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This special commentary provides a critical review of some of the serious hazards associated with modern technological innovation and the substandard interest in the health, safety and welfare of man and the preservation of a safe environment. The authors, scientific experts in the field of atomic energy, draw from their work experience with nuclear technology in presenting some provocative examples of apathy on the part of governmental and industry concerning the long term adverse effects of technological innovation and resulting by-products. In addition the article elaborates on several specific proposals directed to legislative and regulatory governmental bodies concerning the exercise of their responsibility for regulation of new technology. The authors caution that their proposals represent only minimum practical considerations to be fulfilled before proceeding with any new technology.

We have been rudely awakened in the past several years to the realization that our environmental integrity, and thence our health, may be compromised through the injection of technology's by-products into the environment. The most pessimistic among students of ecology consider that this process has already proceeded beyond hope of repair, and

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that human and other species may not survive. The most optimistic see no problem at all. Generally the latter group is closely associated with the entrepreneurs of technology. Whether our oceans are already irreversibly compromised by heavy metals, DDT, or other poisons yet to be washed into the oceans from sources already provided by man's technologies is problematical. If so, there is little more than academic interest in discussing rational possibilities for future behavior.

On the other hand, while we should be thoroughly warned, we may not as yet be beyond the point of no return. In this case it does indeed behoove us to examine why technological advance can lead us to the brink of environmental disaster. And having done this, it would seem profitable to ask how we might improve our future behavior, with the express view of trying to enhance the chances for survival of living things, plant and animal. In particular, these are imperative questions shrouded by simple responses—confusion, self-interest, naivete. Why do major legislative bodies not act to safeguard the multitude of constituency? Why have their past actions been inadequate, inconsiderate, incompetent? *What should be done*?

The endeavor of these writers in the pages that follow is to present some factual allegations and practical considerations derived from scientific training and experience. It is hoped that these considerations will be impressed upon the legal minds of all the bodies of legislative representatives throughout the country, whether they are now, or at some future time will be confronted with the implementation of a new technology and the uncertain potential of the technology by-products for producing deleterious consequences upon the environment.

We were introduced into such considerations through our experiences in atomic energy. What we have learned through such experiences is, to be sure, of great relevance concerning errors, and their correction, in programs of peaceful and military applications of atomic energy. However, far more general lessons are available from such experiences; lessons that should be applicable to a large spectrum of current, or potential, technological by-product poisons. Atomic energy programs, especially nuclear fission for electricity generation, present more glaring, overt examples of mishandling of a technology than do some others. A focus upon such programs is, therefore, especially helpful in delineating larger problems.

The Societal Justification for Technology

There was a time when invention and innovation could perhaps have been regarded as self-evident benefits to man. The simple ma-

chines such as the lever, the wheel, or the pulley would seem to be examples. The internal combustion engine-driven automobile, descended from the wheel, is not at all a clear and unqualified boon to man, at least in its present relationship to society and the environment. Broadly, however, innovation has had such wide acceptance for its "miracles" that few would, until recently, have questioned the "obvious" benefits of technological advance. The reason for questioning arises because of by-product poisons or by-product effects upon our health or way of life, either as a result of manufacturing activities or utilization associated with innovations. It has become apparent that the process by which scientific discovery, invention, or innovation translates into major technological endeavor, including industrial manufacture, operation, and distribution does not necessarily encompass a thorough accounting for potential by-product "undesirables", nor for the effects of such "undesirables". Why should it be that so very late in the period of technological development of our society we arrive at this realization? Answering this requires some critical examination of the way technology and innovation are introduced and operated.

We shall approach several facets of technological innovation, illustrate the pitfalls accompanying each, and suggest possible legislative remedies for protecting the public interest.

The Promotional Bias of Technological Innovation

Inventiveness and innovation are encouraged as the bases for new industrial and manufacturing endeavor in a profit-oriented society, as well as in societies otherwise organized. In either case the presumption is made that more, bigger, and better products will necessarily enhance what we call the "standard of living." Many have appropriately questioned whether the real quality of life is thereby truly improved. It is a characteristic of innovative endeavor that enthusiasm and drive are prominent features. If the enterprise orginates in the private sector, the lure of economic profit is ever-present, and enthusiasm is directly related to the magnitude of potential future profitability. If the enterprise originates in the public sector, *e.g.*, in a governmental agency, there is the promise of "service to the public", as well as the potential for transfer to the private sector with ultimate economic gain.

