Challenges to face for some countries to implement a circular economy

Analia Canoba

NORM X Symposium
9-13 May 2022
Utrecht, Netherlands

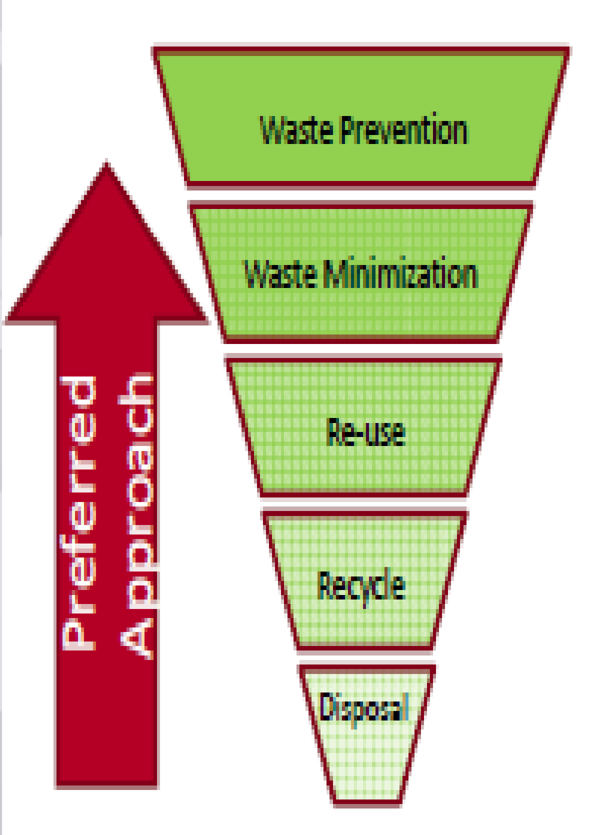
Some concepts

- NORM: Material containing no significant amounts of radionuclides other than naturally occurring radionuclides, that may be raw material or material in which the activity concentrations of the naturally occurring radionuclides have been changed by some process. (ICRP AEDIA)
- NORM Residues: Material that remains from a process and comprises or is contaminated by naturally occurring radioactive material (NORM). (IAEA Glossary)
- NORM waste: Naturally occurring radioactive material for which no further use is foreseen. (IAEA Glossary)

But not all NORM waste is a radioactive waste!

NORM: residues and wastes

Diversity of activities generates NORM residues and wastes. Should be managed in a safe and sustainable manner



Diversity of materials
Liquid, solid residues and wastes. Also fumes
Radioactive and non radioactive pollutants
Long half life radionucleides (long term management)
In terms of radioactivity: Exempted/Cleared, Very low activity, Low activity, Higher activities
Small volumes high concentration (scales)
Large volumes low concentration (tailings)
Considered from generation to disposal

Sustainability: The capacity of the present generation to meet its own needs without compromising or impairing the ability of future generations to meet theirs

Residues management and sustainability

Principle of preventing an undue burden on future generations and the environment by:

- minimizing generation and disposal of waste
- minimizing the use of land, potential soil degradation
- minimizing the potential impact on aquifers and the environment,
- encourage the reuse and recycling of material (moving linear to circular economy)
- Analyzing possibilities of conditional clearance
- Addressing and balance all risks simultaneously applying a graded approach.

UN Sustainable Development Goals

Management of NORM residues needs

A Legal and Regulatory framework

Management of NORM residues arising from new and existing facilities and activities is under the framework of planned exposure situations

Graded approach

A graded approach is applied to NORM industries so that efforts and resources expended on protection are commensurate with the radiological hazards and risks. (in applying controls to NORM residues and dose assessment methodology)

Integrated approach

Other hazards (chemical) with radiological hazard
The regulations and controls that are already in place for non radiological purpose should be considered and integrated.
May be several authorities involved in the management of NORM residues: RP, Environment (national, regional , municipal levels)

To define a NORM strategy

- Legal framework
- Regulatory infrastructure
- Take into account the existing national law and policy for safety, for hazardous waste and for radioactive waste management.
- Allocation of responsibilities between authorities
- National capabilities
- NORM inventory and characterization (over time)
- NORM segregation and identified different streams
- Stakeholders involvement is clue

Policies and strategies should be appropriate to the national circumstances

Residues characterization

For categorization of residues

- residue streams/items
- quantities
- radioactivity concentrations (total and nuclide specific)
- physical and chemical form of the residue
- other hazardous properties (non-radiological elements)
- dose assessment of workers and the public
- environmental impact from the residues

Management options for NORM residues

Generic clearance (1 Bq/g ^{238}U and ^{232}Th and 10 Bq/g ^{40}K),

Conditional clearance (A tool that can help to build a regulatory system that is both safe and workable, based on dose assessment),

Reuse/recycle,

Disposal at conventional/hazardous landfill,

Disposal as Radioactive Waste

Challenge: Long term management of large volume-long half lived radionuclides

Reuse and recycling

- Options attractive if there is a strong economic incentive to use (NORM) residues: economic viability
- Technical feasibility
- Social acceptability by the public
- Needs an appropriate regulatory framework
- Needs the establishment of a suitable criteria.
- Agreement between all Stakeholders

Some issues

- Many countries do not have clear policy/strategies to manage NORM residues
- The need of an appropriate characterization to determine the NORM inventory and their risks to define the strategy. (activity concentrations and dose estimations). Need accredited labs. for reliable data and RP knowledge for dose.
- A methodology to obtain and maintain upgraded NORM inventory
- Need of technical expertise for NORM waste treatment/decontamination
- Technical feasibility for revalorization of residues
- Economic viability (costs involved for implementing options/local market conditions for accepting by -products)
- Public perception
- Generally lack of specific NORM residue management facility for the processing, storage and disposal for NORM residues

Further clarifications related with circular economy

- With the implementation of the 1 Bq/g
  - above 1Bq/g not means a radioactive waste
  - for practicity exemption/exclusion below 1 Bq/g
- Above 1 Bq/g not necessarily means doses above 1 mSv/y

  Application of residues with activity concentration > 1 Bq/g could be still related to irrelevant risks to ionizing radiation
- Many countries ask for tools as conditional/specific clearance for waste management to be able to treat NORM residues as conventional/hazardous waste, or for reuse and recycle.
- How to balance decontamination vs waste generation.
- How to manage NORM residues including other hazards.

