

EXPOSURE FROM NUCLEAR POWER

"AS LOW AS PRACTICABLE" IN THEORY AND PRACTICE

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Abstract

The ICRP introduced the phrase "as low as practicable" into the language of radiation protection some years ago. Since that time, the phrase has served as a qualitative admonition to prudent judgment. The record of the nuclear power industry, in particular, bears witness to the care with which engineers have applied this concept to the design and operation of nuclear power plants.

Recently the U.S. Atomic Energy Commission has proposed to elevate "as low as practicable" to a regulatory standard with numerical limits. This proposal has the effect of reducing the ICRP limit for public exposure by a factor of 100 and essentially wipes out the opportunity for judgment, sound or otherwise.

Such a reduction in an environmental quality standard is probably unique in the field of public health. An action as dramatic as the proposed reduction is properly taken in circumstances of near-epidemic proportions. However, there is no evidence that radiation exposure at the ICRP limits has any demonstrable effects; there is in fact considerable evidence that it does not. Further, the nuclear industry has conducted its operations in such a way that public exposures are far below the ICRP limits.

The justification offered for setting a legal, numerical limit to "as low as practicable" is that if it can be done, it must be done. This is a philosophy that demands careful scrutiny. The costs in effort and money are considerable; the benefits, if any, are miniscule. Further, it is a philosophy without reason and without stopping place. Finally, it is an action which seriously undermines confidence in the ICRP standards.

Introduction

The ICRP introduced the phrase "as low as practicable" into the language of radiation protection in 1958.¹ This phrase, I believe, was intended as an admonition to prudent judgment in the face of the possibility that "any exposure may involve some degree of risk."²

The record of radiation exposure, both occupational and public, during the last several decades bears evidence to the care with which designers, engineers and operators have applied this concept. The public exposures which have resulted from the operation of nuclear power plants are particularly striking in this respect. In all but unusual instances, the public exposures from these plants have been less than a few percent of the limits recommended by the ICRP.

One can only believe that those who labored on the ICRP committee have been gratified with the result of their carefully worded recommendation.

U.S. A.E.C. Proposed Appendix I to 10 CFR Part 50

Comes now, however, the United States Atomic Energy Commission.

About two years ago this body issued a draft of a new proposed regulation.³ The issuance of regulations is, of course, a responsibility of governmental agencies, and the US AEC has met this responsibility fully. The new proposed regulation of concern to us is known as "Appendix I to 10 CFR Part 50." For those of you who are not familiar with this proposed regulation, a terse summary may be useful.

The proposed Appendix I to 10 CFR Part 50 elevates "as low as practicable" to a regulatory standard with numerical limits. These limits are, for all practical purposes, 1/100 of the ICRP public limit; i.e., 5 mrem per year to any organ of the body. There are also, in this proposed regulation, annual release limits for certain isotopes, and some talk of the need for flexibility to allow nuclear power plants to produce electricity now and then. The essence of the regulation is, however, the public organ limit of 5 mrem per year.

The reduction of an environmental quality standard by a factor of 100 is probably unique in the field of public health. What circumstances, one wonders, have called for an action as dramatic as this?

Possible Need for the Proposed Regulation

Is it that the present limits of radiation exposure are producing unacceptably high rates of injury and death?

Is it that the nuclear power industry is abusing the present limits and that the proposed rule is needed to enforce them?

Is it that the margin of safety in the present limits has been found to be smaller than was intended?

Taking each of these possible explanations in turn, we find that (1) there is no evidence that radiation exposure at the present ICRP limits has any demonstrable effects, and considerable evidence that it does not, (2) the nuclear power industry has conducted its operations in such a way that maximum public exposures have seldom exceeded 1/100 of the ICRP limits, and (3) the U.S. National Council of Radiation Protection completed in 1971 an extensive review of the bases for radiation exposure limits and concluded that there is no need to reduce them.⁴

The recent BEIR Report⁵ encourages consideration of quantifying the "as low as practicable" concept, but states that "there should not be attempted the reduction of small risks even further at the cost of large sums of money that spent otherwise, would clearly produce greater benefit."

As far as public health is concerned, there is no demonstrated need for the proposed regulation. Why, then, is this dramatic reduction of exposure limits necessary?

Justification

If one searches through the voluminous material associated with the proposed Appendix I, he finds that the justification given by the AEC is this: since the nuclear industry has shown that it can operate at about 1/100 of the ICRP limits, the industry should be required to operate this way. In other words, if it can be done, it must be done. This is a new concept in public health and deserves thoughtful scrutiny. It is a concept which is beginning to appear in public health areas other than radiation and leads to the ultimate goal where all environmental contaminants are maintained forever at zero, whatever that may be.

The concept that if it can be done, it must be done has no stopping place. For example, suppose that the nuclear industry responds to the proposed Appendix I by designing nuclear plants which operate at 1/10,000 of the ICRP limit; it follows by the concept that they must be operated at this limit. The engineer who designs a safety factor into his plant is rewarded by having it eaten away by the next set of regulations. Such a drive to perfection (if zero is indeed perfection) has certain attractions to some people who do not count the cost, but the cost must be counted and it must be paid.