It would seem of little moment to question whether such enthusiasm is intrinsically undesirable. In truth, it is doubtful that anything new would ever be undertaken without enthusiasm on the promotional side. What is worth emphasizing here is that dollars in huge numbers are a prime requisite for an innovative enterprise of any consequence. And

it is, of course, precisely such enterprises which must concern us, for these are the ones whose by-products can affect a large segment of the nation's population. Entrepreneurs who are about to invest sizeable amounts of capital are not likely to do so if the recommendation by scientists and engineers is hedged with numerous concerns over potentially deleterious by-products or side effects of the new technology. Overtly and covertly such technologists necessarily will tend to see the great promise of the enterprise in producing societal benefits. Hazards will be minimized or overlooked in their "sales" procedure and, further, the technologists are characterized by an undying optimism that science and technology can provide a technical solution for all the potential hazards of environmental or health degradation.

If the enterprise has persisted in the developmental stage for some period of time, the investment of capital will have grown, men will have commited prestige to it, and reconsideration becomes increasingly difficult, both for the technologists and the entrepreneurs. The result is that optimism concerning the enterprise is widely expressed; doubts and hazards are rarely encountered.

A remarkable case in point is the utilization of the atom, via nuclear fission, for generation of electricity. In this case, a governmental bureau, the Atomic Energy Commission, promoted the technology. Congress, in the Atomic Energy Act of 1946,[1] had given the AEC the specific mandate to seek out beneficial applications of atomic energy, in addition to the mandate to provide nuclear weapons for the national security. Controlled chain reactions, utilizing nuclear fission as the source of energy, had been demonstrated to be operable during the wartime production of plutonium. The utilization of such nuclear-fission reactors to produce heat and, thence, steam to drive electricity-generating turbines was obviously possible. The enormous amount of energy available per pound of uranium appeared attractive.[2] The availability of unlimited electric power appeared to be an obvious benefit to society. Small wonder that the AEC launched enthusiastically upon its campaign to sell the idea that nuclear electric power was to become one of the peacetime blessings of the atom.[3] And in the early days of that promotion the promise was suggested that electric power from the atom would be so cheap as not to be worth metering.[4] Elimination of dirty coal mining, coal hauling, belching smokestacks of fos-

1. Atomic Energy Act of 1946, 42 U.S.C. § 2011 *et seq.*
2. U.S. ATOMIC ENERGY COMM'N, UNDERSTANDING THE ATOM, *Nuclear Reactors* (available through U.S. AEC, P.O. Box 62, Oakridge, Tenn. 37830).
3. *See* keynote address of C.E. Bagge, Vice-Chairman of the Federal Power Commission, before the American Power Conference in Chicago, Illinois, April 21, 1970.
4. *Id.*

sil-fueled plants all looked attractive. It is not difficult to understand the enthusiasm with which the AEC carried forward its mission of developing this particular beneficial application of atomic energy. And for the reasons outlined above, it is not difficult to understand the rose-colored glasses through which nuclear power generation was viewed by AEC technologists, with respect to issues like hazards and economics. Congressional appropriations are not enhanced by too fervent a presentation of the potentially negative aspects of a technology.

So the public and the Congress was sloganeered with "clean, cheap, safe" nuclear power.[5] Yet, today, many years down the pike, there is a large and growing public resistance to the installation of nuclear electric power plants in numerous areas of the country.[6] Indeed, there is strong citizen and environmentalist opposition to essentially every existing or proposed installation.[7] Very serious challenges have been presented to each of the three facets of the AEC's slogan—"clean, cheap, safe." It is clear to everyone that nuclear power is anything but cheap, *in spite* of the numerous subsidies this industry has so generously been provided. Serious questions have been raised concerning the "clean" aspects of nuclear power. There is significant evidence that the guidelines for permissible public exposure to radiation from "peaceful atom" programs can lead to a public health calamity of major proportions.[8] For example, the Federal Radiation Council (now incorporated into the Environmental Protection Agency) had specified that the U.S. population could legally be exposed to a radiation value averaging 0.17 rads (1 rad represents 100 ergs of ionizing radiation energy per gram of tissue).[9] Recent estimates show, however, that such an exposure, by

5. GOFMAN AND TAMPLIN, POSIONED POWER: THE CASE AGAINST NUCLEAR POWER PLANTS, *The Nuclear Juggernaut,* introduction (1971).

