Montana Department of Environmental Quality

Memo

TO: Environmental Quality Council

FROM: Shaun McGrath, Director
Jenny Chambers, Waste Management & Remediation Division Administrator

DATE: May 8, 2020

SUBJECT: Technologically Enhanced Naturally Occurring Radioactive Material (TENORM) waste rules

Thank you for allowing DEQ to provide the committee information on the TENORM rulemaking. This memo provides answers to questions **in bold** brought up during the last EQC meeting on April 27, 2020. To aid your understanding of this memo please see the visual on page 2 for some of the common terms used.

BASIC RADIATION PRINCIPLES

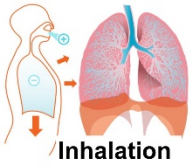
Radiation *means energy that is radiated or transmitted in the form of rays or waves or particles.*

Concentration *is the amount of radioactivity in a material and is expressed in units called Curies. One picocurie (pCi) is 1 trillionth of a Curie.*

Exposure *is a measure of the amount of ionizing radiation in air.*

Dose *The total amount of ionizing radiation absorbed by material or tissues.*

Exposure versus Dose



Inhalation

Environmental Factors
(water, soil, air)

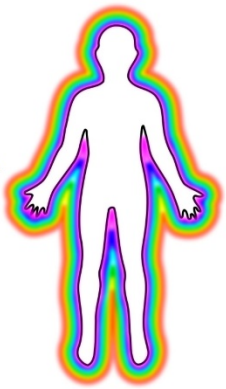
Exposure

(µR)

Through skin

Dose

(mrem)



Ingestion

Roentgen (R) *is the unit of measurement for radiation exposure.*

Microroentgen" (µR) *is one millionth of a roentgen.*

Rem or roentgen equivalent man *is a unit of measure that quantifies the amount of energy deposited by ionizing radiation deposited in human tissue.* ***Millirem (mrem)*** *is one thousandth of a rem.*

Total Effective Dose Equivalent (TEDE) *means the overall measured and/or calculated effective dose that takes into account the type of radiation and the nature of each organ or tissue.*

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Explain the differences between the range of values – gate screening, concentration, and boundary level.

Please see the visual below that explains the different limit requirements TENORM waste management systems are required to meet:

Explain how the department went from 200 pCi/g to 50 pCi/g as a concentration limit.

The proposed DEQ regulations have evolved over the past three years since the Tetra Tech TENORM report was submitted (Tetra Tech, 2016). Changes have been instituted in response to public comments and information derived from stakeholders and testing.

In its Aug. 23, 2019 notice, the department proposed a maximum combined concentration limit within a TENORM waste unit of 50 pCi/g, but proposed to allow TENORM waste management systems to accept individual loads of TENORM waste with concentration up to 200 pCi/g. The department's intent in allowing individual loads with higher concentrations was to discourage illegal dumping, while the overall 50 pCi/g average in the TENORM waste unit would maintain protection of human health and the environment. While the department's original proposed

concentration limit was protective of human health and the environment, the department received numerous comments that the original proposal would be difficult to implement (for both the department and facility operators) and would incentivize waste generators to bring out of state waste to Montana for disposal.

In the Jan. 31, 2020 Supplemental Notice, the department amended the proposed rules to change the concentration limit from 200 pCi/g, with the cumulative average of 50 pCi/g within the waste unit, to a static concentration limit of 50 pCi/g. The department also amended the proposed rules to change the gate screening limit from 200 microroentgen per hour (µR/hr) for TENORM waste and 100 µR/hr for TENORM surface contaminated objects to 100 µR/hr for both TENORM waste and TENORM surface contaminated objects. See the table below:

Proposed TENORM Rules: Comparison of draft limits from August to current

Units	August 23, 2019 Proposed Rule	January 31, 2020 Supplemental*
Concentration Limit	Upper limit of 200 pCi/g and a cumulative average of 50 pCi/g within the waste unit	Static limit of 50 pCi/g
Gate Screening Levels	200 µR/hr and 100 µR/hr for TENORM surface contaminated objects	100 µR/hr for all loads, including TENORM surface contaminated objects
Boundary Limit	100 mrem/yr	100 mrem/yr
*January 31, 2020 Supplemental was in conjunction with the August 23 2019 rule notice, but made some changes to receive additional input and public comment prior to adoption.		

How is the material sampled? What tools and methodology are used for detection, monitoring and reporting?

Before a TENORM waste management system may accept a load of TENORM waste, the generator of the waste must sample and characterize the TENORM waste in accordance with the criteria laid out in the State of Montana requirements ("Requirements for the Characterization of TENORM Waste," Montana DEQ, 2020). The owner or operator of a TENORM waste management system must document this initial characterization and ensure the TENORM waste has been properly characterized.

Samples are taken at the point of generation and sent to a department-approved laboratory for analysis. The laboratory measures radium using several approved methods. The most common method is to use gamma spectroscopy, particularly for solids. The analytical results must be presented to the landfill prior to disposal of the wastes.

