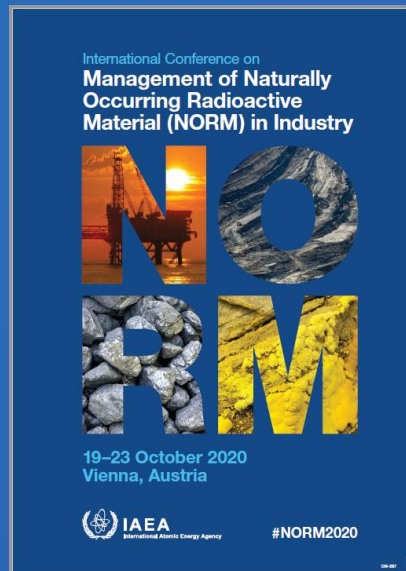




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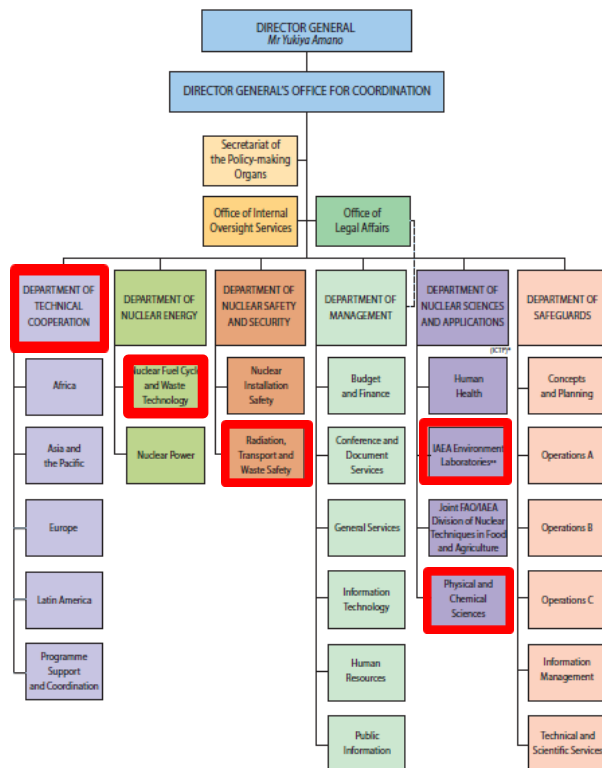
International Atomic Energy Agency



Horst Monken Fernandes
Division of Nuclear Fuel Cycle and
Waste Technology
NORM IX Symposium
Denver, Colorado, USA
23-27 September 2019

**Outstanding Gaps in NORM Management and the
Need for Additional Effort at the International
Community Level: The Path Forward**

The IAEA organisational Structure



NORM related issues are dealt with in different sectors of the IAEA:

- Safety and Regulations – Nuclear Safety and Security Department
- Technological/Managerial Aspects – Nuclear Energy Department
- Instrumentation, Environmental Behaviour – Nuclear Sciences and Application Department
- Support to Member States (by means of national, regional and inter-regional projects) – Technical Cooperation Department

Dealing with NORM imposes a series of challenges:

- Awareness
- Applicable Regulatory Infrastructure (requirements & enforcement)
- Radioactive Waste x Hazardous Waste (Policy)
- Sound management options (including availability of disposal sites – Strategies, Inventory, Cost related issues)
- Harmonization of approaches at the international level (transboundary issues)
- Public Perception

RECAP from Previous Conference – 2004 NORM IV - Poland



- Proliferation of acronyms that had occurred over the last few years (NORM, TENORM, ENOR, NOR, etc.),
 - A single term for referring to material containing elevated
 - NORM was the most general and commonly used term in this regard. It was pointed out that reference to whether or not NORM had been ‘technologically enhanced’ by processing was not always a meaningful distinction, because this did not necessarily correlate with the level of hazard.
- Measurement of radionuclides in various materials
 - The need for simple and inexpensive measurement techniques for monitoring purposes
- Move towards the use of facility-specific measurements, especially for dose assessment purposes, instead of relying on modelling using standardized scenarios and generalized assumptions. (see conclusions from NORM VIII)

RECAP from Previous Conference – 2007

NORM V - Spain



- Regulatory Aspect
 - The issue of **harmonization remains a prospect rather than a reality** and continues to be the subject of much debate.
 - Severe **disruptions in international trade** are being experienced to an increasing extent.
 - A determined effort is therefore needed at the national and international level to **achieve a common and coherent approach to the regulation of NORM.**

