Application of the International Basic Safety Standards to Existing Exposure Situations

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- Application of the BSS to existing exposure situations
- Natural sources
- Contamination of land after emergency
- Radon
- Construction materials
- Food feed and drinking water
- Consumables
- Examples of the application of the BSS

Existing exposure situations

- Situation of exposure already exists
- Includes:
  - Exposure to natural background radiation
  - Exposure to residual radioactive material after an emergency situation has ended
  - Exposure to residual radioactive material from past practices that were:
    - Not controlled
    - Controlled, but not in accordance with the Standards

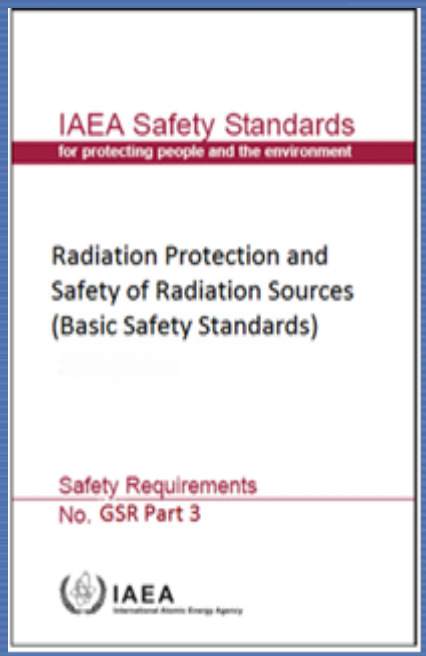
Some times mix situations

- For example:
  1. Transition from an emergency exposure situation to an existing exposure situation
     - The transition process is progressive and complex
     - Decision on when to make the transition requires judgement by the responsible authority
  2. Exposure to natural sources – cosmic rays
  3. Exposure to natural sources – construction materials

The BSS – Interim Edition 2011

Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards GSR Part 3

Reflect International Consensus
Common approach to ensure Safety



The BSS

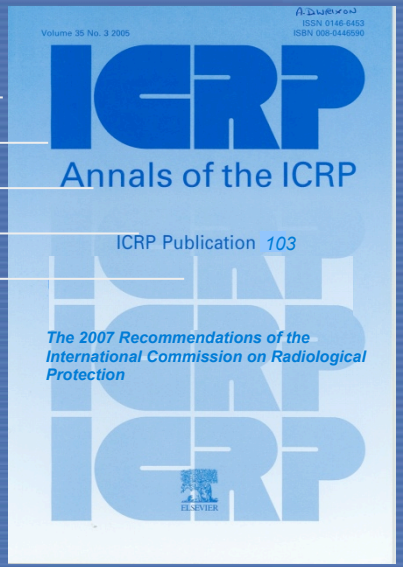
1. INTRODUCTION

2. GENERAL REQUIREMENTS FOR PROTECTION AND SAFETY
Implementation of radiation protection principles
Responsibilities of government
Responsibilities of the regulatory body
Responsibilities of other parties
Management requirements

3. PLANNED EXPOSURE SITUATIONS
Scope
Generic requirements
Occupational exposure
Public exposure
Medical exposure

4. EMERGENCY EXPOSURE SITUATIONS
Scope
Generic requirements
Public exposure
Exposure of emergency workers
Transition from an emergency exposure situation to an existing exposure situation

5. EXISTING EXPOSURE SITUATIONS
Scope
Generic requirements
Public exposure
Occupational exposure



SCHEDULES

Schedule I EXEMPTION AND CLEARANCE
Schedule II CATEGORIZATION OF SEALED SOURCES
Schedule III DOSE LIMITS FOR PLANNED EXPOSURE SITUATIONS
Schedule IV CRITERIA FOR USE IN EMERGENCY PREPAREDNESS AND RESPONSE

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Exposures subject to the requirements for existing exposure situations

- 2 main categories:
  - Exposure to radionuclides from residual radioactive material
    - Can be of natural or artificial origin
  - Exposure to natural sources
- Doses will be well below the threshold for deterministic effects
- Only stochastic effects have to be considered

Exposures subject to the requirements for existing exposure situations

— Radionuclides from residual radioactive material

- Exposures due to contamination of areas by residual radioactive material from:
  - Past activities that were:
    - Never subject to regulatory control, or
    - Subject to regulatory control but not in accordance with the requirements of the Standards
  - A nuclear or radiation emergency, after an emergency exposure situation has been declared ended

