

ONE OF THE IMPLICATIONS OF MONETARY REFERENCE VALUE

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1- INTRODUCTION

To develop this work, we adopt the ICRP in its publication number 55 that uses, as an example, the design of a ventilation system to protect workers in a small uranium mine. The monetary reference value agreed upon this publication is USD 20000/ person-Sv.

Options	0	1	2	3	4	5
X Cost (USD)		10400	17200	18500	32200	35500
S Collective Dose (person-Sv)	0.686	0.561	0.357	0.335	0.196	0.178
Average Individual Dose \bar{H} (mSv ⁻¹)						
Group I - (4 workers)	55.2	40.8	28.4	26.0	17.5	15.8
Group II - (4 workers)	41.8	34.5	22.3	21.0	12.6	11.3
Group III - (9 workers)	33.1	28.9	17.1	16.3	8.4	7.8

Each option has a value of protection cost and, consequently, as to the collective dose. It is observed that $\Delta X/ \Delta S$ is expressed in USD/person-Sv. If this function were continuous, this result would be interpreted as the coefficient of variation of the function in a given interval. If this continuous function derived, we could obtain the rate of change of the function at any point, known as the alpha value in any point of interest of the function.

2- RESULTS AND DISCUSSION

A significant option obtained by the ICRP – 55, is an option whose cost is USD \$21,620.00. According to the result of the derivative, the corresponding alpha value is USD \$19,996.35 / person-Sv. This alpha value, is substantially equal to the agreed value of USD \$20000/ person-Sv. Thus, the optimal option has been identified since other values at any other point of the function would exceed the agreed value.

Alternatively, the results demonstrate that for option 1, considered optimal, all groups receive an Average Individual Dose that far exceeds the value recommended by the ICRP - 60, where it is advocated that although the limit of the annual dose is 50mSv⁻¹ the dose over a period of 5 years may not exceed 100mSv; it is recommended to maintain an average 20mSv⁻¹. This observation is also valid for groups I and II of options 2 and 3.

Considering the recommendations of ICRP – 60 and the results shown in Table, we conclude to recommend option 4, where the group I, which is receiving higher doses, would receive Average Individual Dose of 17.5 mSv⁻¹ and groups II and III would receive 12.6 mSv⁻¹ and 8.4 mSv⁻¹, respectively. However the alpha value at this point for option number 4, would be USD\$ 175,371.45 / person-Sv, which is much higher than the agreed value of USD \$20000/ person-Sv.

3- CONCLUSION

This example clearly shows that it is not possible to optimize thinking by only considering the collective dose and that it is necessary to consider the distribution of individual doses in this process.

Nonetheless we should keep in mind that, although the monetary reference values of the person-Sievert and, consequently, the value given to the annual individual dose distribution may be different for each country, the risks associated with activities involving ionizing radiation and the ultimate goal of decreasing doses to permissible levels, are the same all over the world.

Considering the existence of information systems, such as the Information System for Regulatory Authorities (RAIS), the Information System on Occupational Exposure (ISOE) and Scientific Committee of the United Nations Study of the Effects of Atomic radiation UNSCEAR, there is a large amount of data available regarding the distribution of individual doses in various sectors, including ionizing radiation in the member countries of the International Atomic Energy Agency (IAEA).

Hence, it would be possible and appropriate to conduct a study based on this information in order to find curves of global monetary benchmarks that apply to the different segments involving the use of ionizing radiation that exist in the Member States of the IAEA. Such curves should not depend primarily on the Gross Domestic Product per capita of the countries, but they would be built to take into account the maximum individual dose distribution and, consequently, the collective dose in these different countries.

Due to the economic disparities among countries, it might be interesting that these curves were based on a given index, like the purchasing power parity (PPP). Of course, this discussion would be supervised by the IAEA on the basis of a consensus among its member states.