

**PROSPERING WITH PRECAUTION:
Employment, Economics, and the Precautionary Principle**

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The Precautionary Principle provides a framework for action to protect human health and the environment in the face of uncertainty. The central premise of the precautionary principle is that when an activity poses threats of serious, irreversible harm to human health or the environment, we should act to prevent that damage – even if science has not fully worked out the details of the relevant cause and effect relationships.

Implementation of the precautionary principle means taking a new, forward-looking approach to environmental regulations. It also requires careful consideration of alternative production materials and processes. The evidence shows that implementing the precautionary principle is not just good science; it is also good economics, for at least four reasons:

Precautionary action benefits workers;
Precautionary action does not impose damaging costs on industry;
Precautionary policies can stimulate technological innovation; and
Economic logic supports timely action to avoid massive health and environmental costs.

In the sections that follow, we review the evidence supporting each of these points.

I. Precautionary action benefits workers

Conventional wisdom holds that environmental, health and safety, and other regulation of industries slows economic growth and destroys jobs. But the facts do not support this view. Far from throwing people out of work, environmental protection contributes to job creation.

Some environmental technologies are more labor intensive than the alternatives they replace – recycling waste, for example, creates more jobs than landfilling. Some policies, such as energy efficiency measures, expand local production at the expense of imports: instead of buying more oil from abroad, we can pay for more insulation and energy-efficient construction, creating local jobs. As a rule, the jobs created in support of an environmental protection agenda are securely rooted in the domestic economy;

environmental protection and remediation cannot simply be exported to another country where labor is cheaper.

Technologies employed to control or prevent pollution not only provide public health and environmental benefits; in many cases, they also create relatively high-paying jobs requiring specialized skills. Building, installing, operating and inspecting pollution control equipment create skilled industrial jobs; the money that some industries spend on pollution prevention and controls shows up as payrolls for other industries that produce and install the controls and other new technologies. Economist Eban Goodstein notes that from 1977 to 1991, employment in these areas increased fifty-five percent, making this area of work "one of the most dynamic growth sectors in the US economy." (Goodstein 1999: 18)

In 1998, the US Commerce Department and EPA issued a "Survey of Environmental Products and Services." This report found that "nationwide, production in the environmental-protection industry was valued at about \$102 billion in 1995. Of this amount, at least 17% was in the construction sector..." (Goodstein 1999: 35) Although environmental spending and regulation originate in the public sector, most of the jobs they create are in the private sector (just as defense spending creates jobs in aerospace and other private industries). A detailed EPA economic analysis found that of the jobs created by environmental spending in 1991, 20% were in manufacturing and 11% in construction – higher than the averages for all employment nationwide, which were 16% in manufacturing and 4% in construction. In contrast, environmental spending generates a lower-than-average proportion of government jobs (Goodstein 1999: 36). Transferring funds from almost any other government program into environmental clean-up will create *more*, not fewer, skilled industrial jobs.

There are many jobs indirectly created by environmental spending, often several times the number of people directly employed. In 1991, EPA estimated that "around 4,000 people ... were directly employed in the manufacturing of electrical machinery used in environmental clean-up activities. But the agency also calculated that an additional 21,500 workers in the industry indirectly owed their jobs to environmental spending. This number included people who built electrical machinery that in turn was used to manufacture and transport items such as steel pipe for sewer systems, photocopying machines for environmental service companies, or trucks used to recycle solid waste." (Goodstein, 36) Massive environmental projects, such as building the sewage treatment plants required for the cleanup of Boston Harbor, typically go on for years. Such projects create large numbers of construction jobs that are not tied to the business cycle; the projects generally continue even during times of recession.

