MDE Maryland Department of the Environment

NORMS and TENORMS in Drilling Wastes

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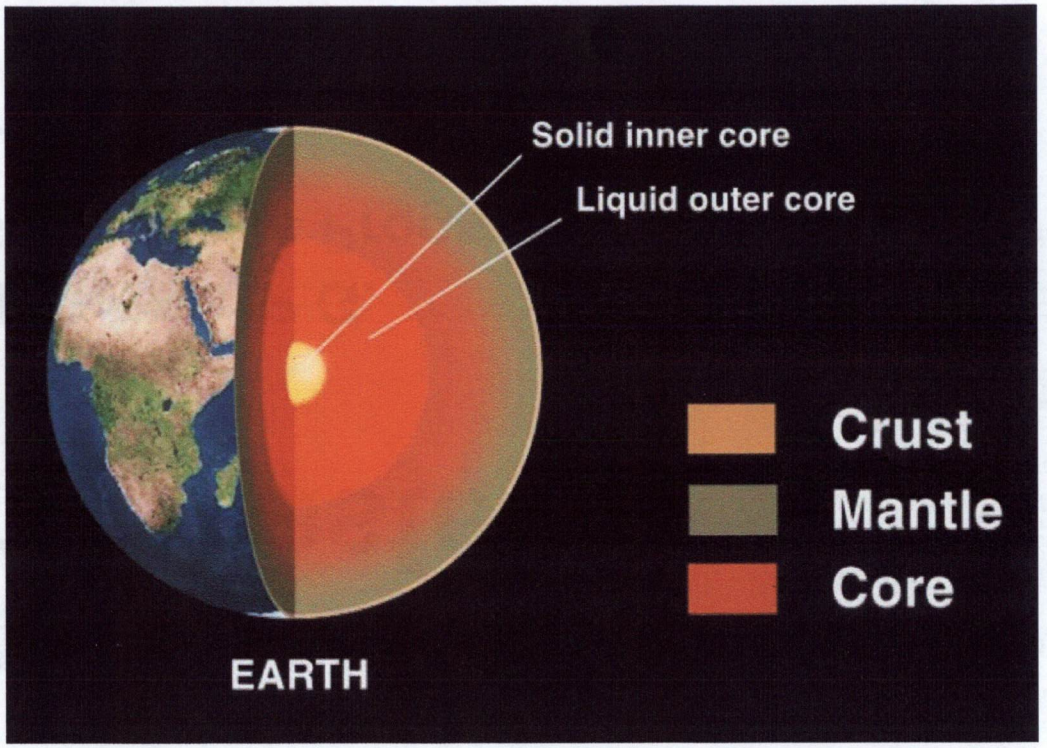
MARYLAND

Geological Background I

- The center of the earth is made up primarily of nickel and iron, but it also contains precious metals and other heavy elements, including radioactive metals, in higher concentrations than are found at the surface. The core is kept very hot by the decay of these radioactive elements, much like a natural nuclear reactor!
- Over time these metals move nearer the surface through volcanism and other tectonic activity, are eroded, and are deposited as sediments in the sea. These sediments contain some of the radioactive elements.



From Wikipedia, http://wsc10science.wikispaces.com/Earth+Structure, Accessed on 5/9/2014.

Geological Background II

- Over more time, these sediments can turn in to rocks and be uplifted. The shales of the Marcellus, and those at the surface in Western Maryland, are sedimentary rocks. These rocks contain naturally occurring radioactive material (NORM).
- During mineral mining, coal mining, and oil and gas production, NORM can be brought to the surface as waste rock, in cuttings and in produced water.
- Solids from produced water, and scale that may build up on pipes can contain a higher concentration than the original NORM; these are called ""technologically enhanced naturally occurring radioactive material", or "TENORMS".

From MDE/LMA/SWP files – Jenkins SS Site/Mine, Allegany County.

