



RADIATION **PROS**

Assessing the Impact of the New TENORM Rules



NORM – naturally occurring radioactive material

TENORM – technologically-enhanced NORM

- Concentration of radioactivity is enhanced by past or present human activities

May be as simple as:

- Putting a pipe in the ground
- Passing water, oil, or gas through a filter
- Sludge settling into the bottom of a tank
- Radon gas accumulating in a building or tank



Who is Most Impacted by the TENORM Rules?

1. Oil & Gas Operations
2. Drinking Water Treatment Plants
3. Wastewater Treatment Plants
4. Mining



Entities Impacted (per CDPHE)

Water Treatment Facilities

- **2,000 Drinking Water**
- **600** Wastewater
- **10** Active Mine

Others Impacted

- **300 Oil & Gas Operators**
- **49** E & P Waste Management Facilities
- **55** Landfills (& Municipalities)
- **5,000,000** Residents Who Rely on Public Drinking Water and Wastewater Treatment Facilities (85% of population)



What Are The Practical Implications?

1. Characterization Costs Will Increase Dramatically
2. Waste Acceptance Will Slow
3. Disposal Costs Will Rise
4. Training Requirements
5. Need for Specific Expertise in Radioactivity



The Biggest Logistical Concerns

- Ingrowth period of 21- to 28-days for **characterization**
- EPA SW-846 substantially increases the likelihood of **repeated sampling events** to gain waste acceptance
- Efficacy of some **lab methodologies**, especially when assessing very low levels
- Role of **field screening** - left to the obscurity of guidance development
- Will CDPHE be able to manage **the registration process** effectively?
- **Will *helpful* guidance be developed fast enough** to ensure waste can be disposed of quickly?



Registration and Licensing Costs

Registration Requirement (if you generate TENORM)

- **\$200/facility/year**, or
- \$200/township/year, which may cover multiple facilities for the same entity in each township

Specific License Requirement \$2,790

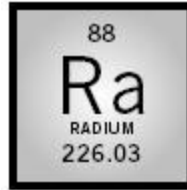
(if you routinely generate and store TENORM waste at a site that exceeds 50 pCi/g)

- May cover more than one facility if within 1 mile
- Reduced fees for additional facilities under the same license (75% for 2nd, 50% for 3rd, and 25% for 4+)
- Additional costs to generator for license preparation

Exempt Concentrations and Quantities

Isotopes of Concern:

- **Radium-226**
- **Radium-228**
- **Lead-210**
- **Polonium-210**



Exempt
Concentration

5 pCi/g*

Exempt
Quantity

0.1 μ Ci



Pipe – no external dose;

