Beaverlodge case study
Phase 1

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EMRAS II TM, IAEA HQ, Vienna
25-29 January 2010

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Background and rationale

- NKS GAPRAD generated new CR data for fish and molluscs for both Pb-210 and Po-210
- Since others will be using ERICA we could contribute with a comparison with predictions made from application of GAPRAD CRs
- The Pb-210 and Po-210 CR for these wildlife groups in ERICA are not particularly well characterised (e.g. no data for Po benthic fish)
- to "test" the GAPRAD freshwater CRs for Po-210 and Pb-210 (as reported by STUK*)

*Ritva Saxen and Iisa Outola, Radiation and Nuclear Safety Authority (STUK), Finland

GAPRAD in short

- GAPRAD - Filling knowledge gaps in radiation protection methodologies for non-human biota
- The project was conducted as a collaborative effort between Norway, Sweden, Denmark and Finland.
- The aim of the project was to identify data on activity concentrations of Po-210 in soil, plants, invertebrate and small mammals
- In addition, there were plans to measure concentration of natural radionuclides like U-238, U-234, Ra-226, Ra-228, Po-210, Pb-210 in fish, brackish waters and sediments where practicable.

NKS-181: Po-210 and other radionuclides in terrestrial and freshwater environments. Edited by R. Gjelsvik and J. Brown

www.nks.org

GAPRAD + ERICA

	ERICA		
Beaverlodge		**CR**	
	Ref. organisms	***Po-210***	***Pb-210***
White Sucker	Benthic fish	240	300
Lake Whitefish	Benthic fish	240	300
Fingernail Clam	Biv. Molluscs	38000	1400
	GAPRAD		
Beaverlodge		**CR**	
	Relevant species	***Po-210***	***Pb-210***
White Sucker	**(Carp) Bream**	**3270**	**344**
Lake Whitefish	**Whitefish**	**7520**	**16**
Fingernail Clam	**Mussel**	**1735**	**533**

