

# Biota Modelling Working Group (WG4)



# ‘Exercise 3’

## Purpose:

Compare unweighted internal and external absorbed dose rates assuming 1 Bq kg<sup>-1</sup> in organism & 1 Bq unit<sup>-1</sup> media respectively

Radionuclides considered – those from ICRP ‘RAP’ report (+<sup>55</sup>Fe)

<sup>3</sup>H, <sup>14</sup>C, <sup>32</sup>P, <sup>33</sup>P, <sup>35</sup>S, <sup>36</sup>Cl, <sup>40</sup>K, <sup>45</sup>Ca, <sup>51</sup>Cr, <sup>54</sup>Mn, <sup>55</sup>Fe, <sup>57</sup>Co, <sup>58</sup>Co, <sup>60</sup>Co, <sup>59</sup>Ni, <sup>63</sup>Ni, <sup>65</sup>Zn, <sup>75</sup>Se, <sup>79</sup>Se, <sup>89</sup>Sr, <sup>90</sup>Sr, <sup>95</sup>Zr, <sup>94</sup>Nb, <sup>95</sup>Nb, <sup>99</sup>Tc, <sup>103</sup>Ru, <sup>106</sup>Ru, <sup>110m</sup>Ag, <sup>109</sup>Cd, <sup>124</sup>Sb, <sup>125</sup>Sb, <sup>129m</sup>Te, <sup>132</sup>Te, <sup>125</sup>I, <sup>129</sup>I, <sup>131</sup>I, <sup>134</sup>Cs, <sup>135</sup>Cs, <sup>136</sup>Cs, <sup>137</sup>Cs, <sup>140</sup>Ba, <sup>140</sup>La, <sup>141</sup>Ce, <sup>144</sup>Ce, <sup>152</sup>Eu, <sup>154</sup>Eu, <sup>155</sup>Eu, <sup>192</sup>Ir, <sup>210</sup>Pb, <sup>210</sup>Po, <sup>226</sup>Ra, <sup>228</sup>Ra, <sup>227</sup>Th, <sup>228</sup>Th, <sup>229</sup>Th, <sup>230</sup>Th, <sup>231</sup>Th, <sup>232</sup>Th, <sup>234</sup>Th, <sup>231</sup>Pa, <sup>233</sup>U, <sup>234</sup>U, <sup>235</sup>U, <sup>238</sup>U, <sup>237</sup>Np, <sup>238</sup>Pu, <sup>239</sup>Pu, <sup>240</sup>Pu, <sup>241</sup>Pu, <sup>241</sup>Am, <sup>242</sup>Cm, <sup>243</sup>Cm, <sup>244</sup>Cm, <sup>252</sup>Cf

Did not include noble gases (Ar, Kr Rn) which had been requested by some group members



# Exercise 3

Organism geometries taken from information supplied for ICRP RAPs to BWG Exercise 1:

Organism	a (cm)	b (cm)	c (cm)	Mass (g)	S (cm <sup>2</sup> )	S/V (cm <sup>-1</sup> )	Ecosystem
Duck	30	10	8	1.3E+03	6.3E+02	5.0E-01	Freshwater
Frog	8	3	2.5	3.1E+01	5.2E+01	1.7E+00	Freshwater
Salmonid egg	0.25	0.25	0.25	8.2E-03	2.0E-01	2.4E+01	Freshwater
Rat	20	6	5	3.1E+02	2.5E+02	7.9E-01	Terrestrial
Earthworm (elongated)	10	1	1	5.2E+00	2.5E+01	4.7E+00	Terrestrial

