MEASURING THINGS: HEALTH RISKS AND ECONOMIC PERFORMANCE

Editor's Note: When we launched *Public Perspective* four years ago, a primary objective was to explore the numbers we live by. The US collects an enormous amount of information bearing upon policy choices. Some of this is public opinion data, but many other types are gathered on a regular basis. Our experience with opinion surveys taught us how hard it sometimes is to measure what's on people's minds, even when skill and sophistication are brought to the task. Reality can be complex. Then, there are all manner of external contaminants—such as those which enter the scene when an interest group decides to "do a poll" to show that "the people" stand squarely behind the group's position.

We've become increasingly aware that many of the problems that affect polling afflict other types of measures, often in much the same way. Economic performance is complex, too, and various interests try to skew findings in this area to their own tastes. All across the arenas of social measurement, the press struggles to convey a balanced picture of findings that are quite intricate and often seem to contradict one another. Everywhere the ordinary citizen finds himself bombarded with competing claims about the effects of this or that. The pages of *Public Perspective* are open, then, to authors who can provide thoughtful guidance on how various statistics and other descriptions of social performance are properly assessed, which merit acceptance and which are highly misleading, etc. In this issue, Philip H. Abelson, who was long the editor of *Science* magazine and is still associated with that publication, reviews the arguments on the impact of various chemical substances on human health and explains the measurement problems risk assessments have encountered. Following that, Alan Reynolds, an economist who is director of economic research at the Hudson Institute, explores frailties of many widely-held descriptions of US economic performance.

THE HIGH COST OF EXAGGERATING HEALTH RISKS

By Philip H. Abelson

The people of the United States enjoy a high standard of living. Our health and longevity are far better than those of our forebears. Nevertheless, many evince a sour and fretful mood. An important reason for this is unwarranted fears of the dangers of so-called cancer-causing chemicals. Because of unrealistic public concerns, the US is in the process of wasting an ever-increasing hundreds of billions of dollars on phantom risks.

During the past 20 years, an enormous federal regulatory apparatus has been created to reduce health and environmental risks. Insofar as risks existed, they have already been substantially reduced. Small residual risks cannot be reduced to zero, and the cost of attempting to do so would be the waste of trillions of dollars for trivial gains. And other costs are involved: among them, the distractions and high fees of litigation; continuing public anxiety; the preoccupation of management, turning it away from creating new ventures and jobs; and decreased international competitiveness.

Here, I will attempt a brief history of the misinforming of the American public that led to a fear syndrome, describing faulty reasoning processes employed by regulatory agencies. Often, the imputed health risks have been officially established by ideological rather than scientific considerations. Cultivation of frightening perceptions has taken precedence over cool judgment. But we can now see the beginnings of change. Increasing numbers of scientists are producing evidence that destroys the fiction of much of the regulatory methodology. City governments, faced with federally-mandated expenditures, are questioning the basis for federal regulations. Key journalists of the print media are showing a lot more skepticism about health and environmental claims. More than a score of books have recently appeared that deflate the fear mongering.

Chemophobia

In *The Apocalyptics*, Edith Efron described tactics that led toward a national chemophobia(1). Claims were made that a cancer epidemic was inevitable—that as many as 90% of the population would suffer cancer arising from exposure to industrial chemicals. No excess cancer other than that due to smoking was then evident. However, an incubation period of as long as 20 years is often required for cancer to appear after exposure to a carcinogen. Thus while there was no evidence for assertions about future cancer incidence, no one could prove the assertions false. Moreover, the media love scare stories and emphasize them.

The concern about a cancer epidemic led to efforts to identify industrial substances that might cause cancer. The major chemical companies increased their health and safety programs, including monitoring of exposure levels in plants.

Data bases on health, morbidity, and mortality of more than a million workers were created, and have since been maintained. In general, in spite of chronic exposure to chemicals, the health and longevity of the workers have been superior to that of the comparable age group of the general population. This has at some times been attributed to a "healthy worker effect." The fact is, however, that workers have been exposed to much higher levels of chemicals than the general public but have not had a major incidence of cancer.