Avoid confusion to Stakeholders

Practical and not contradictory regulatory frameworks should be developed to accept a circular economy

Example: Clearance of radionuclides of natural origin for materials coming for practices: a dose of the order of 10 μSv in a year and not 1 Bq/g.

- Confusion could be caused to Stakeholders by creating different set of values for the same radionuclides.
- Clearance is a clue process in the minimization of waste.
- Residues recycled into construction materials: order of 1 mSv/y.
- Exemption of bulk amounts of material, case by case basis, dose criterion of the order of 1 mSv/y.
- Activity [values]using pragmatic approach: recognition the cost of exercising regulatory control and net benefit to be gained by doing so,
- Continued regulatory control of material would yield benefit? Is this reasonable?
- ***Can affect circular economy approach to waste management***

Some possibilities

- **A more pragmatic approach for use of materials for specific purposes by demonstration of beneficial use?** Values derived *on the order* of 1 mSv/y for *recycling into construction materials: May be higher values justified* taking into account social, economic and environmental benefits associated with the clearance of materials for a sustainable use of resources?
- **Possibility of mixing low level residues to facilitate the process?**
- **Linked with the justification principle of RP in a broader sense**
- **Making beneficial use of by products. Complete technical development**

Examples: possible future production of U with *other valuable materials such as V and Mo,* produced as by-products (renewable energy and steel industry)

U reextraction from tailings? (economic and social viability)

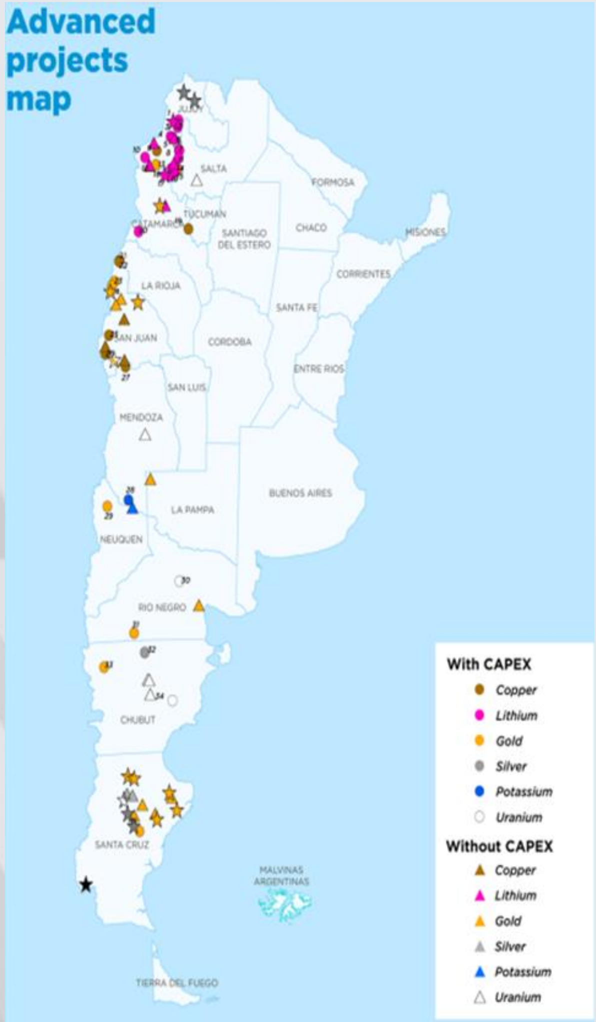
Waste mining considerations containing REE (renewable energy/high technology industry)

Extraction of Th as a by-product of REE production from monazite.

U/ Phosphates projects (Brasil)

Some issues for mining

- ✓ Negative social perception
- ✓ Risk perception to radioactivity
- ✓ Provincial laws against mining
- ✓ Low profit margins
- ✓ Specific Stakeholders attitudes



Challenges and Expectations

- Clear policies established by the Government are clue for implementing a circular economy.
- Appropriate regulatory framework for residues management in the context of national policies of sustainability and circular economy is needed.
- Specific criteria for reuse and recycle should be established/clarified (in line with sustainability principles and safety requirements)
- Stimulation of technical solutions for the profitable valorisation of wastes generated by industries taking into account RP aspects is needed. Economic instruments are needed.
- The needed of involvement of private companies in the context of economic viability.
- Communication with the public is clue to tackle risk perception and understanding

Challenges and Expectations (2)

- Need of training and raise awareness of residue generators, service providers and environmental authorities.
- Promotion of beneficiation: making resources better- by product. Laws and perception could be modified if genuine economic resources and the production of critical materials for clean energy projects are achieve.
- Decommissioning activities in the future.
- For promoting an holistic approach in RP with consideration of sustainable development, the justification principle should not only require a scientific and technical rationality, but also consideration of societal and ethical values in the context of overall wellbeing.
- How to value sustainability aspects, e.g. the benefit of protection of the environment, ecosystems services for applying justification in practice?

The system of radiological protection should provide an appropriate level of human and environmental protection, without unduly limiting desirable human actions and without adversely affecting sustainable development.

Thank you for attention!

acanoba@arn.gob.ar

www.arn.gob.ar