The Hazards of Risk Assessment

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Introduction

The hypothetical presented to this conference deals with an important public problem: how to dispose of trash.[1] Clearly, estimates of the risks to human health and environmental quality generated by alternative means of trash disposal must play a role in choosing among them. We are apparently agreed, as well, that in a democracy the people have a right to participate in this choice and therefore to be fully informed of the risk and other relevant factors, such as cost, before they reach a decision.

Accordingly, in the hypothetical the risk assessment ought to function in this way: first, the town becomes aware that the present technology of trash disposal must be changed. Holes, (*i.e.*, landfills) after all, do fill up. The next step is to examine the alternative ways of disposing of trash and to assess their relative risks to human health and the environment, as well as relevant social issues, such as the burden on a given neighborhood. Finally, based on these considerations, with the public fully participating, the new trash disposal technology is chosen. It goes without saying that in this ideal situation the decision should be based on the relevant facts, such as the risk assessment, which should therefore be developed, made public, and analyzed before the decision is made.

This paper will discuss how risk assessments are used and abused in practice. Although held out as a scientific tool which gives government officials more information on which to base their decisions, I will show how in practice risk assessment is merely used as a way to defend a decision which has already been made. I will also argue that in many cases alternatives, such as

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1. For a description of the hypothetical presented at this symposium, *see*, DelBello, *The Politics of Garbage: The Influence of the Political Process on the Construction of a Refuse-to-Energy Plant*, this volume.

recycling, are not considered by a locality when it confronts the problems of trash disposal.

I. Risk Assessment in Practice

In practice, risk assessments have not been used as tools to evaluate the environmental risks of different regulatory alternatives. Contrary to Mr. DelBello's claim, invariably the new technology is chosen *in advance* of the risk assessment; therefore, the assessment of risk is not used to decide which technology to use, but rather how to best defend the choice already made.[2] As evidence for this assertion, I can cite the case in which both Mr. DelBello and I have been involved, the Brooklyn Navy Yard incinerator.

By 1981 the New York City Department of Sanitation (DOS) had decided that a trash-burning incinerator would be built at the Brooklyn Navy Yard. There was no serious examination of alternatives to the problem of replacing the landfills that then received all of the trash. Certainly, no comparative risk assessments were done. The Department of Sanitation's excuse was that only incinerators were proposed in response to its Request for Proposals (RFP).[3] However, DOS has also admitted that the RFP was written in consultation with the firms who were interested in building incinerators.[4]

Thus, the first of a series of environmental impact statements on the Brooklyn Navy Yard project, which included a risk assessment, opened with the following statement:

> The New York City Department of Sanitation has proposed construction of a facility at the Brooklyn Navy Yard that would

2. *Id.*

3. Steisel & Casowitz, *Incinerate New York Garbage*, N.Y. Times, Aug. 20, 1983, at 21, col. 4; *See also* NEW YORK CITY DEPARTMENT OF SANITATION (DOS), THE WASTE DISPOSAL PROBLEM IN NEW YORK CITY (April, 1984) at I-8. In this document, the Department reaffirms its earlier decision "[t]hat on site incineration (with or without some preprocessing of the waste) with energy recovery is the state-of-the-art for large scale waste disposal facilities and the only technology that meets established criteria for the 'first generation' of new disposal capacity it disposes."

4. Binder, The EIS Process for Resource Recovery Facilities in New York City (1988) (presented at Conference on Solid Waste Management and Materials Policy held in New York, N.Y).

> burn 3000 tons of barge-delivered waste a day to generate steam and recover marketable scrap metals.[5]

It is dated November 1982, three years after the decision was made.

Suffice it to say that no discussion of health risks posed by incinerators, or any alternative to them, took place until after the decision to build an incinerator was made. In fact, as of this date, I am aware of only one municipality in which the full range of trash disposal alternatives has been examined with respect to health risks and costs in advance of the decision. To my knowledge the first such comparison between an incinerator and a recycling system—a major alternative to incineration—is now being made by the Center for the Biology of Natural Systems (CBNS) for the Town of East Hampton, New York, located on Long Island. Yet, clearly such comparisons are essential to the proper evaluation of alternative trash disposal technologies by the public and municipal officials.

With the decision already made, the risk assessment becomes the means of defending the decision, rather than the objective basis for it. Technical consultants are brought in to prepare the environmental impact statement and a risk assessment with precisely that purpose in mind. Since members of the public are likely to oppose the project, these analyses set off an adversarial process. The municipality defends its decision and then the people in the community, if they are lucky, can find some technical help and oppose the decision by contradicting the risk assessment.

