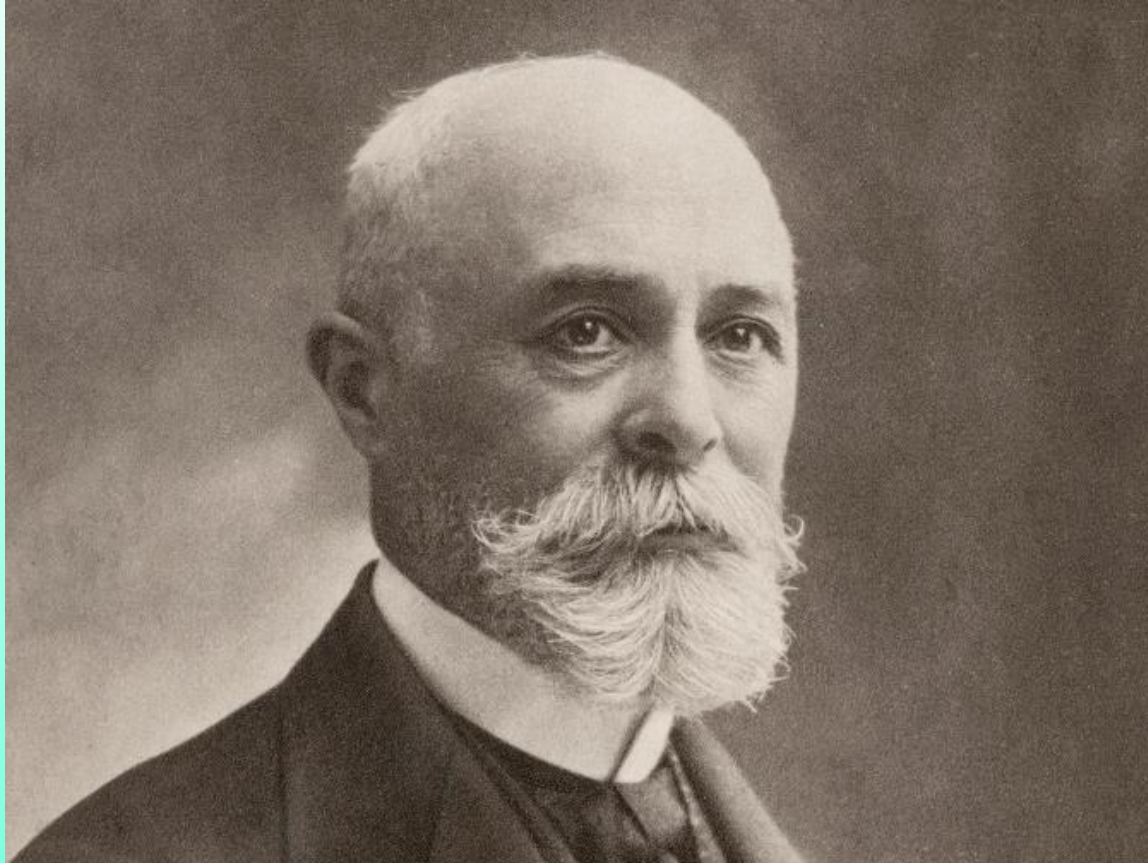


Setting the scene: why should we be concerned about NORM, what are the implications of the new the Euratom Basic Safety Standards?

New Euratom  
legislative requirements on the  
management of **NORM** materials

Augustin Janssens

Setting the scene: why should we be concerned about NORM?



## **Antoine Henri Becquerel**

Antoine Henri Becquerel (15 December 1852 – 25 August 1908) was the first person to discover evidence of radioactivity (1896). The SI unit for radioactivity, the becquerel (Bq), is named after him.



## **Marie Skłodowska Curie**

Marie Skłodowska Curie (7 November 1867 – 4 July 1934) conducted pioneering research on radioactivity, developed techniques for isolating radioactive isotopes and discovered the elements polonium and radium in 1898.



## **Wilhelm Conrad Röntgen**

Wilhelm Conrad Röntgen (27 March 1845 – 10 February 1923) was a German engineer and physicist, who, on 8 November 1895, produced and detected electromagnetic radiation in a wavelength range known as X-rays or Röntgen rays.



## **Sir James Chadwick**

Sir James Chadwick, (20 October 1891 – 24 July 1974) was awarded the 1935 Nobel Prize in Physics for his discovery of the neutron in 1932



## **Irène Curie**

Induced radioactivity was discovered by Irène Curie and F. Joliot in 1934



## **Lise Meitner**

Nuclear fission of heavy elements was discovered on December 17, 1938 by German Otto Hahn and explained theoretically in January 1939 by Lise Meitner and her nephew Otto Robert Frisch.



