safety Act (Lautenberg, 2016), and state policies (See e.g., Ahlers, 2008; Forth, 2008; Geiser, 2009; Jardine, 2003; Santillo, 2006; Silbergeld, 2015; Tickner, 2005; Williams, 2009). No comprehensive evaluation of the California Green Chemistry Initiative has been published to date. Focused publications have mentioned or reviewed the chemical list, the Alternatives Analysis process, and the potential for the program to protect vulnerable populations (Alcantar, 2017; Cowan, 2013).

This policy research project evaluated whether there are politically and scientifically feasible policy enhancements that could strengthen and assist in the implementation of California's existing laws on toxic chemicals, with a focus on the SCP established under A.B. 1879 and the TIC established under S.B. 509. The research project included three overlapping phases of work: (1) A scoping review of the literature to identify best practices in chemical policy; (2) Interviews with experts in green chemistry science and policy to evaluate the Green Chemistry Initiative; and (3) Evaluation of the degree to which breast cancer-relevant chemicals have been addressed by the program. The project was conducted in consultation with a project Advisory Group.

A list of 128 potential interviewees was created from public documents and screened according to three criteria: (1) Does the candidate have direct and current expertise on chemical policy? (2) Does the candidate have a perspective that is unique or different from others already selected? and (3) Is the candidate a recognized influential figure in the field? In consultation with the Advisory Group, a purposeful sample of 24 experts from government, academia, business, and the non-profit sector was selected for the initial semi-structured interviews. Over half of the interviewees were from

“The inclusion of workers was really fantastic, [as was] the requirement for special consideration for exposure to vulnerable populations.”

[NGO]

California, with the remainder from other states, federal, and international perspectives. 13 of the 24 interviewees were scientists and the rest were attorneys or policy experts. Nine interviewees worked at local, state, national, or international government agencies, with 5-7 experts each from nonprofit organizations, academic institutions, and businesses. Several interviewees had more than one perspective or affiliation but were assigned to one category for most analyses. One interviewee with multiple affiliations preferred to be identified as a scientist rather than by a primary affiliation.

Interview questions were developed through a scoping review of the literature and input from the Advisory Group; interviews were conducted by one interviewer in March-April 2018, recorded and professionally transcribed. Transcripts were uploaded to the Dedoose® qualitative research platform and coded by two researchers. The interviews generated 799 unique text excerpts with 2784 code applications for analysis. Preliminary findings were refined through consultation with the Advisory Group and with 10 additional experts from the original list of potential interviewees, representing a broad range of perspectives. The findings were used to create a framework for effective chemicals policy, expanding the framework developed by Wilson et al. (2009), and to assess the performance of the California program against the framework. A complete description of the methods, the interview questions, and a list of interviewees can be found in the supplementary materials.

A list of breast cancer-relevant chemicals was compiled from several existing authoritative lists by researchers at the Silent Spring Institute in Newton,

Massachusetts.¹ This list was compared against the DTSC Candidate Chemicals list, generating a list of 167 chemicals or chemical groups that appear on both lists. This list was then compared against the chemicals that have been identified to date by the Safer Consumer Products Program in pre-regulatory or regulatory product-chemical combinations. Breast cancer-relevant chemicals that are not on the Candidate Chemicals list were evaluated to determine if they are potential candidates for addition.

Findings

Ten ideal attributes of a successful chemical policy emerged from the literature review and interviews and we organized them in the framework of the three gaps identified by Wilson et al. 2009 (Table 2). The elements include: (1) **Data**—Authority to obtain information on product ingredients, exposure, and chemical hazard; (2) **Information Flow**—balancing protection of confidential business information while promoting the public right to know; (3) **Prioritization**—selecting important issues and avoiding less important ones; (4) **Efficiency**—moving to a conclusion within a reasonable time period; (5) **Transparency**—incorporating adequate opportunities for public input; (6) **Protection**—protecting the most vulnerable, and preventing regrettable substitutions; (7) **Authority**—ability to take needed action to protect health and the environment; (8) **Burden**—ensuring that the business is primarily responsible for the safety of their chemicals or products; (9) **Market Guidance**—sending clear signals to drive businesses toward safer chemicals; and (10) **Incentives**—providing education, technical assistance, research and development. The last of these elements is not a direct component of the California regulatory program and will be discussed separately below. We evaluated the performance of

the SCP against these ideal attributes to describe progress addressing the Data Gap, the Safety Gap, and the Technology Gap that initially informed the program’s development, and to identify remaining weaknesses.

Strengths of the Safer Consumer Products Program

The California green chemistry laws in general, and the SCP in particular, are viewed by experts from all perspectives as unique and innovative, having a broad scope and an international impact. The unique and innovative nature of the program was cited as a strength in 75% of the interviews by experts from all perspectives and sectors. For example, a business scientist said, “I think that California is trying to do things that nobody’s done before.”

The SCP was generally viewed as having many of the strengths of a successful program, including: balancing CBI with the public right to know; incorporating public input; protecting vulnerable populations as an express regulatory objective; possessing significant regulatory authority; and generally placing the burden on business. A few experts noted that some of these potential strengths, including regulatory authority and burden-shifting, may exist in the statute but have not yet been fully utilized in practice and may have gaps.

Some experts, especially from the business perspective, also mentioned regulatory flexibility and evaluation of chemicals in the context of their function in products as particular strengths. Other experts, especially from the NGO perspective, also mentioned the broad scope (and large Candidate Chemical List) and the focus on hazard rather than risk. Multiple experts from NGOs and government mentioned the requirement that businesses conduct Alternatives Analysis as a particular strength (Figure 2).

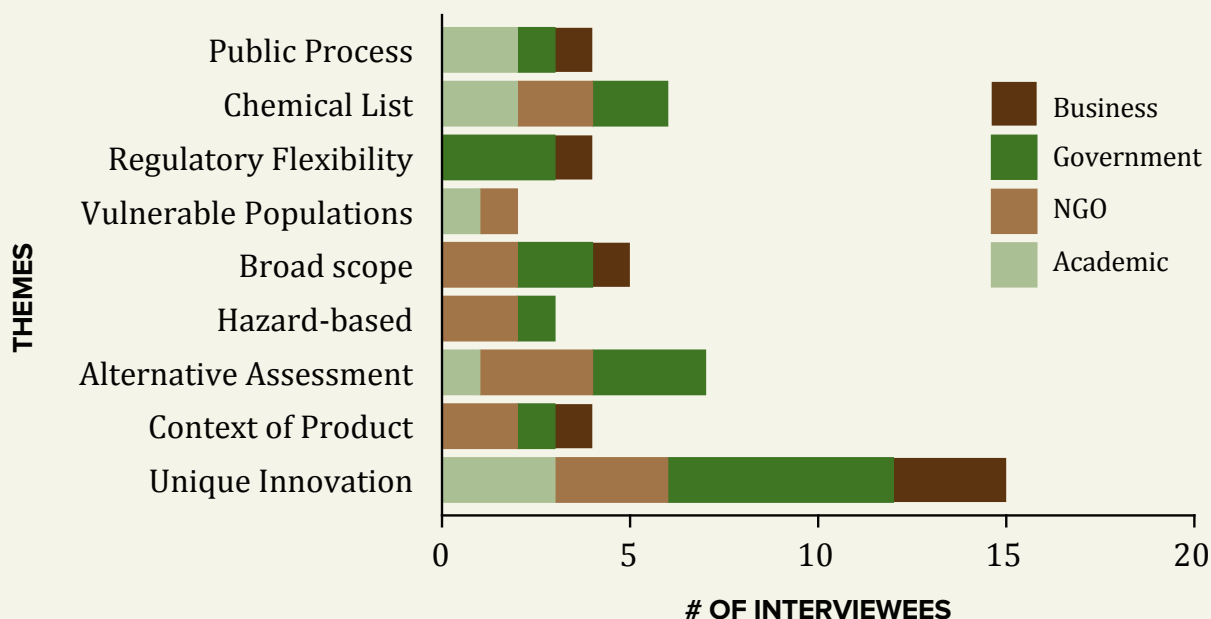
Examples of specific comments related to strengths of the SCP, along with the general perspective of the commenter include:

¹ Lists that were merged to create the list of Breast Cancer-Relevant Chemicals (BCRCs) include: Rudel et al. 2007; Rudel et al. 2011; Judson et al. 2015; EU’s Strategy for Endocrine Disruptors category 1 and category 2 (http://ec.europa.eu/environment/chemicals/endocrine/strategy/substances_en.htm). Personal Communication, Robin Dodson.