There is usually a conflict of interest involved here, since almost every consultant that can serve the municipality as a technical expert is likely to rely on the incinerator industry for clients. I know of one town that asked for consultation on an incinerator problem, but required that anyone bidding should have no incinerator industry clients. They received no replies.[6] In effect, there is an alliance among the incinerator manufacturers who want to build the plants, the public officials who have decided to do so,

5. DOS, EXECUTIVE SUMMARY TO THE PRELIMINARY DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE PROPOSED RESOURCE RECOVERY PROGRAM AT THE BROOKLYN NAVY YARD (1982).

6. Personal communication with Saugus, Massachusetts Councilman Peter Manoogian (1987).

and the technical consultants who are brought in to defend the decision.

The charter that guides CBNS, which I direct, requires that we provide communities and citizens' groups with technical information about their environmental and energy problems. In response to a request from the Williamsburg community, which adjoined the proposed incinerator site, in 1981 we undertook to perform this function with respect to the Brooklyn Navy Yard incinerator, and have continued to do so since.

Initially, a good deal of our work dealt with the incinerator emissions, in particular dioxin.[7] The 1982 DOS risk assessment concluded that the maximum lifetime risk of cancer from dioxin in the emissions would be 0.13 per million, well below the one per million guideline.[8] Previously in community debates DOS had claimed that trash-burning incinerators do not produce dioxin at all. The Department claimed that if the incinerator furnace were hot enough, the dioxin would be destroyed and eliminated from the emissions. DOS was forced to give up that claim when CBNS produced data, assembled from the literature on the subject, that established unequivocally that every tested incinerator emitted dioxin.[9] CBNS analyzed the 1982 risk assessment and discovered a number of additional significant errors.[10] For example, the assessment ignored the toxicity of the full range of dioxin and furan isomers and their uptake by way of ingestion as well as inhalation.

The CBNS critique of the DOS dioxin risk assessment published in August 1984 showed that (using the incinerator's very low emission rate assumed by DOS) the proper value of the maximum lifetime cancer risk from dioxin is twenty-nine per million—

7. Dioxin is the common term used to refer to a family of chlorinated dioxins and furans.

8. Although a maximum lifetime cancer risk of one per million has not been adopted as an official standard, it has guided EPA decisions on the regulation of airborne carcinogens. *See e.g.*, EPA OFFICE OF AIR AND RADIATION & OFFICE OF AIR QUALITY PLANNING AND STANDARDS, ESTIMATED CANCER INCIDENCE RATES FOR SELECTED TOXIC AIR POLLUTANTS USING AMBIENT AIR POLLUTION DATA (1985).

9. Commoner & Shapiro, *The Verdict is Clear on Dioxin and Trash Incineration*. N.Y. Times, Sept. 26, 1983, at A20, col. 4.

10. B. COMMONER, *Environmental and Economic Analysis of Alternative Municipal Solid Waste Disposal Technologies* in A COMPARISON OF DIFFERENT ESTIMATES OF THE RISK DUE TO EMISSIONS OF CHLORINATED DIOXINS AND DIBENSOFURANS FROM PROPOSED NEW YORK CITY INCINERATORS (Dec. 1, 1984) (including a Critique of the Hart Report).

more than a 200-fold increase over the official figure.[11] The Board of Estimate became concerned with this discrepancy and asked DOS for a special study of the dioxin problem. This was carried out by a commercial consultant, who, by remedying most of the same errors that we had found in the original risk assessment, arrived at a figure of 5.9 per million—forty-five times higher than the earlier value.[12]

This points out one of the useful functions of this adversarial process, if it is balanced: to improve the scientific validity of the risk assessment. Following this early encounter over the Brooklyn Navy Yard incinerator, there was a noticeable improvement in the dioxin risk assessments produced in defense of the numerous incinerator projects that began to spring up around the country. Most of them tried to take into account the toxicity of the different dioxin and furan isomers, and the question of ingestion of contaminated dust.

The DOS response to the considerable upward revision of its original risk assessment was astonishing. It issued a subsequent draft, and eventually a final, environmental impact statement (EIS) that had no dioxin risk assessment in it at all.[13] The only explanation I can offer for this strange omission is that if the new DOS dioxin risk assessment—not to mention the CBNS assessment—were included in the EIS, the project would have been extremely vulnerable to criticism because it exceeded the one per million guideline.

