Human and environmental impact assessment

Hildegarde Vandenhove

SCK•CEN
Environment, Health and Safety
Biosphere Impact Studies

hildegarde.vandenhove@sckcen.be

Copyright © 2009
SCK•CEN

Belgian State Visit to Romania
Cercul Militar, Bucharest, July 8, 2009

Outline

- SCK•CEN mission statement
- Scope of presentation
- Human impact assessment
- Environmental impact assessment
- Potential collaboration topics

Copyright © 2009 - SCK•CEN - This is a copyright protected publication (2009). No part of this publication may be reproduced and/or made public without the express written consent of SCK•CEN.

Mission statement

- SCK•CEN has the statutatory assignment to enhance knowledge, to maintain competence and expertise and to perform research and provide policy support related to **protection of man and environment**

Research in human radiation protection

- Radiobiology
  - Developmental biology
    - Effects of ionizing radiation on female germ cells, early embryos and the prenatal brain

  - Genetic susceptibility to ionizing radiation in humans
    - Thyroid cancer problem (Chernobyl), nuclear workers biodosimetry, hadrontherapy, space biology

  - Radiation-sensitive bio-assay for biodosimetry

- Medical applications
  - Research on measurement and simulation techniques
    - Reliable dose assessments for patients (organs and effective doses) and staff (effective doses, dose equiv., extr. doses)

  - Optimization of patient doses
    - Neonatals, vascular or interventional radiology
  - Medical staff radiation protection
    - Extremity dosimetry in nuclear medicine and interventional radiology/cardiology
  - Radionuclide therapy research
- Human impact assessment

Copyright © 2009 - SCK•CEN - This is a copyright protected publication (2009). No part of this publication may be reproduced and/or made public without the express written consent of SCK•CEN.

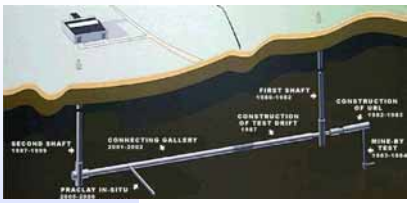
Scope

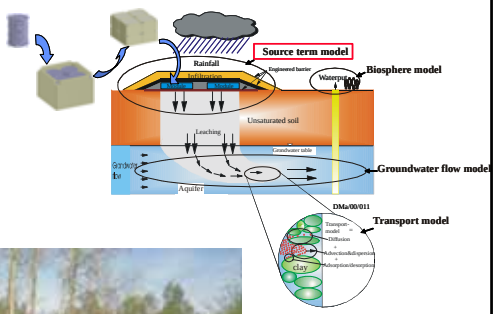
- Human and environmental impact assessment for
  - Routine releases or accidents
  - Practices or past activities

≠ Emergency planning and management

Human impact assessment – modeling (1)

- Biosphere impact assessment for high-medium and low-level waste disposal



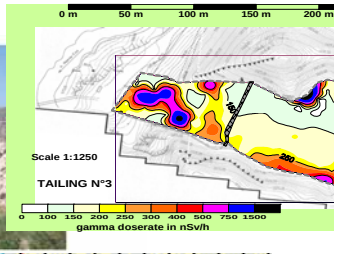


- Routine releases

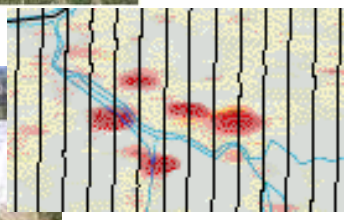
Copyright © 2009 - SCK•CEN - This is a copyright protected publication (2009). No part of this publication may be reproduced and/or made public without the express written consent of SCK•CEN.

Human impact assessment – modeling (2)

