Planning a new IAEA Model Test and Comparison Programme

Gerhard Proehl

Division of Transport, Radiation and Waste Safety

3rd Technical Meeting
Modelling and Data for Radiological Impact Assessments
Vienna, 12 November 2014
Goals of model testing programmes

- Support to fulfil regulatory requirements in Member States

- Improve capabilities in radiological impact assessment
  - Test, compare and develop models
  - Analyse, evaluate and compile data

- Addressing assessments in planned, emergency and existing exposure situations
  - For people
  - For flora and fauna

- Forum for discussion and exchange of experience
IAEA model test and comparison programmes

- **1985-1991: BIOMOVS**
  - BIOspheric Model Validation Study, sponsored by SSI (Sweden)

- **1988-1994: VAMP**
  - Validation of Model Predictions, prompted by Chernobyl

- **1991-1996: BIOMOVS II**
  - BIOspheric Model Validation Study, with SSI, Sweden

- **1996-2001: BIOMASS**
  - BIOsphere Modelling and ASSe ssment

- **2003-2007: EMRAS I**
  - **2009-2011: EMRAS II**
    - Environmental Modelling for Radiation Safety

- **Since 2012: MODARIA**
  - Modelling and Data for Environmental Impact Assessment
Safety Standards Categories

- **Fundamental Safety Principles**
- **Requirements: What to do?**
- **Best Practice to meet Requirements: How to do?**
IAEA Basic Safety Standards (BSS)

- Represents international consensus
- Based on ICRP 103 (2007)
- Defines responsibilities
  - Government and regulatory body
  - Operator
- Defines a framework for Radiation Protection
  - Exposure types
    - Public, Occupational, Medical
  - Exposure situations
  - Radiation protection principles
  - Radiological criteria
Three exposure situations for *Public exposure*

**Exposure situations**

1. **Planned**
   - Operation of facilities
   - Dose limit: 1 mSv/a

2. **Emergency**
   - Accidents, Malicious acts
   - Reference level: 20-100 mSv

3. **Existing**
   - Post-accident
     - Residues from past, uncontrolled practices
   - Reference level: 1-20 mSv/a
Radiation Protection Principles

- **Justification**
  - Actions should be adequate to the risk
  - Do more good than harm

- **Optimization**
  - Exposure levels
  - Number of people exposed
  - Economic and social implications
  - As Low As Reasonably Achievable, economic and social factors being taken into account (ALARA)

- **Limitation**
  - Limitation of doses and associated risks
  - Dose limits
  - Reference levels
Assessment of Exposure to People and the Environment

Application of nuclear techniques in industry, medicine and science; Mining and ore processing

Discharge to the terrestrial or aquatic environment

Environmental transfer

Concentration in environmental media

Living habits, environmental conditions

Exposure to the public

Exposure conditions

Exposure to flora and fauna

Evaluation

Decision

Medical exposure

Occupational exposure

Radiological impact assessment

IAEA
EMRAS II (2009-2011):

- **Reference Approaches for Human Dose Assessment**
  - WG 1 – Reference Methodologies for "Controlling Discharges" of Routine Releases
  - WG 2 – Reference Approaches to Modelling for Management and Remediation at "NORM and Legacy Sites"
  - WG 3 – Reference Models for "Waste Disposal"

- **Reference Approaches for Biota Dose Assessment**
  - WG 4 – “Biota Modelling”
  - WG 5 – “Wildlife Transfer Coefficient" Handbook
  - WG 6 – Biota "Dose Effects Modelling"

- **Approaches for Assessing Emergency Situations**
  - WG 7 – "Tritium Accidents"
  - WG 8 – "Environmental Sensitivity"
  - WG 9 – "Urban Areas"
MODARIA themes and working groups

A Remediation of Contaminated Areas
1 Remediation strategies and decision aiding
2 Exposures following contamination of urban environments
3 Impacts from NORM and contaminated legacy sites

B Uncertainties and Variability
4 Analysis of radio-ecological data
5 Uncertainty and variability analysis
6 Environmental change in long-term safety assessments of waste disposal facilities
7 Models for accidental tritium releases

C Exposures and Effects on Biota
8 Biota modelling: Transfer and exposure models
9 Models for assessing radiation effects on wildlife

D Marine Modelling
10 Marine dispersion and transfer of radionuclides accidentally released from land-based facilities
Applications of models and data

Assessing radiological impacts for regulatory purposes
• Routine discharges
• Accidental releases
• Remediation of existing contaminations
• Long-term safety studies for waste disposal facilities

Scientific and public interest
• Long-term behaviour of radionuclides in the environment
  • Tritium
  • Marine systems
• Retrospective doses assessment
Routine discharges: Issues that could be addressed

- **Regulatory context of assessments**
  - What needs to be assessed? Why?

