VI. DIFFERENT PERSPECTIVES ON RISK ASSESSMENT — EPA/OSHA

THE ROLE OF RISK ASSESSMENT AND COST/BENEFIT ANALYSIS IN DECISIONS CONCERNING SAFETY AND THE ENVIRONMENT

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Those of you who were at the session last night saw, once again, how a discussion about risk assessment and cost/benefit analysis deteriorates into a shouting match. For some of us, this is an exasperating experience. Those kinds of conversations seem to be oft repeated at meeting after meeting, whether the annual AAAS meeting or hearings held to collect evidence regarding a certain standard to be promulgated by a regulatory agency.

What I would like to try to do today is to put these many considerations into some kind of perspective which I hope will be helpful to you, whether or not you happen to share the same political biases. There is an analytical structure that can be used so that at least we understand where different points of view are coming from in this very troubled area. First of all, economic analysis and cost/benefit analysis have entered into the discussion on environmental decisionmaking in a large way.

We have had for a long time what Hazel Henderson called a conflict between ecologists and economists; and what we really see, I am afraid, is not a dialogue between conflicting interests, but a kind of duet of simultaneous monologues with people talking quite past each other. The environmentalists and ecologists are concerned with the health and environmental consequences of the industrial activity, and the economists are concerned with fiscal responsibility and the health of the industrial sector. The one important issue which is a mutual concern to both is technological change. Technological innovation is not only important because it is a determinant of industrial growth, but because it is a method by which we save ourselves from ourselves. The effects of regulation on technology may be much more significant in that regulation may have changed the way we do business in this country (or at least it will change the way we do business) than any particular effect of any specific regulation, such as the banning of DDT.

Let me make an important distinction between economic regulation and environmental regulation. It is important to realize that the critics of regulatory policy, for the most part, are people who have been concerned for a long time with what is called the old regulation: the setting of airline rates between cities, utility regulation, and that regulation which is intended to regulate economic activity in order that the consumer benefit.

The measure of success of that old economic regulation was that its intent was to deliver products at lower prices to the consumer and to ensure an adequate diversity of goods and services. To the extent that the government messed up the system rather than helped it, the role of government was considered fiscally irresponsible and inflationary. The requirement for inflationary impact statements was given birth by people who understood a great deal about economic regulation, but knew precious little about environmental regulation. There is a crucial difference between economic regulation, which seeks to make the market work smoothly and to lower prices, and the role of environmental and safety regulation, whose purpose it is to internalize the social cost of industrial activity.

Internalizing social cost really means that you reflect in the cost of production the costs of the consequences or prevention of occupational disease, environmental pollution, and harm to the consumer. If we are going to internalize social cost, that means that the producer's costs, and hence prices, are going to go up.

In fact, a measure of success of environmental or safety regulation is that prices of certain commodities go up. Now price rises, even Charles Schultze cautions, should not be regarded as inflationary unless the price rises are higher than they otherwise "need to be."

The requirement that all price rises be viewed as inflationary by the early Presidential directive of
President Ford was inherently dishonest because he ignored the fact that price rises may be, in fact, exactly what you want. It is interesting to note that the second time around in issuing the directive, the “Inflationary Impact Statement” was renamed “Economic Impact Statement.”

I want to say further that there is a distinct difference between the old economic regulation and environmental regulation because environmental regulation is not really an instrument of economic policy. It is an instrument of social policy. It is an instrument of policy concerned with the distribution of effects that emerge from industrial activity. Thus, environmental regulation cannot be judged by economic criteria alone.

I think it is also important to distinguish cost/benefit analysis, which is intended to serve as a decision rule, that is, a rule by which one decides whether to regulate or not, from its use as a tool, i.e., as an aid in the decisionmaking process. Most people would agree that the identification of costs and benefits is useful to aid the decisionmaking process. But as a decision rule, as an automatic rule, as a rule which in fact can be effectuated—that is where we begin to fall into two sharply divided camps.

