NRC Waste Classification Table Analysis Impact of ICRP 60/72 Dose Conversion Factors

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Background

- 10CFR61 Table 1 and 2 limits based on ICRP 2
  - NUREG/CR-1759

- Since then continue to be advances in the models for human anatomy and the biological behavior of radionuclides
  - ICRP 26/30 (NUREG/CR-4370)
  - ICRP 60/72 (EPRI Report)
  - ICRP 103 DCF under development

- What are the impacts of the new dose conversion factors on the waste classification tables?

What We Did

- Impacts code used
  - Same code as was used originally to derive current classification limits
- Updated Dose Conversion Factors (DCF's) from ICRP 60/72 used
- All other original assumptions maintained
- Ratio between old and new values determined
- Ratio applied to classification table limits

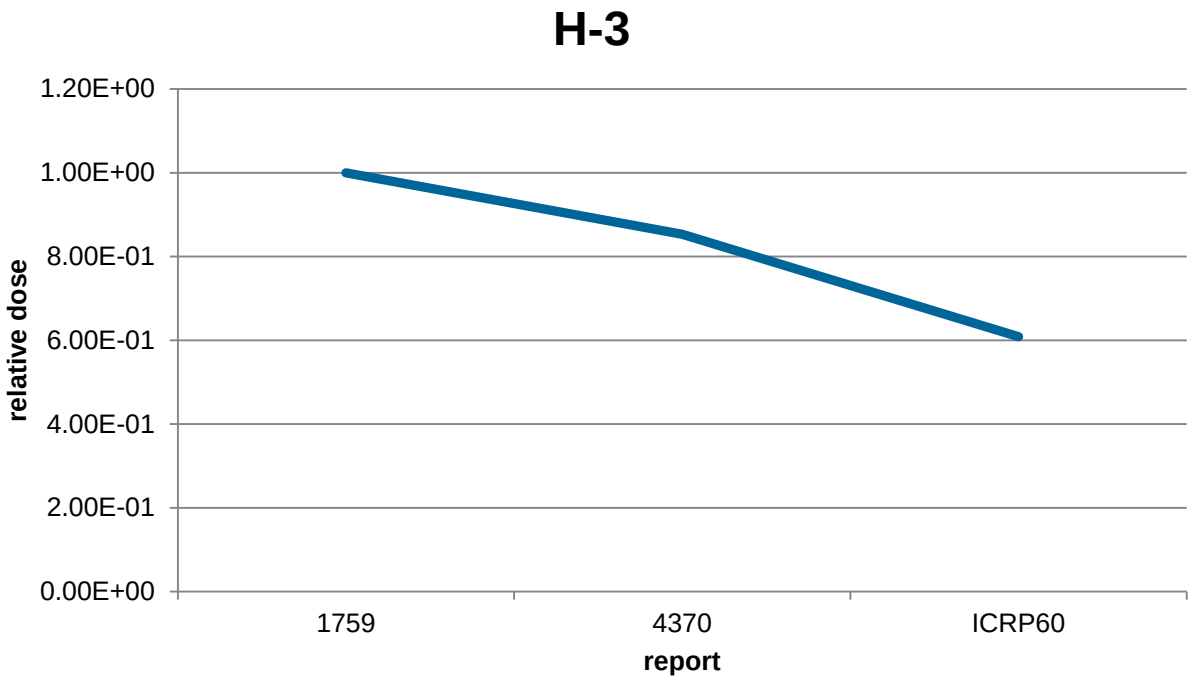
Results –Dose Conversion Factors and Corresponding Dose Evaluation

- All16 radionuclides in Table 1 and 2 evaluated

8 Doses Went Up	8 Doses Went Down
•C-14	•H-3
•I-129	•Ni-59
•Tc-99	•Ni-63
•Pu-238	•Co-60
•Pu-239	•Sr-90
•Pu-241	•Nb-94
•Am-241	•Cs-137
•Cm-243	•Cm-242

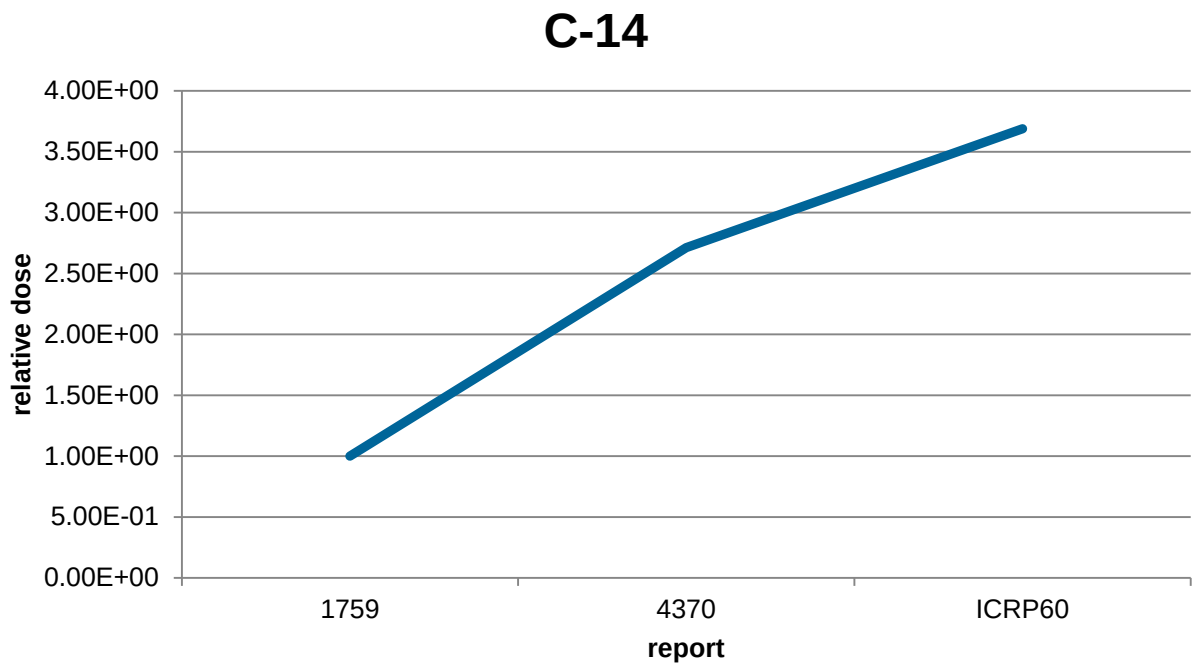
- Phantom 4: Only H-3 dose went down, Carbon, Iodine, and Technetium doses went up
- Nuclides doses that typically control class went down