Recognizing that levels of environmental regulation vary considerably across states in the US, Stephen Meyer of the Massachusetts Institute of Technology examined data on

environmental regulations alongside other economic data for the 50 states. The study found that there was no link between strong environmental policies and weak economic growth. On the contrary, strong environmental regulations tended to be associated with superior economic performance. Among other things, Meyer found a strong link between strong environmental regulations and strong growth in construction. As Meyer notes, his results do not mean that environmental regulations *caused* economic prosperity -- but they make it clear that at a minimum, the regulations did not get in the way of that prosperity. (Meyer 1992) In an update of his study, looking specifically at the 1990-91 recession, Meyer found the same patterns still held, and concluded “contrary to what many argue *environmentally stronger states are not more vulnerable to economic decline during recessions.*” (Meyer 1993 p.9, emphasis in original)

Another study developed a model to test the likely effects of environmental regulations on employment in some of the most polluting industries in the US economy: the pulp and paper, plastics, petroleum and steel sectors. While the study found the effects on employment were small in either direction, environmental protection was at least as likely to increase employment as to decrease it. In their own careful words, the researchers concluded that “while environmental spending clearly has consequences for business and labor, the hypothesis that such spending significantly reduces employment in heavily polluting industries is not supported by the data.” More specifically, the researchers found that in the industries they studied, a million dollar increase in environmental costs could lead to anything between three jobs lost and six jobs gained. (Morgenstern et al.)

Every year in America, more than a million workers are laid off, even in good years; the numbers grow even higher, of course, in recessions. How many of these layoffs are due to environmental regulation? The federal Bureau of Labor Statistics reports regularly on layoffs, and on the reasons for them. Table 1 shows the data for the last six years, 1996-2001. There are an average of more than 6,000 “extended mass layoffs” annually, events in which more than 50 workers are laid off for more than a month. On average, just *seven* of those layoffs – or 0.1%, about 1 in 1,000 – are due to environmental causes. The 7 environmental layoffs per year affect an average of 1,360 workers – again, about 1 in every 1,000 laid-off workers. Of course, environmental protection creates many more than 1,360 jobs annually; thus it creates a net increase in employment.

A widely-held belief, frequently heard in discussions of globalization, is that environmental regulations have caused companies to shut down US plants and relocate to countries with lower environmental standards. Again, this turns out to be a myth. Many studies have looked at the factors that drive firms' decisions about where to locate production. Over all, the data show that environmental protection laws have not harmed the competitiveness of US companies, and have not led US companies to relocate abroad. The reason is simply that environmental protection is not very expensive, almost never amounting to even as much as 2-3% of a company's sales revenue; it is not worth moving a

plant over such small amounts. Businesses move to gain access to new markets, to find cheaper labor, to escape from taxes, or to gain political stability and influence – all of which are far more important to business profitability than the level of environmental regulation.

The industries that have moved to Mexico, or expanded in Mexico, since NAFTA are *not* the ones facing the highest pollution control costs in the US (such as paper, steel, and chemicals). Rather, the industries that expanded most rapidly in Mexico in the 1990s – automobiles and parts, electronics, apparel, food and beverages – were seeking lower wages, and/or access to markets in Mexico and elsewhere in Latin America. They were not fleeing from US environmental regulations. (Gallagher, based on data from United Nations Industrial Development Organization)

II. Precautionary action does not impose damaging costs on industry

Experience has shown time and again that complying with environmental regulations almost never costs as much as industry estimates in advance. Furthermore, environmental costs generally account for just a tiny percentage of a company's total costs. In the context of a company's entire budget, environmental costs are very rarely large enough to guide production decisions.

The history of health and safety regulations demonstrates that environmental regulations are seldom as threatening to industry as executives have feared. Rulemaking by the Occupational Safety and Health Administration (OSHA) has been challenged frequently by industry as imposing severe costs; but a retrospective look at these rules shows that industry vastly overestimated the costs of compliance in many cases. A report by the U.S. Congress' Office of Technology Assessment (OTA) reviewed several case studies and examined the costs OSHA rules have imposed on industry.

