MAKING THE WORLD LESS SAFE: THE UNHEALTHY TREND IN HEALTH, SAFETY, AND ENVIRONMENTAL REGULATION

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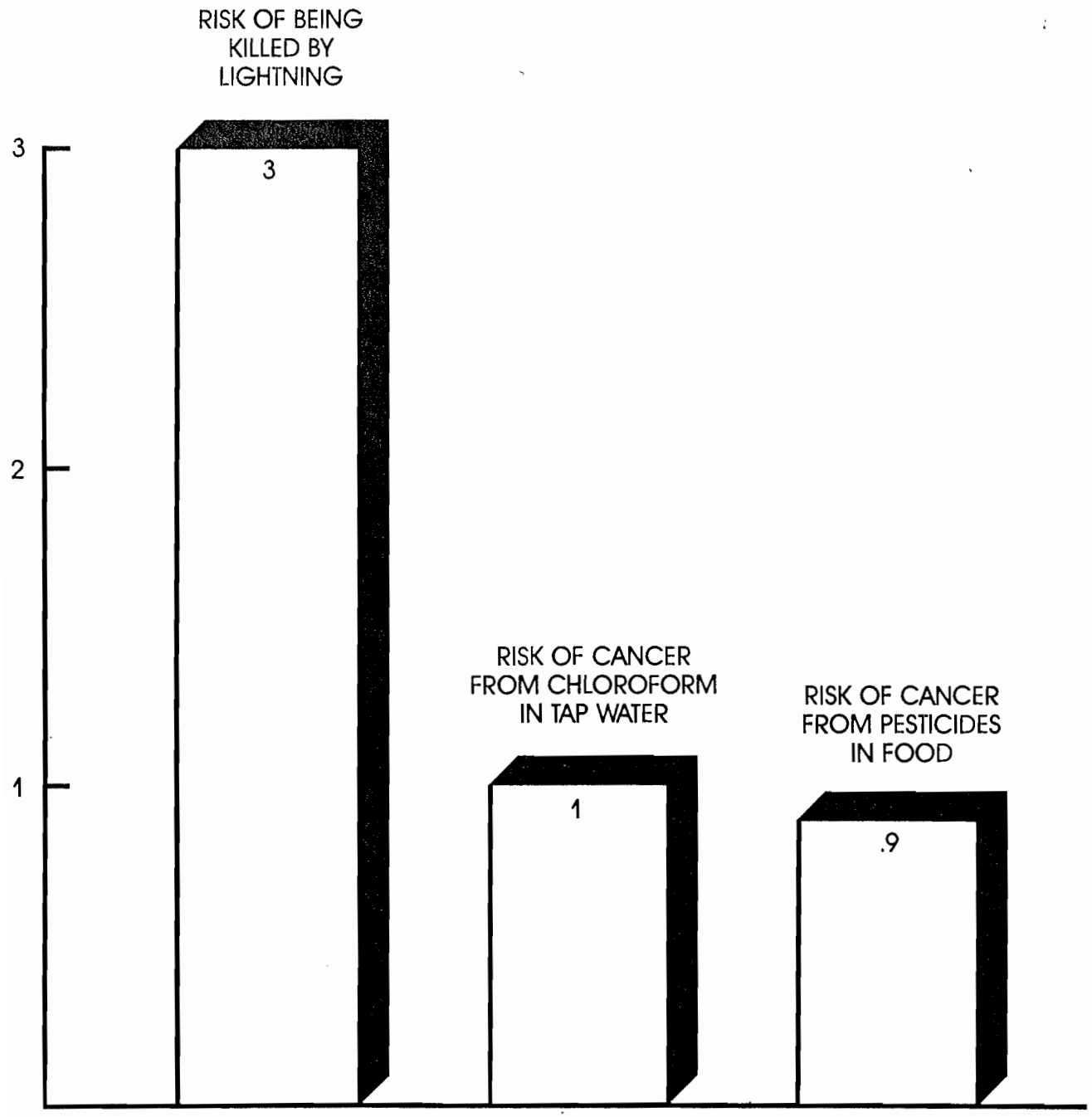

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EXECUTIVE SUMMARY

Because of fear and panic over the possibility that people are being exposed to cancer-causing chemicals, politicians at the state and federal level are enacting unwise laws and regulations. All too often, these laws eliminate a highly visible risk while at the same time increasing our exposure to less visible but more dangerous risks. As a result, legislation passed in the name of "safety" is making us less safe.

- The Environmental Protection Agency (EPA) recently closed 35 wells in California because the water contained trace elements of a carcinogenic chemical; yet California tap water (the most likely alternative to well water) is many times more carcinogenic than the water in the wells which were closed.

- The government has banned the use of EDB as a fumigant in agriculture because it was discovered to be a mild carcinogen in rodents; yet EDB was the safest known way of combating molds, which produce some of the most potent carcinogens found in all of nature.

- The government also has placed a total ban on the use of DDT; yet although DDT apparently is not harmful to humans, it has been replaced by pesticides that are very dangerous for farm workers.

California's Proposition 65, the most sweeping chemical regulatory law ever enacted by a state government, requires that anyone exposing others to carcinogenic substances post warnings. Yet this law could make Californians less safe, not more so. If the proponents of Proposition 65 get their way, California businesses will be posting warnings everywhere. But if every product carries a warning, warning labels will lose their impact and consumers will be unable to distinguish the few major risks from the trivial risks of everyday life.

As recent events have shown, the mere mention of the word "cancer" by public officials has the potential to create national panic and hysteria. That's unfortunate.

- Fully one-half of all natural and man-made chemicals that have ever been tested have been shown to cause cancer in rodents, if administered in very large amounts.

- This means that small (usually trivial) amounts of rodent carcinogens are present in almost everything we eat and in almost all the air we breath.

- On the bright side, the International Agency for Research on Cancer has identified only 26 chemicals that are carcinogens in humans, and it appears that our resistance to carcinogens to which we are routinely exposed is quite strong.

What is missing in the formation of public policies is a sense of perspective.

- Although there is increasing public concern over cancer risk from pesticide residues in our food, the amount of carcinogenic pesticides consumed in a day is one-twentieth of the amount of natural carcinogens in one cup of coffee.

- Although there is increasing concern over cancer risk from polluted air, the amount of carcinogens in the browned and burned food we eat -- the carcinogens are produced by cooking -- is several hundred times greater than the amount of carcinogens inhaled by breathing severely polluted air.

INTRODUCTION[1]

In the United States, government is rapidly increasing its control over activities involving chemical risks. Superfund legislation at the federal level, and Proposition 65 in California, are highly visible examples. These laws have been spurred by public fear that chemicals and their by-products pose grave risks to the environment in general and to human beings in particular. As technology has increased our standard of living, it also has exposed us to many man-made chemicals, which have been labeled carcinogens. Yet cancer risks have not increased. We are living longer, and the risk of death from cancer is decreasing for the population as a whole.

Major reasons for our longer lives include greater affluence and the opportunities created by technological change. The new risks we accept usually replace even greater risks left behind. Automobile travel is dangerous, but mile for mile it is much safer than travel on horseback. People die each year in spectacular airplane crashes, but airplanes are far safer than automobiles. Only the earth's richer residents ride in automobiles, and only the very richest travel the safest way -- by air.

It should not be surprising to learn, then, that richer societies are safer than poorer ones. People in rich societies, whatever their income level, live longer, healthier lives than do those in societies with simpler lifestyles. The benefits of greater income and wealth, including safer travel and safer homes, far outweigh the risks of economic development and technological change.

"Risk" is often interpreted as bad -- a thing to be avoided. Yet all economic and technological progress requires that human beings take risks. It is precisely because our ancestors took risks that we enjoy healthier, longer lives than they did. As Aaron Wildavsky has so persuasively argued, "There can be no safety without risk."[2]

Immunization against childhood diseases is a good example. Each year about 3.5 million children receive vaccines against diphtheria, whooping cough, and tetanus. Of these children, 25,000 get high fevers, 9,000 collapse in some way, 50 are brain damaged, and as many as 20 die. About eight children get polio each year after receiving the polio vaccine. These risks, however, are far preferable to the much more frequent incidence of disease and death that would occur if the vaccines were not administered.[3]

The challenge, then, is to provide protection for the public against clear chemical dangers without unduly crippling the ability of people to enjoy the benefits of chemicals and economic growth, including the contributions of new chemicals and economic growth to better health. This is proving enormously difficult .

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[1]This report is based in part on a larger project, directed by Richard Stroup at the Political Economy Research Center (PERC), investigating the effects of hazardous waste policy and exploring policy options for the future. Richard L. Stroup is Senior Associate at PERC and Professor of Economics at Montana State University, both in Bozeman, Montana. Donald Leal at PERC provided important assistance in the preparation of this report.

[2]Aaron Wildavsky, *Searching for Safety* (New Brunswick: Transaction Publishers, 1988), p. 1.

[3]*Ibid.*, p. 56.

LEGISLATION PRODUCED IN RESPONSE TO FEAR AND PANIC

Increasingly, regulation of chemicals is being governed by political responses to public fear and hysteria rather than by careful, objective evaluations of the actual risks and benefits posed by the chemicals and their use. Consider public policy toward drinking water, for example.[4]

- Recently, the Environmental Protection Agency (EPA) closed 35 wells in California because the water contained trace elements of trichloroethylene (TCE), which is known to cause cancer in mice.

- Yet the most common alternative to drinking well water is drinking tap water containing chloroform, which is 20 times more carcinogenic for mice than TCE.