At this point the State permit process for the incinerator began. The State Department of Environmental Conservation (DEC) noticed the absence of a dioxin risk assessment and called for a new EIS. Mr. DelBello's company hired a new consultant for that purpose. The new risk assessment concluded that the maximum lifetime cancer risk from dioxin in the incinerator emissions was 0.78 per million, still conveniently within the guideline. The consultant took a very creative approach to the risk assessment. He decided that dioxin would take a novel path into the bodies of

11. *Id.* at section I.

12. F. Hart, Assessment of Potential Public Health Impacts Associated with Predicted Emissions of Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzo-furans from the Brooklyn Navy Yard Resource Recovery Facility (1984) (prepared by F. Hart Associates, Inc.).

13. DOS, DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE PROPOSED RESOURCE RECOVERY FACILITY OF THE BROOKLYN NAVY YARD (1984).

people in Brooklyn. Dioxin contaminated dust would be emitted from the plant stack, then, descending to ground level, it would mix with a 10-centimeter layer of soil. After being enormously diluted by the soil, the dioxin would come in contact with people through soil particles scattered into the environment.[14]

There are a couple of things wrong with this picture. In the first place, dioxin will not readily penetrate the soil because it is very insoluble in water. Studies show that, deposited as dust, dioxin would hardly penetrate more than a few millimeters.[15] It is also a fact that there is not much soil exposed to descending emissions in Brooklyn; it is mostly paved. The absurdity of this scheme suggests that it was invented in order to justify an enormous reduction in exposure. Another interesting feature of many risk assessments is that they not only gild the lily, but encrust it with diamonds. They often contain an enormous amount of unnecessary, irrelevant computations. In this case, the consultant went to great trouble to determine how much dioxin people would absorb by eating fish from the lake in Prospect Park—something that very few people are sufficiently rash to do.

Correcting for such errors, the new risk assessment actually leads to a maximum lifetime cancer risk of twelve per million, a rather good agreement with both the CBNS estimate and the estimate produced by DOS's special dioxin report. The agreement is encouraging, but it came about at high cost to the City. According to *Newsday,* New York City has spent nearly nineteen million dollars for consultants and lawyers in dealing with the Brooklyn Navy Yard incinerator project thus far.[16]

I can summarize my experience with this and other risk assessments on trash-burning incinerators in this way: their technical content is designed not to illuminate the issues and support a rational decision, but to justify the preordained conclusion that the incinerator is the best, environmentally blameless, way to dispose of trash.

I have thus far discussed the way in which risk assessments are used in the decisionmaking process regarding trash disposal options. The process is governed less by objectivity than by advo-

14. Health Risk Associates, Health Risk Assessment for the Brooklyn Navy Yard Resource Recovery Facility (1987) (assessment available from authors, Berkeley, California).

15. EPA, HEALTH ASSESSMENT DOCUMENT FOR POLYCHLORINATED DIBENZO-P-DIOXINS (1985).

16. The Expense of Expertise, Newsday, Dec. 18, 1987, at 23.

cacy. Yet, such risk assessments are necessarily based on supposedly objective scientific studies, for example, a study to determine the relation between the level of exposure to dioxin and the expected risk of cancer. Presumably scientific, these studies' conclusions should be objectively derived from the data rather than fashioned to fit a preconceived conclusion. Unfortunately, these quite reasonable expectations are not borne out by the recent "less conservative" revisions of health risks, especially of environmental carcinogens, that Dr. Anderson has praised.[17] These EPA revisions were not dictated by new scientific evidence, but by the Office of Management and Budget (OMB), on wholly unscientific grounds that have been cleverly disguised as science.

The OMB 1987 Regulatory Program discusses in some detail the scientific procedures used to estimate health risks, especially the risk of chemically induced cancer. According to OMB, "[r]isk assessments of health hazards often inform the regulatory officials and the public of only the high end of the range of uncertainty of the risk, *i.e.*, only what the most cautious estimates are."[18] This reflects the practice, in scientific considerations of health effects such as the risk of cancer from exposure to a certain amount of a carcinogenic chemical, of estimating the most probable "upper bound" of the risk, that is, the greatest risk that is likely to be incurred by the exposure. An example of this "overly conservative" approach is the practice of basing cancer risk estimates on the results of tests with particularly sensitive animals. According to OMB this "[t]ends to overpredict the risk to humans, because it assumes that humans are as sensitive as the most sensitive animal tested. . . . A more accurate estimate could be derived from a weighted average of all the scientifically valid, available information."[19]

It is useful to reduce these generalities to practical terms. A good example is the substance AAF (aminoacetyl fluorene), a powerful carcinogen. When fed to rats, AAF invariably induces a high incidence of liver cancer; however, when AAF is fed to guinea pigs the cancer incidence is zero.[20] The explanation is

17. *See* Anderson, this volume.

