Modelling and Data for Radiological Impact Assessments
“MODARIA”

WG 5 – Uncertainty and variability analysis for assessments of radiological impacts arising from routine discharges of radionuclides.

Vienna. November, 14th, 2014
“As the effective dose cannot be measured directly, values of this quantity must be inferred with the aid of models, usually involving environmental, metabolic, and dosimetric components.

Ideally, these models and the values chosen for their parameters should be realistic, so that the results they give can be described as ‘best estimates’.

Where practicable, estimates and discussion should be made of the uncertainties inherent in these results”

ICRP 103 (par. 320)

Identified tasks

Methodology (JC Mora, A. Curti, Anna Mª Blixt-Buhr)

Identify possible tools (All)

Identify scenarios. Hypothetic & Realistic discharges scenario (Iurii Bonchuk, F. Vermorel, C. Mourlon)

Level of conservatism of assessments (D. da Costa Lauria and I. Bonchuk)

Sources of uncertainties (C. Mourlon, F. Vermorel)

Sensitivity analysis (T. Tanaka and V. Nicoulaud-Gouin, L. Marang)

Distributions of parameters and data to be used (C. Mourlon and I. Bonchuk)

Identification of correlation factors (S. Chouhan and P. Krajewski)

Environmental monitoring data (B. Zorko and P. Chyly)

Applications: deterministic and probabilistic assessments (SAUA) (All)

Communication of results (routine releases including SAUA) (A. Curti, Anna Mª Blixt-Buhr)
22 Participants (15 countries)
### Progress

**Methodology (JC Mora, A. Curti, Anna Mª Blixt-Buhr)**

<table>
<thead>
<tr>
<th>Prospective</th>
<th>Retrospective</th>
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<tbody>
<tr>
<td><strong>Deterministic</strong></td>
<td></td>
</tr>
<tr>
<td>Source term: fixed as designed</td>
<td>Environmental concentrations: based on measurements and/or estimations</td>
</tr>
<tr>
<td>Parameters: best estimates</td>
<td>Source term: derived from reliable measurements or estimated</td>
</tr>
<tr>
<td>Habit data: 95th percentile for the major contributor (best estimate the rest)</td>
<td>Parameters: measured and/or best estimates</td>
</tr>
<tr>
<td>Dose coefficients: fixed</td>
<td>Habit data: Preferably local survey (focused in the representative person). Fixed</td>
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# Progress

## Methodology (JC Mora, A. Curti, Anna Mª Blixt-Buhr)

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Identify scenarios. Hypothetic & Realistic discharges scenario (Iurii Bonchuk, F. Vermorel, C. Mourlon)

Atmospheric discharges

Table 8 - Chinon NPP annual atmospheric release rates - year 2011

<table>
<thead>
<tr>
<th>Radionuclides</th>
<th>Stack units 1-2 GBq y⁻¹</th>
<th>Stack units 3-4 GBq y⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>³H(HTO)</td>
<td>1.06E+03</td>
<td>1.06E+03</td>
</tr>
<tr>
<td>¹⁴C (mineral)</td>
<td>6.10E+01</td>
<td>6.10E+01</td>
</tr>
<tr>
<td>¹⁴C (organic)</td>
<td>2.44E+02</td>
<td>2.44E+02</td>
</tr>
<tr>
<td>⁸¹Ar</td>
<td>6.80E+01</td>
<td>6.80E+01</td>
</tr>
<tr>
<td>⁵⁸Co</td>
<td>3.48E-04</td>
<td>3.48E-04</td>
</tr>
<tr>
<td>⁶⁰Co</td>
<td>2.19E-04</td>
<td>2.19E-04</td>
</tr>
<tr>
<td>⁸²Kr</td>
<td>1.47E+01</td>
<td>1.47E+01</td>
</tr>
<tr>
<td>¹³¹I (molecular)</td>
<td>8.60E-03</td>
<td>8.60E-03</td>
</tr>
<tr>
<td>¹³²I (molecular)</td>
<td>5.20E-03</td>
<td>5.20E-03</td>
</tr>
<tr>
<td>¹³³mXe</td>
<td>7.25E-02</td>
<td>7.25E-02</td>
</tr>
<tr>
<td>¹³⁵Xe</td>
<td>5.75E+02</td>
<td>5.75E+02</td>
</tr>
<tr>
<td>¹³⁵Ba</td>
<td>8.65E+01</td>
<td>8.65E+01</td>
</tr>
<tr>
<td>¹³⁴Cs</td>
<td>1.89E-04</td>
<td>1.89E-04</td>
</tr>
<tr>
<td>¹³⁷Cs</td>
<td>2.27E-04</td>
<td>2.27E-04</td>
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Progress

Distributions of parameters and data to be used (I. Bonchuk and C. Mourlon)

- Joint meeting with WG4 (2013): Identified the need to have a pdf for certain parameters
- Anca Melintescu (2014) (H3 pdfs)
- Charlie Yu (2014) (RESRAD Probabilistic Analysis. Input Distributions — PDFs vs. CDFs)
Identification of correlation factors (S. Chouhan and P. Krajewski)
Applications: deterministic and probabilistic assessments (SAUA) (All)