Hmmmm –

Flatfish egg 0.2 0.2 0.2 4.19x10<sup>-6</sup> kg

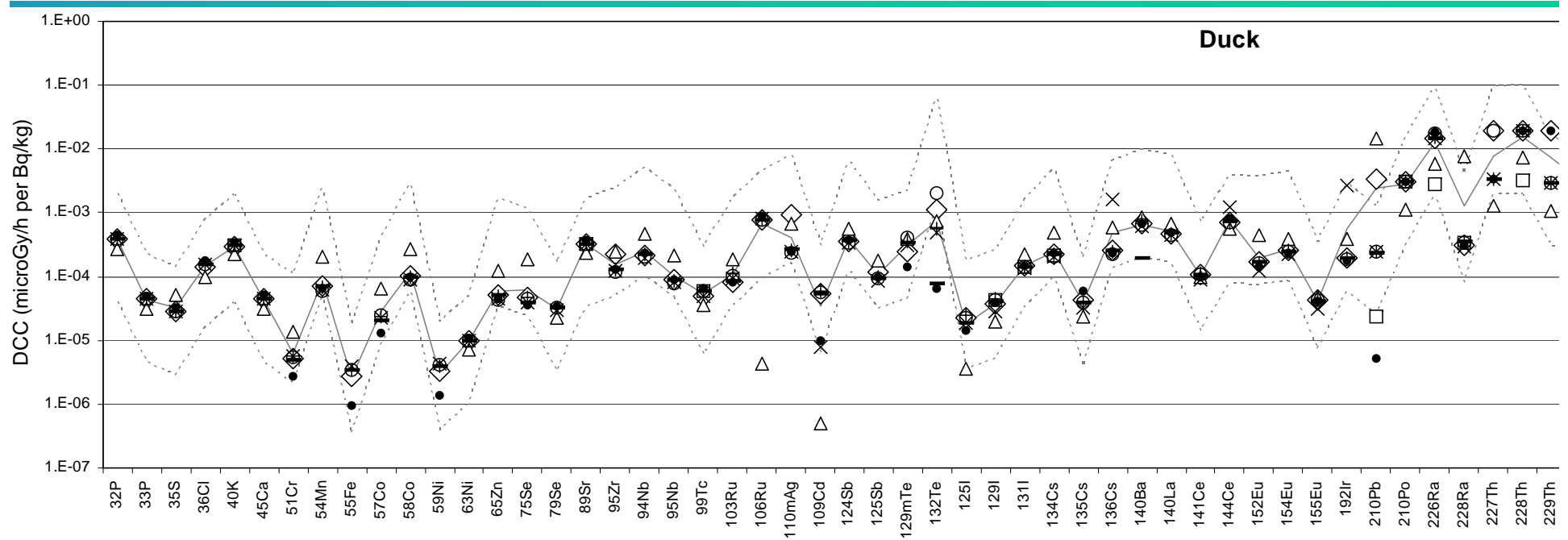
# Exercise 3

Exposure scenarios results requested for:

Organism	Underground	Shore (soil surface)	Benthic interface	Water
Duck		Y		Y
Frog		Y		Y
Salmonid egg			Y	Y
		Soil surface		
	Underground			
Rat	Y (depth 25 cm)	Y		
Earthworm (elongated)	Y (depth 25 cm)	Y		



Model	Participant
RESRAD-BIOTA ['basics']	Sunita Kamboj (ANL, USA)
RESRAD-BIOTA [available software]	Mike Wood (Liverpool, UK)
EA R&D128 ['basics']	Jordi Vives i Battle (WSC, UK)
EA R&D128 [available spreadsheets]	Laura Newsome (EA, UK)
EA R&D128 [analogue approach]	Laura Newsome (EA, UK)
EDEN	Karine Beaugelin-Seiller (IRSN, France)
EPIC DOSES3D	Ali Hosseini (NRPA, Norway)
ICRP RAP report	Nick Beresford (CEH, UK)
K-Biota	Dong-Kwon Keum (KAERI, Korea)
SUJB	Jan Horyna (SUJB)
VIC	Susumu Ryufuku (VIC)
DosDimEco	Geert Olyslaegers (SCK·CEN, Belgium)
ERICA [default]	Laura Newsome (EA, UK)/Hildegarde Vandenhove (SCK·CEN, Belgium)
ERICA [create organism]	Mat Johansen (ANSTO, Australia)



