

Development of a Regulatory Framework for Naturally Occurring Radioactive Material in the United States



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Regulation of Radioactive Materials and NORM/TENORM

- Quick overview of regulatory framework for radioactive materials
- NORM vs. TENORM vs. LLRW (definitions)
- The current status of NORM/TENORM regulations in the United States
- Work being done by national organizations to develop consensus standards

Background

- In the United States, no single federal agency is responsible for setting radiation protection standards and regulating all sources of ionizing and non-ionizing radiation.
- Federal worker protection standards can vary, depending on the agency regulating the source of the radiation.
- State radiation control programs may vary in:
 - Approaches
 - Legislation for regulatory authority
 - Regulations



Who Regulates What at the Federal Level regarding NORM

- U.S. Nuclear Regulatory Commission
 - Source, special nuclear, and byproduct material as defined in the Atomic Energy Act
- U.S. Environmental Protection Agency
 - Basic air emission and drinking water standards
 - Waste standards
- Occupational Safety and Health Administration
 - Worker protection standards for those not in licensed facilities
- U.S. Department of Transportation
 - Transportation of radioactive materials and contaminated items
- U.S. Department of Energy
 - DOE facilities

Legislation and Regulatory Framework for Radioactive Materials under the Federal Atomic Energy Act

- Special Nuclear Material
 - Enriched uranium and plutonium
- Byproduct Material
 - Material that is made radioactive in a reactor
 - Residue from the milling of uranium and thorium
- Source material
 - Uranium
 - Thorium
 - < 0.05% by weight is an “unimportant quantity”

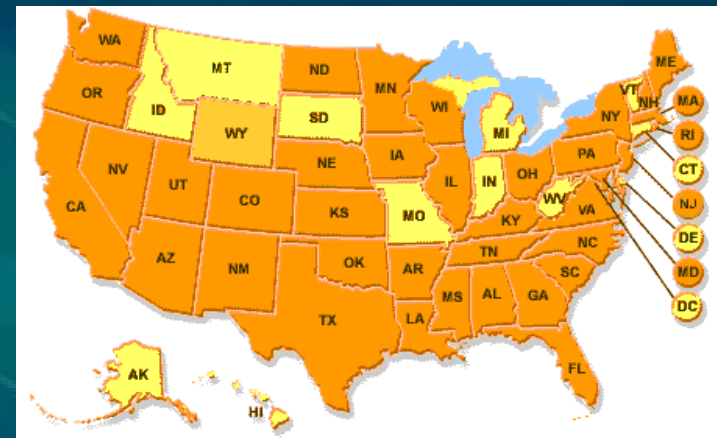
Regulation of Radioactive Material under Atomic Energy Act

NUCLEAR REGULATORY COMMISSION

- Source material above .05% by weight, special nuclear material in quantities not sufficient to form a critical mass, and byproduct material
- Special Nuclear Material in quantities sufficient to form a critical mass (NRC only)
- Federal Facilities (NRC only)

STATES

- Under Agreement with NRC: 38 states
WY latest—U recovery



Legislation and Regulatory Framework for Radioactive Materials

- US EPA establishes standards for environmental protection and US NRC implements the same through licensing program
- Except for NRC radiation protection standards, States may adopt identical or stricter regulations and implement the above
- The same US NRC or Agreement State licenses enforce conditions for public safety, limiting worker exposure, and ensuring security of radioactive materials
- Interagency agreements and memoranda of understanding are established between dual regulating agencies to allocate responsibilities (US NRC and OSHA/MSHA for worker protection)

Other NORM

- And everything else?
 - Uranium and thorium that is less than 0.05% by weight
 - Uranium/thorium ore that hasn't been milled or processed
 - Non-licensed diffuse sources of radium and daughter products
- Although most radioactive materials are regulated and a substantial amount of guidance exists to both federal and state regulators,
- NORM residues from outside those categories discussed are not included in this regulatory framework.