The thing to remember is that the balancing of costs and benefits may already have been done by the Congress in the legislation. In fact, it is often very clear that it has. For example, the OSHA health regulations are limited primarily by technological feasibility. The vinyl chloride standard took into account how far the technology could be forced in order to adopt as safe a level as possible. The standard of one part per million is not safe. It is safer than 50 parts per million. The one part per million requirement is what observers of the technology thought could be brought about.

The other side of the coin of technological feasibility is economic feasibility. However, taking into account economic feasibility is not the same as performing cost/benefit analysis. It is quite a different matter. Feasibility goes to the question of capacity to comply. Cost/benefit analysis addresses the desirability of compliance.

Let me caution you. An attempt to demand economic impact analysis in environmental decisionmaking by the Council on Economic Advisors and the Council on Wage and Price Stability may really be an attempt to reorient various legislative mandates to their own point of view of what is desirable. I submit to you that it is dangerous for a society to let any one group of people, whether it is scientists or lawyers or economists, decide that they have a game plan to set national priorities.

Economic analysis is being dishonestly used. If, for example, the Delaney Amendment is to be repealed because it is viewed as an incorrect expression of societal will, then let us have it repealed. But let us not go through the back door by, throwing roadblocks up in terms of analytical demands or dealing with data which is really not able to be quantified, in order to effectuate the same end. The proper use of any analytical technique is to ensure open government and accountability. Those who would be interested in being behind the scenes to set national priorities are not the only ones who are held accountable. The Council on Wage and Price Stability are not the people who stand before the Congress and who are asked the question, “Why haven’t you regulated pesticides?” It is nice to set national priorities when you do not have to be accountable.

With the time that remains, I would like to deal with several distinct topics which play an important role in environmental decisionmaking. First, there is the problem of risk assessment itself, i.e., the assessing of an environmental or safety threat.

Secondly, and a very different question, is the valuation of the risk as distinct from the evaluation of the risk. Risk evaluation is epidemiology, counting bodies, and the incidence of cancer. Here, I am talking about how one values the risk you have once you have collected the meager scientific data that exists.

Third is the problem of cost evaluation. If we are going to do any kind of cost/benefit analysis, we have to understand both the costs and benefits of risk reduction.

Then I would like to discuss cost/benefit formalism, its limitations in the traditional form, and an expansion which may, in fact, aid the decisionmaking process. How do you compare costs and benefits, especially when the costs of controlling toxic exposure accrue over the short term and the benefits of reducing chronic disease occur over the long term? What discount rates do you use? I would like to discuss how you make the trade-offs. For example, what normative values go into deciding whether asbestos workers should be protected at the expense of the public? Finally, I will address some alternative decision tools or supplementary decision tools that can enter into the decisionmaking process.

Let us first discuss risk assessment. There are, admittedly, some scientific issues for which we really do not have a great deal of agreement within the scientific community. First, take the issues of animal data. How should one perform those experiments and in how many species? Then, there is the problem of in vitro short-term tests. Extrapolating both those kinds of data to the human experience presents much difficulty. There is the limitation of epidemiology done in a real world where people are exposed to multiple hazards, not a controlled experiment with one hazard. There is the problem of synergism, and I submit to you the problem of synergism is much larger than we think. If you think about synergism as exem-
plified by the example of barbiturates and alcohol, I think you are missing the point. The point is that in the society, especially in the industrial workplace, not only are we subjected to a variety of chemicals, but we are also subjected to a number of stressors like noise and heat which, in combination with toxic materials, present a serious problem. Amphetamines, for example, are ten times more toxic under noisy conditions than under ordinary conditions. Noise is a general stressor, and the presence along with chemical toxins in the real world makes the single determination of a threshold limit value of minimal use. If not, in order to establish safe levels of exposure to toxic materials.

Another problem goes to the way one analyzes the risk profile among the population. There are several important characteristics of a population distribution, only some of which are given adequate attention. One is the central tendency. For example, a graph of the percentage of people who get ill, plotted against the minimum effective dose. Another parameter is the standard deviation. But then there is another important feature, and that is what is out in the tails of the distribution? These are the people whom some like to call hypersusceptibles. It has been seriously argued that we could actually hope to screen these hypersusceptibles. It is not at all clear that there is a finite group of people with significant permanent hypersusceptibility. It may be that various ones of us at various times, depending upon our stress background, are more or less susceptible to disease. This probably constitutes a large amount of susceptibility. At any rate, the tails of the distribution are critical because when we move from the scientific to the political arena, where we have legal mandates to protect all workers or mandates to protect all children, or mandates to worry about the aged, then we are indeed worried about the tails, and the data are not any good at the tails.