TABLE 2: Ten Essential Elements for Successful Chemical Policy

ESSENTIAL ELEMENT	EXAMPLES	WILSON ET AL.GAPS	CALIFORNIA ACTIVITIES
1 Data	Obtaining adequate information on product ingredients, exposure, and chemical hazard.	Data Gap	Weak
2 Information Flow	Balancing protection of confidential business information while promoting the public right to know.	Data Gap	Fairly strong
3 Prioritization	Selecting important issues to work on and avoiding less important issues.	Data Gap Safety Gap	Mixed
4 Efficiency	Moving through a process to a conclusion and taking action within a reasonable time period.	Safety Gap	Weak
5 Transparency	Incorporating adequate opportunities for stakeholder input through public workshops, hearings, and written comments.	Safety Gap	Strong
6 Protection	Designing policy actions to protect vulnerable populations, including workers, children, and disadvantaged communities; and preventing regrettable substitutions.	Safety Gap	Strong
7 Authority	Ensuring adequate regulatory authority to take any necessary action to protect health and the environment.	Safety Gap	Strong
8 Burden	Placing the burden of demonstrating reasonable safety on the business rather than on the public or the government.	Safety Gap	Fairly strong
9 Market Guidance	Pushing the market toward safer chemicals and avoiding chaotic or perverse incentives.	Safety Gap Technology Gap	Mixed
10 Incentives	Encouraging the growth of green chemistry through public investment in education, research and development.	Technology Gap	Weak

FIGURE 2: Strengths of the Safer Consumer Products Program



Broad Importance of the California Green Chemistry Program:

- “Everybody cares about it because it’s about products sold in the State of California. And no major product manufacturer, even mid-sized product manufacturer, is going to avoid the California market. It is just too big, economically.” [Business]
- “[The Program has] international implications. [It also has] the opportunity to address things that aren’t getting addressed with other environmental authorities.” [Government]

Voluntary Reformulation of Products:

- “I think we’d be kidding ourselves to think that a lot aren’t looking at what’s in the scope, to think, ‘Well, what do we have out there?’ So I think that the existence of the program in and of itself has given government a pretty major role in voluntary reformulation.” [Business]
- “I’ve found that often time you can get a very significant behavior change in the private sector simply by having the authority to regulate something, and to start talking about that.” [Scientist]
- “Behind the curtain, this is having effects on

supply chains, management and production decisions, particularly for new market entrants... why in the world would you start using any of the chemicals on any of these lists if you can avoid them?” [Academic]

Large List of Candidate Chemicals and Chemical Classes:

- “The various lists, the cascading or tiered lists under the California program are strong and well justified, and useful, as authoritative lists go.” [NGO]
- “[The list] ensure[ed] the department had the ability to grab a class of chemicals. And sometimes a pretty broad class. We’d really like to make sure that people aren’t just switching from one chlorinated or brominated flame-retardant to another, for example. So that is a very, very important part of doing this and implementing this.” [Scientist]

Promotion of Innovation:

- “[I]n contrast to what people often think, regulation actually causes the creation of jobs, because older technologies tend to be highly optimized and when you obsolete those older

technologies or regulate them out, it actually forces companies to do development and actually grows jobs.” [Business]

- “The government drawing attention to chemicals or the government acting on chemicals is a forcing mechanism for Green Chemistry innovation.” [NGO]
- “You start getting change after the first [regulatory] signals—that’s when the innovation starts to happen.” [Business]

Protection of Vulnerable Populations:

- “The inclusion of workers...was really fantastic, [as was] the requirement for special consideration for exposure to vulnerable populations, and the broad criteria that need to be included in an alternative assessment,... transparency, the public process are really great.” [NGO]

Challenges of the Safer Consumer Products Program

Two coding terms, data gaps and ‘slowness’ (the slow pace of the regulatory program), were most frequently associated with discussion of ‘challenges’. Data gaps were mentioned 100 times in the interviews as a challenge, with ‘slowness’ close behind at 99 mentions. These codes were also the top topics for government and NGO experts. Business experts most frequently spoke about challenges associated with the pace of the program, confidential business information (CBI), and Alternatives Analysis. Academic experts most frequently discussed challenges related to data gaps and Alternatives Analysis. Table 3 shows the codes most commonly associated with ‘challenges’, with the top two codes for each perspective highlighted. NGO interviewees also mentioned the Toxics Information Clearinghouse, and government interviewees also frequently discussed funding as a challenge.

SLOW PACE OF THE PROGRAM

All but one of the experts agreed that implementation of the SCP has been very slow. There was, however, significant disagreement about how serious a problem that slow pace has been. The

disagreement generally divided along stakeholder lines. All business and some government experts viewed the pace of the program as expected, and as something that will likely improve with time; NGO and academic experts almost universally viewed the slowness as unacceptable and needing reform. Examples of comments from each of these perspectives include:

Needs Reform:

- “It’s just way too slow. It’s not going to work.” [Academic]
- “It is moving at a pace that it’s really not meeting the goals of the program.” [Government]
- “[The program is] deliberative, deliberative to a point of just endless discussion.” [Academic]
- “You know just the lumbering nature, it’s just so frustrating that a program that has as much potential around alternatives assessment and regulation has taken so long to do anything.” [NGO]
- “Having these convoluted processes to actually do the assessment gives lots of opportunity to just stop action.” [Academic]

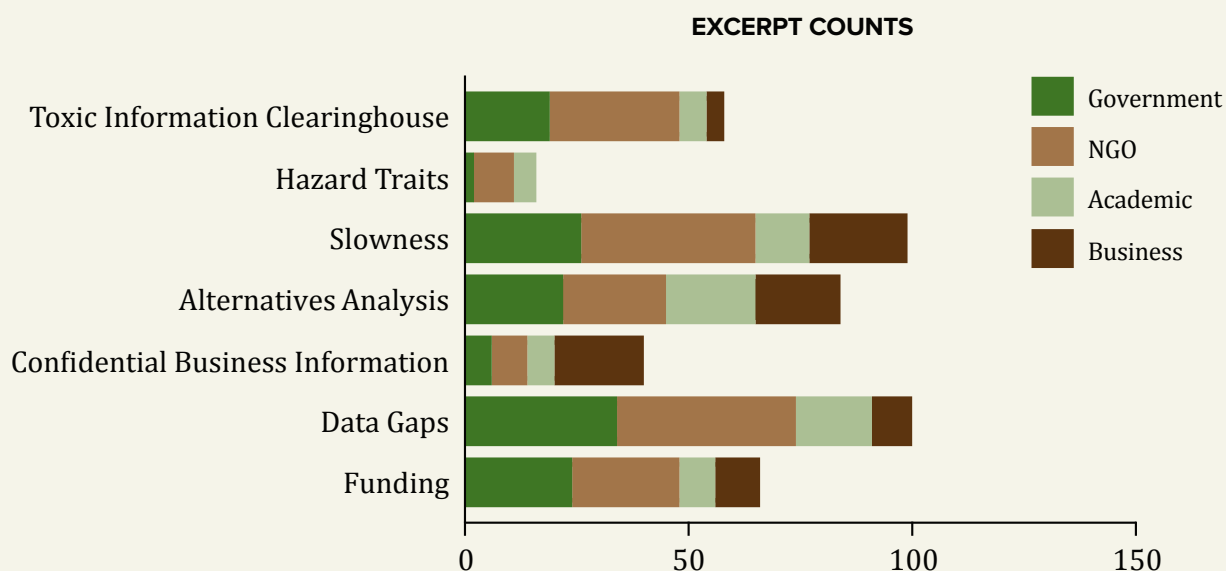
Will Get Faster:

- “Before you’ve established the logical rules for implementation, you can’t gain in efficiencies. You’re always spending the first couple of years, basically, with a couple of trial runs to establish your logic and implementation, which you then can apply much more efficiently afterwards.” [Non-CA government]
- “I think that taking the time to really try and do this in a way that involved as many stakeholders as it did was the right thing to do, and so I feel like this is just like any sort of exponential curve where things go slowly in the beginning and eventually this is gonna be something that is gonna be really positive.” [Business]
- “I don’t think anybody in DTSC was an expert in green chemistry or alternative assessments when all this started. It wasn’t like you’re taking the world’s thought leaders and hitting the ground running. I think it also took a while to figure out any sort of approach that would be legal and acceptable...and those are the kinds of

TABLE 3: Most Frequent Topic Codes Associated with Challenges

TOPIC CODE	BUSINESS	ACADEMIC	NGO	GOVERNMENT	TOTAL
Data Gaps	9	17	40	34	100
Slowness	22	12	39	26	99
Alternatives Analysis	19	20	23	22	84
Funding	10	8	24	24	66
Toxics Info Clearinghouse	4	6	29	19	58
Confidential Business Info	20	6	8	6	40
Hazard Traits	0	5	9	2	16
TOTAL	84	74	172	133	463

FIGURE 3: Most Frequent Topic Codes Associated with Challenges



things that a state regulatory agency has to pay attention to.” [Business]