- In all but two cases, the cancer risk from California tap water was greater than the risks from the water in the wells that were closed, and in two cases California tap water was 50 times more risky than the water from the wells that were closed.

Public policy toward pesticides is another example, reflecting the pervasive view that carcinogenic chemicals produced by man are far worse than those produced by nature, even though scientific evidence indicates otherwise.[5]

- When scientists discovered that large doses of ethylene dibromide (EDB) caused cancer in rodents, the government banned the chemical from use as a fumigant to keep insects and molds off stored grains.

- Yet the average amount of EDB ingested by people with normal diets was 1000 times less risky than the natural carcinogens in two slices of bread.

- Moreover, EDB is the safest known way to combat molds, which produce some of the most potent carcinogens in all of nature.[6]

These are not isolated examples, but are part of a general trend toward policies which seek to eliminate specific risks while ignoring other, related risks. These policies too often increase rather than reduce the overall risks we face. Moreover, there are many new policies on the drawing board.

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[4]See discussion in Bruce N. Ames, Renae Magaw, and Lois Swirsky Gold, "Ranking Possible Carcinogenic Hazards," *Science*, Vol. 236, April 17, 1987, p. 272; and Richard Lipkin, "Judging Limits of Safety Is a Regulator's Nightmare," *Insight*, May 23, 1988, p. 16.

[5]*Ibid.* See also the discussion in Bruce N. Ames, Testimony before the California Assembly Committee on Water, Parks, and Wildlife, October 1, 1986 (hereinafter referred to as "Testimony"); and Richard Lipkin, "Risky Business of Assessing Danger," *Insight*, May 23, 1988, p. 11.

[6]On the recent spread of the natural carcinogen, aflatoxin, in Midwest grain crops, see Scott Kilman, "Spreading Poison: Fungus in Corn Crops, A Potent Carcinogen, Invades Food Supplies," *The Wall Street Journal*, February 23, 1989.

- Although it poses a trivial threat to humans, PCE (the main dry-cleaning solvent used in the U.S.) is under attack because large doses cause cancer in rodents. Yet the alternatives are the flammable solvents which caused numerous fires in early dry-cleaning shops, or the more toxic and hazardous solvent, carbon tetrachloride.[7]

- Polystyrene (used, for example, in McDonald's hamburger boxes) is under attack by environmentalists because it is not biodegradable. Yet polystyrene has been praised by the American Public Health Association because it is far safer than any known food packaging alternative.[8]

- Almost all man-made pesticides are under attack. Yet these synthetic pesticides replaced far more toxic natural insecticides such as lead arsenate, sulphur, lime, cyanide and flourine.

Paul Slovic, a psychologist at the University of Oregon, specializes in studying public perception of risk. According to Slovic,

> Americans today feel they are more at risk from technology than ever before. And yet, in terms of health, life expectancy, even accidents, things have improved greatly. Ironically, the more the nation spends on regulation, no matter how many billions on regulations and environmental controls, the less safe the American public seems to feel. It's a strange paradox.[9]

Slovic and other social scientists tell us that public outrage,[10] as opposed to calm consideration of objective risks, is easily generated when the risks are: 1) involuntary and beyond the control of the individual, 2) unfamiliar or exotic, yet frequently reported, 3) dramatic and focused in time, and 4) perceived to be unfair, in that they are imposed without the individual's approval, for the benefit of someone else.

When presented in dramatic form with skilled, passionate rhetoric, risks from hazardous wastes, chemical pesticides, and other environmental dangers can certainly generate outrage. Once the outrage is created, the objective facts -- the actual dangers under alternative policies -- become much less important. Extreme measures to protect the public from a single danger in focus at the moment seem justified.

In what follows we consider how misperceptions of risk on the part of the general public and policymakers have led to three policy mistakes: the ban on DDT, the creation of Superfund, and California's Proposition 65.

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[7]Ames, "Testimony."

[8]Michael H. Levy, "A Plastics Packaging Perspective on Degradability," *Plastics*, December, 1987, pp. 136-137.

[9]Reported in Lipkin, "Risky Business of Assessing Danger," p. 10.

[10]An excellent review of the outrage factor, in the context of biotechnology risks, can be found in Peter Sandman, "Apathy Versus Hysteria: Public Perception of Risk," in L. R. Batra and W. Klassen, eds., *Public Perceptions of Biotechnology* (Bethesda: Agricultural Research Institute, 1987), pp. 219-231.

From Silent Spring to the Ban on DDT

Following the publication of Rachel Carson's highly influential *Silent Spring* in 1962, an environmentalist campaign was mounted that eventually led to a total ban on DDT in 1972. From a health perspective, DDT had much to commend it. Introduced in 1942, it quickly became the most extensively used pesticide in the world. The chemical deserves credit for stopping a typhus epidemic in Europe during World War II, for helping to control malaria all over the world, and for making a major contribution toward solving the world's hunger problem by increasing agricultural production.

No one doubts that DDT was misused, and that its misuse caused environmental harm, including harm to bald eagles and the peregrine falcon. However, there has never been any convincing evidence that DDT is harmful to man.

- Three years after the DDT ban, an EPA report prepared for the U.S. House of Representatives Appropriations Committee concluded that there were no adequate studies documenting DDT as a carcinogen in man.[11]

- The most recent and comprehensive study on the subject, a decade-long project covering almost 1,000 people found no statistically significant link between DDT and cancer.[12]

The ban on DDT has come at an expensive cost in terms of health and safety. Although the fact has received little public attention, DDT has been replaced by more toxic substitutes. For example, in 1985 the number of accidental poisoning incidents involving pesticides was 14 percent higher than it was in 1973 when DDT was in use.[13] In less wealthy Sri Lanka, the situation was worse. More expensive pesticides were not utilized very much after the ban of DDT there, and malaria rebounded from its low DDT-controlled level of 110 cases in 1961 to 2.5 million cases in 1968-69.[14] As Dr. Philip Handler, President of the National Academy of Sciences, explained,

> "The second generation of pesticides is a darn sight more dangerous than DDT, but because of public outcry the government has needlessly banned DDT for most uses .... The predicted death or blinding by parathion, of dozens of Americans last summer must rest on the consciences of every car owner whose bumper sticker urged a total ban on DDT."[15]

Since applications of the substitute pesticides must be more frequent (unlike DDT, the substitutes are not persistent), and since the pesticides that replaced DDT are much more harmful to people, we can be fairly confident that banning DDT on balance made the world less safe. *Silent*

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[11]Wong, "A Critical Look at Cancer Culprits." Originally appeared in *CHEMTECH*, January, 1987.

[12]Harlan Austin, Philip Cole and Julian Kiel, "A Prospective Follow Up Study of Cancer Mortality in Relation to Serum DDT," *American Journal of Public Health*, January 1989, pp. 43-46.

[13]*Ibid.*

[14]Elizabeth Whelan, *Toxic Terror* (Ottawa, Ill.: Jameson Books, 1985), p. 69.

[15]*Science*, Jan. 15, 1971.

Spring was a moving and influential book. But overreaction to it by policymakers has been very dangerous to humans. A great many people have died because of the resulting policies.

From Love Canal to Superfund

Superfund was created by Congress in 1980 in reaction to the Love Canal crisis, an election-year nightmare for New York Governor Hugh Carey, who asked for help from the federal government.[16] The crisis occurred after the Niagara Falls school board purchased a toxic waste site, which was lined with clay, filled, and capped with clay by the Hooker Chemical Company. The company demonstrated to the school board that the site was potentially dangerous. Under threat of eminent domain, however, it relented and accepted a one dollar purchase price for the property -- but only after writing into the documents of transfer the nature of the dangers, and including a disclaimer of liability for future damages, once ownership of the site was transferred.[17]

Despite the warnings from Hooker, the school board built a school on the site, later selling the remaining land to a developer. Even before the land was developed, the city built water and sewer service lines through the clay walls installed by Hooker to contain the wastes. These gaps in the walls provided pathways for the chemicals to escape, and the chemicals were later found in the soil and even the basements of area residents. Understandably, fear and anger stirred some of the residents to outrage and to political action. After all, their property and homes had been wrongfully invaded by noxious chemicals. In an election year they had little trouble generating a good deal of action, though few would be satisfied with the ultimate results.

The Environmental Protection Agency (EPA) was called in to investigate. In a very quick statistical study,[18] later discredited, EPA announced that it had found evidence of long-term health problems -- an increase in chromosome aberrations in a sample of residents. Federal funds were quickly made available to purchase the homes in the area. These homes were boarded up and the affected neighborhoods were effectively destroyed. Later, additional federal money purchased more homes. To date, however, detailed studies have turned up no clear evidence of cancers or other long-term health threats present in the neighborhoods. And, two decades later, in September 1988, about two-thirds of the area was declared habitable by the New York State Department of Health. Clearly, there were unacceptable chemical leaks and the potential for chemical risks. However, the case can be made that most of the damage to the residents of Love Canal was caused by politics and public policy.[19]

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[16]Superfund, technically the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), provided for "liability, compensation, cleanup, and emergency response for hazardous substances released into the environment and the cleanup of inactive hazardous waste disposal sites." It provided $1.6 billion to clean up abandoned sites. The Superfund Amendments and Reauthorization Act (SARA), passed in 1986, authorized an additional $8.5 billion to finance the Superfund site cleanup effort. In addition, SARA enlarged the enforcement authorities for the purpose of compelling private cleanups. It intends also to shift waste management practices toward long-term prevention, rather than containment of wastes.

[17]The origins of the Love Canal crisis were revealed by the investigative journalism of *Reason* magazine. See Eric Zuesse, "Love Canal: The Truth Seeps Out," *Reason*, February 1981, pp. 16-33.