Tritium



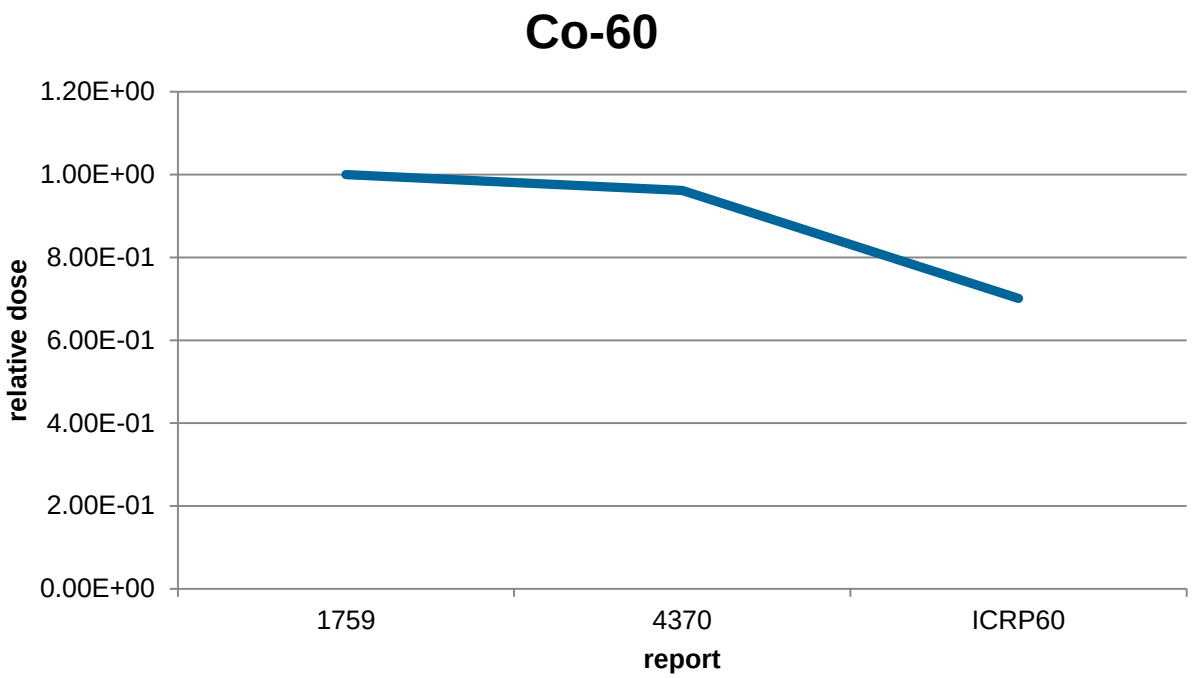
Impacts Model Results - Dose as a Ratio to NUREG/CR-1759

Carbon



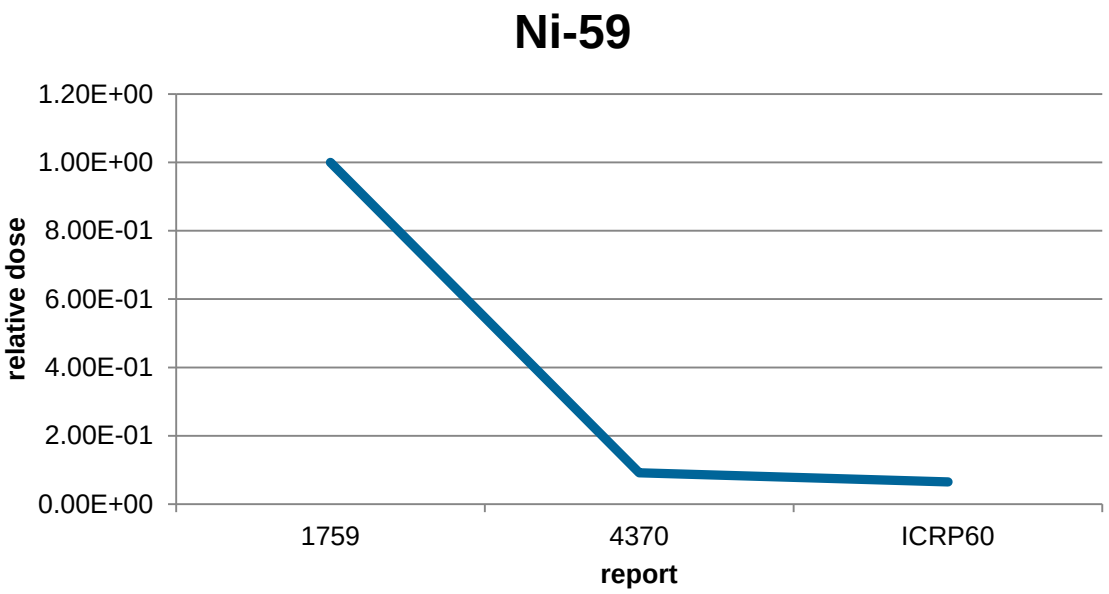
Impacts Model Results - Dose as a Ratio to NUREG/CR-1759