- “I always talk about the...Safer Consumer Products Program as a machine, and they built a machine, and they’re testing the machine and the widgets of the machine, and that takes time. And before you start altering the machine, you have to make sure all the pieces of the machine work, and then you can go back and increase speed.” [Government]
- “[T]hey are going to learn what they’re doing. I would much rather see that than them try to take on more than they handle, do a bad job of it, and then have it collapse in on itself. That would be a terrible outcome. It would be faster, but it would be a bad outcome.” [Business]

Various Possible Strategies to Speed the Program:

Suggested strategies for speeding up the program included: Streamlining or adding deadlines to the law or regulations; an expedited workflow with fewer pre-regulatory steps; narrowing the focus; additional funding and staffing; and clearer authority to fill data gaps. Some of these were recommended by some experts but flagged as potentially problematic by others, so no consensus emerged around any of these suggestions. Examples of these specific suggestions included:

- **Deadlines:** “If we had tighter, clearer mandates backed by deadlines and, of course, fueled by resources, we would expect quicker action and I don’t think that’s been the case in California.” [NGO]
- **Funding and Staffing:** “If there had been a lot more funding, and authorization for positions with the necessary skill sets, then the program could’ve moved more quickly to establish the systems that were in place.” [Scientist]
- **Streamlining Workflow:** “I think the underlying statute and regs provide for more expedited

decision making...I really think that the agency needs to go back, evaluate their processes, and figure out what they can change to shorten that timeline.” [Government]

- **Narrowing the Focus:** “One of the challenges is that the breadth of the program is so large. If everyone agreed we were just going to look at X in the next three years, [it] would go faster.” [Government]
- **Streamlining Statute:** “The California law was extra tortured by the added layers of analysis that were put into the governing statute.” [NGO]

In contrast to the lack of consensus on the above suggestions, experts from all perspectives expressed concern about the single approach to all product-chemical combinations. These experts envisioned multiple paths or tracks through the program, or multiple “points of entry” for chemicals into the program. For example, an academic expert noted that, “the process the DTSC has to go through

“It is moving at a pace that is really not meeting the goals of the program.”
[GOVERNMENT]

is the same whether it is obvious or whether it is non-obvious. So the process is way too elaborate and research-intensive for things that are quite obvious.” An NGO expert concurred, pointing out that “There is a single approach to every priority product. There’s no fast track and there’s no [research and development] track...” Others from all perspectives echoed this concern, recommending a more “agile” process for “egregious” chemical-product combinations. A government scientist cited the Priority Product listing of children’s foam padded sleeping products as an example, saying, “If you think about the first priority product, really? We had to do all this rigmarole to get two of these flame-retardants that are carcinogens out of infant sleeping products? It’s almost laughable.” Others suggested multiple possible faster tracks, including:

Eliminate Unnecessary Chemicals:

- “[If] something that is increasing the toxicity or

other environmental footprint of a product is not functionally necessary, there should be a much more expedited process regulating that, not this tremendous alternatives analysis.” [Academic]

- ➔ “If you can find ingredients that don’t contribute to the function of the product that are in there, and that are causing at least a perceived problem or an established problem, it would seem to me that those probably shouldn’t be in there.” [Business]
- ➔ “[We should] really focus much harder on this question that Debbie Raphael and John Warner always proposed, of really starting from the point of “is it necessary?” That’s not the starting point for the Safer Consumer Products analysis.” [Academic]

Presumptive Phase-Out of Chemicals With Clear Alternative:

- ➔ “If California had more of a presumptive phase-out authority, that would be logically applied to specific uses of specific chemicals for which the alternatives are readily available.” [NGO]
- ➔ “I think where there are clear alternatives and the market is not favoring them in part because of the absence of regulatory pressure, so it’s totally circular, there should be a very expedited process for DTSC forcing the conventional, more toxic, probably lower cost or otherwise easier product off the market. We should not have a cumbersome process there.” [Academic]

Legislative Action to Go Directly to the Alternatives Analysis:

- ➔ “[T]he time it takes to do the regulatory process, which is more than a year by the time you have the initial workshops all the way through the regulations, is time and cost that we should just save. Because if the forgone conclusion is, “We’re going to list this product.” Let’s just have the legislature do that.” [Scientist]
- ➔ “The legislature should skip the queue... if there’s an issue that constituents and citizens think is important and needs immediate attention”. [Business]

DATA GAPS ON PRODUCT INGREDIENTS AND CHEMICAL USE

Along with the slow pace of the program, data gaps were cited as the other principal challenge to the SCP. Multiple data gaps were mentioned, including gaps related to chemical hazard, exposure, and use. Data collection authority was seen as something that was “missing in the law”. Lack of clear authority to collect very broad chemical use data was seen by many as a threshold problem, slowing down efficient identification of priority products. Numerous interviewees explicitly linked the problem of data gaps with the slowness of the product selection process. For example, an NGO policy expert stated, “If the department felt like it had more authority to do those data call-ins earlier, I think that that would help in speeding up the process...so the program would be more successful in achieving its goals.”

In contrast to toxicity and exposure information, where data frequently do not exist, an academic scientist pointed out that chemical use and ingredient information are “one of the places that there is actually information. It’s more about information asymmetry than about actual unknowns and therefore it’s kind of low hanging fruit.” The same scientist went on to say, “I see those information asymmetries as hamstringing decision making at many levels, not just regulation, but also the decision making that happens within companies who are using chemicals. If the chemical producers have that information but the chemical users don’t, all through the supply chain, it’s very hard to make good decisions about chemicals, and of course then it’s also hard to regulate.”

An expert from the business community also mentioned this problem, saying “I don’t know whether I would say stumbling in the dark, but it’s a fishing expedition...you can spend a lot of time and money looking at things that aren’t high-impact.” An NGO policy expert added, “We’re beginning to see some progress on chemical ingredient disclosure in a number of different contexts. It’s part of a growing trend...this notion of ‘radical transparency’ in which all kinds of people in the supply chain, including final consumers in this era of big data, are demanding more and more information about

what's in products." Several experts pointed to models in the European Union, including new waste legislation that will require tracking of certain chemicals from manufacture to disposal. Such approaches were noted to be data intensive, but quite feasible once the information technology platforms are set up.

The issue of CBI was raised, especially by many experts from business, as a potential challenge associated with data gaps. Most interviewees were of the view that the program has appropriately balanced this issue to date, at least in their regulations, but some questions remain about how it will play out in practice. Almost all of the interviewees, including many from the business perspective, believed that most ingredients information should be public. One business scientist stated the majority position as, "There's a role for formulation information being protected and some process information being protected, but we should really be reorienting...I don't see any reason why anybody should be thinking that their ingredient list should be confidential." An NGO policy expert added, "There shouldn't be a conflict between maximizing public right to know and protecting legitimate CBI. It's more when the CBI claims are abused that we run into problems. I think that the California treatment of confidential business information under the green chemistry statute was reasonable."

Four types of data call-in authority for chemical use information were identified as potentially useful. The different suggestions included:

- ➔ **Broad Confidential Market Screening:** "If it were possible for DTSC to [do broad market surveillance] on a confidential basis in the same way that the EPA can get complete formulation information for a pesticide in the registration process, as long as it's kept completely confidential, that would be tremendously helpful in confirming or disconfirming that things are present, finding out their levels, figuring out which products to prioritize." [Academic]
- ➔ **Broad Public Market Disclosure:** "If there was early disclosure against [some or all of] the California Candidate list...in a broad swath of consumer products over a rational, reasonable

time frame, that information flowing into the marketplace would have hugely positive impacts..." [NGO]

- ➔ **Focused Enforceable Data Call-In:** "[Give] DTSC much more ability to essentially demand information from industries where there was some reasonable basis for concern. You can almost think about it as a search warrant, you know. We don't really know exactly what we're going to find, but we're not just rummaging. We have some basis for being worried." [Academic]
- ➔ **Data from Both Chemical and Product Manufacturers:** "[Chemical use information] is something that we're simply going to have to give the department the authority to require. And that authority ought to be available for products—'What are the ingredients in this cup?' And chemical manufacturers—'Where are you selling your chemical X?' So they can look at it from both perspectives, recognizing that everyone doesn't know everything." [Scientist]

DATA GAPS ON EXPOSURE AND NEED FOR PREDICTIVE TOXICOLOGY

Scientists from several perspectives, but most notably from government, pointed strongly to exposure and toxicology as also needing additional attention. Experts pointed to the language in Section 69503.2 of the regulations requiring "... potential...exposure to the Candidate Chemical in the product" as evidence that exposure data are necessary to support a listing. A government scientist pointed out, "Just because something is in the product doesn't mean you're necessarily exposed. It would be good to have environmental fate information associated with the chemical so that you can figure out what's volatile, what's water soluble and what's fat soluble..."

