# Absorbed dose to the urinary bladder using dynamic S-values

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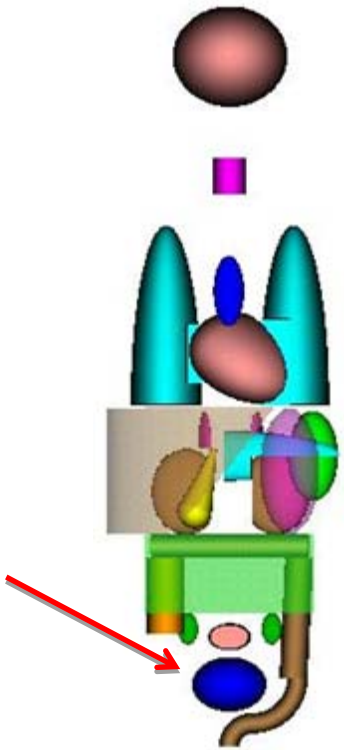
# Introduction



**Cristy & Eckerman (1987)**
**Male phantom**

Radiation dose to Patients from different radiopharmaceuticals are published in ICRP publication 53, 80 and 106.

The absorbed dose to the urinary bladder wall is calculated using a fixed urinary bladder content volume of 202.6 mL.

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# Background - Previous dynamic models

First model: Cloutier *et al.* (1973):

Investigated the dose to a foetus from the urinary bladder

Snyder and Ford (1976):

Started to calculate the absorbed dose to the urinary bladder wall

Latest model: Thomas *et al.* (1999):

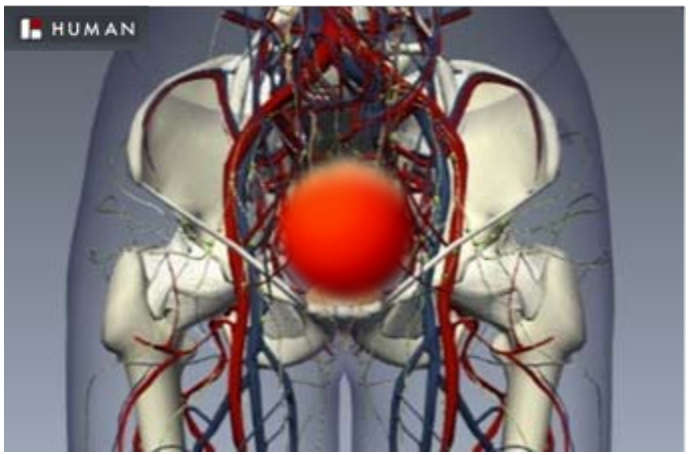
Calculated the absorbed dose to the inner surface of the bladder wall

Cloutier RJ *et al*. 1973 Dose to the fetus from radionuclides in the bladder.
Snyder WS, Ford MR 1976 Estimation of dose to the urinary bladder and to the gonads.
Thomas SR *et al.* 1999 MIRD Pamphlet No. 14 revised: A dynamic urinary bladder modelfor radiation dose calculations

# Aim

To improve the previous models with:

- Dynamic dose conversion factors (S-value)
- Monte Carlo simulated electrons
- Realistic anatomical material
- Calculating the mean absorbed dose to the urinary bladder wall

