



2016 Rio  
**norm VIII**

Eighth International Symposium on Naturally  
Occurring Radioactive Material – NORM VIII  
Rio de Janeiro, Brazil, October 18 -21, 2016

DESAFIOS E SOLUÇÕES

# IMPORTANCE OF PARTICIPATION OF NORM INDUSTRIES IN DEVELOPING NORM STRATEGIES

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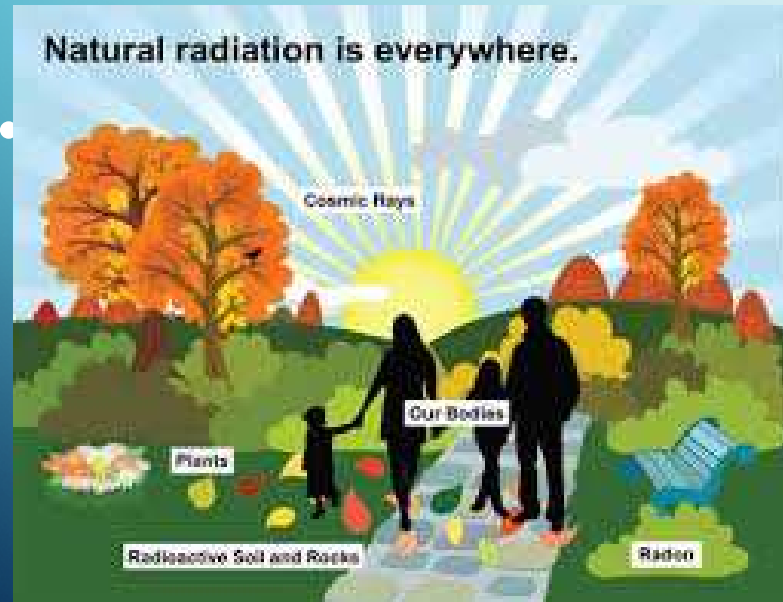
# NORM

- All minerals and raw materials contain radionuclides of natural origin. The most important for the purposes of radiation protection are the radionuclides in the U-238 and Th-232 decay series.
- These elements have always been present in the Earth's crust and atmosphere, and are concentrated in some places, such as uranium orebodies which may be mined.
- NORM is the acronym for **Naturally Occurring Radioactive Material**, which potentially includes all radioactive elements found in the environment.



# NORM

- For most human activities involving minerals and raw materials, the levels of exposure to these radionuclides are not significantly greater than normal background levels and are not of concern for radiation protection.



Life (Natural Radiation).



# NORM

- However, certain human activities can give rise to significantly enhanced exposures that may need to be controlled by regulation.
- Excluding uranium mining and all associated fuel cycle activities, industries known to have NORM issues include:
  - The coal industry (mining and combustion)
  - The oil and gas industry (production)
  - Metal mining and smelting
  - Mineral sands (rare earth minerals, titanium and zirconium).
  - Fertilizer (phosphate) industry
  - Building industry
  - Recycling

# NORM INDUSTRIES

- A wide range of non-nuclear industries are processing large volumes of raw materials containing radionuclides from natural origin.
- Many of these industries are not aware of these problems, neither about the regulatory initiatives that are being developed about this topic by international authorities.
- There is as yet little consistency in NORM regulations among industries and countries.
- This means that material which is considered radioactive waste in one context may not be considered so in another.

Some of the NORM problems:  
waste deposition

SAMPLES	Concentrations				
	U <sub>3</sub> O <sub>8</sub> (ppm)	ThO <sub>2</sub> (ppm)	<sup>226</sup> Ra (Bq/kg)	<sup>228</sup> Ra (Bq/kg)	<sup>210</sup> Pb (Bq/kg)
Metalurgic slag	7.600 ± 380	85.000 ± 4.250	84.000 ± 8.400	220.000 ± 22.000	10.100 ± 1.200
Slag aluminotermia	18.800 ± 800	73.200 ± 1.300	82.000 ± 7.000	180.000 ± 10.000	4.080 ± 1.200



Problems with NORM are not just related only to waste materials and by-products. Sometimes natural radionuclides are transferred during production into final products - **trade barriers**



## SOME DIFFICULTIES – NORM INDUSTRIES

- Industries: Lack of sufficient infrastructure to analyze and interpret radionuclide concentrations in their raw materials, products and residues.
- Qualified experts for radiation protection.
- NORM waste/residues management (is it possible to mix radioactive and non radioactive residues?)
- Participation on the elaboration of legislation (public consultation – very few suggestions)
- Legislation interpretation (graded approach)
- Risk perception and communication

