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A CONGRESSIONAL SEMINAR

(A) THE HISTORY OF ERRONEOUS HANDLING OF THE RADIATION HAZARD PROBLEM IN ATOMIC ENERGY DEVELOPMENT

(Presented by John W. Gofman)

(B) A PROPOSAL FOR A RATIONAL FUTURE PROTECTION POLICY WITH RESPECT TO RADIOACTIVITY AND OTHER FORMS OF POLLUTION

(Presented by Arthur R. Tamplin)

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(A) THE HISTORY OF ERRONEOUS HANDLING OF THE RADIATION HAZARD PROBLEM IN ATOMIC ENERGY DEVELOPMENT

INTRODUCTION

It must come as a shock to members of the Congress that approximately 25 years into the Atomic Era we should be in the midst of a raging controversy concerning potentially disastrous effects upon the health of our population, both of this and future generations, as a result of currently allowable Federal Radiation Guidelines.

We believe a disaster does indeed lie ahead unless several drastic steps are taken. Our purpose is to explain why we, as a Nation, are in this dilemma and to outline essential, constructive steps to extricate ourselves. We believe, further, that nothing short of Congressional action can produce a satisfactory resolution.

Let us start with several positive statements that go directly to the heart of the problem. Then point by point we shall elaborate with the necessary and pertinent details.

I. The Atomic Energy Act appropriately called for the development of the benefits of peaceful atom together with regulation of such development in a manner to protect the health and safety of the citizens of the USA.

II. A hopeless impasse was created through the investiture of both the promotional and regulatory functions in one agency - the Atomic Energy Commission.

There is neither need nor indication to question motives or sincerity of officials of the AEC. The AEC has simply been placed in an impossible position by having the dual responsibility of promotion of peaceful atomic energy and protection of the public from radiation hazards.

(III) The Creation of the Federal Radiation Council with a charge to weigh Benefits of Atomic Energy Development against Risks of Atomic Energy has been a grievous error.

As a body to assemble evidence concerning Risk, the FRC might have functioned effectively. But then the risks and benefits should have been placed in the public forum, for debate on such major issues, followed by decisions in the Congress or even by direct referendum.

There is no evidence that a real Benefit vs Risk Evaluation has ever been achieved by the FRC.

(IV) The Entire Approach to Safety in Atomic Energy Development has been totally the reverse of a sane approach. While the simplest elements of sound public health practise require that a technology promoter prove the safety of his activities, we are faced with the ludicrous situation in Atomic Energy where the public (out of its meager resources) must prove the technology is unsafe, for the AEC assumes the prerogative of going ahead without proving safety of its activities.

(V) The Essence of the Problem is that the AEC Programs will lead to the release of grossly too much radioactivity into the Environment.

(VI) It is inherent in the nature of promotional activity that promotion comes first; protection of the public health and welfare, last. At

all points, where doubt exists, the scale is tipped by promoters against the public health and welfare.

HISTORICAL BACKGROUND

All of you are well aware of the difficult years of the 1950's when controversy raged over the weapons testing program of the AEC and the hazard of radioactive fallout produced. Emotions ran high, because important issues of National Security were involved. As a result, this period provided no reasonable backdrop for a sane approach to the development of the "peaceful atom". Tempers and controversy cooled during the 1958-1961 moratorium, only to flare seriously with the resumption of weapons testing by the USSR in 1961, followed by Pacific and Nevada Test Site weapons testing by the USA. The credibility of the AEC was at a low ebb both among scientists and the lay public as a result of the controversies of the 1950-1960 decade.

In 1962, radioiodine fallout from the Nevada Tests caused serious alarm, particularly in the State of Utah, where milk radioiodine reached disturbing levels. Public anger was high and the AEC Commissioners were under severe criticism. The AEC felt that there must be some way in the future to avoid a recurrence of such a situation, which had further depressed the already low credibility of the AEC with respect to its regard for the public health and welfare.