Trucks are also screened at the gate for exposure before entering the landfill using a gamma ray detector instrument, which are commonly available and affordable. For example, an iodide

(NaI) detector or a plastic scintillator. Loads may not exceed the gate screening exposure limit of 100 microroentgen per hour (μR/hr). The gate screening also serves as an additional check after the radium concentration has already been measured through laboratory analysis to provide reasonable assurance that the reported lab concentrations are accurate.

The department may require other applicable testing based upon the TENORM waste stream to protect human health and the environment.

What about spikes in readings due to radon gas?

Radon emanates from the soil or waste materials into the ambient atmosphere. The concentration of Radon-222 (Rn-222) in air depends on the concentrations in the solid materials and atmospheric conditions. There can be moderate "spikes" in ambient Rn-222 concentrations depending on conditions such as atmospheric pressure, temperature, wind, etc. A study published by the Pennsylvania Department of Environmental Protection in 2016 found that the radon concentrations in ambient air at the fence line of the landfills studied were consistent with U. S. background radon levels.

Rn-222 is a product that results from the radioactive decay of radium-226. Radon gas builds into equilibrium with its parent, radium, over time but would not exceed the radium concentration in the material in question. Therefore, there are no real "spikes" in Rn-222 concentration in the solid material.

Can DEQ provide information on cost and availability of testing equipment, as well as explain if its easily used in the field?

The cost of testing equipment varies depending on the type and brand of equipment used. Lab costs are approximately $100 - $300 per sample, depending on the method used and analysis desired. The equipment for the radiological analyses on site would be in the tens of thousands of dollars or more. The cost of external gamma screening equipment can range from thousands of dollars for a simple survey meter to hundreds of thousands of dollars for automated drive-through gamma screening systems.

What are the State's options or limitations regarding a ban on TENORM waste coming from another state?

The Commerce Clause of the U.S. Constitution limits a state's ability to ban commerce coming from another state. In 1978, the U.S. Supreme Court concluded that a state law prohibiting the importation of solid waste generated in another state was "squarely within the area that the Commerce Clause puts off limits to state regulation" (*City of Philadelphia v. New Jersey*, 437 U.S. 617 (1978)). In other words, such a ban would violate the U.S. Constitution.

While individual landfills, including government-owned landfills under certain circumstances, may refuse to accept out-of-state waste the state may not put in place a regulatory ban on the acceptance of out-of-state waste.

How is compliance determined and what tools do we have for regulatory oversight?

The department has the enforcement authority to ensure rigorous and timely compliance with solid waste rules. Facility compliance is determined through a combination of quarterly and/or annual reporting by the facility as well as on-site inspections conducted by department staff. Most facilities will be inspected at least two times annually based upon compliance status of the facility.

Inspectors observe management and operational practices, provide compliance assistance, make recommendations to remedy violations and may require corrective action. They may sample environmental media if deemed necessary to ensure compliance. Inspectors also review department-approved ground water sampling plans, operation and maintenance plans, and quality control/quality assurance plans.

The department's enforcement authority includes requiring corrective action to address violations of rules and could ultimately lead to closure of the TENORM waste management system if determined necessary to protect human health and the environment.

Additionally, TENORM waste management systems must have the following in place:

- an inventory of radiation survey equipment
- calibration procedures for radiation detection and monitoring equipment and documentation of calibration records, including:
    - annual calibration for radiation detection and monitoring instruments done by a laboratory licensed by an agreement state or NRC
    - daily source and background check procedures for radiation detection and monitoring equipment, as appropriate
- a radiation health and safety plan developed by a health physicist to provide onsite facility knowledge necessary to comply with the requirements of this subchapter and protect public health
- procedures developed by a health physicist for monitoring of TENORM concentrations in a TENORM waste unit
- the Operations and Maintenance (O&M) plan must provide the concentrations be reported to the department quarterly
- provisions developed by a health physicist for continuous monitoring of ionizing radiation dose at the licensed boundary
    - the monitoring must demonstrate the dose a hypothetical person would receive if the person were at the boundary continuously with no shielding for a year
    - the monitors at the boundary will be running continuously and checking this will be part of a waste management's systems daily operations

        - daily source and background check procedures for radiation detection and monitoring equipment are required
        - the measurements are required to be reported quarterly to the department
    - procedures for random inspections of incoming loads and rejection procedures for incoming loads that do not meet the acceptance criteria

Describe the criteria for review and approval of a Class II landfill. Is there a Montana Environmental Policy Act (MEPA) review process and why was Oaks permitted in a drainage?

Review and approval of a Class II landfill is a long process and it can take more than a year to work through the various stages involved. The application is detailed, and the review process entails the development of an Environment Assessment or an Environmental Impact Statement, as appropriate, under MEPA requirements. The process includes public engagement and coordination with the local health officer.

The application for the Oaks landfill was carefully reviewed and approved by department staff through the extensive process listed above. The Oaks landfill met all the requirements for siting and design for a Class II landfill under Subchapters 10 and 12 in the solid waste administrative rules. Those rules include restrictions on siting a landfill near wetlands, unstable areas, sensitive hydrological environments and more.

