Ohio EPA – DMWM  
ATTN: Michelle Braun  
P.O. Box 1049  
Columbus, OH 43216-1049  

Date: November 1, 2013

COMMENTS ON EARLY STAKEHOLDER OUTREACH FOR NEW REGULATIONS AND RULE REVISIONS FOR TENORM ACCEPTANCE AT SOLID WASTE & TRANSFER FACILITIES

On behalf of our over 100 member environmental/conservation organizations and thousands of individual members throughout the state of Ohio, the Ohio Environmental Council (“OEC”) submits these comments to the Ohio Environmental Protection Agency (“OEPA” or “Agency”) for your consideration regarding proposed concepts for regulating the acceptance of Technologically Enhanced Radioactive Material (“TENORM”).

The scientific analysis and technical review for these comments were provided by Dr. Julie Weatherington-Rice, PhD, CPG, CPSS, Sr. Scientist at Bennett & Williams, and Linda Aller, CPG, R.S., Principal Geologist at Bennett & Williams.

INTRODUCTION

During the legislative debates on Ohio House Bill 59 (the Biennial Budget), which included substantive regulation of Oil and Gas related waste containing TENORM, the OEC and other organizations recommended that the General Assembly remove all provisions concerning the acceptance of shale gas waste materials into Ohio’s solid waste landfills. It was our position that if the current administration wants to have this policy debate, it should be a fair and open debate, with separate legislation introduced appropriately analyzing and accounting for the responsibilities of the industry as well as the three state agencies with statutory responsibility over oil and gas and landfills. This is a very complex issue, with many technical aspects, and should have been given adequate time and consultation with Ohio’s scientific community. Most importantly, public health and safety should be given priority over the need to quickly change Ohio’s solid waste laws to accommodate the shale gas industry in Ohio and the demand for shale gas waste disposal from surrounding states.

The General Assembly, however, did not heed that call. While this is not an opportunity to rehash legislative debate, OEC feels that it is important here to emphasize the affect of HB59’s haphazard development on the rulemaking process. For instance, Ohio EPA
and its partner agencies at the Department of Natural Resources and Department of Health now are confined to a regulatory regime that is not as scientifically developed to be protective of human and environmental health, and is not supported with the adequate state agency resources to monitor radioactive shale gas waste materials. Yet, most significantly, due to the provisions in HB59, Ohio does not adhere to the US EPA, National Academy of Science nor American National Standards Institute (ANSI) definitions of NORM and TENORM. Instead, Ohio has codified a definition that predates horizontal drilling and was created before the current situation existed. To be in agreement with Federal standards, and be fully protective of human health, Ohio needs to re-codify these appropriate definitions.

Nevertheless, as the Agency explained in its Fact Sheet for this early stakeholder outreach, the amendments in HB59 are meant provide for greater coordination between Ohio EPA, Ohio Department of Health, and Ohio Department of Natural Resources in ensuring safe management of oil and gas waste. OEC appreciates this, and hopes that such coordination is achieved for health and safety of Ohio’s solid waste landfill workers and the individuals that live in proximity to landfills.

GENERAL COMMENTS

The Fact Sheet defines the input that Ohio EPA is seeking, including:

- “Is the general regulatory framework proposed the most appropriate? Should the Agency consider any alternative framework?”
- What options are available for improving an identified concept?
- Are there considerations that Agency should take into account when developing a specific concept?
- Is there any information or data the Agency would be aware of when developing program concepts or rule language?”

The following general comments address all four of these requests in two specific concept areas. The first relates to drilling cuttings and the second relates to testing methods for radioactive materials.

