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Verification Of the VARSKIN Beta Skin Dose Calculation Computer Code

Presented by:

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Ontario, Canada

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MCNP - VARSKIN
Beta Depth Dose Calculations

- Used the MCNP-5 Monte Carlo transport code as the reference for VARSKIN-3 calculations.
- Used a layer thickness of 10 μm at each depth to calculate the dose at that depth.
- Used the *F8 tally to calculate energy deposition.
- Tried to keep the relative precision at below 5% in most cases.

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MCNP - VARSKIN
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- The dose rates for all geometries were normalized to a total activity of 3.7E4
- Agreement between the codes at 7mg cm^{-2} was within 20%, and in most cases within 10% except doses from Co=60 for iron slab and iron sphere, the result different by 45% and 35%.
- The syringe results also differed by 75% for I-131

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- The difference between MCNP and VARSKIN results differed by a factor of ~ 2.

- 100 mg cm^{-2} is close to the range of beta spectra and different results for the codes were expected.

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Fig. 1. Comparison of point kernels published in the technical literature for a point source of 131-I in an infinite water medium with the corresponding values calculated using MCNP.

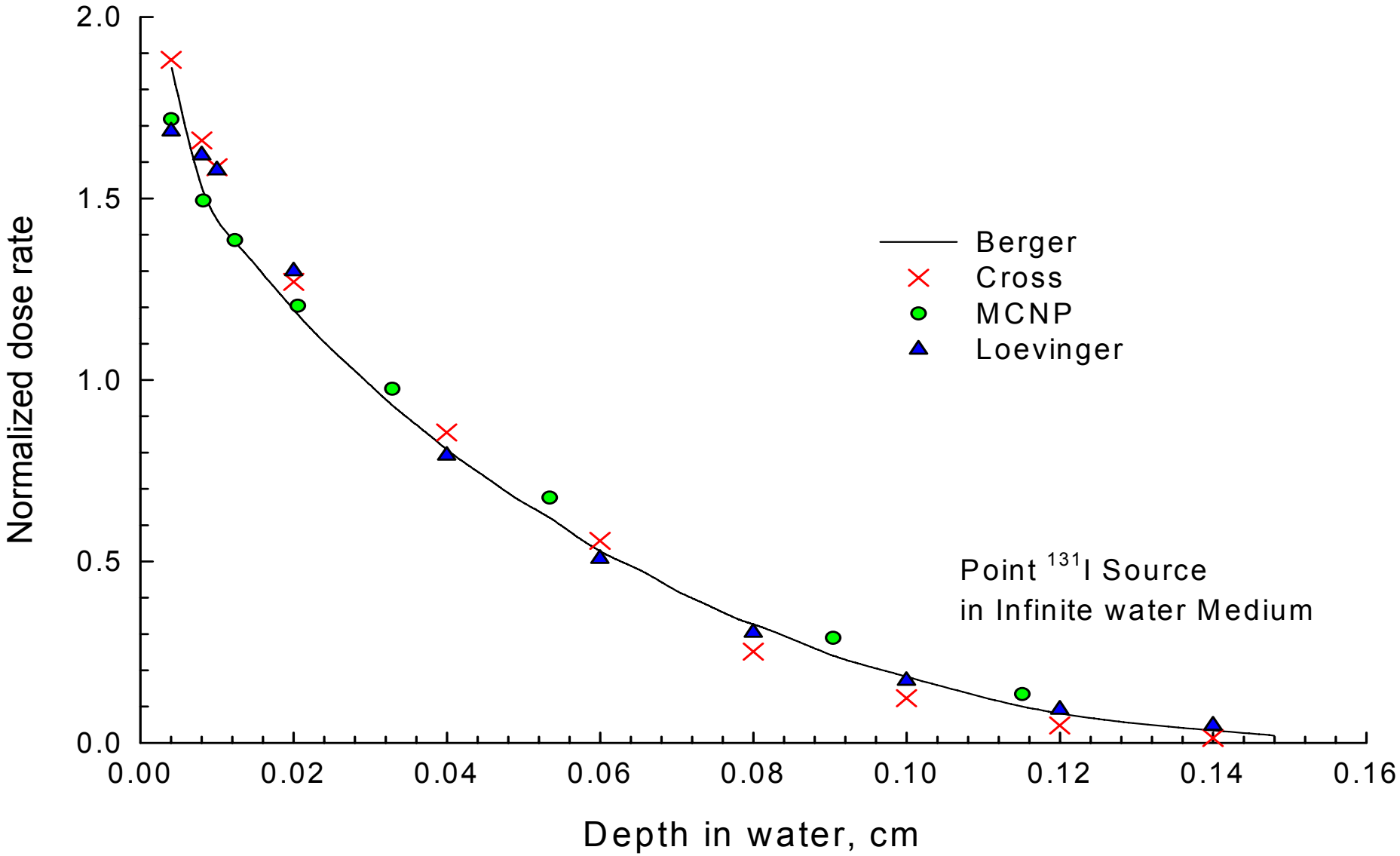

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Fig. 2. Depth dose rates from point sources located on the skin surface. The solid lines represent the VARSKIN results & the points represent the MCNP calculations.

