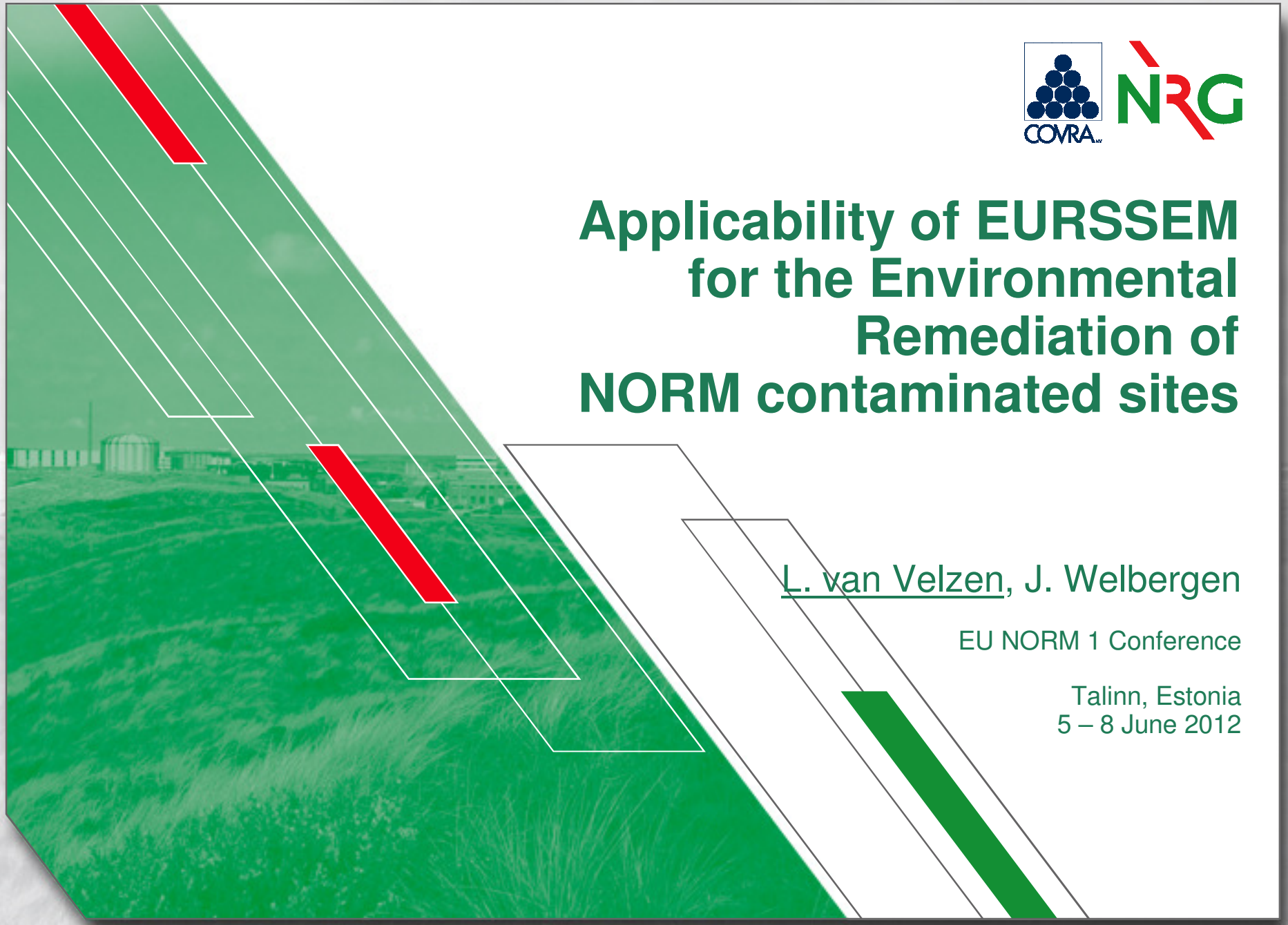

Applicability of EURSSEM for the Environmental Remediation of NORM contaminated sites

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EU NORM 1 Conference

Talinn, Estonia
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Contents

- Introduction
  - EURSSEM (*Environmental Radiation Survey and Site Execution Manual)*
    - Natural radiation sources in the recast EC BSS
      - Review EURSSEM in relation with NORM on Risk assessments, Site characterization plan, Remediation plan, selecting the remediation approach, implementing remediation activities and Stewardship
        - Discussions and conclusion

EURSSEM; Co-ordination Network on Decommissioning, EC-project

~ Aim of this work within the CND project (EC framework)

Main aim was to achieve the start of the development with participants of a document that should describe all key issues in of an environmental remediation project. ➔EURSSEM

EURSSEM provides guidance on the development of a strategy, implementation and execution program to remediate radioactively contaminated sites.

