EMRAS II Working Group 6
Biota Dose Effects Modelling

Tom Hinton; IRSN

BROAD OBJECTIVES

- Dose – Effect Modelling to assist Risk Assessments

- Mathematical Derivation of Screening Level Values / Protection Thresholds

- Reach Consensus; Document Methods; Publish Guidance
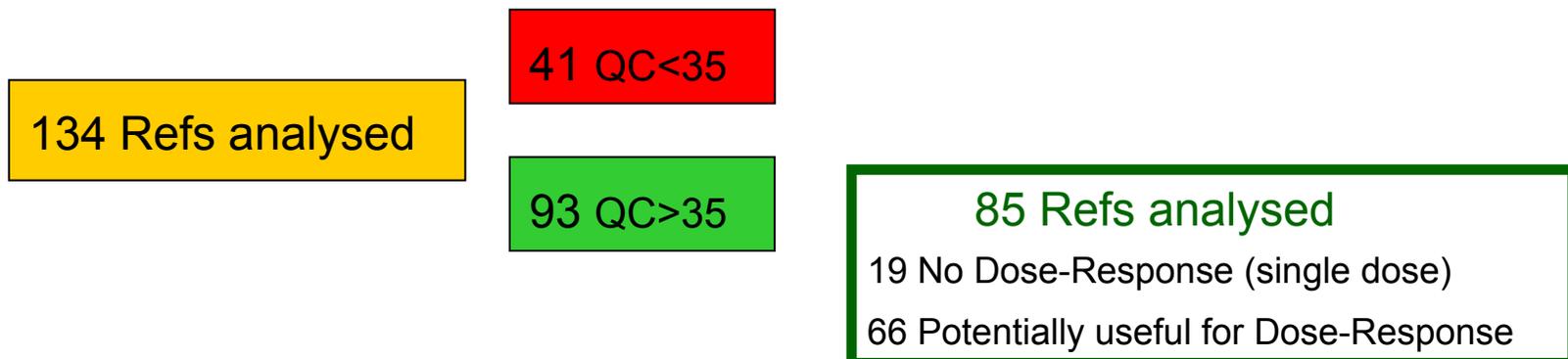
First Year Progress Report

1) UPDATE Dose-Effect DATABASE (**Almudena Real**; Spain)
(UNSCEAR; post 2006; Russian/Ukrainian)

D. Copplestone, S. Geras´kin, N. Horemnas, L. Newsome,, K. Stark, S. Sundell-Bergman, H. Vandenhove, C. Willrodt, S. Yoshida

FREDERICA Radiation Effects Database

www.frederica-online.org

- <u>References found</u>: English (405), Russian (255), Japanese (7), French (2), Chinese (1)

- <u>References included</u>: 141 (FREDERICA= 1,509 Refs; Aprox 10% increase)

  Wildlife groups: Mammals (36%); Amphibians (11%); Insects (8%); Protozoa (8%), Others
  (microorganisms, fish, crustacean, mollusc, aq. plants, soil fauna, fungi) (37%)

  Type of exposure: Acute (75%); Chronic (25%)

  Umbrella effects: Mortality (30%); Reproduction (28%); Morbidity (27%); Genetic (11%); Others (4%)

- <u>Quality Control: Dose-Response Analysis</u>

134 Refs analysed	41 QC<35

 | 93 QC>35 | 85 Refs analysed
19 No Dose-Response (single dose)
66 Potentially useful for Dose-Response |
  |---|---|

First Year Progress Report

1) UPDATE Dose-Effect DATABASE (**A. Real**; Spain)
   (UNSCEAR; post 2006; Russian/Ukrainian)

2) DOSE – RESPONSE Relationships (**J. Garnier-Laplace**; IRSN)
   Species Sensitivity Distributions

C. Della-Vedova, R. Gilbin, T. Hinton, A. Lorentzon A. Real, S. Sundell-Bergman, H. Vandenhove, C. Willrodt, T. Yankovich

DOSE – RESPONSE Relationships
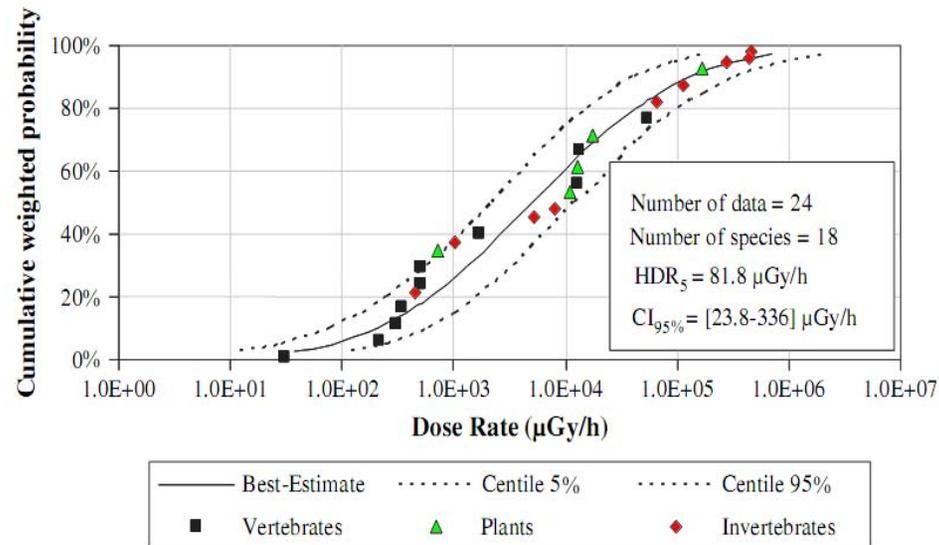
$$PNEV = HDR_{5\%} / SF$$