- Uranium mining and milling

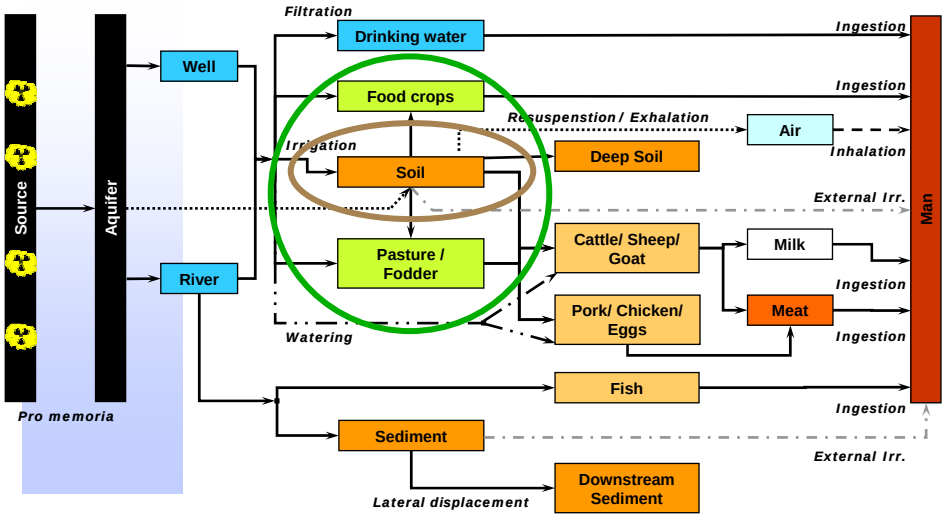


- NORM industry



Rhodania (Zelzate) and Rupel area

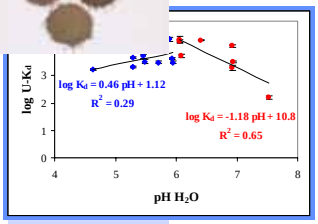
Model comparison - IAEA
Research for improved biosphere modeling



Copyright © 2009 - SCK•CEN - This is a copyright protected publication (2009). No part of this publication may be reproduced and/or made public without the express written consent of SCK•CEN.

Mechanisms of mobility and bioavailability in the terrestrial environment

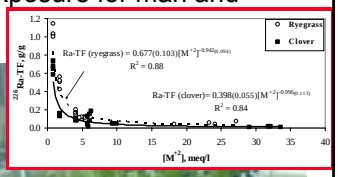
- Understanding the **soil, plant and rhizosphere processes** governing radionuclide mobility and bio-availability in order to come to a better predictability of the transfer and resulting radiation exposure for man and environment



Cs, Sr

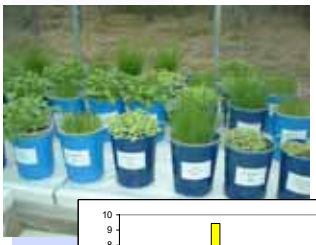
U, Ra, Po

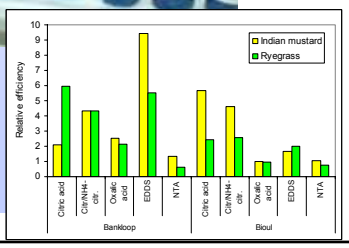
Tc, Nb



Contaminated land management

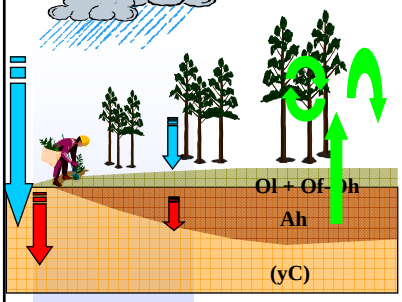
- Amendments to decrease mobility and uptake
- Phytomanagement
  - Enhanced phytoextraction
  - Alternative landuse





Copyright © 2009 - SCK•CEN - This is a copyright protected publication (2009). No part of this publication may be reproduced and/or made public without the express written consent of SCK•CEN.

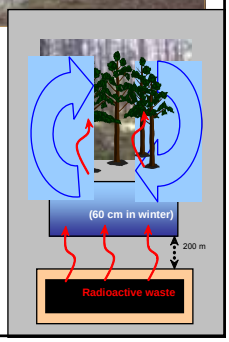
Biogeochemical cycling of radionuclides in relation to management of contaminated sites and waste disposal



- Processes and dynamics of ^{137}Cs cycling in forest of Belarus

- Impact of (re)vegetation on RN recycling at U-mining site (SE Germany)

- Biomass, water and element cycling in forest area affected by a shallow water table