**COUNCIL DIRECTIVE 2013/59/EURATOM of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation ...**

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Uitgave  
in de Nederlandse taal

**Wetgeving**

57e jaargang  
17 januari 2014

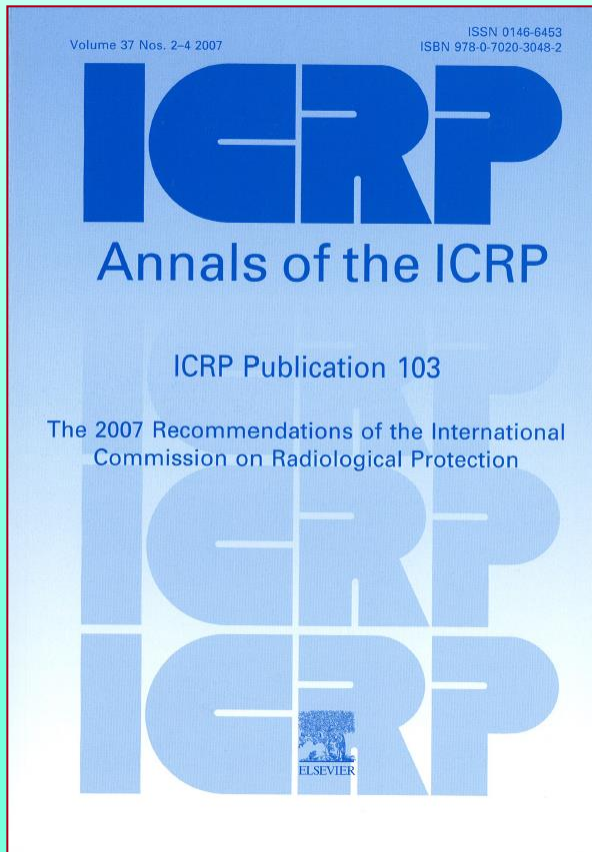
Inhoud

II Niet-wetgevingshandelingen

RICHTLIJNEN

- ★ Richtlijn 2013/59/Euratom van de Raad van 5 december 2013 tot vaststelling van de basisnormen voor de bescherming tegen de gevaren verbonden aan de blootstelling aan ioniserende straling, en houdende intrekking van de Richtlijnen 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom en 2003/122/Euratom ..... 1