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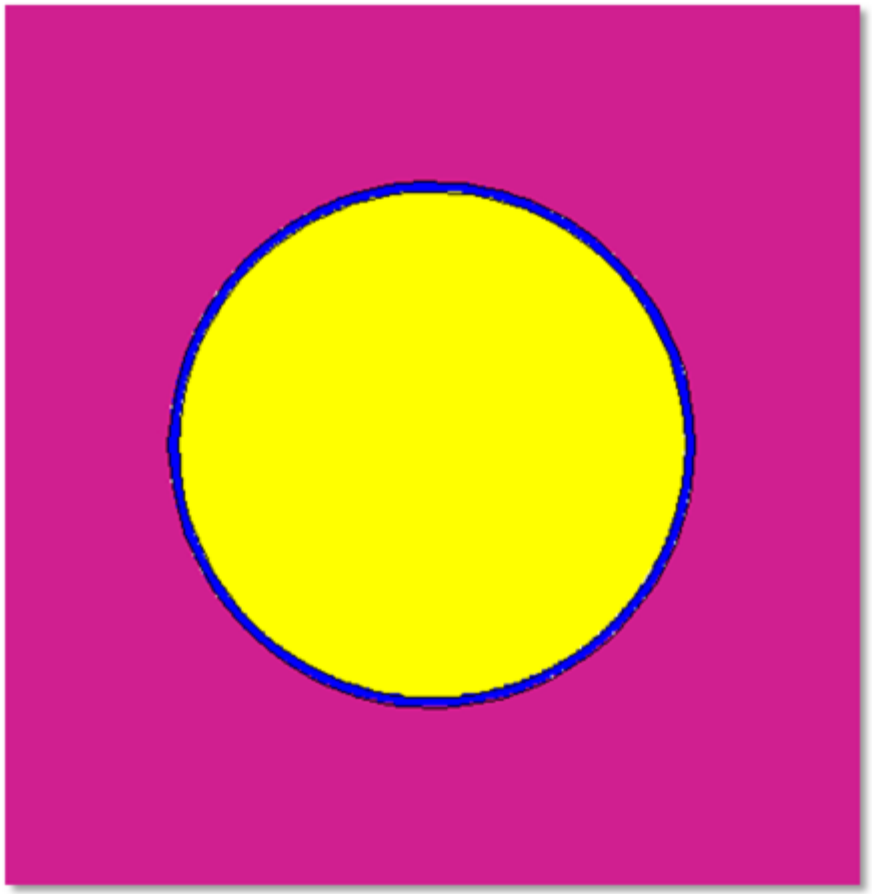
# Methods -Simulation (MCNP5)



Anatomy:

- Yellow = Urine
- Blue = Bladder wall
- Magenta = Water

Mass of bladder wall:

- Male=50.01 g
- Female= 40.00 g

Elemental compositions from ICRP publ. 110

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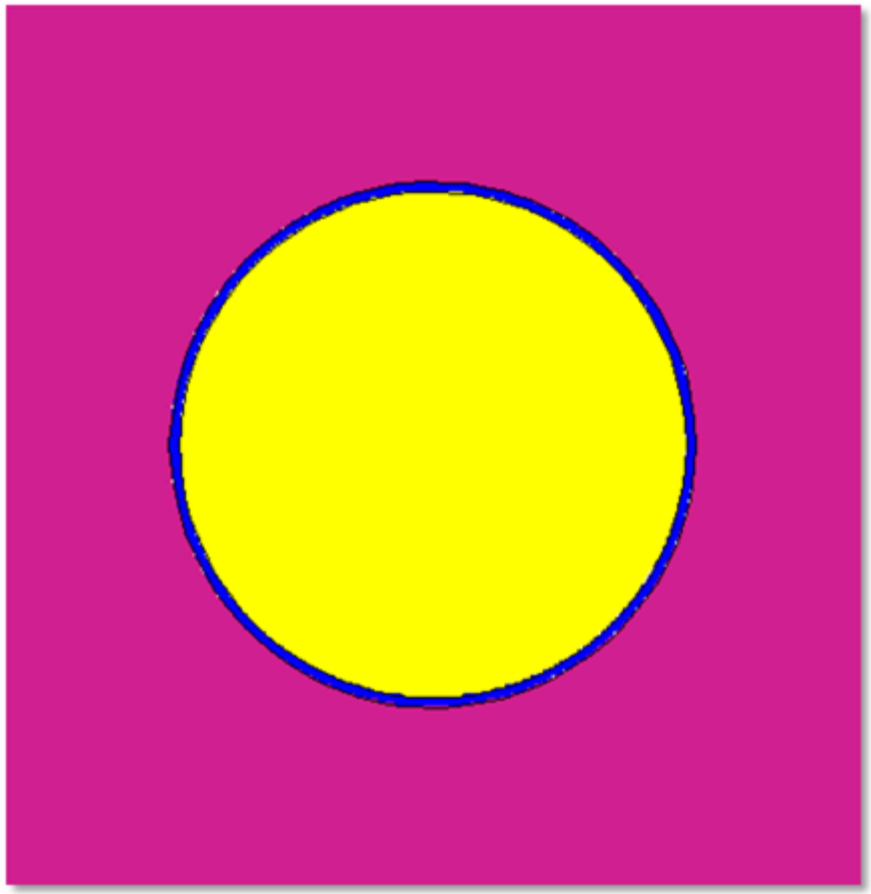
# Methods – SAF values