And so science has its limitations. Yes, we should do research. Yes, we should clarify. Yes, we should demonstrate the generality of some of these problems. But in the political arena, we are going to deal with legal facts as distinguished from scientific facts. As far as the law is concerned, the data, to use a court interpretation, are "on the frontiers of scientific knowledge."

In the court cases contesting the OSHA asbestos standard and vinyl chloride standard, the opponents of the regulations argued that "the data are just not good enough to draw scientific conclusions," i.e., the data are not good enough to make a conclusion which a scientist would be proud to submit to the toxicology journals. But that is not the point.

We are making a political decision and the Congress is risk-averse. Whether or not it makes sense depends upon your political view, but I am afraid that the legal-political system is the system which mediates the social demands, not the demands of scientists.

Any attempt to resolve these issues through the system of a science court, in which it is naïve assumed that you can separate the objective determination of risk from policy calls, is doomed to failure. You cannot separate the objective determination of facts from what you do with the data, because the confidence level which you use to deem something as causative happens to be a value-laden decision itself.

Now, the distinction between legal and scientific facts is something which causes a great deal of tension in the community because there are honest intellectual arguments about when is proof good enough. I think it is important to remember Ralph Nader's quote that "if scientists think that lawyers present one-sided cases, they need to rediscover themselves." I think we know the role of expert testimony in the standards hearings. I think we are growing up enough to realize that there is rarely a neutral scientific decision. It is value-laden, just like all the other decisions we make.

Now, the issue of risk assessment aside, suppose we have some data indicating risks of toxicity, cancer, or what have you. How do we value that risk? Who values that risk? First of all, the basic assumption to be questioned is that it can be valued. How do you value the harm that might result 30 years from now from working with asbestos? What is the appropriate discount rate applied to the avoided harm? Can we relate to long term, low probability risks? I think if you know anything about the behavioral literature concerning risk-taking with regard to earthquakes or smoking or other long-term risks, you realize that man is a non-rational animal. Now, he does make choices. One observes him to make choices, but any consistency between those choices is, in fact, very hard to find. Yet we proceed as if the valuation can be made rationally. We assume man's ability to relate to some probability of harm, but probability is a complex function. It happens to have a profile and a distribution; it cannot be represented by a single number.

How do you relate to the tails of a probability distribution? The whole issue of nuclear risk, with a very low probability of a very high catastrophic event, is a very different kind of problem than time-dispersed events of toxic substance exposure adding up to an equivalent number of deaths.

There is another crucial problem with regard to valuation. The person who values or is willing to assume a risk, assumes that risk in a way which reflects the bundle of economic goods he comes into the marketplace with. It is naive to talk about workers who sell their wages off for their health as if that were something that were derived from first principles. A
worker sells his wage off for his health cheaply if he does not have a large bundle of economic goods. On the supply side, the selling price is determined by the whole set of economic goods the worker has. If you think it is unfair for poor people to sell their wages off more cheaply than wealthy people, then you do not like the working of the market. If you do not care, then you are willing to allow the working of that market mechanism. It comes down to a fundamental issue of the distribution of wealth. You cannot avoid that issue. Economic efficiency reflects the maintenance of the current economic arrangements, and decisions made by the market are themselves value-laden. You cannot be indifferent to the distribution of wealth, and the fact is that the distribution of wealth determines at what price risk is assumed. To ignore equity is to consider equity irrelevant. Deciding what a life is worth by market criteria is value-laden itself.

There are a number of alternative schemes which have been suggested to value the risk. One is the willingness to pay to avoid the risk. That is a market valuation just like the willingness to sell your wage off for your health. There is also the cost of avoiding the harm, for example, by buying a safety device. A threshold question goes to whether consumers can decide for themselves how much a safety device is worth. Do they have the information? Are they rational? Should seat belts be imposed? Should the air bag be imposed?