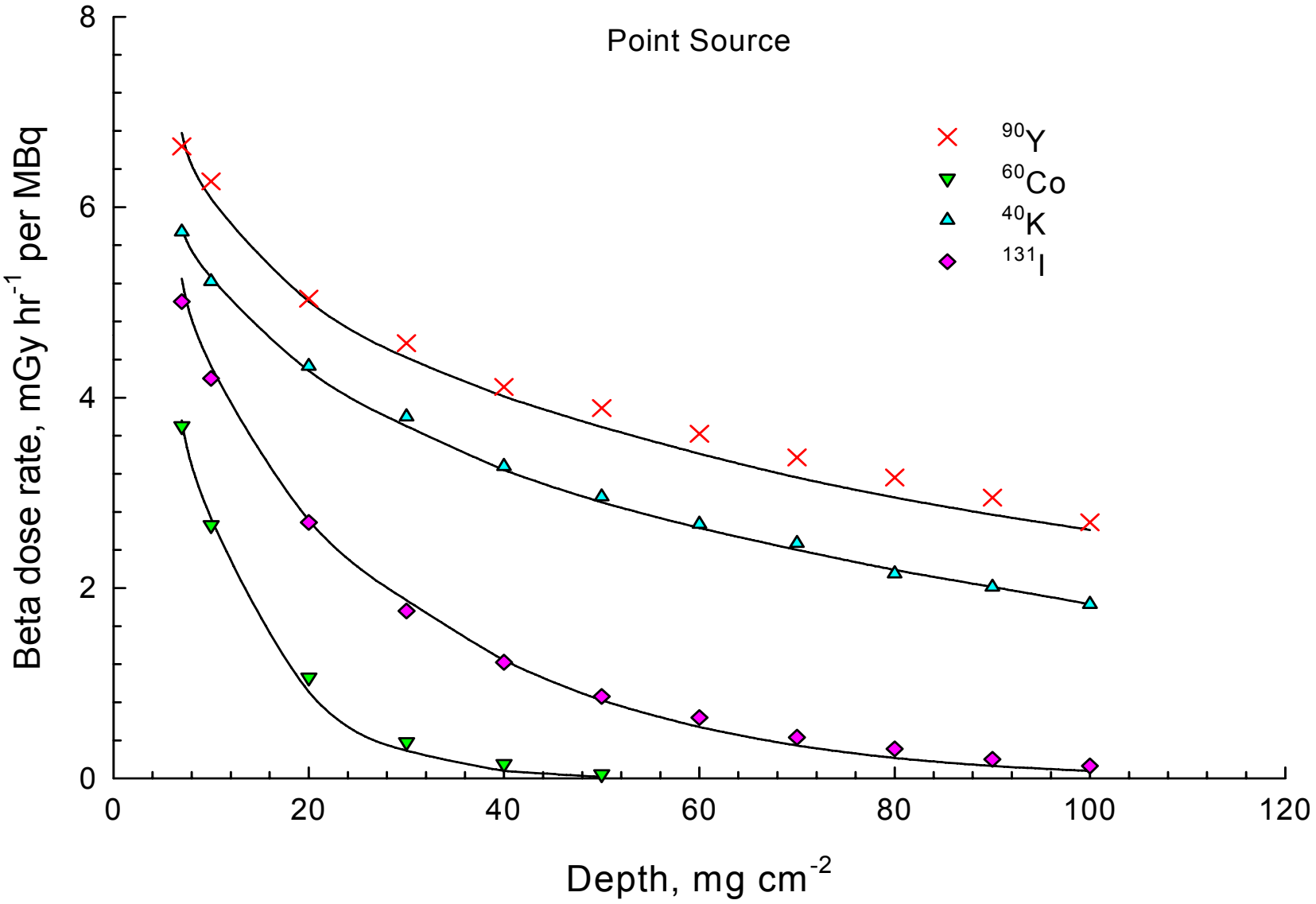

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Fig. 3. Depth dose rates from disc sources located on the skin surface. The disc has an area of 5 cm^2 and zero thickness. The solid lines represent the VARSKIN results and the points represent the MCNP calculations.

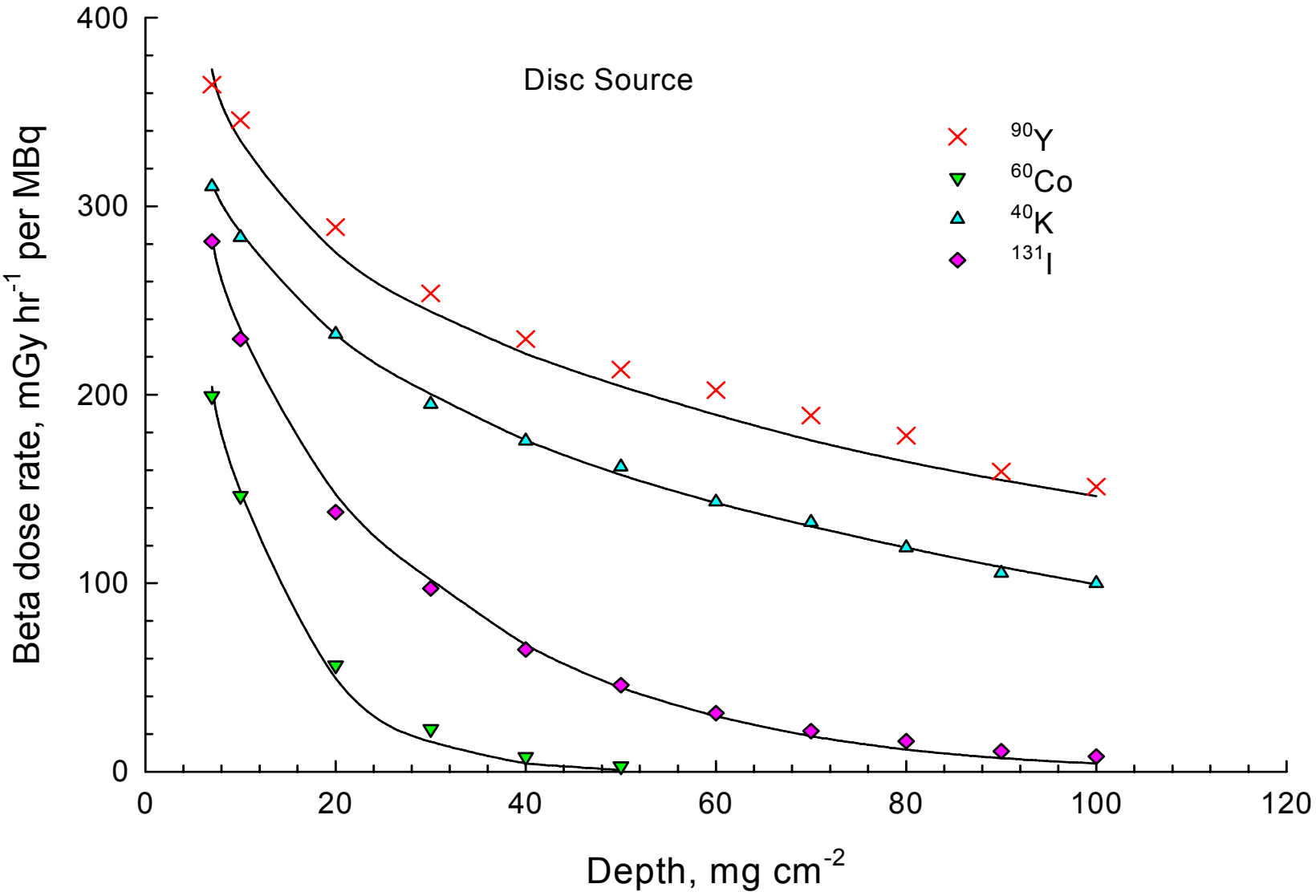

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Fig. 4. Depth dose sources from water slab sources located on the skin surface. The slab measured 2 X 2 mm and 1 mm thick. The solid lines represent the VARSKIN results and the points represent the MCNP calculations.

