



INFORMATIZATION OF MULTI-CRITERIA ANALYSIS OUTRANKING: A SOFTWARE TO IMPROVE DECISION-MAKING IN RADIOLOGICAL PROTECTION OPTIMIZATION PROGRAMS

Albuquerque, Sergio M.¹; Levy, Denise S.^{1,3}; Sordi, Gian-Maria A. A.^{1,2}; Levy, Patrick J.³

1 Instituto de Pesquisas Energéticas e Nucleares – IPEN-CNEN/SP, São Paulo, SP, Brasil

2 ATOMO – Radioproteção e Segurança Nuclear S/C Ltda, São Paulo, SP, Brasil

3 Ômicron Programação Gráfica, São Paulo, SP, Brasil

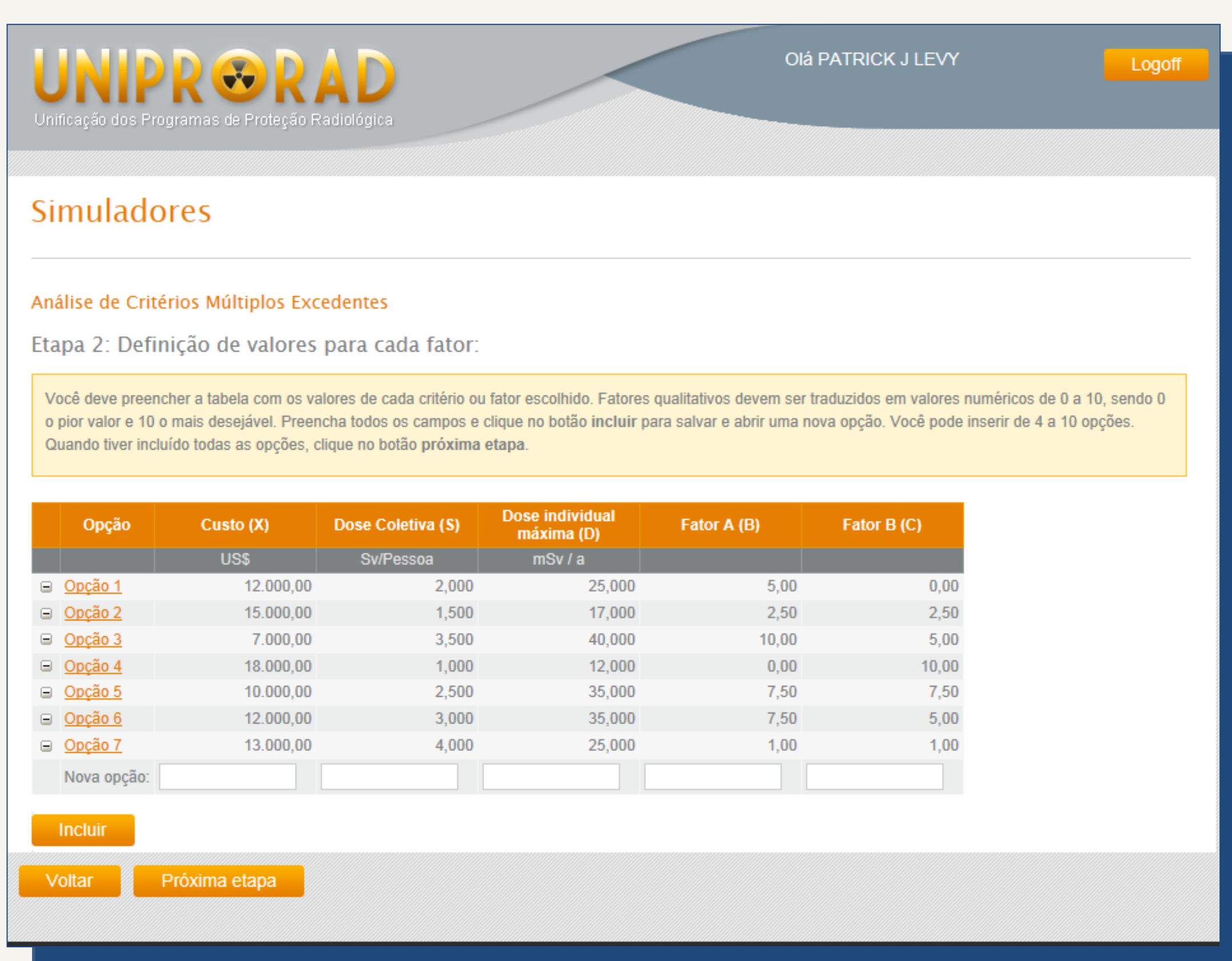
info@uniprorad.com.br

INTRODUCTION