California has multiple programs that monitor air, water, soil, and food. The programs are spread across numerous boards and departments across multiple agencies, and the data are spotty, with numerous gaps. Several experts noted that there has been limited effort to integrate the existing monitoring data online across environmental media, and the monitoring programs vary widely in their use of newer technologies and methods.

Some experts pointed to the need to identify exposure trends over time in order to evaluate the efficacy of regulations and guard against poor chemical substitution choices. Other experts also pointed to the program's focus on children, workers, and other vulnerable populations, and the ways that exposure monitoring could help identify chemicals to which certain populations are highly exposed. A government scientist pointed out the need for significantly more monitoring data to help facilitate prioritization, "Monitoring, monitoring, monitoring. Monitoring is a chronically under-funded environmental area, be that water monitoring, air monitoring, wearable technologies to look at what we are getting exposed to, exposure monitoring. I think that really would accelerate government decision-making." Several experts also pointed to the role of biomonitoring for chemicals in humans to identify priorities for regulation. One business scientist said bluntly, "They should support the California biomonitoring program."

Other interviewees highlighted the importance of toxicity data. An NGO policy expert stated, "I feel strongly, if I had to choose, I would say companies should be investing heavily in toxicity data and be required to provide more of that." Several spoke of predictive toxicology data for potential use in expanding the Candidate Chemical List, prioritizing chemicals in products, and comparing chemicals in the AA. A business scientist said, "High-throughput toxicity screening is a great role for government. It will help us get better on the predictive side." Several experts raised concern about whether DTSC has the toxicology expertise to utilize the newer toxicology data. One government scientist noted, "OEHHA has more toxicology expertise. They have more people who have been interested in the new tox-testing paradigms and using the information from those assessments... Maybe there is a way to have the program at [DTSC] maintain the parts of the program that they really developed expertise in and have OEHHA be doing more with the candidate chemical part and adding chemicals as they assess hazard, using not just traditional stuff but the newer methods."

"There's a role for formulation information being protected and some process information being protected, but we should really be reorienting...I don't see any reason why anybody should be thinking that their ingredient list should be confidential."

[BUSINESS SCIENTIST]

PRIORITIZATION CHALLENGES AND OPPORTUNITIES

The experts generally recognized prioritization as a challenge, and many of the discussions of data gaps and slowness also related to the difficulty of choosing priority product-chemical combinations. One business policy expert acknowledged: "It is such a massive undertaking to start the process of saying, 'Well, what is this chemical? What is this product? Who uses it? Where is it used? How often is it used? How is it used?' Getting through all of that, it has got to be a pretty arduous process."

The experts had multiple, and often conflicting, suggestions for how to prioritize chemical-product combinations. Some advised focusing on chemicals with already established alternatives. A business scientist said, "[They should] define things that people are trying to find a reason to finally get out of, and help 'em...I'd look for the sick antelope". Others suggested pushing for change in functional use spaces where there has been very little innovation. For example, another business scientist said, "if you're leading the way, you need to start defining the edges—start going after things where you don't see alternatives...You need more shots on goals to map that space." However a third business scientist responded, "The technology-forcing has some value to it, but I think that if anything's gonna slow down this process, it's gonna be to use it exclusively to identify where you can force the technology 'cause then it's not just a matter of doing the assessment, it's also a matter of waiting

for invention to happen.” In the end, most experts seemed to agree with the view of a government policy expert who said: “What is really exciting to me is that we have a law that allows us to do both.”

Many experts from the NGO, academic, and government perspectives spoke of the importance of prioritizing broad chemical classes in multiple products, and several experts lamented missed opportunities to identify multiple chemicals or categories of chemicals in the first few priority products. Several experts pointed to the recent listing of perfluoro/polyfluoroalkyl substances (PFAS) in carpets as a model. The general recommendation from almost all experts, except those from business, was to broaden the priority categories, but there were multiple ideas about how to do that. The suggestions included:

- ➔ **Chemical Classes:** “Any opportunity we have to consider a class I think is better reflective of the science...it’s actually more intellectually honest, but also does reflect the reality in the industry... there’s just quick shifts within the industry and it’s so hard to track that. We’re always chasing it.” [Academic]
- ➔ **Functional Use Categories:** “Where are these functional attributes where we have crappy design solutions? You know, if you look at the universe of solvents or adhesives they are just terrible, just terrible choices.” [Academic]
- ➔ **Priority Chemical across Products:** “[Look] at exposure data, [look] at biomonitoring data, and try to figure out what are the worst chemicals that Californians are being exposed to the most, and then go after those chemicals across classes of products. So, that it’s not a single chemical product combination, but it’s a chemical across all of the exposure routes.” [NGO]
- ➔ **All Chemicals in a Product:** “Once you’ve gotten an understanding of a product, then you can actually rather efficiently look at many chemicals in that very same product.” [Non-CA government]
- ➔ **Product Class:** “If you’re gonna look at food packaging don’t just look at BPA; don’t just look at PFAS; don’t just look at perchlorate...at the end of the day...you could get rid of all the

perfluorinated chemicals, but you’ve still got a crap-load of other toxic stuff.” [NGO]

- ➔ **Toxicity Class:** “I mean, how many neurotoxicants do you know that are not worse in a developing organism? Really, I can’t think of any...If they’re looking at women of childbearing age and infants and children, really neurotoxicity should be way on the top I think. As well as endocrine disruptors because you’re talking about disrupting normal development.” [Government]
- ➔ **Jump Among Multiple Chemicals and Product Categories:** “It’s also important for the department to be able to signal manufacturers of a pretty broad array of products that they might get into their areas. So, if they said, ‘All we’re going to do for the next five years is perfluorinated chemicals and maybe we’ll do that in eighteen classes of products,’ everybody else just goes to sleep.” [Scientist]

Other experts agreed with going beyond single chemicals in narrow product categories, but raised cautions about choosing overly-broad categories. For example, a scientist who has worked in multiple sectors noted, “If you grab functional use too broadly you wind up with so many different kinds of products that it’s really hard to think about the decision making all at once, so you have to break it into pieces.” An NGO policy expert added, “A lot of chemicals have lots of functions and uses, so the solutions need to be crafted around the specific type of product.” A government scientist concurred, saying, “[Taking a very broad approach] has its own downside in that, all of a sudden you have a bunch of manufacturers that all have to do their Alternatives Analysis, which the department has to review. Still, I think it would be better than this slow practice that is going on now.”

A policy expert from the business perspective spoke against selecting broad classes of chemicals, saying, “It is very expensive to go through that AA process...I don’t think it would be well received for folks to go through the process unnecessarily, solely because as a policy matter DTSC has decided to list classes rather than go after the chemical they really have decided they want to go after, right?”

One expert from the business perspective suggested there be “some sort of...competition for designing a system for coming up with the right chemical/product combinations. Because... to some extent, it’s the inherent toxicity of the chemical, to some extent, it’s the widespread use of products, to some extent, it’s levels of exposure. And all that information is scattered here and there and hard to get to.” A government scientist suggested a prioritization “look-back” within the next year or two, to evaluate the process and identify approaches that might be more effective and efficient.

A non-California NGO expert referred back to the concern about the single priority track in the SCP, saying: “I don’t know that the priority-setting needs to be altered... [But] if there was additional authority and earlier action, whether it’s disclosure or some presumptive phase out for extremely hazardous substances, then you might need to be more thoughtful about...which priority is going to which bucket.”

POTENTIALLY CUMBERSOME ALTERNATIVES ANALYSIS

The interviews revealed significant uncertainty and anxiety about the AA process. Although many interviewees cited this process as a conceptual strength of the California approach, many also worried about how it would work in practice. A prime concern was that the process would be too complex and slow. Business interviewees also worried about the cost. Examples of the degree of concern included:

- ➔ “If I happened to be at the point of this lance, I would chew my arm off rather than do an alternatives assessment. And the reason is because if you just sat back and looked at it, it appeared to be an infinite amount of work for indeterminate benefit.” [Business]
- ➔ “[They] took an alternatives assessment and made it a draconian process...the analysis gets to be at an oppressive level that it takes forever to do it.... Alternative assessments are supposed

to support decision making and support action, so the minute you bog it down in lots of analysis, you one, remove creativity, and two, remove action, because now you’re talking about years and years before action actually takes place.” [Academic]

- ➔ “If anyone ever gets to do an alternatives assessment, one of the requirements is that they have to do economic modeling of the impact of the original substance versus the alternative, and today it is virtually impossible to do that because no one has an estimate of the actual impact of any of these candidate chemicals. It’s the number one flaw, number one problem in the entire regulation. Well meaning, but totally screwed up.” [Business]

Several interviewees pointed to the legislative list of 13 criteria for evaluation in the AA as overwhelming and excessively rigid. A government policy expert stated, “Oh my God, if I could do one thing that I’d change in the statute, it would be the A through M criteria -- the fact that it is just everything and the kitchen sink.” In contrast, others opined that the large number of criteria was “not a big deal” because there is no requirement to do a “detailed analysis of everything”. One scientist noted, “CEQA requires you to cover a huge broad list of issues, but...I’ve written neg decs² in a couple days, it’s not really that hard. So, I guess I don’t see that as such a big deal.” In general, however, the lack of flexibility in the statute and the large number of criteria were seen as a challenge.

