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Hazards of Solid Waste Management: Bioethical Problems, Principles, and Priorities

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The putative hazards of solid waste management cannot be evaluated without placing the problem within a cultural climate of crisis where some persons consider such by-products of "high, hard technology" to have raised unresolved moral and ethical issues. In order to assist scientific and technical efforts to protect public health and safety, a bioethical perspective requires us to examine three controversial aspects of policy-making about public safety. Failure to recognize the qualitative difference between two cognitive activities—risk-measurements (objective, scientific probabilities) and safety-judgments (subjective, shifting value priorities)—has had three unfortunate consequences. Sophisticated methods of risk analysis have been applied in a piecemeal, haphazard, ad hoc fashion within traditional institutions with the false expectation that incremental risk-reducing programs automatically ensure public health and safety. Ethical priorities require, first and foremost, a whole new field of data arranged for comparable risk-analyses. Critics of cost/risk/benefit quantifications attack the absurdity of "putting a price on human life" but have not been confronted with its threefold ethical justification. The widening discrepancy in risk-perceptions and loss of mutual confidence between scientific experts and ordinary citizens has placed a burden of social responsibility on members of the scientific and technical community to engage in more effective public education through the political process, notwithstanding advocates of a nonscientific adversary process. The urgency of effective public education has been demonstrated by the extent to which we have lost our historically balanced judgment about the alleged environmental hazards posed by advanced technology.

Underlying the theme of this symposium is a bifurcated assumption. Hazardous solid wastes derived from a number of technology-induced sources not only exist in significant volumes in our environment, but also constitute a potential biohazard to the extent that past and proposed disposal options are not technologically "sound" and/or they entail risks of uncertain public acceptability. Whatever the technical facts of the matter may be, the shadowy specter of increasing increments to environmental degradation, plus diminished protection of public health and safety, appear to raise moral and ethical issues of some importance. It remains to be seen whether these problems are "shadow" or "substance."

By way of introduction, I should make clear that the bioethical perspective adopted throughout my reflections on this subject represents a departure from that which is considered "mainstream" and "accepted" among current specialists in the area of bioethics. In their view, the major problems with which bioethics should be concerned are these: genetic engineering, human experimentation, death and dying, abortion, behavior modification, allocation of scarce medical resources, and the like. It is my view, however, that such problems have for years been regarded as belonging to the realm of biomedical ethics which is actually a species of professional ethics. By contrast, it should be the task of bioethics to address itself to a relatively new set of problems arising from, and gravitating around, human efforts to enhance and exert control over the quality of life of the biosphere—considered as a total system of conditions which sustain and protect the health and safety of living organisms, primarily and principally human beings.

To address a recently recognized set of problems as yet poorly attended to, bioethics must perforce adopt a multidisciplinary approach. It needs a more

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comprehensive methodology that will formulate those problems more adequately than heretofore, devise a more wholistic or "total-system" perspective, and propose more fitting public policies and social structures for coping with them. We do not lack ethical norms and values. Indeed, we have more than we know how to implement in any coherent, consistent, cohesive manner where public policy is at stake. What we urgently need is a proper perspective and greater insight in formulating the problems about our common humanity under present global conditions and in a cultural climate of crisis.

As public debate about "high technology" has become increasingly polarized and politicized, public leaders in the environmentalist movement, political activists, religious groups, and certain government officials tell us that our "unsafe, unforgiving, alienating, centralized hard technologies" raise key issues which are not technical or economic or scientific, but "moral and ethical." They go on to assert that experts in high technology are professionally unqualified for making ethical or moral judgments, because they can only make technical assessments or economic cost/benefit analyses. Moreover, even if experts were qualified, their moral judgments would be tainted, self-serving, and clouded by motives of profit and avarice. Experts are accused, by implication, of valuing their careers over human lives. Only persons who are scientifically illiterate and technically ill-informed can be trusted to raise moral and ethical issues for public debate. It would appear that expertise in scientific and technological matters is a corrupting influence on the purity of moral judgments.