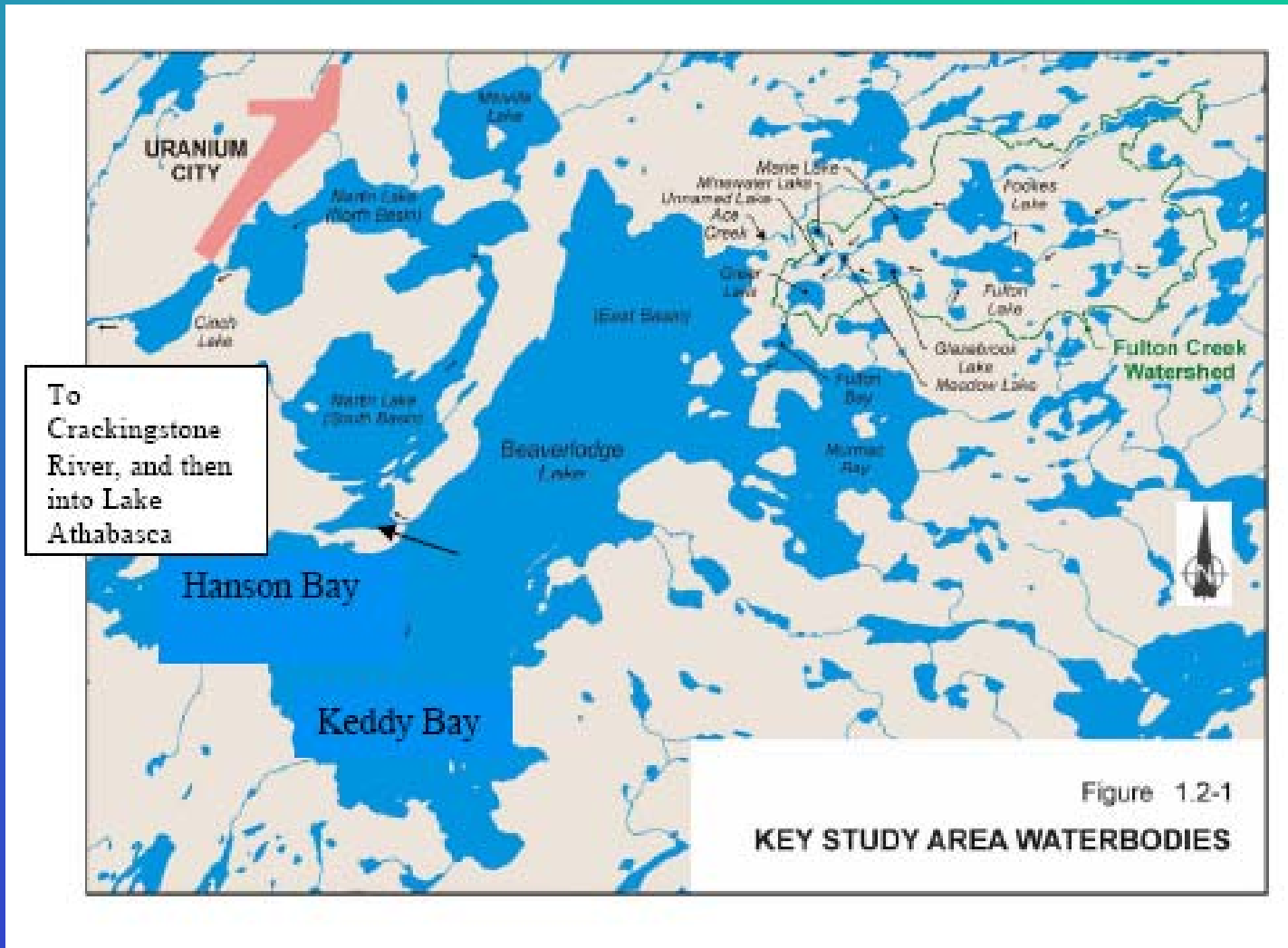
With some exceptions – approaches are giving similar estimates of dose. Some checks to be made of inputs.

More variation external exposure & small geometry (Flatfish egg)