For example, in 1974 OSHA promulgated a rule that reduced allowable exposures to vinyl chloride monomer (VCM) in plants producing vinyl chloride monomer or polyvinyl chloride (PVC). Industry representatives argued that the costs of reducing workers' exposure would be prohibitive. Even the technical consultant hired by OSHA estimated that total costs would be around \$1 billion (1974 dollars). In the end, however, industry spending was only around a quarter of this amount, as industry developed a more efficient new technology that reduced emissions at unexpectedly low cost. OTA's analysis notes that while the regulation did raise production costs, "there was little evidence that the financial status or ability to respond to customer needs in the affected industries had been strained." In other words, it was possible to reduce hazards to workers -- and to save workers' lives -- without undermining the industry as a whole. (OTA 59)

Similar patterns show up in other regulations. A 1997 study by economist Hart Hodges found that costs estimated in advance of regulation were more than twice actual compliance costs in 11 out of 12 cases. For example, reducing workers' exposure to

asbestos cost industry only half of the amount expected. Controlling benzene emissions from chemical plants was expected to cost hundreds of thousands of dollars per plant, but once regulations were in place, alternatives were identified and costs fell to almost zero. Costs of reducing toxic emissions in the vinyl chloride industry were overestimated by more than 400%; costs of controlling coke oven emissions in the 1980s were overestimated by around 1000% (one thousand percent); and costs of controlling cotton dust were estimated by over 200%. (Hodges 1997) Another study found that advance cost estimates were more than 25 percent higher than actual costs for 14 out of 28 regulations; advance estimates were more than 25 percent too low in only 3 of the 28 cases. (Harrington et al. 2000) The well-publicized debate over the costs of the Clean Air Act provides another example. Before the 1990 Clean Air Act Amendments took effect, industry had anticipated that the cost of sulfur reduction under the amendments would be \$1,500 per ton. In 2000, the actual cost was under \$150 per ton.

Nicholas Ashford of the Massachusetts Institute of Technology argues that this pattern is the rule, not the exception. Ashford suggests four reasons why expected costs are almost always higher than actual costs. First, estimates developed by government often rely heavily on estimates provided by the firms to be regulated. These firms have an incentive to overestimate prospective costs. Second, these estimates often do not take economies of scale into account. In general, as a technology is used more, the costs of providing that technology fall. This is often true for environmental protection technologies, as for many others. Third, companies learn over time how to comply with regulations in a cost-effective way. And finally, cost estimates usually ignore the fact that technological innovations may reduce costs significantly. (Ashford 1999)

III. Precautionary policies can stimulate innovation

As Ashford suggests, some economists have found strong evidence that environmental regulations can benefit the economy by stimulating innovation. Michael Porter of Harvard Business School, along with colleagues, has made the case that in the absence of regulations, businesses do not always choose the most efficient means of production. Well-designed environmental and health and safety regulations can turn companies' attention to efficiencies that would not have been identified in the absence of these regulations. Regulation can even push industry to innovate, as in the case of OSHA's vinyl chloride standard. Other examples supporting the so-called "Porter hypothesis" include: (from Porter and van der Linde, 101-04)

A 1991 recycling law in Japan encouraged businesses to create products that were easier to disassemble. This law stimulated innovations that led to elimination of expensive materials, reduction of unnecessary packaging, and simpler product designs.

A jewelry company in Attleboro, Massachusetts faced the possibility of having to close down because it had violated permits for discharge of toxic substances into water. The company developed a closed-loop, zero-discharge system for the water used in its jewelry

plating process. Water purified through this system was 40 times cleaner than city water. In addition, jewelry plating through this system was of higher quality than before. In this case, the innovations catalyzed by the need to comply with water quality standards made the business as a whole more competitive.

A study by the environmental research group INFORM looked at actions taken to reduce pollution at 29 chemical plants in California, Ohio, and New Jersey. Of 181 changes that were made at these plants to reduce pollution, only one was found to have increased operating costs.