Another valuation scheme is the actual cost of the harm in terms of the lives you pick off the highway. Then there is the collective willingness to pay in terms of what fire departments spend in protecting individual human lives. Another collective measure is the appropriations voted by Congress to support the legislative mandates which direct the government to protect certain groups of people, like workers or children. Still another mechanism, which economists do not like at all, is the court-awarded damages for harm. Suppose we were to take the highest award awarded someone in a suit for being injured, and multiply that by the number of potential claimants, times the probability of being harmed. I submit to you that you will get a value of human life which is several orders of magnitude larger than people's willingness to pay to avoid that harm. We really cannot agree on how to value human life. There are groups of people to differ sharply on what market signals you use. I am left with the conviction that what we would better do is quantify things in their more unequivocal units.

If you can, quantify the number of lives lost, the change in longevity, the number of tumors, and so forth, and leave those things in proper units and do not attempt to monetize, because there is no unique valuation which will be accepted by all those concerned.

Let us next consider the costs of compliance. Are the costs of compliance in any better shape because they can be easily monetized? They are highly uncertain. Furthermore, the people who are really qualified to assess the cost of compliance work for the regulated industry are unlikely to present unbiased estimates. The regulatory agencies do not have the access to the information concerning alternative products and processes, and costs, which will enable them to come up with the best estimates of the cost of compliance. Even if an honest assessment of costs is attempted, two crucial issues are often ignored: (1) learning experience with regard to how people gain experience and efficiency in compliance, and (2) the effect of regulation on technological innovation. The costs of compliance cannot be based on static assumptions about the firm and its technology; otherwise, a large overestimate will result.

Traditional cost/benefit analysis, in which all units are expressed in terms of dollars, does assume a rationality not only of human beings in their relationship to risk, but it also assumes a rationality with regard to firm behavior. If you know anything about management science—if you know anything about the problems the economy happens to be in today—you would question seriously the rational basis upon which we manage our industrial plant. We are in trouble technologically in this country, not because of environmental and safety regulations, but because we have had it so good for so long that we have been very lazy intellectually in reexamining our technological growth problems.

The one place where we always enjoyed a favorable balance of payments was in the high technology areas, and today we are losing ground in those areas. We are losing in Japan; we are losing to Europe. Europe now sells more to the Third World than we do. The point is that we are not competitive and we are in trouble in this country with regard to technological innovation. Industry and the minds that are capable of creating new technology to improve productivity are not being successful.

If you cannot be rational in the area in which you stand to profit and upon which your industry is built, then how rationally are you managing your industrial plant? I think industry is doing itself a great disfavor by not looking carefully at the process of technological innovation in terms of future design and competition. To the degree that industry does not deal ser-
consequently with environmental problems, it is going to in-
jure to its own detriment.

Aside from the assumption that firms and people
act rationally, other problems exist with using tradi-
tional cost/benefit analysis as a decisionmaking tool
in the regulatory area. I have already discussed the
problem of correctly estimating compliance costs, the
problem of monetizing the benefits, and the prob-
lems of dealing with these kinds of valuations in the
face of great uncertainty. In addition are the prob-
lems of discounting both the benefits and the costs,
and a methodological defect which is terribly impor-
tant: the selection of a basis against which to com-
pare a particular event. I will first discuss the dis-
counting problem. There are three different ap-
proaches to the discounting of non-monetizable
benefits, such as the reduction of adverse health ef-
facts:

- discount the health benefits at the same discount
  rate used in the monetary benefit or cost calcula-
tions;
- discount the health benefits, but at a lower dis-
  count rate than that used in the monetary benefit
  or cost calculations;
- do not discount health benefits at all.

The first approach would apply the traditional
present-discounted value criterion to non-market
items. The approach has the advantage of allowing
parallel treatment of all costs and benefits. Any pos-
itive discount rate would value one year of health im-
pairment saved in an early year higher than one year
of impairment saved in later years. For example, if
the discount rate is 7 percent, then one year of health
impairment prevented today would be equivalent to
1.4 years of health impairment prevented in five
years, or two years of health impairment prevented in
10 years, or 7.7 years of health impairment prevented
in 30 years.