< 50 feet long, and < 600 dpm/cm²

**Above background*

TENORM Rules

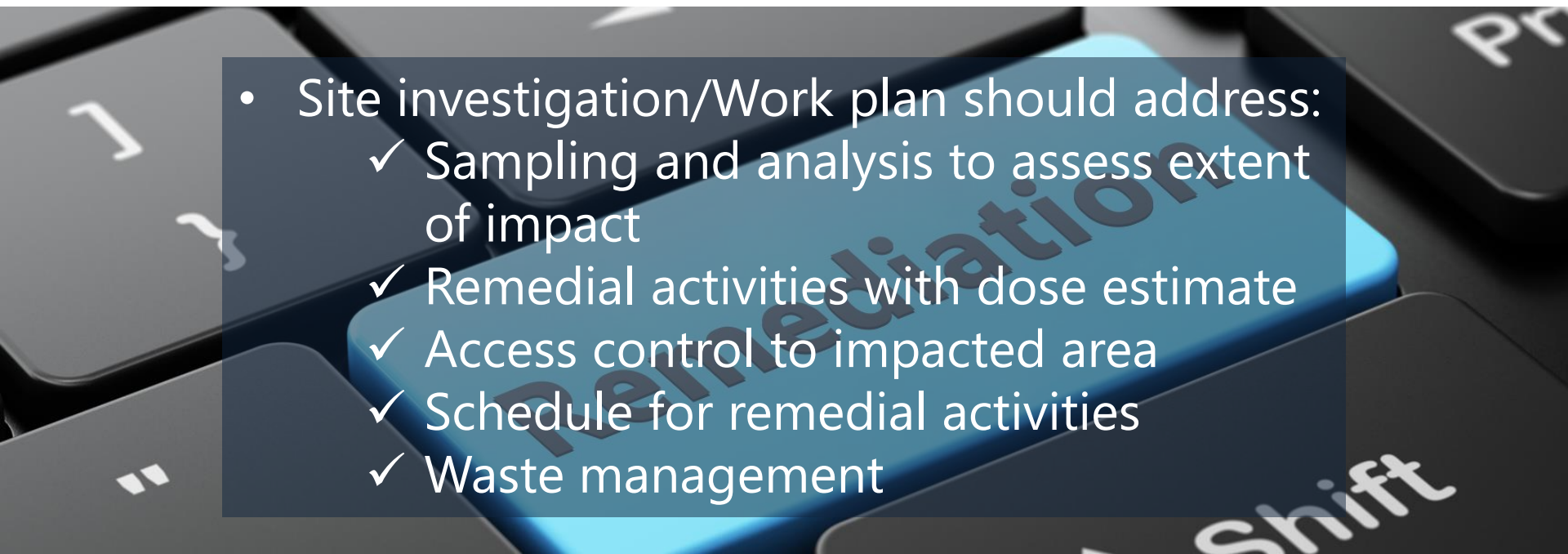
Registrant Obligations

- No purposeful dilution
- Can't abandon TENORM
- Must secure and label TENORM
- Properly package and transport
- Recordkeeping
- Minimize contamination
- Appoint a responsible individual
- Maintain ALARA
- Training
- Only trained personnel may perform equip maintenance
- Spill reporting



Spill Reporting

- Report **within 24 hours** of reporting to COGCC
- CDPHE may require a:
 - ✓ Site investigation
 - ✓ Groundwater and surface water impactions
 - ✓ Potential for anyone to exceed 100 millirem

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- Site investigation/Work plan should address:
 - ✓ Sampling and analysis to assess extent of impact
 - ✓ Remedial activities with dose estimate
 - ✓ Access control to impacted area
 - ✓ Schedule for remedial activities
 - ✓ Waste management

Registrant Requirements

Training Requirements

- Initial training that aligns with potential for exposure
- Refresher training every 3 years
- Applies to all registrants
- 40-hours for designee with a specific license



Registrant Paperwork

Recordkeeping Requirements

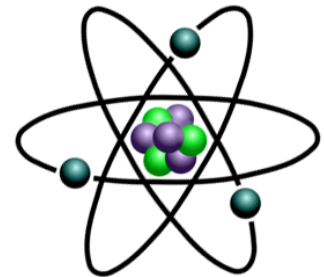
- Initial and periodic characterization of TENORM materials
- Routine periodic area/facility radiation surveys and occupancy or access
- Monitoring records
- Staff training records
- Receipt, transfer or disposal records
- Land application records
- Records associated with the reporting of events involving spills or releases, loss or theft of materials, or other events of radiological significance.



More Requirements

Monitoring/Surveying Requirements

- Routine periodic area/facility radiation surveys
- Monitoring of occupancy or access
- Detection/monitoring **equipment costs**
- Radon



DOT and CDPHE Compliance

- Training in compliant TENORM transport
- Effort and costs associated with TENORM Rule compliance

Licensed Contractor Needed

Services Contracting

- Use of a *licensed* Radioactive Materials Contractor when levels exceed 50 pCi/g
- Surveys/Sampling/Site Assessments
- Material handling, transport, and disposal
- Site remediation and demolition
- Decontamination
- Decommissioning
- Free release activities
- Waste brokering



Complexities of the New Rules

- Characterization of sludges and liquids can be difficult
- All characterization is to be done on a **dry weight basis**
- Dry weight basis presumably produces more consistent and comparable lab results, but it exaggerates the risk
- CDPHE's answer: Introduce dose rates
 - ✓ Requires more special equipment
 - ✓ Outside expertise - health physicist
- Gaining waste acceptance at the landfill can be difficult
 - ✓ Individual WAC and strict interpretation of guidance
 - ✓ CDPHE suggests establishing waste profiles will mitigate the need for continuous sampling and analysis



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Allowable Possession Limits - Registrants

Waste	Isotopes	Registrant Allowable Range (above background)	Dose Rate Survey Needed?	Dose Rate Limit
Produced Fluids	Ra-226, Ra-228, Pb-210, Po-210	5 - 250 pCi/g	No	-
Oily Waste	Ra-226, Ra-228, Pb-210, Po-210	0 - 50 pCi/g	No	-
Pigging Waste	Pb-210, Po-210	0 - 500 pCi/g	No	-
Filter Socks	Ra-226, Ra-228, Pb-210, Po-210	0 - 500 pCi/g	Yes, if > 50 pCi/g	2 millirem/hour
Equipment, Pipe & Scale	Ra-226, Ra-228, Pb-210, Po-210	n/a	Yes	2 millirem/hour
Other Waste	Ra-226, Ra-228, Pb-210, Po-210	0 - 50 pCi/g	No	-
RCRA Hazardous Waste	Ra-226, Ra-228, Pb-210, Po-210	5 - 100 pCi/g	Yes, if > 50 pCi/g and > 10% solids	2 millirem/hour