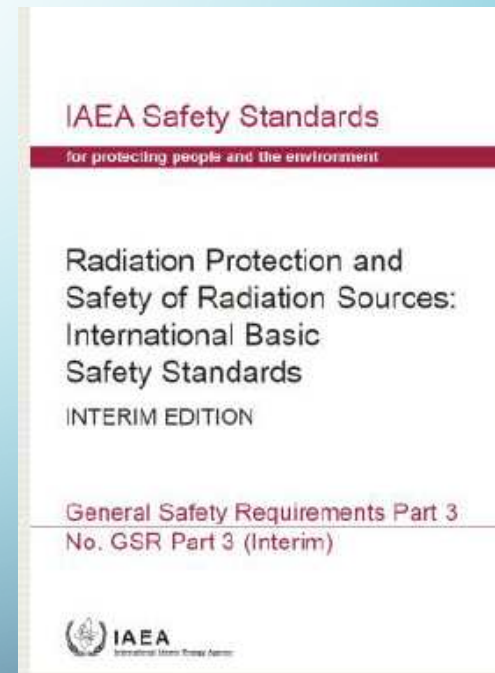
# EVERY DAY LIFE -SOME CONCEPTS STILL NOT CLEAR

- **Exposure situations**

- Planned exposure situation
- Existing exposure situation
- Emergency situation

## **NORM industries**

The exposures are generally (but not always) moderate with little or no likelihood of extreme radiological consequences from accidents.





## Graded approach to regulation

1. **Exemption** (Decision not to regulate)
  - If dose from gamma and dust is less than about 1 mSv/a, after taking existing industrial hygiene controls into account
2. **Notification**
  - If dose from gamma and dust  $\ll$  dose limit, after taking existing industrial hygiene controls into account (similar to exemption but regulator remains informed)
3. **Notification + registration**
  - Minimal additional controls for gamma and dust needed, after taking existing industrial hygiene controls into account
4. **Notification + licensing**
  - Specific measures to control actions of workers – needed only when dealing with very high activity material in significant quantities

## Difficult Concepts

- Dose
- Activity concentration
- Risk assessment
- Exposure scenarios



# CHALLENGES

- Usually, radiation protection in NORM industries is a complex and challenging matter from technical point of view as well as from societal, institutional and communication point of view (lack of harmonization).
- Radiation risk perception: a huge discrepancy between the experts and the general population.

# RISK PERCEPTION: RADIATION (INCLUDING NORM)

Asosiation with LILW repository (Slovic, 1991)	%
Danger; health and environment	45
Dread, harm, dirty, NIMBY	9,3
Accidents, war	9
Personal opposition	7,5
Positive attitude	5,9
Other	12,4
	5,2



# RISK PERCEPTION

- Very different views between an expert and a layperson towards radioactivity and radiation/nuclear and NORM facilities:

## What Should the Public Know about NORM?

Radiation is everywhere around us and is emitted from a great many common household items.



NORM is not nuclear waste; it is naturally occurring waste with a very low level of radioactivity.



NORM does not pose a direct threat to public health when proper disposal protocols are followed.



...a, easy to manage, the consequences of doses are small, ...nes to safe and technically feasible solutions.

...n of danger, effects on health and environment, dread, ...es,

...fferent views between 2 groups: no effective and

...ries of the public opinion, operators and regulators ...active way.

# NORM SYMPOSIA

- Amsterdam, Netherlands 1997
- Krefeld, Germany 1998 (NORM II)
- Brussels, Belgium 2001 (NORM III)
- Szczyrk, Poland 2004 (NORM IV)
- Seville, Spain 2007 (NORM V) Marrakesh, Morocco 2010 (NORM VI)
- Beijing, China 2013 (NORM VII)
- Rio de Janeiro, Brazil 2016 (NORM VIII)

**Main Goal:** To creating a forum for discussion between industries, scientists and regulators.



## SOME IMPORTANT RESULTS

- Considerable progress in harmonizing standards worldwide
- General agreement on 1 mSv criteria
- Difficulty in transforming this value to activity concentration
- The nature and level of the radiological risk varies considerably from one industrial process to another.
- Management of Residues/wastes
- Risk based and situation specific approach is essential.





# NORM SYMPOSIA

- The participation of international and governmental organizations, as well as research institutes and universities, has been intense.
- However, the involvement of private companies has not been so significant, perhaps due to the stigma associated with radiation exposure.



# OPPORTUNITIES

- The dialogue among all these institutions that takes place on such occasions can contribute to a better understanding of the significance of exposure to enhanced natural radiation and radiological protection issues in NORM industries.
- Moreover, it allows a joint search for sustainable solutions in handling NORM wastes/residues and the implementation of a more realistic legislation adapted to the real conditions of NORM industries.
- Possibility of developing joint research projects.