[18]Dante Picciano, "A Pilot Cytogenic Study of the Residents Living Near Love Canal, A Hazardous Waste Site," *Mammalian Chromosome Newsletter*, 21, (3).

[19]For additional details on the Love Canal crisis and the similarly tragic case of dioxin exposure in Times Beach, Missouri, see "Politicizing Environmental Risks," a working paper of the Political Economy Research Center, in Walter Block, ed., *Economics and the Environment: A Reconciliation*, (Vancouver, Canada: Fraser Institute), forthcoming.

In establishing Superfund, the Carter administration faced an extremely difficult political problem in an election year. The holy war rhetoric of some environmental activists had fanned the flames of public outrage over "environmental atrocities" perpetrated by "greedy and uncaring corporations." It is true that a great deal of waste and pollution are generated each year, and that much of it can be dangerous if not properly handled. But the actual dangers often are greatly exaggerated, and misguided policies often are adopted in an emotionally charged atmosphere.

For example, soon after Superfund was established, the program quickly turned into a political football, benefitting politicians and lawyers far more than the general public.[20]

- Every state was entitled to at least one hazardous waste site worthy of federal cleanup, enabling every Senator to claim credit for at least one cleanup effort.
- The Environmental Protection Agency (EPA) was instructed to find at least 400 waste sites, roughly matching the number of Congressional districts.
- After seven years, Superfund has paid for cleanup efforts at only about a dozen hazardous waste sites, and most of these sites are still leaking toxic waste into the groundwater.
- Of more than one billion dollars Superfund has already spent, about three quarters of the money has gone toward litigation and endless studies.

Has Superfund made us safer? That's not clear. Superfund's primary method of cleanup is to transfer hazardous waste from a waste site to a disposal site at which the waste is stored for a period of time. Often, this system has simply spread the waste problem. For example, the Government Accounting Office determined that most disposal sites which have received waste from Superfund sites are leaking themselves.[21]

Nor is it clear how anyone could find out if Superfund has made us safer. Except for Love Canal, identified before the creation of Superfund, not a single Superfund site has been analyzed to determine the health risks for area residents. In fact, there is only one site for which the government has a complete list of people exposed to the hazardous wastes.

Perhaps the worst damage done by Superfund is that it has discouraged private sector solutions to the problem of hazardous waste disposal, especially voluntary cleanup efforts. Prior to Superfund and other environmental legislation, firms sufficiently solvent to be accountable for their torts generally did a responsible and competent job. In the case of Love Canal, for example, the protection built in by Hooker (presumably to avoid liability from potential damages from leaks) was judged decades later to be sufficient to meet even the tough EPA standards of the 1980s.[22]

[20]James Bovard, "The Real Superfund Scandal," Cato Institute Policy Analysis No. 89, August 14, 1987.

[21]*Ibid.* See also, Aaron Wildavsky, *Searching For Safety*, (New Brunswick: Transaction Publishers, 1988) pp. 201-202.

[22]According to EPA's chief of Hazardous Waste Implementation, William Sanjour, "Hooker would have had no trouble complying with these (Resource Conservation and Recovery Act) regulations." Only paperwork would have been required, he said. See *The New York Times*, June 30, 1980.

Hooker's clay walls and cap protected the surrounding area until the school board (whose members were not liable for damages) took over the land.

Today, however, things are very different. Any voluntary cleanup will be seen by the EPA as a confession of guilt. Moreover, before private parties can clean up a site, they must negotiate settlement terms with the EPA -- a form of judicial consent decree under which a private company must agree to accept EPA's administrative mandates. EPA also withholds information and subjects private companies to lengthy delays. As a result, EPA has discouraged and almost prevented private companies from cleaning up hazardous waste.[23]

From Cancer Scare to California's Proposition 65

The legislative launching pad for state-required warnings on chemical risk was Proposition 65, formally called the Safe Drinking Water and Toxic Enforcement Act of 1986, in California. Proposition 65 was passed by a voter Initiative, receiving 63 percent of the vote. Drafted by the Environmental Defense Fund and the Sierra Club, introduced by Tom Hayden, and backed by his wife Jane Fonda and other Hollywood celebrities, Proposition 65 is the most sweeping chemical regulatory law ever enacted by a state government.

Among other provisions, Proposition 65 bans the discharge into drinking water of chemicals "known" to cause cancer or reproductive harm, and requires warnings for individuals who are exposed to these chemicals.[24] The list of chemicals to which the law applies immediately became a political battleground.[25] As of July 1, 1988, 216 substances were officially listed as carcinogens and 15 substances were listed as reproductive toxins. That list could grow considerably, however. California officials are considering chemical substances ranging from cocaine to aspirin, and ultimately Californians may discover that it is virtually impossible to enter a retail store or place of work without seeing warning labels everywhere.[26]

Where California treads, other states often follow. Proposition 65-type bills have been considered in Hawaii, Tennessee, Missouri, Massachusetts, Illinois, New York and Louisiana; and an effort is underway to put a Proposition 65 Initiative on the ballot in Massachusetts in 1990. Before citizens of other states follow California's lead, however, they may wish to consider the following.

Legislating Distrust of Politicians and the Regulatory Process. The very language of Proposition 65 suggests that the authors of the Initiative distrusted politicians and the regulatory process and fully anticipated that public officials would attempt to frustrate the intent of the act. Public employees are required to notify the news media when they discover violations,

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[23]Bovard, "The Real Superfund Scandal."

[24]For a summary of the key provisions of Proposition 65, see Richard J. Denny, Jr., "California's Proposition 65: Coming Soon to Your Neighborhood," *Toxics Law Reporter*, December 17, 1986, pp. 789-794; and Jerome H. Heckman, "California's Proposition 65: A Federal Supremacy and States' Rights Conflict in the Health and Safety Arena," *Food Drug Cosmetic Law Journal*, Vol. 43, 1988, pp. 269-282.

[25]Paul Jacobs, "27 Chemicals Added to the List," *Los Angeles Times*, June 19, 1987; and Richard C. Paddock, "56 Chemicals to be Added," *Los Angeles Times*, February 2, 1988.

[26]Jerome Heckman, "Proposition 65 -- A Legal Viewpoint: Reflections on the Political Science of How Not To Do It," paper presented to the American Industrial Hygiene Association's Toxicology Symposium on August 8, 1988 in Williamsburg, Virginia, p. 4.

and are subject to criminal penalties if they do not disclose the violations they discover. The law does not merely open the door to numerous lawsuits, it encourages them through bounty hunter provisions that allow private citizens to collect 25 percent of the fines imposed if they initiate successful suits against violators of the act.

Imposing Penalties for Hypothetical Harm and Undefined Risks. To be guilty of violating Proposition 65, you do not have to actually harm anyone, or even put them at risk. Instead, the standards for violations are entirely hypothetical. In the case of carcinogens, a violation has occurred if you expose someone to a chemical and that person *would have been at significant risk if* the exposure level had been maintained over the whole of the person's lifetime. In the case of reproductive toxins, a violation has occurred if the chemical *would have* produced an observable effect *if the person were exposed* at a level 1,000 times the level at which the person was actually exposed. Even if we can determine what would have happened, what constitutes a significant risk? This term and many related key terms in Proposition 65 are left undefined.

Politicizing Science. A chemical is required to be covered by the provisions of Proposition 65 provided that the following is true:

> A chemical is known to the state to cause cancer or reproductive toxicity within the meaning of this chapter if in the opinion of the state's qualified experts it has been clearly shown through scientifically valid testing according to generally accepted principles to cause cancer or reproductive toxicity ...[27]

Yet Proposition 65 asks scientists to do precisely what they cannot do. In the first place, the term "significant risk" is not a scientific term. There is nothing in science, for example, that says that a one-in-one-million risk of cancer is not significant while a two-in-one-million risk of cancer is.

In the second place, the very nature of scientific progress entails challenging previous studies and "generally accepted" beliefs. Dr. Alvan R. Feinstein, Professor and Director of Clinical Epidemiology at Yale University, has discovered studies that directly contradict each other in 56 cases where a specific menace has been alleged to cause a disease.[28] To those familiar with the methods of science, this discovery will come as no surprise. Yet the implications for Proposition 65 are devastating.

We may soon see the day when each new scientific study is immediately introduced into the political fray developing over the regulation of chemicals. A new study, challenging previous research, performed anywhere in the world, will have the potential to help establish the innocence of the formerly guilty or the guilt of the formerly innocent in the California courts.

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[27]Section 25249.8(b).

[28]Michael Specter, "Some Medical Studies Make Life Needlessly Frightful, Epidemiologist Says," *Washington Post*, December 2, 1988.

TABLE I

KEY PROVISIONS OF CALIFORNIA'S
PROPOSITION 65

BAN ON DISCHARGES INTO WATER	No person may discharge or release into drinking water a significant amount of a chemical known to cause cancer or reproductive toxicity.
REQUIRED WARNINGS FOR CHEMICAL EXPOSURE	No person may knowingly expose another person to a significant amount of a chemical known to cause cancer or reproductive toxicity.
DEFINITION OF SIGNIFICANT AMOUNT FOR CHEMICALS THAT CAUSE CANCER	Exposure must cause no significant risk assuming lifetime exposure at the level in question.
DEFINITION OF SIGNIFICANT RISK	NONE.
DEFINITION OF SIGNIFICANT AMOUNT FOR CHEMICALS THAT CAUSE REPRODUCTIVE TOXICITY	Exposure must result in no observable effect at 1,000 times the exposure level in question.
WARNING LABEL FOR CARCINOGENS	"WARNING: This product contains a chemical known to the State of California to cause cancer."
WARNING LABEL FOR REPRODUCTIVE TOXINS	"WARNING: This product contains a chemical known to the State of California to cause birth defects and other reproductive harm."
ENFORCEMENT PROVISIONS:	
CRIMINAL PENALTIES FOR PUBLIC EMPLOYEES	Government employees who learn of an illegal discharge must notify the local Board of Supervisors and the local health officer. Failure to comply carries criminal penalties.

