MODARIA:
Modelling and Data for Radiological Impact Assessment
Context and overview

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Outline

• IAEA Safety Standards
• Assessment of exposures
• Modelling and Data for Radiological Impact Assessments (MODARIA)
• Peer reviews and Advisory Work
• The last point
• Summary
IAEA Safety Standards
Article III, Functions
Paragraph A.6.

“To establish or adopt, in consultation and, where appropriate, in collaboration with

- the competent organs of the United Nations and
- with the specialized agencies concerned,

standards of safety for protection of health and minimization of danger to life and property (including such standards for labour conditions), and

to provide for the application of these standards
to its own operation as well as to the operations making use of materials, services, equipment, facilities, and information made available by the Agency ...; “
Development of International Standards

UNSCEAR: Scientific Reports

ICRP: Recommendations

IAEA: Safety Standards
Safety Standards Categories

Fundamental Safety Principles

Requirements: What to do?

Best Practice to meet Requirements: How to do?

Safety Guides

Safety Requirements

Safety Fundamentals

IAEA Safety Standards
for protecting people and the environment

Fundamental Safety Principles

IAEA Safety Standards
for protecting people and the environment

Predisposal Management of Radioactive Waste

IAEA Safety Standards
for protecting people and the environment

Safety Assessment for Near Surface Disposal of Radioactive Waste
IAEA Basic Safety Standards (IAEA GSR part 3)

- *International consensus* on Radiation Protection
  - Based on ICRP 103 (2007)
- Defines responsibilities
  - Government and regulatory body
  - Operator
- Defines exposure situations
  - Planned, existing, emergency situation
- Radiation protection principles
  - Justification, Optimization, Limitation
- Radiological criteria
  - Public in all exposure situations
  - Workers
Three exposure situations

- **Planned exposure situation**
  - Exposure due to *planned operation* of a facility or activity

- **Emergency exposure situation**
  - Exposure due to *accidents* or unexpected events requiring prompt action to reduce or avoid consequences

- **Existing exposure situation**
  - Exposure due to natural sources or *presence of radioactive contamination*
  - Need to control and reduction of exposure
Related Safety Guides

- **Radiation Protection** of the Public and the Environment
  — Application of Radiation Protection Principles in all exposure situations
- Regulatory **Control of Radioactive Releases** to the Environment from Facilities and Activities
  — Setting discharge limits for nuclear facilities in planned exposure situations
- **Radiological** Environmental **Impact Assessment** for Facilities and Activities
  — Guidance to assess exposures to people and the environment in planned exposure situations
- Application of the concepts for **exclusion, exemption and clearance**
- **Environmental and source monitoring** for purposes of radiation protection
- **Remediation** Process for Areas with Residual Radioactive Material
Assessment of exposures
Public and environmental exposure

- **Applications**
  - Routine discharges
  - Accidental releases
  - Remediation of existing contaminations
  - Legacies
  - Uranium mining
  - NORM contaminations
  - Long-term safety studies for waste disposal facilities

- **Ecosystems**
  - Terrestrial
  - Urban areas
  - Freshwater
  - Marine
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 conditions

Exposure to the public

Exposure to flora and fauna

Evaluation

Decision
Generic models for assessment of exposures

1982

IAEA

2001

International Atomic Energy Agency, Vienna, 2001
MODARIA: Models and Data for Radiological Impact Assessments
Goals of MODARIA

- 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

- Support to fulfil regulatory requirements in Member States
Previous International IAEA modelling testing 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 Assessment, 1996-2001,

• 2003-2007: EMRAS I

• 2009-2011: EMRAS II
MODARIA Working Groups

Theme A: Remediation of Contaminated Areas

1 Remediation strategies and decision aiding techniques
   • Post-accidental conditions
   • Uranium legacies

2 Exposures in contaminated urban environments and effect of remedial measures
   • Models for external and internal exposure
   • Atmospheric dispersion in cities
   • Atmospheric dispersion in

3 Modelling radiological impacts arising from NORM and radioactively contaminated legacy sites
   • Assessment framework based on IAEA Standards
   • Development of an assessment methodology
   • Application to contaminated sites
MODARIA Working Groups
Theme B: Uncertainties and Variability

4 Analysis of radio-ecological data
- Data analysis and evaluation
- Identify key radionuclides and associated parameters
- Address human and wildlife exposure assessment

5 Uncertainty and variability analysis for assessments
- Radiological impacts arising from routine discharges of radionuclides
- Influence of national regulatory requirements

6 Environmental change in long term safety assessments of radioactive waste disposal facilities
- Influence of climate
- Implications of landscape evolution
- Development of “future environments”

7 Models for accidental tritium releases
- Implications of dry/wet, day/night, summer/winter
- Inter-comparison, simplification, harmonization
MODARIA Working Groups

Theme C: Exposures and Effects on Biota

8 Modelling exposures to biota
- Test and comparison of existing models
- Compilation, analysis and evaluation of transfer data
- Development of exposure scenarios to fulfil regulatory requirements (if they exist)

9 Radiation effects on populations of wildlife species
- Acute vs chronic exposure
- Laboratory vs field conditions
- Explore effects on populations

Theme D: Marine Modelling

10 Modelling of marine dispersion and transfer of radionuclides accidentally released from land-based facilities
- Post-Chernobyl scenario: Baltic Sea
- Post-Fukushima: Pacific Ocean
Participation and results

All programmes were well attended
- MODARIA:
  - About 150 participants from 42 Member States

Results
- IAEA-TECDOCs (all Working Group reports)
- IAEA Safety Reports
  - Handbook of Parameter Values for the Prediction of Radionuclide Transfer in Terrestrial and Freshwater Environments (IAEA TRS-472)
  - Handbook of Parameter Values for the Prediction of Radionuclide Transfer to Wildlife, (IAEA –TRS 479)
- Numerous publications in peer reviewed scientific journals
Follow-up: MODARIA II

- Four year programme (2016 – 2019)
- **First Technical Meeting**
  - 31 October – 4 November 2016
  - *Programme to be developed in early 2016*
- **Tentative themes**
  - Exposures in urban environments following accidents
  - Modelling releases to the environment
  - Marine modelling
  - Exposure and effects to wild-life
  - Biosphere modelling for long-term safety assessments of waste disposal facilities
  - Radioecological data
  - Remediation and decision making
Funding

- **Mainly self-supporting**
  - Small amounts of IAEA
  - Limited to few participants with key contributions who could otherwise not attend

- Big interest from countries in Africa, Asia, Latin America, and Eastern Europe
- Less than 10 nominees from these countries could manage participation
Further information

MODARIA

Modelling and Data for Radiological Impact Assessments

Fourth Technical Meeting

The Fourth Technical Meeting (TM) for MODARIA was held at the IAEA’s headquarters in Vienna from 9 to 13 November 2015 and was the final meeting for this phase of the MODARIA Programme. The TM was attended by 135 participants from 35 Member States and was again chaired by Ms Jane Simmons of the United Kingdom.

As for all three previous TMs, this final meeting commenced with a Plenary Session, where the Leaders of the 10 Working Groups reported on their respective working group’s results, achievements and progress made since the Third MODARIA TM last year and the subsequent Working Group Interim Meetings which were held during 2015. It became apparent that many of the Working Groups are well advanced with their respective final reports which will be published as IAEA TECDOCs in due course. Moreover, many of the working groups already have ideas and plans of how they’d like to move forward during the next phase of MODARIA and expand on the important work they’ve already accomplished.

Thank you!