Based on these and other examples, Porter and van der Linde argue that there is not necessarily a trade-off between low-cost production and environmentally sound production. Companies do not automatically choose the lowest-cost production technologies; environmental regulations can often guide them toward more efficient choices.

This reality has been clearly observed in Massachusetts. The landmark Massachusetts Toxics Use Reduction Act (TURA) requires that manufacturing firms account for chemical use and develop biyearly plans of how they will try to reduce chemical waste, emissions, and use. The process of analyzing how they were using chemicals led many firms to recognize inefficiencies in their management of materials (waste is a sign of inefficiency in production). While industry representatives originally argued that TURA would result in massive job losses and dislocation, the results have been much different. From 1990 to 2000, companies affected by TURA achieved substantial reductions in their use, production, and releases of toxic chemicals per unit of production. Production-adjusted use of toxic substances decreased by 40%, production of toxic byproducts by 58%, and toxic releases by 90%. (Massachusetts DEP, 2000) As of 1995, the most recent year in which costs and savings were evaluated, these reductions were associated with substantial monetary savings. The total costs to businesses of implementing the TURA program, including training programs, data collection, and capital investments, amounted to \$76.6 million. Savings in operating costs resulting from these activities added up to \$88.2 million, producing a net savings of \$11.6 million. (Massachusetts Toxics Use Reduction Program, 1997) This figure does not include the non-quantified health and safety and environmental benefits of the changes these companies made in production processes.

IV. Human Health and the Environment: The Costs of Inaction

Workers are often exposed to higher levels of toxic emissions than the population at large. For this reason, workers are the "canary in the coal mine": illnesses caused by environmental exposures often show up first in workers. Using alternative, cleaner products and production processes means that workers are exposed to fewer workplace health hazards.

The precautionary principle guides us to act early to prevent likely harms to human health and the environment, in the workplace, in communities, and even on a global level.

Acting early can prevent untold suffering from cancers, birth defects, and other devastating health problems. Acting early can also save society huge costs associated with these health problems. It is often impossible to gauge the full cost of inaction on an environmental or human health problem until it is too late.

The history of benzene use over the course of the 20th century provides an illustration of how workers have suffered from the lack of precautionary action. Benzene, a carcinogen, has been used in many industries; manufacturing of cars, shoes, and food wraps are among the many examples. Hazards of benzene exposure were recognized as early as 1897, when women manufacturing bicycle tires in Sweden developed a blood disorder linked to benzene exposure. Over the course of the 20th century, action was repeatedly delayed in favor of continued debate over benzene's health effects.

A 1977 epidemiological study found, dramatically, that benzene exposure raised leukemia rates five to tenfold at exposure levels allowed between 1940 and 1971. The Occupational Safety and Health Administration (OSHA) responded to this information with an attempt to limit benzene exposures to an average of 1 part per million (ppm) over the course of an eight hour work day. The American Petroleum Institute challenged OSHA's rule in court, and it was not until 1987 that OSHA was able to finalize the regulation. Even this rule was minimally protective of workers; the new exposure level was expected to produce ten leukemia deaths per 1000 workers.

It is estimated that this decade-long delay -- not taking into account the delays that preceded it -- will be responsible for 275 unnecessary deaths from leukemia and multiple myeloma in US workers. This estimate does not include other diseases, including other types of cancer, associated with benzene exposure. Essentially, the petroleum industry bought time -- using workers' lives as currency. (Infante 2001)

The tragedy of asbestos exposure provides another illustration of the costs of inaction. Hazards associated with asbestos exposure were first identified more than 100 years ago by a factory inspector in the UK. Over the course of the 20th century, the case against asbestos grew steadily; links to cancer were found repeatedly in the 1930s through the 1960s. But at the end of the 20th century, the use of asbestos was still subject to debate. It was not until 1998-99 that the European Union banned all forms of asbestos. (Gee and Greenberg 2001) In the US, asbestos has still not been banned. This century of delay translated into lower costs for the asbestos industry, and tragically high costs for workers and consumers.