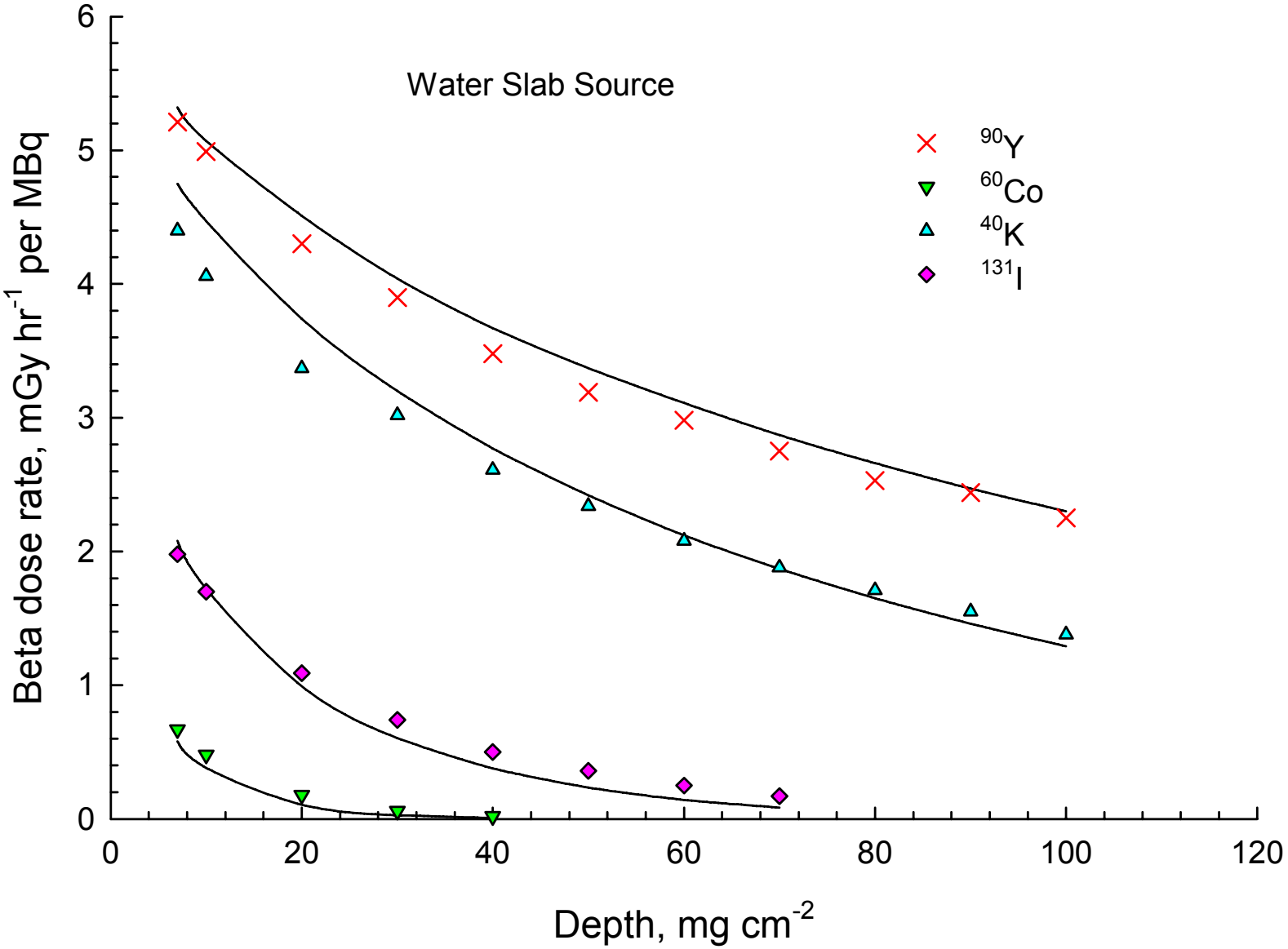

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Fig. 5. Depth dose rates from iron slab sources located on the skin surface. The slab measured 2 X 2 mm and 1 mm thick. The solid lines represent VARSKIN results and the points represent the MCNP calculations.

