

# California Puts Green Chemistry Under the Microscope

*By Joel Makower  
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There's a classic, geeky science joke that "Chemists have all the solutions." That's starting to appear true from an environmental perspective, though it remains to be seen whether those solutions will actually come to market. Green chemistry, a common-sense discipline that's less than twenty years old, has been emerging in recent years from the lab and into the marketplace, making inroads in conventional chemical companies and creating opportunities for upstarts. As I've [noted in the past](#), this has been taking place at a slow, almost imperceptible pace, with relatively little fanfare, considering the implications. And there's a long way to go before green chemistry fulfills its catalytic potential to transform the way we make things, doing so in a way that reduces risks to both human health and the environment. But new attention is being paid to the discipline, and that's encouraging. Green chemistry, a seeming oxymoron, is defined by two of its pioneers, Paul T. Anastas and John C. Warner, authors of the 1998 textbook [Green Chemistry: Theory and Practice](#), as the utilization of a set of principles that reduces or eliminates the use or generation of hazardous substances in the design, manufacture, and application of chemical products. Or, as a recent report from a California state advisory panel nicely put it: The science of green chemistry addresses pollution prevention at the molecular level. The [Green Chemistry Initiative Science Advisory Panel](#), convened by the California Environmental Protection Agency, was formed in 2007 to "generate ideas that could fill information and safety gaps about chemicals, develop overall policy goals, and identify and recommend policy options." The group issued its findings recently ([download - PDF](#)), a 190-page tome that offers no fewer than 38 recommendations, from regulatory to educational to informational, about how to make green chemistry the rule, not the exception. The need for green chemistry is obvious. There continue to be substantive gaps in understanding the health and environmental effects for the great majority of the 83,000 chemical substances listed in the TSCA Inventory, the registry created under the federal Toxic Substances Control Act (TSCA) of 1976. And over the past twenty years, more than 20,000 new substances have been added to the Inventory, as global chemical production continues to grow at about 3% per year, doubling every 25 years. As has been well documented since the publication 46 years ago of [Silent Spring](#), many of these chemicals come in contact with people — in the workplace, in homes, through the use of products, and through air, water, food, and waste streams — and many enter the earth's ecosystems at some point during their life-cycle, some remaining persistent for decades. The California panel identified three gaps which, it says, are critical to making green chemistry mainstream:

- a Data Gap, in which manufacturers and businesses currently can sell a chemical or product without disclosing sufficient information about its potential health or environmental hazards.
- a Safety Gap, in which public agencies often are unable to efficiently regulate known hazards in an integrated, comprehensive manner, or require producers to accept greater responsibility for the lifecycle impacts of their products.
- a Technology Gap, with insufficient private or public investment in green chemistry research, development, education, and technical assistance.

Together, says the panel, these gaps have produced "a flawed market for chemicals and products in the U.S." in which the health effects of many chemical exposures are poorly understood; hazardous chemicals and products are competitive in the market; the majority of the costs of health and environmental damage related to chemical exposures and pollution are carried by the public; broad investment in green chemistry across the chemical industry sector is inconsistent; government has limited authority and information with which to adequately assess the risks of most chemicals; and there is very little attention given to green

chemistry in high school, college, or university curricula. That needn't be the case, and the report's recommendations show that it will take both "supply-side" options — initiatives in education, research, economic incentives, etc. that will help to facilitate the creation and dissemination of greener chemicals, processes and technologies — and "demand-side" options — chemicals policy elements that will drive demand for these greener chemicals, processes and technologies, by better informing the market, providing a level playing field on which greener options can fairly compete, and creating a regulatory climate that drives both the development and the adoption of greener alternatives. The California report recommends a wide scope of remedies, from education about green chemistry starting in K-12 and continuing through graduate programs in both chemistry and business; to establishing Green Chemistry Science and Technology Innovation Centers across the state; to creating awards and design competitions; to launching a California Chemistry Research Challenge; to establishing "one or more independent non-profit institutes to identify, develop, and test safer alternatives." That's just on the supply side. On the demand side, the panel recommends that the state develop a comprehensive "map" of the flow of chemicals in California; require chemical manufacturers and users to systematically identify and consider safer alternatives; provide retailers with access to guides for selecting greener alternatives to toxic products, via a retailer clearinghouse; develop a "green scorecard" for chemical products that lets both producers and consumers know which products truly are greener than others; and incorporate green chemistry criteria into state procurement processes. There's more — as I said, 38 recommendations in all. It's a blueprint not just for promoting green chemistry in California, nationally, or even globally, but also for how enlightened environmental thinking at the state level can circumvent or overcome the inexcusable failings of national leadership. Of course, it's not just up to government, however enlightened. What strikes me as a big problem is the opposition of the chemical industry toward basic policy steps that would level the playing field for green chemistry. Case in point: [a bill introduced in the California legislature](#) in June would require manufacturers to disclose information about ingredients for certain consumer products. That's one of the California panel's 38 recommendations, following the observation that "existing product labeling requirements and material safety data sheets reveal very little about the chemical components of common products, whether in formulations (i.e., chemical mixtures) such as cosmetics or household cleaners, or in finished goods like toys, clothing, and automobiles." Mandating disclosure of consumer products like air fresheners and household cleaners would likely spur manufacturers to eliminate hazardous chemicals for more benign ones, a key tenet of green chemistry, thus accelerating demand for green chemistry at a large scale. One problem: the chemical industry has lined up squarely against the bill. Chemists may have all the solutions, but they don't seem to want to use them. And it's no joke.

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