Drilling Cuttings

There appears to be an overarching political verses practical confusion on the part of the Agency concerning the separation of NORM drill cuttings and TENORM drilling muds. While politically OPEA seems to think they are separate, in reality, they are not. TENORM is defined as “tank bottoms, spent drilling muds, and pipe scale. TENORM does not include drill cuttings.” However, this legal separation is physically impossible to achieve using current drilling practices. When drilling a well using mud rotary or reverse mud rotary, a thick drilling mud is injected down into the hole, either through or beside the drilling bit. The viscous nature of the muds is used to carry the rock cuttings to the surface. The rock cuttings must be ground up small enough to “float up” with the circulating muds. Once at the surface, the mud slurry, complete with rock cuttings, is poured over a shaker or screen with a fine enough mesh to catch the majority of the rock cuttings (or the cuttings are
allowed to settle), and then the mud is recirculated to pull up more rock cuttings. As a consequence of the drilling process, the collected rock cuttings are coated with a skim of drilling muds - the more viscous the muds, the thicker the coating (all things being equal). Therefore, the concept of NORM rock cuttings and TENORM drilling muds being separate from each other is not based on the physical reality of the drilling process, regardless of what the law or policy states. In order for rock cuttings to be completely separated from drilling muds, the rock cuttings would need to be washed off with water, which would require volumes of water that most likely would become radioactive (depending on concentrations in the mud and dilution) and have to be addressed.

Clearly, by definition, drilling cuttings have been exempted from the definition of TENORM. However, the drilling muds that coat the drilling cuttings are equally clearly classified as TENORM. Because they cannot easily be separated (as discussed above), the regulatory framework should include a provision for testing drilling cuttings (that are by extraction coated with drilling mud, and therefore, adulterated) to ensure compliance with the 5 pCi/g requirement. This concept should be included both in program concepts and in rule language. This would prevent disposal/use of materials that may be higher in radioactivity than envisioned when drilling cuttings were exempted because they were envisioned only as crushed natural materials.

Testing for Radioactivity

While the Ohio EPA fact sheet quotes ORC Section 3734.02(P)(2) and (3) (which discuss the acceptance of TENORM wastes and the 5 pCi/g standard), the footnote at the bottom of the page indicates that “No rules are necessary to implement these statutory requirements.” In fact, there are no standard methods identified in the law for testing to reach a scientifically defensible result of 5 pCi/g. In this portion of the framework, clearly the concept of testing methods needs to be addressed. In this way, the concept could be improved and the results could become scientifically defensible. In this way, again, the health and safety could be safeguarded. The testing methods should apply not only the contaminated drilling cuttings mentioned above, but also the other TENORM materials, including but not limited to tank bottoms, spent drilling muds and pipe scale. The mantra for this regulatory scheme must be: Test all of it, and test it right!

Other states have been trying to address the same issues – how to test and get accepted, accurate results. However, OEC believes (after much research) that it is critical to follow United States Department of Energy (DOE) protocol for sampling and analysis if the Ohio EPA is serious about enforcing the current 5 pCi/g standard. The DOE protocol requires that materials be statistically sampled, the samples jarred and held for 21-days, and analyzed in a laboratory by gamma spectrography to determine the levels of radioactivity. The 21-day timeframe is critical for scientifically defensible determination of the amount of radium 226 and 228 because this method measures gamma emission decay of specific isotope daughters which are then used to backcalculate the amount of radium 226 and 228 (which are alpha or beta emitters as opposed to gamma emitters). If there is not enough time to record the ingrowth of the decay chain, then the accuracy of the concentration of radium 226 and 228 is significantly diminished. The 21-day hold is the DOE protocol and should be used to the exclusion of shorter holding periods or real-time hoop detectors.
Why? Sampling drilling waste loads with hand held geiger counters or on-site gamma hoop recorders will indicate if there is some combination of gamma emitting isotopes in the load, but it will not speciate the isotopes or tell how much of each isotope is in the load. Because radium is an alpha or beta emitter (as opposed to gamma), these readings provide no direct information about how much radium is in the waste load. ORC section 3734.02(P)(2) states that

“The owner or operator of a solid waste facility shall not accept for transfer or disposal technologically enhanced naturally occurring radioactive material if that material contains or is contaminated with radium-226, radium-228, or any combination of radium-226 and radium-228 at concentrations equal to or greater than five picocuries per gram above natural background.”

Similarly, ORC section 3734.02(P)(3) states that a landfill

“may receive and process for purposes other than for transfer or disposal technologically enhanced naturally occurring radioactive material if that material contains or is contaminated with radium-226, radium-228, or any combination of radium-226 and radium-228 at concentrations equal to or greater than five picocuries per gram above natural background.....”