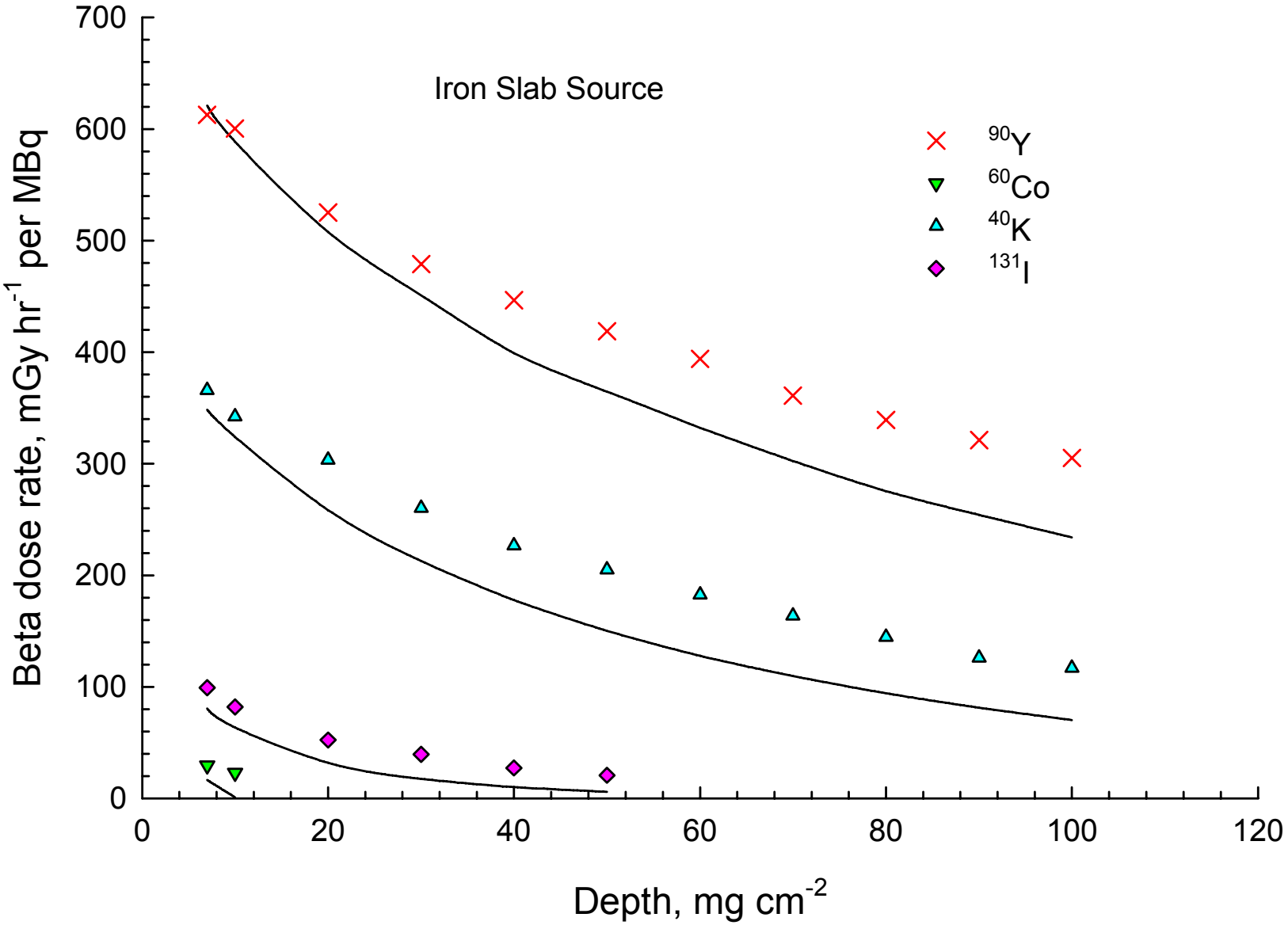

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Fig. 6. Depth dose rates from water cylindrical sources, 1 mm diameter and 1 mm thick, located on the skin surface. The solid lines represent the VARSKIN results and the points represent the MCNP calculations.

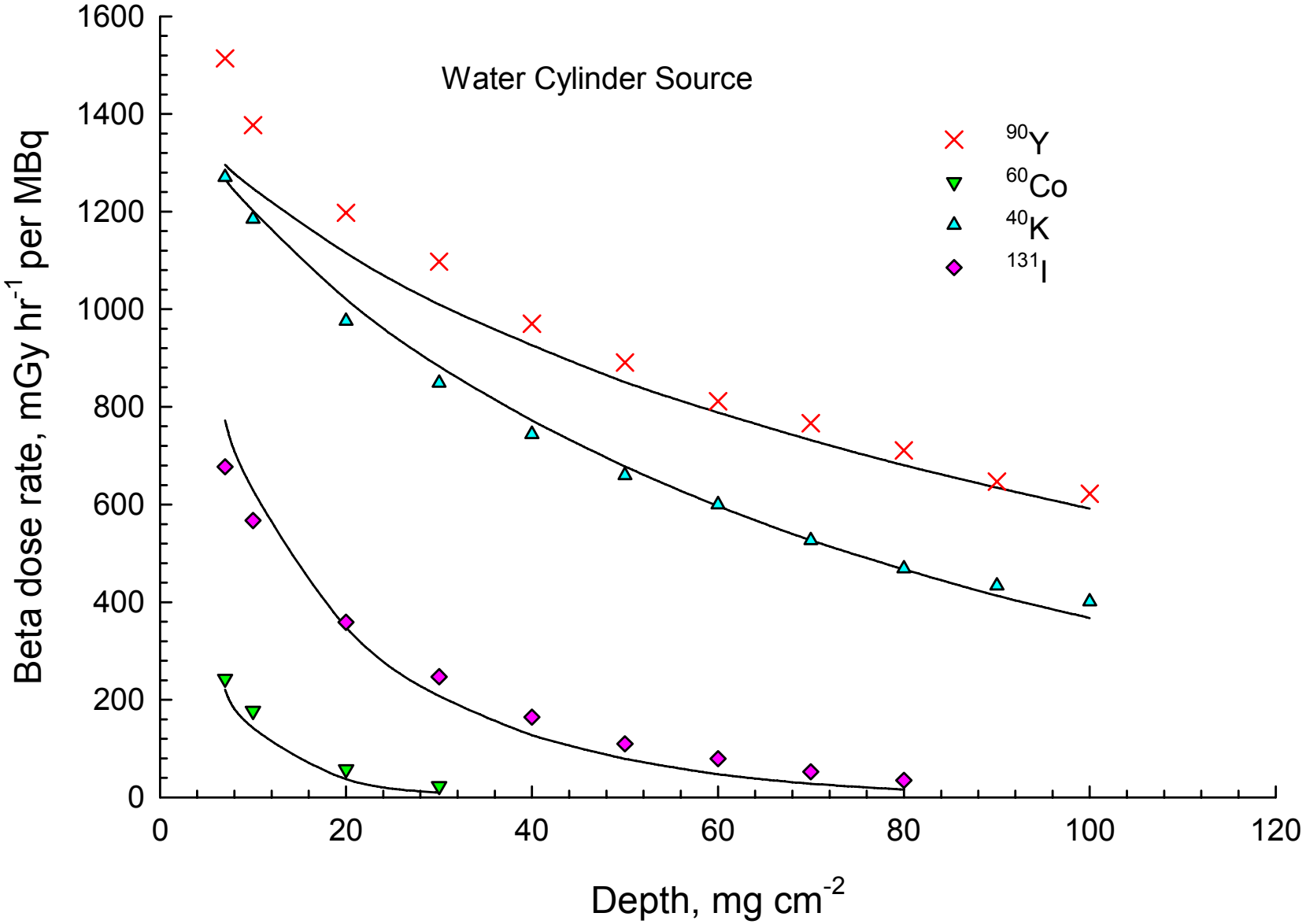

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Fig. 7. Depth dose rates from iron cylindrical sources, 1 mm diameter and 1 mm thick, located on the skin surface. The solid lines represent the VARSKIN results and the points represent the MCNP calculations.