In the 1970s, the above information was not available, and the need to know about possible hazards prompted experimental programs employing rodents. Rationale for using mice and rats included their normal life span—of about two years. Cancer is primarily a disease of old age. With rodents, results would be forthcoming in two years instead of twenty or more. Another argument was that the effects of the various chemicals in rodents would be similar—even identical—to that in humans. In other words, it was assumed that, for cancer risk assessment purposes, humans are huge rodents. That assumption is proving to be unreliable. However, in the 1970s the US initiated a mouse and rat program testing many chemicals. Huge, usually toxic, nearly lethal doses—commonly referred to as the maximum tolerated dose or MTD—were administered to animals five days a week for a lifetime. Some of the animals developed tumors. As results became available, they were publicized, thus creating cancer scares and further misinforming America.

What Was Wrong With The Rodent-Test Programs?

In its risk assessments for chemicals, the Environmental Protection Agency (EPA) still employs the rigid, arbitrary assumptions and testing procedure formulated during the 1970s cancer scare. The basic unproved assumption is that effects noted as a result of administering huge doses of a substance to obese, inbred, cancer-prone rodents can be used to predict reliably the effects of tiny doses in humans.

For good reasons humans have long had taboos against inbreeding. Experience has shown that hereditary biochemical deficiency diseases result. Nevertheless, the vast majority of risk assessment studies are conducted on inbred rodents. An example of hereditary defects in them is seen in the B_6 C_3 F_1 mouse—which plays the major role in US risk assessments(2) but which has a high rate of spontaneous liver cancer. In humans, absent disease or alcoholism, liver cancer is rare. Nevertheless, when a substance induces liver cancer in B_6 C_3 F_1 mice, it is declared a possible or probable carcinogen in humans, even though other rodents are not affected.

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Other strains of rodents have high natural levels of cancer. It is EPA policy to depend on the results from *the most sensitive species or sex*. The use of inbred rodents can also be criticized on the basis that succeeding generations of inbred strains sometimes undergo further genetic impairment, often resulting in changing and higher natural cancer rates.

Dependence on the results of administering huge doses of a test chemical is also highly questionable. This in reality is merely a test to determine if huge doses can cause cancer in rodents. Typical exposures that humans may incur are often a million-fold smaller, or even less. In the rodents, the huge doses are often toxic, causing cellular death accompanied by cellular proliferation which itself often leads to cancer(3). In general, small doses of chemicals do not cause these effects.

Results of the use of huge doses in risk assessments prove once again the wisdom of Paracelsus, the Swiss alchemist-physician, who was an early (16th century) proponent of chemical pharmacology and therapeutics. "All things are poison," he commented, "there is nothing that is harmless." That is, the dose makes the poison. We know of many examples of substances that are essential to life but lethal if administered in large doses. Even water is lethal. Ordinary table salt in high dosage is a carcinogen. As with common salt, when substances are tested in rodents at doses lower than the maximum, often no cancer is observed.

One of the most questionable assumptions made by EPA is that mathematical models can serve adequately in the extrapolation of the effects of huge doses in rodents to tiny doses in humans. Mathematical models can neither take into account the complexity of metabolic processes and repair mechanisms nor the fact that they differ with each chemical tested. In rodents and humans there are literally thousands of different enzymes and metabolic pathways.

The Case of TCE

Trichloroethylene (TCE) is, on the whole, a relatively benign substance. It has even been employed in anesthesia. TCE is the chemical most frequently found at Superfund sites and in the ground water associated with them. It has also been found as a major contaminant at many government-owned sites. Costs for treating it, at taxpayers' expense, could range above $100 billion. In addition, it will probably be discovered at 10,000 or more additional abandoned waste sites. More than 13 billion pounds of the chemical were very broadly distributed prior to 1975. It was used as a degreasing agent in machine shops, and millions of machinists have been exposed to it with no proven excess of cancer. Indeed, on the basis of epidemiological studies, the American Conference of Governmental and Industrial Hygienists stated that TCE is not a carcinogen(4). However, EPA on the basis of liver tumors in the tumor-prone B_6 C_3 F_1 mouse has declared TCE to be a carcinogen(5). It set a maximum concentration level of 5 parts per billion in water with a goal of zero.