NOTIFICATION OF THE NEWS MEDIA	Local health officers who learn of an illegal discharge must notify the local news media.
CIVIL PENALTIES FOR PRIVATE VIOLATORS	For each violation, a fine of $2,500 per day may be imposed.
BOUNTY HUNTER PROVISION	Any private citizen who brings a successful suit against a violator shall be paid 25 percent of the penalty.
BURDEN OF PROOF ON THE DEFENDANT	Defendants under the act shall have the burden to prove that a discharge or chemical exposure without warning caused no significant risk.

Making California Less Safe: The Proliferation of Warning Labels. Under Proposition 65, there is no penalty for an unnecessary warning. There is a penalty, however, for mistakenly failing to warn. Moreover, those accused of a failure to warn bear the burden of proving that a chemical exposure did not put anyone at a significant risk -- a burden that is scientifically impossible to meet. What Proposition 65 does is produce a lineup of suspects doomed to remain just that -- suspects. Without viable ways to prove their innocence, businesses will tend to compound the problem by posting unnecessary warnings. Indeed, they may label all their products just as a precaution.[29]

This has already happened in the housing industry, where many builders have posted warnings on all new houses -- just to play it safe.[30] Recently, however, a California district attorney sued a group of housing developers under other provisions of California law -- claiming that the developers posted warnings without really knowing whether the chemicals in their houses posed a "significant risk" and claiming that the posting of warnings as a precaution against a possible violation of Proposition 65 was itself unlawful because these acts dilute the value of such warnings. This damned-if-you-do-damned-if-you-don't legal quagmire is making its way through the California courts.[31]

If everything is labeled, especially if all labels contain the same warning, then warning labels lose their value. A warning label will affect behavior only if consumers can distinguish the few, especially dangerous risks from the thousands of minor risks they take every day. Putting a warning label on every product robs the warning label on the truly dangerous product of any meaning. California law also has the potential to misdirect attention and focus in dangerous ways -- away from noncarcinogenic risks and dangers that we should be concerned about and toward trivial cancer risks that are no greater than what we experience when we travel on an airplane.[32]

The worst feature of the California law, however, is the wording of the required warnings. The statement:

> ***This product contains a chemical known to the state of California to cause cancer.***

is very different from the statement:

> ***There is one chance in 100,000 that a lifetime of consumption of this product will cause cancer.***

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[29]David Roe of the Environmental Defense Fund, a staunch proponent of Proposition 65 and defender of warning requirements, admits that business may trivialize the law with unnecessary warnings. Yet he believes that the withdrawal from the market of a few products is more than enough compensation. See Michael deCourcy Hinds, "As Warning Labels Multiply, Messages Are Often Ignored." *The New York Times*, March 5, 1988.

[30]"Houses With Warning Labels," *The Sacramento Bee*, July 25, 1988.

[31]*Salano County v. Webb and Associates, et al.*

[32]The danger is created by increased exposure to natural radiation. See Table III, below.

The first statement is the warning Californians see. The second is the standard California currently uses to decide whether a warning is required. The first statement implies certain danger. The second implies a very low-probability risk, based on hypothetical consumption patterns.

California warnings, then, do not convey useful information to consumers. Rather, they mislead and misdirect. In theory, this defect could be corrected by constructing accurate warnings about the risks involved. But Professor Kip Viscusi argues that people cannot distinguish among low-probability risks. In consumer experiments, a risk of one in two million often is treated as being equivalent to a risk of one in ten thousand because consumers are not skilled or experienced in evaluating low probabilities.[33]

If the goal is to convey useful information, a better warning would be one which relates the risk involved to risks associated with everyday activities. But this type of warning would merely underscore the silliness of Proposition 65. In most cases, the risk of consuming a product is lower than the risk of driving to the store to buy it.

Making California Less Safe: The Potential Ban on Chemicals that Promote Health and Safety. One of the strangest features of California's Proposition 65 is that it seeks to rule out risks of cancer and reproductive toxins while ignoring all other risks to human health and safety. For example,

- Chlorine, used in the production of milk, leads to the production of chloroform -- one of the chemicals listed in California as carcinogenic.
- Yet chlorine is necessary in order to prevent a much more serious danger -- the risk to children of death by food poisoning from nonchlorinated milk.
- The spirit of the California law, however, would appear to require a warning label on chlorinated milk, but no warning label for much more dangerous nonchlorinated milk.

Similarly, trace amounts of carcinogens are found in almost all food and food packaging materials. Yet the packaging materials are chosen precisely because they eliminate more dangerous, noncarcinogenic risks. If all food and food packaging material carried warning labels, little would be accomplished other than an increase in public anxiety.[34]

To the most radical supporters of Proposition 65, incidentally, posted warnings are only an intermediate step. The long-run goal is to *ban* carcinogenic substances altogether. For example, at a workshop sponsored by the Environmental Defense Fund, the Sierra Club, and the Natural Resources Defense Council, Tom Hayden said that he hoped California would "lead other states down the path that will ultimately lead to legislation that will eliminate all carcinogens and toxic substances that the American people are subjected to."[35]

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[33]W. Kip Viscusi, "Predicting the Effects of Food Cancer Risk Warnings on Consumers," *Food Drug Cosmetic Law Journal*, Vol. 43, 1988, p. 288.

[34]Under emergency regulations issued by the governor, products regulated by the FDA are exempt from Proposition 65. This ruling is being challenged in the courts, however, by environmentalists who claim that the exemption is "blatantly illegal" and a "massive loophole." See Heckman, "Proposition 65: A Legal Viewpoint," pp. 5-7 and p. 10.

[35]Quoted in Heckman, "California's Proposition 65, " p. 271, n. 3.

When the worry is focused on phantom or insignificant risks, it diverts personal attention from risks that can be reduced.[36]

Milton Russell, former Assistant Administrator, Environmental Protection Agency and Professor of Economics at University of Tennessee

Everyone knows that if you spend all of your time on trivia and don't focus on important problems, it is completely counterproductive. If we devote too much of our attention to traces of pollution and away from important public health concerns . . . we do not improve public health, and the important hazards are lost in the confusion.[37]

Bruce N. Ames, Chairman of the Department of Biochemistry at the University of California at Berkeley

It will be very difficult to convey information to people in a meaningful fashion about low-probability risks. Perhaps the greatest danger from any risk-communication effort is that instead of informing people these programs will serve to unduly alarm them and cause overreaction.[38]

W. Kip Viscusi, George G. Allen Professor of Economics at Duke University

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[34]*Insight*, May 23, 1988, p. 14.

[35]Ames, "Testimony."

[36]"Predicting the Effects of Food Cancer Risk Warnings on Consumers," *Food Drug Cosmetic Law Journal*, Vol. 43, 1988, pp. 287-288.

Making False Assumptions About Science. Proposition 65 is not a law with a few errors that can be corrected by amendment or patchwork reform. It is a law fundamentally flawed by faulty assumptions about the nature and role of science. Among other unstated assumptions, Proposition 65 is based on the beliefs that (1) we are exposed to only a few carcinogenic substances, (2) we have reliable means of identifying those substances; and (3) we can eliminate our exposure to those substances with minimal discomfort. As we shall see in the next section, all of these beliefs are wrong.

CANCER FACTS

Nothing frightens the voting public more, or brings faster action from elected officials, than the potential risk of cancer. This is not surprising. In the political arena, expressions of outrage are easy and those who demand action expect others to pay the costs of that action. Often, big corporations or other faceless entities are thought to be picking up the tab for politically established regulations.

The same citizens, however, act quite differently in accepting and avoiding risk when they control the degree of risk through their own behavior, and when they bear the direct costs, and reap the direct benefits of their actions. Epidemiologists estimate that at least 70 percent of human cancer is in principle avoidable through behavioral changes. These facts are widely known, and have been broadly disseminated.[39] Yet they have not caused undue alarm and have induced slow and moderate changes in personal living habits.

Individuals also have little trouble remaining calm and careful in the face of newly revealed dangers such as the natural cancer risk from radon gas in their homes, despite the fact that this danger can be considerable. As many as one million homes are believed to be generating radon decay exposure levels in excess of the exposure received by uranium miners, and as much as 10 percent of lung cancer in the United States has been tentatively attributed to radon pollution in houses.[40] Such revelations have not caused panic, but have instead created a market for detection devices, allowing people to take cost-effective actions to reduce their radon exposure.

Risk avoidance in the political sector is another matter. As we have seen, fear of cancer has been the driving force behind the passage of Proposition 65 and behind other state and federal legislation, including the banning of DDT and the creation of Superfund.

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[39]Richard Doll and Richard Peto, "The Causes of Cancer," *Journal of the National Cancer Institute*, Vol. 66, June 1981, Table 20, p. 1256.

[40]Ames, et. al., "Ranking Possible Carcinogenic Hazards," pp. 274-275.