~ Need? YES

~ Why? Driver was to develop a consistent guidance.

~ Relevant documents cover a large time span, change of vision over time, new gained experiences, new developments in techniques and materials, ….deals in general with one main topic.

EURSSEM: Why?

Overview of IAEA relevant ER documents

Integrated Approach to Planning the Remediation of Sites Undergoing Decommissioning **IAEA-NW-T-3.3** 2009	Naturally Occurring Radioactive Material (NORM VI) **IAEA-PUB-1497** 2008	Release of sites from regulatory control on termination of practices **IAEA-WS-G-5.1** 2006	Radiation protection and the management of radioactive waste in the oil and gas industry **IAEA-TRCS-40** 2010	Radiation Protection and the Management of Radioactive Waste in the Oil and Gas Industry (safety report document) **IAEA-TRS-419** 2003
Remediation for Areas Affected by Past Activities and Accidents **IAEA-WS-G-3.1** 2007	Naturally Occurring Radioactive Material (NORM V) **IAEA-PUB-1326** 2008	Management of long term radiological liabilities: stewardship challenges **IAEA-TRS-450** 2006	Radiation Protection and NORM Residue Management in the Zircon and Zirconium Industries (safety report document) **IAEA-SRS-51** 2007	Technologies for remediation of radioactively contaminated sites **IAEA-TECDOC-1086** 1999
Management of Long Term Radiological Liabilities: Stewardship Challenges **IAEA-TRS-450** 2006	Regulatory and management approaches for the control of environmental residues containing naturally occurring radioactive material (NORM) **IAEA-TECDOC-1484** 2006	Environmental Contamination from Uranium Production Facilities and their Remediation **IAEA-PUB-1228** 2005	Soil sampling for environmental contaminants **IAEA-TECDOC-1415** 2004	Restoration of environments affected by residues from radiological accidents: Approaches to decision making **IAEA-TECDOC-1131** 1994
Non-technical factors impacting on the decision making processes in environmental remediation **IAEA-TECDOC-1279** 2002	Naturally occurring radioactive materials (NORM IV) **IAEA-TECDOC-1472** 2005	Soil sampling for environmental contaminants **IAEA-TECDOC-1415** 2004	Factors for formulating strategies for environmental restoration **IAEA-TECDOC-1032** 1998	Characterization of radioactively contaminated sites for remediation purposes **IAEA-TECDOC-1017** 1998
Technical options for the remediation of contaminated groundwater **IAEA-TECDOC-1088** 1999	Extent of Environmental Contamination by Naturally Occurring Radioactive Material (NORM) and Technological Options for Mitigation **IAEA-SRS-34** 2003			

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EURSSEM: Why?