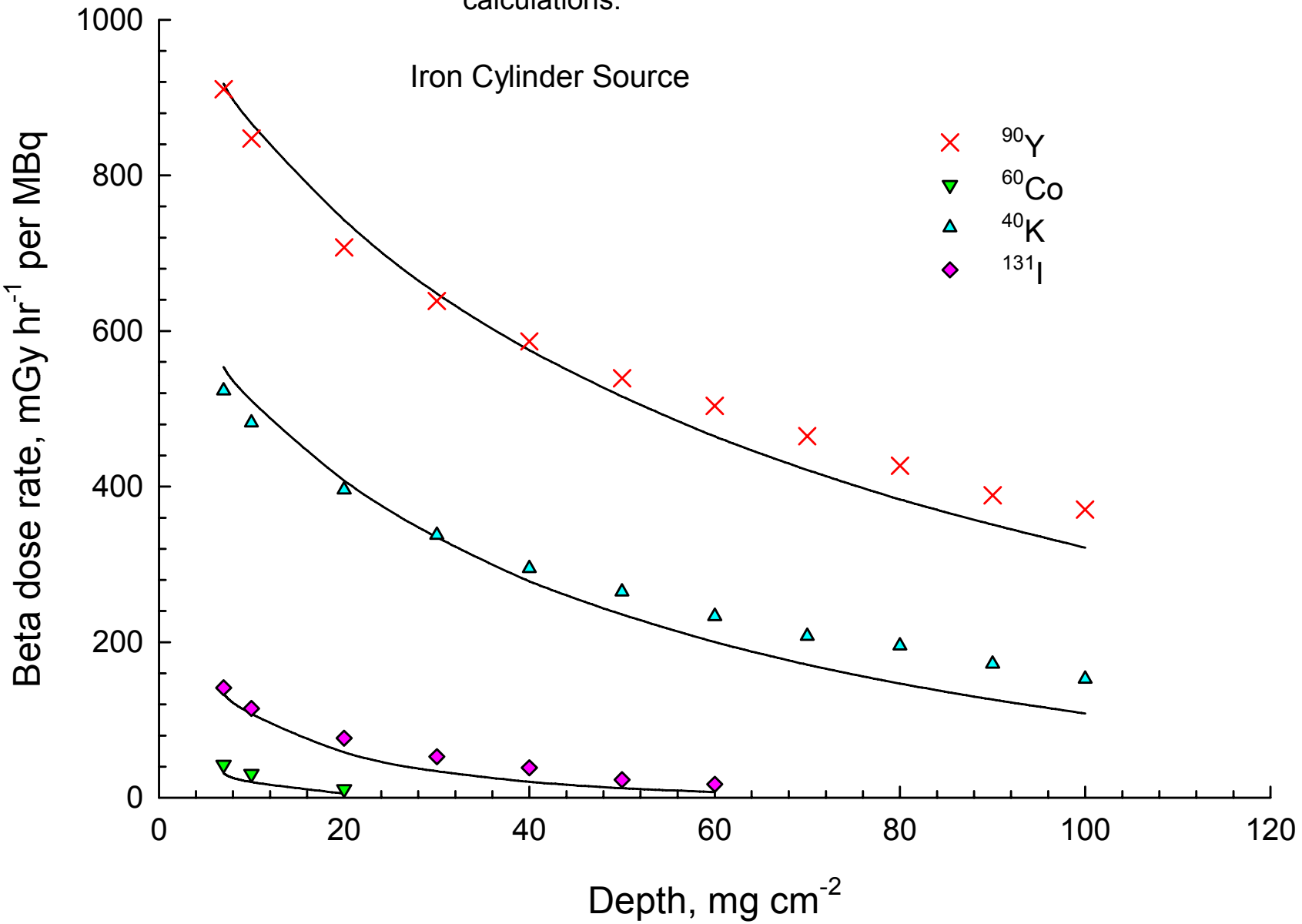

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Fig. 8. Depth dose rates are from water spherical sources, 2 mm diameter, located on the skin surface. The solid lines represent the VARSKIN results and the points represent the MCNP calculations.

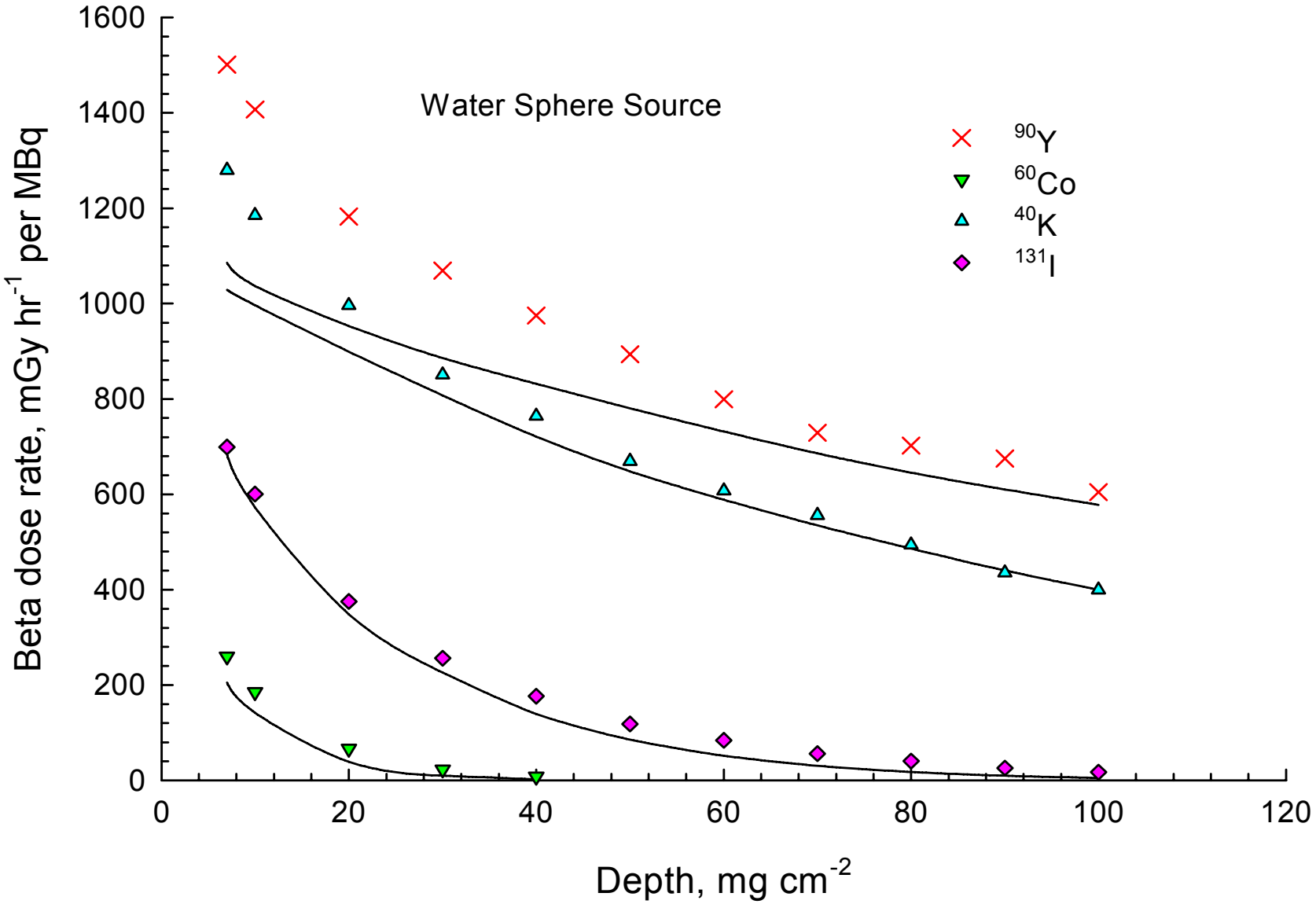

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Fig. 9. Depth dose rates from iron spherical sources, 2 mm diameter, located on the skin surface. The solid lines represent the VARSKIN results and the points represent the MCNP calculations.