Obviously the impediments to formulating ethical problems in accord with such reasoning are multiple and profound, but one fact of life is becoming increasingly clearer: ours is a new ethical situation. Heretofore, ethicists have assumed that the effective range of consequences of human action—hence human responsibility—was confined to the here and now, to known and intended effects, to defining "the human good" as an imperative to be expressed in the moral quality of "neighbor values"—justice, truthtelling, freedom, respect for human rights, etc. So conceived, ethics is anthropocentric, with the nonhuman world of Nature serving as a backdrop, an ethically neutral instrument subject to human purposes. But science, technology, and a population explosion have drastically changed the causal scale of human activities, as well as our integration within nature's delicate web. As a consequence, traditional "neighbor" ethics has become increasingly problematic, because it is too individualistic, too shortsighted and piecemeal in its definition of problems, goals, and moral values. When confronted with seemingly awesome changes in the range and power with which human actions have global effects continuing into future generations, a traditional "neighbor" ethic is simply inadequate to the task of defining criteria for effecting "the human good." To formulate the problems which reflect a new ethical situation, our perspective must be enlarged, not only with a more comprehensive time horizon, but also with a capacity to acquire and disseminate an unprecedented degree of accurate, scientific, technical knowledge which is both presently verifiable and predictive.

This situation is complicated further by a curious social paradox: as public attention to complex social issues mounts upward, public understanding gyrates downward under the burden of complexity. Confidence in our social institutions has undergone a dramatic decline; fears and fantasies have all but obliterated public recognition of reasonable arguments. As in previous times of deep historical change, we are now experiencing an irruption of superstition, a withdrawal into mysticism, a surge of emotionalism and irrational fascination with disaster movies and dramas about demonic possession. Many persons express a desire for a simpler life, a return to a low-consumption and low-energy society. This desire becomes linked with an anti-technological attitude, a mounting distrust of persons engaged in applying advanced technologies within a society. An "anti-expert" emotion leads to the credibility problem: "The experts cannot be trusted" because they have a stake in the outcome of scientific research or technological success. It is not to be wondered at that public debates over the potential hazards and risks of recombinant DNA research, genetic engineering, birth and death control, as well as centralized industrial technologies have become natural outlets for ventilating many irrational needs at this juncture in human history.

It is essential to recognize this state of affairs as a precondition for doing any sort of justice to public concern over alleged biohazards associated with solid waste management. We may be persuaded that ours is a rational scientific age where blind beliefs, prejudices, and presuppositions can be exposed, if not dispelled under the purifying light of objective facts. But the record of events in this decade alone should convince us that the mesh of the net which filters "the facts" is still being woven by psychic forces which succumb to fateful determinism, to superstitious fascination with the Demonic, with personified powers of Evil lurking at the edges of social reality. Facts are held hostage by perception.

Using that skeleton key, an ethicist considering

the problems of solid waste management will sooner or later discern that the issues being raised are clustered into at least three distinct levels. The clustering correlates with a capacity to perceive, analyze, and weigh a spectrum of risks. So far, the most prominent "moral issues" have clearly emerged from a horizon of perception fixated at its narrowest focus. They are dictated by a personal risk-aversion, with only marginal consideration, if any, of greater social risks and costs that are at stake. A few issues have been raised by those whose perception has recognized the inescapable connection between risks and benefits which must be weighed and balanced so as to determine the acceptability of perceived risks. Still fewer issues have emerged from a perception that certain risks must be accepted when compared or contrasted with other greater risks which are much less acceptable.

A fundamental ethical premise emerges: if ethical issues are to be adequately raised and debated publicly, then they must be based not upon risk-aversion, nor simply upon cost/risk/benefit analyses, but more comprehensively, on comparable-hazard and risk/risk assessments. It is ethically irresponsible and unjustifiable to foreclose public consideration of deeper ethical reflections by making moralistic *a priori* judgments. Two examples are currently prominent. "Since plutonium is the most toxic substance in the world and can be made into weapons, it is intrinsically evil." Or, "Making safety-policy decisions based on assigning finite, monetary values to human lives is immoral."