The second approach would allow for discounting
of non-monetizable benefits, but at a lower discount
rate. This approach can be defended in terms of a be-
thief that certain amenities, such as health, become
more valuable relative to other goods in this society
as time passes and the standard of living improves.
The following relationship would separate the factors
affecting the present value of health impairment
prevented in year n:

\[
\frac{x(1 + r)^n}{(1 + r)^n}
\]

Where:

- \(x\) = metric, expressed in years of
  health impairment prevented
- \(\epsilon\) = fractional annual increase in
  value of health impairment pre-
  prevented
- \(r\) = annual discount rate

For small values of \(r\) and \(\epsilon\), this is equivalent to:

\[
x
\]

\[
(1 + r - \epsilon)^n
\]

Thus, the "effective" discount rate \((r - \epsilon)\) will be
less than the discount rate used for monetary benefit
or cost calculations. (Note that, in principle, if the
society's valuation of health benefits increases rapid-
lly, the effective discount rate for benefits could be
negative!)

The third approach would not discount non-mone-
tizable benefits but simply leave them expressed in
natural units with a note as to the time-distribution
of their realization. This result can be reached
through two considerations.

First, there is a question of the appropriateness of
applying a discount rate to consequences of an action
which has significant beneficial effects on future gen-
ergations. Clearly, any positive rate of discount will
discriminate in favor of choices that involve adverse
impacts on later generations but not on earlier ones.
Because the benefits of environmental/safety regu-
lation often extend beyond the costs of the current
generation, a similar situation is presented. If the deci-
sionmaker is concerned with intergenerational
equity, then an argument could be made that the ap-
propriate social rate of discount is zero (not including
inflation).

Secondly, the "benefit" of removing a person now
from risk of future damage, which is irreversible, in-
evitable, and non-arrestable once the risk exposure
occurs, can be considered to be a present bene-
fit—and quantified, for example, as the benefit of re-
moving those presently at risk from future harm.

The manner in which the discounting problem is
handled can alter the comparison of benefits and
costs and render the use of cost/benefit ratio as a
decision rule highly suspect, even when used to de-
cide between alternative regulatory strategies on
health investments.

The present value of the net effects of any given
regulation, or the rank ordering of the effects of
alternative regulatory regimes, can change markedly
depending upon the discount rate used in the
cost/benefit calculation. For example, using a dis-
count rate of zero for future health benefits (i.e., not
discounting future health benefits) may make a regu-
latory choice tenable while using a discount rate for
health benefits comparable to the discount rate for
capital expenditures may show a proposal to be unde-

\*A complete adoption of this argument might not allow for dis-
counting of costs where the benefits are received currently and the
costs are incurred in later generations.
sirable. Further, since the consequences of many regulatory actions may be to impose compliance costs today in order to bring about health benefits far into the future, the choice of a discount rate can make one regulatory option look better or worse than an alternative, depending on the magnitude of the discount rate. Since there is no consensus on what that rate should be, the policymaker’s preferences for a particular regulatory option can, but should not, be hidden in the choice of a discount rate.

* * * * *

Even if one could successfully deal with the quantification and discounting problem, how does one decide whether or not a specific regulation is good or bad? It seems to me that it has to be measured against some other alternative. For example, if there were no particular regulation, would there have been consumer suits? Would there have been new contract demands by labor? The choice of the alternative against which one measures a particular regulation is important for determining whether or not the regulation was good or bad, whatever that means to the evaluator.

You rarely measure a regulation against doing nothing, because the world would not likely have done nothing in the absence of regulation. For example, if the Toxic Substances Control Act had not taken the form it took, would nothing have been done? Or would OSHA, the Food and Drug Administration, and the EPA been increased in funding?

What alternative scenario the evaluator chooses can, of course, make the actual regulation look better or worse. Unless we have an alternative universe that we can even begin to define for analytical purposes, evaluations of the effects of a regulation are on very shaky ground.