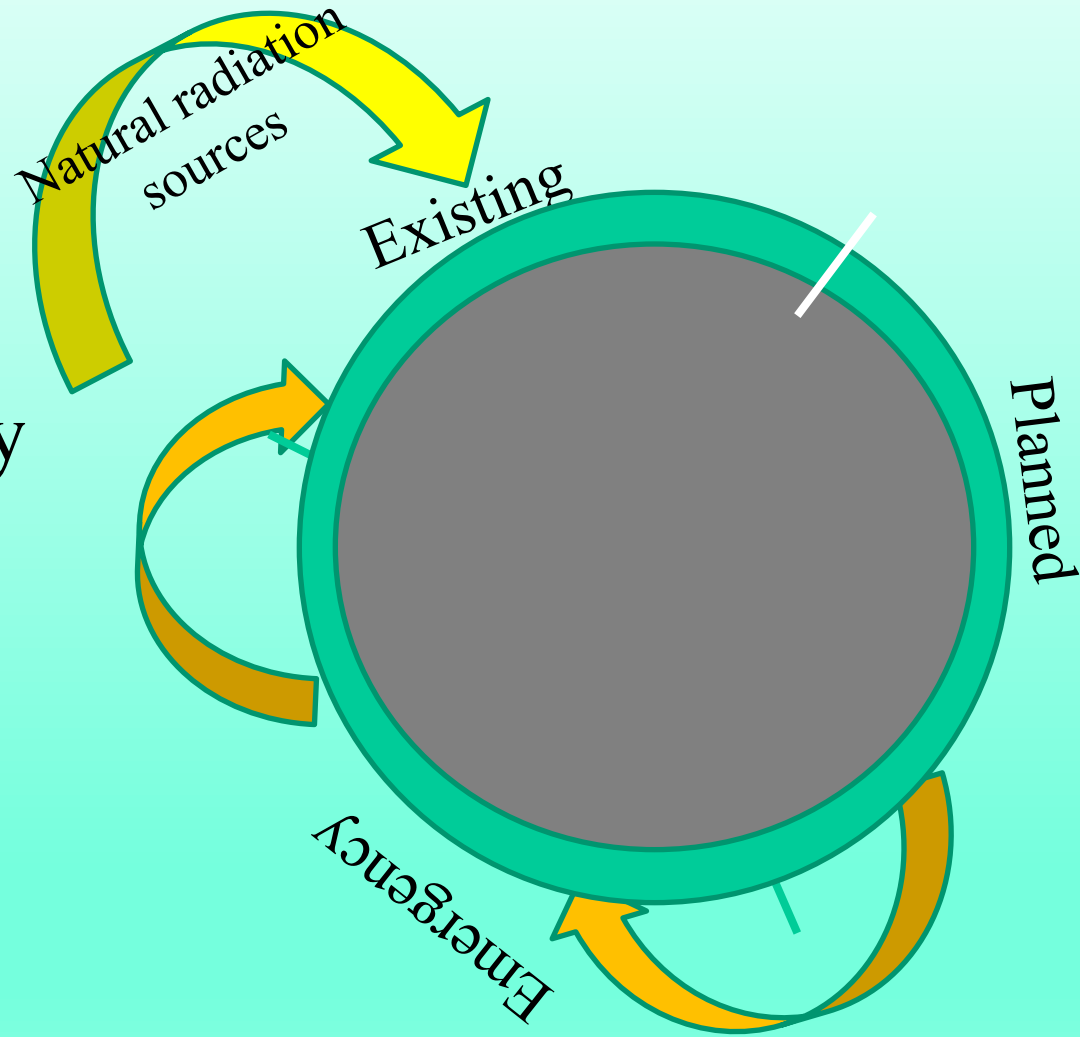
# Council Directive 2013/59/Euratom



- Consolidation of current Directives
- Allow for international BSS (IAEA and co-sponsors)
- Allow for ICRP
  - Exposure situations
  - **Incorporate natural radiation sources**
    - Radon in dwellings and workplaces
    - Air- and space crew
    - **NORM industries** (planned exposure situation)
    - **Building materials** (existing exposure situation)

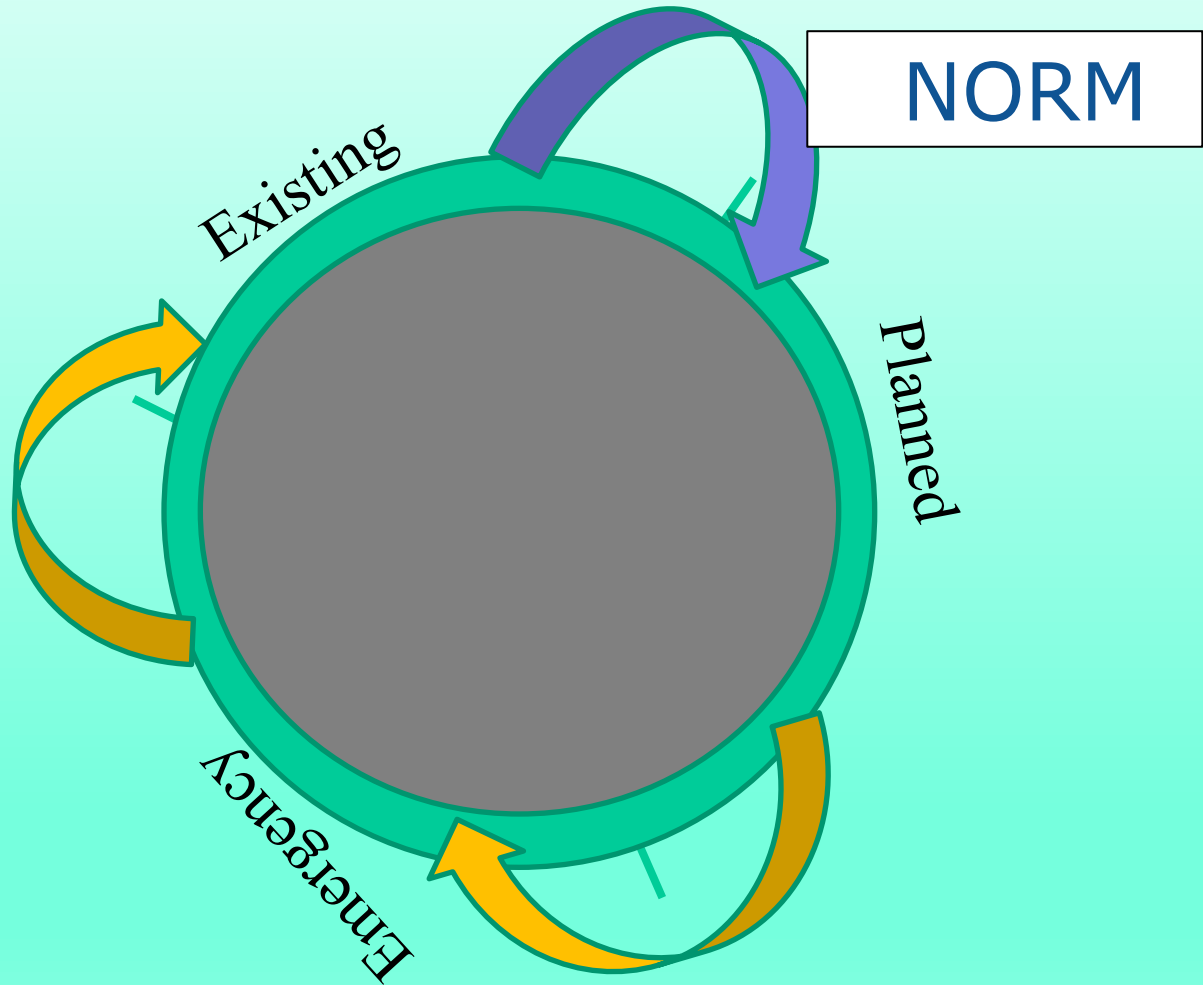
# Exposure situations (ICRP)

