



Updates to TENORM Management in the United States

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Main Points

- The U.S. Environmental Protection Agency (EPA) is the primary federal agency responsible for protecting the public and environment from naturally occurring radioactivity in the U.S.
- Management of TENORM in the United States is primarily left to the states to address
- While based on federal statutes, states have chosen a variety of regulatory approaches to management and disposition of TENORM
- Industry waste management practices have resulted in some states prohibiting or further restricting certain types of discharge or disposal.
- In such cases, an unintended consequence can be the movement of waste to states that do not have such prohibitions or restrictions.



EPA Authority

- The EPA is authorized under a number of environmental laws to prepare regulations or guidance to limit radiation exposures of the public from certain *sources* of radiation, or from *practices* that can expose members of the public to radiation. These include:
 - ✓ Atomic Energy Act (AEA) –
 - Operations of uranium fuel-cycle facilities
 - Radioactive waste management and disposal
 - Uranium and thorium mill tailings
 - ✓ Safe Drinking Water Act of 1974 (SDWA) - Radioactivity in drinking water
 - ✓ Clean Water Act of 1977 (CWA) - Radioactivity in liquid discharges
 - ✓ Clean Air Act (CAA) - Airborne emissions of radionuclides



EPA Authority (cont...)

- ✓ Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA); AEA - Remediation of radioactively contaminated sites
- ✓ Indoor Radon Abatement Act of 1988- Indoor radon
- ✓ Toxic Substances Control Act of 1976 (TSCA)-NORM, NARM and TENORM, which are not subject to regulation under the AEA



Definitions Vary – NORM and TENORM

➤ EPA definitions:

- ✓ NORM: “Materials which may contain any of the primordial radionuclides or radioactive elements as they occur in nature, such as radium, uranium, thorium, potassium, and their radioactive decay products, that are undisturbed as a result of human activities.”
 - Radiation levels presented by NORM are generally referred to as a component of “natural background radiation.”
- ✓ TENORM: “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.
 - Technologically enhanced means that the radiological, physical, and chemical properties of the radioactive material have been altered by having been processed, or beneficiated, or disturbed in a way that **increases the potential for human and/or environmental exposures.**”



States definition

- The Conference of Radiation Control Program Directors (CRCPD) definition, which is used by many states, is limited to the increased concentration of radioactivity in materials
 - ✓ does not include materials that have not been modified by human activities, yet have been disturbed in such ways that they can present an additional potential for exposure.
- This basic inconsistency in definitions has resulted in differing management and regulation of some NORM/TENORM in different states.
- The CRCPD has created a working group to address this definitional question.



The Times are a Changing...

- State TENORM regulations are in varying stages of development
 - ✓ primarily among states affected by increased activity in the oil and gas industry.
- State TENORM regulations can differ from one state to another in numerous ways,
 - ✓ depending on the presence of industries that generate TENORM wastes or,
 - ✓ in some cases, whether a state has a requirement to adopt and incorporate regulations that were developed by the CRCPD (e.g., Colorado).
- Stakeholders, including industry and the public, are asking EPA for greater clarity on basic standards of care for management and disposition of TENORM.



Data and Guidance

- Some organizations, both governmental and non-governmental, are developing standards of good practice that may be applicable to the management of TENORM.
- Ongoing studies are starting to provide data to support a more uniform approach, and there have been legal actions brought that may speed up the regulatory process.
- When new information or different practices prompt states to review existing standards and rules, it is also possible for states to conclude that less restrictive conditions will provide the desired level of environmental and public health protection.



Distributed Regulatory Responsibility

- States also differ in how they distribute regulatory responsibility for TENORM management. These differences fall into three categories, States:
 - (1) that have their radiation protection and radioactive waste disposal requirements residing within a **department of health** or **radiation control agency**;
 - (2) whose radiation protection and waste disposal regulations reside within a land-management agency (**department of natural resources**) or **environmental protection** (or similar agency); and
 - (3) whose radiation protection and waste disposal regulations for TENORM have been developed by a **state oil and gas conservation commission** or similar agency.
- Most states fall into more than one of these categories.



States Keeping Options Open

- There are also some states that have not developed their own TENORM regulations to date.
- Some differences between states, or even within state programs, may arise from the approach taken to the issue by the regulatory authority,
 - ✓ For example, addressing TENORM from a **waste management perspective** as opposed to a **radiation protection perspective**.
- Lacking a definitive, complete set of federal standards for TENORM to follow, states have elected to be flexible to meet their own needs in choosing whether or not to develop a TENORM standard, and what to include in it (or them).



Flexibility

- Over the decades, different states have faced challenges from different industries that have predicated a variety of actions (e.g., phosphogypsum, drinking water treatment, hard rock mine tailings, monazite sands, rare earths).
- Some states have adopted NRC radiation protection standards as part of their Agreement State roles, plus EPA requirements for water protection and waste disposal, as well as (possibly) OSHA/DOT occupational worker protections.
- Public awareness of TENORM, and most recently oil and gas TENORM, has often been raised by news reports related to large quantities of TENORM wastes, spills and discharges.
- This tends to create an impetus to address the issue for the regulatory agencies, the industry looking for the regulatory framework to work within, and the public that is uncertain how to interpret unanticipated waste management and exposure situations.



Existing standards

- EPA's UMTRCA standards for radium concentration limits in contaminated soil surface (0.185 Bq/g) (≤ 5 pCi/g) have been generally adopted by oil- and gas-producing states, but up to 1.11 Bq/g (30 pCi/g) in some cases, including landspreading, has been allowed in Louisiana and Texas, and included in the IOGCC (2001) standard.
- Some states have applied regulatory approaches to TENORM wastes from other industries that could prove applicable to oil and gas residuals.
 - ✓ Water Treatment
 - ✓ Injection Control



Liquid Discharges

- States have taken similarly diverse approaches to managing liquid effluents from oil and gas activities, in particular produced water.
- Some states permit discharges of produced water containing TENORM into their streams,
 - ✓ with the potential for radium concentrating in stream sediments and water potentially being used as source water for community water systems (CWS).
 - ✓ Pennsylvania has identified some areas of contamination at discharge outfalls.



Cleanup Levels

- Given the potential for future cleanups of TENORM from spills and improper disposition of wastewater, sludges and solids, it is important to consider what the states will use to derive the action levels for response; possibilities include:
 - ✓ the EPA risk range for CERCLA (Superfund) or
 - ✓ the exemption level adopted by many states for radium (e.g., 0.185 Bq) (5 pCi/g).
 - ✓ It is possible that states may use a variety of criteria for different situations.



Ongoing Studies

- There is a paucity of publicly available data relative to TENORM associated with more recent oil and gas development practices.
- A 2016 investigation by Pennsylvania is the most current study on TENORM associated with natural gas in the Marcellus formation.
- EPA is conducting a study looking at impacts to drinking water from unconventional oil and gas that includes some discussion of TENORM.
- As part of its broader TENORM program, EPA has also evaluated TENORM in uranium overburden and in the copper belt in southwest Arizona.



Legal Challenges

- Legal challenges relative to TENORM have resulted in settlements, many taking decades to work through the appeals process.
- These include cases in Louisiana that resulted in surface contamination and worker exposure and the Martha Oil field in Kentucky that spread contamination over the surface from liquid discharges.
- Many communities are trying to restrict where drilling can be utilized, but most of those actions do not specifically cite TENORM.
- There has been a recent suit brought by the National Resources Defense Council and others against the EPA for allegedly not updating solid waste disposal regulations in a timely manner.
 - ✓ TENORM is specifically called out in the complaint.



Thank You

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