* * * * *

I have thus far discussed the inherent limitations in using cost/benefit analysis: (1) to fashion a decision rule to decide whether or not to regulate; or (2) to evaluate the goodness or badness of a past regulation; or (3) to choose between alternative strategies. Does this mean that there can be no rational approach to environmental decisionmaking? Not at all. However, the answer lies in beginning with a tradeoff analysis which does not obscure the differences between factors such as health, environment, and dollars by monetizing everything—and which does not obscure the identification of who benefits and who is made worse off as a result of a regulatory action. Curiously enough, the use of trade-off analysis is suggested by a question, often asked by regulatory critics: “Should the public interest be outweighed by special interests?” The question just begs to be answered, “Of course not!” This question, when first asked, applied to issues concerning economic regulation. Antitrust regulation was formulated in order that the public interest, i.e., the society, not be disadvantaged by anti-competitive practices of the private business sector. With environmental or safety regulation, who are the “special interests?” The answer is eighty million workers, 150 million consumers, and the countless victims of toxic substances pollution. Isn’t the question rather strange in this context?

The trade-off analysis which one must do in order to perform rational environmental decisionmaking is not hopelessly complicated when applied to real-world problems. The difficulties do not lie principally in cost estimation and quantification of benefits, but rather in how to meet legislative mandates and remain politically accountable. Let us examine in detail the elements of a cost/benefit matrix, properly constructed so as not to obscure the differences between the health, environmental, and economic effects and the differences between the actors (Figure 1). In this matrix, we will tally for each actor the consequences of a particular regulatory action and ultimately compare those consequences against what might have accrued in the absence of that action. Note that the actors are divided into four groups: producers, workers, consumers, and others. The group called “others” are distinguished from workers and consumers because they are usually in neither a contractual/employment relationship with producers (as are workers) nor in a commercial relationship with producers (as are consumers). Note further that workers, consumers, and the others have no relationship with each other, eight contractual or commercial.

Net costs, Cₙ, include items which have accepted, uncontroversial dollar values such as profits, wages, prices, and taxes. Health/safety benefits, Bₚₛ, include items which can be quantified, but in terms difficult to compare such as incidence of disease, changes in longevity, morbidity, and probability of harm. One special health benefit, the benefit of improved health/safety associated with a drug/chemical, Bₚₑₚₛ, is separated in the analysis for reasons which shall become clear. Environmental benefits, BₑₚₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑeventId through the way, let us analyze the major consequences of the predominant regulatory categories.

*The problem is exacerbated when a market/institutionalized "price" exists for health benefit. For example, an asbestos-using firm may either install a ventilation system today to get rid of asbestos or instead pay compensation costs thirty years from now when a worker develops cancer. What should the rational owner of a firm do? The owner can have the use of his money for thirty years, send a worker's children to school, bury him in a gold coffin, and still be ahead financially. Will traditional economic analysis provide a correct answer?
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*Bₜ/H/S refers to benefits of reducing hazards which impair health or safety.
†Bₑfficacy refers to the intended benefits to health from use of chemicals such as drugs or food preservatives.

**Figure 1. Cross impact matrix of environmental/safety regulation.**

**OSHA Health/Safety Regulations**

For these regulations the following emerge as the major consequences:

- Producers
- Workers
- Consumers

Producers, workers, and consumers may share increased costs of disease/accident prevention, while workers gain health benefits. The major trade-off is between economic costs to producers/consumers and health benefits to workers. Although it has been argued that workers can themselves trade off their wages for their health through the employment contract, involuntary risk assumption, difficulties in relating to long-term, low-probability risk, and under-

**CPSC Regulations**

For these regulations we have:

- Producers
- Workers
- Consumers

Here too producers, workers, and consumers may share increased costs of accident/disease prevention. The consumer is the health beneficiary. The major trade-off is between economic costs to the producer and economic costs and health benefits to the consumer. While caveat emptor (let the buyer beware) is no longer the operating principle, the CPSC protects...
consumers from "unreasonable risk" which the agency judges after considering the economic value of the product to the consumer. The agency attempts to act in the interest of the consumer; it does not perform cost/benefit analysis for the society. An apparently less protective posture from OSHA on the part of the CPSC is understandable since: (1) consumers may be in a better economic position to value their own safety; (2) their assumption of risk (in purchasing products) is more voluntary than workers' (in the case of obvious hazards); and (3) substantially greater incentives exist for improving product safety through the threat of products liability suits. (Workers' compensation has seriously limited most worker suits against their employers in exchange for a limited liability insurance system with relatively low premiums.)