6. *See, e.g.,* citizens interventions at construction and licensing hearings for nuclear electricity plants:
   (1) The Sierra Club with respect to the Bodega Head Reactor proposed by Pacific, Gas and Electric Corporation;
   (2) The Lloyd Harbor Study Group intervention (1971) in the Shoreham, L.I., proposed Reactor of Long Island Lighting Corporation;
   (3) Multiple Intervenors v. Consumers Power Company (with respect to the Palisades Nuclear Plant), AEC Reports, Vol. 3, Opinions & Decisions, 175 (1967).
      (a) Michigan Steelhead and Salmon Fisherman's Association.
      (b) Thermal Ecology Must be Preserved.
      (c) Concerned Petitioning Citizens.
      (d) Michigan Lake and Stream Associations, Inc.
      (e) Sierra Club.

7. *See, e.g.,* speech by H.C. Brown, Jr., The AEC Goes Public, A Case Study in Confrontation, before the Atomic Industrial Forum's Topical Conference on Nuclear Public Information, Los Angeles, California, February 11, 1970.

8. Gofman and Tamplin, *Low Dose Radiation and Cancer,* in INSTITUTE FOR ELECTRICAL AND ELECTRONIC ENGINEER TRANSACTIONS ON NUCLEAR SCIENCE, 1-9 (NS-17, February 1970).

9. FEDERAL RADIATION COUNCIL, STAFF REPORT NO. 1, *Background Material for the Development of Radiation Protection Standards,* Part V, at 26-30 (May 13, 1960).

no means reached yet, would ultimately lead to 32,000 extra cancer and leukemia deaths per year in the exposed population.[10] Further, it has been indicated that the genetic mutation rate would be increased between 5 and 50% from this exposure, leading ultimately (in several generations) to between 100,000 and 1,000,000 extra deaths per year from genetically determined diseases for a population of 200-million persons.[11] So the guidelines of "permissible" or "allowable" exposures under which peaceful atom programs, such as nuclear electricity generation, proceed are under serious challenge with respect to acceptability.

Numerous challenges have been made in state after state concerning AEC permissible radio-activity releases to the air and water, with concern over irreversible fouling of the environment.[12] Disposal of astronomical quantities of radioactive fission products (inevitable by-products of nuclear electricity generation) has properly aroused serious concern. A National Academy of Sciences report has criticized AEC disposal practices at several installations.[13] An acceptable mode of disposal (or more properly, guardianship) of these fantastic quantities of radioactive waste from nuclear electricity generation, while under development, has by no means been successfully put into operation.[14] Yet nuclear reactors are being planned and installed in numerous metropolitan areas[15] and, if operated, will generate these enormous quantities of radioactive waste. The nuclear power plants now on drawing boards and being built are commonly of the order of 1,000 megawatts, electrical. In one year of operation such a plant generates long-persistent radioactive fission products equivalent to those produced by a 20-megaton nuclear fission bomb (approximately 1,000 times that of the bomb exploded over Hiroshima, Japan).[16] So with respect to potential environmental contamination and injury to public health, nuclear electricity

10. TAMPLIN AND GOFMAN, POPULATION CONTROL THROUGH NUCLEAR POLLUTION 16 (1970).

11. *Id.* at 22-27.

12. *E.g.*, the State of Minnesota Pollution Control Agency proposed regulations for the Monticello Plant of Northern States Power Company in 1969 which were fifty times more stringent than AEC regulations. The Vermont Public Health Department has done likewise for the Vernon, Vermont, Yankee Nuclear Power Plant, 1970; as has the Illinois Pollution Control Agency for the Dresden-III Nuclear Plant of Commonwealth Edison Company, 1971.

