STATENS STRÅLSKYDDSINSTITUT

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Professor Joshua Lederberg
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Dear Dr. Lederberg,

It was very interesting to see the two letter copies that you sent me on October 30. I am enclosing copies of some reports which partly illustrate my own standpoint and which seem to be remarkably well in line with your own thinking.

SSI: 1970-028

This is the text of a paper presented at a conference in Brighton in May this year. It contains the substance matter which Dr. Morgan refers to as having been mentioned by me at the ICRP meeting in London the following week.

You will notice that Dr. Hedgran and I have made an empirical approach, trying to find out what health physicists are in fact willing to pay for the reduction of one manrad. The number was found to be of the order of $ 500 (our quantity "ℜ" in Table 1, page 6). This is surprisingly identical to your own estimate on genetic grounds. You will also notice our estimate on page 3, based upon the assumption of a total cancer risk of 10^{-4} per rad and a genetic risk of the same order of magnitude. The latter estimate does not include the effects of recessive gene mutations but is essentially an estimate of the first generation effects according to ICRP Publication 8 and the UNSCEAR reports. We would therefore be expected to arrive at a lower number than you. Our estimate is also very much depending upon the assumed "cost" of a human life. Nevertheless we arrive at $ 100 per manrad, which, again, is very close to your own estimate. Incidentally, you might be critizised for not having included in your estimate any "cost" equivalent of the suffering of the individuals burdened by the biological effects but only the direct cost to society. Or is this included in yourestimate of $ 200 B for ill health costs in the U.S.A.?

We have not wanted to press the argument for a very high value of the equivalent cost of one manrad but have assumed that the value might well be $ 200 per manrad (page 7). We have then looked at some consequences of this in the medical x-ray case (Table 2, page 9).

SSI:1970-027

This is a document in which Dr. Hedgran and I have tried to draw the conclusions of the present ICRP recommendations with regard to

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activity releases from nuclear power plants. The policy suggested in this paper will be discussed at a Nordic meeting in Stockholm in November, in order to find out whether it is possible to reach an agreement on the application of the basic principles.

As you will see from this document, we stress the point that the "available" dose limit must not be available for just one purpose alone, nor must it be used up immediately. Planning for the future is essential also at an early stage.

There is one point which is not so obvious from our paper and which you have not mentioned either, but which I think is of utmost importance. This is that one must not control just the annual dose but the annual dose commitment. I can give the following example:

Assume that the operation of a nuclear plant can be shown to give rise to an annual dose equal to 100 (arbitrary units). If this dose is contributed by longlived substances, one year's operation of the reactor will not only give the exposure 100 the same year but also a dose commitment for the years to come. If we assume that the annual doses the next few years, from one year of operation are 70, 50, 30 and 10, respectively, the continued operation of the reactor will accumulate doses in the following way:

contribution from year 1:	100	70	50	30	10	-	-	-	-	-
2:	-	100	70	50	30	10	-	-	-	-
3:	-	-	100	70	50	30	10	-	-	-
4:	-	-	-	100	70	50	30	10	-	-
5:	-	-	-	-	100	70	50	30	10	-
6:	-	-	-	-	-	100	70	50	30	10
...										
accumulated total:	100	170	220	250	260	260	...			
annual dose commitm:	260	260	260	260	260	260	...			

Of course this is very simple and obvious, but it is important to note that the annual dose, after equilibrium has been reached, is 10 + 30 + 50 + 70 + 100 = 260 units, which is equal to the total contribution (dose commitment) from one year of practice. If we wish to limit the equilibrium annual dose, we must therefore begin to control the annual dose commitments rather than the annual doses.

SSI:1970-026

This was an invited paper at the Brighton conference. It has perhaps no original ideas but may give a helpful review of the whole medical field of radiation protection.

If you have comments, advice or critizism of any of these papers or of this letter, I would be very pleased if you let me know.

Yours sincerely,

Bo Lindell

Professor and Director
(Swedish) National Institute
of Radiation Protection

Copy: Dr. Arne Hedgran
Dr. K.Z. Morgan