Cobalt



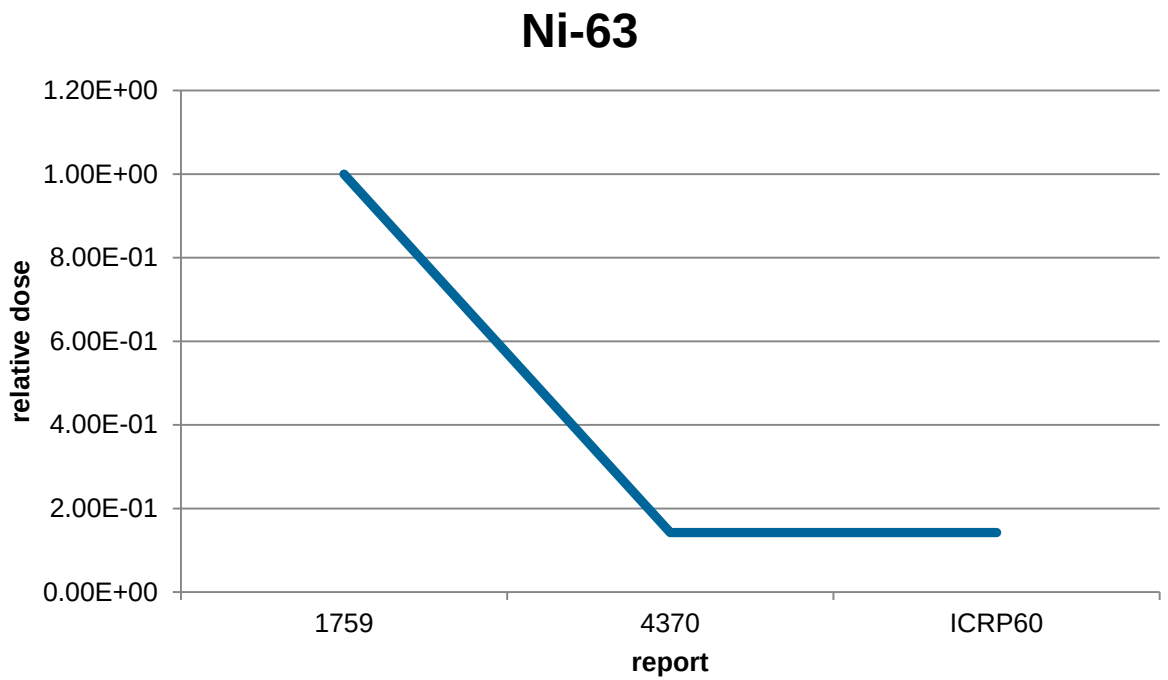
Impacts Model Results - Dose as a Ratio to NUREG/CR-1759

Nickel-59



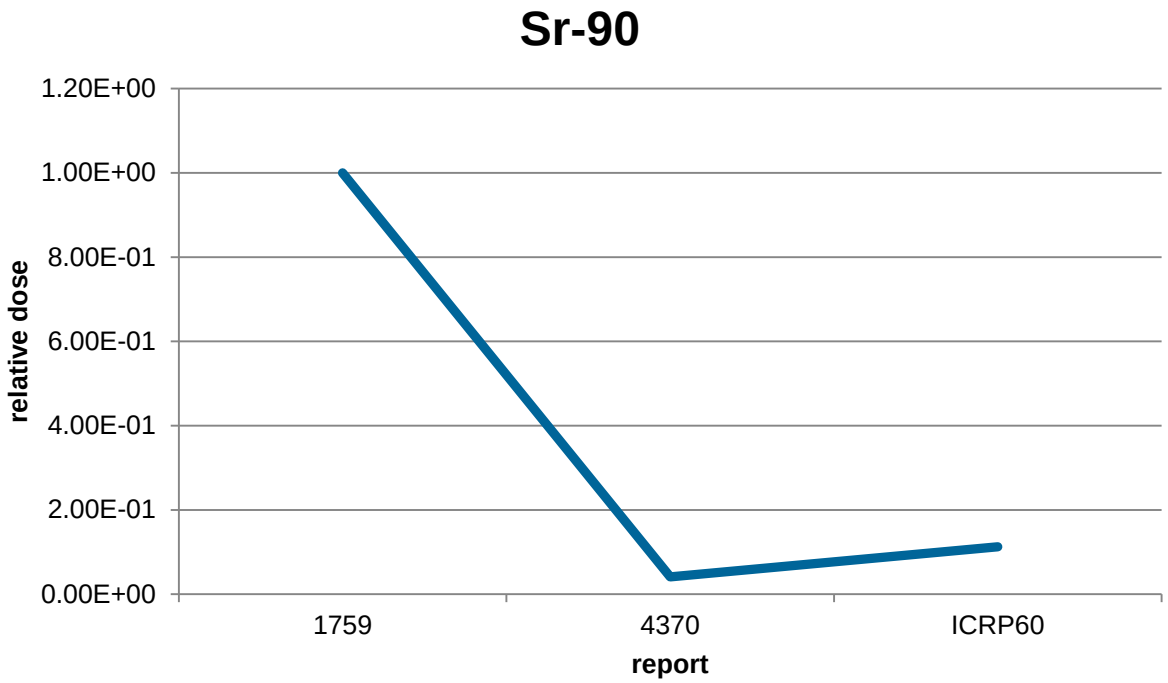
Impacts Model Results - Dose as a Ratio to NUREG/CR-1759