13. Report to the Division of Reactor Development and Technology by the National Research Council to the Atomic Energy Commission, May, 1966 (unpublished report available from National Academy of Sciences, Washington, D.C.).

14. *A Nuclear Graveyard,* NEWSWEEK, March 29, 1971, at 60.

15. *See* U.S. ATOMIC ENERGY COMMISSION, NUCLEAR POWER PLANTS IN THE UNITED STATES, June 30, 1970. (This report covers plants operable, plants being built, and those planned. It is updated biannually and is available through the U.S. AEC, Washington, D.C.) As of June 30, 1970, 95 such plants in toto were operable, being built, or planned.

16. J. GOFMAN AND A. TAMPLIN, POISONED POWER: THE CASE AGAINST NUCLEAR POWER PLANTS, *The Nuclear Legacy: Radioactive Wastes and Plutonium,* c.8 (1971).

generation is by no means *obviously* clean. Whether all steps in the complex pathway from uranium mining to ultimate radioactive waste disposal can be accomplished without environmental fouling and population over-exposure to radiation is extremely problematical. We witness utterances by the AEC and the electric utility industry that the public will never receive more than a small fraction of the "permissible" exposure.[17] At the same time the AEC fights desperately to prevent any reduction in the codified "permissible" doses to the public. This overt inconsistency in promises and actions has resulted in widespread skepticism concerning AEC credibility.

Lastly, with respect to "safe" nuclear power generation, it can be stated flatly that no one is in any position to predict the risk of a major accident at a nuclear power plant. Bland, unsupported guesses abound from nuclear power promoters.[18] The unadorned fact is that we simply have no actuarial experience on nuclear power plants that would allow assurance that the risk of a major accident is as low as one per hundred per year.[19] Yet such plants are now being built close to major metropolitan centers throughout the country. If one considers that we are told there will be 100 such installations by 1980,[20] we find there is no reassurance we won't have *one* major accident per year. The AEC itself produced a study which indicated that a major accident could result in seven *billion* dollars worth of property damage and require evacuation of several hundred thousand humans.[21] Since that report was prepared, the reactors being built are some five times larger, and because of longer planned operating cycles, may contain, overall, 10 times as high an inventory of long-lived radioactivity. One author, W. H. Jordan, has suggested that additional engineering safeguards might cut the potential radioactivity release in an accident by 10-fold.[22] But, with 10 times the inventory present, this still could lead to the same disastrous consequences as those described in AEC's earlier report. So the "safe" aspect of nuclear electricity generation is anything but accepted. There simply exists no evidence to document

17. *See, e.g.,* speech of T. Thompson, AEC Commissioner (deceased), Power Technology and the Future, delivered at Briefing Conference for State and Local Government Officials on Nuclear Development, Columbia, South Carolina, May 21, 1970.

18. *See, e.g.,* Speech by G.T. Seaborg, AEC Chairman, Misunderstanding the Atom, delivered at the National Press Club Luncheon, in Washington, D.C., March 22, 1971.

19. INGLIS, *Nuclear Energy and the Malthusian Dilemma* in SCIENCE AND PUBLIC AFFAIRS: THE BULLETIN OF THE ATOMIC SCIENTISTS, January, 1971, at 14.

20. *See* note 15 *supra.*

21. U.S. ATOMIC ENERGY COMMISSION, THEORETICAL POSSIBILITIES AND CONSEQUENCES OF MAJOR ACCIDENTS IN LARGE NUCLEAR POWER PLANTS, WASH-740, March, 1957.

22. Jordan, *Nuclear Energy: Benefits versus Risks,* PHYSICS TODAY, May, 1970, at 32.

safety. Jordan has suggested "the only way we will know what the odds really are is by continuing to accumulate experience in operating reactors."[23] Residents of major metropolitan centers ask why they should be the guinea pigs in this gigantic experiment to determine the chance of a major nuclear power plant accident.