Other experts suggested making some adjustments to the AA guidance to make it more streamlined. Some pointed to models they consider more efficient, such as the alternatives assessments done by some leading businesses, BizNGO, or under TURA in Massachusetts, although others noted that those do not meet the long list of statutory criteria under A.B. 1879. One government policy expert suggested, “they can create some type of...modular process that expedites decision making.” The same expert suggested, “a more focused set of guidance documents could be produced that would help

² CEQA is the California Environmental Quality Act, and a “neg dec” is shorthand for a Negative Declaration, which can be done after an initial study showing that there is no substantial evidence that the project may have a significant effect on the environment.

“If California had more of a presumptive phase-out authority, that would be logically applied to specific uses of specific chemicals for which the alternatives are readily available.”

[NGO]

facilitate decision making rather than explaining the myriad possibilities that are out there for decision making.”

The interviewees pointed to numerous other models that could facilitate aspects of the AA. Many of these models have proven effective in other states or in the European Union. Suggestions included:

Presumptive Phase-Out Pending an AA:

→ “The European Chemicals Agency...has said, ‘We’re going to move out of all or most uses of these chemicals unless you step forward with your alternative analysis, showing us in turn that it’s not available or if there’s some kind of outrageous socioeconomic effect...that we didn’t consider.’ For certain, that speeds things up because those that feel like they have such a stake in the continued use of those substances are highly motivated to step forward and defend, and those that are only marginally defensive of their product weigh the cost with benefit saying, ‘Screw it. I’m going to move on to something else.’ They’ll let it go.” [NGO]

Expedite if there is an Existing AA:

→ “If we know there are alternatives out there that are indeed safer... Like, if somebody... BizNGO, they have their projects where they do alternatives assessment. If there’s already [an] alternative assessment out there...then it would be great to have a more streamlined part of the program that can say, “...This is already out there, use that.” And then to focus its energy on driving the innovation.” [NGO]

Fees for Review of AA or Third-Party AA:

→ “The Maine statute has fee authorization in a specific form for alternative assessments, such

that the burden initially is on the manufacturer of the product to conduct the alternative assessment. If they refuse to do so, or if the work product in the judgment of the agency is not deemed to be satisfactory, then the agency is authorized by statute to contract for an independent alternative assessment and to assess a fee on the product manufacturers to pay for that. The [provision] has actually been used once...to assess the alternative to [Bisphenol A in] infant food packaging and the state made the companies pay, because they did a half-assed job, and set up their own contract. They got a good work product issued to uphold the proposed phase out ultimately.” [NGO]

- “If you want to get really good alternative assessments from people, being able to charge them when the agency reviews them would be helpful.” [Non-CA government]
- “It seems like having more of the Massachusetts system where...you have a relatively simple guidance, and then there’s some level of flexibility to do the analyses as you want, and then...a third party certifies or third-party reviews...so that the government doesn’t have to review every one...” [Academic]

Government-Conducted AAs:

→ “Maybe we don’t have to wait around for the traditional alternatives assessment process which is, find a chemical, list it, engage the industry, make them do it, then maybe regulate it. In some areas maybe...government could go ahead—and do an AA and just be able to make that information available to get out ahead of it. You don’t have to wait.” [Non-CA government]

Some experts raised questions about whether government-conducted AAs are feasible unless the

issues around data gaps are adequately addressed. In addition, a DTSC evaluation of existing approaches to alternatives assessments found that none of the existing methodologies address all of the statutory criteria in A.B. 1879, making it difficult for the program to simply adopt an existing AA (DTSC, 2018). An existing AA, however, could be a starting point to expedite the process.

S.B. 509 Challenges and Opportunities

HAZARD TRAITS COULD BE EXPANDED AND INTEGRATED

Less than half of the experts interviewed for this study were familiar with S.B. 509, the second of the linked green chemistry laws. Those who were, however, overwhelmingly pointed to the hazard traits defined by OEHHA in 2011 as an important area of strength. These were described as “very powerful” and “brilliant”. Specific comments included:

- “[S.B.] 509, I think is the silent hero...When else have we said, ‘We’re gonna look at hazard endpoints, and we’re gonna look at all of them and we’re gonna put them on paper in a way that they can be measured’...in my mind, this was the foundation that was going to propel us into the next 25 years.” [Government]
- “Getting those hazard traits on the books and defined is a really, really useful contribution.” [Academic]
- “It was written in an open-ended way to allow the state to capture toxicological end points—both environmental and human health ones—some of which might not have even really been fully thought about at the time the regulation was written.” [Scientist]
- “[They have] propelled the conversation about how chemicals interact with our environment and with human health so far in one regulation package, that for somebody who works on these issues, it was exciting to see.” [Government]

However, several experts suggested that the hazard traits be revisited to “allow us to anticipate more problems” and “to describe the hazard of chemicals

that we don’t have a lot of animal data on.” One business scientist suggested that “OEHHA [could] be doing more with the candidate chemical [list] and adding chemicals as they assess hazard using not just traditional stuff but the newer methods.” A government policy expert said, “I don’t think we’ve done as much as we can with that regulation package. When you have a foundation like that, there are so many things we could do with it.”

THE TOXICS INFORMATION CLEARINGHOUSE (TIC) HAS LIMITED UTILITY

In contrast to the Hazard Traits, the interviewees uniformly expressed disappointment in the TIC. Most experts supported the concept and the intent of an information clearinghouse, but did not find the current website useful. No expert said they had used the TIC for any purpose. Common responses included: “it’s not useful at all”, “I’m not sure who that’s serving”, “They slapped it up there”, “I don’t have the impression that it’s been particularly consequential”, “I don’t know anybody who uses it”. One government policy expert stated: “You can get more out of a Google search than you get out of the TIC.” Experts were split on whether to entirely eliminate the TIC or to fix it in some way. Arguments on both sides included:

Eliminate the TIC:

- “I don’t believe the state will ever have the capability in the [information technology] world to do that task.” [Government]
- “Without any funding to do that, that’s almost impossible, and that’s a huge scientific task. I mean, basically being the world’s clearinghouse for chemical information to support decision making about chemicals and products is a many, many million dollar, you know, tens of million dollar mandate. And I just don’t see how that happens.” [Business]
- “[We have the Organization for Economic Cooperation and Development] OECD eChemportal, to Pharos, to non-profit stuff, for profit stuff, all the work that’s been done with Green Screen,...[the Interstate Chemicals Clearinghouse]...It’s just a huge amount of stuff...there was a time for it, and it passed...There is a

plethora of data systems for hazard assessment, for alternative assessment, and the last thing the world needs is another one, right?” [Academic]

Repurpose the TIC:

A slightly greater number of experts from NGO, government, and academic perspectives disagreed with any suggestion of eliminating the TIC, making comments such as, “It’s the State’s duty to make it right”; there is a “mandate to do it”; “[other databases are] not perfect either. I don’t think that we should rely on somebody else outside.” An academic scientist said, “There’s still a strong argument for accessible chemical information. The question is, what is not happening today that California could fill in without reinventing or repeating what’s already out there?”

There were multiple suggestions for repurposing the TIC by creating other “data structures for looking at product ingredients and chemical information.” The TIC was mentioned by a couple of experts as a potential place for displaying data obtained from any new “data call-in authority”. This could integrate the TIC and the current CalSAFER platform into a public resource for more information about current Candidate Chemicals. Others suggested that the TIC might best be housed at OEHHA and could be more clearly structured around the Hazard Traits for individual chemicals. Specific comments about repurposing the TIC included:

- ➔ “[They could be] taking thousands of chemicals, some of which have in vivo information, more of which have in vitro information on their toxicity and their potency, and then taking a big data approach.” [Business]
- ➔ “California can populate their own database [and]...they can link the public data in that database to the OECD eChemPortal and contribute effectively to the worldwide chemical management with the information that California collects.” [Non-CA Government]
- ➔ “[I]f they use the Clearinghouse as a way to house the data that they generate through a data call-in, they could see where are all the places that Californians are being exposed to phthalates, or to these perfluorinated chemicals.” [NGO]

Need for a Greater Emphasis on Green Chemistry in California

Market guidance and incentives were both identified as essential elements for promoting green chemistry. The original California Green Chemistry Initiative included multiple reports recommending that California incentivize development of safer chemicals. The Green Chemistry Science Advisory Panel identified these as “Supply Side” recommendations. Wilson et al. (2009) used the term “Technology Gap” to describe problems ranging from a lack of toxicology literacy among chemists, to the fact that—in the absence of transparency on hazards in products—safer products can have difficulty competing with cheaper, more toxic formulations in the marketplace.

