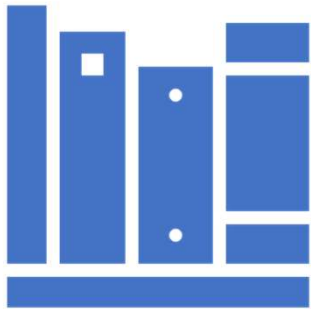


TENORM

Technologically Enhanced Naturally Occurring Radioactive Material

Katie Koplitz – Senior Regulatory Compliance Specialist



What is
TENORM?



Past Colorado
Regulations



New Regulations:
SB 18-245



Impacts to
Wastewater
Treatment Facilities

TENORM DISCUSSION



What is TENORM?

Technologically enhanced naturally occurring radioactive material whose radionuclide concentrations are increased by or as a result of past or present human practices.

TENORM does not include:

- Background radiation or natural radioactivity (rocks/soils)
- Byproduct material or source material (as defined by statute)
 - Uranium/Thorium
- Enriched or depleted uranium (as defined by statute)

TENORM does include:

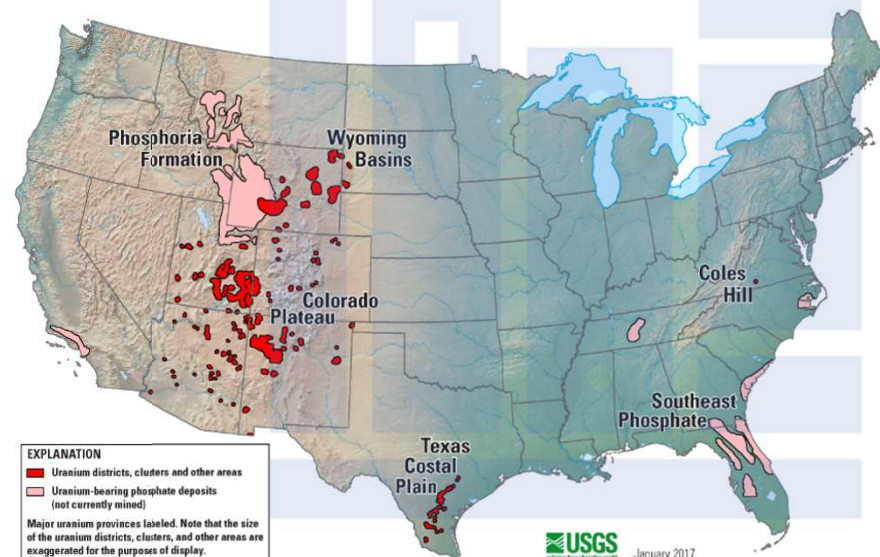
- Radium 226, 228, & progeny



Rocky Mountain Specific Problem

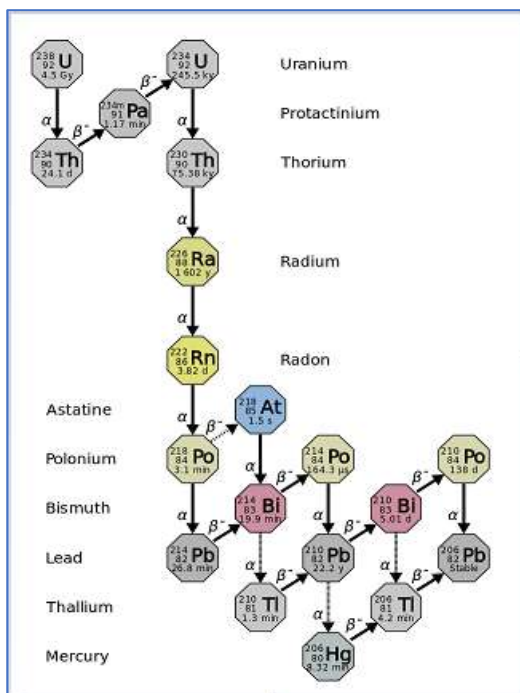
- Naturally occurring in the environment in many rocks and minerals (especially in the Western U.S.) and therefore occur frequently in groundwater that travels through these rocks.
- Most common examples of radionuclides in groundwater are uranium, radium, and radon