Nuclear electric power, with all of its sloganeered virtues, cheapness, cleanness, and safety, is under serious challenge. And such challenge is not being answered satisfactorily after many years of research and development. Indeed, the challenges are not being answered at a moment when major plants are being designed, built, and put into operation.

Any intelligent person is, of course, led to ask why all the hard questions have not been asked earlier in this development of nuclear electricity. Hasn't anyone been given a mandate to investigate the hazards of nuclear electricity generation? Of course, such a mandate has been provided—to the Atomic Energy Commission. Through the action of Congress, this one executive agency was asked to seek out beneficial applications of atomic energy and to do so with due concern for the public health and safety.[24] The evidence indicates that such a dual charge is an impossible responsibility.

The very nature of technological innovation, in atomic energy or in other areas, is such that the promotional aspect cannot fail to dominate where both promotional and regulatory functions are under one roof. But the difficulty goes much deeper. Even if the functions are separated, it is rare that adequate funding would be provided to enable discovery and publicity concerning the adverse potentialities of any new technology. Thus, we truly have a major *missing* institution in our technological era—*adversary* assessment of technology.

Legislation is urgently needed to establish this missing institution.[25] Unless some reprisal-free group is given a specific mandate to search out the potentially adverse aspects of a new technology, it can hardly be expected that the entrepreneurs, private or governmental, will do so. Atomic energy is a classic case where the entrepreneurs have failed to

23. *Id.*
24. Atomic Energy Act. of 1946, 42 U.S.C. § 2011 *et seq.*
25. Although the AEC is a federal agency the federal government has not totally preempted the field for regulation of the associated problems in the nuclear technology. The Atomic Energy Act of 1954, as amended in 1959, expressly allows the Atomic Energy Commission to delegate regulatory powers over certain atomic radiation hazards to the states. 42 U.S.C.A. § 2021. California concluded such an agreement with the Atomic Energy Commission in 1962, and codified it as CAL. HEALTH & SAFETY CODE §§ 25875, 25876. Presently the states may regulate by product materials, source materials, and special nuclear materials not sufficient to form a critical mass. CAL. HEALTH & SAFETY CODE § 25876.

provide the "other side of the picture" openly and forthrightly. Nor should this reasonably be expected of the promoters of a technology.

The legislative response we suggest requires that whenever a new major technology is considered, a certain fraction of the investment should be placed into an agency, free of domination by the entrepreneur. The funds so set aside should finance a vigorous adversary group of scientists and technologists (plus economic and social scientists) with the explicit *mission* of developing the strongest case *against* the new technology. Further, the findings of such adversaries must be placed in the open forum so that a dialogue in full public view can be conducted between the promoters of a technology and the adversaries.

Some may suggest that such a process could prevent the development of any new technology. Not at all. If the promoters of a new enterprise cannot answer the adversary arguments, they obviously have further homework to do before exposing the environment *and* the public to the potential hazards of the technology. And if the dialogue is held behind closed doors, the opportunity for suppression of findings is self-evident.

This article proposes that such legislation, in order to develop the other side of the picture, encompass technologies introduced *either* by the private or the public sector. We submit that the cost of the adversary investigations will, in general, be very small compared to the cost of the technology itself, probably far under one percent of the funding of the development of the technology.[26] Had such a viable institution of adversary assessment existed during the past 20 years of atomic energy development, it is extremely doubtful that the current heated debate over nuclear electrical generation would exist.

There is considerable latitude for description of precisely how the adversary function should be set up. This is a fertile field for the country's legislative bodies to explore. The key requirements are:

(a) Independence and reprisal-free status for the adversaries.
(b) Open, public presentation of the adversary findings.
(c) All major technological innovations must be subjected to adversary assessment at an early point in their development.

Public Disenfranchisement

Atomic energy presents us with another extreme example of dangerous practices in a technological era, practices which definitely require legislative remedies. Only poorly known to most of the public, includ-

26. Gofman and Tamplin, *A Proposal to Establish an Adversary System of Scientific Inquiry*, 9 ENVIRONMENT ACTION BULLETIN, January 2, 1971, at 4-6.

ing, no doubt, an appreciable segment of the legal profession, are two pernicious features of the development of nuclear electricity. These are:

(1) Loss of the right to redress in the event of property damage from nuclear power accidents.
(2) Loss of insurance protection in the event of nuclear accident damage to property.