RECAP from Previous Conference – 2007 NORM V - Spain



- Options for minimizing NORM waste
 - The use, reuse and recycling of NORM residues and NORM-contaminated items — including, where appropriate, the dilution of NORM residues to reduce the activity concentration — is now starting to be recognized as a legitimate and desirable option for minimizing the quantities of NORM that need to be disposed of as waste. (**dilution contradicted in NORM VIII**)
 - It has been demonstrated that **NORM-contaminated metal scrap can be safely recycled in a suitably controlled melting facility** and this recycling option now seems to be gaining greater acceptance by the general steel industry

RECAP from Previous Conference – 2007 NORM V - Spain



- Management of NORM residues designated as waste
 - Despite the many opportunities for use, reuse and recycling, there are still many NORM residues that will ultimately have to be disposed of as waste.
 - There is now a considerable body of knowledge on appropriate methods for conditioning, storage and disposal of the various types of NORM waste, but the **necessary facilities and regulatory provisions are in many cases not yet in place.**
 - Scales and sludges, which are generated in small volumes but which may have activity concentrations reaching very high levels → usually have to be held in storage pending the establishment of suitable disposal facilities.
 - NORM residues from the chemical extraction of rare earths from monazite are produced in significant quantities and have characteristically high activity concentrations → Such wastes can be suitably disposed of either in earthen trenches or in engineered cells, depending on the activity concentration.

RECAP from Previous Conferences – 2010 NORM VI - Morocco



- Regulatory Aspects
 - Further **progress has been made towards the harmonization of standards and regulatory approaches** for the control of exposure to NORM, but this progress is by **no means universal and there is still a long way to go**
 - There is growing recognition that an **industry driven (or even process driven) approach is needed** for ensuring that exposures to NORM are controlled sensibly and effectively. Industrial activities involving NORM, and legacy situations from such activities, are very diverse and each has to be addressed by developing ‘good practice’ according to the particular set of circumstances — **there is no such thing as universal best practice for NORM.**

RECAP from Previous Conferences

2010 NORM VI - Morocco



- Transport of NORM
 - Transport of NORM is falling increasingly under the spotlight because of the triggering of alarms designed to detect radioactive sources in scrap metal or to combat the trafficking of illicit nuclear material.
 - Detection systems are becoming increasingly widespread and sophisticated and progress is being made in developing techniques for identifying, characterizing and allowing the passage of NORM without compromising the effectiveness of the detection systems

RECAP from Previous Conferences

2010 NORM VI - Morocco



- Use of NORM Residues
 - There is increasing recognition of the **need to regard NORM residues as a resource rather than as waste.**
 - There is a **lack of uniformity in the approach to the use of NORM as a component of building material**
- Disposal of NORM residues as waste
 - The choice of disposal option is often specific to a particular industry
 - **Increasing use is being made of disposal in conventional landfill facilities** established for industrial or hazardous waste

RECAP from Previous Conferences

2013 NORM VII - China



- In terms of the priorities from NORM VI it can be seen that there has been progress, and in some cases this has been significant. Even so, it is in fact **possible to take the same list of priorities forward to NORM VIII.**
- Issues such as NORM residue management cannot be expected to be completely resolved in just a few years. Progress can be expected in terms of preparing the way for such options to be implemented.
- **Further clarification on the system of protection for NORM and its implementation in practice is needed from international organizations.**
- At the same time, **industries themselves need to think about how they can make convincing optimization cases for the full NORM life cycle.** This in turn needs to be supported by radiation protection experts, for example by producing reliable data on exposures to underpin the decision making process.
- The issue of stakeholder engagement also needs to be taken forward.
 - Very few examples of it being undertaken were presented at this symposium.
 - Experience suggests that this can be a slow and lengthy process

RECAP from Previous Conferences

2016 NORM VIII – Brazil



- Regulatory Aspects
 - Encouraging progress is being made around the world in implementing the relevant requirements of the latest version of the IAEA BSS
 - **Regulatory approaches, guidance and understanding are becoming more consistent between countries**, although many differences still exist.
 - **The requirements for NORM are clearer and more explicit** than those published previously and are generally well understood, but some aspects are still giving rise to confusion and/or misinterpretation.
 - **Further clarification of the system of radiation protection for NORM and its implementation in practice is needed**. Guidance is needed on practical applications using case studies as examples.
 - The implementation process at the national level is becoming increasingly based on the graded approach to regulation and **better use is being made of the regulatory option of exemption**.
 - **Regulatory systems for NORM are becoming more robust and based to an increasing extent on well structured policies and strategies**. These developments should help to **avoid overregulation and reduce costs** (a source of concern in recent years).
 - Concern has been expressed that **NORM industries are not making use of the guidance and supporting information** available at the international level on the implementation of standards for NORM and are **no longer participating significantly in international events such as the NORM symposia**. A closer working relationship with industry is needed.
 - There are ongoing problems with the practical implementation of the IAEA Transport Regulations with respect to international shipments.