Exposures subject to the requirements for existing exposure situations — Radionuclides from residual radioactive material (continued)

- Exposures may arise:
  - Directly from the contaminated areas
  - Indirectly from commodities contaminated by radionuclides from the residual radioactive material
    - e.g. food, animal feed, drinking water, construction materials
- The radionuclides may be of natural or artificial origin

Exposures subject to the requirements for existing exposure situations

— Exposures to natural sources

1. Residues from unregulated or poorly regulated past activities
2. Everyday commodities *regardless of radionuclide concentration*
   - Food, animal feed, drinking water
   - Fertilizer, construction materials
3. Public exposure to indoor radon
4. Occupational exposure to cosmic radiation above the Earth's surface

Aircrew and space crew

Public exposure is excluded

The basis for determining the most appropriate type of exposure situation

- **The mechanism for exposure control used in planned exposure situations is not suitable for existing exposure situations**
- Choose on the basis of PRACTICAL CONSIDERATIONS

- Choose the option that provides the *most practicable mechanism of control*
  - Not just radiological issues – social and economic issues as well
  - e.g. radon in homes, contaminated land
- Involvement of senior levels of government and national authorities other than the regulatory body
- Legally binding dose limits not appropriate
  - Control measures out of proportion to the benefit obtained
  - Conflict with the principle of justification

- More suitable mechanisms may be already in place for non-radiological reasons:
  - Control of the safety and quality of basic commodities (e.g. food, water, fertilizer, construction materials)
    - Public health regulations, food & agriculture regulations, building regulations, etc.
  - Commercial aviation – safety control
    - Restrictions on aircrew flying times

Existing exposure situation	Exceptions (planned exposure situation)
Residual radioactive material from past activities	No exceptions
Everyday commodities	No exceptions
Material *other than* everyday commodities	If U, Th series >1 Bq/g or ^{40}K >10 Bq/g). Applies also to discharges and waste from such facilities, irrespective of activity concentration
Public exposure to indoor radon	No exceptions
Occupational exposure to radon	(i) If other U, Th series radionuclides are controlled (as a planned exposure situation); or (ii) If Rn concentrations exceed reference level
Occupational exposure to cosmic radiation other than at Earth's surface	No exceptions

Planned exposure situation or existing exposure situation?

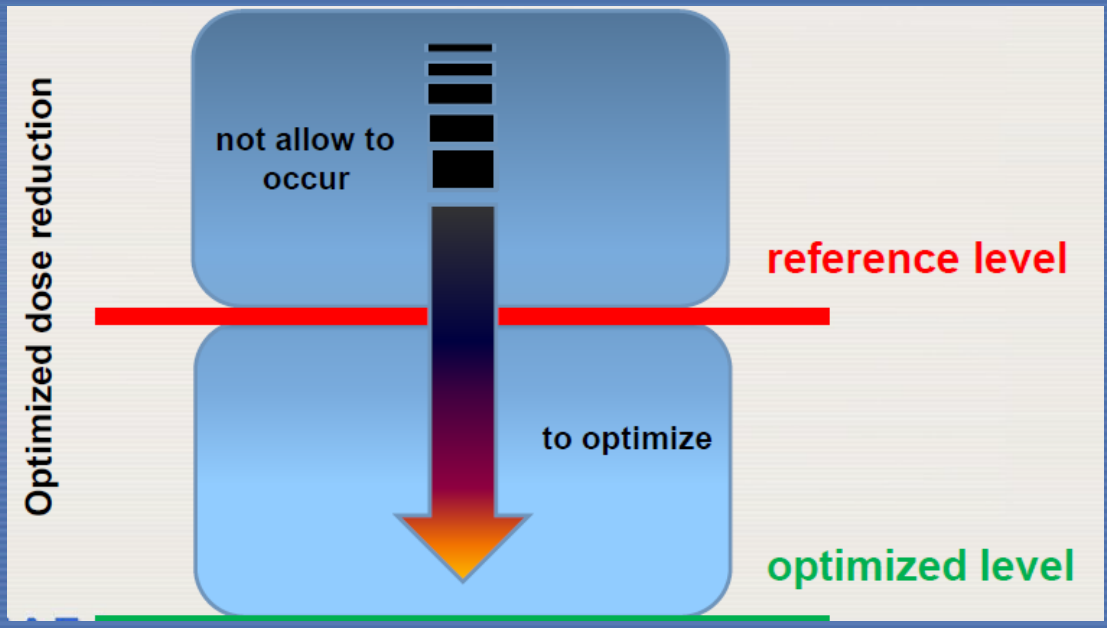
The following exposures are controlled in accordance with the requirements for EITHER existing OR planned exposure situations:

Source of exposure	*Existing exposure situation*	*Planned exposure situation*
Material other than environmental residues and food, drinking water etc.	≤1 Bq/g (U, Th series) and ≤10 Bq/g (^{40}K)	>1 Bq/g (U, Th series) or >10 Bq/g (^{40}K)
Radon in workplaces: • Exposure required by or directly related to the work	×	√
• Exposure incidental to the work	≤1000 Bq/m^3	>1000 Bq/m^3

Existing exposure situations – reference levels

Reference levels are not the same as action levels

- Action levels are levels at or below which remedial action (and thus the need for optimization) is not normally necessary
- Reference levels are levels above which it is inappropriate to plan to allow exposures to occur, and below which optimization of protection should be implemented
  - Retaining the same numerical value implies a significant increase in the stringency of control



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Existing exposure situations – reference levels

General reference levels (applicable to both natural and artificial sources):

- Normally in the range 1–20 mSv/a
- Commodities: ≤1 mSv/a
- Radon:
  - Expressed in terms of radon activity concentration in air
  - ≤300 Bq/m^3 in homes
  - ≤1000 Bq/m^3 in workplaces
  - These values are roughly equivalent to 10 mSv/a in terms of latest ICRP thinking:
    - The risk per unit intake is now thought to be about twice the ICRP65 value

Examples - Fukushima

- Fukushima remediation : The NSC considers that the areas in the emergency exposure situation can be shifted to the existing exposure situation when the release of radioactive materials from the Fukushima Dai-ichi NPP is under control and exposures due to residual radioactive materials in the areas can be managed to be a certain level or less.
- On the other hand, some areas have been under the existing exposure situations without passing through the emergency exposure situation due to the radioactive materials deposition.
- Hence, the areas around the Fukushima Dai-ichi NPP are currently considered to be under emergency exposure and existing exposure situations in parallel
- Indication levels
- Provisional Reference levels – 5 mSv/y ….long term goal : 1 mSv/y

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- The Japanese government has defined a set of reference levels to control the exposure of the public.
- In areas where the annual effective dose is estimated to be above 20 mSv, the national government aims to reduce the estimated annual exposure dose to less than 20 mSv.
- In areas where an estimated annual exposure dose is less than 20 mSv, the national government will work with municipalities and local residents to conduct effective remediation work, with a long term target of keeping the estimated annual exposure dose below 1 mSv.
- Specific attention is being given to the exposure of children.
- Therefore, initial efforts focus on measures to reduce exposures in schools and kindergartens, with the aim to reduce the exposure to children to an effective dose of 1 mSv per year during the time children are at school.
- This approach is in accordance with the recommendations of the International Commission on Radiation Protection and the BSS.

Example of transition phase

- Special Act for Remediation (26Aug.2011)
- The Emergency Evacuation Preparation Zone was lifted on 30 September 2011 as advised by the Nuclear safety Commission based on conditions of NPP and radiological monitoring data.
- emergency exposure situations – areas where citizens could be exposed to an annual dose above 20 mSv

- Local governments implement remediation plans for areas which are in “existing exposure situations”, i.e. areas below 20 mSv/year. In these areas the ultimate decision whether to remediate or not rests with the landowner.
- Practical involvement of all stakeholders

Remediation

- Decontamination of a school ground
- Removal of top 5cm soil reduced the radiation field by 95%.