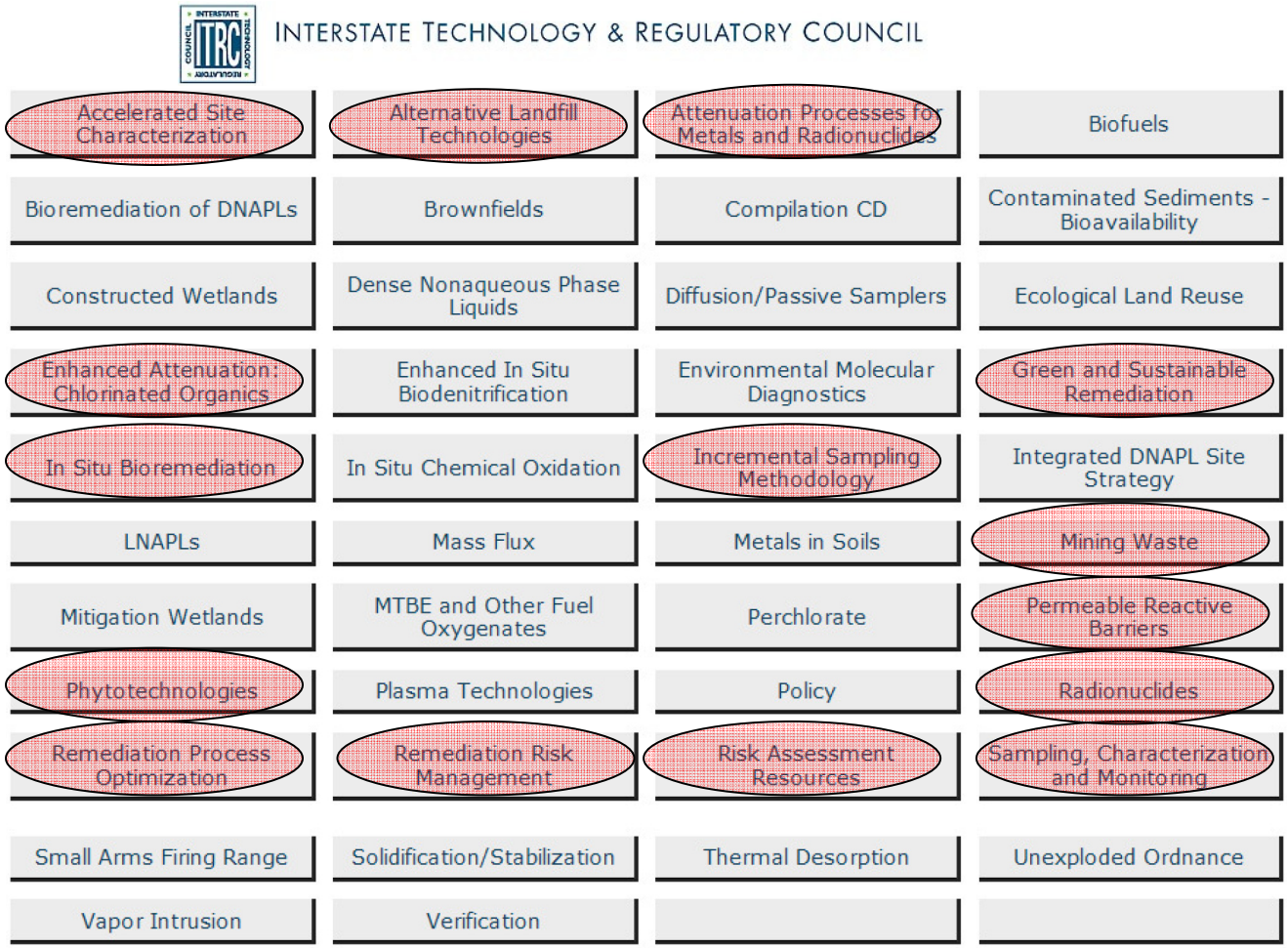
Overview of the document topics at the US-ITRC website.

INTERSTATE TECHNOLOGY & REGULATORY COUNCIL

Accelerated Site Characterization	Alternative Landfill Technologies	Attenuation Processes for Metals and Radionuclides	Biofuels
Bioremediation of DNAPLs	Brownfields	Compilation CD	Contaminated Sediments - Bioavailability
Constructed Wetlands	Dense Nonaqueous Phase Liquids	Diffusion/Passive Samplers	Ecological Land Reuse
Enhanced Attenuation: Chlorinated Organics	Enhanced In Situ Biodenitrification	Environmental Molecular Diagnostics	Green and Sustainable Remediation
In Situ Bioremediation	In Situ Chemical Oxidation	Incremental Sampling Methodology	Integrated DNAPL Site Strategy
LNAPLs	Mass Flux	Metals in Soils	Mining Waste
Mitigation Wetlands	MTBE and Other Fuel Oxygenates	Perchlorate	Permeable Reactive Barriers
Phytotechnologies	Plasma Technologies	Policy	Radionuclides
Remediation Process Optimization	Remediation Risk Management	Risk Assessment Resources	Sampling, Characterization and Monitoring
Small Arms Firing Range	Solidification/Stabilization	Thermal Desorption	Unexploded Ordnance
Vapor Intrusion	Verification		

EURSSEM: Why?

Overview of the document topics at the US-ITRC website.



EURSSEM; How established

~ Combining literature:

- IAEA; Member states – consensus-
- MARSSIM (2002); US Regulator/Agencies
- CIRIA Safegrounds; UK Nuclear Industry and Defense sites
- ITRC; US Regulator

.....