It is not my purpose here to debate, much less resolve, complex theoretical disputes about which issues are legitimately ethical or moral. My task is a more modest one, namely to bring the perspective of bioethics to bear on one fundamental question: what ethical principles and priorities might serve to clarify the difficult task of utilizing sophisticated risk-analyses, of educating public perceptions about risks that seemingly diminish "safety," and of maintaining social realism as we consider the case before us.

This bioethical perspective on the putative risks entailed by managing hazardous solid wastes begins with some commonsense assumptions. In the first place, I presume that the term "wastes" is being applied with a modicum of technical precision as well as respect for ordinary usage. In the interest of definitional clarity, the term should denote anything which is unproductive or has exhausted its value or is without immediate or foreseeable utility for fulfilling human needs. The origins, locations, and volume of hazardous solid wastes are matters of fact. Presumably, it is a matter of scientifically established fact that adverse health effects, somatic or genetic, may result from exposure to certain kinds of solid wastes under conditions where the dose is in excess of certain levels of tolerance. It remains a matter of value judgment, however, that certain types of wastes ought to be considered a potential source of unacceptable risks to the environment and health of human beings. That is to say, such wastes could be judged "unacceptable" in either of two ways: first, they are perceived to be so hazardous and intractable that technological methods of disposal must provide for, and indeed guarantee, both their permanent containment and isolation from a human environment for as long as they have potentially adverse effects on human health; or secondly, the risks associated with hazardous wastes are so unacceptable that their technological sources must be eliminated from a human environment without regard to cost, social or financial.

To make either of these judgments in a manner which is as ethically and socially responsible as can humanly be expected, we are compelled by their far-reaching consequences, as well as by our current cultural situation, to give careful consideration to the ethical problems that derive from three controversial aspects of policy-making about public safety: the appropriateness of using sophisticated, scientifically-calculated risk analyses of experts having unintended side-effects on public risk-perception; the proper responsibility of scientific experts, legislative bodies, and regulatory agencies in shaping the process of policy-making for public safety; the status of public education concerning the risks and hazards that allegedly threaten our quality of life in a high technology society.

All too frequently and uncritically, many people assume that the "safety" of any human artifact or process is an intrinsic property that can be measured by the reduction (or even absence) of risks. The difficulty underlying this assumption is complex, both philosophically and technically. There is little disagreement about saying, "A thing is safe if its risks are judged to be acceptable," or in defining risk as "a measure of the probability and severity of harm to human health" (*1*). The difficulty takes root in the fact that risk-measurement—however objective and scientific—is nonetheless probabilistic. The ordinary citizen is neither trained nor accustomed to thinking in probabilistic terms, rather, he/she thinks in what Philip Pahner calls a mixed "rational-intuitive manner," greatly influenced by a threshold of awareness or perception anchored in subconscious images of horrifying events (*2*). Indeed, when probabilities are given numerical quantifications and indexes (e.g., one in a million) anxieties are not appeased but magnified. Another

source of the difficulty is the fact that judgments about the acceptability of risks, or safety judgments, are derived from subjective, shifting, evolving personal and social value priorities. Measuring risks does not automatically entail judging safety. These are two distinct cognitive activities, qualitatively different from each other. Here lies the root of public misconceptions, disputes, and false expectations about the ability of scientific experts to "measure safety." It is risks that are measurable, quantifiable, predictable, whereas safety is an immeasurable, relativistic value judgment. Failure to recognize two basically different activities at work in policy-making for public safety has had a number of unfortunate consequences.

In the first place, on the assumption that ever more exhaustive knowledge of actual and potential risks associated with a product or process, in this case "solid wastes," will automatically yield greater degrees of safety, enormous sums of money and hours of human effort have been poured into risk analysis. Every conceivable category in the anatomy of risk seems to have been exhaustively addressed, namely: psychological research into factors influencing or determining public risk-perception; multiple types of risk-analysis expressed in probabilistic quantifications and extrapolations into "maximum credible accident" and "worst case" scenarios; studies about units and costs of risk-reduction either of the consequences or of the frequency of an incidence; cost/risk/benefit quantifications designed as an instrument for decision-analysis; acceptable-risk criteria designed to conform to public perceptions about risks to present and future generations.