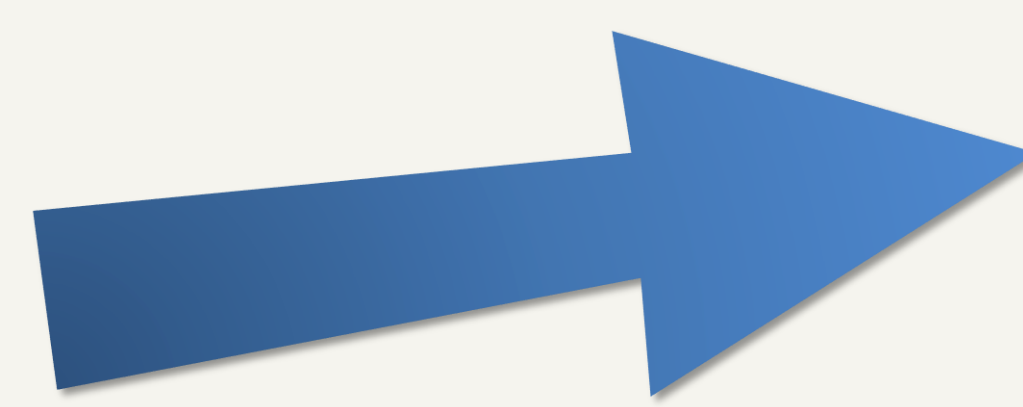
This project aims the informatization of the decision technique known as Multi-Criteria Analysis Outranking, used in radiological protection optimization programs. The system was developed mostly according to criteria and methodology established by the ICRP-55.

SOFTWARE DESCRIPTION

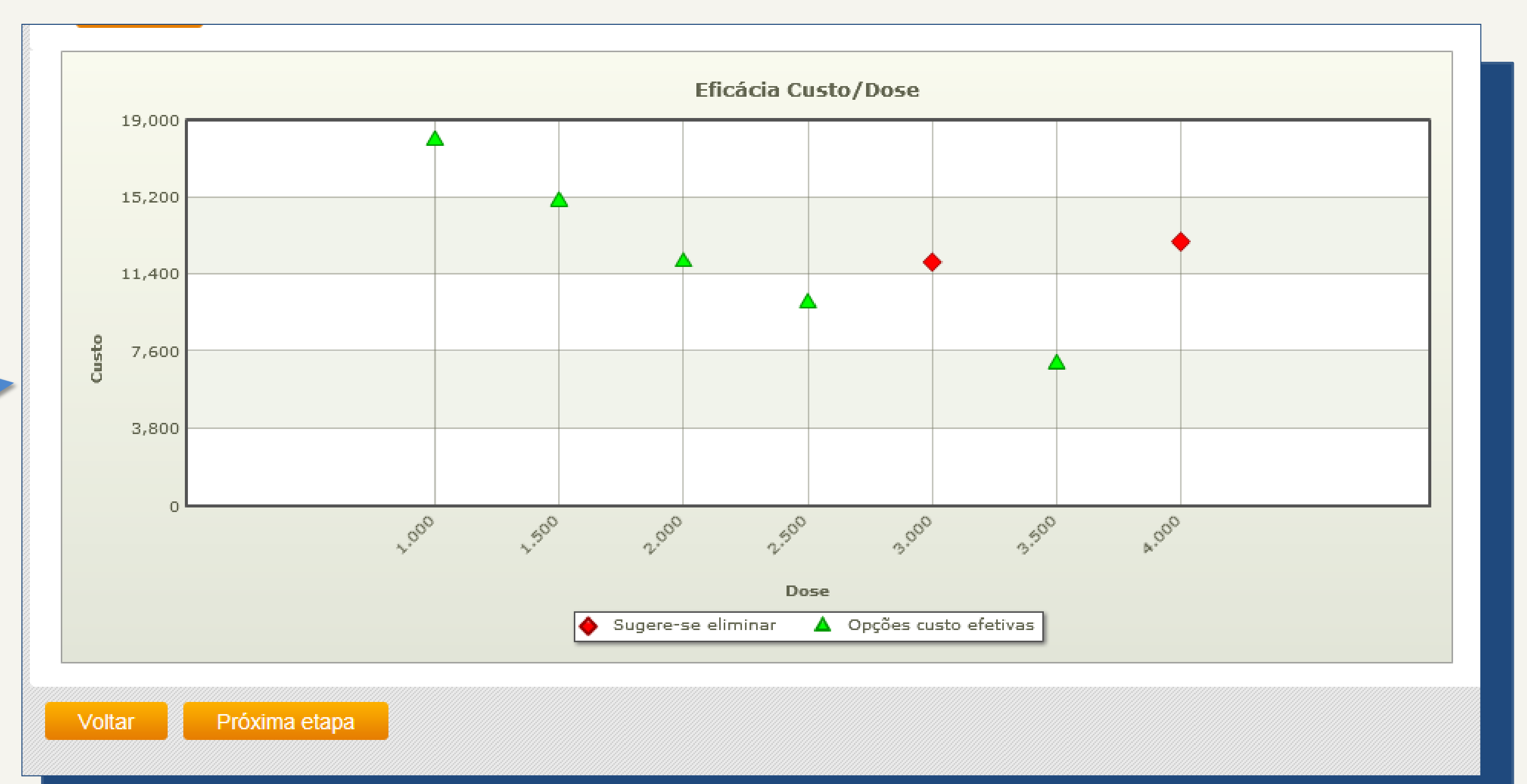
Defining factors, criteria and radiological protection options to be adopted. User may choose up to ten options and the values should be entered as numeric data.