**EPA Air and Water Pollution Regulations**

Here we have:

- Producers \[ C_1 \]
- Workers \[ C_3 \]
- Consumers \[ C_3 \]
- Others \[ C_3 + B_{H-S} + B_{environment} \]

Producers, workers, and consumers may share the costs of pollution abatement. In the case of utilities and mobile sources, most of the costs are passed on to consumers. For other industrial polluters, the beneficiaries of these regulations are persons not tied in a meaningful way, contractually or commercially, to the producer. This represents the classical externality and collective goods problem. Society assumes health risks unknowingly and involuntarily. The major trade-off is represented in the question: How much pollution abatement are we willing to pay for? The answers implemented by EPA vary according to the type of hazard, availability of technology, regional economic impact, and whether or not the pollution is from stationary or mobile sources. These environmental regulations were the early attempts at dealing with naively drawn legislation. They do not provide consistent examples nor guidelines for toxic substances control.

**EPA Toxic Substances Control Act**

Here we have:

- Producers \[ C_3 \]
- Workers \[ C_3 + B_{H-S} \]
- Consumers \[ C_3 + B_{H-S} \]
- Others \[ C_3 + B_{H-S} + B_{environment} \]
The Toxic Substances Control Act represents the most far-reaching trade-off problem. Regulations yet to emerge are likely to provide substantial health benefits to workers, consumers, and to others while imposing costs to producers and consumers. The legislative guidelines provide protection against "unreasonable risk to human health or the environment," while not imposing "unnecessary economic burdens on technological innovation." Strong and diverse regulatory authority is given to EPA and the legislative directives place primary emphasis on health and safety.

What emerges from the trade-off analysis of federal environmental and safety regulations is that a rational decisionmaking process does, in fact, exist. The regulatory mandates require application of considerably more sophisticated and appropriate decision rules than those which have been naively suggested as regulatory reforms by some critics. The factors which enter in are: (1) how serious the hazard is; (2) who are the recipients of the costs and benefits; (3) what costs of regulation are imposed on the beneficiaries of the regulation; and (4) how informed and voluntary is risk assumption.

In general, it appears that agencies do consider the distributional and social cost consequences of regulation. For example, when given the choice between two alternatives of either increasing the life expectancy of 10,000 workers/consumers by one year or of increasing the longevity of 1,000 workers/consumers by eight years, an agency may choose to avoid the more tragic event. It may opt for the latter alternative although the number of man-years saved is not maximized. In making this choice, the decisionmaker considers the concern and loss that society feels when the more tragic events occur.

Similarly, there is a requirement on the part of an agency concerned with health and safety for minimizing equity regret. Whenever a person is not fully compensated for a loss, a question of equity arises. Also, when a person is forced to incur losses that others are not selected to incur, this too is unfair. An agency may seek to avoid unfairness for example, it is conceivable that asbestos might be banned from use as a brake lining with the result that more lives are lost on the highway (due to less braking effectiveness) than are saved in asbestos manufacturing operations. The asbestos workers are, however, a non-voluntary, selected group exposed to harm that others in society are not forced to incur. Community ties and family relations may restrict the workers' job mobility for generations and prevent them from leaving the group. Further, if asbestos workers are already a disadvantaged group in society, an additional equity consideration is brought to bear. A consideration of equity along all these lines might justify the increase in the loss of lives on the highway in fairness to the asbestos workers.