- Specific absorbed fraction is the absorbed fraction divided by the mass of the target region

$$\Phi(r_T \leftarrow r_s, E_{R,i}) = \frac{\varphi(r_T \leftarrow r_s, E_{R,i})}{M_{r_T}}$$

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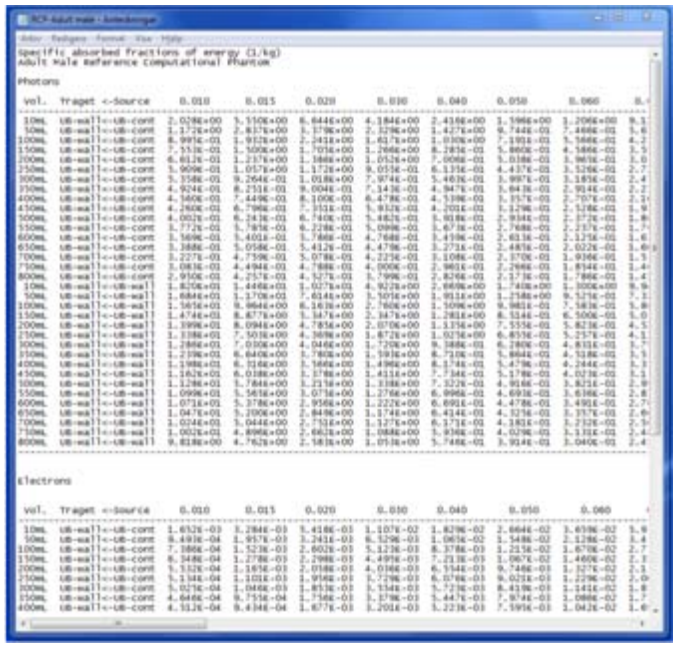
# Methods - Dynamic SAF-values

Dynamic SAF-values:

- 17 different volumes (raging from 10 mL to 800 mL)
- 25 different mono-energetic values for both photons and electrons (ranging from 10 keV to 10 MeV)
- Source regions:
  - Urinary bladder wall
  - Urinary content

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# Calculations

- The time-dependent bladder content volume:

$$V(t) = V_0 + \int U(t)dt; \qquad 0 \le t < T_1$$

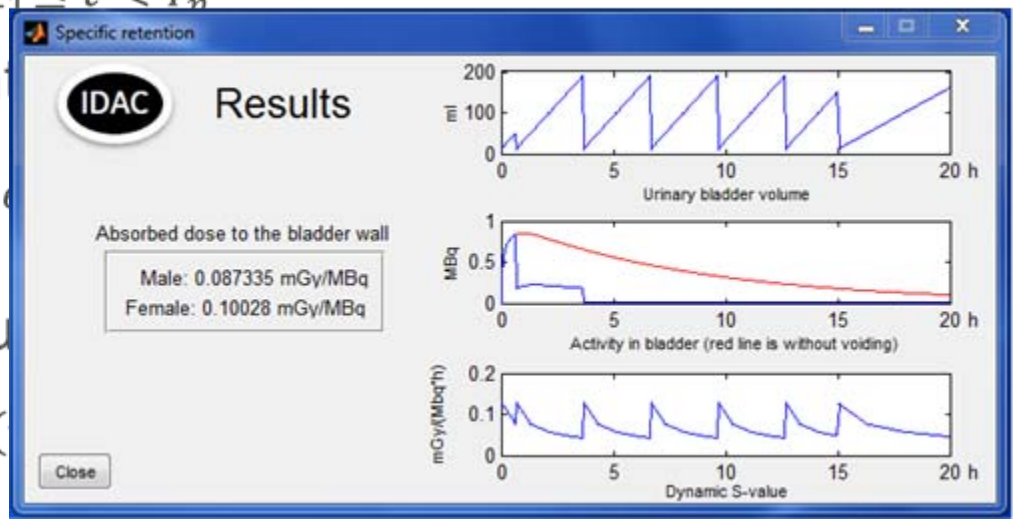
$$V_r + \int U(t)dt; \quad T_{n-1} \le t < T_n$$