The AEC proposed to the Lawrence Radiation Laboratory at Livermore that an integrated program of Bio-Medical Research, closely associated with a nuclear explosives development laboratory, might obviate such crises in the future. Dr. John Foster, then Director of the Laboratory consulted with me, with Dr. Tamplin, and others concerning the wisdom of

establishment of such a program at LRL Livermore. The need for an integrated program dedicated to a total evaluation of radionuclide release (through AEC programs) upon the biosphere, particularly upon man, was clear. The question in all of our minds was whether such a program carried out in an AEC weapons research laboratory would achieve any credibility whatever in the Community-at-large, or whether it would be labelled as self-serving and untrustworthy. The issue of promotion and protection in one Agency was all too clear even then - to all of us. Three points convinced us to go ahead with this integrated Bio-Medical Program.

(a) The directors of LRL-Livermore assured us that we of the Bio-Medical Program would have absolute independence to carry out the requisite investigations, no matter how much the findings might represent a thwart to Programs promoted by LRL or by the AEC or both.

(b) AEC Chairman Seaborg and Commissioner Haworth reassured us that all they wanted was the truth, in response to our assertion that we would not brook any effort to interfere with full disclosure publicly of our research findings.

(c) We, ourselves, felt the issues at stake were of the highest national importance and that we were fully capable of resisting any efforts to suppress the truth.

In retrospect, we feel we should not have been nearly so optimistic that unfettered investigation of the public health hazard of a technology is possible under a promoter's auspices. The dilemma became obvious early, became progressively worse, and has become essentially explosive at the present time.

The lesson to be learned by scientists, by the public, and by the Congress is that with everyone involved being of the highest motivation and sincerity, promotion of a technology and protection of the public from ill effects of the technology represent a totally impossible, unworkable situation "under one roof". Such a combination should never again be allowed to develop for atomic energy or any other major technology. It is simply unfair to all the humans involved, and cannot fulfill its appropriate responsibility to the public.

THE NATURE OF THE PROGRAM TO EVALUATE THE IMPACT OF RADIONUCLIDE RELEASE UPON THE BIOSPHERE AND MAN

We visualized our program as having 3 parts:

(a) Understanding how much radioactivity was going to be released by such AEC programs as Weapons Tests, Plowshare, nuclear reactors, and radioisotope utilization.

(b) Tracing such radioactive materials through geosphere, atmosphere, and hydrosphere, through food chains with the ultimate objective of estimating the radioactivity and radiation burden to humans and their ecosystem.

(c) Paramount, understanding the effects upon man of whatever radiation burden was to be received from AEC programs.

We have worked diligently, and, we believe, effectively, toward achieving these objectives.

Some Early, Grave Concerns

Two issues began to bother us very seriously from the outset. First, several of the AEC programs clearly envisioned appreciable or large releases of radioactivity in what can be regarded in no manner

other than uncontrolled dissemination. The various Plowshare programs involving cratering, canals, harbors, etc. looked particularly disturbing, and early we made our views known concerning this. It was, therefore, no shock to us that the Plowshare program enthusiasts at the Laboratory soon came to refer to the Bio-Medical Program as "The Enemy Within".

Second, our earliest studies of the Effects of Radioactivity upon Man led us squarely to the issue of how anyone had ever come up with a so-called "Permissible" or "Allowable" dose of radiation. Yet the Federal Radiation Council had set such an "Allowable" dose, both for the population-at-large and for atomic energy workers.

We searched hard for any scientific evidence that any such "Allowable" or "Permissible" dose of radiation could truly be regarded as safe, in the sense of being free of harm to humans, or virtually free of such harm. We could find no such evidence. We were quite disturbed at this and so informed the LRL Laboratory Directors repeatedly, as well as AEC officials and numerous AEC advisory bodies, including the General Advisory Committee, the Plowshare Advisory Committee, and others.