It is important to note that the law requires that the amount of radium-226 and radium-228 be specifically determined. Therefore, the “instant” readings of radioactivity (which only can be used to screen gamma radiation and not to determine the amount of radium 226 and 228 required by the rule) cannot be used for compliance with the rule.

So what are other states doing? For example, the three-day testing that Pennsylvania is considering will provide less than a 50 percent ingrowth curve so a reading of 2 pCi/g +/- 15 pCi/g of uncertainty may or may not be below the 5 pCi/g level. Therefore, the statistical error levels could be far higher than the threshold values. This test may work for Pennsylvania because their waste management process and their testing limits are different. They assume all wastes go into a monofill unless they exceed a threshold limit. Ohio is assuming the materials are “clean” unless they exceed a much lower threshold limit. Because of the significant difference of need and outcome of the Pennsylvania testing regime, OEC does not support it as an option. OEC maintains that proper testing levels cannot be obtained with shorter holding times and handheld devices.

Under proper, federally recognized protocol, reliable data for these levels using anything less rigorous than the 21-day hold laboratory gamma spectrograph test recommended by the Department of Energy is not possible if trying to establish a 5 pCi/g threshold for radium. The 21 day hold, achieves a 98% ingrowth curve. Longer duration holding times beyond 21 days achieve an even higher level of ingrowth (and therefore, an even more scientifically reliable result, if desired).

The DOE invented the testing protocol for such materials and certify the laboratories equipped to test appropriately. These are Federal standards that are also used internationally. We do not think that Ohio would want to use something less rigorous, and we believe, legally, Ohio cannot use something less rigorous. Indeed, according to the Ohio
EPA Fact Sheet, ORC 3734.02(Q) prohibits “acceptance of TENORM without representative analytical results”.

**SPECIFIC COMMENTS**

The Early Stakeholder Outreach Fact Sheet asks stakeholders whether the general framework proposed is the most appropriate, or whether there are alternatives. The following comments provide alternatives to the proposed framework, addressing those issues for rulemaking proposed in the Fact Sheet referring the HB59’s amendments to the Revised Code.

**Monitoring leachate (landfills and transfer facilities) and groundwater (landfills)**

Because ORC 3734.02 (P)(4) authorizes the Director to impose additional rules for TENORM wastes, OEC recommends that there be no exceptions to this “discretionary” adoption of rules. Where radioactive wastes are disposed, testing should be required. The question, then is how often and using what method. Regarding the question of how often, we can look to neighboring states for guidance. The State of West Virginia has adopted a frequency of sampling leachate twice a month. Recognize that West Virginia has recently elected to require drilling wastes to be segregated and disposed in monofills (established in January) and then tests the leachate, twice a month, for radiation. The leachate sample is subjected to the proper DOE standard protocol for testing, (a 21-day hold for lab gamma spectrographic testing at a DOE certified lab to allow for the ingrowth of the Bi-212, Bi-214, Pb-212, and Pb-214 daughters). Obviously, West Virginia required sampling twice a month (approximately fifteen days apart) even though the sampling results of the previous sample are not reported from the laboratory prior to the collection of the next sample.

Bi-monthly testing for radioactivity is a reasonable sampling frequency in leachate, particularly because leachate from landfills is disposed in wastewater treatment plants in Ohio, where no change in radioactivity is effected as part of the “treatment” process. In order to ensure that radioactivity in leachate is just not released into Ohio’s streams, the leachate needs to be tested at this frequency. OEC also believes that leachate testing for radioactivity should be conducted not only until closure and throughout the 30-year post-closure care period, but also should extend basically into perpetuity because the radioactivity will be present into perpetuity.

With regard to sampling of radioactivity in groundwater, groundwater around landfills is frequently sampled for Appendix 1 to OAC 3745-27-10 on a semi-annual basis. OEC recommends that the Appendix 1 list include sampling for radioactivity in groundwater on this semi-annual frequency once any drilling wastes have been accepted by the landfill.