Despite its good intentions, purposes, and promises, risk-analysis has been applied unfortunately within traditional institutional frameworks in ways that force risk-assessments to be piecemeal, ad hoc, haphazard, isolated for one-at-a-time consideration. In the public domain, one hazard is spotlighted for a time, giving way to another in unending succession: DDT, lead, cyclamates, the Pill, red dye #2, PCBs and PCVs and PBBs, now saccharin.

Moreover, each regulatory agency has its own mandate to control one category of hazards on which to conduct ongoing research, at the same time making a case for more federal funds to do more research in further risk reduction. Not only does piecemeal, selective concentration magnify certain hazards at the data-gathering and risk-analysis levels, but the public is led to believe that the more studied risks are by that very fact the more dangerous to public health and safety. But this is clearly not the case.

Radiation control programs are an apt illustration. The BEIR Committee has recognized the possibility that cost/risk/benefit analyses—if truncated or inadequately conducted—might single out some biohazards for regulation, and in so doing, actually set up conditions for a decrease in public health. This admonition is stated in this way: ". . . the public must be protected from radiation but not to the extent that the degree of protection provided results in the substitution of a worse hazard for the radiation avoided. Additionally, there should not be attempted the reduction of small risks even further at the cost of large sums of money, which spent otherwise, would clearly produce greater benefit" (*3*).

The Environmental Protection Agency seems to have disregarded this caution when applying its great zeal to implement the upper limit, zero-threshold, linear-dose model which the BEIR report proposed simply as a recommendation. An EPA regulation imposed on the uranium fuel cycle requires that it contribute nothing in excess of 25 mrem/year to the exposure of any member of the public. If radiation protection philosophy requires regulatory agencies to set radiation standards that safeguard the public from demonstrable, detectable biomedical effects, then the upper limit of 25 mrem could just as well be 75 or 100 or more without any greater probability of increasing noteworthy, detectable adverse effects. Moreover, it has often been pointed out that this regulation is much more stringent than radiation levels ignored, or at least tolerated, by EPA regulators in several other technology-induced sources. The 25 mrem ceiling per year is: "a factor of 20 less than the 500 millirem per year measured in the Grand Central Station in New York City; a factor of 20 less than the 500 millirem per year of cosmic radiation received by an airline stewardess who spends 20 hours per week at high altitude; a factor of 4 less than the 100 millirem geographical difference in natural background radiation between Denver, Colorado, and New Haven, Connecticut; a factor of more than 1000 below the lowest dose rate at which any harmful effects have been observed on either people or test animals" (*4*).

There is no evidence that any member of the public has suffered injury or death from the uranium fuel cycle. By contrast, routine medical x-rays, according to one conservative estimate, exact a cancer toll of 2700 deaths per year. By any commonsense standards of comparable-hazard analysis, public concern over uranium fissioning and expenditures of huge sums of money to reduce already negligible risks even further have been magnified out of all due proportion.

By selecting certain risks for piecemeal public consideration, and failing to represent comparable

or greater risks as a contextual frame of reference for balanced consideration, responsible legislators and regulators—and their scientific consultants—are systematically excluding ethical priorities in providing protection to public health and safety.

It may seem amusing to suggest that something in this nation has not yet been counted, but we have some urgent undone business here. What we really need is a whole new field of numbers. We need to know, with the most comprehensive overview, how much public money is spent to reduce ordinary diseases and accidents and hazards that afflict major segments of the population, the cost per capita to reduce them, and precisely at what point vast amounts of money may be pouring into budgets that can assure only minor gains in the status of public health. We have a surfeit of statistics on public health, but those data are not arranged by any responsible public institution so as to look at risks to the entire population relatively, to make comparisons, to maximize cost-effectiveness so as to get the most public health for the many out of the expenditure of public money. Comparable risk-analysis is talked about, but it is not acted on or used responsibly at a comprehensive level by those state and federal agencies empowered to do it.