Nickel-63



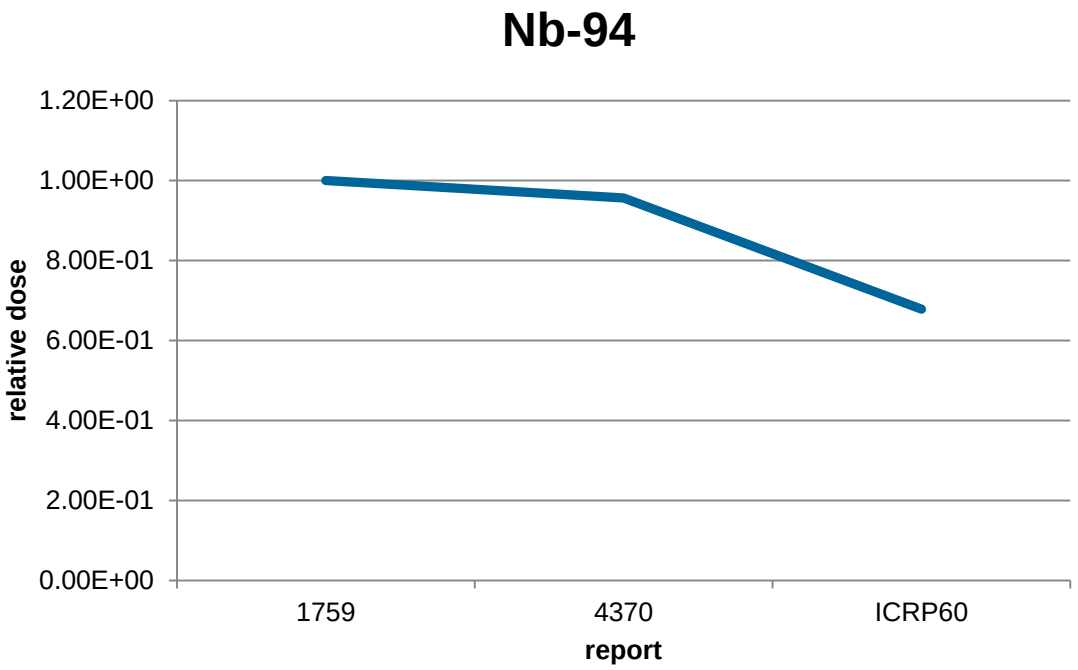
Impacts Model Results - Dose as a Ratio to NUREG/CR-1759

Strontium



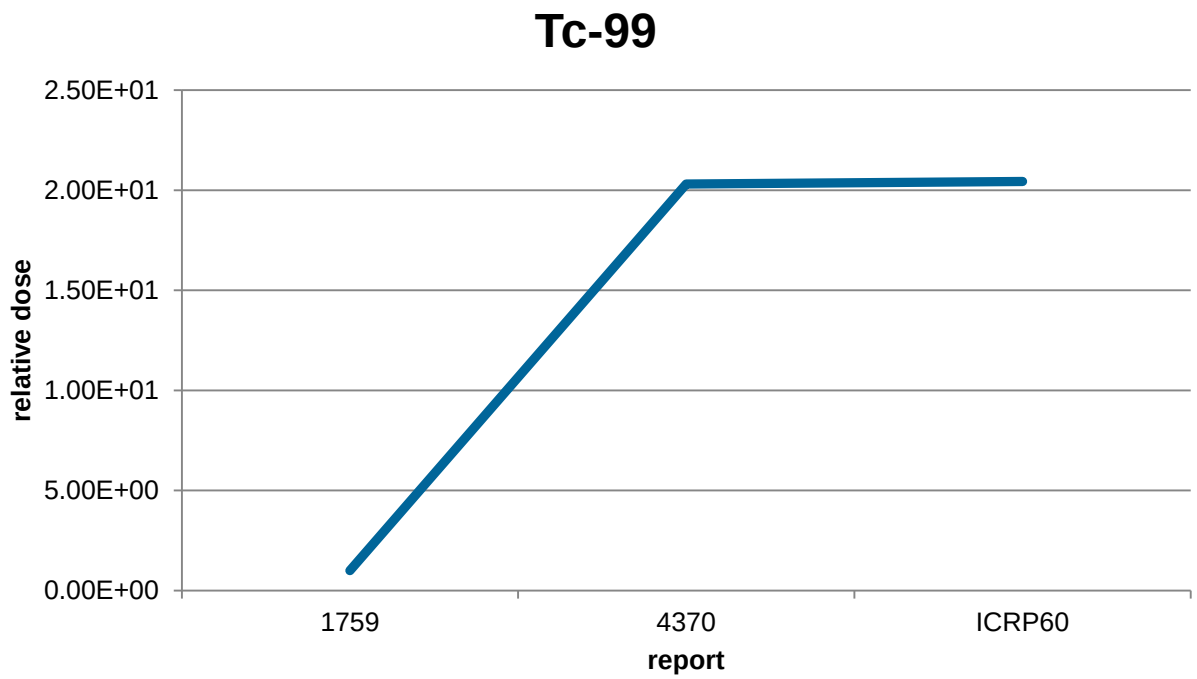
Impacts Model Results - Dose as a Ratio to NUREG/CR-1759

Niobium



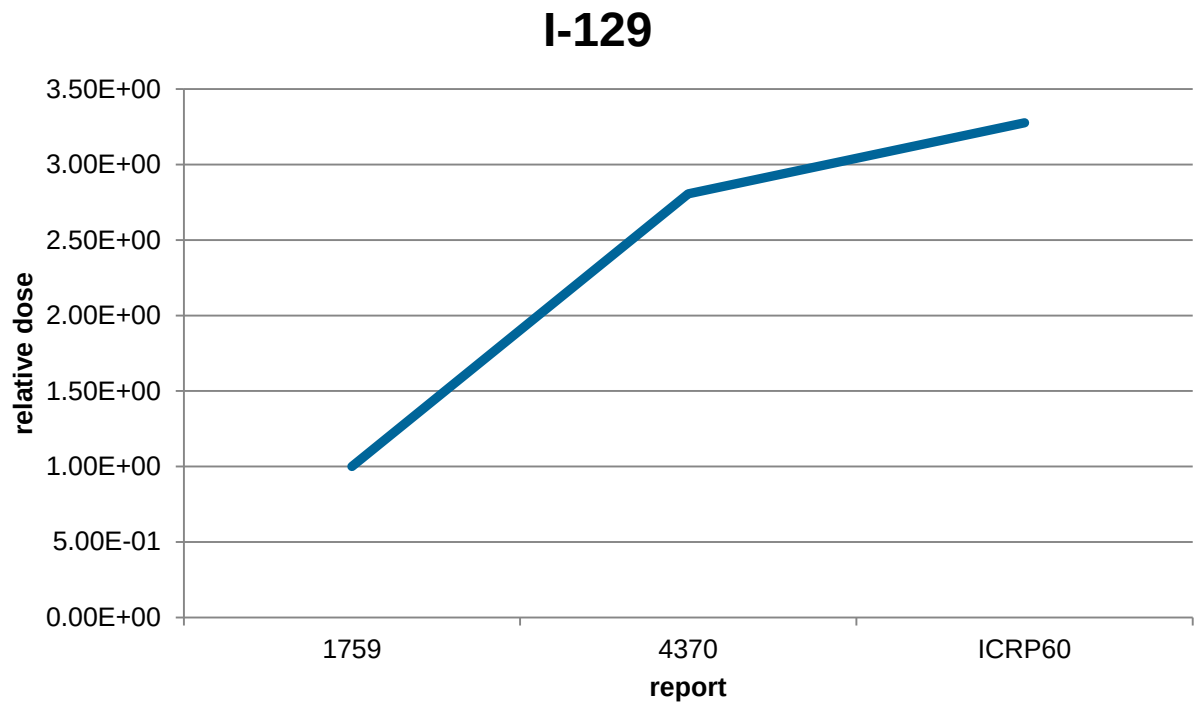
Impacts Model Results - Dose as a Ratio to NUREG/CR-1759

