



http://www.epa.gov/radiation/tenorm/sources.html#summary-table

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TENORM Sources

TENORM

Radioactive materials are prevalent in many soils and rock formations and consequently in the water that comes into contact with them. Extraction and processing of these resources may expose or concentrate naturally-occurring radionuclides, causing them to be classified as Technologically-Enhanced, Naturally-Occurring Radioactive Materials.

The EPA and others working on the problem have identified many sources of TENORM. Identifying sources and determining the potential risks from them remains a major focus of our work.

Descriptions of the range of activity in these waste is provided in the [Source Summary Table](#) below.

More detailed information is provided for TENORM from these sources:

- [Mining Wastes](#)
- [Energy Production Wastes](#)
- [Water Treatment Wastes](#)
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Summary Table of Reported Concentrations of Radiation in TENORM

The summary table below provides a range of reported concentrations, and average concentration measurements of Naturally-Occurring Radioactive Materials (NORM) that become concentrated in various wastes and materials. Once the NORM is concentrated or exposed by human activities, such as mining, it is classified as TENORM (Technologically-Enhanced, Naturally-Occurring Radioactive Materials). This is not a comprehensive list, as TENORM radiation is known to occur in many other materials, but should provide a general sense of the hazards posed by this class of radioactive substances.

Note:

Unless otherwise noted, the radiation level of each waste is shown in the units [pCi/gram](#). For comparison purposes, the average level of radium in soil ranges from less than 1 to slightly more than 4 pCi/gram. "NA" indicates data is not available.

Source:	Radiation Level [pCi/g]
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Source:		Radiation Level [pCi/g]		
		low	average	high
Soils of the United States		0.2	NA	4.2
Geothermal Energy Production Wastes (fact sheet)				
		10	132	254
Oil and Gas Production Wastes (fact sheet)				
	Produced Water [pCi/l]	0.1	NA	9,000
	Pipe/Tank Scale	<0.25	<200	>100,000
Drinking Water Treatment Wastes (fact sheet)				
	Treatment Sludge [pCi/l]	1.3	11	11,686
	Treatment Plant Filters	NA	40,000	NA
Waste Water Treatment Wastes (fact sheet)				
	Treatment Sludge [pCi/l]	0.0	2	47
	Treatment Plant Ash [pCi/l]	0.0	2	22
Aluminum Production Wastes (fact sheet)				
	Ore (Bauxite)	4.4	NA	7.4
	Product		0.23	
	Production Wastes	NA	3.9-5.6	NA
Coal Ash (fact sheet)				
	Bottom Ash	1.6	3.5-4.6	7.7
	Fly Ash	2	5.8	9.7
Copper Mining and Production Wastes (fact sheet)				
		0.7	12	82.6
Fertilizer and Fertilizer Production Wastes (fact sheet)				
	Ore (Florida)	7	17.3-39.5	6.2-53.5
	Phosphogypsum	7.3	11.7-24.5	36.7
	Phosphate Fertilizer	0.5	5.7	21
Gold and Silver Mining Wastes (fact sheet)				
Rare Earths (Monazite, Xenotime, Bastnasite) Extraction Wastes (fact sheet)				
		5.7	NA	3224
Titanium Production Wastes (fact sheet)				
			8.0	24.5
	Rutile		19.7	NA
	Ilmenite	NA	5.7	
	Wastes	3.9	12	45
Uranium Mining Wastes (fact sheet)				

Source:		Radiation Level [pCi/g]		
	Uranium Mining Overburden			low hundreds
	Uranium In-Situ Leachate Evaporation Pond	3	30	3000
	Solids	300		
Zircon Mining Wastes (<u>fact sheet</u>)				
	Wastes	87	68	1300

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