Smart Tools & Pigs



Gas Waste Streams

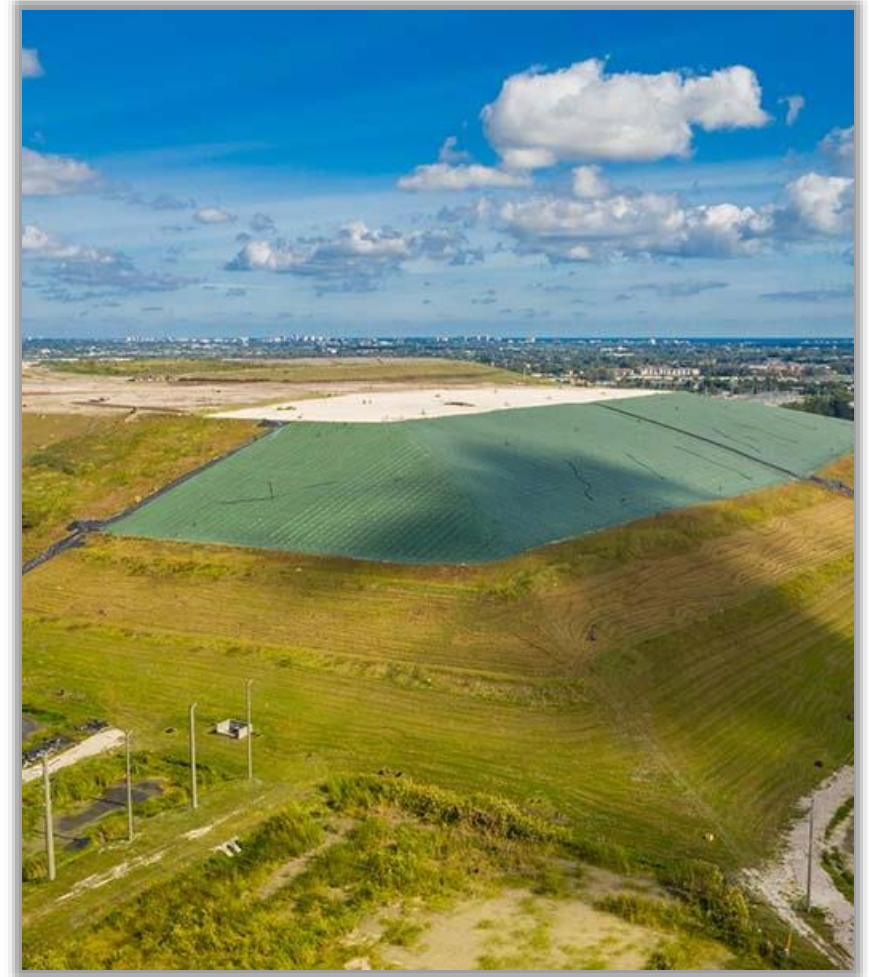


Intricacies of TENORM in Gas Waste Streams

- Pb-210 - not detectable with a standard scintillator probe
- Shows as a dusty film or “black rouge” in pipes, CS, MS, gas plants
- Filters show wide variability in levels
- RCRA co-contaminants create big issues for transport and disposal

Landfills

- Landfills may register and accept TENORM up to 50 pCi/g
- Approval from CDPHE is in the rule, provided the landfill meets some minimum standards
- Not required to accept it
- Subject to county approval – will there be NIMBY issues?



New Rules – Additional Notes

- 100 millirem/year exposure limit
- Included production water as a potential source of TENORM
- Radon monitoring if material > 50 pCi/g and is inside



Water/Wastewater Treatment Plants

- Beneficial re-use
- Biosolids



U.S. Shale Formations



Radiation Pros, LLC (Rad Pros)

- Environmental firm – *licensed* radioactive materials management
- Surveys, Sampling, Site Assessments, and Characterization
- Training for Oil & Gas and Water Treatment
- Project Management/RSO Support
- Remediation and Demolition (RAD)
- Packaging, Transport, and Disposal
- Regulatory Consulting/Assistance
- Radiation Safety/Protection Programs



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