Technetium



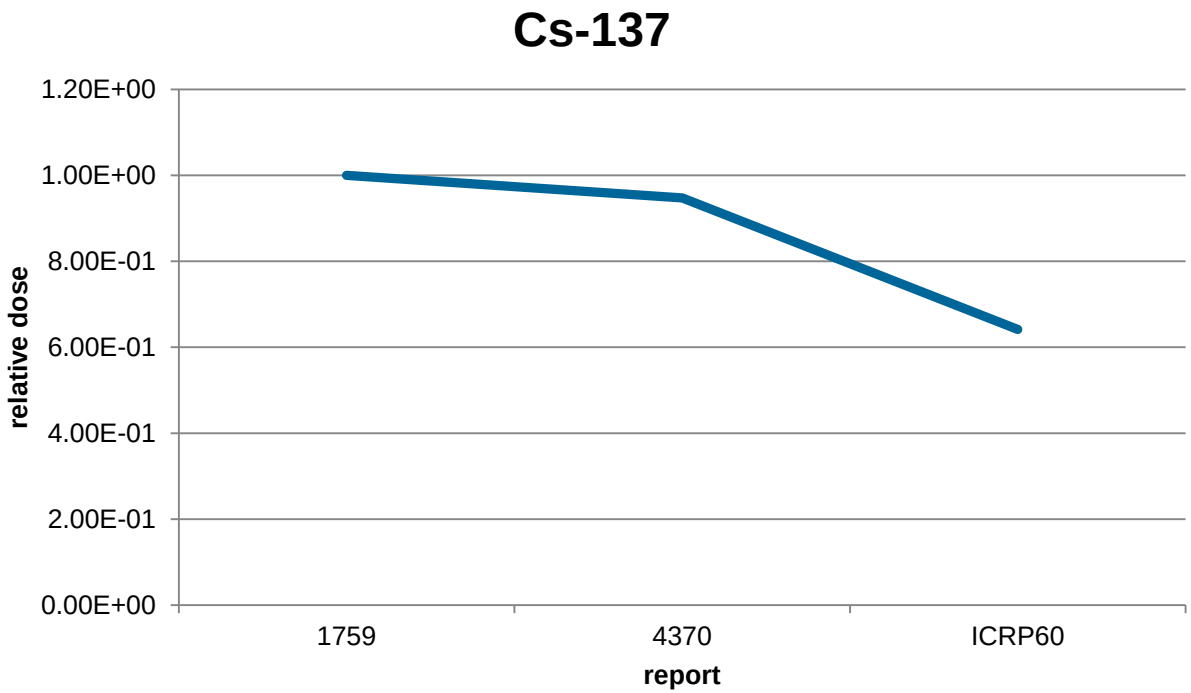
Impacts Model Results - Dose as a Ratio to NUREG/CR-1759

Iodine



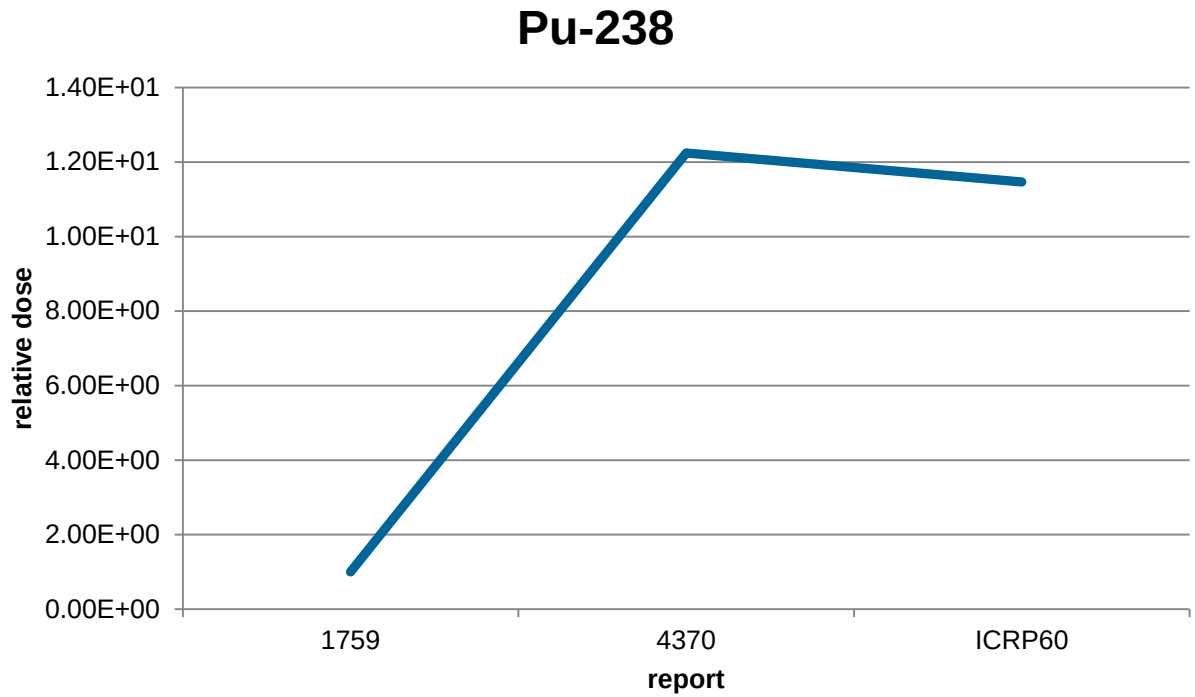
Impacts Model Results - Dose as a Ratio to NUREG/CR-1759