Additionally, an agency must question the extent to which health and safety losses can actually be fully compensated. We certainly believe that a minor laceration can be fully compensated for, but what of the loss of an arm or mental capacity? And, although a worker or consumer might be willing to settle for some level of "compensation," would providing this compensation restore that person's future welfare to the level he enjoyed before the loss? The operating principle does not seem to be to maximize worker or consumer health, but rather to reduce our regret about both equity and economic effects.

The decision rules clearly a concern for equity to workers, consumers, and society—and the desire to minimize the regret of not regulating a particular activity. This is accomplished by choosing among different hazards to regulate and by choosing a level of protection for a specific hazard which avoids small probabilities of large harm. Thus, it should be clear that trade-off analysis, rather than traditional cost/benefit or cost/effective analysis, is a more useful analytical tool. Environmental regulation is, after all, an instrument of social policy, not an instrument of economic policy. Society may not merely want the market for safety to work efficiently. It may wish to go much further in protecting workers, consumers, and potential victims of toxic substances pollution than even a well-functioning market would bring about.

However, regulatory decisionmaking must go much further than making a trade-off analysis which includes only short-term cost, benefit, and distributional effects traceable directly to a specific regulation. The indirect pay-off due to leveraging the private sector to deal with unregulated hazards, the longer-term changes in the legal environment, the effects on technological innovation, and the proper treatment of uncertainty need to be factored in, if a complete rationale is to be developed for regulatory decisionmaking. There are no facile rules-of-thumb, no quick fixes, no simple indices of correctness. Until evaluation methodologies can be sufficiently well developed to deal with these additional considerations, it may be unwise to impose upon the regulatory decisionmakers a requirement to undertake regulatory impact analyses that are overly quantitative and restrictive. What can be entered into a tallying matrix is only a small part of the picture. Efforts to improve regulatory decisionmaking at this time might be better focused at ensuring that the government, workers, consumers, and industry have better access to information as to the nature and extent of health hazards, and information as to the technological capabilities of the regulated industrial segments in being able to respond to regulatory controls.
DISCUSSION

Park: You said, in effect, that industry isn’t being very innovative right now, which I guess is true to some extent. Don’t you feel that part of that is due to the uncertainty they are facing with respect to the inconsistency and capriciousness of some of the regulatory agencies?

Ashford: The simple answer is “no,” I do not view the agencies to be manned by mindless bureaucrats. If any inconsistency or uncertainty exists in the regulation, it is that generated by the regulated industry itself. If they think they can defeat the regulation, then they are going to wait to make any capital investments before they really have to. That is where the source of uncertainty comes, not because cost/benefit analysis is difficult to do.

Vincent: You were talking about the problems that occur when technological innovation begins to suffer. I would like your comments on this. Suppose that a company is investing three percent of its income, and let’s not quibble about how we define the income, in something that has to do with technological innovation. Let us say they are pushing back the frontiers of science. They are looking for some way, some new product process, whatever.

Along comes the government regulatory situation. Not only do they have to spend this three percent, but they have to spend three percent plus something else. In the European countries or Asia, you mentioned Japan I believe, they don’t have this situation. All they have is the three percent of what they are spend-

ing for technological innovation. How do you feel that this is going to affect us in the United States in the long run?

Ashford: First of all, your statement is not true. Most developed countries have these regulations. In fact, in Japan, they have a compensation system for victims of pollution that takes quite a bit of money out of the industrial coffers. The issue of capital flight is not an issue that is serious with regard to transfer to other industrialized nations. Regulations in all developed countries are moving rapidly in that same direction. Suppose you have a certain innovation under development, and along comes an environmental constraint. You say it’s forcing you back to the drawing board, and it is costing a lot of money and delay and this hampers innovation. What is also true is that if you recognize the environmental issue to begin with, you view it as a market opportunity to improve safer products and given them competitive advantage. That is what the pollution control industry is all about.

What we are talking about here is a shift between the manufacturing of safe products and unsafe products, and between old plant and new plant, and between marginal firms and those which can take up this challenge. There will be a shift in the industry to be sure, but in this country, the industry will evolve stronger, better, safer, and that is what the adjustment to this problem, which has been ignored for 30 years, needs. Adjustments cost you time and money, but they will benefit those who view these environmental constraints not as constraints, but as market opportunities.