# SUCCESSFUL BRAZILIAN EXPERIENCE

- Joint project: regulator, academy and operators
  - Use of PG in agriculture
  - Use of PG in civil construction and cement industries
  - Discussion and elaboration of new regulations





# SOME EXAMPLES



Resolução CNEN 179/14  
Novembro / 2014

## USO DO FOSFOGESSO NA AGRICULTURA E NA INDÚSTRIA CIMENTEIRA

Resolução CNEN 113/11  
Publicação: DOU 01.09.2011

Resolução CNEN 147/13  
Publicação: DOU 25.03.2013

Resolução CNEN 179/14  
Publicação: DOU 10.12.2014



Ministério da  
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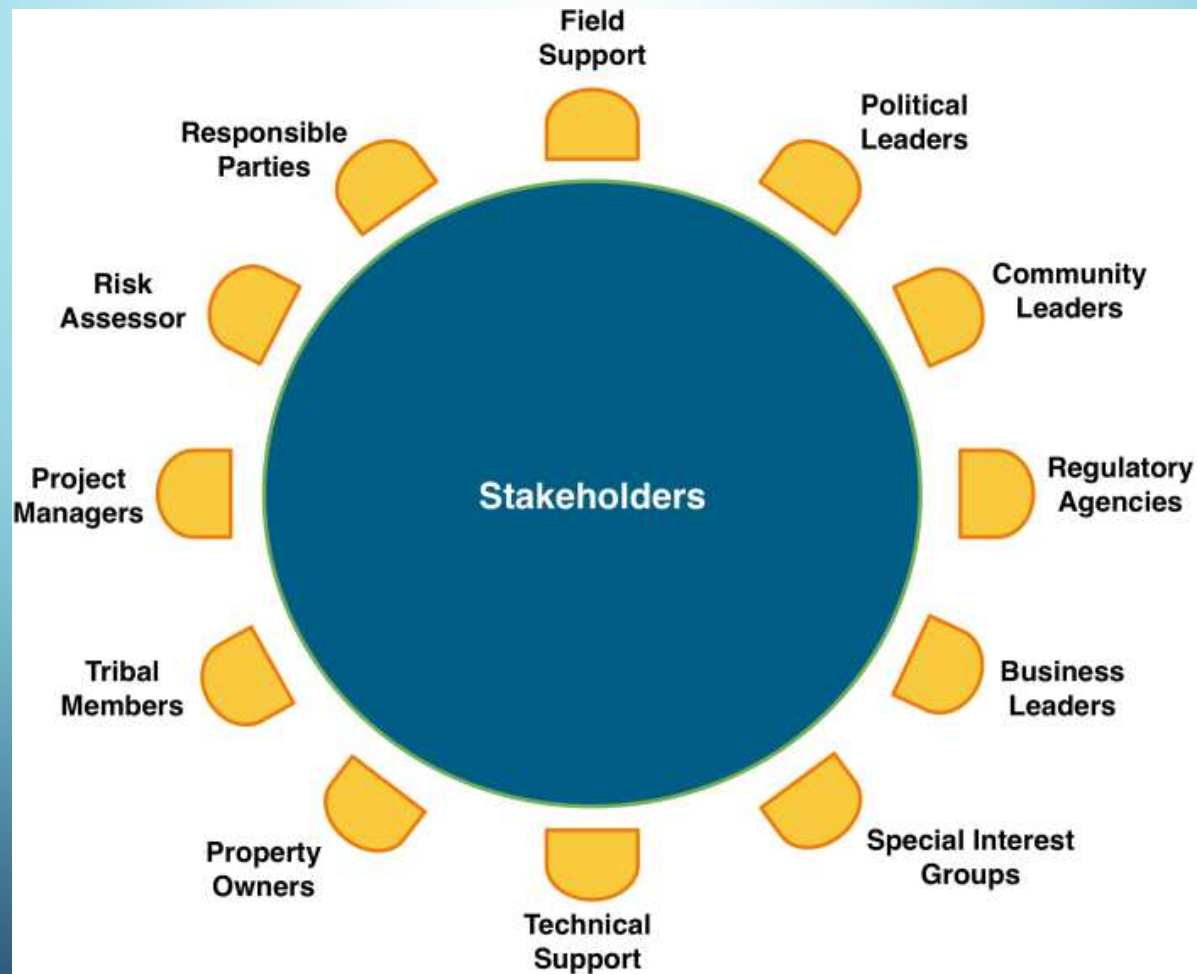
## SOME QUESTIONS ??????????

- How to change risk perception about NORM?
- How to change risk perception? Concept of natural radiation.
- How to deal with risk communication?
- How to get a more effective participation of operators and regulators in NORM symposia?
- How to implement a more intense contact between the different involved parties, as operators, regulators, labor organizations, and the general public?





# SUSTAINABLE OPTIONS





THANK YOU!!!!!!!

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