The words of the Federal Radiation Council were that the "allowable" dose of radiation was set at such a level such that the benefits to society of development of atomic energy were sufficient to be worth the risks. Unfortunately, any specifics of consequence either with respect to benefits or risks were simply absent. So we had a benefit-risk calculation with no numbers for benefits, no numbers for risks, nor even a statement of who would get the benefits and who would take the risks.

We presented publicly our concerns over the absence of scientific justification for "allowable" doses of radiation and over the

vacuous nature of the "benefit-risk" jargon at a Plowshare Symposium in 1964 at Davis, California. Reaction was swift. A famous scientist at our laboratory labelled me as a "Trojan Horse" with respect to the Plowshare Program. Washington AEC displeasure was readily discernible, although controlled. Above all, it was becoming increasingly clear that the valiant words "all we want is the truth" were likely to be honored primarily in the breach.

Why Didn't We Make a Loud Criticism of Standards in 1964?

It can be validly asked why we did not actively challenge all radiation standards in 1964 if we were unable to defend them. In retrospect, we truly wonder this ourselves. But there were certain specific factors operative:

(a) Plowshare programs and nuclear power reactors were not about to burgeon forth immediately on a wide scale.

(b) We, like many others, were mesmerized by what represents a fantastic error of thinking that has characterized atomic energy development. This error is that if one can't prove a particular dose of radiation is unsafe, the technology is allowed to proceed - even though it may be doing massive harm. How we came under this mesmerizing spell, we really shall never know. We have no defense, other than that we were simply foolish. What we can say is that we, at least, have broken the bonds of this nonsensical spell, while so many of our AEC colleagues are totally and blissfully still mesmerized.

It pays to look even closer at why we failed to see what should have been obvious to us in 1964. We said then we could not defend the standards set by the FRC, but we didn't fight them. In addition to the

erroneous public health approach of going ahead when safety is not assured, there were two specific mythologies widespread in atomic energy circles. Even we were taken in by these extremely soothing myths. One can properly regard these myths as an invention, conscious or subconscious, that always serves the purposes of a promoter.

MYTH No. 1: "Maybe there exists some amount of radiation that is a "safe" threshold." By this is meant that possibly cancer or leukemia or genetic injury won't occur provided the total radiation dose is kept below some magic number. We now know that this is a convenient hope -- especially of atomic energy promoters, but it is a hope unsupported by any scientific evidence. Indeed, what supposed evidence was said to exist for so-called "safe" thresholds has been discredited by numerous reputable scientists repeatedly. But the promoters keep hoping that somehow, somewhere evidence will be developed that a safe amount of radiation exists. Indeed, even now, the present leadership of the Bio-Medical Division has a program labelled "The Search for a Safe Threshold of Radiation". At the same time, stronger and stronger direct evidence in man and in experimental animals points clearly to the law that no safe amount of radiation exists. Harm, in the form of extra cancers, extra leukemias, will occur down to the lowest doses. We even know from the remarkable work of Dr. Alice Stewart in England, confirmed in the USA by MacMahon, that just a diagnostic x-ray examination in late pregnancy provokes a 50% increase in childhood cancer and leukemia! So, as you can see, the idea of a "safe" amount of radiation has been rather hopelessly shattered.

MYTH No. 2: "Maybe slow delivery of radiation, as in atomic energy applications, won't produce as much cancer and leukemia as delivery all

at once". Some apparent evidence in experimental animals seemed to support this idea. Why we didn't realize early that this evidence was erroneous, we don't know. We think possibly our psychology was such that we just didn't want to question this "last hope" for radiation being safe.

Many scientists did question this, notably Lewis and Pauling, and others. Indeed, even before our rude awakening, the International Commission on Radiological Protection had stated clearly that it was unsound to count on any protection against cancer and leukemia from slow delivery of radiation. They refused to count on such protection. Strangely enough, even the U.S. Federal Radiation Council claimed it didn't count on such protection by slow delivery of radiation. The real point concerning the FRC is that they didn't use their own statement in practise.