Cesium



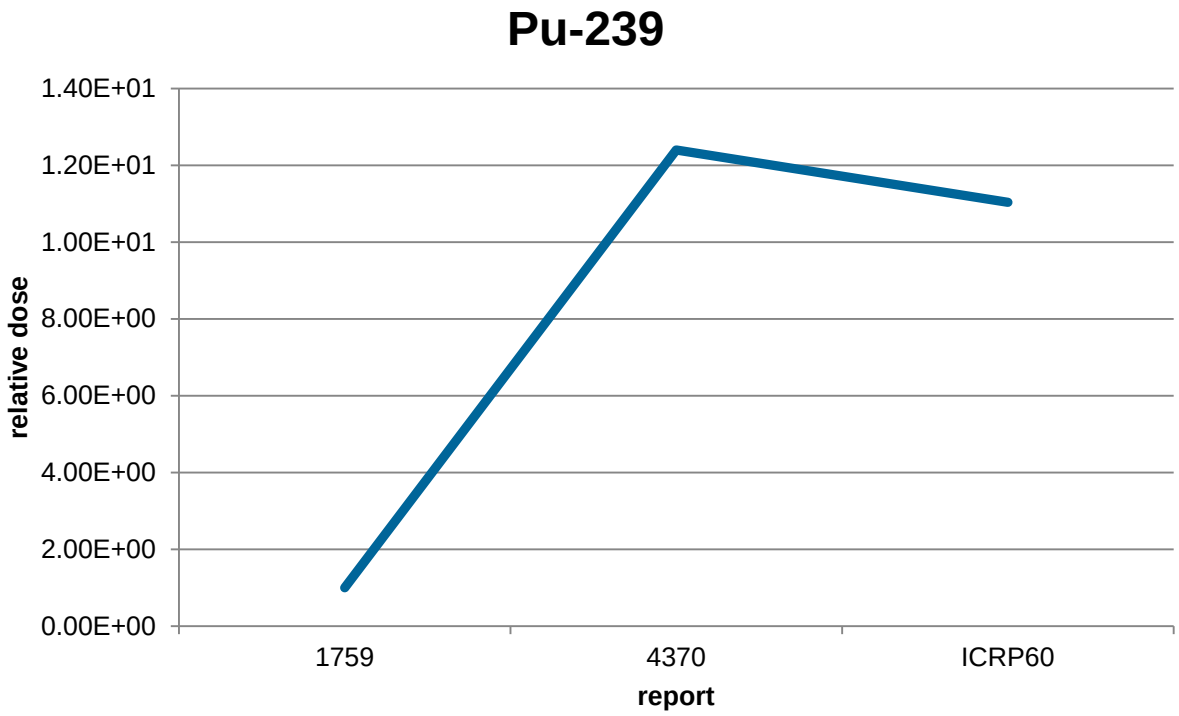
Impacts Model Results - Dose as a Ratio to NUREG/CR-1759

Plutonium -238



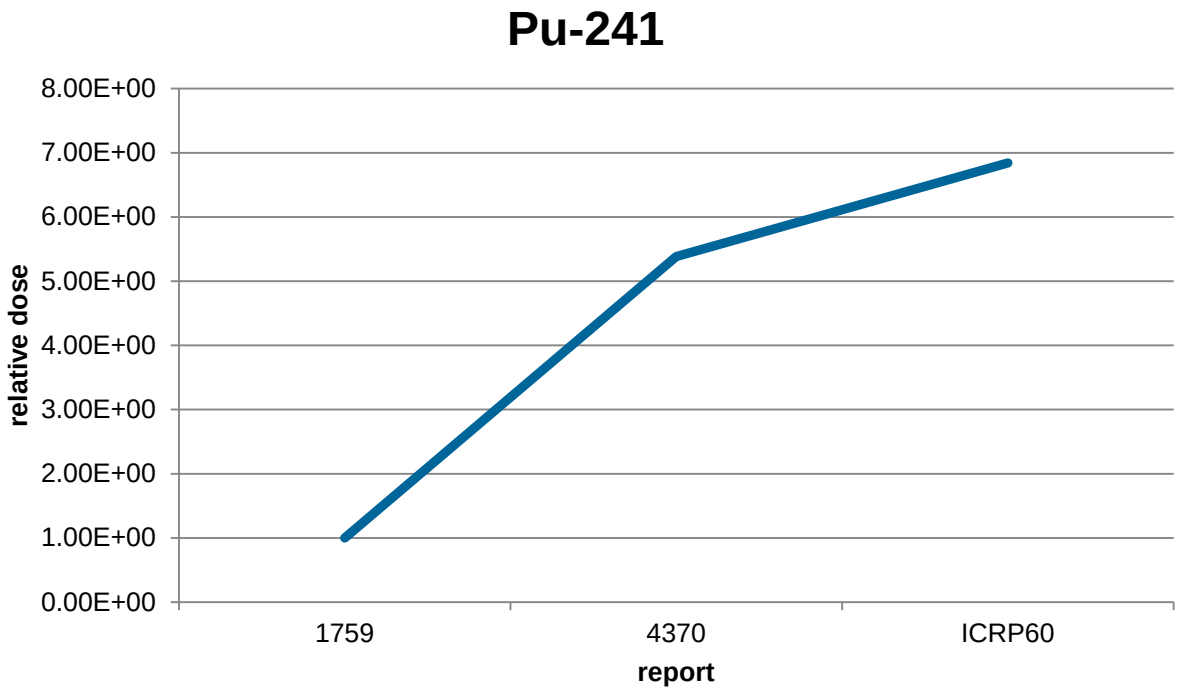
Impacts Model Results - Dose as a Ratio to NUREG/CR-1759