RECAP from Previous Conferences

2016 NORM VIII – Brazil



- Industrial activities involving NORM
 - While measurement techniques are becoming well developed, the interpretation and **assessment of measured data is suffering from a lack of harmonization** between groups of countries with different needs and agendas.
 - When providing technical support in this regard, there should be a clear understanding of a country's needs.
 - The Symposium highlighted once again the **tendency to overestimate doses arising from industrial facilities involving NORM, for instance by relying on conservative exposure modelling** rather than measurements on site, by adopting assessment approaches that are too simplistic, or by not taking into account the contribution of background radiation.

RECAP from Previous Conferences 2016

NORM VIII – Brazil



- Management of NORM residues
 - Industry has failed to maintain its former economic performance. **A new approach is needed which encompasses, among other things, an environmentally sustainable, socially acceptable, affordable solution to the problem of residues.**
 - **These residues should not be regarded as waste** — rather, the new concepts of ‘comprehensive extraction’ and ‘zero waste’ should be embraced, in terms of which the returns from all co-located resources in the vicinity of the operation are optimized and the generation of waste is avoided through innovation, technology and efficient use of resources.
 - A key part of this strategy is the recycling or by-product use of residues. It was evident during the Symposium that the use of this approach for NORM residues is slowly but surely gaining acceptance among governments, regulatory bodies, facility operators and other interested parties.

RECAP from Previous Conferences

2016 NORM VIII – Brazil



- With respect to the dilution of NORM residues with lower activity material such an approach is not encouraged. Need to convince regulatory bodies and environmental groups that this approach is in best the interests of society (through a reduction in the hazards and liabilities associated with the disposal of enormous amounts of NORM waste).
- In the case of NORM residues used as construction materials, it was questioned whether such use was justified.
- When NORM residues have to be disposed of as waste, greater attention should be given to the possibility of **using facilities for disposal of industrial waste (hazardous or non-hazardous) rather than facilities for the disposal of radioactive waste.**
- It was concluded that, in view of the fundamental nature of many of the issues in the management of NORM residues, some of them requiring major shifts in policies and attitudes, these issues cannot be expected to be completely resolved in just a few years.

RECAP from Previous Conferences

2016 NORM VIII – Brazil



- Stakeholder involvement
 - There was growing acceptance of the benefits of, and necessity for, stakeholder involvement and that such involvement needed to be strengthened.
 - Efforts to communicate with members of the public have not always been successful, resulting in ongoing misconceptions. It was clear that this was a very challenging task, but there were indications that such efforts could (and should) be made to work

In Summary

- Harmonization remains a prospect rather than a reality → achieve a common and coherent approach to the regulation of NORM.
- Modelling x Assessment based on acquired data
- Still work to be done in Many Member States
- Need to have consistent involvement from Industry
- Application of Waste Management Hierarchy: Avoid, (Re)use, (Re)Cycle
 - Dilution → Acceptance Regulatory & Social
 - Clearance → Analytical capabilities
 - Disposal Routes → Landfill
 - Environmentally sustainable, socially acceptable and affordable solutions

What are the Member States Saying? Summary of the Requests Placed by in Technical Cooperation Projects (1/2)



- Analytical Aspects:
 - Improvement and upgrade of the analytical and technical capabilities
- Safety and Regulatory
 - Design and implementation of monitoring programmes
 - Establishment of administrative and standard operating procedures and assessing possible NORM contamination and its impact to the workers and environment
 - Establishment of good operational practices in production in relation to the radiological safety of the workforce and the environment
 - Establishment of an appropriate regulatory framework associated with NORM industry operations

What are the Member States Saying? Summary of the Requests Placed by in Technical Cooperation Projects (2/2)



- Technical Issues and Waste Management
 - Establishment of a Policy and Strategy (P&S) for NORM Waste
 - Identification of concepts in NORM waste management
 - Training on the identification of NORM generating industries, NORM generation estimates, decontamination techniques, radon measurements and NORM waste treatment and storage
 - Advice on plans for NORM disposal, techniques for conditioning and storage, long term storage design and cost (design + facilities + operations)
 - Training on technical works required for waste treatment, storage, radiological measurements and disposal options
 - Provide and discuss examples of procedures for decontamination, conditioning and pre-storage and calculation of the cost of disposal facilities
 - Build regional capacities of specialists to carry out comprehensive NORM waste management options
 - Remediation → Programme of action to minimize the impact of radioactive residues on populations and to create a favourable conditions for the sustainable development of the affected territories