(1) Loss of right to redress.

As the Atomic Energy Commission proceeded with its development of nuclear electric power technology, it attempted to interest the electric utility industry to start building nuclear power plants.[27] A reluctant utility industry expressed concern over the potential liability in the event of a nuclear disaster.[28] The private insurance industry refused to insure against such liability for the obvious reason that the potential cost was estimated to be enormous.[29] Atomic power development appeared to face an impasse. Congress, under the prodding of the Joint Committee on Atomic Energy, resolved this problem by passage, in 1957, of the Price-Anderson Act,[30] possibly the worst piece of legislation pertinent to technology. This Act established a ceiling on the liability for damages arising out of an accident in a nuclear power facility. Originally, the maximum liability was set at 500-million dollars;[31] later increased to 560-million dollars.[32] Even so, the private insurance industry refused to carry more than 82-million dollars of this insurance liability, so the public assumed the burden for the remainder of the 478-million dollars worth of insurance.[33] Now, since estimates of potential damage have ranged in the neighborhood of 7-billion dollars,[34] it appears inescapable that, at best, the public stands to recover seven cents on each dollar of property damage from a major nuclear power plant accident. This can hardly be regarded as a good prospect of redress for damage incurred from the nuclear electricity technology. The electric utility industry, freed of liability, was willing to build nuclear power plants *after* the Price-Anderson Act was passed.

It is hard to understand why an agency of government, such as the

27. *See* note 3 *supra.*
28. *See* note 5 *supra.*
29. *See* note 21 *supra.*
30. Price-Anderson Act, Pub. L. No. 85-256, 71 STAT. 576.
31. *Id.* at § 170(c).
32. Atomic Energy Act of 1946, c. 724, § 170, 60 STAT. 755, *as amended,* Pub. L. 89-645, §§ 2, 3, 80 STAT. 891.
33. Green, *The Risk/Benefit Calculus in Nuclear Power Licensing,* in SYMPOSIUM ON NUCLEAR POWER AND THE PUBLIC, University of Minnesota, October 10-11, 1969 (1970).
34. *See* note 21 *supra.*

United States Atomic Energy Commission, should be permitted to license the construction and operation of nuclear power plants that are uninsurable. If, as the optimists of the AEC and the electric utility industry claim, nuclear power plants are safe, they should certainly be insurable. If they are not safe enough to be insured fully, they clearly are not safe enough to be licensed. The Price-Anderson Act should be repealed forthwith, and similar future legislation absolving industries of liability for damage they may produce should itself be prohibited by some type of legislation.

(2) Loss of insurance protection.

As the nuclear electricity industry burgeoned forth, the private insurance industry observed it carefully and took important action *over* and *above* its refusal to insure the nuclear power plants directly. Presented here are two exclusion clauses from a homeowner's insurance policy.[35] Such clauses are the rule in current homeowner's policies.

> Nuclear Clause—Section I: The word 'fire' in this policy or endorsements attached hereto is not intended to and does not embrace nuclear reaction or nuclear radiation or radioactive contamination, all whether controlled or uncontrolled, and loss by nuclear reaction or nuclear radiation or radioactive contamination is not intended to be and is not insured against by this policy or said endorsements, whether such loss be direct or indirect, proximate or remote, or be in whole or in part caused by, contributed to, or aggravated by 'fire' or any other perils insured against by this policy or said endorsements; however, subject to the foregoing and all provisions of this policy, direct loss by 'fire' resulting from nuclear reaction or nuclear radiation or radioactive contamination is insured against by this policy.
>
> Nuclear Exclusion—Section I: This policy does not insure against loss by nuclear reaction or nuclear radiation or radioactive contamination, all whether controlled or uncontrolled, or due to any act or condition incident to any of the foregoing, whether such loss be direct or indirect, proximate or remote, or be in whole or in part caused by, contributed to, or aggravated by any of the perils insured against by this policy; and nuclear reaction or nuclear radiation or radioactive contamination, all whether controlled or uncontrolled, is not 'explosion' or 'smoke'. This clause applies to all perils insured against hereunder except the perils of fire and lightning which are otherwise provided for in the nuclear clause contained above.