What Brought Us to Life in October, 1969

Unhappy as we were about the radiation standards we were still partially mesmerized by the myths I've just described to you. We studied the developing evidence carefully. And much evidence kept pouring in. The humans irradiated in Hiroshima-Nagasaki were, with the passage of years, developing not only leukemia, but other forms of cancer, of lymph glands, of the thyroid, of the lungs, of the breasts. Humans irradiated in England for treatment of a form of arthritis of the back first started to show excessive leukemia, and then with the passage of years, they showed excessive lung cancer, lymph gland cancer, bone cancer, pharynx cancer, and stomach cancer. From elsewhere came additional supporting evidence of the various cancers being induced in humans by radiation.

We poured over all this evidence; we looked for some features common to all the evidence. And what we found was startling, shocking, and enormously disturbing. What we already knew from experimental animal work was now painfully clear for humans. All the major forms of human cancer are produced by radiation. Indeed, there is every reason to believe it can be said that all forms of human cancer are produced by radiation, since even if the rare ones weren't, it wouldn't affect the magnitude of the disaster that loomed up.

What was even more startling was that it appeared quite clear that a particular dose of radiation increased all forms of cancer and leukemias to approximately the same degree. By this we mean, if spontaneously a particular cancer would occur in 100 people in a population, a certain dose of radiation would increase this form of cancer by about 10%, and it would increase all other forms of cancer by 10% of their spontaneous occurrence rates. And, even worse, it appeared clear that children and infants-in-utero were even 10 times more sensitive to cancer and leukemia induction by radiation!

Up to that point most people had already become convinced that leukemia and thyroid cancer were clearly induced by radiation. The developing evidence from Japan and Britain had added all the others alluded to above. But, in general, estimates of hazards of radiation were still primarily based upon leukemia, with a small allowance for other cancers.

Our evidence and generalizations indicated that the cancer + leukemia hazard was 10 to 20 times worse that most workers thought!

We quickly calculated that the currently allowable Federal Radiation Council Guidelines could lead to 16,000-32,000 extra cancers + leukemias each year in the USA -- and this would be a real national disaster. To be conservative, and non-alarmist, we chose to minimize the problem - and only report the 16,000 extra cancers + leukemias.

How Did We Come to Life in October, 1969?

Clearly, the time for action concerning radiation guidelines had arrived. Nuclear reactors and Plowshare were no longer dreams; they were imminent realities. Radioactivity releases approaching the FRC Guidelines must be averted. We decided to present our evidence before a highly respected learned body, in the best tradition of science. The Institute for Electrical and Electronic Engineers was holding a major Scientific Symposium on Nuclear Science and the Environment, and had invited us to speak on our radiation work. We made our evidence public before this learned scientific body, the Proceedings of which become part of the scientific literature.

In spite of our developing reservations about the desire of the AEC to know the truth, we felt our evidence was so overwhelming that they would join us in a recommendation for an immediate lowering of the allowable radiation exposure. Thus, in our presentation, we urgently invited the Atomic Energy Commission, who shared our concern about the public health, to join us in this effort.

The Instinctive Reaction of the Promoter

Far from joining us in an effort to protect the public health and welfare, the AEC unleashed a blistering attack upon us, with slander, ridicule, denial - with everything but any valid evidence refuting our

findings. Platitudes and non-sequiturs emanated from the AEC like the unloading of the clip of an M-16. Many of our laboratory colleagues turned on us with statements like, "Don't you realize what that will do to our budget?" Or, "So you say 16,000 to 32,000 extra deaths from cancer and leukemia will occur from guideline radiation - what makes you think that's too many?"

Well, we are more concerned about human health and welfare than about our laboratory budget. Second, we hadn't even remotely seen any benefits that made it necessary to kill 16,000 to 32,000 extra Americans annually from leukemia and cancer - and besides, the choice of deciding whether so many deaths were acceptable belonged to the American public - we had to let the facts be known.