18. Office of Management & Budget, Regulatory Program 1987.

19. *Id.*

20. Miller & Miller, *The Metabolism of Chemical Carcinogens to Reactivate Electrophiles and Their Possible Mechanism of Action in Carcinogenesis*, in Chemical Carcinogens, ACS Monograph 173 (Searle ed. 1976).

that AAF must be acted on by a liver enzyme before it becomes carcinogenic and that rats possess the enzyme, while guinea pigs do not.[21] Most carcinogens must be chemically transformed in this way. Quite properly, the risk to people is based on the rat experiments. People, like rats, possess the carcinogen-transforming enzyme, but at greatly varying levels. These differences appear to be under genetic control.[22] This is a typical situation in the human population: a very wide range in the expression of any single genetically controlled characteristic, for example, height, resulting from the enormous genetic heterogeneity of the population. In contrast, cancer tests are done on carefully inbred strains of animals that vary much less in genetic make-up than does the human population. They are extremely uniform in size, hair color and in basic physiological characteristics, including sensitivity to carcinogens and other toxic chemicals.

Thus, where a factor such as sensitivity to a chemical carcinogen varies from one species or strain of animals to another, the human population can be expected to include individuals with sensitivities that differ over the wide range of variation that encompasses *all* the species and strains. In effect, with respect to, let us say, the response to carcinogens such as AAF, some people behave like rats, some like guinea pigs, and most somewhere in between. This is not only due to the genetic heterogeneity of the human population, but also to the fact that, unlike the test animals, the population includes people of all ages and physiological conditions, factors that frequently influence vulnerability to disease.

As a result, the statistical basis chosen to determine an exposure standard is actually a decision as to what part of the human population is to be protected. If the standard is based on the most carcinogen-sensitive test animal, it will tend to protect infants, old people, and other particularly vulnerable individuals, as well as the more numerous, less vulnerable people. On the other hand, if, as OMB prefers, the standard is based on some statistical average, it represents a decision to protect the average person and to leave the fewer, particularly vulnerable individuals outside the protection that the standard provides.

21. *Id.*

22. Nagayama, *Inducing Potency of Aryl Hydrocarbon Hydroxylase Activity in Human Lymphoblastoid Cells and Mice by Chlorinated Dibenzofuran Congeners*, 107 ENVTL. HEALTH PERSP. 59 (1985).

This is not, of course, a scientific decision, but a moral or social judgment. OMB, however, has disguised this procedure in the statistical language of science, with the lofty declaration that it is "a more accurate estimate . . . derived from a weighted average of all the scientifically valid, available information."[23] Thus, OMB has constructed a scientific facade that hides a far-reaching moral, social—and probably political—decision, protecting it from the open public discussion that would certainly countermand it.

Unfortunately, this deception seems to have taken in some scientists. In the last few years EPA scientific committees, echoing OMB's call for "less conservative" carcinogen standards, have reviewed earlier standards and have recommended that they should be relaxed. As the following example shows, they are likely to be guided by the OMB version of good science.

One of the most difficult and controversial problems is determining the cancer risk from exposure to dioxin. The scientific disagreement relates to the role that dioxin plays in the biological process that leads from exposure to a chemical to the appearance of a tumor. According to a well-known theory, this process is characterized by two sequential steps. First, a substance (an "initiator") causes a genetic change in the exposed cells. Then, subsequent exposure to another substance (a "promoter") causes these now predisposed cells to proliferate and produce a tumor.

Mathematical models based on animal experiments have been developed to estimate the risk of cancer in people exposed to given amounts of dioxin. Some models assume that dioxin is an initiator (or a complete carcinogen, capable of both effects), and others assume that it is a promoter. In general, the risks computed from initiator-based models are considerably greater than the risks computed from promoter-based models. However, dioxin lacks the diagnostic property of an initiator in that it does not cause genetic mutations.[24] It also lacks the diagnostic property of a promoter since there is no clear evidence that dioxin causes cell proliferation.[25] According to the actual evidence, then, dioxin is *neither* an initiator (or complete carcinogen) *nor* a promoter. This means that the initiator/promoter scheme is not

23. *See supra* note 18.