The experts interviewed for this project almost uniformly pointed out that the incentives-related recommendations were never implemented in California, and urged that more attention be paid to incentivizing greener chemistry. One academic scientist said, “I think there was a much bigger vision about really comprehensive chemical policy reform that dealt with driving alternatives while supporting innovation.” An NGO policy expert pointed out, “Having a carrot is always easier than beating people with a stick. And it’s a lot easier to put pressure on somebody to take something bad out if you have something to turn to.” An academic policy expert pointed to the supply-side problem, saying: “We’re hearing this from chemical-using companies saying, ‘Our consumers want safer chemicals. We need a supply of safer chemicals.’ They’re not getting that.” An academic scientist drew a comparison with clean energy investments: “[W]hen did renewable energy start taking off in the United States? It’s when California said, ‘This is a key economic development issue.’...And that has not happened for safer chemistry.”

GREEN CHEMISTRY EDUCATION AND TECHNICAL ASSISTANCE

Multiple experts specifically pointed to the importance of education, and of California educational institutions, in the development of green chemistry. Such institutions were seen

both as a way of educating the next generation of green chemists and as a way of providing technical support to both government and business around alternatives assessment and chemical substitution. The Toxics Use Reduction Institute (TURI) in Massachusetts and Green Center Canada were mentioned by several experts as important models and as incubators for greener technology. Others pointed to the existing program at the University of California Berkeley and urged that it be expanded significantly. Specific comments on education included:

- “That’s a huge role that the academic community can play in terms of preparing the next generation of people to address these problems in a more holistic way.” [Business]
- “[We need] California, born-and-bred green chemists...cultivating a green chemistry industry within the state, that could make the process of safe substitution less painful.” [NGO]
- “I certainly would try to provide some support and encouragement for collaborative work with the university system, because it is also a great asset in California that really should be...more heavily invested.” [Non-CA Academic]
- “I’m still not really convinced that Green Chemistry has been integrated into chemistry curricula...So, I just want to put in a plug for I think that there’s value in it.” [NGO]
- “It’s a win-win situation to teach this curriculum, but it needs to be developed at each school. State funding can be valuable there. Get it into state schools and community colleges. Keep funding this year after year, instead of one-off. The state can fund a small amount and then the schools can raise the rest from other sources.” [Business]
- “[We need] to assist California businesses to lead the world in greener design and production... Then if the program actually prioritizes a chemical that doesn’t have a safer substitute, you could incentivize the industry to come up with it. And California could be partnering with billionaires to offer X prizes for the creation of a safer surfactant, or preservative, or something like that.” [NGO]
- “[T]here’s been some work done to create more of a grand challenge approach, like [the Green Chemistry & Commerce Council] did one with preservatives, where they convened companies that may be competitors but they all have sort of the same challenge around how to preserve consumer products.” [Non-CA government]
- “California’s businesses are some of the world’s leading businesses. And aligning with those firms, such as...Apple, and HP, and Google in promoting a new program that sets a new course for California’s green and safe economy would be a wonderful thing to do.” [Academic]
- “I know a number of case studies where by virtue of whether you call it industrial policy or something else, the government has funded and directed development of new materials, new technologies. Some as solutions to environmental problems, some just as economic development engines, and there are numerous success stories in which that has made huge difference. It has bettered the lives and environmental quality and health of people. We need that role by government.” [NGO]

PARTNERSHIPS AND X-PRIZES FOR GREEN CHEMISTRY

Many experts pointed to potential public-private partnerships as an area where California could stand out. Multiple interviewees pointed to the confluence of forward-thinking businesses and venture capital, and urged that more partnerships focus on directing resources toward green chemistry and safer products.

FUNDING FOR GREEN CHEMISTRY

Funding was highlighted as an important challenge over 60 times in the interviews. Specifically, more reliable and significant funding commitments were identified as an important need for environmental and exposure monitoring, implementation of the SCP program, further development and implementation of the OEHHA Hazard Traits, and support of green chemistry research and education. The SCP effort, in particular, was seen by many as struggling in significant part due to insufficient funding and staffing. There were multiple

comments on the need for additional resources, such as:

- “We have to have the money to...pay for the scientific expertise for a robust program. And if we don’t do that, people are less and less going to trust their products....If there had been a lot more funding, and authorization for positions with the necessary skill sets, then the program could’ve moved more quickly to establish the systems...” [Scientist]
- “[R]eally the legislature needs to give DTSC some money... It’s going to take a lot of money to do what they want the agency to do.” [Government]

There were also numerous suggestions about how to fund these efforts. Experts from the business community generally believed that the current funding source³, or the state General Fund, would be the most appropriate funding mechanism. Experts from all other perspectives had a variety of other suggestions, including placing fees on chemicals on the Candidate Chemicals List or in the Workplan, recovering costs if regulatory action occurs, charging a fee associated with new data call-in authority, or charging a fee for review of AAs. Several experts suggested the need for a funding study to determine the magnitude of fees or other funds needed to sustain all aspects of a robust California Green Chemistry Program. Specific suggestions for funding the work included:

- “If you’re gonna charge one cent for every product, it wouldn’t affect really the cost, or it wouldn’t really affect the business, but it could provide a huge source of income for an agency to actually run a program like this.” [NGO]
- “[They should do] what they did with the Montreal Protocol. They [put a phased-in fee on ozone-depleting chemicals] and then by X year it cost you three times what it was originally.” [Non-CA Government]
- “[Y]ou pay X if you give us complete formulation information...about everything you make that

is in this bucket, but you pay 4X if you don’t.” [Academic]

- “[Under REACH], in order to put a chemical on the market, you have to register your chemical. As part of the registration, you pay a fee. For example, if you manufacture or import a chemical in a volume above 1,000 metric tons, then you have to pay €50,000....in order to get an authorization to use one of the substances of very high concern, then you also pay a fee for each use. The fee there is also €50,000 for each use.” [Non-CA Government]
- “I would want to see a small fee attached to every product that contains a chemical that’s on DTSC’s list.” [NGO]
- “[A]t the end of the process for whatever manufacturers that you’re dealing with, if you undertook a regulatory action you could essentially do cost recovery.” [Government]
- “I actually think that the way that it’s funded is okay, in tying it to the cleanup. Because in theory, you’re free cleaning.” [Business]

Breast Cancer-Relevant Chemicals

167 breast cancer-relevant chemicals (BCRCs) are on the Candidate Chemicals list. An additional 427 BCRCs did not match with Chemical Abstract Services (CAS) numbers on the Candidate Chemicals list. However, more detailed review of the latter chemicals revealed that most of them are excluded from the scope of the program under Section 69501(b)(2) of the regulations because they are drugs (~107 chemicals), pesticides (~135 chemicals), or foods (~14 chemicals). Over 30 of the BCRC chemicals not on the Candidate Chemicals list appear to be used only for research purposes. Nearly two dozen are chemical intermediates of production; some of the latter may appear as contaminants in consumer products, but this information was not available. Many of the remaining chemicals are environmental or metabolic breakdown products of other chemicals,

³ The Safer Consumer Products Program is currently funded from the Toxic Substances Control Account, a fund created in 1997 and supported by a small annual fee on California businesses with 50 or more employees, cost recovery from responsible parties, fines, and penalties. This account also funds DTSC’s Site Mitigation and Brownfield Reuse Program, and multiple other programs including Biomonitoring California. The account is currently in a structural deficit and is projected to run out of money within the next year or two unless the fee is increased by the legislature.

including natural products of metabolism. For these reasons, very few chemicals were identified as significant potential omissions from the DTSC list.

Approximately 82 non-matching BCRC chemicals are already included in a chemical category that appears on the Candidate Chemicals list even though the specific CAS number is not listed (e.g., dioxins, furans, PCBs, PBDEs, PAHs, Nitro PAHs, nitrosamines, aromatic amines, tributyl tin compounds, p,p'-bisphenols, azo dyes, benzidine dyes). The absence of CAS numbers of numerous chemicals that are actually on the list could mislead some businesses into erroneously thinking that they are using a chemical that is not on the list.

A few BCRCs were specifically noted as potentially relevant future additions to the Candidate Chemicals list. For example, multiple chemicals that act as ultraviolet (UV) stabilizers are BCRCs, including benzophenone-1, benzophenone-2, benzophenone-3, benzophenone-6, 3-Benzylidene camphor (3-BC), Enzacamene, and 4,4',4-Ethane-1,1,1-triyltriphenol. Although benzophenone-3 is on the Candidate Chemicals list, the others in this category are not, and may be relevant to consider.