Why is there a difference between human experience and mouse studies? Because there are differences in metabolism for mice and men. In mice, TCE is rapidly converted to a toxic acid, which induces cancer in the liver. In the rat, metabolism is slower, the concentration of acid is small, and no liver cancer results(6). Human metabolism of TCE is also slow; low levels of acid do not affect liver cells in vitro.

When extrapolating from mice to humans, EPA has routinely assumed that a carcinogen will be about 12 times as effective in humans as in mice. The argument is that humans will metabolize the carcinogen more slowly by a factor proportional to body area rather than to concentration in mg/kg. This assumption was employed when regulatory levels for TCE were set, based on liver cancer in B_6 C_3 F_1 mice (5). The use of the factor of 12 is totally in error. *It is the fast metabolism of TCE that gives rise to cancer in the mice.* EPA should have decreased the estimated risk by a large amount instead of magnifying it by the factor of 12.

Test results on $B_6C_3F_1$ mice are the basis on which cancer risks of a majority of chemicals have been officially assessed. The resultant regulations will cost the nation many hundreds of billions of dollars. Therefore, further information about this strain is relevant.

Further Problems With Rodent Tests—The Case of Phenobarbital

A further example of studies employing $B_6C_3F_1$ mice involves phenobarbital. This drug, which has a long history of use, has not caused cancer in humans. However, it is a potent liver carcinogen for the B_6 C_3 F_1 mouse.

The B_6 C_3 F_1 mouse is a hybrid of two inbred lines, C3H and C57BL. There is a high normal rate of liver tumors in C3H controls, but no liver tumors in C57BL controls. When exposed to 0.5% phenobarbital in drinking water for a year, 100% of C3H and 100% of B_6 C_3 F_1 animals were found to have liver tumors(7). No liver tumors were found in C57BL mice even after 18 months of exposure to the phenobarbital-treated drinking water. Thus results from the B_6 C_3 F_1 mice were wrong in predicting the effects of phenobarbital on humans and on one of the parents of the B_6 C_3 F_1 mice.

Different control batches of male B_6 C_3 F_1 mice have had spontaneous liver tumor rates of 14-58%(8). In other words, one batch of untreated mice may have a spontaneous incidence of liver cancer of 14%; another, 58%. One batch of B_6 C_3 F_1 mice does not predict the behavior of another. Can these mice then be reliable predictors of effects on humans who have practically no liver cancer? Should the appearance of increased numbers of liver tumors in these mice following two years of treatment with huge toxic doses of a chemical be the sole justification for the expenditure of hundreds of billions of dollars?

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Pesticides and Human Health

Pesticides are one of the classes of synthetic chemicals that have come under attack. As a result, some consumers are willing to pay handsome prices for "organically grown" food. In practice, the Food and Drug Administration (FDA) monitors the nation's food, and the hazard—if any—from synthetic pesticides is negligible or zero. The major threat comes from nature. Food plants are attacked by innumerable insects, fungi, viruses, and other pathogens. To survive they employ chemical defenses—that is, natural pesticides. Some of these are toxic. When 77 of the natural pesticides were tested on rodents in the manner employed with industrial chemicals, about half of the natural substances were found to induce cancer in the animals. Large amounts of the natural pesticides are present in virtually every fruit or vegetable. Two distinguished scientists, Bruce Ames and Lois Gold, have pointed out that a typical person ingests 10,000 times more of the natural pesticides than those of industrial origin(3).

Compounding the confusion here, vegetables and fruits containing so-called carcinogens *are actually beneficial in reducing the incidence of cancer.* This fact casts further doubt on the validity of the federal program for testing industrial chemicals.