Ethics cannot do the data-gathering and risk measurement which are minimal and indispensable to making value judgments. Ethics can only examine and justify a set of priorities, based on some fundamental principles. We find such a set of principles at work in this statement by Cohen (*5*). "In limiting the release of harmful materials to the environment, therefore, a balance or trade-off must be determined between expenditure and degree of restriction of release, the objective being to maximize the effective use of financial resources. . . . It should be noted that in expenditures to reduce a particular hazard [whether carcinogens, radiation, urban or industrial pollutants etc.] at some given cost (C), the return per unit expenditure decreases as the total expenditure increases. It may also be noted that no matter how much money is expended, a further reduction could be attained by additional spending. Beyond a certain point, however, money might be more efficiently spent to reduce a different hazard where the benefit per unit of investment would be greater. This point would be at the intersection of the cost-effectiveness guideline and the diminishing returns curve."

Since safety is a value judgment based on personal and social priorities, then it becomes sensible to say that—when cost/risk/benefit ratios make it clear that a point of diminishing returns on investment of time and public money has been reached—then the particular product or process under scrutiny is "safe enough."

Such reasoning is objectionable to some persons, however, again because of the failure to recognize two different cognitive activities at work in safety-policy making. Critics attack the methodology of cost/risk/benefit quantifications for the absurdity of "putting a price on human life" or "giving a finite monetary value to a being that is infinitely valuable." They see it as a case of "measuring the immeasurable." They do not recognize the distinction between two discrete activities involved in making safety judgments. Those who defend the methodology have sometimes used simple observations, such as "There are necessary tradeoffs in any public policy decision," or "Everyone puts a finite, monetary value on one's life when buying life insurance, installing safety mechanisms in a home or auto, taking hazardous jobs because they pay higher wages." Such analogies are true enough, but not sufficient. The public must be educated and confronted with the fact that any society has but a finite amount of money to spend on public health and safety, and that the ethical problem is to get the most protection for the most people from this finite amount.

What is really at issue in this methodology is not the propriety or impropriety of putting some callous "dollar value" on human life or injury as a moral judgment of individual worth, much less of using economic losses to society as a measurement of personal expendability. The point at issue is how efficaciously we as a society are expressing the valuation we place on human life. The public should have long since been confronted with a threefold ethical justification for cost/risk/benefit quantifications, namely: we are in fact maximizing the value we as a society place on human life when we endeavor to allocate public monies in such a way as to reduce widespread hazards, thereby preventing as much loss of life and protection from injury as possible; by utilizing this method, we minimize arbitrary, piecemeal, isolated, selective decisions, and instead aim at the most socially responsive and responsible process of decision-making about the cost-effectiveness of finite resources and public revenues; with this method we have visible and verifiable standards for judging the accountability of elected or appointed officials in their allocation of public monies in a just and equitable manner.

Those responsible for making public policy in the management of solid wastes have only begun to wrestle with a basic ethical question. Have we in fact maximized the value we place on human life if we spend billions of dollars to avoid lethal exposure of a few persons to solid wastes, while the expenditure of public monies on preventing the death of

thousands of persons from accidents at rail-crossings, dam failures, or inadequate health care delivery to the elderly, the poor, the vulnerable persons in our society is by comparison a matter for national embarrassment? To be sure, we spend more money per capita on medical care than any other nation, but how trivial it seems by comparison with the amount of public money expected to be spent on managing solid wastes which, when contrasted with other greater risks to the public health of the many, pose levels of risk approaching negligible proportions.

The quest for "safety" via sophisticated methods of risk analysis has another unfortunate side effect, namely, a widening discrepancy between the quality of risk-perception among scientific and technical experts, and the quality of risk-perception induced in the so-called "plain man" by various second- and third-hand interpreters. Experts in psychological research have sought to identify, not only the factors determining public risk-perception, but also specific criteria that would have to be met to render risks socially acceptable. By endeavoring to tailor proposals for criteria that will conform to existing levels of public perception, several experts in the scientific and technical community are not engaged in any studies of how to educate public risk-perception, but instead how to capitulate to a set of conditions wherein the public has grown steadily out of touch with, and antipathetic toward, the technical sophistication embodied in risk-analysis of various scientific and technological advances.