35. Hartford Insurance Company, Homeowner's Policy issued to J.W. Gofman, in force, 1971.

The private insurance industry has, through such exclusion clauses, expressed its lack of confidence in the safety of the nuclear electricity industry. One cannot fault the private insurance industry for taking the necessary steps to protect itself from the nuclear electricity industry. One should condemn both the Atomic Energy Commission and the electric utility industry for failure to point such exclusion clauses out as they describe the wonders of the atom.

Whenever a technological development occurs, and the private insurance companies resort to exclusion clauses to protect themselves, public hearings must be ordered to ascertain why this has occurred. Licensing of such technologies should be withheld pending such hearings and subsequent action. It would seem that under such circumstances the affected public should be entitled to express their opinions by a vote on whether or not the technological installation should be permitted. Further, even with such a vote, it should be a requirement that government provide the full insurance denied by the exclusion clauses before government is permitted to issue licenses for construction or operation of such facilities.

The "Standards" Hoax

Most people assume that when a government agency sets a "permissible", "tolerable", or "allowable"[36] level of a toxic material, they (the public) can presume exposures below such a level are without biological harm. Witness the use of the term, "standard", to describe such levels. The very word is meant to imply safety. Where the public derived such confidence is hard to explain, other than the general concept that government operates in the public interest. Representatives of governmental agencies and spokesmen for the particular technology producing such toxic materials unabashedly contribute to the public misimpression that "permissible" means "safe". The recent history of the radiation standards controversy is a classic illustration of the hoax being perpetrated upon a trusting public.

In our work experience with atomic energy and nuclear fission we have found there is no scientific basis for *any* "permissible" level of a toxic substance released into the environment. No scientific basis exists for designating any amount of radiation as "safe", nor is there any scientific basis for similar "standards" for lead, mercury, chlorinated hydrocarbons, or a variety of food additives. In general, it can be quite fairly stated that *all* such so-called standards are fabricated from thin air.

36. 10 C.F.R. Chapter 1, § 20 *et seq.*; *see* note 9 *supra.*

If a challenge is made concerning safety of so-called "permissible" levels of a poison such as radioactivity, the agencies involved will generally retreat to the position that the benefits to be achieved will outweigh the risks of exposure at the specified level of the toxic material. But in no case of which we are aware has a presentation ever been made to the public (or to anyone else) of the benefits to be received or of the risks experienced. Moreover, it has never been demonstrated that the benefits ostensibly to be received are indeed received by those who suffer the risks.

This entire deception is intimately bound up with the promotional nature of the technological innovation. Once it becomes clear that a by-product poison is associated with a technological endeavor, relief is required for the promoter in the form of a "permissible" dose for public exposure. The biomedical community is prevailed upon to provide standards the technology can live with. Obviously the more stringent the standards, the higher will be the cost of containment for the technological poison. So the requirement, if the technology is to compete, is for the greatest possible laxity in the standard-setting procedure. The biomedical scientists generally chosen to provide the "standards" are either directly in the employ of the technology (governmental or private employer) or are recipients of research grants or consultantships from the technology. Imputing evil motives to no one, it seems apparent that a massive conflict of interest exists. If the "standards" are challenged, resort is quickly sought in the statement, "[o]ur greatest scientific experts set the standards." This is supposed to dismiss all questions. If, indeed, this nonsense is accepted for a variety of technologies, we as a society are assuredly well launched on the path to genocide. For most of the toxic materials, with radioactivity as a prime example, the serious effects which concern us are cancer or leukemia 5 to 40 years after exposure, teratogenic effects upon fetuses in utero, and genetic effects, these last only being expressed in one or more generations. Since the effects are almost invariably delayed, it follows that human evidence should *never* be demanded before the toxic material is judged potentially harmful to man. But this is precisely the reverse of our established practices for radioactivity and for many other toxic materials of commerce. We are all narcotized by such statements as, "[n]o detrimental effects have been observed in humans for the exposure levels permitted."[37] The unwary public *presumes* this means that an adequate