Space limitations preclude an adequate discussion of other faulty risk assessments made by EPA. One of them involves asbestos. Removal of this material from buildings continues at an eventual cost of more than $100 billion. The public has been told that one asbestos fiber can cause cancer. Owing to the weathering of rocks, asbestos fibers are naturally present in air everywhere. The typical person breathes in a million fibers a year. The amount of asbestos fibers in the air of most buildings is no more than that in outside air. Ripping out the asbestos produces many airborne fibers and is a hazard to the laborers and subsequently to the normal occupants. The EPA produced a scare about asbestos that has been a fiasco(9)(10). Risk assessments by EPA of radon, lead, and acid rain have also been questionable. Media coverage, however, has fostered public fear and has led to an enormous regulatory structure.

The Regulatory Burden on Cities and Small Companies

Eight different regulatory agencies administer 26 different statutes. Some of these statutes, such as the Clean Air Act, have been extensively amended and are extremely complex. Legislation that originally occupied 50 pages in the Federal Register has been expanded to 500-800 pages. Correspondingly, federal regulations based on the statutes have expanded in complexity and numbers. EPA is a leader among the various regulatory agen-

cies. It has issued more than 9000 regulations, and their number continues to mount. Rarely are regulations loosened.

In the 1970s major chemical companies were the principal target of regulations. They were thought to have deep pockets and to be able to absorb costs. The companies had long maintained health and safety programs. They had noted a few instances in which specific chemicals had caused cancer and had curtailed exposure to them. But when the cancer scare alarmed the public, the chemical industry did not respond adequately and soon lost public credibility, which it has not regained. In recent years it has increased in-plant monitoring, substantially decreased emissions, and made hundreds of epidemiological studies of present and past chemical workers. In general, the major companies are quietly complying with EPA regulations and maintaining a low public profile.

Perhaps in consequence EPA has increased regulatory enforcement affecting municipalities and small companies. Cities and towns now find that they must comply with 11 statutes and as many as 419 "essential" EPA regulations. The text of the mandates are complex and rigid. A regulation stemming from the Safe Drinking Act requires the measurement of more than 130 chemicals in municipal water supplies nationwide—without regard to the variability of local circumstances, in which some substances are known not to be present. The EPA drinking water standards are based on the assumption that people will obtain their fluid intake from drinking 2 liters (2.2 quarts) of tap water a day for 70 years. Fluid intake of the average adult is only 1.4 liters per day, and much of it is in the form of soft drinks, milk, and other beverages. When water is heated to make coffee, most TCE, chlorine, or chloroform escape. The EPA assumption exaggerates risks by at least threefold. The permissible concentration of the contaminant in the tap water is set at a level such that a person will have less than one chance in a million of incurring cancer due to a lifetime of drinking the water. If the regulatory level is exceeded, the local government must install expensive treatment facilities and fund operation and maintenance.

Due to threats of fines for non-compliance, provision for EPA mandates has top priority in city budgets. This leads to withholding funds from important health and social programs. Early in 1993, mayors of 114 cities signed a letter to Congress complaining about the diversion of funds and questioning the science employed by EPA in establishing its regulations.

Regulations are causing increasing problems for small businesses. EPA is now enforcing regulations on companies that cannot afford to become expert in the complexities of hundreds of environmental rules. Moreover, changes in regulations occur frequently, making it difficult to plan ahead. Failure to comply with environmental laws can mean huge fines and jail sentences for company owners, managers, and employees. Companies are being counted on to create jobs, but the hazards of legal problems arising from EPA divert attention from fresh initiatives. The existence of this problem has been recognized in high political circles. Last year during the electoral campaign, candidate Clinton stated, "Expanding regulations threaten to overwhelm the nation's entrepreneurs and divert them from the task of building strong innovative companies."

The Imperative of Sound Science on "Hazardous Wastes"

Perhaps the most costly consequence of faulty risk assessment of chemicals will be sustained in attempts to remediate so-called hazardous waste sites. Projected costs continue to mount and now range in the neighborhood of a trillion dollars or more, not counting legal fees. The known abandoned waste sites now number 32,000, but a total of 75,000 will probably be found. Some 1,200 of them have been designated as Superfund sites. In addition, under the Resource Conservation and Recovery Act, there are at least 37,000 active waste sites where corrective action may ultimately be needed.