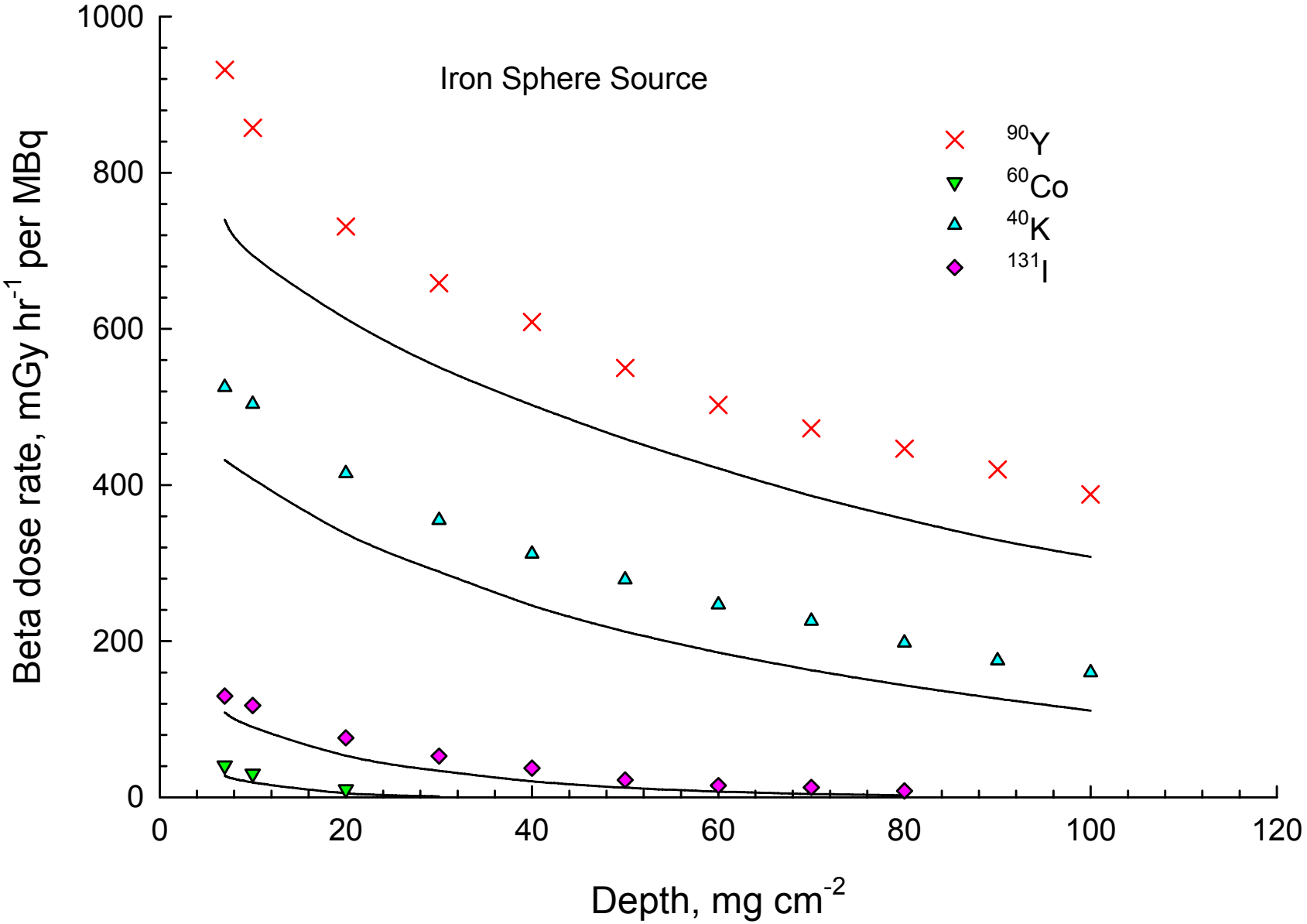

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Fig. 10. Depth dose rates from offset point sources located on the skin surface. The source was offset 5 mm from the center of the dose calculation area of skin. The solid lines represent VARSKIN results and the points represent MCNP calculations.