As the gap of mutual confidence and trust widens, the scientific and technical community is being drawn inescapably into the public and political arena where it is reluctant to enter for two understandable reasons: *qua* scientist, the professional expert feels committed to objectivity, distance, immunity from distorting biases; *qua* researcher, the expert wants to exercise extreme caution, so as to assure continued funding from financial sources that are public and to minimize vulnerability to charges of conflict of interest. However understandable, these reasons are no longer self-justifying in our current cultural situation. By abdicating a social responsibility to engage in effective public education through the political process, members of the scientific and technical community are abandoning the field to special interest lobbies, self-appointed social reformers, and ambitious journalists.

Besides their own reluctance, members of the scientific community have been offered other excusing reasons. Representatives of the legal and political community, such as Harold Green, have argued that scientists and technical experts are not *per se* qualified to participate in public safety determinations based on cost/risk/benefit methods of evaluating drugs, industrial pollutants, and the like; that the political process should not be made to conform to scientific standards for objectivity, factual accuracy, and "informed value judgments," and that since the goal of the political process of policy-making is "the optimum resolution of conflict," the adversary process "may require the symbolic acceptance of something as true which in fact is untrue or only partly true" (*6*). In sum, deliberate distortions and factual errors are not only tolerable but inescapable in democratic policy-making, including safety policy.

Quite apart from the questions of intellectual honesty and professional ethics which this line of argument raises, it does not constitute an ethical justification which relieves members of the scientific and technical community from their increasing public responsibility to educate the citizens of a democracy. Contrary to Harold Green, scientific expertise and professional standards for factual accuracy, as well as "informed value judgments," are not an elitist substitution for a political decision-making process, but an indispensable enrichment of it as a condition for protecting the public interest.

The problem of public education in matters of risk-measurement and safety judgments has steadily acquired a special urgency. For a decade, we have been living in a cultural climate dominated by what is popularly called "the environmental crisis," "our crisis of finitude," or "man's discovery of an ecological conscience."

Without a doubt, we are the best informed society in history. Consequently we are the most forewarned, anxiety-prone, exhorted, and guilt-ridden of cultures. This state of affairs is unprecedented for three reasons: dire predictions are being made, not simply by run-of-the-mill alarmists, but by several "authorities" or "experts" who appear credible; their projected catastrophies are not local or national but global; their credibility is enhanced by the dramatic medium of mass communication, and the public's insatiable thirst for bad news.

At least since Earth Day 1970, we have been inundated with allegedly hard evidence that the deterioration of the human species and our natural environment is accelerating at an exponential rate, and that our only habitable planet has been raped and polluted by technological man, recklessly driven on by rugged individualism and selfish greed for profits. The damage inflicted seems to approach eco-catastrophe. Rivers and streams have been turned into sewers. Species of birds, animals, and plants are supposed to be becoming extinct at a rapidly increasing rate. Insecticides and weed

poisons help to produce more food for starving populations, but their toxic chemicals appear to have found their way up the food chain to enter and poison ourselves.

Technological interventions, pretending to be "solutions" to problems we had not thought through adequately are indicted for being not only insufficient but downright dangerous: it is advanced technology in industry, agriculture and medicine that has generated the environmental crisis in the first place. Our high technology society is accused of having done more than any other to release toxic chemicals and radiation sources into the environment. Allegedly, radioactive carcinogens have made the preparation of food a lethal operation. Expert environmentalists testify at congressional hearings that even mother's milk is now poisoned. The world has become dismally unsafe.

Permit me to suggest that this environmental-crisis mentality, plus the broad social movement, the federal legislation of 1969 (NEPA), and all the regulatory machinery generated by it, constitute an urgent problem about public education: namely, how are we to recover and maintain some historical and scientific perspective that will introduce a balanced judgment about the alleged environmental hazards posed by advanced technology? Many insist that these biohazards have generated a self-evident crisis. But no crisis is self-evident. There are only recognized problems which have, in some people's minds, assumed critical importance.