- PNEV used as the screening value at the ERA should be highly conservative
- SF = 5
- PNEV ≈ 10 µGy/h

DOSE – RESPONSE Relationships   (July 2009)

J. Garnier-Laplace and C. Della Vedova conducted a **TRAINING COURSE**

how to use FREDERICA data base and develop dose-response curves

• **how to determine if data meet appropriate criteria to be included**

• **how to enter data in a "R-package" statistical software program**

• **how to use software to derive sigmoidal & hormetic dose-response curves**

ERICA and PROTECT: SSDs derived from acute, gamma, laboratory data

EMRAS-ii: SSDs: field vs lab; acute vs chronic; for specific taxonomic groups

First Year Progress Report

1) UPDATE Dose-Effect DATABASE (**A. Real**; Spain)
   (UNSCEAR; post 2006; Russian/Ukrainian)

2) DOSE – RESPONSE Relationships (**J. Garnier-Laplace**; IRSN)
   Species Sensitivity Distributions (acute vs chronic; field- vs lab-derived;
   at various taxonomic levels)

3) Incorporate POPULATION MODELS (**T. Sazykina**; Russia)
   (Review existing models; life history data; data analyses)

F. Alonzo, R. Heling, T. Hinton, I. Kawaguchi, A. Kryshev, A. Lorentzon ,
L. Monte, J. Vives i Batle

POPULATION MODELS (**T. Sazykina**; Russia)

Reviewed existing population models appropriate for adaptation to radiation effects assessments for non-human biota

Emphasis was placed on 8 models, that collectively formed the basis for developing a generic population model

- **Predator- prey interactions**
- **Discrete age classes**
- **Limited environmental resources**
- **Migration**
- **Damage, as well as repair from exposure to radiation**

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2) DOSE – RESPONSE Relationships (**J. Garnier-Laplace**; IRSN)
   Species Sensitivity Distributions (acute vs chronic; field- vs lab-derived;
   at various taxonomic levels)

3) Incorporate POPULATION MODELS (**T. Sazykina**; Russia; Jan. '11)
   (Review existing models; life history data; data analyses)

4) Multiples Stressors (**H. Vandenhove**; Belgium; with **IUR**)
   (Review literature; chemical industry; report on applicability to IAEA)

   D. Copplestone, R. Gilbin, T. Hinton, N. Horemans, s. Mihok, D. Oughton, K.
   Stark, T. Sazykina, S. Sundell-Bermman, T. Yankovich, S.Yoshida

Multiples Stressors
(**H. Vandenhove**; Belgium with **IUR**)

- **Established a radiation-multiple-stressor database**

  57 entries from open literature; 7 organism/ecosystem combonations

- **Examined methods used for chemicals from the EC-NoMiracle project** (Novel Methods for Integrated Risk Assessment of Cumulative Stressors in Europe)

- **Organising a mixture toxicity workshop at SCK•CEN**

  (in 2010, collaboration with IUR – co-funding)

  Output: Reivew manuscript multiple stressor research
  with recommendations for IAEA (draft stage)

First Year Progress Report

5) <u>Canadian Benthic Data (</u>**S. Mihok**; Canada)
(Uranium mining; derive dose to benthos; multivariate stats)

- large and diverse data set of sediment cores taken from U mining areas

- includes population abundance / diversity info on benthic invertebrates

- archived data have been retrieved, validated and annotated into Excel.

- discussion on statistical analyses at the current meeting

First Year Progress Report

5) Canadian Benthic Data (**S. Mihok**; Canada; July '09)
   (Uranium mining; derive dose to benthos; multivariate stats)

6) Alternative Approaches (**T. Sazykina**; Russia; Jan. '11)
   (will non-parametric and Bayesian methods produce screening levels similar to SSD?)

7) Develop and Publish Guidance Documents (**T. Hinton**; France; July. '11; Documentation of methods to derive screening levels; guidance on use of screening levels; guidance in conducting effects type research)

8) Final Reports to IAEA (**T. Hinton**; France; Jan. '12)