The ultimate cost of cleanups will depend strongly on the level of cleanliness sought. It would be literally impossible to restore pristine conditions. Any attempt to do so would not come close, and it would bankrupt the nation. The cost will also be heavily dependent on the degree to which realistic health standards are imposed. Costs would diminish substantially if the permissible concentration level of chemicals were established using good science. Earlier the faulty assessment of TCE was mentioned. If the true, scientifically demonstrated hazard of this substance were recognized, costs of cleanup would be reduced by $100 billion or more.

In its management of Superfund sites, EPA has often followed procedures which increase costs while not appreciably improving the safeguarding of human health. An example has been cited by Chief Judge Stephen Breyer of the United States Court of Appeals for the First District in Boston. In his 1992 Oliver Wendell Holmes Lectures at Harvard University, he pointed to an example of excessive zeal by EPA in the cleanup of a site involved in a case heard in his court. Ten years and a large amount of money had been spent on the site. A small amount of chemicals remained, most of which would disappear naturally in another 15 years. However, EPA insisted on an immediate cleanup costing $9.3 million. How much extra safety did this $9.3 million buy? The record shows that without the extra expenditure, the waste site was clean enough so that children could eat small amounts of dirt on 70 days each year without harm. Treating of the soil by burning it would make it clean enough for children to eat small amounts 245 days a year without significant harm. But there were no dirt-eating children in the area, for it was a swamp. Nor were dirt-eating children likely to appear there, for zoning rules forbade building.

Regulators should display a greater sense of urgency in discriminating between minor and major risks(11). They should start by questioning such standard practices as uses of the most sensitive animal and the administration of huge

toxic doses. They should devote more effort to elucidating the detailed metabolic pathways, particularly of the most sensitive animals. They would discover many more examples of unique differences between the most sensitive animal, other strains of the same species, other species of rodents, and human tissues. And once it is determined that the evidence for carcinogenicity of a substance is flawed, regulations should be modified promptly. Delays in implementing good science will result in needless waste of huge sums of money and loss of credibility for the federal government.

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THE HIGH COST OF ECONOMIC MISINFORMATION

By Alan Reynolds

The *Washington Post's* David Broder commented recently (June 11) on a remarkable discovery he had made in Europe: "It is startling to be told," he wrote, "that no major economy is growing as fast or generating jobs as well as the United States is today." To understand this, Broder added, "you have to make a mental adjustment that I found difficult. You have to see the United States, not as most Americans do, as a nation beset by problems and maybe headed down the chute, but as a citadel of economic and political strength in a world of stumbling economies..." As Broder discovered, the facts are quite incontestable—the US economy has been far outperforming most other countries for well over a year, often for more than a decade. In the year ending April 1993, for example, industrial production was up 3.5% in the US—but down 3.8% in Japan and down 7.7% in Germany.

Yet public perceptions are quite different, as Broder observed. One suspects that this is because economic news so often emphasizes the negatives, and substitutes opinions for fact. The public is constantly barraged with dramatic statistics about the economy that are designed to be alarming. One reason is that journalism schools teach reporters that "human interest" stories grab a bigger audience than cold facts. Television cameras thus put a human face on the quite genuine suffering caused by every plant closing, even if the plant had been producing shoddy, over-priced products. Television cannot and does not show a comparable visual picture of the larger number of better jobs being gained.

Various interest groups often have a stake in pushing misleading statistics to justify the government assistance they are seeking. They put out propaganda tracts that are often cited as "studies" by unduly innocent reporters. Estimates that are little better than wild guesses are reported as though they were solid facts. Numbers become weapons in a battle for political power. Such gamesmanship with economic statistics contributes to public gloom and cynicism.

We are told that 37 million Americans are without health insurance, that 5.9