In the expert interviews, one business scientist raised concerns about emerging chemicals and mixtures of chemicals not being adequately addressed on the Candidate Chemicals list, saying: "What it doesn't do, is it doesn't find things that are new. It doesn't find things where a low exposure can have a high impact, or a cumulative impact, or mixtures, or all the things that people are now becoming more aware of. While you wouldn't want to not consider the [Candidate] Chemicals list,... that list does not cover emerging chemicals. It just doesn't. Everyone knows it doesn't. That's a concern." This suggests that although currently-identified BCRCs have been captured, there may still be a need to update the list over time, and to capture chemicals with predictive data showing that they possess Hazard Traits consistent with BCRCs or other important health hazards.

Of the 167 chemicals and chemical classes that are BCRCs and are on the Candidate Chemicals list, three have been included in the six Priority Product categories identified to date (Table 1). The



identification of methylene chloride in paint and varnish strippers; nonylphenol polyethoxylates (NPEs) in laundry detergents; and perfluoro/polyfluoro alkyl substances (PFAS) in carpets and rugs are all important activities to reduce consumer exposure to breast cancer-relevant chemicals in common products. It therefore appears that the program is addressing chemicals of importance for breast cancer at a pace comparable to the general pace of the program. In other words, the program has identified relatively few product-chemical combinations to date, but half of those identified have been relevant to breast cancer. It is important to note that other chemicals identified by the program are carcinogens (e.g., TDCPP and TCEP) or developmental toxicants (e.g., 1-methyl-2-pyrrolidone), and may therefore be relevant to breast cancer even though they are not listed as BCRCs.

Multiple chemicals that occur in consumer products appear on the list of BCRCs; many of these are included in the current Workplan. Examples of potential product-chemical combinations that would fall within the Workplan include: 1,4-dioxane as a contaminant in shampoo or other personal care products; benzophenone-3 in sunscreens; p, p'-bisphenols (including bisphenol A) in food packaging; and ortho-phthalates in many different product categories including food packaging, nail salon products and others. Other BCRC chemical classes potentially in consumer products include parabens, short-chain chlorinated paraffins (SCCPs), and aromatic amines. To the extent that trichloroethylene (TCE) and perchloroethylene (PCE) are still present in any products sold in California, these would be important BCRCs for action.

Recommendations

The expert interviews and literature review showed that many of the ten attributes of a successful chemical policy are present in the California Green Chemistry Initiative and more specifically in the Safer Consumer Products Program. There is no indication from this research project that accomplishing the goals of the Green Chemistry Initiative would require a wholesale change in direction. Instead, there was general agreement that it is time to make some adjustments to the current laws and programs to ensure that they function as efficiently and effectively as possible.

The ten recommendations are organized into four categories. The first four recommendations focus on enhancements to strengthen and streamline the statutory authority in A.B. 1879 and allow the SCP to be more effective. Three recommendations focus on improvements to the California scientific programs related to exposure monitoring, chemical hazard identification, and public information on toxic chemicals. Two recommendations address the need to enhance California's commitment to fostering a robust green chemistry industry through public-private-academic partnerships. The final—and in many ways most fundamental—recommendation focuses on development of a sustainable long-term funding strategy to ensure California's future environment and people are safe from toxic chemicals.

Recommendations to Enhance A.B. 1879 and the Safer Consumer Products Program

Recommendation 1: Amend the Legislation to Allow Expedited Action on Certain Product-Chemical Combinations

Additional flexibility in the statute would allow DTSC to move directly to a proposed regulatory action on a product if it can make any of the following findings: (1) The chemical is not necessary for the function of the product; (2) Major manufacturers have already identified and changed to an alternative considered to be safer by DTSC

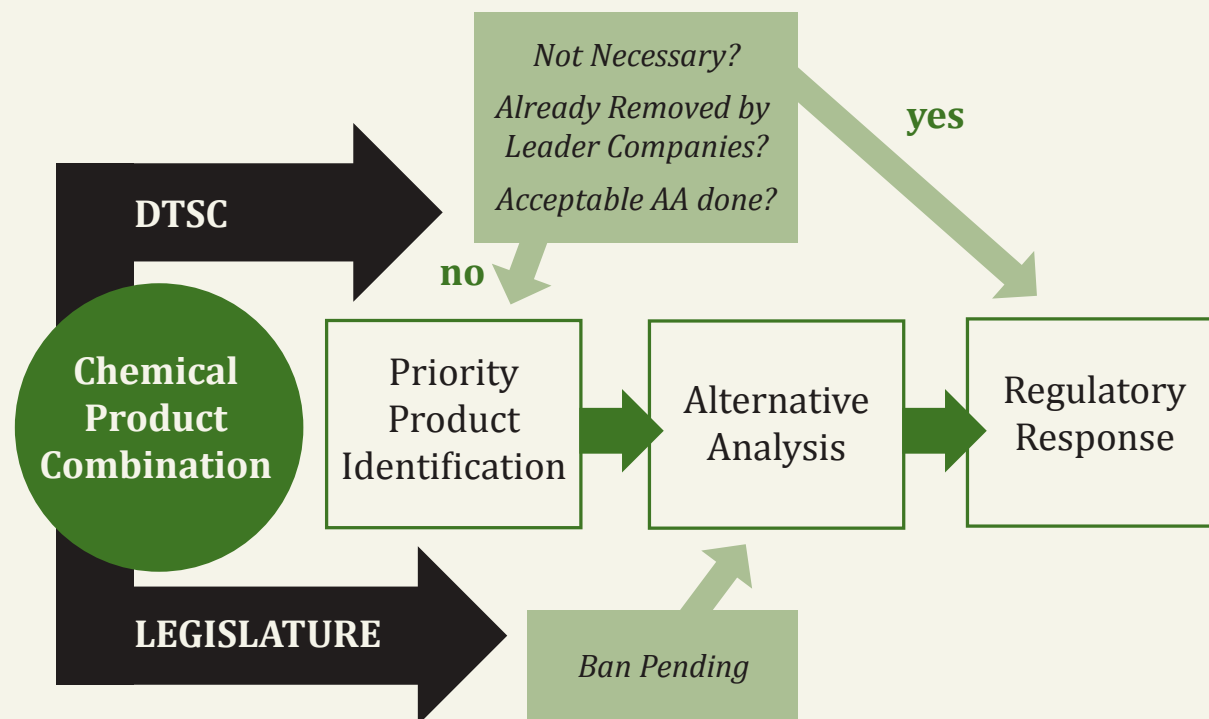
or another authority; or (3) A satisfactory AA has already been conducted on the product-chemical combination. If DTSC proposes to move directly to a regulatory response, the notice and comment process would allow stakeholders to present information arguing that the product-chemical combination should go through the regular process. This more expedited track would allow DTSC to use the AA process to focus on more complex chemical substitution dilemmas.

The legislature could also choose to directly ban a chemical in a product if the chemical is toxic and not necessary for the function of the product. However, if the chemical is toxic but may be functionally necessary, the legislature could skip the initial Priority Product identification process and send the product-chemical combination directly to an AA, thereby expediting the process. This approach would guard against regrettable substitution, and even allow a manufacturer to demonstrate a lack of safer and feasible alternatives. These pathways are illustrated in Figure 4.

Recommendation 2: Clarify and Strengthen DTSC Data Call-in Authority

Legislative action is required to clarify that DTSC has the ability to: (1) Require chemical manufacturers to disclose use information for their chemicals; and (2) Require product manufacturers to disclose their product ingredients and functional uses in the product to DTSC. Such disclosures would be covered, where appropriate, by the current DTSC protections for Confidential Business Information (CBI). DTSC should be authorized to collect penalties against businesses for failure to disclose information. The functional use disclosures would minimize the potential for regrettable substitutions and would allow DTSC to track and document changes in chemical use that occur directly or indirectly due to SCP activities.

FIGURE 4: Flow Chart of Multiple-Track Approach for Safer Consumer Products



Recommendation 3: Evaluate the SCP Prioritization Process

DTSC should perform an assessment of the scientific and procedural foundation of its prioritization process to date to ensure that: (1) It is as efficient and transparent as feasible given the language of the statute and the regulations; and (2) The strategy for product selection is resulting in appropriate product choices that meet the goals of the program. In performing this review, DTSC should involve the GRSP. This review may result in the need to change the regulations, eliminate some pre-regulatory steps, or articulate a more focused strategy.

Recommendation 4: Streamline and Support Alternatives Analysis

The legislature should allow some flexibility in the 13 statutory criteria for the AA. This would permit DTSC to streamline its regulations and guidance and utilize existing high-quality alternatives assessments more easily. DTSC should re-evaluate

its Alternatives Analysis guidance to ensure that it defines a process that will generate sufficient information to make a reasonably informed decision within the requisite timeframe. A modular approach, or decision tree framework could be helpful in this regard.