Regulation of Naturally Occurring Radioactive Material (NORM) not Covered under the Atomic Energy Act

FEDERAL AGENCIES

- EPA:
 - Basic release standards for air and water
 - Some RCRA and TSCA provisions regarding waste
 - Indoor radon standards and recommendations
- DOT: Transportation
- OSHA/MSHA:
 - Worker protection standards

STATES

- Regulations for management of NORM
- Disposal options
- Worker awareness training
- Indoor radon control

Other NORM

- US EPA still has the capability to regulate NORM at a federal level
- EPA's approach has been to identify and quantify the NORM exposure concerns on an industry-specific and media-specific basis and to provide guidance to states
- NORM, if regulated at a federal level (US EPA), is media or activity based
- That which is not addressed is left to the States to regulate as they see fit

State Regulation of NORM

- Some states have elected to regulate NORM, but often on an industry-specific basis.
- Licensing requirements, disposal activities, and definitions vary by state.
- Some states have elected to implement licensing programs
- The majority of states either do not, do so only for select industries, or regulate/permit only distinct portions – such as waste management



State Regulation of NORM

- Why isn't this material regulated in the same manner?

From the Interagency Jurisdictional Working Group:

- SECY-03-0068 regarding limiting NRC authority to uranium and thorium that are extracted or purposely concentrated for the use of uranium or thorium.
- *Other industries are generally already regulated by another agency to control exposures*
- *Worker exposures (in all but a few scenarios) is less than 1mSv/a (100 mR/year)*

Regulation of NORM in States

- Why did States elect to regulate it then?
 - Continued, long-term deposition of NORM wastes into the environment could cumulatively exceed public exposure limits
 - There could be scenarios where workers are being exposed and do not receive any training or information about the exposures
 - Perception of risk/limitation of public exposure long-term



TENORM

TENORM – Technologically Enhanced
NORM

From International Atomic Energy Agency
(IAEA):

NORM is defined as “Radioactive material containing no significant amounts of radionuclides other than naturally occurring radionuclides”

TENORM

TENORM – Technologically Enhanced
NORM

From United States EPA:

"Naturally occurring radioactive materials that have been concentrated or exposed to the accessible environment as a result of human activities such as manufacturing, mineral extraction, or water processing."

TENORM

Are NORM and TENORM interchangeable?

NORM and TENORM are physically the same, i.e. uranium and thorium and progeny. The difference is in the definition of "technologically enhanced" which varies from organization to organization. Health Physicists treat NORM and TENORM the same (i.e., if the activity concentration and/or volume results are significant from a risk and/or exposure standpoint, the NORM/TENORM will be addressed accordingly), regardless of definition.



Purpose of CRCPD

- To provide a common forum for the exchange of information among State and local radiation control programs.
- To provide a mechanism for States to communicate with the federal government on radiation protection issues.
- To encourage and support programs that will contribute to radiation control for all



Suggested State Regulations

SSRCRs – Suggested State Regulations for the Control of Radiation (SSRs for short)

- Set up as “model” state regulations
- Developed as a consensus document with collective involvement of state members, advisors, and resource individuals from medical and industrial communities, as well as federal agencies
- Provide compatibility with federal regulations (NRC, DOT, FDA, etc.)
- Use of other national and international standards
- Peer-review process, followed by approval by CRCPD Board and federal partners

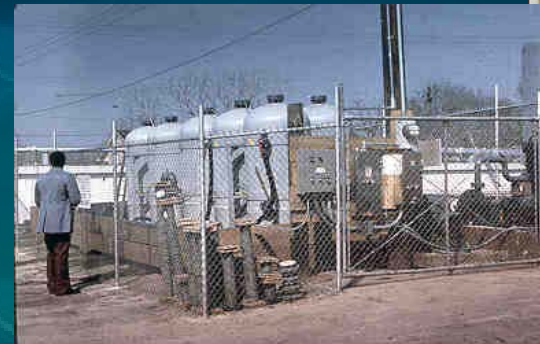
NORM/TENORM

- NORM Contamination Studies: 1977, 1981 and 1994
- SSR Part N Committee started work in late 1980's
- Several revisions and guidance
- Not all states have TENORM regulations, and those that do still vary, depending on the industry involved
- Continual process to ensure responsiveness to changes in industry and addresses recent technological developments