Plutonium-239



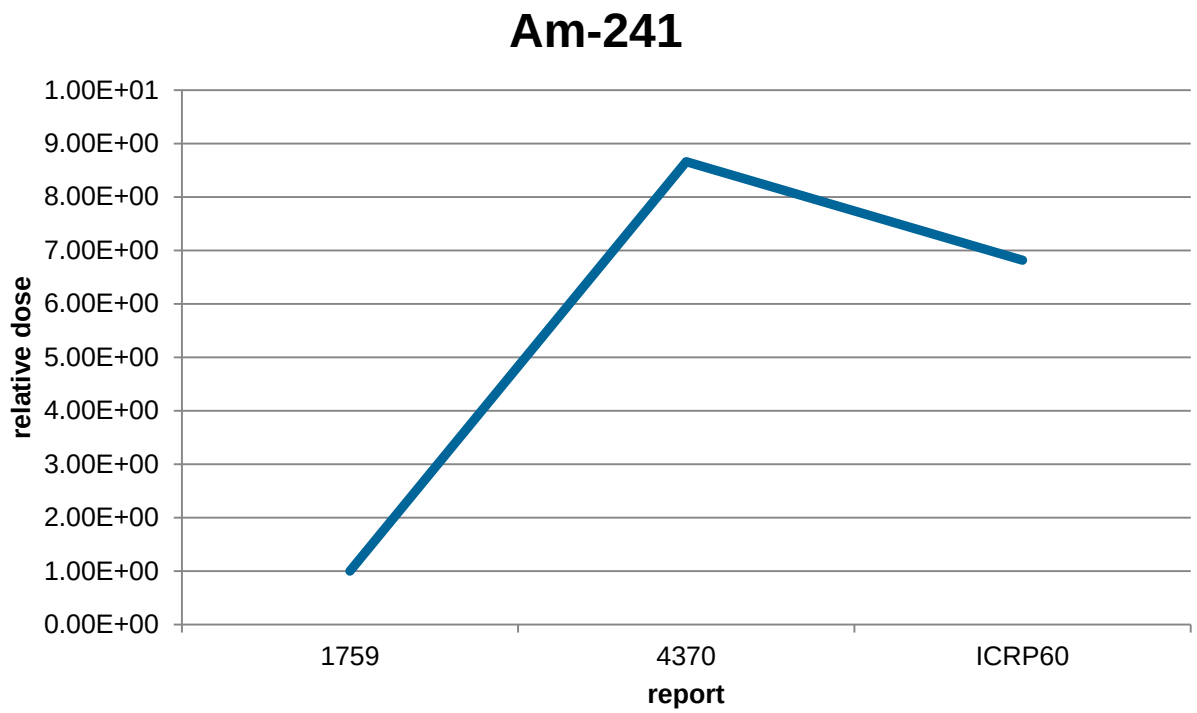
Impacts Model Results - Dose as a Ratio to NUREG/CR-1759

Plutonium-241



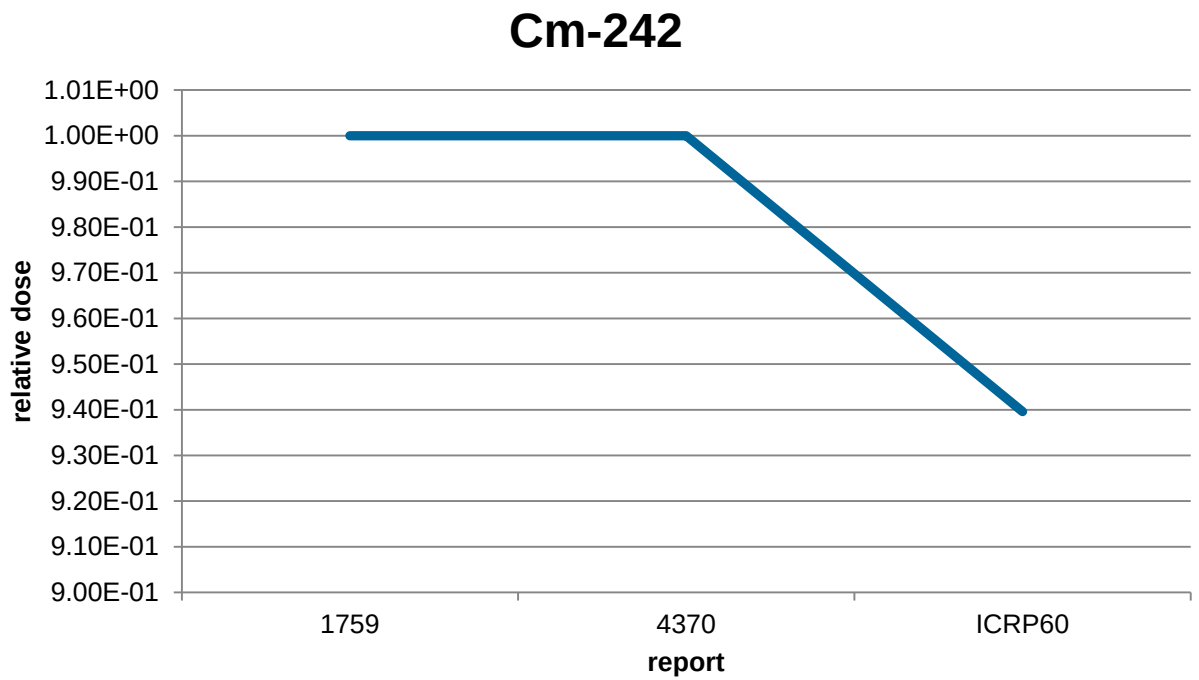
Impacts Model Results - Dose as a Ratio to NUREG/CR-1759