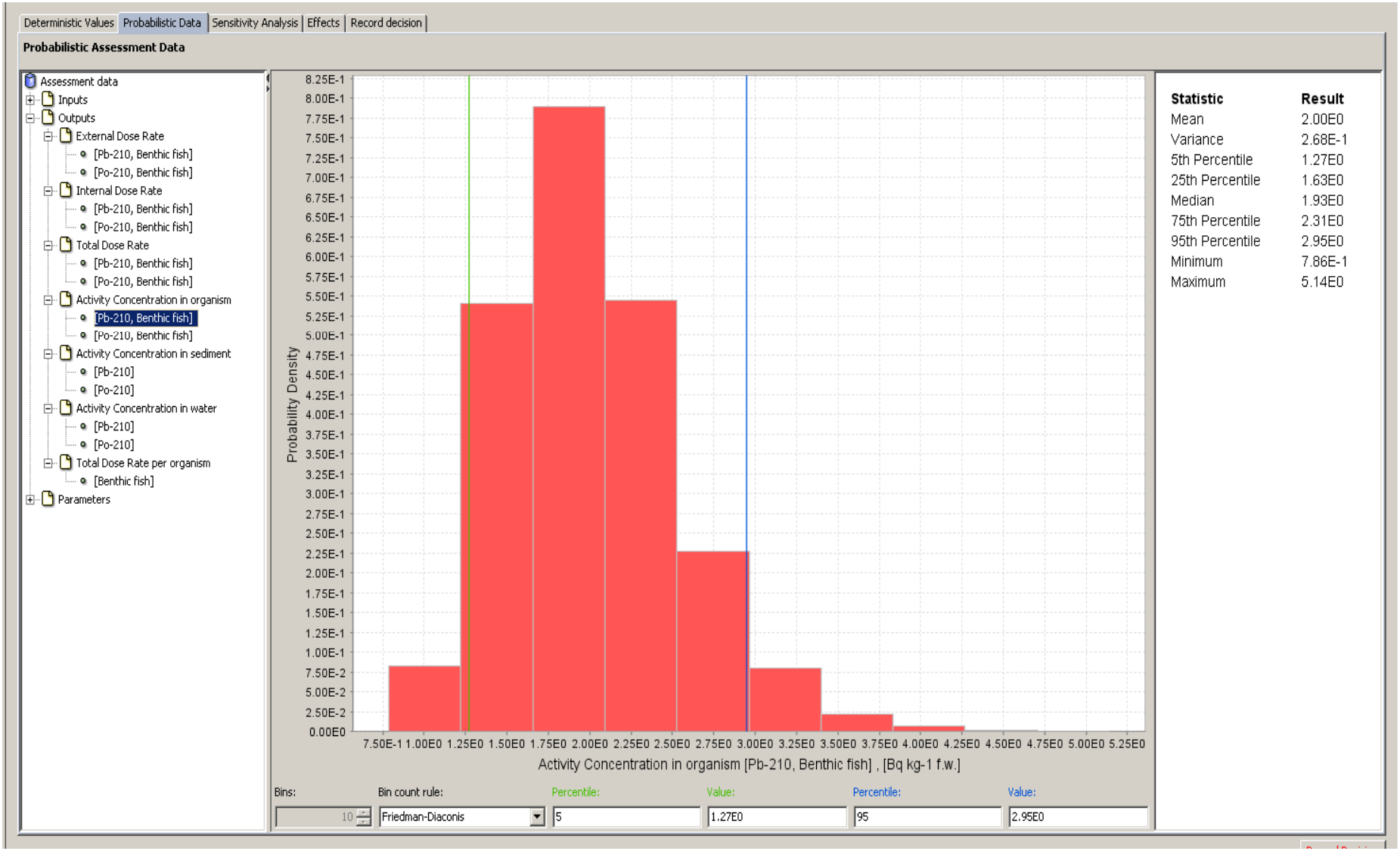
Method

- In order to estimate the biota activity concentrations and the associated uncertainty Tier 3 of the ERICA Tool has been used.
- Before performing such simulations, however, Probability Distribution Functions (PDFs) have to be assigned to all input values, i.e. media activity concentrations and parameters (CRs).
- These are each assigned a PDF using the following simple rules:
- where a mean and a standard deviation were available a lognormal distribution was applied;
- where the only available statistical information was a mean an exponential distribution was applied;

Assigning PDFs

Area	Site	Po-210 (Bq/l)		
		mean	SD	PDF
Lake Athabasca	Dixon bay	5.00E-03		Exponential (0.005, 0.0, infinity)
Lake Athabasca	back bay	4.00E-02		Exponential (0.04, 0.0, infinity)
Lake Athabasca	Zeemel Bay	5.00E-03		Exponential (0.005, 0.0, infinity)
Lake Athabasca	St.Mary's channel	1.00E-02		Exponential (0.01, 0.0, infinity)
Ace Creek Watershed	Dubyna Lake deep	3.00E-02		Exponential (0.03, 0.0, infinity)
Ace Creek Watershed	Schmoo Lake Deep	5.00E-03		Exponential (0.005, 0.0, infinity)
Fulton creek watershed	Fulton Lake	7.50E-03	3.54E-03	Lognormal (0.0075, 0.0035, 0.0, infinity)
Fulton creek watershed	Greer Lake	5.00E-02	1.41E-02	Lognormal (0.05, 0.0141, 0.0, infinity)
Lake Athabasca	Langley Bay	3.00E-02	1.41E-02	Lognormal (0.03, 0.0141, 0.0, infinity)

Once input data and parameters have been assigned suitable distributions, the ERICA Tool was implemented to apply Monte Carlo probabilistic simulations, based on 10000 runs in order to propagate the uncertainties in the inputs and parameters through the model.



Fish results

	Pb-210 (Bq/kg f.w.)	Po-210 (Bq/kg f.w.)
White sucker	6.9 - 72.3	16.3 - 163
Lake Whitefish	0.3 - 3.4	37.6 - 375
Generic Freshwater fish*	2.6	6.5

*Hosseini et al. (Submitted). Background dose-rates to reference animals and plants arising from exposure to naturally occurring radionuclides in aquatic environments