By Carolyn Raffensperger

Green Chemistry In EPA, Congress

There is a Republican-sponsored bill in the House Science Committee that would move society closer to a chemical industry that consistently searches for safer, cleaner ways of doing business. The Green Chemistry Research and Development Act of 2004, H.R. 3970, would increase federal investment in this new field. Coincidentally, that icon of chemical hazards, Love Canal, has just been proposed for de-listing from the Superfund site list — EPA is satisfied that the area is safe. But in March, one of the key funding mechanisms of Superfund (the law inspired by Love Canal), the industry-funded "orphan share" trust fund which has not been authorized since 1995, suffered another negative vote in the Senate.

The story of Love Canal, Superfund, and the story of green chemistry are really the same story, the story of human stupidity, then learning, then ingenuity.

Decades before Rachel Carson's expose of the chemical industry in her 1962 book *Silent Spring*, the Hooker Chemical Company was filling a canal in upstate New York with more than 21,000 tons of organic solvents, acids, and pesticides. Most of the waste was in flimsy drums that broke or rusted over the years. In 1945, a Hooker engineer wrote in a prescient internal memo that Love Canal was a "quagmire which will be a potential source of lawsuits."

In 1952 a growing city of Niagara Falls sought the land for a new public school. Hooker, concerned about liability, refused to sell but was threatened with eminent domain. The sale went forward. Hooker went to extreme lengths to warn the government and future owners of the hazards. The warnings were ignored by the school district. Development went forward with schools, playgrounds, and homes.

In 1953 Hooker closed the site. The quagmire description proved apt when fires and explosions became regular neighborhood events. In 1977, things came to a head. The neighborhood was grossly contaminated and the evidence was everywhere, from lawns that wouldn't grow to sick children.

Enter Lois Gibbs, one of the great environmental heroines. Gibbs was a local resident who read a newspaper series on the site. She connected the dots between her children's illnesses and the contamination. She organized the Love Canal Homeowners Association in 1978. Two years later President Carter declared a federal emergency and evacuated 900 families out of Love Canal. The site became the impetus for the Superfund law, which was signed by Carter in 1980.

As government struggled to do something with Love Canal and other hopelessly contaminated sites, two things became clear. First, we had to clean up the messes we'd created. Superfund was designed to do that. The second task was figuring out how to prevent new messes.

You can try to do that through an intense regulatory regime like RCRA-TSCA. Or you can try green chemistry.

This new field was born in part out of the Pollution Prevention Act of 1990 and, according to EPA's website, is the "design, development, and implementation of chemical products and processes to reduce or eliminate the use and generation of substances hazardous to human health and the environment." At the heart of EPA's program is an innovative research agenda and program that generates green chemistry solutions to global problems. As one leader in the field commented, "These are not laboratory curiosities or individual research projects. This is a field aimed at large global problems such as climate change, energy consumption, and management of our water resources."

Green chemistry is based on 12 principles that were developed by Paul Anastas and John C. Warner, authors of the Oxford University Press book *Green Chemistry: Theory and Practice*. They are worth listing here, in simplified form:

1. It is better to prevent waste than to treat or clean it up.
2. Maximize the incorporation of all materials used in the process into the final product.
3. Use and generate substances that are as nontoxic to human health and the environment as possible.
4. Chemical products should be designed to preserve effectiveness while reducing toxicity.
5. Try not to use solvents, separation agents, etc. If you have to use them, make them as innocuous as possible.
6. Because energy has environmental and economic impacts, minimize its use. Work at ambient temperature and pressure.
7. Use renewable raw material feedstocks whenever technologically and economically practical.
8. Avoid using blocking or protecting groups or any temporary modifications if possible; such derivatives use additional reagents and generate waste.
9. Use catalysts in reactions, which can be reused, not stoichiometric reagents, which cannot.
10. Design products that break down and do not persist in the environment.
11. Analytical methods need to be developed to allow for real-time in-process monitoring and control to allow intervention prior to the formation of hazardous substances.
12. Use substances that minimize the potential for chemical accidents, including releases, explosions, and fires.

Yes, we need to remember Love Canal and protect people from our past follies, but we can demonstrate that we are educable as a species and adopt green chemistry, thereby preventing future disasters. Science Committee Chairman Sherwood Boehlert, whose district is also in Upstate New York, has scheduled hearings for H.R. 3970. The Green Chemistry bill deserves to be passed by Congress. No more quagmires.

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