A 1999 study by Hans Heerings looked at the deaths -- and associated financial costs -- that have resulted from asbestos exposure in just one country. In the Netherlands, the spraying, processing, and use of blue asbestos was banned in 1977; many other uses of asbestos-containing materials were banned in 1993; and as recently as 1998, a ban was placed on individual use of asbestos-containing materials in the home. (Heerings 1999: 4)

Between 10,000 and 33,000 workers were exposed to asbestos between 1945 and 1994 (in a country of 16 million people, roughly comparable to New England). Between 1969 and 1994, people in the Netherlands are estimated to have suffered more than 10,000 cases of asbestos-related disease. The Dutch government has estimated that between 1996 and 2030, more than 42,000 more people will develop asbestos-related diseases. (Hearings 4-6)

What are the costs, in money terms, of this public health disaster? Hearings estimated the costs in terms of money actually spent to address problems created by asbestos. This includes money spent on asbestos removal; medical treatment of victims; compensation to victims; clean-up costs after 'asbestos fires'; asbestos disposal; and other after-the-fact attempts to repair the damage. The total monetary costs are projected to eventually reach 67 billion guilders, or about \$30 billion – roughly \$2,000 per person in the Netherlands. (Hearings 8, converted at July 2002 exchange rate). And this is only the monetary cost; it does not include the agony of the deaths and illnesses due to asbestos. This enormous human and monetary cost could have been avoided by paying attention to the early warnings of health and environmental hazards of asbestos. If most asbestos uses had been banned in 1965, rather than twenty-eight years later in 1993, approximately 34,000 lives would have been saved.

V. Support for a Just Transition

To a large extent, the roots of the perceived tension between jobs and environmental protection lie in the fact that, due in part to low unionization rates, workers in the US have limited access to health services, financial security, and retraining in the event that they are laid off. (Goodstein 175-177.) Advocates for worker safety, children's environmental health, and other forms of precautionary policy need to work simultaneously for safety improvements in the workplace *and* for protection of workers who are laid off. Providing for workers who lose their jobs is a crucial component of a healthy economy, whether those changes stem from periodic business cycles or from other changes in the economy. The small number of workers affected by environmental policy, such as coal miners who might be laid off due to clean energy policies, deserve public support and protection -- just like the much larger number of workers who lose their jobs due to business-oriented "free trade" schemes, unsound tax cuts, and budget cutbacks.

The Just Transition blueprint, developed by a coalition of labor and environmental leaders, calls for a coherent package to serve workers affected by economic change. The vision of the Just Transition goes beyond the simple concept of retraining, which in some cases has become a polite term for placing workers in low-paying jobs when their good jobs disappear. Elements of the compensation package proposed for workers who lose their jobs include two years of full income replacement, including benefits; "up to four years of full time training or educational benefits"; and two years worth of additional support for

extend their training. It also includes the option of additional income replacement in place of retraining for workers near retirement age. For communities that depend heavily on a single industry where jobs are lost, the package includes community development assistance. This policy proposal is similar to, but more modest than, existing programs in Europe. (Barrett and Hoerner 2002: 3, 12-13)

VI. Conclusion

The economic costs of inaction to protect public health and the environment can be enormous, far outweighing the economic costs of taking precautionary action. In many cases, workers are the first to be injured by careless and wasteful business practices that contaminate the workplace and the surrounding environment.

In the vast majority of cases, implementing the precautionary principle will not harm either businesses or workers. In many cases, implementing the precautionary principle will actually benefit workers and the economy as a whole, both by stimulating innovation and by creating safe, relatively high-paying, unionized jobs. In the small percentage of cases where job losses can be attributed to environmental regulations -- just as in all cases where economic change leads to job losses -- it is crucial to develop realistic and equitable programs to serve those workers who are affected by the change.

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