

MEMORANDUM

TO: DAVID CRANE
CC: TRACY ARNOLD
FROM: JASON ELLIOTT
DATE: JUNE 25, 2007
RE: GREEN CHEMISTRY & ECONOMIC DEVELOPMENT

Exposure to toxic chemicals costs California \$9.5 billion every year due to lost wages, medical expenses, lawsuits, etc.¹ Green chemistry has the potential to stem this tide of losses, and California can emerge as a leader in research and compliance if the State begins to train scientists in the principles of green chem.

California could become the world leader in Green Chemistry by developing a labor pool of non-PhD scientists trained in the principles and applications of Green Chem – non doctoral scientists command more affordable salaries but also provide the added benefit of green chemistry knowledge. If the State set up a Green Chemistry curriculum through the UC system or the community colleges, industry would flock to California to take advantage of experts in the budding field. Private firms need non-PhD salary-level scientists fluent in the principles of sustainable chemistry, and California is uniquely positioned to provide this labor pool with its environmental consciousness, strong academic culture, and entrepreneurial spirit.

Setting aside the obvious positive environmental aspects of green chemistry, taking the lead in this emerging scientific trend could also provide economic development opportunities for the State.

A cluster of green chem-trained scientists would lead to economic development in three ways:

- 1) Firms will find California, with its labor pool of green chemists, a highly attractive place to locate for help with environmental regulatory compliance.
- 2) The UC system will benefit through increased research grant money from industry and government and revenues from patenting/marketing new technologies.
- 3) Independent houses of invention, toxicity research and compliance consulting will sprout up, leading to a reputation for California as the worldwide green chem leader – high paying jobs will result.

¹ According to Dr. Richard Liroff, Senior Program Manager, World Wildlife Fund and Executive Director of the Investor Environmental Health Network

- **Industry Needs In-House Green Chemists**

Industry has made it abundantly clear that scientists with training in Green Chemistry are desirable, and would be put to use in labs immediately. In order to come into compliance with a growing number of environmental regulations on chemicals, firms like Dow (as well as smaller companies) want to eventually transition large portions of their staffs into green chemistry-certified scientists, according to a Pfizer representative. In fact, Pfizer already operates training sessions to teach current employees about Green Chemistry. If the State developed a Green Chem curriculum and, as a result, a labor pool of green chemists, firms would choose to locate in California and employ these people instead of expensive PhDs with no training in environmentally sustainable chemistry.² When a substance is banned by a government, private firms have no standing ability to quickly develop an acceptable alternative – this is precisely what a pool of green chem-trained scientists located in California would be able to do.

- **Universities Need In-House Green Chemists**

Universities in California will benefit from employing green chemistry experts because industry is desperate for replacement substances for their most toxic products and inputs, but no serious infrastructure exists to invent these new technologies. A concentration of green chem knowledge will make California's institutes of higher education the logical first choice for companies looking to hand out research money.

Furthermore, the UCs stand to earn windfall profits from patenting and marketing green chemistry inventions that are presently ignored or underutilized. Many green chem breakthroughs happen during University research, but these discoveries are accidental accomplishments during the pursuit of a more commercial goal. If the University had a scientist on staff who could identify the commercial potential of such a green chemistry discovery, the school could patent these new technologies (if the granting entity passes on its first right of refusal). The perfect type of employee for this would be a graduate of a toxicology and green chemistry marketing curriculum at a UC school. As it stands now, the UCs employ non-scientists at the administration level for the purpose of identifying and marketing potential green chemistry breakthroughs – many stakeholders say this system is ineffective.

For example, one scientist was commissioned by a major electronics firm to develop a new kind of light bulb, and during the trial process, discovered a new type of hyper-efficient LED. This however, was not the goal of the grant, so the discovery was shelved because its marketable green chemistry properties went unrecognized.

- **Independent Green Chemistry Firms Would Emerge**

Chemical production firms have a difficult time keeping up with the patchwork of green chemical regulations across different countries. This occurs for two reasons: a lack of infrastructure to test chemicals for toxicity and the confusion of trying to comply with divergent regulations across different nations. UC-trained green chemists, therefore, could be highly successful in the inventing, testing and consulting businesses. Multinationals could employ these independent green chemists to develop new materials, test for toxicity and offer advice on compliance issues. Small domestic chemical companies could farm out expensive and highly specialized toxicity testing to these dedicated green chem labs.

² Note: I have heard this sentiment echoed from academia and industry.

EXAMPLES OF GREEN CHEMISTRY LEADING TO ECONOMIC BENEFITS³

- Süd-Chemie, a German firm, developed a new pathway to synthesize solid oxide catalysts; this new product now has a \$100 million market.
- Buckman Laboratories of Tennessee invented a new enzyme to clean paper mill machinery. In one specific mill, production increased by more than six percent after switching to the new chemical, which amounted to a \$1 million annual benefit.
- Novozymes, a Danish company, developed cleaner cotton processing system that does not use sodium hydroxide and cuts water usage costs by 30% to 50% in the production process. Considering the size of the worldwide cotton industry, this enzyme has the potential for annual water savings of 10 billion gallons globally.

NOTES ON GREEN CHEMISTRY

- There are two schools of thought on green chemistry, and they are in tension against each other:
 - *Berkeley*: Represented by Dr. Michael Wilson at UC Berkeley. This school of thought advocates a system of green chem specialists that help industry identify toxic chemicals. This school seems more focused on environmental regulation and less on cooperation with industry.
 - *Lowell*: Represented by Dr. John Warner of UMass-Lowell, this is the old-school green chemistry. Students should be traditional chemists with additional training in green chem principles. Their main goal should be designing better alternatives, not just identifying problems.
- The American Chemical Society in Washington, DC is frustrated with the State of California's view of green chemistry as an excuse to ban toxic substances instead of working to develop suitable alternatives. According to one specialist, "California is seen as the killer of green chemistry."
- Estimated Minimum Green Chemist Salaries by sector (US):⁴
 - > \$80,000 in industry
 - > \$74,000 in government
 - > \$52,000 in academia
- California Environmental Associates (CEA) completed an assessment for the Heinz Foundation which makes clear the cross-sectoral demand for green chem expertise (government, academia, and industry). This report also pushes Pittsburgh as a logical home for Green Chemistry.⁵

³ US EPA. "Green Chemistry Award Winners." <http://www.epa.gov/greenchemistry/pubs/pgcc/past.html>

⁴ American Chemical Society. "2005 ChemCensus." 2006. Derived by looking at median salaries of Master's level non-green chemists and operating under the assumption (given by Dr. Warner) that chemists with green chem training are intrinsically more valuable.

⁵ Memo from California Environmental Associates to the Heinz Endowments from 5/3/2006 obtained confidentially.