~ Approach:

- Service point of view, document free of names/pointers to commercial organizations, governmental regulations, etc.
- Leading strategies, leading practical option(s), etc.; all strategies, practical options ….. no judging.
- Applicable for all stakeholders involved in processes to remediate or restore radioactively contaminated sites for restricted or unrestricted (re)use.

EURSSEM; Contents

Guidance is provided on:

- Designing a remediation program; major steps;
- Stakeholder involvement;
- Historical site assessment;
- Risk assessment;
- Health physics, safety, and environmental protection plan;
- Site characterization plan;
- Remediation plan;
- Waste management and transport of radioactive materials plan;
- Stewardship;
- Record keeping;
- Archive for future referencing;
- ……

NORM in the recast EC BSS

- Present EU BSS issued in 1996 [Euratom 96/29];
  - Includes special provisions concerning exposure to NORM, however some exposures where also excluded;
    - It addressed the concept *"significant increase in exposure due to NORM"*.

NORM in the recast EC BSS

- Recast EC BSS;
  - Includes NORM in process industries, building materials, indoor exposure, exposure of air and space crew;
    - However no clear levels for ER.
  - States that *"that the regulatory framework for NORM industries should essentially be the same as for other practices with artificial nuclides";*
  - Development of Action Plans; criteria for delimitation of radon prone areas, basis for establishing reference levels, National authorities shall define radon prone areas.

NORM in the recast EC BSS

Conclusion:

- Regulatory framework the same;
  - Reference levels will be established at a national level;
  - The process of optimization of protection ALARA has to be applied;
  - Questionable if the recast EC BSS will prevent new NORM legacy sites or expanding old.

Review: EURSSEM & NORM

Guidance is provided on:

- Designing a remediation program; major steps;
- Stakeholder involvement;
- Historical site assessment;
- *Risk assessment;*
- Health physics, safety, and environmental protection plan;
- Site characterization plan;
- Remediation plan;
- Waste management and transport of radioactive materials plan;
- Stewardship;
- Record keeping;
- Archive for future referencing;
- ……

Review: EURSSEM & NORM

The review of EURSSEM should be concentrating on providing the answer on the question:

Is existing guidance for the environmental remediation of radioactively contaminated areas taking into account the problems of the exhalation of radon or more generic: exhalation of nuclides in a gasiform sufficient?

Review: EURSSEM & NORM

Review: EURSSEM guidance on "Risk assessments"

~ Unambiguous objectives and established remediation criteria;

Band No.	Range of annual doses (to average member of the critical group)	Is remediation needed?	
		With constraint	Without constraint
Band 6	> 100 mSv/a	Always	Always
Band 5	10 – 100 mSv/a	Always	Almost always
Band 4	1 – 10 mSv/a	Almost always	Usually
Band 3	0.1 – 1 mSv/a	Usually	Sometimes
Band 2	10 – 100 µSv/a	Sometimes	Rarely
Band 1	< 10 µSv/a	Almost never	Almost never

~ Scenarios for the evaluation of the source term;

~ No guidance is provided on the strength and weaknesses of these models for modeling certain nuclide-pathway combinations or advantages from existing modeling tools.

Review: EURSSEM & NORM

Review: EURSSEM guidance on "Site characterization"

- Guidance on:
  - General radiological survey design aspects including Ground gas surveys;
  - Additional guidance for *"nuclides in a* gasiform":
    - Gas sampling:
    - Radon progeny measurements;
    - Radon emanation measurements.

- Guidance is sufficient. As next to NORM the U-mining and milling industry is still developing it is worth to follow these developments and incorporate these in the existing guidance.

Review: EURSSEM & NORM

Review: EURSSEM guidance on “Remediation Plan”

- Guidance on:
  - General guidance for defining and setting up a remediation plan. Such a plan has four major aspects of which:
    - Remediation approaches and techniques;
    - Implementing remediation activities.

  have to reviewed for their applicability for NORM.