- Existing
- Planned
- Emergency



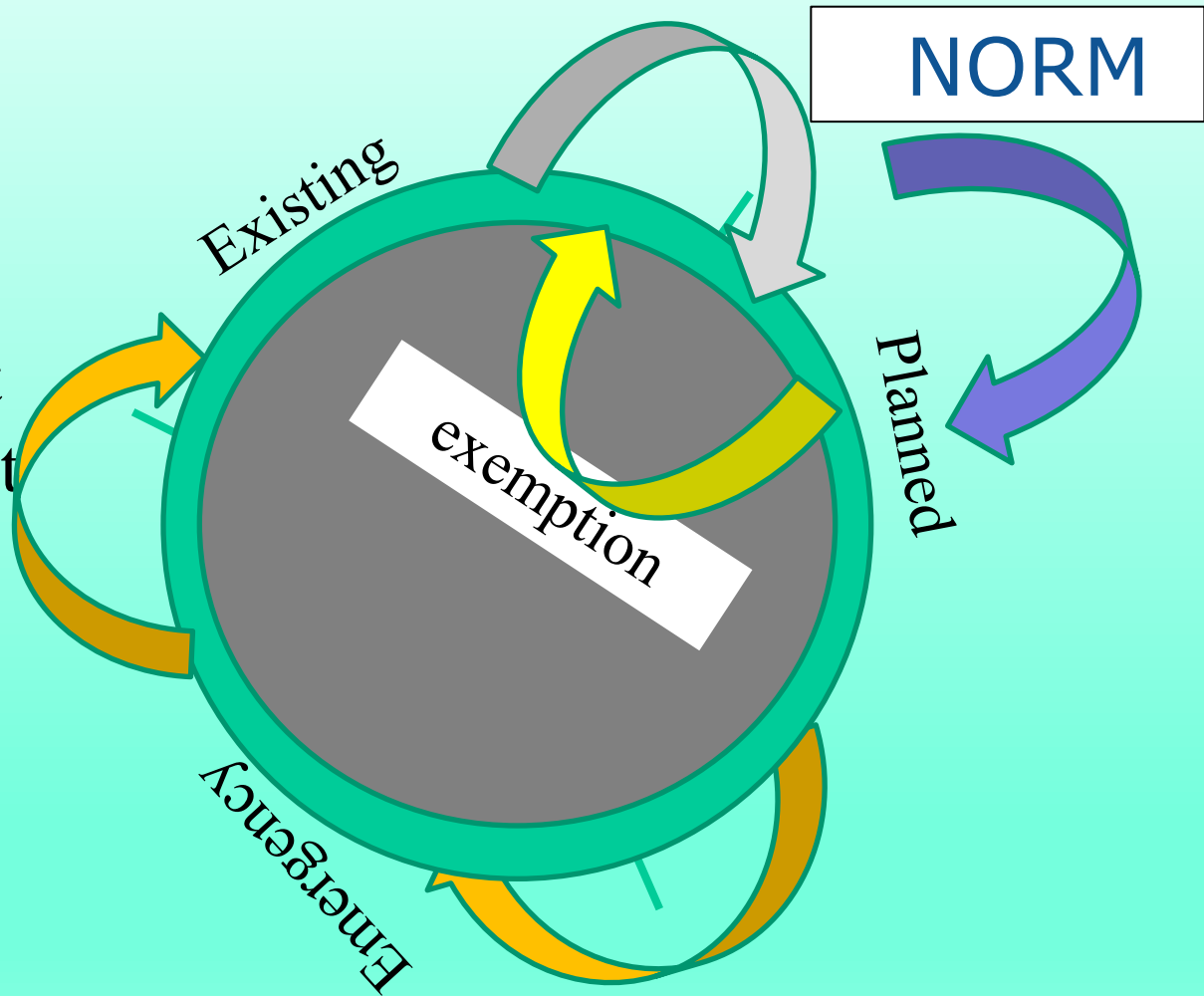
# Exposure situations (IBSS)