Environmental impact assessment Context

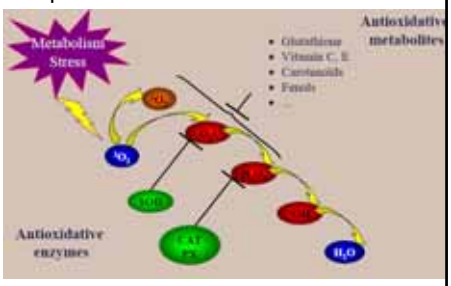
- ICRP-Paradigm “if man is protected, then environment is protected” contested
- Framework for environmental protection in development
  - ICRP-IAEA-UNSCEAR …
  - EC-FASSET, EC-ERICA, EC-PROTECT
- Legislation forthcoming

- Lack of quality data and understanding mechanisms
- Lack of chronic effects and multiple stressor studies
  - Need for these studies for justified setting of standards

Copyright © 2009 - SCK•CEN - This is a copyright protected publication (2009). No part of this publication may be reproduced and/or made public without the express written consent of SCK•CEN.

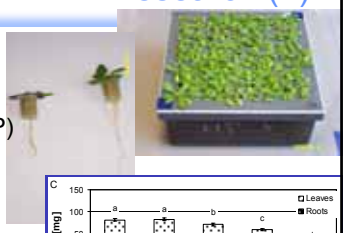
Environmental impact assessment Research (1)

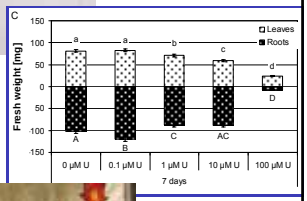
- Biological effects induced in terrestrial plants by radiation and/or radionuclide uptake
  - Analyse biological effects applying a multi-biomarkers approach (oxidative defence/signaling, DNA damage, DNA repair) viewed as early responses for individual disturbances (growth, reproduction)
  - Advanced molecular and genetic techniques
    - Metabolomics, transcriptomics
  - Test plant: *Arabidopsis thaliana*

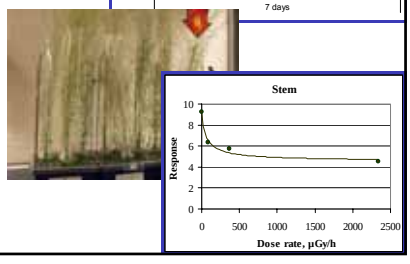


Environmental impact assessment Research (2)

- Exposure of *A. thaliana* to
  - U, gamma, U+Cd, U+gamma
  - Alfa-bèta-gamma (~ liquid discharges of NPP)
  - U-Th-Cd (~ discharges from U-mining areas)
  - (gamma-neutrons →space conditions)
- ECOTOX – test with Lemna







Copyright © 2009 - SCK•CEN - This is a copyright protected publication (2009). No part of this publication may be reproduced and/or made public without the express written consent of SCK•CEN.

Environmental impact assessment
Tool development/studies

- Project: Evaluate effect of radiological liquid discharges from Belgian NPP on environment
- Project: Strategic Environmental Assessment for High Level Waste Disposal - Effects on Environment
- Participate in Expert Group discussing problematic of former U mining and milling in Limoges, France

- IAEA-working group: Non-human biota
  - Update effects database
  - Updated screening values
  - Update transfer data base
  - Multiple stressor effects–challenging SS benchmarks

Potential areas for collaboration

- Environmental impact assessment for nuclear facilities
- Biological effects studies
- Radioecological sensitivity of areas surrounding NPP
- Phytomanagement
- Behaviour of critical radionuclides
- ….

Copyright © 2009 - SCK•CEN - This is a copyright protected publication (2009). No part of this publication may be reproduced and/or made public without the express written consent of SCK•CEN.

Copyright notice

Copyright © 2009 - SCK•CEN

All property rights and copyright are reserved.
Any communication or reproduction of this document, and any communication or use of its content without explicit authorization is prohibited. Any infringement to this rule is illegal and entitles to claim damages from the infringer, without prejudice to any other right in case of granting a patent or registration in the field of intellectual property.

SCK•CEN
Studiecentrum voor Kernenergie
Centre d'Etude de l'Energie Nucléaire

Stichting van Openbaar Nut
Fondation d'Utilité Publique
Foundation of Public Utility

Registered Office: Avenue Herrmann-Debrouxlaan 40 – BE-1160 BRUSSEL
Operational Office: Boeretang 200 – BE-2400 MOL

Copyright © 2009 - SCK•CEN - This is a copyright protected publication (2009). No part of this publication may be reproduced and/or made public without the express written consent of SCK•CEN.