Plan towards submitting a paper (Radiation Env. Biophysics) *circa* April

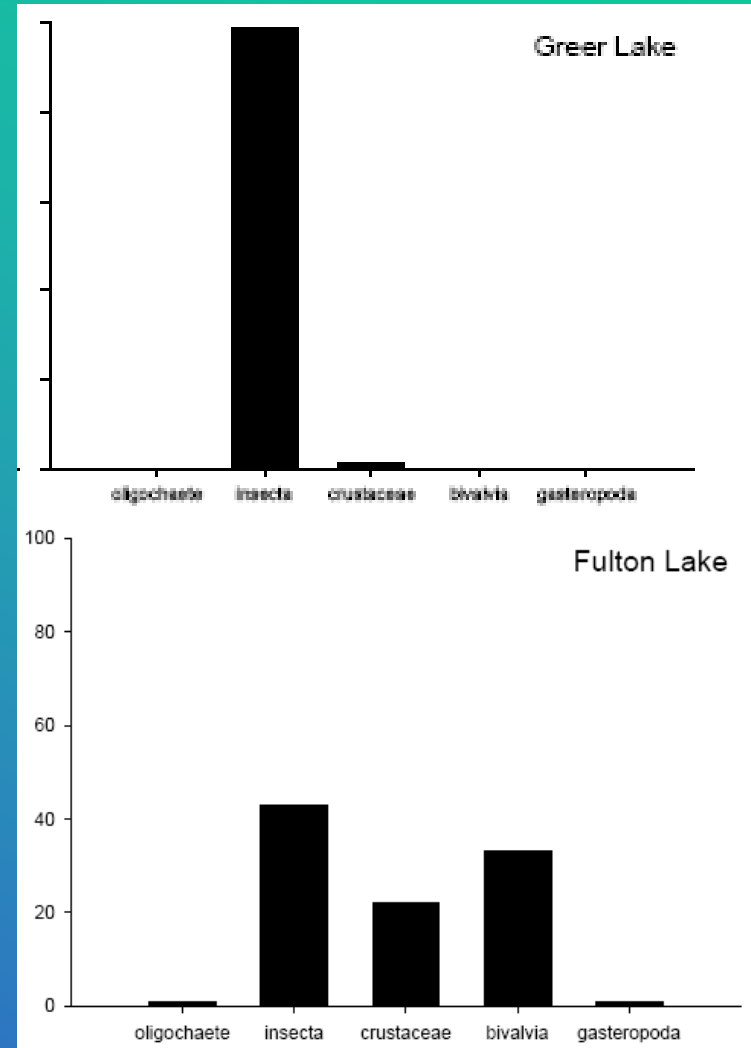


# Beaverlodge uranium mine (CNSC)



# Beaverlodge

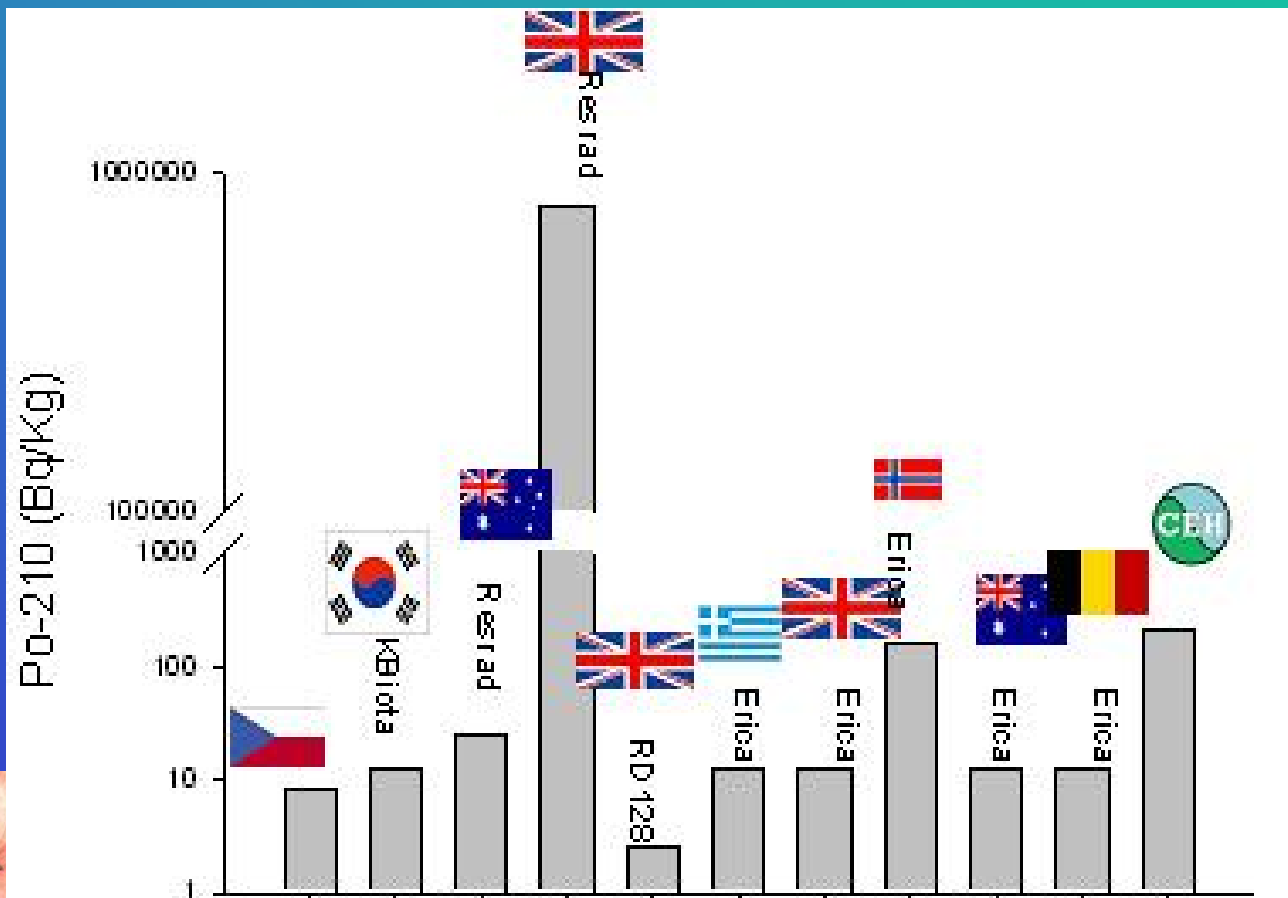
- Sediment, water & fish data available over a number of years [enables model-data comparison]
- Reduced invertebrate populations/effects in fish/multi-contaminants – interaction with WG6
- Provide informed opinion on real issue