- Existing
- Planned
- Emergency



# Exposure situations (EBSS)

- Existing
- Planned
- An activity that needs to be kept under a regime of regulatory control and enforcement
- Emergency



# Exposure situations: Euratom approach

- Existing: resulting from features of the location (not the type of human activity)
  - indoor Radon (ingress from soil)
  - commodities managed together with the exposure situation:
    - building materials (gamma exposure, radon exhalation)
    - foodstuffs (post-accidental situation)
- Planned: new source or new pathway of exposure resulting from the human activity
  - industries processing naturally occurring radioactive materials (NORM)
  - operation of aircraft and spacecraft (specially authorised)
- Responsibility of the employer for exposure to radon at work managed in the same way as for a planned exposure situation

# Requirements in BSS Directive

**NORM Activities - General Regulatory Requirements  
(BSS, Arts. 23, 24, 25, 26 and 27, and Annexes VI, VII)**

**NORM Legacy contamination (BSS, Art. 73; Art.100)  
Waste management strategy (BSS, Art 30.1, -.2, - .4)**

**Building Materials  
(BSS Art. 75.2, 75.3, Annexes VIII, XIII)**

## Building materials (Annex XIII)

- Natural materials
  - Alum-shale
  - of igneous origin (granitoides etc)
- Materials incorporating residues from NORM industries
  - Fly ash
  - Phosphogypsum
  - Phosphorus slag
  - Tin slag
  - Copper slag
  - Red mud (Aluminium production)
  - Residues from steel production