The Costs

The additional costs which will be imposed on the electric energy produced in nuclear power stations by the proposed Appendix I may be examined in two ways: (1) in terms of the benefit-cost ratio, or (2) in terms of cost per person-rem avoided. (Women are being liberated by elimination of the unit man-rem from the U.S. vocabulary). Application of the benefit-cost ratio to the proposed Appendix I is a simple matter: the benefit to public health is zero; the cost will be appreciable; the value of the ratio is zero. So much for the benefit-cost analysis.

At the previous meeting of this Association, Hedgran and Lindell gave a charming paper which lead to an estimate of the value of a man-rem as about 1,000 Swedish crowns.⁶ Currency fluctuations in the intervening years have introduced more uncertainty in this figure than the uncertainty of their estimate. Estimates of the costs of the person-rem to be saved by the enactment of Appendix I range from less than one hundred "early 1973 dollars" to four million dollars per person-rem.⁷ Whatever the value of the dollar in terms of the crown, the Appendix I person-rem appear likely to be expensive.

There is another aspect to these Appendix I person-rem, quite apart from their cost. Hedgran, Lindell and the others who have speculated on the proper expenditure to spare a man-rem were considering actual exposures. Appendix I, on the other hand, is concerned largely with fictitious person-rem received by an imaginary child, drinking imaginary milk produced by an imaginary cow which is grazing on an imaginary pasture at the boundary of the plant site. Thus, real dollars are to be spent to spare make-believe doses. Estimation of the value of a make-believe person-rem may belong in the realm of fables, but surely not in the realm of radiation protection.

The Critics of Nuclear Power

You will see that our search for some justification of the numerical interpretation of "as low as practicable" has so far been in vain. Perhaps looking at the matter from the point of view of the U.S. Atomic Energy Commission may suggest an answer.

Some years ago the late Andre Cipriani said that one should remind himself that government bureaucrats, in their inner hearts, are not purposely trying to make life impossible for the rest of us. (This, as friends of Dr. Cipriani will realize, is a sanitized version of his original statement).

Critics of nuclear power have predicted an assortment of disasters which make Dante's Inferno look like a summer afternoon in the park should the development of nuclear power continue. These critics have pleaded for reduction of radiation limits by factors of ten or more, reduction of these limits to zero (whatever that may be), a moratorium on nuclear power plants until it can be shown that they are absolutely safe, and the elimination of these plants altogether and forever. Still mindful of Dr. Cipriani's comment, I realize that to some extent a governmental agency should respond to the wishes of the public it serves. Perhaps it is here that we may find the explanation for Appendix I.

Nothing on this aspect of the case appears in the pages of reports, testimony and response to which Appendix I has given rise. There is no way of knowing how near to the truth is the suggestion that the purpose of this proposed regulation is to buy off the critics, but it is the only plausible explanation I have found. If this is in fact the explanation, it is ironic indeed: the critics of nuclear power have been trying for years to discredit the AEC; now, by proposing this rule, the AEC discredits itself.

There are circumstances in which one could forgive a frightened bureaucracy for proposing a regulation as unfortunate as Appendix I. Imagine, if you will, a world where radiation is the only cause of illness and death, where nuclear power is the only source of radiation, where alternate sources of power are in ample supply, and where the production of electricity by means other than nuclear power has no ill effects on public health and the environment. In such a world, Appendix I would make good sense. It is such a world as this that many of the critics of nuclear power envisage, but our world is nothing like this. The proposed regulation makes no sense whatever for today's world.

The public has become somewhat confused and suspicious by the controversy over radiation standards. The proposed Appendix I destroys confidence in the ICRP standards, which are surely the most firmly based and carefully conceived the world has ever known.

Summary and Conclusion

In theory, the principle of "as low as practicable" is an appeal to cautious judgment. The very low public doses and the complete lack of any ill effects on public health attest to the excellence of the theory and the scrupulous observation of it by the nuclear power industry.

In practice, as in the proposed Appendix I, the principle of "as low as practicable" becomes a stringent numerical standard, which is unnecessarily low and essentially unmeasurable. The proposal has already done considerable harm. It has increased the costs of designing, constructing and operating nuclear power plants. It has introduced bewildering confusion into the planning for electric power generation. The proposed Appendix I may increase cost and public opposition to the point where fission and even fusion are eliminated as sources of energy. This, in my opinion, would be a tragic development. I urge that the Appendix I interpretation of "as low as practicable" be buried as quickly and as quietly as possible.

References

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3. Atomic Energy Commission (10 CFR Part 50) Licensing of Production and Utilization Facilities, Light-Water-Cooled Nuclear Power Reactors, Proposed Rule Making. Federal Register Vol. 36, No. 111, ps. 11113-11117, June 9, 1971.
4. Basic Radiation Protection Criteria, Recommendations of the National Council on Radiation Protection and Measurements, NCRP Report No. 39, Washington, D.C., January 15, 1971.
5. The Effects on Populations of Exposure to Low Levels of Ionizing Radiation, Report of the Advisory Committee on the Biological Effects of Ionizing Radiations, Division of Medical Sciences, National Academy of Science, National Research Council, Washington, D.C. November 1972.
6. A. Hedgran and B. Lindell, PQR - A Special Way of Thinking, Health Physics 19: 121, 1970.
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