Radium Values for Common Materials

- According to EPA, the average level of radium in soil ranges from less than 1 to slightly more than 4 pCi/gram ranging from a low of 0.2 to a high of 4.2 pCi/gram for the samples surveyed.
- In geothermal well production waste – should be similar! - EPA reports a low of 10, average of 132, and a high of 254 pCi/gram.
- In oil and gas production waste, EPA reports a range of 0.1 tp 9,000 pCi/gm in the production water – but <0.25 to over 100,000 pCi/gm in pipe and tank scale.
- In sewage sludge from typical WWTPs, EPA reports a range from low of non-detect, average of 2, and high of 47 pCi/gram.
- In coal fly ash – sort of a TENORM – EPA reports a range from low of 2, average of 5.8, and high of 9.7 pCi/gram.

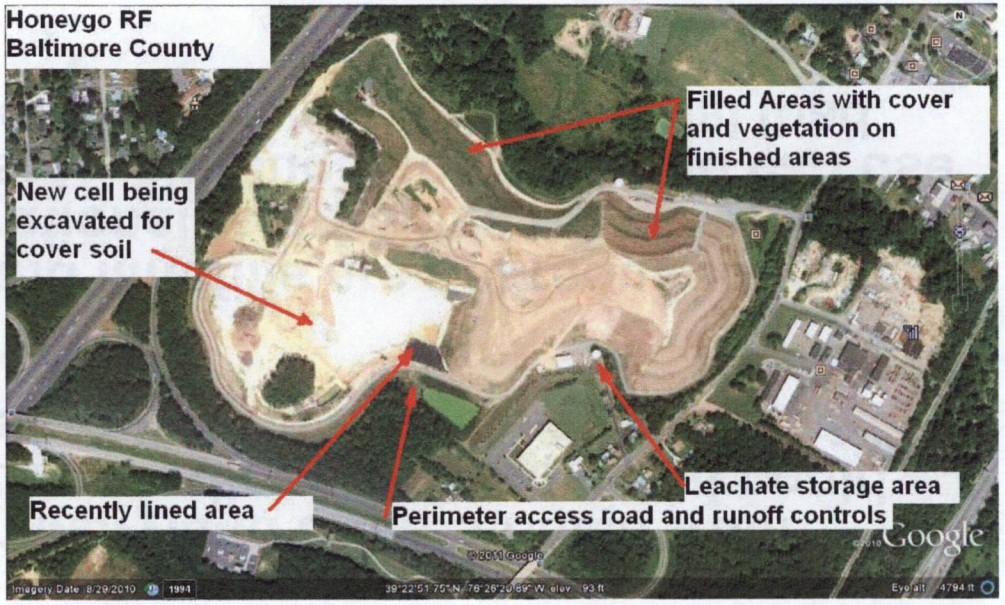
From EPA webpage entitled "Summary Table of Reported Concentrations of Radiation in TENORM", http://www.epa.gov/rpdweb00/tenorm/sources.html#summary-table , accessed on 5/15/2014.

Disposal Options

- The federal government does not regulate NORMs and TENORMs.
- Instead, regulation of NORMS and TENORMS is left to individual states.
- Municipal waste landfills in Maryland are restricted from accepting regulated hazardous radioactive waste, but could accept or reject unregulated radioactive waste at their discretion.
- Unlike some states, Maryland landfills are not required to have radiation detectors or operational restrictions on the receipt of unregulated radioactive waste, although some do and can use this as a criteria when choosing to reject an individual load.

Landfill Safety

- **The MSW landfills ("Municipal Solid Waste Landfills", or MLFs for short) in MD meet State and EPA design standards, and are capable of safely containing NORMs and TENORMs.**
- **These wastes are not significantly different in chemistry than the other domestic, commercial, institutional, and industrial wastes that the MLFs are designed for and are allowed to accept on a daily basis.**