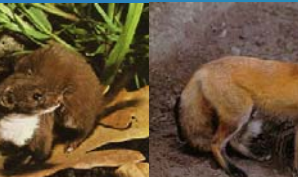
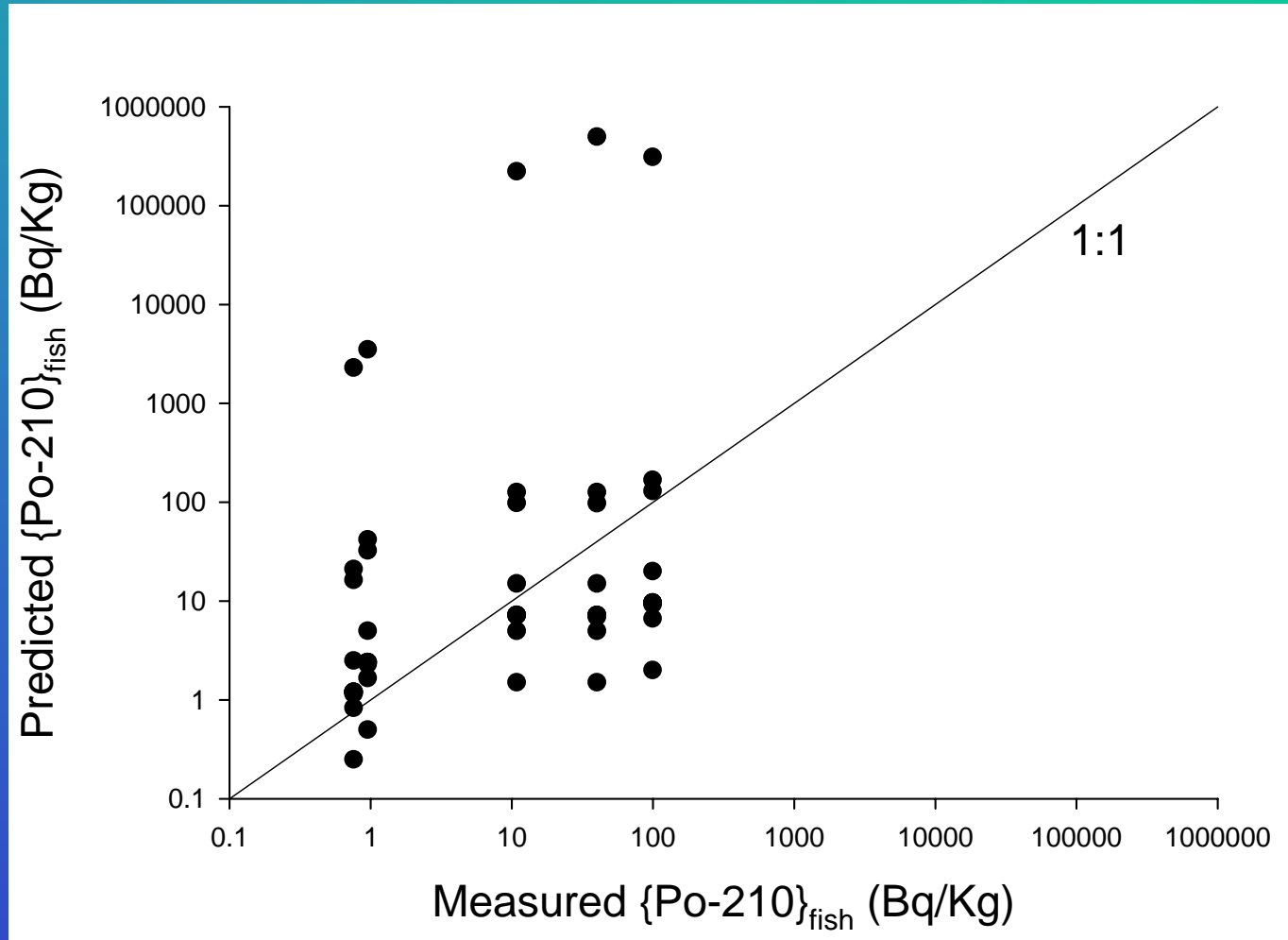