- **Assessments for Reference Cases**
  - Large nuclear facilities
  - Small facilities: labs and hospitals
  - Link of assessments for humans and biota
  - Application of the graded approach
    - How much assessment efforts are necessary

- **Generic models**
  - Possibilities and limitations of generic models
  - Uncertainties

- **Source and environmental monitoring**
  - Link of results from models and monitoring to improve dose assessments
  - Monitoring to check compliance with the discharge authorization

- **Realistic assessments vs cautious assessments**
  - When do we need what?
  - How reduce conservatism?
Accidental releases: Issues that could be addressed

- **Regulatory context of assessments**
  - What needs to be assessed? Why?
  - Which assessment endpoints are useful beyond regulatory requirements?

- **Data analysis and evaluation**
  - Radio-ecological observations in Japan since March 2011
    - Seasonal factors
    - Long-term observations
    - Natural ecosystems

- **Assessments for Reference Cases**
  - Urban environments
  - Rural environments

- **Realistic versus cautious assessments**

- **Link of monitoring and models**
Management and remediation of existing exposure contaminations: Issues that could be addressed

- **Regulatory context of remediation**
  - What needs to be assessed and why?
  - Which assessment endpoints are useful beyond regulatory requirements?

- **Post-accidental situations**
  - Systematic link of results from models and monitoring
  - Analysis and summary of existing compilations for remedial actions
    - EURANOS, IAEA TRS-475, etc.

- **Past practices**
  - Uranium mining, NORM contaminations
  - Nuclear legacies
  - Link of models and monitoring

- **Freshwater environments**
  - Possibilities for remediation

- **Realistic dose assessment as a base for remediation**
  - How conservative can an assessment be without causing problems
Long-term safety studies for waste disposal facilities: Issues that could be addressed

- Regulatory context
  - What needs to be assessed? Why?
- Generic dose assessment models
  - Link to climate, hydrology, landscape evolution
- Systematic exploration of analogue approaches
- Review of existing model exercises
  - BIOMASS
  - EMRAS and MODARIA
- Assessments for Reference Cases
  - Further developments based on BIOMASS
  - Cooperation with BIOPRPTA
Special areas

- **Tritium and Carbon-14**
  - Systematic uncertainty analysis of models
    - Accidental releases (H-3 only)
    - Normal operation
    - Long-term performance of waste disposal facilities (C-14 only)

- **Exposures to biota**
  - Regulatory context for assessments
  - Simplification of assessments
  - Reliability of simple models

- **Modelling the input of radionuclides to agricultural land through irrigation**
  - River water: normal operation
  - Ground water: long-term safety assessments of disposal facilities

- **Marine Modelling**
  - Fate of radionuclides released to marine systems

- **Radio-ecological data**
  - Review and update of bases
Examples for data compilations

Handbook of Parameter Values for the Prediction of Radionuclide Transfer in Terrestrial and Freshwater Environments

Handbook of Parameter Values for the Prediction of Radionuclide Transfer to Wildlife
The next steps to define a follow-up programme

- November 2014: 3rd MODARIA TM
  - Call for topics to be included in a MODARIA follow-up IAEA model test and comparison programmes

- 2015
  - Participants, interested parties, individuals are encouraged to develop proposals for a new programme
  - Proposals can be sent at any time to IAEA
  - Presentation & discussion of proposals at the 4th MODARIA TM (Nov. 2015)

- 2016
  - Setup of a new IAEA assessment model test and comparison programme

- End 2016 / early 2017
  - Start of the new programme
Elements of proposals

Proposals should include:

- Title
- Aims and Objectives
- Main working steps
- Expected results

Can be sent at any time to the IAEA

g.proehl@iaea.org
Thank you!