Opção	Custo (X)	Dose Coletiva (S)	Dose Individual máxima (D)	Fator A (B)	Fator B (C)
	US\$	Sv/Pessoa	mSv / a		
Opção 1	12.000,00	2,000	25,000	5,00	0,00
Opção 2	15.000,00	1,500	17,000	2,50	2,50
Opção 3	7.000,00	3,500	40,000	10,00	5,00
Opção 4	18.000,00	1,000	12,000	0,00	10,00
Opção 5	10.000,00	2,500	35,000	7,50	7,50
Opção 6	12.000,00	3,000	35,000	7,50	5,00
Opção 7	13.000,00	4,000	25,000	1,00	1,00



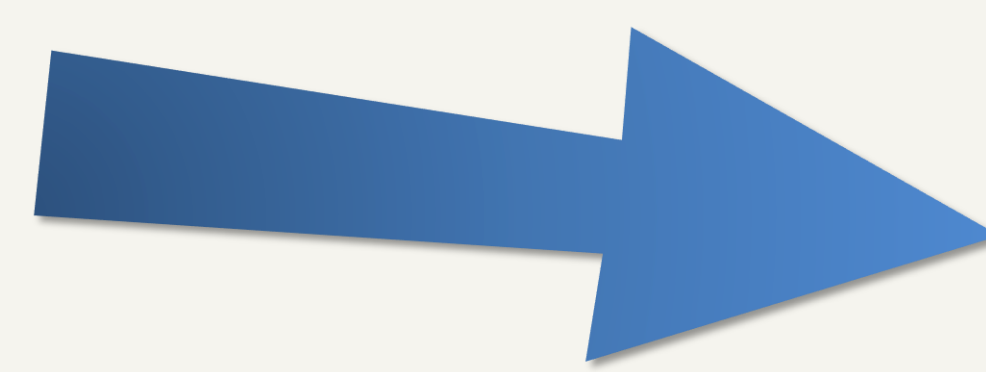
Cost-Benefit Analysis of all options pointing the cost effective solutions. The system suggests non-cost-effective options to be eliminated.



Defining build-up factors, the exclusion criterion ($Ec_{i,m}$) and elimination criteria when options outrank others but are not themselves outranked.



FATOR / CRITÉRIO	IDENT.	CONSTANTE CRESCIMENTO	K NORMALIZADO
Custo	K (X)	1,00	K (X) = 0,20
Dose Coletiva	K (S)	0,80	K (S) = 0,16
Dose individual máxima	K (D)	1,40	K (D) = 0,28
Fator A	K (B)	1,20	K (B) = 0,24
Fator B	K (C)	0,60	K (C) = 0,12



Calculating advantage index and comparing outranking relations, and checking more discriminatory elimination criteria whenever it is necessary.



Etapa 5: Tabela dos critérios de exclusão $Ec_{i,m}$

O critério de exclusão foi calculado de acordo com o parâmetro escolhido na etapa 3.
Critério de exclusão: Fator A com o valor de $Ec_{i,m}$: 0,30

	Opção 1	Opção 2	Opção 3	Opção 4	Opção 5
Opção 1	-	0	1	-	0
Opção 2	0	-	1	0	1
Opção 3	1	1	-	1	0
Opção 4	1	0	1	-	1
Opção 5	0	1	0	1	-

Tabela dos indicadores de vantagem $Ad_{i,m}$:

Os indicadores de vantagens foram calculados tomando por base a tabela precedente, considerando 0 o melhor valor e atribuindo valor 1 às opções que representam prejuízo.

	Opção 1	Opção 2	Opção 3	Opção 4	Opção 5
Opção 1	-	0,44	-	-	0,44
Opção 2	0,56	-	-	0,44	-
Opção 3	-	-	-	-	0,44
Opção 4	-	0,56	-	-	-
Opção 5	0,56	-	0,56	-	-

COMMENTS

In order to assist the decision maker to identify the optimal analytical solution, this system was developed mostly according to the criteria and methodology established by the ICRP-55. Nevertheless, differently from ICRP method, the system calculates the “exclusion criteria” ($Ec_{i,m}$), first than the “advantage index” ($Ad_{i,m}$). This inversion decreases considerably the calculations, limiting the “advantage index” to the options that have obtained the zero value. Besides the optimal analytical solution, the program provides spreadsheet calculation which can be saved or printed.