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**Progress**

- **SRG 19**: 0.14 mSv (~71%)
- **95%**: 0.25 mSv
- **99%**: 0.29 mSv

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**Histrogram of the parameter values**

- **Mean**: 3.09E+000
- **Limit, 95%**: 6.54E+000

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**Map**
Progress

Applications: deterministic and probabilistic assessments (SAUA) (All)

Population with maximum annual dose: 0.4 μSv/year
Applications: deterministic and probabilistic assessments (SAUA) (All)

| TEMPLATE FOR RESULTS OF THE EXERCISES |

Institute: ABment, Trnava, Slovakia.

Scenario: Realistic scenario from a French NPP - CHINON.

Code: ESTE AI (Annual Impacts).

1. DETERMINISTIC APPROACH

Selection of values (environmental parameters, habit data – source of information):

In the calculation we used the following data provided by the description of the scenario:

a) Loire river environment:
   i) Width and depth of the river.
   ii) Mean annual flow rate
   iii) Mean dissolved inorganic carbon concentration.
Role of environmental monitoring data in uncertainty analysis processes

B. Zorko, M. Korun + members of WG5

Introduction

Article 35 of the Euratom Treaty requires each Member State to establish the facilities necessary to carry out continuous monitoring of the level of radioactivity in the air, water, and soil and to ensure compliance with the basic standards.

Article 36 of the Euratom Treaty requires the national authorities to periodically communicate to the Commission on the environmental checks — it is kept informed on the level of radioactivity to which the public is exposed. The information on the checks also concerns the information on level of radioactivity in discharges (needs for the assessment).

Jožef Stefan Institute (JSI) is complying with the issue of reporting radionuclides’ activities near the natural limit (zero-values). The work considers activities which are measured in discharges (emissions) and those in the environment (emissions), and its main objective is to prepare the guideline in the row for the harmonisation of the information reported — which is of significance and transparency of the Commission’s reports and proper calculation of annual averages of activities on which the annual effective dose calculation is based (dose assessment).

Commission recommendation 2004/21/Euratom [2]: the Recommendation defines information selected for monitoring and reporting to the EC on radionuclides discharged or liable to discharged from NPP and reprocessing plants in normal operation. Special concern is devoted to the measured values, which include activities in the environment. The harmonisation of this information is achieved on the level of these values.
Sensitivity analysis (T. Tanaka and V. Nicoulaud-Gouin, L. Marang)
Progress

Communication of results (routine releases including SAUA) (A. Curti, Anna Mª Blixt-Buhr)

- On going work

- Previous generic work identified

- Task will be focused in communication of results including uncertainties for routine releases.

"The value of knowing how little you know"

*Morgan MG, Henrion M.*

*Uncertainty: a guide to dealing with uncertainty in quantitative risk and policy analysis.*

18 Presentations + 1 joint meeting (WG10):

F. Vermorel “The CHINON NPP realistic scenario ”
I. Bonchuk “Chinon scenario by using revised SRS19”
L. Lipták “Chinon results using ESTE AI”
C. Mourlon “CHINON NPP results using SYMBIOSE ”
C. Mourlon (on behalf of M. Cornu) “Deriving pdfs fos Symbiose”
C. Yu “Deriving pdfs for RESRAD”
A. Melintescu “Deriving pdfs for H3”
V. Nicoulaud-Gouin “Sensivity analysis using different methods”
T. Tanaka “Sensitivity analysis – Ongoing task”
P.M. Ravi “Bhabha atomic centre activities – Providing in situ data!”
S. Chouan “Uncertainties and correlations using Cs137 values”
B. Zorko “Environmental monitoring data in dose assessments”
B. Howard (WG4 leader) “SRS19 update for animal TF”
A. Blixt-Buhr “Methodology ideas”
A. Blixt-Buhr “Communication in routine releases”
Future

- Continuous advance of each task
- Peer review of the report
- Possible articles (Pawel, Benjamin, Valerie & Taku, Adriana & Anna Maria, Iurii)
- Refinement of calculations with different tools and new data
- Comparison deterministic/probabilistic according to our developments
MODARIA. WG 5 – Routine Discharges

Future

WG5 PROPOSALS FOR NEXT PROGRAM

Integrated dose assessments for humans and non-human species in routine discharges.

- Considering the upcoming IAEA’s guidances (DS427, DS442, DS432 and revised SRS19), explicit demonstration of the protection of biota, integrated with human system of protection, needs to be tested, and comparison respectively with recommended levels and dose limits should be carried out.

Testing the conservatism of dose assessments in routine discharges.

- Several assumptions introduced in the state of the art models for dose assessments in routine discharges will be proved to be valid, as the use of annual average values instead of spike releases, “conservative” parameters, and other.
Next meeting to be held in Lyon (EdF and CIDEN)

April-May 2015
Thank you!

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