To be considered

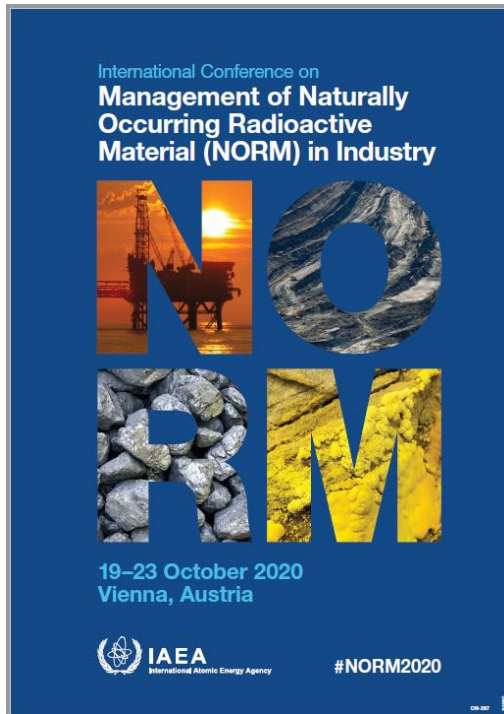
- Waste Management
 - At the Policy Level
 - Adoption of the waste hierarchy principle
 - Waste management supply chain to develop management options
 - Remove barriers to the development of a robust and efficient market for waste management

To be considered

- At strategic level
 - Secure – waste management options are available
 - Sustainable – the waste management options are safe
 - Resilient – NORM waste producers have access to a range of management options

To be Considered – key aspects

- Clarity of regulatory regimes
- Identifying and removing policy barriers to the development of waste treatment and disposal facilities
- Need for good data and information about current and future waste arisings



UPCOMING IAEA INTERNATIONAL NORM CONFERENCE 19 – 23 OCTOBER 2020

Objectives of the Conference



- Foster the sharing of experiences in the management of NORM in industrial operations with the aim of contributing to the harmonization of approaches and adoption of good practices that are simultaneously cost effective and safe taking into consideration members of the public and workers.
- This new conference aims to explore the good practices that have been put in place worldwide and bring together different players to identify current issues and expected future challenges and possible strategies for dealing with them.
- Conference will consider the latest technological developments and research work, taking into account regulatory requirements and safety aspects.

Expected Results

- Increased knowledge and raised awareness in Member States on technical aspects specific to Management of NORM residues/wastes to prevent the creation of new legacy sites requiring remediation, and management of existing legacy sites and wastes;
- Enhanced national capabilities to develop policies and strategies for NORM residue/waste management and remediation of legacy sites, and associated required infrastructure;
- Improved understanding of NORM institutional infrastructures (i.e., policy, strategy, regulation, laboratories, reuse options, storage and/or disposal facilities) and NORM inventories (i.e., NORM-generating industries and processes, residue/waste streams,

Topics



- NORM Inventories
 - Identification of NORM-related industries operating within the country
 - Amounts of residues/wastes being generated
 - Radioactivity concentrations or exposure rates
 - Other hazardous materials of concern

Topics



- National Policies and Strategies
 - Setup of waste management organization.
 - Centralized vs multiple dispersed facilities.
 - NORM-dedicated facilities vs facilities accepting multiple types of wastes.
 - Stakeholder involvement
 - Environmental impact assessment

Topics

- NORM Characterization in Industrial Operations
 - Appropriate sampling and monitoring methodologies.
 - Analytical methodologies:
 - Laboratory measurements.
 - On site measurements (e.g. in situ measurements, mobile lab).
 - Infrastructure and equipment requirements.
 - Quality assurance and quality control.
 - Recordkeeping.

- Residue and Waste Management
 - Life cycle management to help prevent environmental contamination.
 - Cost assessment across all aspects of residue/waste management.
 - Management options for residues/wastes — application of the waste management hierarchy:
 - Prevention.
 - Minimization.
 - Reuse (i.e. using the NORM in its current form).
 - Recycle (i.e. reprocessing of the NORM into a new form), including NORM contaminated scrap metal.
 - Disposal.
 - Selection of management options, including reuse, recycle, storage, and disposal:
 - Justification and optimization:
 - Cost/benefit analysis.
 - Multi-criteria decision analysis.
 - Financial guarantees.
 - Other considerations (e.g. economic impacts).
 - Transportation requirements and controls.

Topics



- Decommissioning of NORM Facilities and Remediation of Contaminated Sites
 - Decommissioning and waste management plan.
 - Decontamination technologies.
 - Dismantling technologies.
 - Remediation.
 - Identification of contaminated sites.
 - Conceptual site model.
 - Site characterization.
 - Remedial action evaluation and selection.
 - Costing and funding.
 - Long term stewardship of closed or decommissioned NORM management facilities/sites.
 - Institutional controls.



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Thank you!