Understanding the Risks of Cancer[41]

Almost every statement about the risk of cancer is a hypothesis -- not a fact that has been scientifically proved. Among the chemicals tested in rodents, a high percentage have been found to cause cancer when administered in very high doses. Yet it is not clear what inference we can draw from these experiments about the risk to human beings, especially at very low exposure levels. The International Agency for Research on Cancer (IARC) lists only 26 chemicals or groups of chemicals as showing definite evidence of human carcinogenicity.[42] Even for these 26 chemicals, very little is known about the mechanism by which they cause cancer.

Two things seem certain. First, we cannot avoid exposure to carcinogenic substances. Carcinogens are present in almost all the food we eat and almost all the air we breathe, and even occur naturally in our body. Second, evolution must have endowed us with biological defenses against carcinogens or we could not have survived constant, daily exposure to them.

What follows is a brief summary of current knowledge about the causes and risks of cancer in an attempt to put current public policy debates into perspective.

Cancer Rates are Falling, Not Soaring. A popular belief is that an epidemic of cancer is sweeping the modern world as a result of increasing chemical inputs into the human body. This belief is false. The scientific literature reveals many warnings of potential dangers. New chemicals could of course be deadly, and the effects on humans might not show up for many years. Yet the increasing production of chemicals and human exposure to them has gone on for decades. In "The Causes of Cancer," a comprehensive survey sponsored by the Office of Technology Assessment of the Congress and published in the *Journal of the National Cancer Institute*, Richard Doll and Richard Peto conclude that except for the increase in lung cancer and skin cancer, "examination of the trends in American mortality from cancer over the last decade provides no reason to suppose that any major new hazards were introduced in the preceding decades."[43] Over the decade 1974 to 1983,

- Stomach cancer fell 20 percent, cancer of the cervix-uterus fell 30 percent, and cancer of the ovary fell eight percent.

- The only cancer rates that clearly increased were lung cancer, up 15 percent for men, 72 percent for women, and thought to be caused by smoking, and skin cancer, up 20 percent, and thought to be caused by sunlight exposure.

Exposure to Carcinogens is Unavoidable. Carcinogens are everywhere. Without any help from man, carcinogens are naturally present in almost every meal. They are present in

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[41]This section is based in part on the testimony of Bruce Ames before the California Assembly Committee on Water, Parks, and Wildlife, October 1, 1986. The standing of Dr. Ames and the absence of conflict of interest in his position are indicated by the following statement prefacing his written testimony: "Professor Ames is Chairman of the Department of Biochemistry, University of California, Berkeley, and was formerly on the board of directors of the National Cancer Institute (National Cancer Advisory Board). He is a member of the National Academy of Sciences. He was the recipient of the most prestigious award for cancer research, the General Motors Cancer Research Foundation Prize (1983), and of the highest award in environmental achievement, the Tyler Prize (1985). He does no consulting for the chemical, drug, or food industry, or for law firms."

[42]Lester B. Lave, Fanny K. Ennever, Herbert S. Rosenkranz, and Gilbert S. Omenn, "Information Value of Rodent Bioassay, "*Nature*, Vol. 336, December 15, 1988, p. 631.

[43]Doll and Peto, "The Causes of Cancer".

mushrooms, parsley, basil, celery, cola, wine, beer, mustard, peanut butter, bread, lima beans and hundreds of other everyday foods.

Human beings also produce carcinogens through everyday activities. Baking bread, browning meat, cooking bacon and eggs -- all of these activities cause chemical reactions that produce carcinogens. Allowing a sliced apple to become slightly brown involves an oxidation reaction that produces carcinogenic peroxides. Carcinogens also occur naturally inside the human body. For example,

- Isotopes of potassium, produced naturally in the body, expose us to natural radiation.
- Our normal metabolism produces carcinogens such as hydrogen peroxide and other reactive forms of oxygen.
- Many common metal salts naturally present in our bodies are carcinogenic, including lead, cadmium, beryllium, nickel, chromium, selenium, and arsenic.

Arsenic is not only carcinogenic, it is a well-known deadly poison in large quantities. Yet in small quantities it is apparently essential to life. Like the other carcinogens listed above, the risk of cancer from arsenic found in our bodies is believed by most experts to be trivial. But even if the risk is not trivial, it should be clear that if we are to eliminate death by cancer we will have to find a "cure" for cancer. We will not be able to do it by avoiding carcinogens.

Most Man-Made Pollutants Pose Insignificant Cancer Risks When Compared to the Background of Natural Carcinogens. A widespread fear is that we are being subjected to ever-increasing risks of cancer because of man-made chemicals introduced into the air, food and water. Yet the weight of the evidence indicate that man-made pollution poses very small cancer risks when compared with natural carcinogens to which we are exposed:

- Although there is increasing public concern over the cancer risk from pesticide residues in our food, the amount of carcinogenic pesticides consumed in a day is one-twentieth of the amount of natural carcinogens in one cup of coffee.[44]
- Although there is increasing concern over the cancer risk from polluted air, the amount of carcinogens in the browned and burned food we eat in a day -- the carcinogens produced by cooking -- is several hundred times greater than the amount of carcinogens inhaled by breathing severely polluted air.[45]

In general, the cancer risks from pesticides in food and from additives in our diet are trivial in comparison with the quantities of natural carcinogens we routinely consume. At the microscopic level, nature is a virtual carcinogenic factory:[46]

- Natural carcinogens and other toxins are present in all plants and serve to protect plants against fungi, insects, and animal predators.
- These natural toxins make up from five to 10 percent of a plant's dry weight.

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[44]Ames, "Testimony."

[45]*Ibid.*, p. 274.

[46]*Ibid.*, p. 272.

- Because of their presence, we ingest in a normal diet 10,000 times more natural toxins than we ingest of man-made pesticide residues.

An estimate of the relative risk from substances that may cause cancer is presented in Table II. This table, taken from a survey article by Bruce Ames and his colleagues, ranks relative cancer risks based on experiments with rodents and ordinary human exposure levels.[47] In each case, the risk has been normalized for comparison with ordinary tap water, which carries a tiny risk of cancer from the chloroform which is present in chlorinated water. As the table shows,

- The risk from consuming all major pesticides (EDB, PCBs, DDE/DDT) in a typical diet is 30 times less than the risk from drinking ordinary tap water.

- The risk from consuming pesticides is 100 times less than the risk from natural carcinogens in a raw mushroom, 400 times less than the risk from natural carcinogens in a typical sandwich, and thousands of times less than from the natural carcinogens in cola, wine, or beer.

- The risk of the food additive saccharin in a diet cola is 45 times less than the risk associated with the natural carcinogen formaldehyde, found in the same drink.

It is important to note that all of the items listed in Table II, in the quantities indicated, are believed to create a trivial risk for human beings. These items are presented here only to help establish perspective.

Although We Have Identified Hundreds of Carcinogens, We Know Very Little About the Causes of Cancer. There was time, not long ago, when it was widely believed that most foods we consumed and most chemical-containing products we used were completely safe. That has changed, in part because of the ability of scientists to detect trace elements of chemicals in amounts as small as one part per billion and even one part per trillion. Scientists also have the ability to test these chemicals on rodents in large doses. For example, in one test on a decaffeinating agent for coffee, rodents were given the equivalent of 12 million cups a day.[48] Of all known chemicals, only a tiny handful have been tested. For example,[49]

- There have been about 392 tests of chemicals in both rats and mice.

- There are more than seven million man-made chemical compounds listed in the American Chemical Society's registry and more than 63,000 are in current use.

Of the chemicals tested, a surprisingly high percentage have proved to be carcinogenic at some dosage level -- 60 percent of man-made chemicals tested and 45 percent of natural chemicals. Moreover, there is every reason to believe that further tests will indict literally thousands of additional synthetic and natural chemicals as rodent carcinogens.

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[47]*Ibid.* See also Bruce N. Ames, "Dietary Carcinogens and Anticarcinogens," *Science*, Vol. 221, 23 Sept. 1983, pp. 1256-1261. Not all scientists, of course, agree fully with either of these summaries. For one rather detailed exchange among scientists, including Ames and some of his critics, see "Letters," *Science*, Vol. 224 (18 May 1984), pp. 658-670, 757-760.

[48]Wong, "A Critical Look At Human Cancer Culprits."

[49]See Ames, et. al., "Ranking Possible Carcinogenic Hazards," pp. 275-276.

What do these tests mean? That's not clear. For example, almost half of the tests that produced cancer in mice failed to do so in rats, or vice versa. Since rats and mice are biologically similar and both are dissimilar from humans, extrapolating from these rodent experiments to statements about risks for people is a considerable leap. In addition, it is not clear what we can infer from high-dosage rodent experiments about the risk faced by humans when exposed to low dosages.[50]

Despite the hundreds of experiments conducted and the enormous amounts of money spent on such tests (from $250,000 to $500,000 per experiment), we still know very little about how cancer is caused. Even cigarette smoking, the most heavily studied of all carcinogenic risks, still remains much of a mystery. For example, two-thirds of all cigarette smokers do not get lung cancer and 25 percent of people who do get lung cancer do not get it from smoking. No one knows why.

In general, the risks of cancer from man-made chemicals are far smaller than one might gather from the impassioned rhetoric of some environmentalists, or even from news reports which fail to distinguish between the dangers from tiny doses of exposure to humans on the one hand, and those from megadoses administered to rats on the other. A fundamental principle of toxicology is that "the dose makes the poison." Substances such as vitamins and minerals which are essential to human life in small doses are, at the same time, deadly in large doses. Also, what is a deadly poison to one species may be quite safe for another, even in the same dosage relative to body size. Rodents, for example, vary in their sensitivity to certain toxins by a factor of many thousands.

