Overview of C5
Protection of the Environment

ICRP Meeting

October 21-27, 2013 – Abu Dhabi, UAE

Kathryn Higley
Vice-Chair, ICRP Committee 5
Committee 5 Membership

Carl-Magnus Larsson, Australia, Chair
Kathryn A. Higley, USA, Vice-Chair
Almudena Real, Spain, Secretary
David Copplestone, UK
Jacqueline Garnier-Laplace, France
Jianguo Li, China
Kazuo Sakai, Japan
Per Strand, Norway
Alexander Ulanovsky, Germany
Jordi Vives I Batlle, Belgium
“C5 is concerned with radiological protection of the environment. It will aim to ensure that the development and application of approaches to environmental protection are compatible with those for radiological protection of man, and with those for protection of the environment from other hazards”
Evolution of two parallel pathways

Planned, emergency, and existing exposure situations

Environmental radionuclide concentrations

Reference Male & Female, and Reference Person
Reference Animals and Plants

Dose limits, constraints and reference levels
Derived Consideration Reference Levels

Decision-making regarding public health and environmental protection for the same environmental exposure situation by way of representative individuals and representative organisms
Review of ethics and principles, recommending that the System for Environmental Protection should

- focus on biota;
- consider *adequate protection on the basis of understanding of effects*;
- identify reference animals and plants (RAPs); and
- let the RAPs guide the derivation of
  - exposure scenarios (CFs and DCFs)
  - effects data
  - dose rates benchmarks
aim is...preventing and reducing the frequency of deleterious radiation effects to a level where they would have negligible impact on the maintenance of biological diversity, the conservation of species, or the health and status of natural habitats, communities and ecosystems.

Reference Animals and Plants.....
<table>
<thead>
<tr>
<th>WILDLIFE GROUP</th>
<th>RAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large terrestrial mammals</td>
<td>Deer</td>
</tr>
<tr>
<td>Small terrestrial mammals</td>
<td>Rat</td>
</tr>
<tr>
<td>Aquatic birds</td>
<td>Duck</td>
</tr>
<tr>
<td>Amphibians</td>
<td>Frog</td>
</tr>
<tr>
<td>Freshwater pelagic fish</td>
<td>Trout</td>
</tr>
<tr>
<td>Marine fish</td>
<td>Flatfish</td>
</tr>
<tr>
<td>Terrestrial insects</td>
<td>Bee</td>
</tr>
<tr>
<td>Marine crustaceans</td>
<td>Crab</td>
</tr>
<tr>
<td>Terrestrial annelids</td>
<td>Earthworm</td>
</tr>
<tr>
<td>Large terrestrial plants</td>
<td>Pine tree</td>
</tr>
<tr>
<td>Small terrestrial plants</td>
<td>Wild grass</td>
</tr>
<tr>
<td>Seaweeds</td>
<td>Brown seaweed</td>
</tr>
</tbody>
</table>
ICRP 108 reviews biological characteristics

- Occurrence
- Taxonomy
- Life cycle and life span
- Reproductive strategy
- Physiology
- Ecology
- .....other factors.....
ICRP 108

DCCs for simple geometries

Trunk and branch
ICRP 108
Derived Consideration Reference Levels, DCRLs

- Invertebrate benchmark
- Plant benchmark
- Generic benchmark
- Vertebrate benchmark
- Background level

Benchmarks from other studies/systems
Concentration Ratios for 39 elements and 12 RAPs

- with associated statistics;
- based on existing field and laboratory data;
- using new methodology to derive data (‘surrogate data’) where such are missing;
- taking in to account life cycle stages and habitats, when possible; and
- discussing the robustness of the data
ICRP 124

Application in planned exposure situations

Increasing dose rate

DCRL

DCRL for relevant RAP

Reference point for the sum of all sources
Application in existing exposure situations

Potential for dose rate reduction

DCRL for relevant RAP

Minimum level of ambition

Increasing dose rate
ICRP 124

Application in emergency exposure situations

Order of magnitude bands of dose rate

DCRL

Severe Effects Level

Dose rate to relevant biota

Time after event
Past Experience / Future Work

• Past efforts identified data and process gaps

• Activities initiated *because* of ICRP:
  • Voxel phantoms (partitioning of radionuclides)
  • Dynamic transfer modelling (moving away from steady-state assumptions) e.g., emergency & pulsed systems
  • Spatial/temporal factors in dose
  • Filling RAP-specific effects data gaps

• Testing DCRLs in light of new data and their proposed application
Looking ahead

Consolidation of system and data bases

- Extrapolating from RAPs to Reference Organisms for use in assessments. Outline of report structure developed.

- RAP monographs. Compilation of data on biology, life cycle, stable element ratios, exposure scenarios (incl background), transfer factors, effects, (dynamic) models, conclusions.
Looking ahead
RAPS monographs

Vlad the crab
Looking ahead
Application

Reference Animals and Plants

‘Derived Consideration Reference Levels’

Representative organisms

Radionuclide intake and external exposure

Planned, existing & emergency exposure situations
Looking ahead
Species sensitivity

R² = 0.9467
KSpvalue = 0.500

SSD - Log Normal

Cumulative weighted probability

Dose rate (µGy/h)

Best-Estimate
Vertebrates
Plants
Invertebrates

Centile 5%
Centile 95%
Max. concentrations of radionuclides in air, water and ‘soil’

Authorised Release Rate(s)

Environmental compliance index.
If:
- $\sum$ radionuclides not greater than $x$
- no individual radionuclide greater than $y$
then
OK for man and/or the environment
Conclusions

- A robust system has evolved that is compatible with the RP system for man and the EP system developed for other hazards
- Considering the environment in its own right is appropriate and facilitates communication
- Simple to apply using default RAPs databases – but can also cope with complex exposure situations
- Priority during this term to
  - Consolidation
  - Broadening the scientific basis
  - Improving applicability