Time-dependent bladder cont

$$A(t) = A_0 e^{-\lambda t} \sum_{j=1}^{m} \alpha_j (1 - $$

Mean absorbed dose to the u

$$D(r_T, T_D) = \sum_{r_s} \int A($$




The absorbed dose for $^{99m}$Tc MAG3

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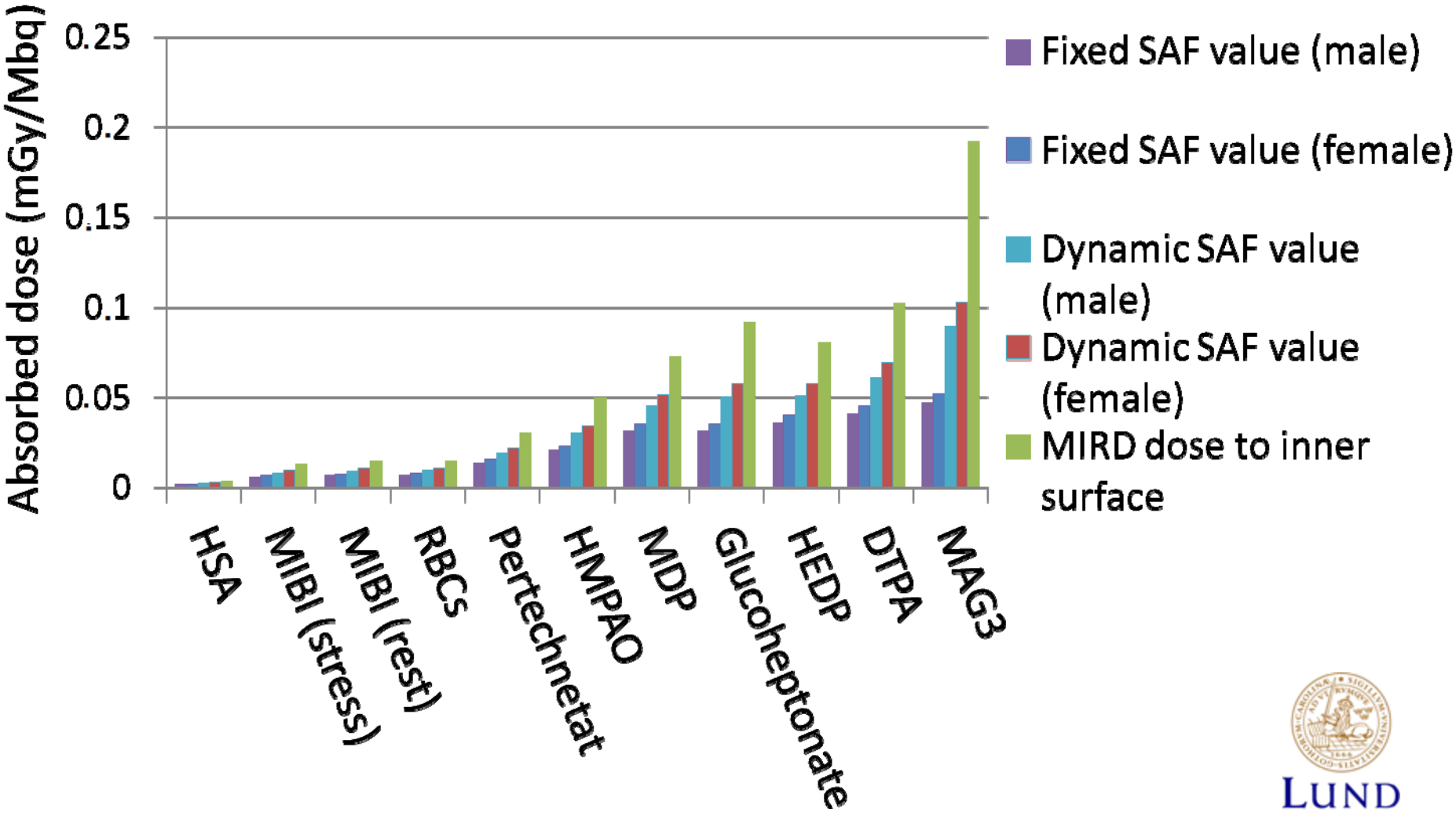
# Results $^{99m}$Tc

