

William Sound; and the American Forest and Paper Association's "Sustainable Forestry Initiative" was implemented after the U.S. Fish and Wildlife Service protected the northern spotted owl. Nash cites empirical evidence that casts doubt on the efficacy of these programs. Chemical firms that participate in Responsible Care, for example, emit no fewer toxic pollutants than otherwise similar firms that do not participate. This is especially dramatic given the substantial selection bias that would favor finding large effects of the program. Nash concludes that these industry self-regulatory agreements do more to protect the industries' reputations than the environment.

My favorite chapter in the book (ch. 16) is by Kathryn Harrison, perhaps because she is a fellow economist (and judging from the chapter a fellow skeptic). She begins by noting that the deck is stacked against traditional regulations, which are typically compared to a benchmark of perfect compliance and cost-effectiveness. By contrast, voluntary programs are lauded as successful if members show any improvement relative to an arbitrary baseline. The chapter examines government-industry voluntary arrangements, the best example of which is the EPA's "33/50" program. In 1991, the EPA challenged firms to reduce releases of 17 toxic chemicals by 33 percent by 1992, and by 50 percent by 1995, relative to their 1988 baselines. Harrison notes that while 33/50 has been praised because participants made substantial reductions, much of the change occurred before the program's inception, and non-participants made improvements as well.

Any book on a topic this broad will leave some stones unturned. A chapter on marketing energy conservation skips the economic literature on why people fail to invest in energy-efficient appliances even when it is in their best financial interest to do so. Essays on recycling and green consumerism promotions do not compare those programs to the dozens of communities that have recently implemented marginal-cost pricing of trash as a means of encouraging recycling and waste reduction. A chapter on the lessons learned from disaster preparedness campaigns does not ask what the market failure might be (see "Samaritan's dilemma"). Perhaps some citizens did not stock up on duct tape and plastic sheeting following the Department of Homeland

Security's February 2003 "Ready Campaign" because they reasoned that the costs outweighed the benefits.

The authors in this collection express a range of opinions as to the merits of these new policies. While I found the skeptics most convincing, the one clear message from the book is that this is an area ripe with important unanswered research questions: Controlling for selection bias, do voluntary industry-association programs improve the environment relative to traditional regulations? Are environmentally educated citizens more likely to take private actions for the public good? Do public information campaigns encourage desired behavior more efficiently than a tax or equivalent market-based measure? Ultimately, this book provides two worthy contributions: a useful survey of a nascent public policy, and fertile ground for new research questions for environmental economists.

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*Materials Matter: Toward a Sustainable Materials Policy.* By Kenneth Geiser. Cambridge, MA: MIT Press, 2001. Pp. xvi, 479. \$24.95. ISBN 0-262-07216-5.

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Why does the U.S. economy produce such large quantities of toxic materials and toxic waste? Why are we using up our raw materials so quickly? Geiser wants to know why companies don't search for more benign substitutes and why the economy has not done more to curb the profligate use of materials by reusing or recycling them. The book documents extensive past problems, from adding tetra ethyl lead to gasoline to using chlorofluorocarbons for refrigerants and blowing agents. Finally, Geiser pulls these threads together to recommend an approach to an environmentally benign, sustainable materials policy in a sustainable economy.

The book is an entertaining, compact history of technology, the growth of the chemical industry, and the uses of, and advances in, materials. His scholarship is wide ranging, from Ramazzini in 1700 on occupational disease to Alice Hamilton arguing in 1925 that lead should not be added to gasoline. I was fascinated at the history of inventing new materials and technologies and how dominance in exploiting the technology tended not to stay with the country

of invention; "first mover" advantage has been small. Geiser describes both the serendipity of the invention of nylon and the trial and error that finally led to vulcanizing rubber. Amateurs and professionals achieved impressive goals in producing materials to feed the 1917-1918 and 1941-1945 war efforts when international trade was disrupted, setting the stage for U.S. economic dominance.

The rapid rate of innovation in chemistry from 1850 to 1950 produced miraculous new materials and products. Surely there is no mystery about why business and political leaders, and the public, focused more on the possibilities than the possible liabilities of the new materials and processes. With an immense continent of endless trees, mineral deposits, soil, and water, no economist would be surprised that Americans adopted a different attitude toward exploiting natural resources than prevailed in Europe. The vestige of this "unlimited resources" attitude is reflected in the U.S. lag behind the EU in recycling laws and concern for the discharge of toxic materials and the emissions of greenhouse gases.

American concerns for safety and health were pragmatic: Industrialists such as DuPont and Dow worked to eliminate explosions in their factories and worker exposure to toxicants that resulted in debilitating disease. The concern stopped at the factory gate and observed effects in workers. By 1912, air pollution had gotten so bad that 22 large U.S. cities had smoke control ordinances. But, in an era of 12 hour work days, low income, and low life expectancy, the death of a few workers or a degraded environment were not central concerns.

As living standards improved, environmental laws restricted pollution discharges into the air, water, and land, and even mandated that new chemicals had to be certified by the EPA before they could be manufactured. Unfortunately, the success of the air pollution control regulations has not lowered public concern for exposure to toxicants, even at low levels. Geiser writes that the best materials policy is to not produce toxicants, rather than to try to control them later. He gives many examples of materials substitution that resulted in less toxic materials. The underlying premise is that there are many ways to accomplish a goal. Materials of quite different toxicity can be used, although the functionality is not

identical. In the best cases, there is no loss in functionality.

Geiser is less successful in examining his central theme. To his eyes, synthetic is bad and natural is good: "In its carefully mediated materials cycles, nature is quite selective about the materials that are employed" (p. 208). But some of the deadliest poisons are natural, and Bruce Ames describes a billion years of chemical warfare between plants and herbivores and between prey and predator. Nature is not benign.

Current environmental quality and sustainability are not congruent. With current technology, a more fuel-efficient car has higher pollution emissions. Growing enough biomass to eliminate petrochemicals in producing plastics would have effects on environmental quality.

What are the priorities and how can they be achieved? Geiser presents a 2x2 classification of chemicals by toxicity and environment persistence. A third dimension, total production/discharges/exposure is needed. With the exception of substances that bioaccumulate, exposure levels are as important as inherent toxicity. Three centuries ago, Paracelsus, the father of toxicology, wrote that all substances are toxic—it is the dose that makes the poison. The combination of Geisel's matrix and estimating exposure levels would be a good way to set priorities.

Geiser is correct that markets, government incentives, labels, public and worker education, etc., have the greatest potential for improving environmental quality and increasing sustainability. We should stop subsidizing mining and minerals use and work to have their prices reflect the social cost of producing and using them. But how much recycling should occur is an economic and public preference question. Doing more recycling than makes economic sense (after accounting for externalities) increases the use of current resources, reducing sustainability. One way to think of landfills is that they are ore deposits for future generations to mine when the technology and materials costs make that profitable.

Geiser has written a valuable book. If his policy recommendations are less than compelling, he is reflecting the current state of thinking.

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