WASTE MANAGEMENT & REMEDIATION DIVISION
WASTE AND UNDERGROUND TANK MANAGEMENT BUREAU
SOLID WASTE SECTION

Technologically Enhanced Naturally Occurring Radioactive Material (TENORM) Fact Sheet

What is NORM/TENORM?

- NORM stands for "naturally occurring radioactive material". It is a substance that naturally contains one or more radioactive isotopes, also called *radionuclides.*
- The amount of radioactivity in a material is expressed in units called Curies. One picocurie (pCi) is 1 trillionth of a Curie.
- NORM is present at low levels in soils and rocks.
- Radionuclides are also present in some foods and common household items, including bananas at 4 pCi/gm, Brazil nuts at 6 picocuries per gram (pCi/g), cat litter at 5 pCi/g, coffee at 27 pCi/g, granite countertops at 27 pCi/g, and phosphate fertilizer at 123 pCi/g.
- TENORM is NORM that has been concentrated as a result of human activities, such as through manufacturing, mineral extraction, or water processing.

How do these rules help prevent potential exposure to TENORM?

- **TENORM is not waste from nuclear energy, weaponry or medical industries.**
- TENORM emits all three common forms of ionizing radiation: alpha particles, beta particles, and gamma radiation.
- Time, distance, and shielding actions minimize a person's exposure to radiation in much the same way as they would to protect a person against overexposure to the sun.
- The department is proposing the following requirements to minimize exposure: daily cover of waste; dust monitoring and control; radiation health and safety plans; and continuous monitoring of ionizing radiation dose at the licensed boundary.
    - Boundary monitoring measures the dose a hypothetical person would receive if the person were at the boundary continuously with no shielding for a year.

How is TENORM Regulated?

- There are no federal regulations or guidance specific for managing TENORM waste disposal.
- Several states have, or are developing, specific rules for managing TENORM waste.

How is TENORM Regulated in Montana?

- TENORM waste management systems are regulated under Montana Code Annotated (MCA) Title 75, chapter 10, part 2, and Administrative Rules of Montana (ARM), Title 17, chapter 50 (to see specific ARMs and MCAs go to: http://deq.mt.gov/Land/solidwaste/lawsrules).
- TENORM waste management systems are thoroughly evaluated by DEQ before being licensed to receive waste.
- Public participation in the DEQ evaluation and licensure of a TENORM waste management system is mandated by the Montana Environmental Policy Act (MEPA).
- Liners and soil surrounding TENORM in landfills act as protective barriers between waste and the environment.
- TENORM waste management systems must protect human health and the environment through measures such as but not limited to: ground and storm water, and air quality monitoring.
- Inspections of these waste management systems occur on a regular basis to ensure continued compliance with rules.

For more information contact DEQ's Solid Waste Program at (406) 444-5300.

Common Radioactive Terms

ALARA	As Low As Reasonably Achievable, which means making every reasonable effort to maintain exposures to ionizing radiation as far below the dose limits as practical, consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest.
alpha particle	A positively charged particle made up of two neutrons and two protons emitted by certain radioactive nuclei. Alpha particles can be stopped by thin layers of light materials, such as a sheet of paper, and pose no direct or external radiation threat; however, they can pose a serious threat if ingested or inhaled.
beta particle	An electron or positron emitted by certain radioactive nuclei. They travel several feet in air and can penetrate clothing and skin. They are blocked by most solid objects.
curie	A unit of ionizing radiation (radioactivity), symbolized Ci and equal to 3.7 x 10^{10} disintegrations or nuclear transformations per second.
dose	Amount of radiation energy deposited in human tissue.
dose equivalent	A unit of biologically equivalent dose, defined as the absorbed dose in rad multiplied by the quality factor (Q).
exposure	A measure of the amount of ionization produced in air by gamma photons or x-rays.
gamma rays	High-energy electromagnetic radiation emitted by certain radioactive nuclei. They can travel through most forms of matter. Shielding from gamma rays can be provided by lead, concrete, rock or soil in varying degree of thicknesses.
ionizing radiation	Radiation that carries enough energy to free electrons from atoms or molecules, thereby ionizing them. Ionizing radiation is made up of energetic subatomic particles, ions or atoms moving at high speeds (usually greater than 1% of the speed of light), and electromagnetic waves on the high-energy end of the electromagnetic spectrum.
microrentgen (*μ*R)	One millionth (10^{-6}) roentgen.
millirem (mrem)	A unit of equivalent dose that is equal to one thousandth of a rem.
picocurie: (pCi)	One one-trillionth (1/1,000,000,000,000 of a curie).
radioactive	Emitting or relating to the emission of ionizing radiation or particles.
radiation	Alpha particles, beta particles, gamma rays, x-rays, neutrons, high-speed electrons, high-speed protons, and other particles with sufficient kinetic energy to strip electrons from atoms. Radiation does not include non-ionizing radiation, such as radio or microwaves, or visible, infrared, or ultraviolet light.
radioactive decay	The process in which a radioactive nucleus emits (gives off) radiation and changes to a different isotope or element. A number of different particles can be emitted by decay. The most typical are alpha, beta particles, and gamma rays.
radionuclide	A radioactive species of an atom having a characteristic nucleus.
roentgen (R)	The unit of measurement for x-radiation or gamma radiation producing one electrostatic unit of positive or negative ionic charge in one cubic centimeter of air under standard pressure or 0.000258 coulombs per kilogram of dry air.
roentgen equivalent man (rem)	A unit of measure that quantifies the amount of energy deposited by ionizing radiation deposited in human tissue modified by the effects of the specific type of radiation.