37. *See* remarks by T. Thompson, AEC Commissioner (deceased), prepared for conference on Nuclear Power and the Environment at the University of Vermont, September 1, 1969, at 23. (Proceeding available through U.S. A.E.C., Washington, D.C.)

set of observations has been made. This is almost never the case. When the promoters of technology say "no effect observed", it invariably means no meaningful study has been made. But they are rarely challenged concerning this overt deception. Further, if we are concerned, for example, about genetic mutations in humans, shall we wait one or more generations to learn that a "permissible" dose of technological by-product may have compromised the future of the human species?

In order to protect the environment in which we live from "the standards setting hoax", we would recommend that a legislature, faced with the problem of regulating an existing or proposed technology, take into account the following minimum practical considerations.

(1) The "Permissible" Level of Toxic Materials Must be Set at Zero. All Deviations from Zero Pollution Are to be Negotiated.

The so-called "standard-setting" bodies, which are composed of scientific "experts", have been making profound moral judgments for society. This is the only interpretation of their setting "standards" based upon benefit-risk relations. Nothing qualifies *any* expert to make such judgments.

It is perfectly proper for bodies of scientific experts to make estimates of anticipated risk per unit of exposure to a toxic by-product. Such bodies must be required to present any such risk estimates in an open, public forum, subject to challenge by independent or adversary groups. Only in this way will the knowns and uncertainties be thoroughly aired for such risk estimates.

Any *deviation from zero* as a "permissible" level of man-made toxic material must be *negotiated* before a Pollution Control Board, chosen to be representative of a broad segment of the public community. Any such deviation will, in general, represent the moral judgment that human suffering and premature deaths are acceptable in exchange for a presumed benefit of a technology. It is this latter realization that makes expert bodies of scientists so inappropriate for setting allowable exposures. Such experts simply have not been ordained to make *moral* judgments for society as a whole.

(2) Evidence of Injurious Effects Upon Humans Should Never be a Requirement for Assessment of Hazard.

Until the present, the philosophy underlying the introduction of by-product poisons into the environment has been that the potential victims must prove, through producing *human* corpses, that harm accrues

to humans. The burden of proof must be shifted to the polluter; that is, the polluter should be required to prove safety.

Repeatedly one encounters apology for potentially toxic materials based upon the statement, "[t]oxicity has only been proved for rats or mice."

While it is true that response or sensitivity variation in species does indeed exist, this variation is hardly an excuse for permitting human exposure in the absence of direct evidence in humans. A *minimum* public health principle should be the assumption that humans are *at least* as sensitive as the most sensitive experimental animal species tested.

(3) Toxic Effects of a By-Product Must be Assumed to be Proportional to Dose (Unless Positive Evidence to the Contrary is Available).

It is commonly stated that potential human exposures to toxic by-products will be at doses much lower than those for which toxic effects have been demonstrated in experimental animals. It is tacitly hoped, by promoters, that such a statement will be sufficient to dismiss concern over low-level exposure. Until and unless proof is presented that the dose-response relationship is other than direct proportionality, such proportionality must be assumed down to the lowest dose levels.

It may be objected that requirements such as those listed here be restricted to those potentially toxic by-product materials which can affect significantly large numbers of humans. But modern technology is *characterized* by its rapid introduction on a nation-wide basis. As a result, it is almost a certainty that a very large segment of the population will rapidly be exposed to risk by any toxic products of the technology.

Summary

This article has endeavored to identify some serious hazards associated with burgeoning technologies. Atomic energy provides prime examples of the kinds of hazards that can arise. Legislative remedies are urgently needed as a *beginning* effort to cope with such hazards, for atomic energy or similar technologies. We believe there is serious reason for questioning the survivability of the human species in the absence of legislation directed toward provision of remedies. It is felt, further, that our task is to point out the general aspects of the kind of legislative relief required. The legislature is far better qualified to consider the detailed implementations of such recommendations.