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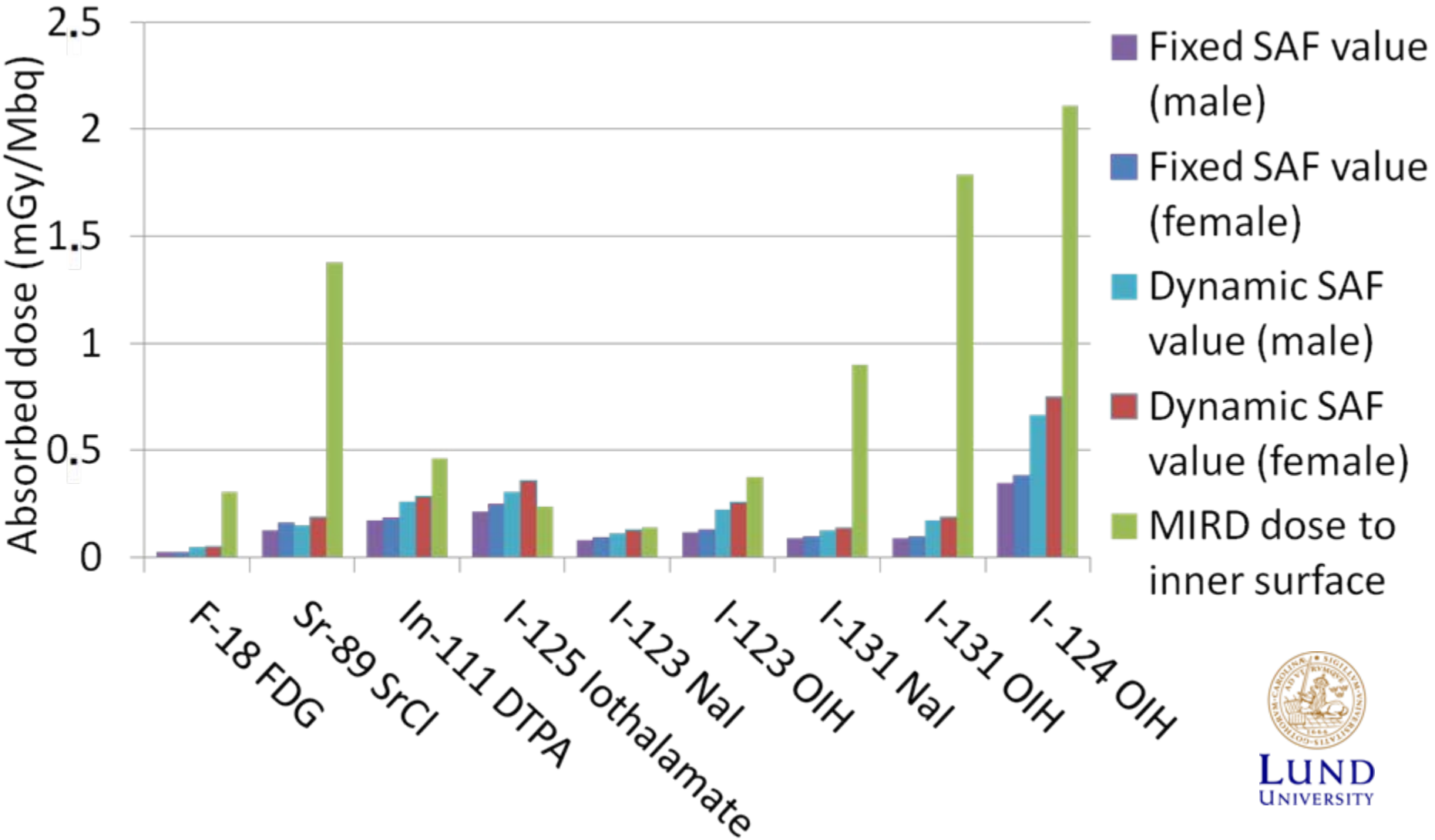
# Results

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# Conclusion

- New more realistic SAF values that calculates the mean absorbed dose to the bladder wall
- An increase in absorbed dose using dynamic SAF values compared to static SAF-values.

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# Thank you for listening

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