24. EPA Dioxin Task Force, A Cancer Risk-Specific Estimate for 2,3,7,8-TCDD, External Review Draft (1987).

25. Thorslund, Quantitative Dose-Response Model for the Tumor-Promoting Activity of TCDD, (February 17, 1987) (prepared for EPA, Contract No. 68-01-6939).

a sensible way to account for the effect of dioxin on cancer incidence, and that risk assessment models based on either of these assumptions are not valid.

Yet, there is the paradoxical fact that rats and mice that are exposed only to dioxin exhibit a significant incidence of tumors, in proportion to the dose.[26] Thus, dioxin acts like a complete carcinogen, but must do so in ways not encompassed by the conventional theory. This apparent paradox can be explained by the fact that dioxin greatly enhances the activity of the enzyme system that converts most environmental carcinogens into active agents. Apparently, dioxin can so powerfully stimulate the enzyme as to increase the activity of the small amounts of carcinogens present in the laboratory food, water and air and generate the increased tumor incidence observed when only dioxin is provided to the test animals. Thus, the presence of dioxin translates into an increased concentration of the carcinogens. In effect, dioxin influences tumor production by enhancing the activity of carcinogens.

In 1985, a group of EPA experts prepared a detailed analysis of the cancer risk due to dioxin based on the theory that dioxin is a complete carcinogen. Computing from the effect of measured doses on rats and mice, the group concluded that dioxin is the most potent cancer-inducing synthetic chemical.[27] Since 1985 this assessment has been used to evaluate the risk of dioxin-induced cancer from, among other things, the emissions of trash-burning incinerators; the exposure of Vietnam veterans to the military defoliant, Agent Orange, and the effect of dioxin-contaminated soil in Missouri. Based on the standard derived from the 1985 EPA assessment, it has been found that a number of incinerators generate lifetime cancer risks ten to twenty times the one-in-a-million "acceptable level".[28] Moreover, it was also found that it was necessary to abandon the town of Times Beach, MO, to avoid unacceptable exposures and that the 1985 assessment readily accounts for the statistically significant increase in cancer incidence

26. Kociba, *Results of a Two-Year Chronic Toxicity and Oncogenicity Study of 2,3,7,8-Tetrachlorodibenzo-p-dioxin in Rats*, 46 TOXICOL. APPL. PHARM. 279 (1978).

27. *See supra* note 15.

28. Commoner, *The Origin and Health Risks of PCDD and PCDF*, 5 WASTE MGMT. & RES. 327 (1987).

among exposed veterans, as compared with unexposed controls.[29]

All this was fair game in the OMB campaign to minimize the significance of environmental carcinogens, and, obediently, in 1987 EPA appointed a committee of staff scientists to review the 1985 dioxin assessments. The committee produced a draft report that is a literal caricature of OMB's "scientific" precepts. The report notes that in addition to this complete carcinogen-based risk assessment, there are several others, developed by other agencies, which yield risk assessments nearly 100,000 times lower than the EPA 1985 value. These low risk estimates are based on the assumption that dioxin is a promoter. Most scientists confronted by this disparity would then examine the relative validity of the two conflicting theories and base their risk estimate on the one that seemed most plausible, or preferably find a new and better explanation. As noted above, such an explanation exists.

But the task force was marching to a different drummer—OMB—and proceeded, in keeping with OMB principles, to "make use of all the data" by averaging the five disparate values. This reduced the 1985 estimate of cancer risk sixteen-fold. The decision to take the midpoint of the two types of risk estimates is nonsensical. Clearly, if dioxin is a promoter, it is not an initiator and vice versa. This leads to the conclusion that at least one of the two classes of risk estimates is wrong. But since dioxin lacks the properties of *both* promoters and initiators, the logical base of both risk models is destroyed, which is a defect that surely cannot be cured by averaging their results.

II. Examining Alternatives for Garbage Disposal—Recycling vs. Incineration

One of the unfortunate consequences of incinerator risk assessments distorted by post-decision advocacy and politically motivated "science" is that they have hindered attention to the main alternative, which is intensive recycling. One of the little-known facts about trash is that about ninety percent is capable of being recycled and that most of this is also burnable. Clearly, both incineration and recycling can dispose of most of the trash. But

29. Albanese, United States Air Force Personnel and Exposure to Herbicide Orange (1988) (USAF School of Space Medicine, USAFSAM-TR-88-3).

they are mutually exclusive and therefore compete in the contest for a new trash disposal system.