The lesson of hopelessness of the dual role of promoter and protector (the AEC status) was painfully clear to us. Gone completely were the pious phrases about "We want you to tell the truth". Faced with a threat to its bureaucratic, parochial interests, the AEC clearly demonstrated that, when the chips are down, the promotional role wins out handily over the protector role!

We are not critical of the AEC, nor of the apoplectic reaction of its officials, sputtering and fuming insults at us. They are victims of having been placed in a hopeless quandary by the Atomic Energy Act which assigned them two conflicting, irreconcilable roles - promoter and protector. The proper approach is not to criticize the AEC, but rather to take away from them all the authority and responsibility for public health protection and all aspects of regulation of atomic energy. Once this is accomplished by the Congress, the AEC will undoubtedly function satisfactorily.

The AEC Programs Plan to Release Too Much Radioactivity

An even more important lesson has been learned from the AEC reaction to our findings. That is the obvious fact that the AEC has plans to release far too much radioactivity into the biosphere and the environment. How do we know this? From several lines of evidence.

(1) When we announced our suggestion of at least a 10-fold reduction in allowable radiation for the population, the AEC countered with the claim that nuclear power reactors would give even less radiation than our new proposed standards. The nuclear power industry claimed the same. To all this, we said, "Bravo, then you certainly can have no objection to our proposed lowering of radiation guidelines". But they (AEC + nuclear power industry) still fought the reduction of the allowable dose, which means that they really must not believe what they are saying about delivering a very low dose.

(2) Further, for AEC itself, they have a variety of Plowshare programs (peaceful nuclear explosives), every one of which is accompanied by the discriminate or indiscriminate spewing of radioactivity into the environment. One of the most pernicious programs (although all are pernicious) is natural gas stimulation by underground nuclear explosives, with the production and sale of radioactive gas to the unsuspecting consumer. When asked about the radioactivity, the stock answer is, "We'll never exceed the guidelines of radiation exposure". What this translates into is, "We won't produce any more cancers + leukemias than the FRC Guidelines legally permit". The Plowshare Program, above all, is desperately furious about the thought of not being permitted to irradiate humans. This technology we regard as an

answer looking for a question. Nuclear bombs, the Plowshare advocates reason, have to be good for something!

(3) The Executive Director of the Federal Radiation Council, Dr. Tompkins, has frequently pointed out in Congressional testimony that he thinks the guidelines are not too high, indeed he thinks they could be raised three-fold or so. He usually adds that "operational requirements" are as important as risks in deciding guidelines.

Lest these euphemisms are unclear, we must translate them for you. If AEC Programs burgeon forth and release radioactivity to the point where the current guidelines are in danger of being exceeded, his approach would be that "operational requirements" dictate giving people more radiation. A three-fold increase in guidelines would mean 96,000 extra cancers + leukemias instead of 32,000 per year.

The reasonable idea that maybe the wrong programs are being sponsored by AEC and lead to high exposure of humans simply doesn't seem to occur to these people.

WHAT'S HAPPENED RECENTLY

We have continued to probe more deeply into all the evidence, from human studies, from experimental animal studies. It has become quite certain that the true number of cancers + leukemias will be closer to 32,000 extra deaths per year, rather than the 16,000 we originally announced. We had suspected this at the outset, but we wanted, as mentioned above, to be very sure.

The myth that a safe radiation threshold exists is now all but totally exploded. Every evidence we look at points away from any

safe threshold and points to the correctness of the statement "No amount of radiation is safe".

The myth that slow delivery of radiation gives less cancer than fast delivery is all but exploded. The supposed evidence came from experiments where slow delivery extended late into the animal's life, when sensitivity is lower. All that these experiments prove is that we should be especially wary about irradiating children!