- Phase 1:

- Model-data comparison for fish (Po, Ra)
- Model:model benthic invertebrates & fish



# Po-210 fish



# Beaverlodge - future

- Confirm fish predictions
- Estimate Canadian CR values
  - use these in future model runs (from database being collated for WP5)
- Concentrate on sites with data/of interest
  - Estimate dose
  - Put into context against various dose rate benchmarks (summer workshop)
  - Interaction WP6



# Little Forest Burial Ground (ANSTO)

- Waste trenches  
(1960's)
- Radionuclides include:  
U,  $^3\text{H}$ , Pu Am, Cs, Sr,  
Co



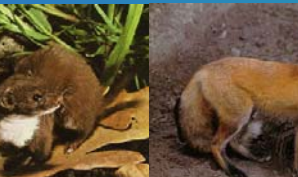
# Little Forest Burial Ground (ANSTO)

- Different range of species present than considered in assessment
- Radionuclides include: U,  $^3\text{H}$ , Pu Am, Cs, Sr, Co
- Scenario presented here
  - available c. 1 month
  - review results summer workshop
- Focused participation



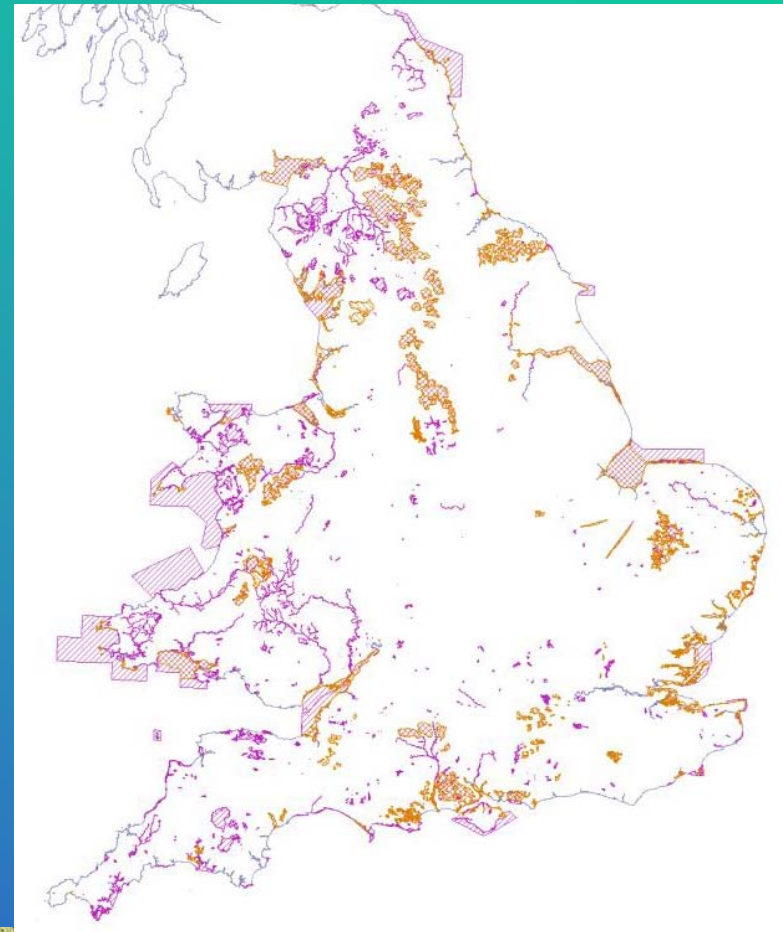
# Wetland (Stockholm Univ.)

- Potential approach to scenario presented
- Will be worked up and presented to group in summer 2010



# Screening tiers

- Example - England & Wales 'Habitats' [Natura2000] assessments
- Assessed 715 radioactive discharge authorisations
- 600 authorisations did not require assessment more detailed than initial conservative level
- Screening level to enable sites of negligible concern to be identified and removed from need for further assessment – **with a high degree of confidence**



But considerable variation (2-5 orders of magnitude) in screening tier predictions