## Industrial NORM practices (Annex VI)

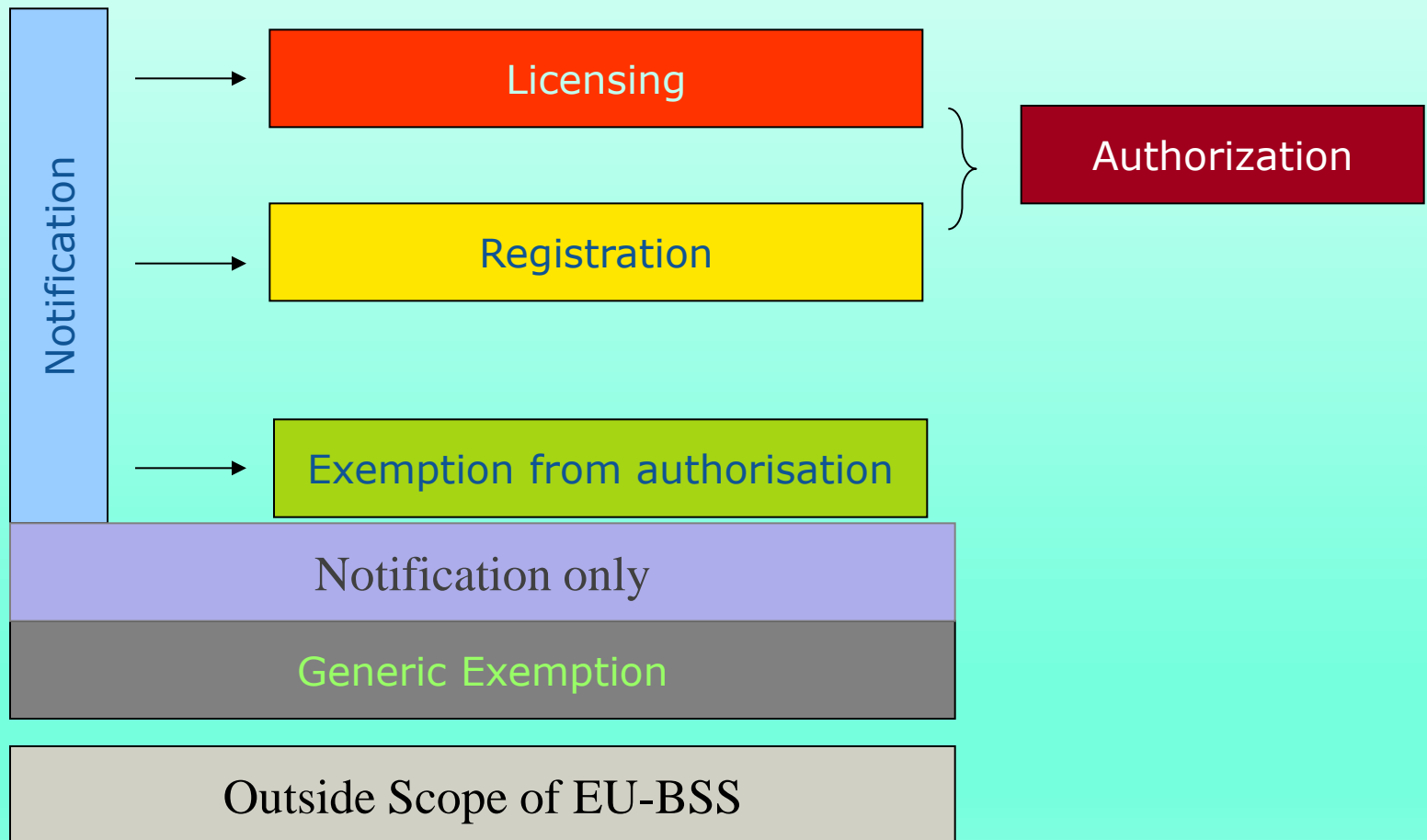
Extraction of rare earths  
Production of thorium compounds  
Niobium/tantalum ore  
Oil and gas  
Geothermal energy  
TiO<sub>2</sub> pigment production  
Zircon and zirconium industry  
Thermal phosphorous production  
Production of phosphate fertilizers  
Cement production  
Maintenance of boilers of coal-fired power plants  
Phosphoric acid production  
Tin/lead/copper smelting  
Ground water filtration  
Mining



# NORM industries

- Managed as *planned exposure situations*
- Subject to the same requirements as practices (including dose limits)
  - Protection of workers
  - Protection of members of the public
    - Liquid and gaseous effluent
    - Products and residues
- Subject to regulatory control
  - Graded approach

# Graded Approach



# Exemption and Clearance

- Clarification of the concepts of exemption and clearance
- Harmonisation with International BSS
  - Exemption values
  - General clearance levels
- Application to NORM industries

# Exemption values and Clearance levels

- Total activity: current exempt quantities (Bq)
- Concentrations (kBq/kg): same levels for both concepts
- Artificial radionuclides (Table A part 1):
  - General exemption or clearance: based on RS-G-1.7
  - Exemption criterion 10  $\mu\text{Sv}$  per y (same as in 1996)
- Naturally occurring radionuclides (Table A part 2):
  - RS-G-1.7 exemption value **1 kBq/kg** (10 kBq/kg for K-40)
    - instead of 0.5-5 kBq/kg in RP 122 part II (2002)
  - Exemption criterion **1 mSv per y**
    - instead of 0.3 mSv in RP 122 part II

# General exemption and clearance criteria

The general criteria for the exemption of practices from notification or authorisation or for the clearance of materials from authorised practices are as follows:

- (a) the radiological risks to individuals caused by the practice are sufficiently low, as to be of no regulatory concern; and
- (b) the type of practice has been determined to be justified; and
- (c) the practice is inherently safe.

....

For compliance with the general criterion (a), it shall be demonstrated that workers should not be classified as exposed workers, and the following criteria for the exposure of members of the public are met in all feasible circumstances:

## **For artificial radionuclides:**

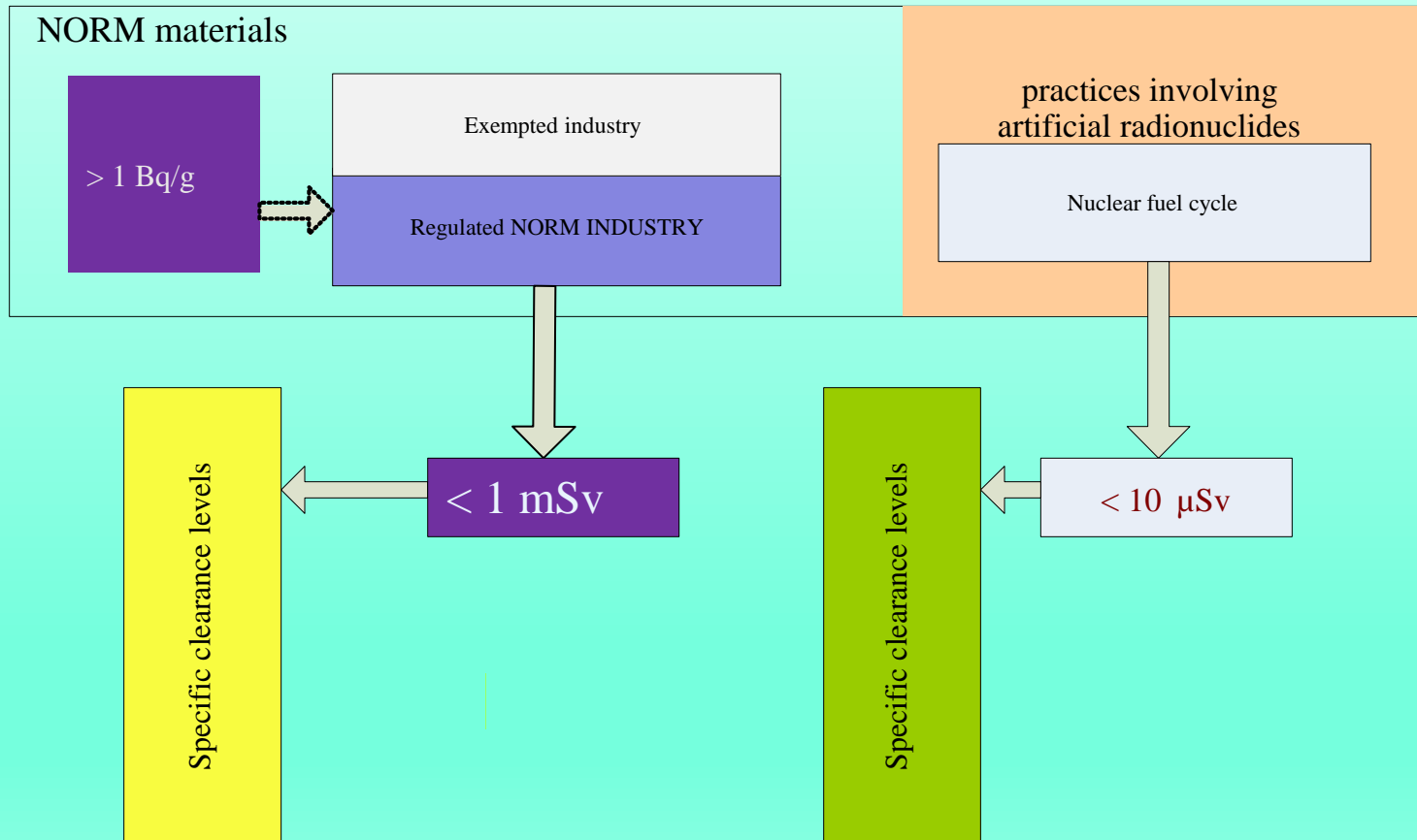
The effective dose expected to be incurred by a member of the public due to the exempted practice is of the order of 10  $\mu$ Sv or less in a year.

## **For naturally-occurring radionuclides:**

**The dose increment, allowing for the prevailing background radiation from natural radiation sources, liable to be incurred by an individual due to the exempted practice is of the order of 1 mSv or less in a year.**

# Clearance criteria

## NORM and nuclear fuel cycle residues



# General exemption and clearance criteria

The general criteria for the exemption of practices from notification or authorisation or for the clearance of materials from authorised practices are as follows:

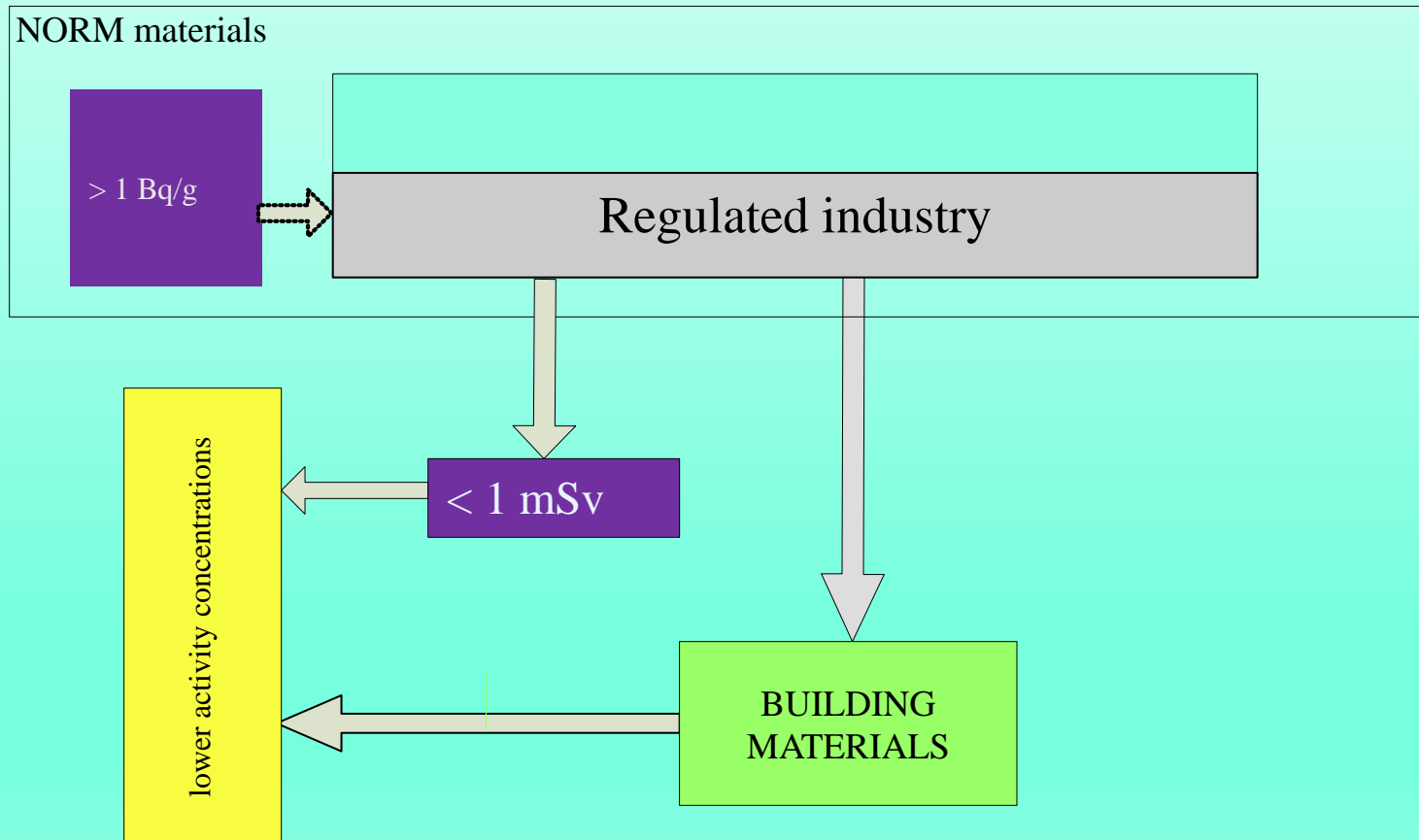
- (a) the radiological risks to individuals caused by the practice are sufficiently low, as to be of no regulatory concern; and
- (b) the type of practice has been determined to be justified; and
- (c) the practice is inherently safe.

....

Practices involving amounts of radioactive substances or activity concentrations below the exemption values laid down in Table A, Part 1, or Table B, are deemed to comply with criterion (a) without further consideration. **This is also the case for the values in Table A, Part 2, with the exception of the recycling of residues in building materials or the case of specific exposure pathways, for instance, drinking water.**

# NORM residues

## Clearance criteria for recycling in building materials





# Release from regulatory control

3. Member States shall ensure that for the clearance of materials containing naturally-occurring radionuclides, where these result from authorised practices in which natural radionuclides are processed for their radioactive, fissile or fertile properties, the clearance levels comply with the dose criteria for clearance of materials containing artificial radionuclides.
4. **Member States shall not permit the deliberate dilution of radioactive materials for the purpose of them being released from regulatory control. The mixing of materials that takes place in normal operations where radioactivity is not a consideration is not subject to this prohibition. The Competent Authority may authorise, in specific circumstances, the mixing of radioactive and non-radioactive materials for the purposes of re-use or recycling.**

# Conclusions

- NORM industries managed as a planned exposure situation, but graded approach to regulatory control
  - Flexibility, more judgment by the regulatory authority
- Novel approach for mixing/dilution
  - The recycling of secondary NORM materials (for instance in building materials) may be judged to be justified and be authorized
- Building materials are managed as an existing exposure situation, subject also to EU legislation