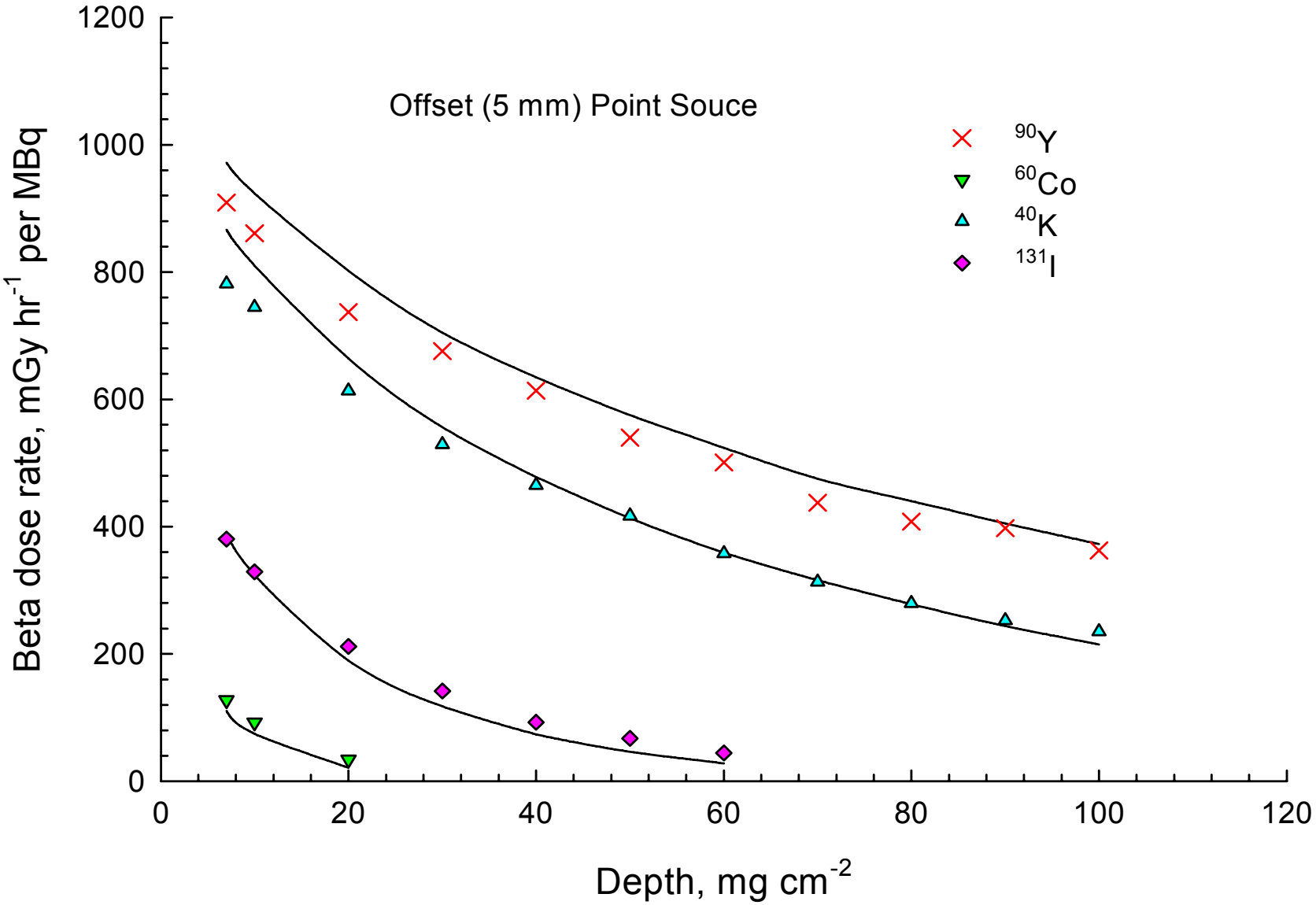

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Fig. 11. Depth dose rates from point sources with absorber between the source and the skin. The absorbers consisted of a 1 mm layer of polyethylene and a 2 mm layer of cotton. The solid lines represent the VARSKIN results and the points represent the MCNP calculations.

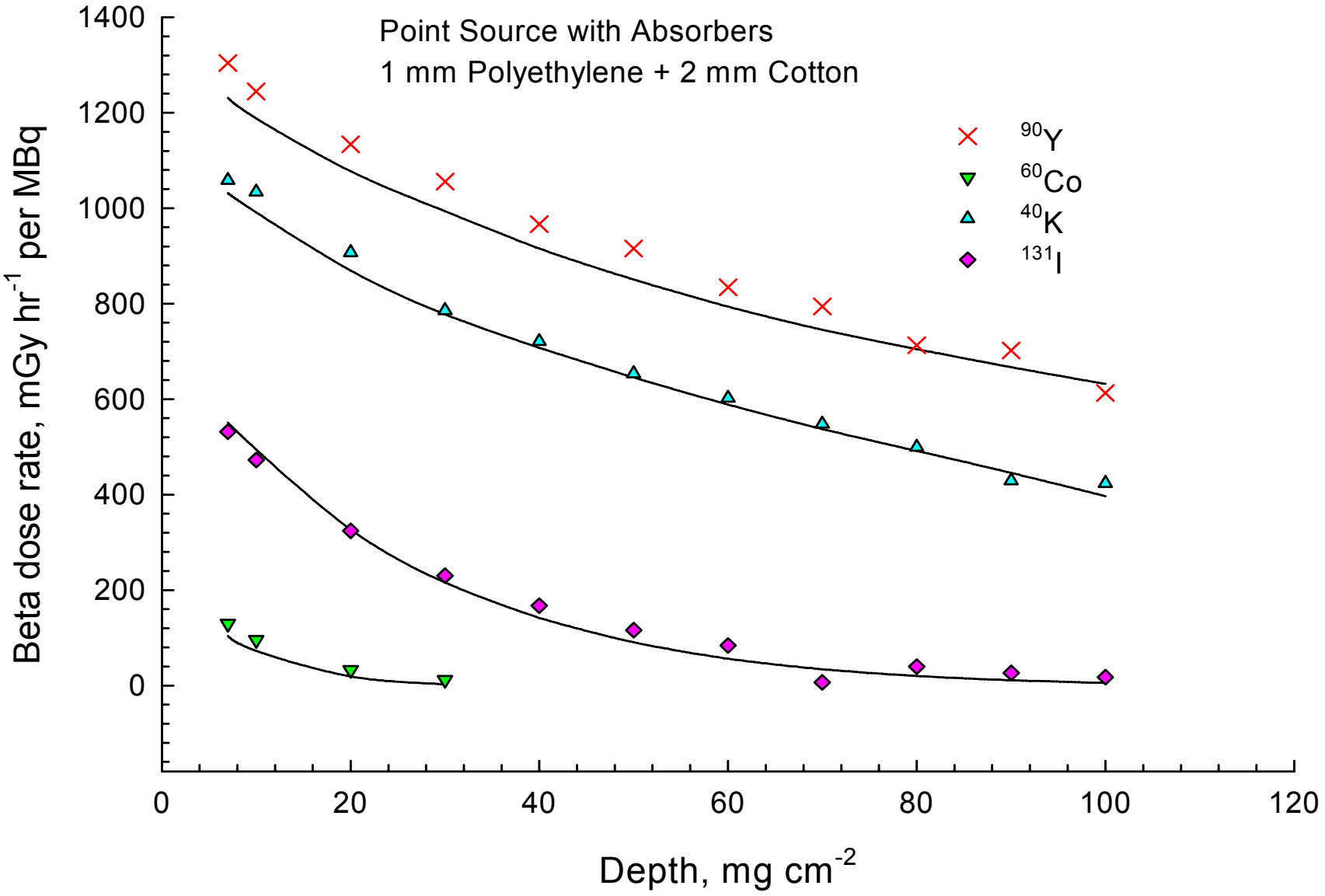

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Fig. 12. Percentage deviations of the VARSKIN results from those obtained using MCNP. The dose rates are all for a depth of 7 mg cm^-2 in water. The letters (w) and (i) indicate water and iron source materials, respectively.