These facts should make clear that when a chemical is "carcinogenic," it may either be deadly in doses likely to be encountered by humans, or it may be quite safe in those doses. Even if it is dangerous to humans, the chemical may or may not be worth avoiding, depending on the benefits of using it. If the benefits are large and the substance hard to replace, the danger may be smaller than the best available alternative.

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[50]For a recent review of the literature which is highly critical of inferring the risk to humans from rodent experiments, see Lave, et. al., "Information Value of Rodent Bioassay," pp. 631-633. See also Kenneth Chilton, "A Guide to Understanding Risk Assessment and Its Potential to Resolve Regulatory Conflicts," Center for the Study of American Business, Working Paper No. 118, May, 1988.

TABLE II

RISK OF GETTING CANCER

(Relative to Drinking Tap Water)

Water

Relative Risk [1]	Source/Daily Human Exposure	Carcinogen
1.0	Tap Water - one liter	Chloroform
4.0	Well Water - one liter (worst well in Silicon Valley)	Trichloroethylene

Risks Created by Mother Nature

Relative Risk	Source/Daily Human Exposure	Carcinogen
30.0	Peanut butter -- one sandwich	Aflatoxin
100.0	Mushroom - one, raw	Hydrazines, etc.
2,800.0	Beer -- 12 oz.	Ethyl alcohol
4,700.0	Wine -- one glass	Ethyl alcohol
0.3	Coffee -- one cup	Hydrogen peroxide
30.0	Comfrey herbal tea -- one cup	Symphytine
400.0	Bread -- two slices	Formaldehyde
2,700.0	Cola -- one	Formaldehyde
90.0	Shrimp -- 100 g.	Formaldehyde
9.0	Cooked bacon -- 100 g.	Dimethylnitrosamine, Diethylnitrosamine
60.0	Cooked fish or squid, broiled in a gas oven -- 54 g.	Dimethylnitrosamine
70.0	Brown mustard -- 5 g	Allyl isothiocyanate
100.0	Basil -- 1g of dried leaf	Estragole
20.0	All cooked food -- average U. S. diet	Heterocyclic amines
200.0	Natural root beer -- 12 oz. (now banned)	Safrole

Food Additives and Pesticides

Relative Risk	Source/Daily Human Exposure	Carcinogen
60.0	Diet Cola -- 12 oz.	Saccharin
0.4	Bread and grain products -- average U.S. diet	Ethylene dibromide
0.5	Other food with pesticides -- average U.S. diet	PCBs, DDE/DDT

Risks Around the Home

Relative Risks	Source/Daily Human Exposure	Carcinogen
604.0	Breathing air in a conventional home -- 14 hours	Formaldehyde, Benzene
2,100.0	Breathing air in a mobile home -- 14 hours	Formaldehyde
8.0	Swimming pool -- one hour (for a child)	Chloroform

Risks At Work

Relative Risks	Source/Daily Human Exposure	Carcinogen
5,800.0	Breathing air at work -- U. S. average	Formaldehyde

Commonly Used Drugs

Relative Risks	Source/Daily Human Exposure	Carcinogen
16,000.0	Sleeping pill (Phenobarbital) -- 60 mg.	Phenobarbital
300.0	Pain Relief pill (Phenacetin) -- 300 mg.	Phenacetin

Note: The items listed above are for illustrative purposes only, and are not intended as a guide for safe behavior. Relative risk is based on experiments subjecting rodents to very high dosages. The risk of these items to humans, in the quantities given above, is thought to be trivial.

Source: Bruce N. Ames, Renae Magaw, Lois Swirsky Gold, "Ranking Possible Carcinogenic Hazards," *Science*, Vol. 236, April 17, 1987, pp. 271-236.

[1] The underlying measure of risk used here is a HERP value: Human Exposure dose divided by Rodent Potency dose. The measure of rodent potency is the milligrams of substance per kilogram of rodent body weight necessary to produce cancer in one-half the rodents, given daily exposure over the rodents' lifetime. Human exposure is measured by the daily consumption indicated in the table per kilogram of human body weight. In the table above, the HERP values have been normalized with respect to the HERP value for water. A value of 100,000 means that the human exposure dose per kilogram of weight is exactly equal to the amount of the substance per kilogram of weight necessary to produce cancer in one-half of the rodents.

Putting the Risk of Cancer in Perspective

How important is the risk of consuming carcinogens compared to other risks we face? Table III compares the relative risk of a number of everyday activities, indicating for each how it increases the probability of death by one in one million -- a risk level often used by federal and state governments in setting required levels of safety. As the table shows,

- The risk of getting cancer by drinking tap water for a year is less than the risk of cancer from increased exposure to cosmic radiation by making two round-trip airline flights between Los Angeles and New York City.

- The risk of getting cancer from the saccharin in 30 diet colas is equivalent to the risk of cancer from living two months in Denver.

- Virtually all the cancer risks from our diet are trivial compared to the risk of driving to work each day.

Table IV presents a number of risks from occupational, sporting, and other activities from a different perspective. Combining it with Table II, note that many voluntarily chosen human activities such as hunting, boating, and farming are hundreds of times more dangerous than consuming pesticides.

The data and scientific evidence cited above is not secret. It is available to all, in the scientific literature. Yet the legislative process at both the federal and state levels seemingly has given little weight to these facts. Instead, the outrage of citizens, uninformed about toxicology and swayed by articulate and passionate rhetoric condemning each potential danger -- usually without regard to the problems of alternative courses of action -- has led from the Love Canal tragedy to the Superfund fiasco, and from largely phantom carcinogenic chemical threats in California to Proposition 65.

TABLE III

RISKS WHICH INCREASE THE CHANCE OF DEATH
BY ONE IN ONE MILLION

Activity	Cause of Death
Smoking 1.4 cigarettes	Cancer, heart disease
Drinking 1/2 liter of wine	Cirrhosis of the liver
Living 2 days in New York or Boston	Air pollution
Living 2 months in Denver on vacation from N.Y.	Cancer caused by cosmic radiation
Living 2 months in average stone or brick building	Cancer caused by natural radioactivity
Traveling 6 minutes by canoe	Accident
Traveling 10 miles by bicycle	Accident
Traveling 300 miles by car	Accident
Flying 1000 miles by jet	Accident
Flying 8000 miles by jet	Cancer caused by cosmic radiation
One chest x-ray	Cancer caused by radiation
Eating 40 tablespoons of peanut butter	Liver cancer caused by aflatoxin B
Drinking Miami drinking water for 1 year	Cancer caused by chloroform
Drinking 30 12-oz. cans of diet soda	Cancer caused by saccharin
Eating 100 charcoal-broiled steaks	Cancer from benzopyrene

Source: Richard Wilson, "Analyzing the Daily Risks of Life," *Technology Review*, February, 1979, p. 45.

TABLE IV

ANNUAL FATALITY RATES PER
100,000 PERSONS AT RISK

Activity/Event	Death Rate
Motorcycling	2,000
Aerial acrobatics (planes)	500
Smoking (all causes)	300
Sport parachuting	200
Smoking (cancer)	120
Fire fighting	80
Hang gliding	80
Coal mining	63
Farming	63
Motor vehicles	24
Police work (nonclerical)	22
Boating	5
Rodeo performer	3
Hunting	3
Fires	2.8
1 diet drink per day (saccharin)	1.0
4 tbs. peanut butter per day (aflatoxin)	0.8
Floods	0.06
Lightning	0.05
Meteorite	0.000006

Source: Adapted from E. L. Crouch and R. Wilson *Risk/Benefit Analysis* (Cambridge: Balinger, 1982). Reported in Paul Slovic, "Informing and Educating the Public About Risk," *Risk Analysis*, Vol. 6, No. 4, 1986, Table 1, p. 407.

THE CONTRADICTIONS IN CURRENT PUBLIC POLICY

Individuals charged with the responsibility for regulating health and safety in the United States face an impossible task. On the one hand they are confronted with a naive public demand that all products be "safe." This view was nicely summarized by Roger Lane Carrick, an environmental lawyer who was one of the leading proponents of California's Proposition 65. In an interview with *The New York Times*, Carrick said,[51]

> Do consumers have a right to walk into a store and know the products sold there are safe? Or do they have to be analytical chemists, reviewing the full list of chemicals and making their own informed choices? I think consumers have an expectation that the government won't let unsafe foods be sold . . . If it's not safe, it shouldn't be sold.

On the other hand, once the regulators gain even the skimpiest knowledge of science, they quickly learn that these demands are impossible. In particular, they are faced with the reality that

- There is no such thing as a safe lunch or a safe product -- everything we consume involves risk.
- There is no scientific definition of significant risk -- nothing in science tells us that a one-in-a-million chance of death is "insignificant" whereas a two-in-a-million chance is "significant."
- Our knowledge about the causation of cancer is highly uncertain, since we will not tolerate experiments on humans and high-dosage experiments with rodents provide us with questionable results -- everything is toxic at some dosage level, even non-chlorinated water.
- Were we to choose a risk level such as a one-in-a-million chance of death and outlaw all products and activities above that risk level, life as we know it would come to a grinding halt.

Regulators seem to know, if only intuitively, that the demand for "safety at any price" is really a demand for safety provided that no one's income is lowered and no one's lifestyle is significantly altered.

Some Indefensible Biases In Current Policies

Faced with impossible and contradictory demands, regulators frequently respond to the safety fad of the moment as well as special interest pressures. The result is a byzantine maze of regulations, impossible to justify by any rational standard. The following are some of the bizarre outcomes of this regulatory process.