However, until recently there was no procedure capable of actually recovering all the trash recyclables. To meet this challenge, CBNS has developed an Intensive Recycling System with a goal of recycling at least seventy percent of the trash stream (the same weight reduction achieved by an incinerator when it burns urban trash). Although designed for households, the principles are readily extendable to commercial waste. The system begins in the household or the commercial establishment, where trash is separated into four containers: food and other putrescible material, clean mixed paper and cardboard, metal cans and glass bottles, and non-recyclables (largely plastic and composites). Then, intermediate processing facilities convert the recyclable components into marketable commodities. At one facility food garbage is converted into compost, a useful soil additive. At a second facility the paper component is separated into several marketable grades, and the can/bottle component is processed to yield marketable aluminum, tin cans and crushed glass.

CBNS has conducted a ten-week pilot test of the Intensive Recycling System in East Hampton, New York, with 100 volunteer households. The test was designed to estimate the physical efficiency of the system, which depends on the combined effectiveness of source separation and subsequent processing of the separated components.

Each participating household separated its trash into four containers: (1) food garbage and soiled paper; (2) mixed clean paper; (3) metal cans and glass bottles; and (4) "all the rest." A total of about eighteen tons of separated trash was collected over the ten-week period. As shown in the following table, the contents of Container IV, which represent materials that are not currently recyclable, were 13.2 percent of the total trash stream by weight.

TABLE 1

PILOT TEST PHYSICAL RECYCLING EFFICIENCY

Container	Material	Percent of Trash	Percent of Fraction Rejected*	Percent of Fraction Recycled	Recycling Efficiency
I	Food garbage	32.9	3.0	97.0	31.9
II	Paper/cardboard	40.5	0.6	99.4	40.3
III	Bottles/cans	13.4	9.3	90.7	12.2
IV	Non-recyclable	13.2	100	0	0
	TOTAL Physical efficiency of Intensive Recycling				84.4

* Percent of fraction rejected as non-recyclable

The material collected in Container I was composted (together with yard waste, sewage sludge and wood chips). When the compost was mature, it was screened and extraneous material removed and weighed. The material in Container III and a 9,432-pound sample of the Container II material were processed by Resource Recovery Systems Inc., in Groton, Connecticut.

The results of the test are summarized in the above table. Only 3.0 percent of the Container I material, 0.6 percent of the Container II material, and 9.3 percent of the Container III material were rejected as not recyclable. As the table shows, the efficiency of the overall process, *i.e.*, household separation plus processing, is 84.4 percent.

Additional studies show that a full-scale East Hampton Intensive Recycling System would be thirty-five percent less costly than an incinerator.[30] Moreover, by supplanting the environmentally hazardous incinerator, and avoiding pollution from the production of virgin metal, glass and paper, intensive recycling helps to restore environmental quality.

It is appropriate to note at this point that although DOS continued to press for approval of the Brooklyn Navy Yard incinerator, it was rejected by every local Community Board. In December 1988, the New York State DEC refused to grant a construction permit because of the project's problems with the disposal of toxic ash and because inadequate consideration had been given to the alternative of recycling.

30. Commoner, CBNS, Development and Pilot Test of an Intensive Municipal Solid Waste Recycling System for the Town of East Hampton—Final Report to N.Y. State Energy Research & Development Authority (1988).

III. CONCLUSION

Risk assessment is usually praised as a way of introducing objective data and rational, data-based analysis into the process that governs decisions about public projects. At least in the case of trash disposal, and I believe more generally, risk assessments are perversely used for purposes that conflict with this rational aim. They are usually designed to provide "scientific" support for preconceived conclusions; to hide moral, social and political judgments from opposition by cloaking them in seemingly scientific statistics; and to protect the preconceived decision from the challenge of alternatives.

The conventional view is that the risk assessment is an effective antidote to thoughtless public opposition to worthwhile public projects. In reality the converse of this proposition is true. In the case of the Brooklyn Navy Yard incinerator (and many similar examples can be cited as well), it was the public opposition that generated a true assessment of the project. The lesson to be learned is that public opposition—sufficiently enduring and properly armed with technical resources—is the means of restoring some sense to a process twisted out of rational shape by its use as an instrument of advocacy.