Most important of all, and adding to the despondency of the AEC, is the fact that we are by no means alone in our estimates of cancers + leukemias from federally allowable radiation dosages. After our initial publications, we received a copy of Publication-14 of the highly respected International Commission on Radiological Protection. When we use the latest numbers in that publication, and treat the data very conservatively, we find their numbers lead to a minimum estimate of between 11,000 and 18,000 extra cancers + leukemias per year from FRC Guideline Radiation. So we are in no conflict with the ICRP.

But the AEC can count on some stalwarts from the laboratories it supports with research funds. These stalwarts produce no evidence that our numbers are wrong. They just produce no evidence at all. Instead we hear:

"The AEC has a wonderful record".

"No hazards are better understood than radioactivity".

"The standards are fine right where they are".

"The benefits outweigh the risks".

But no evidence.

And this teaches us, and should teach the Congress, a most important lesson in the effort to preserve a livable environment for humans with respect to radioactivity or other pollutants: -- Expecting scientists, whose research and livelihood come from a promoter of technology, to provide the truth concerning hazards, where the truth thwarts the technology, is like expecting our Christmas Eve dreams of Sugar Plum Fairies to become reality. Sugar plum fairies may be real, but we better not count on it.

A SCIENTIFIC CHALLENGE TO THE ATOMIC ENERGY COMMISSION STAFF CONCERNING THE CANCER + LEUKEMIA RISK FROM RADIATION

Because the AEC Staff had criticized where we presented our findings, when we presented our findings, and to whom we presented our findings, we decided to find out if they really wanted to get at the truth of our findings.

In the Halls of Congress, on January 28, 1970, we issued the following challenge: (Quote)

"Chairman Holifield, we urge you to nominate a jury of eminent persons, physicists, chemists, biologists, physicians, Nobel Prize Winners, or National Academy of Science members, or American Association for Advancement of Science members -- none of whom have any atomic energy axe to grind. We urge you to serve as Chairman of a debate. Dr. Tamplin and I will debate each and every facet of the evidence concerning the serious hazard of Federal Radiation Council Guidelines against the entire AEC Staff plus anyone they can get from their 19-odd laboratories, singly, serially, or in any combination.

With their 20-year background on this problem and their large staff to draw on they should be razor-sharp at a moment's notice. We are ready now. If there is any valid reason for questioning our submission to peers and for questioning our evidence, this eminent jury of peers will certainly determine so. If the debate before eminent peers is not held, then by default I think the entire country and the world will know the answer without further question."

That was January 28, 1970.

Today is April 7, 1970.

The AEC Staff has not been heard from.

It appears as if the true answer <u>is</u> known by AEC default.

(B) A PROPOSAL FOR A RATIONAL FUTURE PROTECTION POLICY WITH RESPECT TO RADIOACTIVITY AND OTHER FORMS OF POLLUTION

INTRODUCTION

Environmental pollution is a matter of extreme moment. Decisions concerning pollution should not be made in secret by so-called experts. The burden of proof should be shifted from the public and/or the government regulatory agency to the pollutor. The pollutor must be made responsible for convincing the public that he has done everything possible to reduce the level of pollution and that the benefits to be derived from his activity outweigh the risk of the remaining pollution.

POLLUTION AND THE FRAGILE HUMAN ORGANISM

Mankind seems to have an unbelievable amount of self-esteem. We believe that we can take a tremendous amount of adversity and survive and in this belief, we are correct. But the important fact that we seem to overlook is that we pay for these insults to our physiological competence. We pay for them in terms of reduced physical fitness and a shortened lifespan.

For the wide variety of toxic materials that are introduced into our environment as pollutants, there are various standards established that are called permissible levels or maximum permissible levels. Generally, these standards represent concentrations below, usually considerably below, the level where immediate and obvious symptoms of disease would occur. We are therefore lulled into complacency by being

led to believe that concentrations below this permissible level are harmless. This is not necessarily true. In fact, for most pollutants it is undoubtedly incorrect. Although it is below its permissible level, a pollutant is most likely still causing its adverse effect but at a rate that was too small to observe in the small number of short-lived experimental animals upon which it was tested, or in the brief period of time that it was tested in a small group of human subjects. The human subjects are usually adults and little is known about the long-term effects on the growing and developing child. As a result, the pollutant may have an effect that was overlooked in the testing procedures or could not have been observed in the tests. Such would seem to be the case with thalidomide, and, as a result, new drugs are now tested for their effect on the developing fetus.

