ASSESSMENT OF DOSE TO THE NURSING INFANT FROM RADIONUCLIDES IN BREAST MILK

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Introduction

• Software package DANI (Dose Assessment for Nursing Infant) was developed to estimate dose to infant from intake of radionuclides in breast milk
• Estimates based on measured activity in mother’s total body and/or excreta
• Builds on general approach of ICRP Pub. 95, but in contrast to Pub. 95:
  – All systemic biokinetic models depict realistic transfer paths from mother’s body burden into breast milk
  – Allows virtually any intake scenario for the mother
  – A somewhat different set of elements is addressed
Software modules

• Three main modules:
  – Computational module, driven by a user interface
  – Library of biokinetic files
  – Library of dose coefficients for ingestion by infant

• Biokinetic library
  – Current ICRP respiratory and GI models
  – Systemic models include some current ICRP models and some updates

• Infant dose coefficients from ICRP Pub. 72
Systemic Biokinetic Models

• Build on current ICRP recycling models
• Software includes model solver
• Biokinetic model library can be expanded without modifying computational module
• Current library addresses isotopes of H, P, Fe, Co, Sr, Ru, Rh, Pd, I, Cs, Pm, Eu, Gd, Tm, Yb, Ir, Po, Ra, U, Pu, Am, Cm, Cf
Example

DANI: Dose Assessment of Nursing Infant Dose: (based on maternal bioassay)
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Output will be written in G:\CODEDEV\NIDMAT\OUTPUT.

Mother: Mary Cesium

Mother experienced an inhalation intake of Cs-137 (Type F/AMAD 1um) on 12/01/2012 prior to pregnancy. Infant was born on 01/01/2013 and nursed until 02/28/2013.

- Radionuclide: Cs-137 T1/2 = 1.102E+04 d
- Intake mode: Inhalation - Type F AMAD = 1 um
- Bioassay: Urine
- Intake: Mother - 1.00E+05 Bq
  Infant - 1.97E+03 Bq
- Infant effective dose = 4.13E-05 Sv

Would you like to view the output files (y/[n])? n

Interpretation of Cs-137 Urine Measurements

- Graph showing daily urinary excretion (Bq) as a function of time (d) post acute intake.
- Points representing observations.
- Line representing expectation.
- Infant born on day 31.