Americium-241



Impacts Model Results - Dose as a Ratio to NUREG/CR-1759

Cadmium-242



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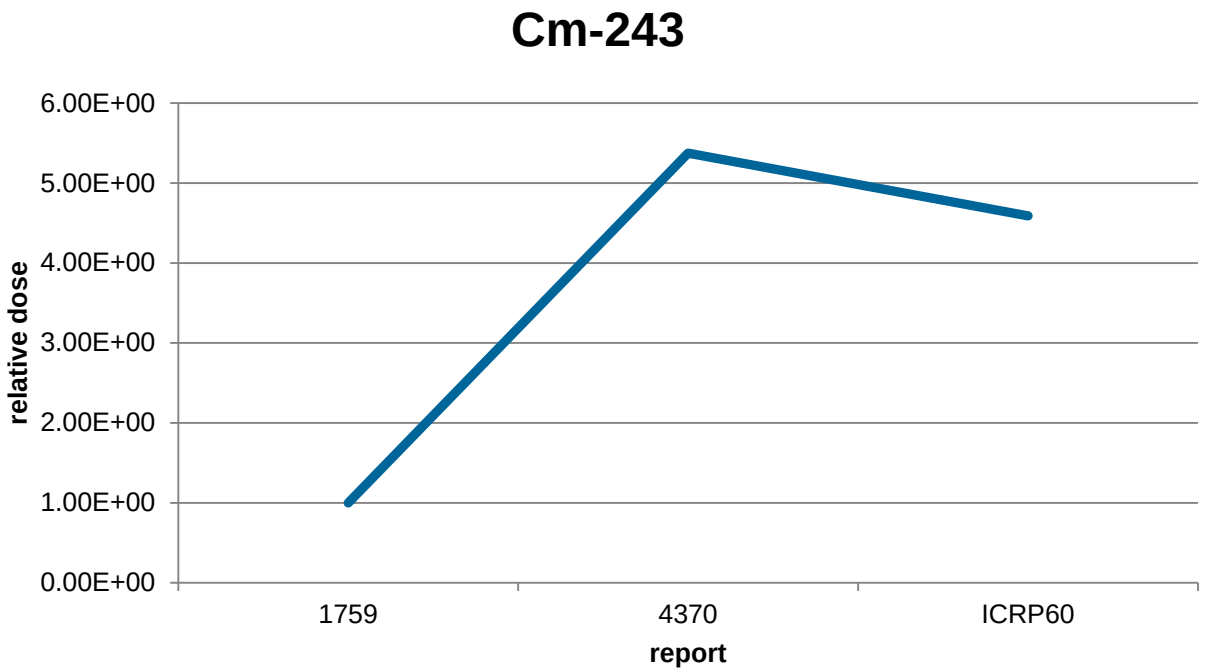
Cadmium-243



Impacts Model Results - Dose as a Ratio to NUREG/CR-1759

Comparison of Table 1 Limits

Code of Federal Regulations Title 10 Part 61.55 Table 1

Radionuclide	Value (Ci/m^3)	New Value (Ci/m^3)
C-14	8	2
C-14 in activated metal	80	20
Ni-59 in activated metal	220	3300
Nb-94 in activated metal	0.2	0.29
Tc-99	3	0.14
I-129	0.08	0.024
Transuranics w/ $T_{1/2} > 5$ yr	100	8.7
Pu-241	3500	500
Cm-242	20000	21000

Comparison of Table 2 Limits

Code of Federal Regulations Title 10 Part 61.55 Table 2

Radionuclide	Value (Ci/m^3)			New Value (Ci/m^3)		
	Class A	Class B	Class C	Class A	Class B	Class C
$T_{1/2}$ < 5 yr	700	*	*	NC	*	*
H-3	40	*	*	65	*	*
Co-60	700	*	*	1000	*	*
Ni-63	3.5	70	700	24	490	4900
Ni-63 in activated metal	35	700	7000	240	4900	49000
Sr-90	0.4	150	7000	3.5	1300	61000
Cs-137	1	44	4600	1.5	65	7100

* No value for these radionuclides, NC = No calculation performed for Co-60 & $T_{1/2}$ < 5 yr radionuclides

To Update or Not to Update (I)

- Public reasonably assumes the limits in the classification table are protective
- If all of the current limits were too high – that is the new dose conversion factors indicated the limits should be lower to maintain the same level of protection
  - There would be a compelling driver to update limits to ensure protection
- If all of the current limits were too low
  - There would not be a compelling driver to change limits for the sake of ensuring protection
- What we have is a mix
  - Half went up and half went down

To Update or Not to Update (II)

- In general, the 10 CFR 61.55 Table 2 limits increased and the 10 CFR 61.55 Table 1 limits decreased.
  - decreasing the importance of Cs-137, Sr-90 and Ni-63
  - increasing the importance of C-14, Tc-99, and TRU
  - greatest suspect data for C-14 and Tc-99 (manifesting guidance to improve accuracy is critical)
- More filters would likely be Class C
- More resins would likely be Class A
- Argues for an update to increase proper classification
- Leaving tables as is does not reflect the best science and understanding of the risk

Why Not Just Delete the Tables

- Site specific performance assessments could be used in lieu of the tables
- If the tables are discontinued when does that happen?
  - before SSPA are in place?
  - When one state has them place?
  - When all disposal site states have them in place?
- The tables existence does not preclude an SSPA that calls for different limits based on site characteristics
- Removal of the tables could unintentionally nullify state laws where the tables have been used to establish limits
- Elimination of the tables places a burden on states by removing previously established boundaries or norms and further opens a scientific basis to political manipulation.

- EPRI believes the tables should be updated to reflect the latest science

The tables provide a conservative measure of safety

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