Uranium Resources of the United States

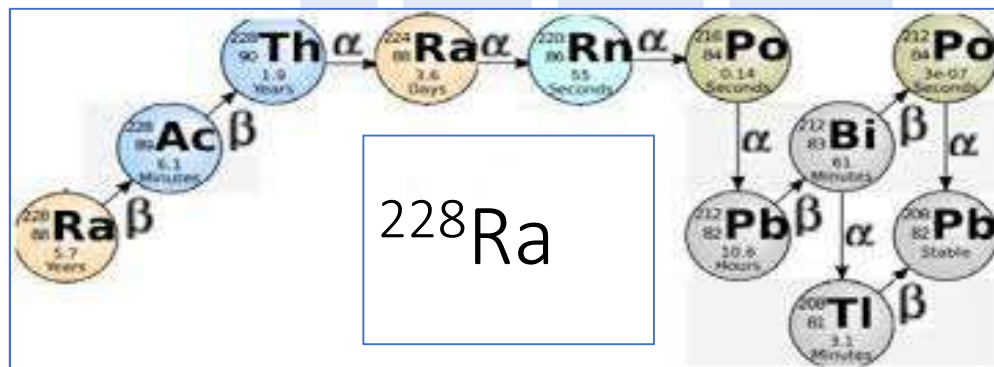




Decay Process



^{226}Ra





Health Effects

- Low levels of radium in nature are normal.
- High levels of radium can cause cancer (especially bone cancer), anemia, a problem with the blood; fractured teeth and cavities, and cataracts.
- Exposure to high levels of radium can lead to higher chances of bone, liver and breast cancer.



Past Regulations

"The state board of health may adopt regulations concerning the disposal of naturally occurring radioactive materials at any time **after the promulgation by the federal Environmental Protection Agency** or its successor of rules for the disposal of naturally occurring radioactive materials." *Radiation Control Act §25-11-104 (1)(b)*

Thorium/Uranium covered by Source Material Regulations. Radium is not.

"Interim Policy and Guidance Pending Rulemaking for Control & Disposition of Technologically-Enhanced Naturally Occurring Radioactive Materials in Colorado – Draft 2007" – created to provide relief to radium

Concern about "level playing field"



NEWS > ENVIRONMENT

Colorado landfills are illegally burying low-level radioactive waste from oil and gas industry, Denver Post learns

Colorado health officials are trying to stop the practice and make new rules for low-level radioactive waste



Photo provided by Pewnee Waste LLC

Construction crews are building a new landfill near Grover to handle oil and gas industry waste, including low-level radioactive waste. They will use clay and plastic liners to protect land and groundwater.

Why the change?



Senate Bill 18-245

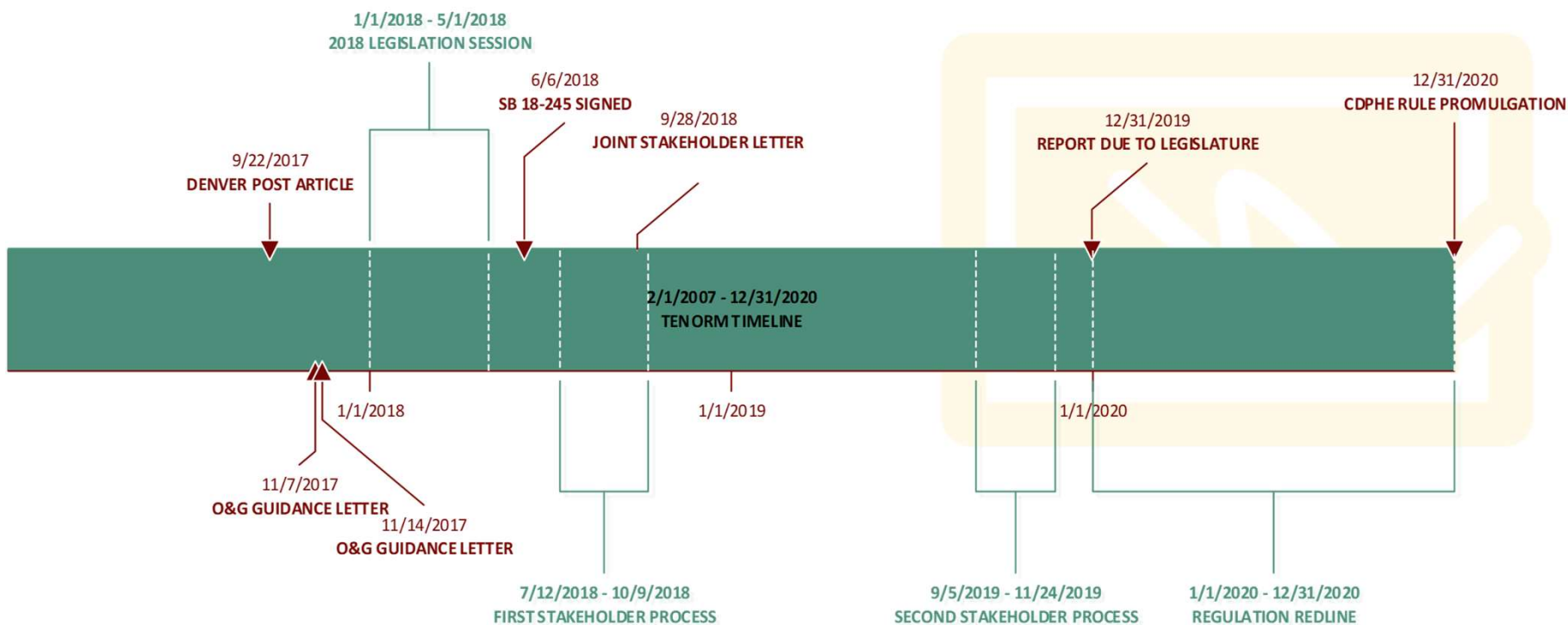
Gives authority to Colorado Department of Public Health (CDPHE) to promulgate rules for safe management of TENORM