Moreover, the effect of two pollutants in combination may be far worse than the sum of the effects of the individual pollutants. For example, radiation combined with cigarette smoking is ten times worse than radiation alone. It appears most likely that this synergism among pollutants will prove to be the rule rather than the exception. We should seriously consider such statements as those of Dr. Saffiotti, Associate Scientific Director for Carcinogenesis, National Institute of Health. "The striking potentiation of effects of low levels of a systemic carcinogen in the lung by as simple a treatment as the pulmonary penetration of a dust warns against the dismissal of any carcinogenic exposure--even at low levels--as being 'safe'."

It must be remembered that even a food additive is a potential pollutant and could have a small adverse effect on every individual, or

a serious adverse effect on 1 in 10,000 individuals. Either effect could have been unobserved or unobservable in the testing procedures. Either effect could cause a large amount of injury when, aided by mass distribution and mass communication advertising, the product is made available and attractive to 200-million individuals. Secretary Finch's decision on cyclamates was a courageous departure from the past and an essential setp into the present.

The point I am trying to make here is that the uncertainties connected with the effects of radioactive atoms are shared by practically every form of environmental pollutant. We are most likely paying a price for each pollutant, and the net effect of all of them may be more than we would like to pay.

WHY DO WE HAVE POLLUTION?

When we survey the arsenal of scientific and technological knowledge that is available to this nation and its industry, it is obvious that the means are available to essentially eliminate all forms of environmental pollution. There is one exception to this, and that is waste heat. I will return to this problem subsequently. There are numerous signs today which demonstrate that the present levels of pollution are detrimental to man and his environment.

The developing nuclear industry in the country offers a current example of why we have such a serious pollution problem. At the same time, we can and should learn from this industry what is required to improve the quality of the environment and the quality of life in this country. This industry is at the heart of the problem because, in addition to being a polluter itself, it will generate the power to operate other industrial polluters.

As long as there is a legal limit or no limit to pollution, any nonsensical industry can pollute. A legal limit to pollution either implies that there is a safe level of contamination or that the process of polluting has a benefit to society that outweighs the attendant risk. We have no evidence whatsoever to indicate that there is a "safe" level for any form of pollution. Moreover, when a legal limit is established, pollution occurs without any balancing of benefit vs risk.

The AEC suggests that they have done a risk vs benefit calculation and have found that the benefit outweighs the risk. But, they never present a benefit value, and they detest people like us who dare to present a risk value. Consider the statement by Dr. Werth, Associate Director for Plowshare at LRL commenting on a question posed by Senator Gravel. "It is difficult to balance a risk of radioactivity against a benefit. There is a need for natural gas. One of the most thorough studies is that by the Federal Power Commission entitled 'A Staff Report on National Gas Supply and Demand',* Bureau of Natural Gas, Federal Power Commission, Washington, D.C., September 1969. If more gas were available, it could be burned in more cities and significantly reduce the smog and health hazard associated with the presence of smog. Balancing the health hazard due to smog against a possible health hazard due to background levels of radioactivity has not been done to my knowledge". Why don't we do this study before spending millions of dollars on the gas stimulation program? Would such a study show that piping radioactive gas into homes is a reasonable solution to the smog problem? It would seem that even Congressman Holifield doubts the risk vs benefit in this case because he asked why 50,000 million cubic feet

*Notice how he equates need with demand.

of gas should be shipped to Japan each year if the shortage of natural gas was as serious as the AEC said.