Review: EURSSEM & NORM

Review: EURSSEM guidance on “Remediation Plan”

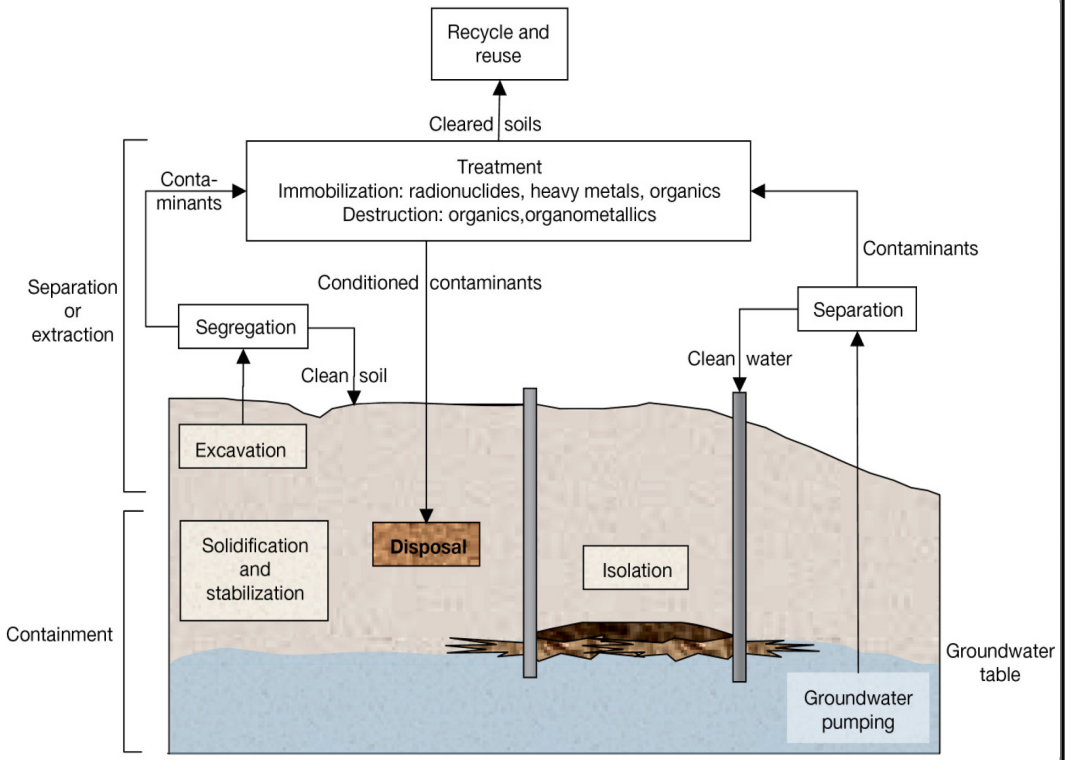
Remediation approaches and techniques

~ Guidance about options for reuse and environmental restoration, and selection of remediation technologies, as:

~ Monitored non-intervention;

~ Containment or blocking pathways;

~ Source term removal.



~ Guidance about “Cover techniques” should be extended.

Review: EURSSEM & NORM

Review: EURSSEM guidance on "Remediation Plan"

Implementing remediation activities

- Guidance provided about:
  - Procurement of the selected technology;
  - Preparation of the site;
  - Development of a health and safety plan;
  - Development of operations procedures;
  - Staff selection and training;
  - Completion of site clean-up;
  - Verification;
  - Waste disposal;
  - Release of the site for any future use.
- Based on the review: There is a need for developing guidance "how to remediate or deal with large amounts of remains coming from the NORM industry in a safe and sustainable way.

Review: EURSSEM & NORM

Review: EURSSEM guidance on “Stewardship”

~ The provided guidance on Stewardship is generic, providing assistance to select applicable activities and working these out in details for a unique site.

~ The radon aspect applies for the NORM industry as well as for the U-mining and milling industry. Information and experiences at this point are valuable and needed to be addressed more clearly and extended with the latest information.

Discussions and conclusion (1)

- ~ The recast EU BSS will have an influence on NORM industries as the regulatory frame work should be the same as for the nuclear industry. National Action Plans should be developed including criteria for radon, ALARA, etc. It is indistinct if this new BSS will prevent new NORM legacy sites;
- ~ The provided guidance by EURSSEM on an Environmental Remediation Program is consistent on major and many detail aspects for radioactively contaminated sites with artificial nuclides;

Discussions and conclusion (2)

- In the case of NORM, guidance should be extended on:
  - Modeling tools: strength and weaknesses for nuclide-pathway combinations for gasiform nuclides;
  - “Cover techniques”;
  - Remediation and dealing with large amounts of remains;
  - Latest developments in the U-mining and milling industry.


Thank you for your attention