Requirements:

- Develop proposed residual management rule based on report that includes regulatory limits for at least landfill disposal, beneficial reuse, and exemption levels. The rule **must allow for the beneficial reuse of water treatment residuals and by-products of the wastewater treatment process.**
- Prepare a report due to the legislature by 12/31/2019
 - CDPHE hired Rule Engineering to evaluate the major industries affected by TENORM
- Develop rule/regulation by 12/31/2020



Regulatory Timeline





Stakeholder Meeting Proposals

Biosolids

Exempt

- 5 pCi/g is exempt

Generic License/Registration

- 5 pCi/g – 50 pCi/g

Land Application

Land Application Limit

- 25 pci/g

20 years/crop cycle limit without department approval

No environmental covenant required

Still need discuss details on composting & other “beneficial use”



Stakeholder Meeting Proposals

Landfills

Exempt

- 5 pCi/g is exempt

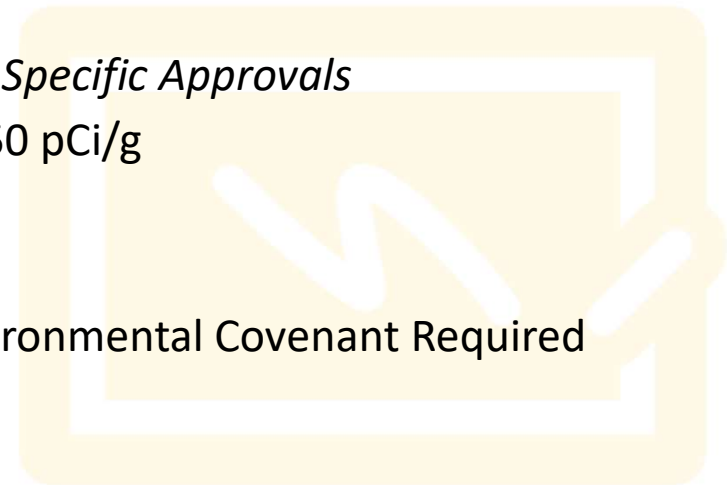
Generic Approval

- 5 pCi/g – 50 pCi/g
- Basic engineering standard (RCRA D)

Site Specific Approvals

- > 50 pCi/g

Environmental Covenant Required



Still need discuss details on composting & other “beneficial use”