To see the application form for a Class II landfill, go to:
https://deq.mt.gov/Portals/112/Land/SolidWaste/Documents/newapplications/class2.pdf

What facilities are permitted to accept TENORM waste? Which ones are currently accepting TENORM Waste and what is the status of others? Do we have any pending?

The department has approved five Class II landfills SWMS to accept TENORM wastes for disposal. All are designed to meet the rigorous siting and construction requirements currently established in the Montana administrative rules.

Oaks Disposal, a Class II landfill located in Dawson County, is the only licensed TENORM landfill currently operating in the state.

There are two licensed Class II TENORM landfills that are not yet constructed. Those include BAC, located near Outlook in Sheridan County, and Clay Butte Disposal, located near Culbertson in Roosevelt County.

The Republic Services Class II landfills located in Missoula and Cascade Counties are operational municipal solid waste landfills that have modified operation and maintenance (O&M) plans to allow for the acceptance of TENORM wastes in accordance with current guidelines. Therefore, in addition to the routine acceptance of household garbage, both Republic Services landfills can accept TENORM wastes as those facilities meet siting and construction standards established in current solid wastes rules for Class II landfills. Both

landfills modified their O&M plans to accept TENORM waste two years ago, but neither facility has accepted any TENORM wastes. Both facilities would need to review and revise their O&M plans to ensure compliance after the proposed TENORM rules are adopted.

For Oaks, explain the compliance history and any violations over the last 6 years.

The department has inspected the Oaks landfill nine times since the landfill began operating in June 2013. During that period, the department noted one minor operation and maintenance violation that occurred in the early operational phase of the facility during the transfer of ownership. The new owner misinterpreted the O&M plan and accepted several loads without the full suite of analytical data. None of these loads exceeded any of the established limits. Oaks landfill corrected the violation and the department verified that Oaks' operations returned to compliance. The facility has adhered to its approved O&M plan since that time.

The only other violation noted at the facility was for the late submittal of Water Quality Discharge Monitoring Reports. All the reports have been submitted and Oaks landfill has not violated any water quality parameters in their storm water discharge permit.

Although not a violation of ground water quality standards, ground water monitoring reports in 2016 indicated high chlorides values in down gradient wells. TENORM wastes that result from oil and gas production are typically high in chlorides, so initially the concern was that waste in the landfill may had impacted down gradient wells via a breach in the liner system. Upon further investigation, the department determined that the liner does not appear to be compromised and subsequent ground water reports over the last three years indicate the high chloride levels have been decreasing. The department continues to work with Oaks, their consultant and interested stakeholders to determine the cause of the chloride spike and to ensure that there are no future spikes in chloride values.

Leachate monitoring and management for Class II landfills are currently required in existing Montana solid waste rules. Based on the department's experience with Class II landfills, these rules perform well in addressing leachate monitoring and management. Class II landfills may remove leachate and properly dispose of it in Class I underground injection wells. Currently, excess leachate generated at the Oaks landfill is disposed of in Class I underground injections wells in North Dakota.

How is TENORM waste different and what are the health impacts with overhandling?

There is more diversity and uncertainty in the radionuclide components in TENORM waste. Determining the average concentrations in TENORM waste is a matter of compliance with regulatory limits and health and safety of workers. TENORM poses a potential radiation health risk not only from direct radiation exposure, but also from inhalation or ingestion of dust particles associated with the material. Proper landfilling of TENORM waste, such as requiring

daily cover, dust monitoring, and dust control, minimizes the potential radiation dose associated with radionuclides.

Can you clarify efforts to coordinate with North Dakota?

The department has been in close contact with North Dakota during the development of the proposed TENORM rules. Montana's proposed rules match North Dakota's TENORM regulations with regard to the concentration, gate screening, annual dose limit and the definition of TENORM. The department will work with stakeholders and neighboring states to address the issue of illegal dumping to ensure higher concentration loads will be disposed of at facilities licensed to accept loads higher than 50 pCi/g. Montana and North Dakota provide notification to one another when higher concentration loads are rejected in either state.

TENORM Limits	**Montana (proposed in supplemental notice)**	**North Dakota**
Concentration Limit	50 pCi/g	50 pCi/g
Gate Screening Limit	100 µR/hr	100 µR/hr
Lower Limit	<5 pCi/g	<5 pCi/g
Public Dose Limit	100 mrem/y	100 mrem/y

What are the impacts and timeframe associated with an informal objection and what does the department intend to do?

The EQC objection to the proposed TENORM rules delays the department's timeline for adopting the proposed rules. At a minimum, the department may not adopt the proposed TENORM rules until after EQC has a chance to address the objection at its May 27-28 meeting. Prior to that meeting, the department will continue working to provide EQC with additional information and answer questions raised regarding the proposed TENORM rules.

If EQC maintains its informal objection following its next meeting, the department may not adopt the rules until July 24, 2020, which is the last Montana Administrative Register publication date prior to the expiration of the six-month period for adopting the proposed rules under the Montana Administrative Procedure Act.