Bias: Death by Cancer is Worse than Death by Other Causes. As noted above, the spirit of Proposition 65 could lead to a ban on the use of chlorine in the production of

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[51] "Out West, Food Safety: Can State Rule Nation?", *The New York Times*, August 10, 1988.

milk. Yet if this were done, the death rate in California would surely rise because chlorine prevents other, more serious risks to health and safety. The bias in Proposition 65 is that death from cancer is worse than other causes of death. This same bias is reflected in the infamous Delaney Amendment to the Food, Drug and Cosmetic Act, which governs the behavior of the FDA. This amendment states that "no additive shall be deemed to be safe if it is found to induce cancer when ingested by man or animal." The amendment makes no provision for balancing the risk of cancer against other health risks, however.

Bias: Man-made Chemicals are Worse Than Natural Chemicals. In principle, the FDA has jurisdiction over all food products and their safety. Yet the Delaney Amendment applies only to food additives -- chemicals put in food by man -- and is silent on the agency's duties with respect to natural carcinogens. Thus,

- The FDA banned cyclamates in soft drinks and attempted to ban saccharin because both chemicals are mild carcinogens in rodents.[52]

- At the same time, the FDA allows the sale of comfrey pepsin tablets in health food stores, although these tablets are at least 100 times more risky than saccharin in a soft drink because of their natural carcinogens.[53]

As noted above, a similar bias is shown by the EPA, which banned the use of EDB as a fumigant in order to protect consumers against the risk of cancer from EDB in food, while ignoring the more serious threat of natural carcinogens produced by molds.

Bias: Popular Poisons Are Not As Bad As Unpopular Poisons. Just as federal regulatory agencies often follow newspaper headlines in their pursuit of chemical risks, they tend to tread cautiously where their actions would prohibit the public from buying and consuming popular products. Thus,

- While some government agencies measure carcinogens in parts per billion and parts per trillion in some products, people have no difficulty purchasing and consuming alcohol.

- Yet because of the natural carcinogen ethyl alcohol, a can of beer is 46 times more toxic and a glass of wine is 78 times more toxic than the saccharin in a diet cola.[54]

Sometimes government agencies take contradictory stands on the same product, depending on its perceived popularity. For example,[55]

- The Consumer Products Safety Commission (CPSC) has branded methylene chloride as a hazardous chemical and the FDA supports a ban on its use in hair sprays.

- Yet the FDA is trying not to ban the use of methylene chloride as a decaffeinating agent for coffee, probably under the assumption that the public's demand for decaffeinated coffee is about as strong as its desire for diet cola.

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[52]In 1977, Congress passed a special act to keep the FDA from banning saccharin.

[53]Ames, et. al., "Ranking Possible Carcinogenic Hazards," p. 273.

[54]*Ibid.*

[55]Wong, "A Critical Look at Cancer Culprits."

Bias: Sporting Risks Are Not As Bad As Other Risks. Another strange phenomena in federal regulatory policy toward health and safety is the enormous amount of time and effort spent on minor risks, while major risks are completely ignored. Why bother with seat belt regulations without banning motorcycles when the risk of riding a motorcycle is almost 100 times as great as the risk of riding in an automobile? Why quibble over the risk of saccharin in a diet cola when the risk of boating is five times higher, the risk of hang gliding is 80 times higher, and the risk of skydiving is 200 times higher? The unwritten rule seems to be: Safety is OK so long as it doesn't interfere with our fun and pleasure. If it is reasonable to allow individuals the choice of participating in dangerous sports, it is even more reasonable to allow individual freedom of choice with respect to much smaller risks.

Bias: Special Interest Pressures Matter. In the absence of any clear guidelines on how health and safety regulations should be determined, small wonder that the influence of special interest groups is reflected in the regulations. How else can we explain the fact that:

- The EPA has banned EDB as a pesticide.
- Yet OSHA allows workers in certain industries to be exposed to EDB at a level of 40 percent greater than the comparable exposure level needed to produce cancer in one-half of the rodent population.

One of the worst examples of special-interest politics is the requirement that coal-burning utility plants employ scrubbers to reduce sulfur oxide emissions, regardless of the type of coal used. This provision, adopted as a result of lobbying pressure from high-sulfur coal interests in the East, encourages utilities to purchase high-sulfur coal rather than the low-sulfur coal found in the West. Politics aside, it would be less expensive for many utilities to avoid the cost of the scrubbers and use low-sulfur coal instead.

As it turns out, however, the required scrubbers are unreliable and often break down. During these periods, utility plants spew enormous quantities of sulfur oxides into the air. The result is more pollution, on the average, than would have occurred if utility companies could buy low-sulfur coal without scrubbers.[56]

Why Safety Regulations Often Make Us Less Safe

As regulators act in response to the latest media blitz, or uninformed public outrage is directed at a specific chemical, no one should be surprised when the new regulations make the world less safe. Nor is this phenomenon confined to the regulation of pollutants and food additives.

Out of a concern for the environmental effects of fuel consumption, Congress has mandated Corporate Average Fuel Economy (CAFE) standards for U. S. automobile manufacturers. As a result, in 1989 U. S. automobiles must average 26.5 miles per gallon. However,[57]

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[56]Wildavsky, *Searching for Safety*, p. 198.

[57]Robert W. Crandall and John D. Graham, "The Effect of Fuel Economy Standards on Automobile Safety," *The Journal of Political Economy*, forthcoming.

- In order to comply with CAFE standards, auto makers are producing smaller cars, which are less safe for occupants when accidents occur.

- By one estimate, the 1989 standards alone will cause between 2,200 and 3,900 additional fatalities.

- Over the next decade, CAFE regulations may cause as many as 20,000 additional deaths.

The regulations of the Food and Drug Administration (FDA) are notorious for systematically depriving Americans of lifesaving drug therapies in the name of safety. In the latest episode,[58]

- The FDA, until recently, refused to allow the sale of TPA to treat heart attack victims, despite the National Heart, Lung and Blood Institute's declaring TPA the drug of choice three years ago.

- This foot-dragging by the FDA is estimated to have cost as many as 30 lives per day.

In the area of transportation, there has been mounting pressure to re-regulate airlines out of a concern for passenger safety. Yet not only has there been no noticeable increase in fatalities among airline passengers since 1978, greater access to air travel has substantially reduced the use of the automobile and, therefore, automobile accidents:[59]

- On the average, because of airline deregulation there are 66,000 fewer automobile accident injuries each year and 1,700 fewer deaths.

- Moreover, it is estimated that airline deregulation saves more lives each year on our highways than the total number of lives lost in domestic airline crashes in the last 12 years.

Safety regulations often make us less safe because politicians want to be seen as "doing something" and because action is seen as better than inaction -- even if it turns out that the action was wrong:[60]

- As a result of the Clean Air Act, many local power plants were required to build smoke stacks 1,000 feet or more in height in order to disperse the pollutants. Now it turns out that this dispersal may contribute to acid rain.

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[58]Sam Kazman, "TPA Foot-Dragging Costs 30 Lives a Day," *The Washington Post*, November 3, 1987. See, however, a study questioning whether TPA is more effective than alternative drugs: Harvey D. White, et. al., "Effect of Intravenous Streptokinase as Compared with That of Tissue Plasminogen Activator on Left Ventricular Function after First Myocardial Infarction," *The New England Journal of Medicine*, Vol. 320, No. 13, March 30, 1989, pp. 817-821.

[59]Richard B. McKenzie and John T. Warner, "The Impact of Airline Deregulation on Highway Safety," Center for the Study of American Business, December, 1987.

[60]Wildavsky, *Searching for Safety*, p. 195-203.

- After banning EDB as a fumigant, the EPA approved the use of methyl bromide phosphine gas as an alternative. Yet phosphine and methyl bromide are both more poisonous than EDB and have contributed to far more worker accidents than EDB.

- Asbestos is virtually harmless as long as it remains on walls and is not flaking off and being dispersed as dust that can be inhaled. Yet asbestos removal programs make asbestos dust airborne and often create far more hazardous conditions than if it had been left alone.

- Because of safety fears, the use of whooping cough vaccine has dropped in a number of countries. This has resulted in outbreaks of the disease in Sweden, Britain, and Japan -- where a whooping cough epidemic killed at least 40 children.

- In the Silicon Valley, the semiconductor industry was required to place storage tanks for solvents underground as a safety measure in the 1960s. Yet this made it more difficult to detect leaks in the tanks, and solvent residues are now showing up in drinking water.

- In the early 1970s, the Consumer Products Safety Commission (CPSC) required that children's sleepwear be treated with the fire-retardant chemical TRIS. Later it was discovered that TRIS is highly mutagenic and possibly also carcinogenic.

Many more examples could be given. Of course not all safety regulations make us less safe. But all too frequently, regulators forbid one activity and insist on another with no knowledge of what the consequences will be. Small wonder, then, that these regulations often do more harm than good.

Regulation in the name of health, safety, and environmental protection also has made us less safe in another way: It has lowered productivity in the workplace and caused us to have less income.

WEALTHIER IS HEALTHIER

A common attitude among environmentalists is that in formulating health, safety, and environmental regulations, we should ignore the economic costs of those regulations. As Lori Mott of the Environmental Defense Fund puts it, there is "no room for consideration of the benefits of pesticides."[61] Yet from the point of view of health and safety, it's hard to imagine worse advice. As it turns out, higher incomes for countries and for individuals contribute more to good health and life expectancy than all risk regulations combined. In general, the higher our income, the more options we have -- to change our lifestyle, regulate our diet, and choose our risks selectively.[62]

The higher our income, the more likely we are to fly rather than drive, to drive larger and therefore safer cars, to pay for safety equipment and safety-enhancing maintenance on our

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[61]Reported in Tom Hazlett, "Ingredients of a Food Phobia," *The Wall Street Journal*, August 5, 1988.