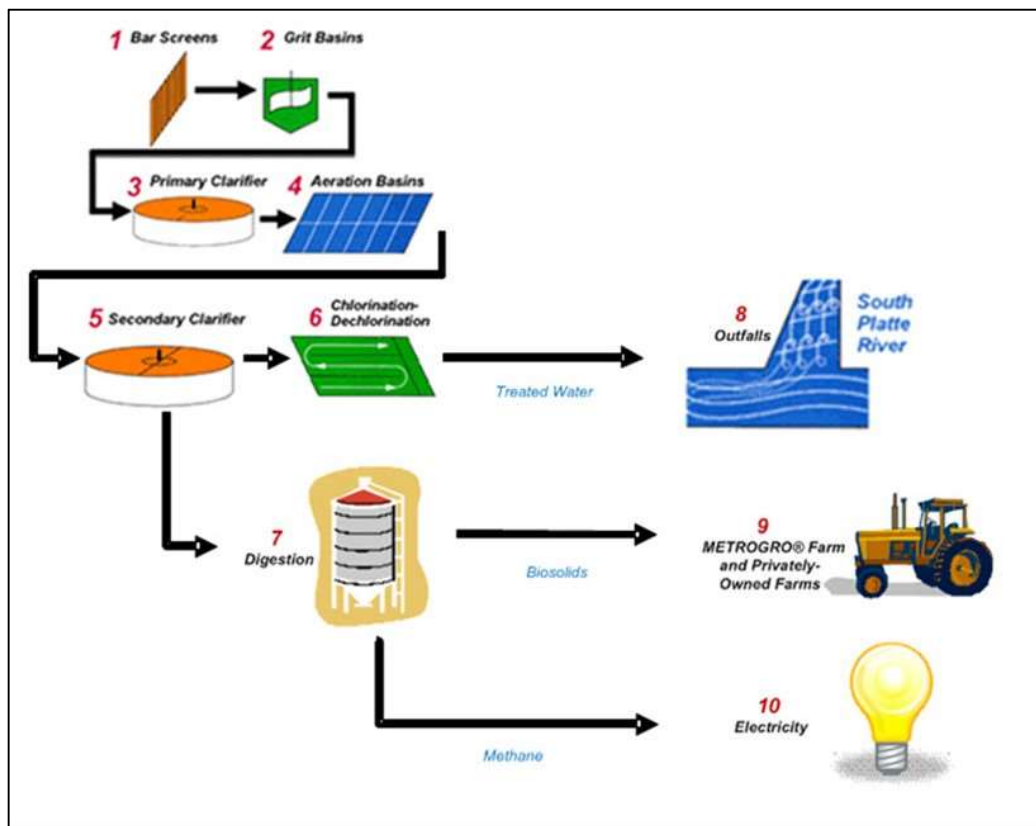
How to

Facility:										
Estimate X (x bar) / sample mean					Appropriate number of samples to be collected					
(straight average of previous measurements)										
		estimated	calculated							
Sample Mean equals		6	3.2667			Upper limit of CI				
Estimate S² Variance of sample										
S²										
Variance of sample		0.04333333								
	X	X ²	sum of X ²	sum of X	(sum of X) ²	n (number of samples)	(sum of X) ² /n	(sum of X ²) - [(sum of X) ²]/n	[(sum of X ²) - [(sum of X) ²]/n] / n-1	
1	3.1	9.61	32.1	9.8	96.04	3	32.01333333	0.08666667	0.04333333	
2	3.2	10.24								
3	3.5	12.25								
4	0	0								
5	0	0								
6	0	0								
7	0	0								
8	0	0								
9	0	0								
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25	0	0								
Appropriate number of samples to be collected										
$\Delta = RT - \bar{X}$										
RT = regulatory threshold										
$n = t^2_{.20} * S^2 / \Delta^2$										
t _{.20} from table 9-2										
	RT	Δ	Δ^2	t _{.20}	t ² _{.20}	S ²	n			
	5	1.7333	3.004444444	1.886	3.556996	0.043333333	0.051302627			
Confidence Interval										
$S = \sqrt{S^2}$										
$S_{\bar{x}} = S/\sqrt{n}$										
CI = Confidence Interval										
$CI = \bar{X} \pm t_{.20} * S_{\bar{x}}$										
	S	S _{xbar}	CI							
	0.21	0.12	3.27 ±		0.23					
Upper limit of CI		3.49								



Impacts to Wastewater Treatment Facilities





Surface Water

- 5 CCR 1002-31
 - 5 pCi/L

Biosolids

- Exemption level

Air

- Radon?

WWTP Interferences

- N/A

Human Health & Safety

- 100 mrem

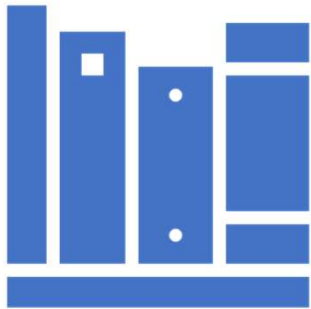


Impacts to Pretreatment

Common Industries of Concern

- Public water treatment facilities
 - Residuals generated
- Private water treatment facilities or support media industry
 - zeolite media regeneration
- Groundwater dewatering
- Hospitals
- Mining
- Energy production
 - Oil & gas production wastes
- Fertilizer & wastes
- Granite countertops
- Building materials
- Landfill leachate





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Questions?

kkoplitz@mwr.dst.co.us