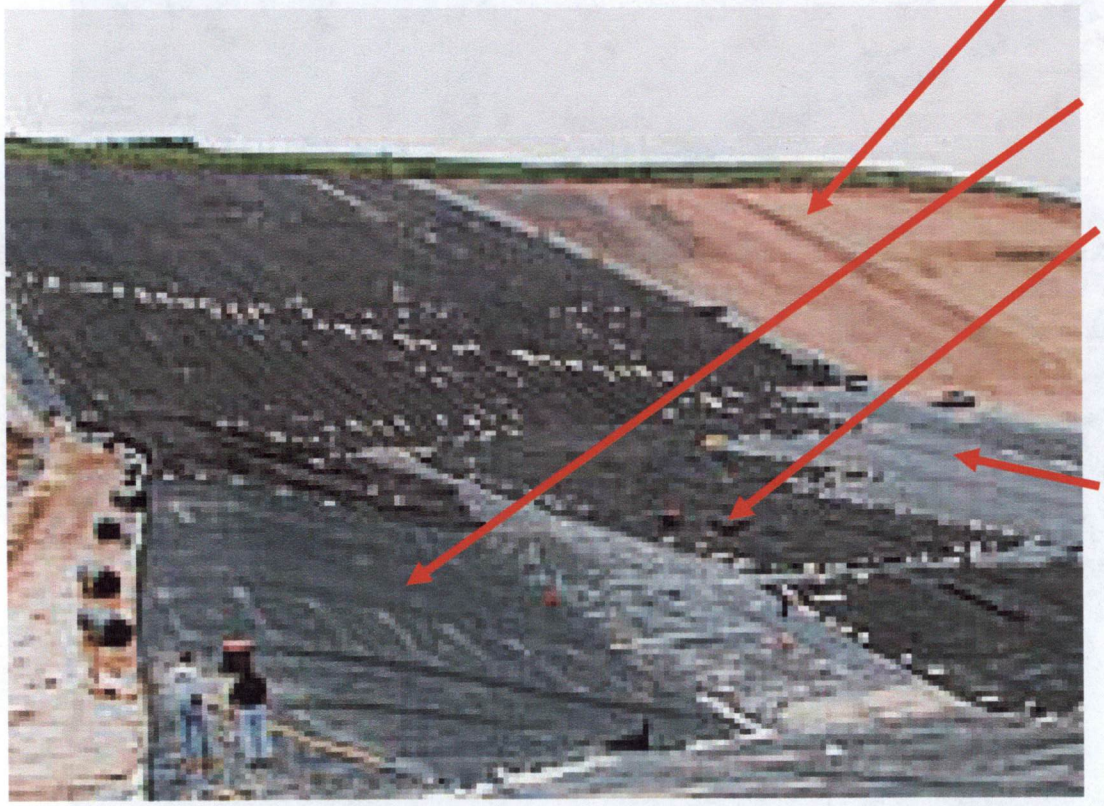
Typical Landfill, from MDE/LMA/SWP files

Landfill Protective Systems

Modern landfills have liners, leachate collection systems, sediment controls, and groundwater monitoring systems to protect the environment and the public health.

Liner and Leachate Collection System being installed at a Washington County landfill in Western Maryland.

Liner Under Construction:



- Compacted clay subbase
- Plastic Liner
- Protective geotextile & drainage layer
- Gravel & pipes
- Then 2’ protective soil layer on top
- Note workers for scale

Other Controls:

Municipal Waste Landfills must also have:

- Sediment erosion and stormwater control system
- Groundwater monitoring systems (except stump dumps)
- Landfill gas monitoring and control system (just municipal and some rubble landfills)
- Leachate management system – onsite treatment or discharge to local wastewater treatment plant.
- Procedures for dust & odor control; managing dragout of mud onto offsite roads; litter control; and vector control.

Groundwater Monitoring

- The MLFs have groundwater monitoring systems that check for a wide range of contaminants that are indicative of the diverse kinds of waste in the landfill.
- The TENORMS are not likely to behave differently, and especially not to move preferentially faster, than all of the other pollutants that could come out of the landfill.
- Therefore, we do not believe we need to add any parameters if these wastes were to go there.
- However, the regulations allow us to specify additional parameters that the landfill operators must use for their sampling procedures if we find that advisable.

Ongoing Evaluation

- The Conference of Radiation Control Program Directors (CRCPD) is working on a white paper on the NORM/TENORM issue.
- Pennsylvania has an extensive sampling program underway to characterize oil and gas production and exploration wastes with respect to radioactivity.
- Details are available at <http://www.portal.state.pa.us/portal/server.pt/community/oil___gas_related_topics/20349/radiation_protection/986697> under "Oil & Gas Development Radiation Study".
- We will be following developments, and may make changes to our landfill permits or to the regulations should we see a need. (Changes to the permits can be done a lot faster than regulatory changes).

Questions?

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