Among others, William Lowrance in *Of Acceptable Risk* urges us not to succumb to historical amnesia. When certain environmentalists deplore the degradation which "technological pollution" has in their eyes wrought on this planet, he suggests that we remember what life without it at the turn of the century was really like: spoiled food, impure water, boiling laundry kettles, the backyard lye pot; nutritional deficiencies and poisoning from many natural/organic vegetables. Rivers were so filthy with raw sewage from human wastes that, according to the saying of the times, bait died on the hook. The major insecticide 75 years ago—sprayed on everything from apples to strawberries to grapes—was not DDT, but lead arsenate or Paris green. Women canned food with such preservatives as boric acid and formaldehyde in high concentrations. Red food coloring was not red dye #2, but lead chromate—a horror to today's biochemist. Fatal diseases were not leukemia or Hodgkins disease or subtle forms of cancer. They were pneumonia, influenza, tuberculosis. Average life expectancy was 40-45 years, and 13% of all infants died before their first birthday. Today, as some people worry about the disinfectant hexachlorophene in soap, why do they so easily forget the harsh carbolic acid it has replaced and the surgical operations it has made safer? Have the risks and hazards to public health and safety increased in fact, or only in our levels of perception? Lowrance puts the case well: "We now have the luxury to worry about subtle hazards which at one time, even if detected, would have been given only low priority beside the much greater hazards of the day" (*1*).

Not for a moment am I suggesting that new hazards do not exist or that we should abandon attempts to control technology-induced risks to health, to teach industries better habits of efficient use of resources and of waste management, or to insist that social costs should be internalized by industry so that consumers are not forced to pay for what they disapprove of. But I am suggesting strongly that those responsible for educating present and future citizens of this globe, and those responsible for setting regulatory standards, must meet ethical priorities for maximizing public health for the many—that is, for the working classes, the poor, the elderly, the vulnerable persons in our society—and not the vocal minority.

Let us not lose sight of the fact that the ecology movement flourishes only in affluent nations, and only among groups of persons whose socio-economic level and quality of life have guaranteed that basic subsistence and security needs have been abundantly met—usually by parents, or a network of charitable or self-appointed public interest organizations. Among those who find the concepts "small is beautiful" and "soft technology" most appealing, how many of them actually live in conditions where these concepts exist as concrete realities? It is less than wise to select long-term public policies based on predilections of those who are still in an impressionable stage, or who have yet to meet the demands of making a living, or who have not actually lived within an entire social system made to conform to what they are recommending.

George T. Lock Land, author of Grow or Die: The Unifying Principle of Transformation, has this to say about environmentalist priorities (*7*):

> "Even the most calculated over-dramatization of future environmental horrors has not yet begun to approach the realities of a world in which most people live without the 'malevolence' of man's evolutionary technology.
>
> Frenzied alarm over 'ecocide' generates an insidious camouflage that hides the truly apocalyptic human suffering of today. Pollution? Eight of ten humans lack sanitary disposal and seven of ten still are without an adequate supply of safe water. Waste of resources? Over half of the human race lives with hunger, which drains energy and stunts body and mind. . . .
>
> Rebalancing the books of disease, starvation and

misery is our mission, not protecting nature's balance and its extravagant claims on the suffering of the human race."

The burden of responsibility to educate ordinary citizens in the art of evaluating risk-potentials and reaching a consensus on reasonable levels of safety cannot be carried principally, much less alone, by academicians from nonscientific disciplines. We share a common social problem of effective public education. If it does not receive major attention soon, we shall most assuredly be depriving ourselves of resources and scientific advances that are unequivocally essential for the preservation and ongoing improvement of the quality of public health and safety for the many.

We can and shall continue to devise technical solutions to the management of solid wastes and other threats to the quality of our physical environment. If only we could manage to balance our excessive concern and expenditure of public money to reduce risks from various pollutants (or excessive concern for endangered species of plants and animals), with a concern to reduce the risks we are bequeathing to future generations from the unsolved problems of starvation, poverty, racism, and social inequities—then our legacy would indeed be a spiritually gratifying benefit for our common humanity.

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