The legislature should give DTSC authority to assess a fee for the purpose of reviewing and ensuring the quality of AAs. DTSC should also have the authority to determine that an AA is seriously deficient and to assess a larger fee in such cases for the purpose of contracting with an independent third party to conduct an AA. As funding permits, DTSC should consider contracting with third parties to conduct preliminary AAs for functional uses of some potential Priority Products, in order to accelerate decision-making on product categories in the Workplan.

Recommendations to Enhance S.B. 509 and Scientific Information

Recommendation 1: Integrate and Enhance Exposure Monitoring

CalEPA should ensure that environmental monitoring data collected within the Agency are current, publicly-available, and user-friendly. The Agency should hire data scientists to analyze and integrate the monitoring data, along with other health, demographic, and social data, in order to identify areas and issues of potential concern. Other relevant data, including information from CalOSHA and CDPH, could be integrated with the environmental data. California's environmental monitoring programs should be updated and enhanced to use new detection methods and technologies to ensure that emerging chemicals of concern are captured.

One of the most relevant forms of exposure monitoring is biomonitoring of pollutants in people. The California Environmental Contaminant Biomonitoring Program should expand to sample a representative sample of Californians; identify vulnerable and highly exposed subpopulations; and generate data on existing and emerging chemicals to evaluate the effectiveness of California's chemical policies over time.

Recommendation 2: Update, Expand, and Integrate the Hazard Traits

OEHHA should reevaluate the Hazard Traits regulation to ensure that the criteria are consistent with the most current toxicology approaches, including predictive toxicology and high-throughput toxicology. OEHHA should also compile a "Watch List" of chemicals that exhibit certain Hazard Traits, including chemicals that may be poorly studied but that have been shown through predictive toxicology, high-throughput toxicology, or other alternative test methods to exhibit potential Hazard Traits. Such an effort would require additional resources, but is important because it can help ensure that emerging chemicals with toxic characteristics would be identified early.

Recommendation 3: Re-Structure the Toxics Information Clearinghouse

The TIC is not useful in its current form, and should be substantially restructured. Two potential approaches to restructuring are: (1) A Clearinghouse to house and display data obtained by DTSC from data call-ins. This could be integrated with the existing DTSC CalSAFER site, and also could be connected to the OECD eChemPortal and other existing databases. (2) To house and display the chemical Watch List developed by OEHHA, including all of the available toxicity and exposure information about these emerging chemicals of interest; in this second case, the responsibility for the TIC would be transferred from DTSC to OEHHA. Either of these recommendations would require additional resources to implement successfully. The Green Ribbon Science Panel should review the existing tools and databases that are currently available and advise DTSC on how the TIC should be repurposed.

Recommendations to Enhance California's Commitment to Green Chemistry

Recommendation 1: Support Centers for Green Chemistry at California Educational Institutions

There is an urgent need for more education and research in California to integrate and propel forward the science of chemistry, predictive toxicology, and alternatives assessment. Academic centers would be a resource to the state and to California businesses as they innovate and move toward safer products. The Berkeley Center for Green Chemistry is one existing model that could use additional support, but such a center could also be appropriate at any California university that has sufficient breadth of expertise in chemistry, toxicology, exposure science, and policy, and can successfully integrate these disciplines.

Recommendation 2: Partner with Leading Businesses to Advance Green Chemistry

DTSC should engage with businesses that are leaders in advancing safer consumer product chemistry. These companies often have expertise

“[Give] DTSC much more ability to essentially demand information from industries where there was some reasonable basis for concern. You can almost think about it as a search warrant, you know. We don’t really know exactly what we’re going to find, but we’re not just rummaging. We have some basis for being worried.”

[ACADEMIC]

and useful information, and they can help direct DTSC’s attention to important areas. Many companies in the private sector have developed methodologies for conducting alternatives assessments, and these can serve as models, where appropriate. DTSC has already evaluated some existing methodologies for conducting AAs, and this work should continue and expand as resources allow.

DTSC should also engage with businesses that are struggling to identify or develop safer chemicals for functional uses where no safer alternatives currently exist. Jointly funding challenge grants, awards, or other strategies to spark innovation, would be an effective way to leverage state resources. DTSC would likely need additional funding in order to enable these strategies to be effective.

Over-Arching Recommendation to Support California’s Commitment to a Safe Future

Substantially Increase Funding for the State’s Green Chemistry Work

Many of the challenges in the implementation of environmental- and bio- monitoring, Safer Consumer Products, the TIC, and green chemistry are related to funding. These programs do not currently have dedicated funding streams, even though they are essential for protecting the health of the people of California. There are many possible ways to support California’s programs related to green chemistry and health protection. Various fee structures could be effective, as could a small tax to fund the effort.

The legislature should request that CalEPA develop a funding proposal to enhance environmental monitoring and biomonitoring; sustainably support the Safer Consumer Products Program; enable OEHHA to track the Hazard Traits of chemicals; build the TIC into a useful data source; and allow the State to provide support and incentives for green chemistry development in California. Development of such a proposal should include review of other existing model programs such as the Massachusetts Toxics Use Reduction Act and the European Union REACH program.

Conclusion

This project revealed significant strengths of the Green Chemistry Initiative, and significant potential for greater benefits in the future. Although the Safer Consumer Products Program has been relatively slow to implement, it has national and global reach. Experts assert that the program is already bringing new formulations and safer products to California. Some additional authorities and resources would strengthen the California program and allow it to take greater leadership in promoting safer chemicals. The program could make significant progress towards reducing toxic chemicals in products, supporting innovative businesses, and ultimately improving health and environment.

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Appendix: Experts Interviewed

Kathryn Alcantar, California Policy Director, Center for Environmental Health (CEH)

Mike Belliveau, Executive Director, Environmental Health Strategy Center of Maine

Nancy Buermeyer, Senior Policy Strategist, Breast Cancer Prevention Partners

Bill Carroll, Ph.D., Principal at Carroll Applied Science, LLC; former Vice President, Occidental Chemical Corp.

Grant Cope, J.D., Deputy Secretary for Policy and Programs, CalEPA

George Daston, Ph.D., Victor Mills Society Research Fellow, Procter & Gamble Company

Richard Denison, Ph.D., Lead Senior Scientist, Environmental Defense Fund

Ken Geiser, Ph.D., Professor Emeritus, Lowell Center for Sustainable Production, University of Massachusetts Lowell

Bjorn Hansen, Ph.D., Executive Director, European Chemicals Agency

Helen Holder, M.S., Corporate Material Selection Manager, Hewlett-Packard Co.

Tom Jacob, Senior Consultant, Chemical Industry Council of California

Bruce Jennings, former Consultant, California State Senate, Committee on Environmental Quality

Dawn Koepke, Partner, McHugh, Koepke & Associates; Co-Chair, Green Chemistry Alliance

Michael Lipsett, M.D., J.D., former Chief, Environmental Health Investigations Branch, CA Dept. of Public Health

Melanie Marty, Ph.D., former Deputy Director for Scientific Affairs, OEHHA

Jennifer McPartland, Ph.D., Senior Scientist, Environmental Defense Fund

Kelly Moran, Ph.D., President, TDC Environmental, LLC; Co-Chair, Green Ribbon Science Panel

Marty Mulvihill, Ph.D., Co-Founder and Partner, Safer Made

Janet Nudelman, Director of Program and Policy, Breast Cancer Prevention Partners

Karl Palmer, Chief, Safer Consumer Products Branch, DTSC

Claudia Polsky, J.D., Director, U.C. Berkeley Environmental Law Clinic; former Deputy Director, DTSC

Debbie Raphael, Director, San Francisco Department of the Environment; former Director, DTSC

Anthony Samson, J.D., Senior Attorney and Policy Advisor, Arnold and Porter

Meg Schwarzman, M.D., M.P.H., Associate Director of Health and Environment, U.C. Berkeley Center for Green Chemistry

Joel Tickner, Sc.D., Associate Professor, Department of Community Health and Sustainability, University of Massachusetts Lowell

John Ulrich, former Executive Director, Chemical Industry Council of California

Andria Ventura, Toxics Program Manager, Clean Water Action

Rachel Wagoner, Chief Consultant, California State Senate, Committee on Environmental Quality

Meredith Williams, Ph.D., Deputy Director, Safer Consumer Products Program, DTSC

Mike Wilson, Ph.D., National Director for Occupational and Environmental Health, BlueGreen Alliance

Ken Zarker, Manager, Pollution Prevention and Regulatory Assistance Section, Washington State Department of Ecology

(Note: Affiliations are for identification purposes only)



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