After you listen to their arguments for a second time, if you are not too terribly naive, you realize that all they have done is a cost analysis. For example, nuclear reactors are only marginally competitive with fossil fuel plants today. Any additional restrictions would price them out of business. When I say business, I mean big business. The bill for the present reactors exceeds 25-billion dollars. The industry would like to increase that 2 or 3-fold. Because of the size of the market, some nuclear critics are accused of being in the employ of the coal industry.

All the nuclear critics that I know deplore fossil fuel generating plants as much as, and even more than, nuclear plants. No one can deny the ill effects of the noxious gases that belch from the chimneys of these fossil fuel plants. And this is why society as a whole must become involved in this controversy. If the fossil fuel plants are forced to remove their noxious gases, their cost will increase. The nuclear plants can then meet more restrictive controls and stay competitive. The question which has never been seriously considered is whether or not society is willing to accept an increase in their electricity bills. Strangely enough, all indications are that they would.

But noxious gases and radioactivity are not the only by-products of electric power production. There is waste heat. Enough waste heat to drastically change our ecology if our projected power needs are real. Consequently, public discussions must not be restricted to, for example, at what temperature shall the heated water from a given plant be discharged into the public waters or how much radioactive waste shall be discharged

into our common air supply. To begin by asking these questions is to begin in the middle of the story. We must start with the fundamental question.

What then is the fundamental question involved with the electric power industry? It is, "Why more power?" This question has not been publicly discussed until very recently. A flat and unqualified statement that "...power needs are doubling every eight years" is not sufficient. To accept this statement without question is to accept and endorse the notion that electrical power consumption is a desirable end in itself. Today, when environmental questions are paramount, it becomes necessary to question the basis for all intrusions on the environment. I do not know that we need more power. The population of the United States increases at about one percent per year. It is certainly not obvious that a population increase of one percent per year demands an increased power consumption of about ten percent a year.

It is manifestly not obvious that power demands are equivalent to power needs. How is the power to be used? Our utility friends advertise the use of power for lighting hospital operating rooms, running audiovisual aid equipment in elementary schools, making possible stereo recordings of Brahms and Beethoven, and a host of other culturally interesting uses. It is highly unlikely that these uses account for a significant fraction of the present or projected power use. If we look closely, we will probably find that the Pacific Northwest needs more power to operate aluminum smelters in order to meet the growing need for beer cans and TV dinner trays. I think we must face the unfortunate fact that power consumption today does not correlate with the nebulous

"standard-of-living". Power consumption is correlating with the production of garbage and the decline in the quality of the environment.

A RECOMMENDATION FOR POLLUTION CONTROL

This then brings us to the means of controlling pollution. The reason we have pollution is that it is permitted either by law or by the absence of law. As I stated earlier, if there is a legal limit or no limit to pollution, any nonsensical industry can pollute. A legal limit to pollution either implies that there is a safe level of contamination or that the process of polluting has a benefit to society that outweighs the attendant risk. We have no evidence whatsoever to indicate that there is a "safe" level for any form of pollution. Moreover, when a legal limit is established, pollution occurs without any balancing of benefit vs risk.

To properly protect the public health and safety, the laws should read that the acceptable limit of pollution is zero and that the privilege of releasing a pollutant to the environment must be negotiated. The prospective pollutor should be required to demonstrate in a meaningful manner that his activity will produce benefits to those affected that outweigh the risk.

This weighing of benefit vs necessary risk should occur in public hearings before pollution control boards. It is important to emphasize the word necessary - the benefits must be weighed against the necessary risks. The right to overrule a decision of the control boards should be reserved for the public through the courts or by referendum.

Environmental pollution is a matter of extreme moment. Decisions concerning pollution should not be made in secret by so-called experts. The burden of proof should be shifted from the public and/or the government regulatory agency to the pollutor. The pollutor must be made responsible for convincing the public that he has done everything possible to reduce the level of pollution and that the benefits to be derived from his activity outweigh the risk of the remaining pollution.