[62]See Aaron Wildavsky, *Searching for Safety* (New Brunswick: Transaction Books, 1988), Ch. 3.

automobiles, to maintain working smoke alarms in our homes, etc. Higher incomes open the door to literally thousands of opportunities to improve our health and safety.

Mortality and Income. Table V presents life expectancy data taken from countries around the world. As the table shows, people in more developed countries have considerably longer life expectancies than people at lower levels of economic development despite -- and arguably because of -- the greater use of chemicals. What is true of whole societies is also true of the individuals within them. For example,[63]

- In England, adult males in the highest socioeconomic class earn more than twice as much income as individuals in the lowest socioeconomic class.
- Death from cancer among males in the highest socioeconomic class are 25 percent below the national average and death from respiratory disease is 63 percent below the national average.
- In contrast, death from cancer and respiratory disease is 31 percent and 87 percent above the national average, respectively, among males in the lowest socioeconomic class.

Similar evidence exists for the United States. For example, one study of mortality and income for U. S. counties found that a 20 percent increase in income reduces mortality by 1.0 percent.[64] Based on this study, Peter Huber calculated that increasing the income of a 45-year-old man working in manufacturing by 15 percent will do more to expand his life expectancy than eliminating every single hazard from his workplace.[65]

Regulation and Income. Thus it is sobering to realize that government regulation in general, and health and safety regulation in particular, may have done far more harm than good when measured solely in terms of effects on health. For example,[66]

- Between 1959 and 1969, productivity in U. S. manufacturing increased by almost one percent annually.
- Between 1973 and 1978, however, manufacturing productivity fell by more than one-half of one percent annually.

Studies indicate that a significant portion of this drop was caused by regulations imposed by the Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency (EPA). In particular,[67]

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[63]*Ibid.*, Table 2, p. 63.

[64]Jack H. Hadley and Anthony O. Osei, "Does Income Affect Mortality? An Analysis of the Effects of Different Types of Income on Age/Sex/Race Specific Mortality Rates in the U.S.," *Medical Care*, Vol. 20, No. 9, September, 1982, pp. 901-914.

[65]Peter Huber, "The Market for Risk," *Regulation*, March/April, 1984, p. 37.

[66]Wayne B. Gray, "The Cost of Regulation: OSHA, EPA and the Productivity Slowdown," *American Economic Review*, Vol. 77, No. 5, December, 1987, pp. 998-1006.

[67]*Ibid.*

TABLE V

LIFE EXPECTANCY AND ECONOMIC DEVELOPMENT:
INTERNATIONAL EVIDENCE

Level of Economic Development (Average Energy Consumption)[1]	Average Life Span (Years) 1950	1960	1970
10	45	52	56
100	48	53	57
1,000	64	66	65
10,000	67	71	72

[1] Measured as kilograms of coal (or the energy equivalent) consumed per person per year.

Source: Aaron Wildavsky, *Searching for Safety* (New Brunswick: Transactions Books, 1988), Table I, p. 62

- Thirty-one percent of the overall drop in manufacturing productivity was due to regulatory burdens created during the 1970s by OSHA and EPA.

- Nineteen percent of the drop in productivity growth was due to OSHA regulations, and 12 percent was due to regulation by the EPA.

Moreover, the productivity drop between 1973 and 1978 did not affect all industries equally. Productivity fell by more than two percent per year in highly regulated industries, yet rose during the same period in less regulated ones.

Since increases in worker incomes are roughly equal to increases in productivity, it appears that the damage to health and safety OSHA and EPA may have caused by reducing income growth may have more than offset any health improvements these agencies may have been made through regulation.

GUIDES TO GOOD PUBLIC POLICY

Risk-taking is part of everyday life, and the most serious risks people are exposed to are voluntarily chosen. A third of the population smokes. Most people are not monogamous, and thus accept some risk of AIDS. About three-fourths of all occupants of automobiles do not use seat belts. Almost everyone eats foods widely reported to be unhealthy. And most people allow their children to engage in risky activities, using items such as motorcycles, all-terrain vehicles (ATVs), skate boards, diving boards, boxing gloves, baseballs, and footballs.[68]

Aside from individual behavior and lifestyle choices, risk-taking is essential for health and safety from a social point of view. If our ancestors had been unwilling to take risks, we would not enjoy the level of safety, science, medicine, and technology created for us today. If we are unwilling to take similar risks, our legacy to future generations will be a world less safe than it is today.

Public policies must develop from a reasoned balancing of the risks we face, not in response to momentary panic. Policymakers who wish to apply the scientific principles summarized above, and generate policies more likely to increase than reduce public safety, should bear in mind the following general rules:

1. **Private solutions usually are better than public solutions.** Individual or private decision-making in the context of common law liability is giving us most of the considerable safety we enjoy with the most publicized pollutants of the day, toxic wastes. Even prior to Superfund and other environmental legislation, firms sufficiently solvent to be accountable for their torts generally did a responsible and competent job. In the case of Love Canal, for example, the protection built in by Hooker (presumably to avoid liability from potential damages from leaks) was judged decades later to be sufficient to meet even the tough EPA standards of the 1980s.

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[68]See William B. Johnston, "To End Coverage of High-Risk Behavior Holds Society to Impossible Standard," *Hudson Opinion*, Hudson Institute, January, 1989, p. 1.

2. **Where the problem is local, local regulation usually is better than national regulation.** Most chemical risks are quite localized and when they are, state or local regulations are more appropriate than federal controls. This is especially true of hazardous waste disposal.[69]

3. **Where the problem is national, federal regulation is better than local regulation.** Environmental problems that are national or even global in scope are better dealt with at the national level. If CFCs are depleting the ozone, or if there is a threat from a global greenhouse effect, local regulations are unlikely to contribute in a positive way to a realistic solution.

4. **Emergency legislation is seldom justified.** Emergency legislation is seldom carefully considered and valid for the longer run. No emergency, and no need for emergency legislation, exists in the general area of chemical risks.

5. **Richer is safer.** Empirical data suggests that although richer societies face more risks -- from chemicals and other technological developments not available to people with simpler lifestyles -- rich *and* poor people in richer societies live longer, healthier lives.

6. **Resilience is more reliable than anticipation.** Unlike the turtle, which anticipates blows to its body and grows a shell to protect it, the human being reacts quickly to danger and repairs injuries to itself. In the public policy arena, anticipation means using up resources or forbidding options in order to avoid feared or forecasted dangers. Resilience means being adaptable and able to respond to danger when it is actually present. As already noted, wealth enables individuals and societies to react decisively when danger does appear.

   At the same time, applying the centuries-old doctrine of common-law liability causes potential polluters to act as they did at Love Canal to avoid costly damages from the chemicals they manage. The most resilient society is often the best protected.[70]

7. **Safety requires risks.** Risk and safety are usually interconnected. A runner is more likely to die of a heart attack while he is running. But running also builds up resilience to help survive any future heart attack, and many other ills as well. In the United States, much risky activity, including the risky investment of venture capital, is controlled through the exercise of private property rights. In the case of chemical risks, however, the freedom to innovate is being severely curtailed by anticipatory regulations. New activities often are allowed only if shown to be almost "risk free." The economic costs of safety regulations often are explicitly ignored. More importantly, this approach is profoundly unsafe.

   Just as people die waiting for drugs which could be used if less rigorous testing for safety and effectiveness were required, so too can the unintended side effects of "uncompromisingly tough" environmental standards be dangerous.

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[69]See Richard L. Stroup, "Environmental Policy," *Regulation*, 1988, No. 3, pp. 46-51 for more on this topic.

[70]See Wildavsky, *Searching For Safety*, Chapter 8.

CONCLUSION

Ecologist William Clark has pointed out that in the Middle Ages half a million people -- ostensibly witches -- were burned at the stake.[71] It was essentially impossible for accused witches to demonstrate that they did not pose a real threat to the community. They could deny that they were harmful, but they could not prove it. So with plagues and other terrible risks in prospect, how could an authority of state or church not act against a witch in defense of the community? So it is today with persons using new chemicals, biotechnology, or other innovations. Like the authorities of the Middle Ages, today's elected officials are often pressured by an outraged but ill-informed public, to act against actual and potential polluters.

There is another similarity between medieval witch hunts and current governmental programs. When witches were burned, their property was confiscated by the authorities. Businesses politically "convicted"are assessed billions of dollars in Superfund taxes and cleanup costs, and thus help to fund the agencies which prosecute them. This is *not* to imply that those who "go after" polluters are acting selfishly or in bad faith. Many were undoubtedly drawn to their work precisely because they believe deeply in the "anti-pollution" mission of their agencies. But the fact is that additional public outrage expands their agency budgets and thus their career possibilities. They have little incentive to stress or publicize facts which might combat the uninformed outrage of the public. For this and other reasons, the general public remains badly uninformed about the risks actually posed by man-made chemicals.

An economically strong nation is resilient. It can survive all sorts of disasters -- military attacks, natural disasters, even large policy blunders. But a less wealthy nation, such as Sri Lanka, is more vulnerable to all such risks. The fruits of small risks taken by accountable individuals and firms have added up over the decades to a very strong and healthy America. If further progress is to be prohibited if even small risks are incurred, we will ultimately find ourselves far less safe.

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[71] See William C. Clark, "Witches, Floods, and Wonder Drugs: Historical Perspectives on Risk Management," in Richard C. Schwing and Walter Albers, Jr., (eds.), *Societal Risk Assessment: How Safe is Safe Enough?* (New York: Plenum Press, 1980), pp. 287-313.