Examples - NORM Residues

- Many instances of residue recycling and use
- Instances of dilution
- Increasing acceptance on the concept of use of NORM residues rather than disposal
- Conditional use of NORM residues are considered by some regulatory bodies
  - Examples : Sweden - ^{238}U decay series do not exceed 3 Bq/g, for historical NORM residues
  - India - the use of phosphogypsum in building materials is permitted if the ^{226}Ra concentration does not exceed 1 Bq/g (after dilution with lower activity material if necessary).
  - EC : Building materials can be used without restriction if the dose from indoor external exposure does not exceed the background outdoor external exposure by more than 1 mSv per year

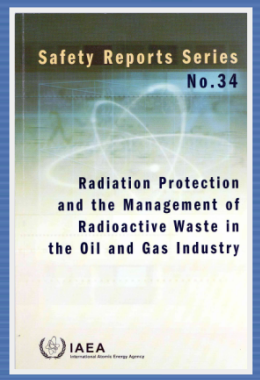
Management of NORM Residues/wastes..contd..

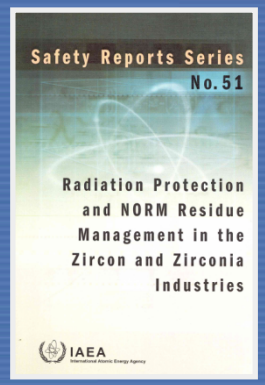
- Lack of uniformity in the approach to the use of NORM as a component of building material
- Agreement on the value of 1 mSv as a general reference level for building materials, there was less of a common view on how this should be translated into measurable quantities such as activity concentration.
- A restriction based only on external exposure might not be sufficient to adequately control radon exposure
- Some countries in Europe – additional criterion specifically to control radon exposure from building materials
- Different views on whether the 1 mSv dose criterion should refer to the total external dose from the building material or just the contribution from NORM contained within it.
- A risk-based and situation specific approach is essential for the establishment of good practices for the management of NORM waste.

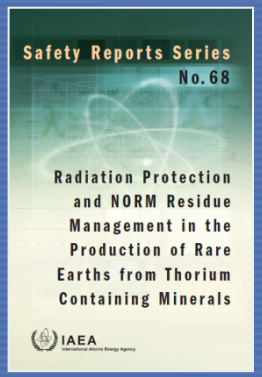
Legacy issues

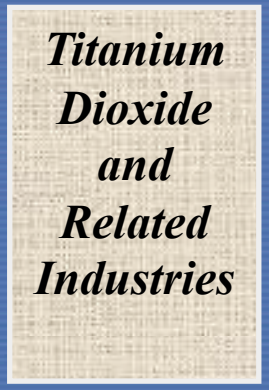
- Former industrial activities
  - Uranium mining sites (example : cental Asia)
  - Heavy metal mining and processing sites
  - Monazite and thorium processing sites
  - Fertilizer plants
  - Thorium mantle factories
  - Old oil production fields
  - Scrap metal dumps
  - Tailings sites
- Coordinated international efforts for remediation - a challenge

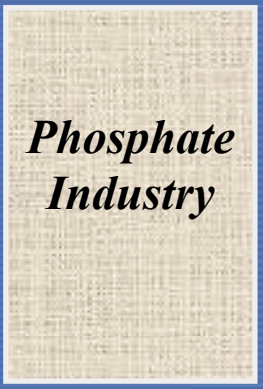
For NORM issues - IAEA Industry Specific Safety Reports

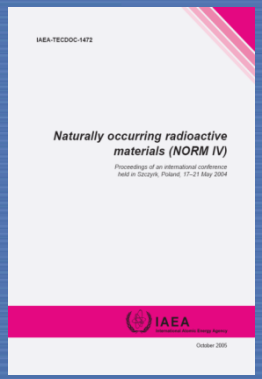


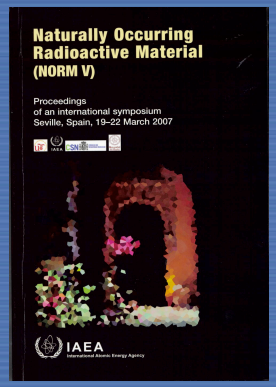












NORM VII Symposium - 2013

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More information : www.norm7.org

Deadline for abstract submission : 30 September 2012

Summary

- Considerable progress towards harmonization of standards and regulatory approaches for the control of exposures in existing exposure situations.
- The new BSS provides more numerical criteria, for exposure to natural sources
- A graded approach for regulatory control should be applied.
- Major challenges : Residual radioactivity after emergency exposure situations, Radon in workplaces, construction materials, legacy issues and remediation.
- Further guidance needed in the practical implementation of the standards.

Many thanks for your attention…

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