



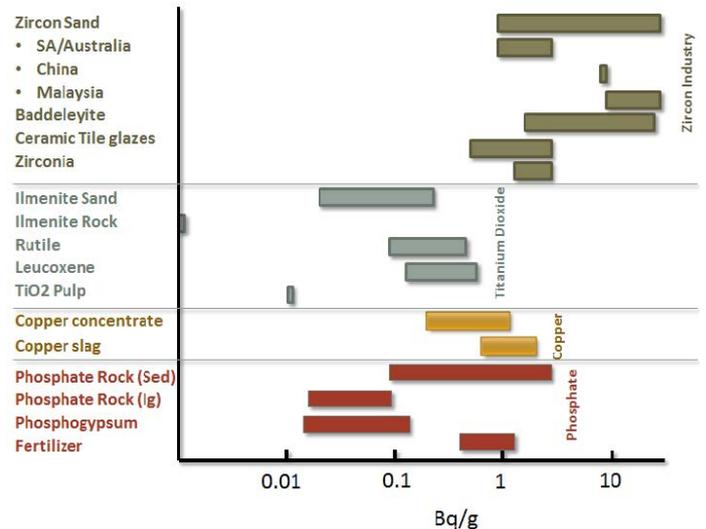
## Naturally occurring radioactive material

### What is Naturally Occurring Radioactive Material (NORM)?

Naturally occurring radiative material (NORM) is radioactive material containing no significant amounts of radionuclides other than naturally occurring radionuclides. The most important factor for the purposes of radiation protection are the radionuclides in the Uranium-238 (U-238) and Thorium-232 (Th-232) decay series. 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. However, certain work activities can give rise to significantly enhanced exposures that may need to be controlled by robust regulation.

NORM is often found in its natural state in rocks or sand. It can also be associated with oil and gas production residue (such as mineral scale in pipes, sludge and contaminated equipment), coal ash (produced from burning coal for energy production) and on filter media (such as the used filters from municipal drinking water treatment equipment). NORM can also be present in other products, including building materials (like brick and cement blocks), granite counter tops, glazed tiles, phosphate fertilizers

### TYPICAL ACTIVITY DISTRIBUTION



and tobacco products. Because of a potential exposure to workers, certain industries, like for example those dealing with NORM may require some form of regulatory control.

Additionally, other areas, where there is a need to pay attention to exposure from NORM are those for instance engaged in the production of oil and gas, phosphate fertilizers, forest products and thermal electricity; mineral extraction and processing; tunnelling and underground workings; metal recycling; waste management; and water treatment.

## What do the IAEA Safety Standards say?

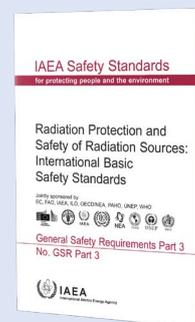
In 2014, the IAEA published the *General Safety Requirements Part 3: Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards*. This is often referred to simply as the BSS. The BSS is jointly sponsored by eight international organizations with responsibilities in various areas of radiation protection.

The requirements in the BSS take account of the most recent scientific evidence relating to exposure due to radiation. The BSS is used by many States as the basis for their national regulations dealing with radiation protection and safety.

The International Basic Safety Standards (GSR Part 3) establishes requirements for industrial processes involving NORM under planned and existing exposure situations. Exposure due to natural sources is, in general, considered an existing exposure situation. However, the relevant requirements for planned exposure situations apply to NORM where the activity concentration in the material of any radionuclide in the uranium decay chain or the thorium decay chain is greater than 1 Bq/g or the activity concentration of  $^{40}\text{K}$  is greater than 10 Bq/g.

Guidance on managing NORM in workplaces can also be found in the General Safety Guide on *Occupational Radiation Protection* (GSG-7) and safety report introducing good practices from Member States are available in industry specific report in the *Occupational Radiation Protection Networks* (ORPNET).

Many industrial processes involving NORM follow a common cycle with several stages from the extraction of materials to the fabrication and the use of products and by-products, including the generation of discharges, residues and waste. An integrated approach to safety and protection is recommended, bearing in mind that the radiation protection system is not necessarily the driving force and development of such an integrated approach requires involvement of combination of expertise.



## Challenges



Industries involving NORM may give rise to multiple hazards, such as hazards from heavy metals, high temperature or organic compounds, and the radiological hazard is not necessarily dominant. The industries are diverse and may involve exposure of people and the environment where protective actions need to be considered. In some cases, there is a potential for significant routine exposure of workers and members of the public if suitable control measures are not in place.

However, in most cases radiation protection of workers from exposure to NORM in industrial processes can be appropriately addressed using principles of justification and optimization of protection.

An integrated and graded approach is recommended for the protection of workers, members of the public, and the environment. Steps should be considered in which non-radiological hazards are integrated with radiological

hazards, and the approach to protection is optimised (graded) so that the use of various radiation protection programme elements are consistent with the associated risk.

Specifically, for workers, the graded approach starts with characterisation of the exposure situation, and if necessary through identification of specific protective actions to complement the protection strategy already in place or planned to manage other workplace hazards.



Priority areas are the following:

- Application of the graded approach for regulation of industrial process involving NORM including their residues, based on good knowledge and understanding of the diverse industrial sectors.
- Synergies and system optimization with integrated consideration of radiological and non-radiological hazards for proper worker protection.
- Siting and long term management of bulk amount of NORM residues, including consideration of institutional control and financial aspects.
- Remediation of legacy sites and sustained monitoring of these lands after remediation.
- Reuse and recycle of NORM residues for avoidance of the need of long term management and disposal.
- Build stakeholder trust by having regular dialogues and improving communication efforts.

## How does the IAEA support Member States?



The IAEA supports its Member States in the implementation of all aspects of the Safety Standards through the organization of national and regional workshops and other training events. [E-learning on NORM](#) material is available and [Online webinars](#) are also regularly organized.

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### Email:

[Occupational-Protection-Unit.Contact-Point@iaea.org](mailto:Occupational-Protection-Unit.Contact-Point@iaea.org)