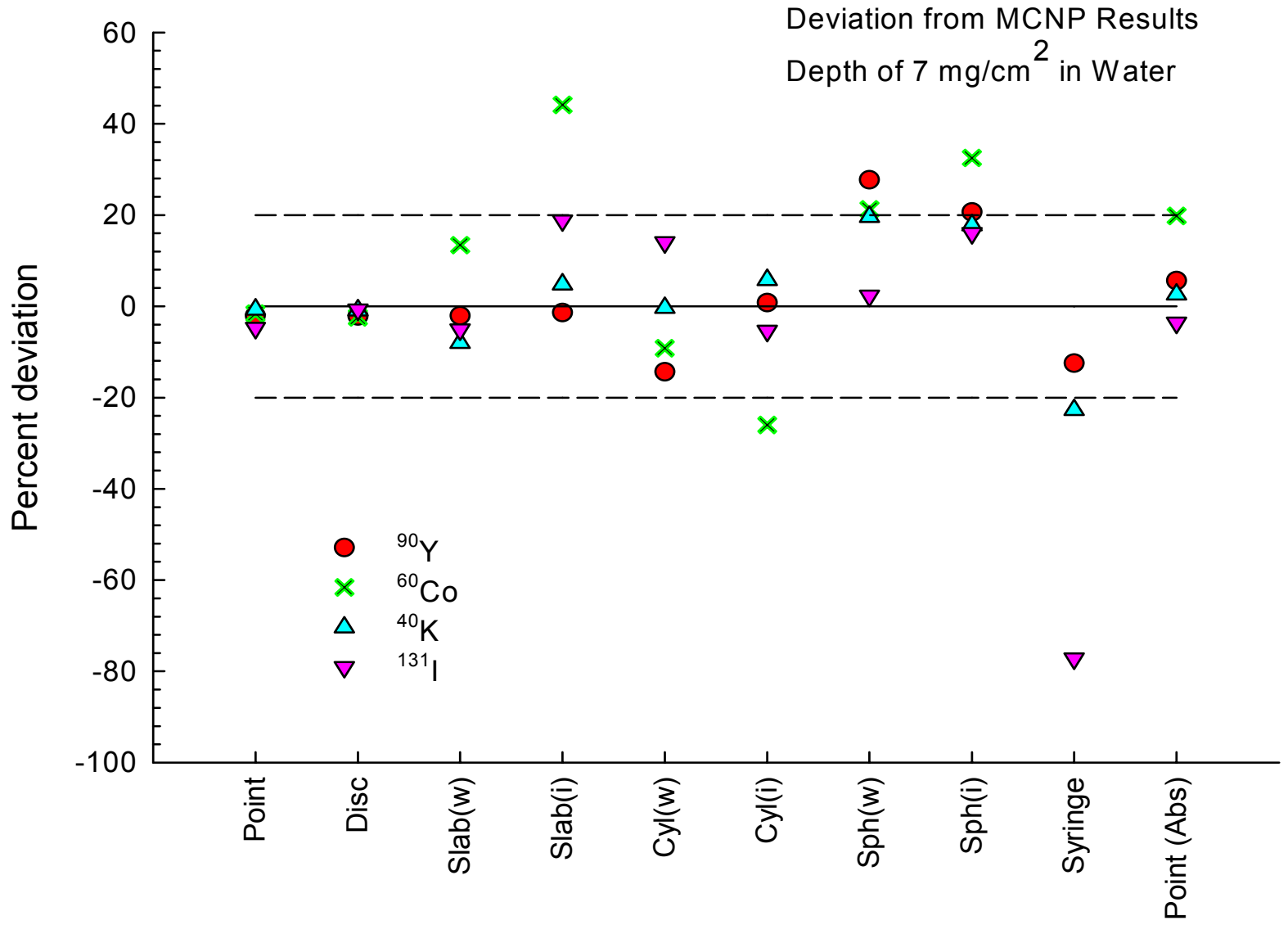

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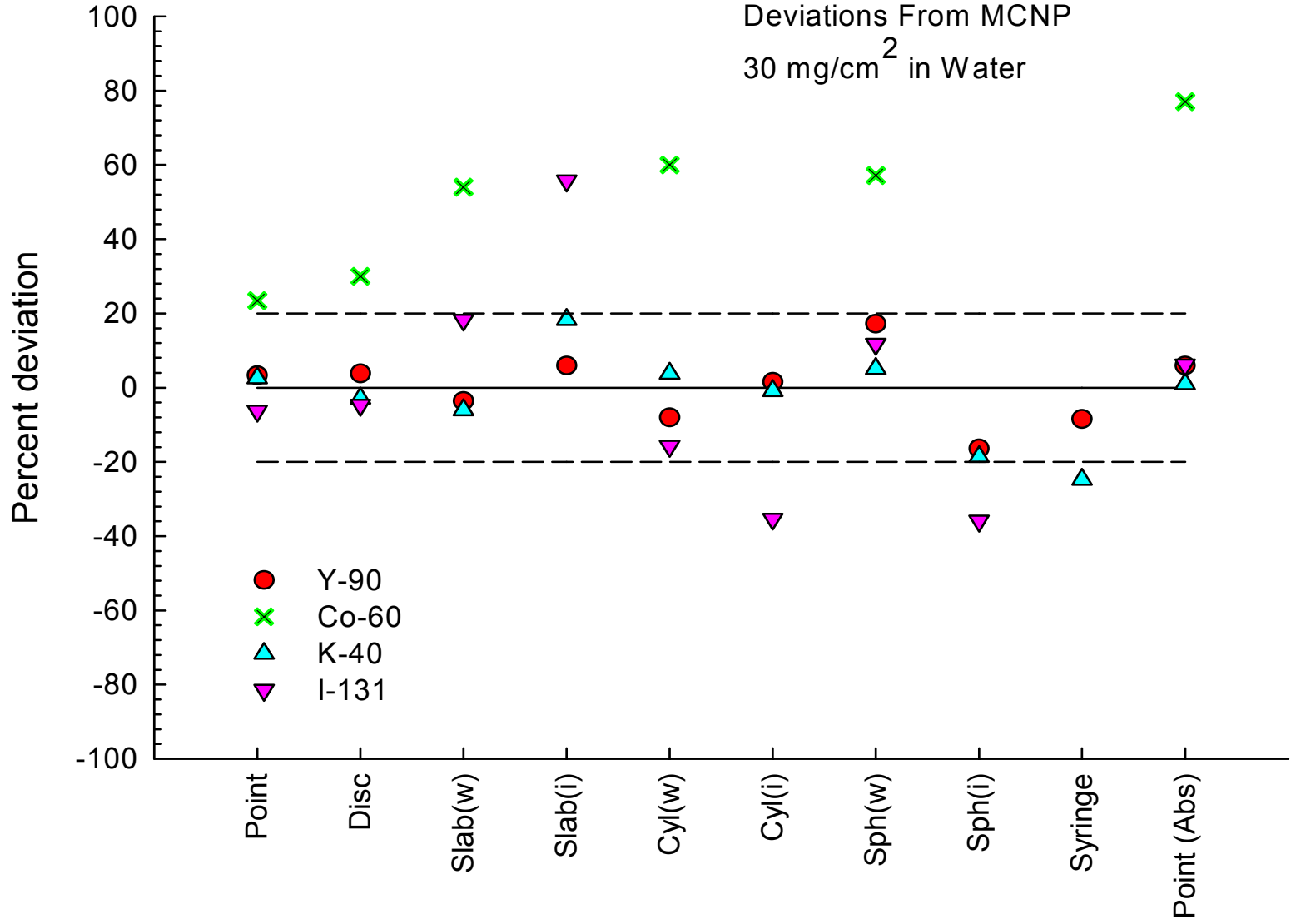
Fig. 13. Percentage deviations of the VARSKIN results from those obtained using MCNP. The dose rates are all for a depth of 30 mg cm^-2 in water. The letters (w) and (i) indicate water and iron source materials, respectively.



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