Oil and gas production



Water treatment



Phosphogypsum



States Regulating TENORM

- Regulation of TENORM may or may not be in the form of a radioactive materials license
- As a result, the scope of regulation may or may not encompass waste handling, worker protection, or TENORM from more than one industry
- In fact, the very definition of TENORM remains in debate. *(USEPA recently updated their definition to include any NORM that was relocated)*
- Some states indicate they possess the ability to regulate TENORM under their existing licensing authority; however, not all exert that authority

Highlights of CRCPD Part N

- Applies to all TENORM, except that which is defined as byproduct or source material by AEA of 1954
- 185 Bq/kg (5 pCi/g) radium exemption
- Industry specific exemptions (*fertilizer, zircon*)
- 1 mSv (100 mrem) per year TEDE exemption
- Radon excluded from dose calculation

Highlights of CRCPD Part N

- Worker protection standards from US NRC regulations
- Land application up to 370 Bq/kg (10 pCi/g)
- 0.50 $\mu\text{Gy/hr}$ (50 $\mu\text{R/hr}$) release limit for scrap
- Radioactive materials licensing
- Contamination limits 5000 dpm/100cm², 1000 dpm/100cm²

Developments in TENORM

- The CRCPD has worked for 30+ years to develop a nationwide template for licensing NORM which would implement consistent environmental and worker safety standards
- Last version in 2004
- 2012 revision began, with major work to harmonize with ICRP 103 and DS 459



Developments in TENORM

- “*Control and Release of TENORM*” ANSI N.53-2009
- “*The Recommendations of the International Commission on Radiological Protection*” ICRP Report 103. 2007
- “*Management of Radioactive Residues from Uranium Production and Other NORM Activities*”, DS459. International Atomic Energy Agency. Draft 2016
- Drinking Water Regulations and increased radium removal

TENORM: Collaboration with Other Organizations and Stakeholders

- Review of TENORM in the Oil and Gas Industry-2015
- New changes being developed for Part N of Suggested State Regs based on best practices, national and international standards
- Collaboration with NCRP for national guidance for the management of TENORM for use in future regulatory framework and guidance to states



NCRP Approach

- Commentary
 - Literature review
 - Gap analysis
 - Recommendations for full report
- Guidance document that fills gaps
 - Radiation exposure scenarios and dose estimations
 - Radiation monitoring protocols
 - Guidance regarding environmental and worker protection issues

Revision on Suggested State Regulations for NORM/TENORM

- CRCPD is in the process of revising the suggested (model) state regulations for NORM/TENORM
- Draft changes take into account:
 - IAEA recommendations in DS-459 and General Safety Requirements Part 3 as applied to NORM
 - ICRP and NCRP recommendations
 - A graded approach to a regulatory framework
 - Specific licenses vs general licenses (license by rule), and allows states to use registration of facilities to accommodate different waste disposal criteria and the fractionation of responsibilities of different regulatory agencies

Planned vs Existing Scenarios



Water Treatment
Facility



Phosphogypsum

International Collaboration

- International members and speakers
- NGO Status with IAEA since 2003 and Liaison Organization with ICRP
- CRCPD members requested for IAEA missions and as technical consultants and speakers at IAEA
- Practical Arrangement with IAEA which states have the primary role: New medical technologies, NORM, and radon
- CRCPD hosting the 9th International Symposium on NORM in Sept 2019



CRCPD will be hosting NORM IX in association with IAEA next September. The Call for Abstracts has been extended until 31 January 2019. Registration and exhibitor registrations will soon be available online. More information and abstract submission details can be found at : <https://www.crcpd.org/mpage/NORMIX>



**The Ninth International Symposium on
Naturally Occurring Radioactive Material
23-27 September 2019 - Denver, Colorado**



NORM IX Conference Main Objectives

- A national/international platform for NORM industries, academic and research institutions, and Federal and States regulatory authorities to share experiences, review progress made, identify opportunities and address challenges and good practices;
- A forum for exchange of information, networking, and interaction with stakeholders.

Summary



To harmonize radiation protection rules, guidance and practices among all the states and territories, CRCPD is coordinating nationally and internationally to address radiation protection issues involved managing and regulating NORM.