Regardless of the frequency, it is the testing method that lends credence to the results. If the testing method is not robust, then the results are considered not reliable. Based on what we know at this time, OEC recommends that DOE testing protocols be employed for testing wastewater as well as groundwater.
Procedures to ensure that TENORM \( \geq 5 \text{ pCi/g} \) are not accepted

The first question the agency must ask, in developing this regulation, is how the agency will determine background radiation at each site? Assuming the landfills have been taking “rock cuttings” for some period of time, the background levels could already be quite elevated. If this is the case, then public health and safety may be compromised with the addition of further radioactive materials (or, in fact may already be compromised by previous disposal). For worker safety and general health, it would be more realistic to simply require the US EPA-designated background level of 2 pCi/g be used as the background level for all sites. Practically, setting in rule a background of 2 pCi/g means that any TENORM-contaminated materials entering the site would be restricted to less than 7 pCi/g. Without this stipulation, a landfill with existing elevated backgrounds (maybe as high as 10, 15, or 20 pCi/g or more) from NORM rock cuttings as well as other sources, could allow for significantly higher levels of TENORM being allowed on site. The determination of the background levels is not merely an environmental protection issue, but fundamentally is a worker safety concern.

The establishment of a site-wide value (as opposed to trying to determine a controversial background level at each site) makes enforcement more uniform and eliminates controversy about alternate levels and the methods used to establish them. But, more importantly, the emphasis is on protection of the workers, nearby landowners, and citizens and biota downstream of wastewater discharges containing leachate from landfills. The structure of the statute allows the agency to set one background level. The wording in the statute does not prohibit establishment of a standard uniform state-wide background amount. Similarly, the wording of the statute does not specifically require the Agency or the landfill facilities to set site specific background levels. Therefore, given the wording in the statute, OEC recommends that the US EPA-designated background level of 2 pCi/g be established as the state-wide background level.

With regard to disposal of TENORM less than 5 pCi/g from an oil and gas operation (as well as any other wastes from oil and gas drilling operations), OEC recommends that these wastes be segregated at the landfill and disposed in a monofill. Our neighboring states, Pennsylvania, West Virginia, and Michigan spent some time formally discussing the NORM/TENORM issue as it relates to shale development. While testing frequency may vary, in the end, it is our understanding that these states take all solids and semisolids and that contain or possibly contain TENORM as well as NORM and put them into monofills in a landfill. This approach has several advantages. First, the wastes are physically separated from other landfill wastes, thereby preventing co-mingling with other solid waste materials. Second, the leachate is collected separately, tested separately, and can be disposed separately. Therefore, if there is an identified issue with radioactivity in the leachate, there is a smaller volume of leachate to address. This is an advantage not only from the standpoint of protection of the environment, but also an advantage to the landfill operator in that costs to treat/dispose of smaller volumes of affected leachate is more economical than co-mingled large volumes. Third, testing for a time frame longer than a typical 30-year post-closure requirement could be implemented with a minimal cost for the owner (again, because the wastes are segregated). In summary, three of our neighboring states (including Pennsylvania, which has been on the leading edge of the good and bad of shale gas drilling)
have determined that segregation of wastes is not only a good idea, but a mandatory requirement for disposal. OEC recommends that Ohio adopt this framework as well.

**Solidification Processing of TENORM**

OEC believes that downblending, or the mixing (dilution) of radioactive waste materials with other materials to meet the safe threshold of radioactive waste materials is an unacceptable practice for the state of Ohio. Rather than "diluting" the radioactive material as is intended, the process actually creates more radioactive waste material by turning the once-benign filler material into radioactive material. In fact, we can find no other states that allow for the practice of "downblending" of NORM or TENORM. The whole idea of “mixing” to downblend TENORM to below 5 pCi/g only works if the radium is chemically bound so the radium and other daughter products do not leach from the blended mixture when exposed to precipitation and/or leachate. While it is interesting that the landfills will be able to downblend the materials on site, if they are not able to then landfill this material, what are they going to do with their piles of downblended materials? If it is shipped offsite, will the landfill then become the generator of the waste? Clearly, once the downblended waste is present at the landfill site, the most profitable and easy way to dispose of the wastes is for the landfill to request to be able to landfill and/or use the downblended wastes for beneficial uses on site. OEC believes that this is a slippery slope that should be avoided. OEC strongly objects to any rule that encourages downblending at a landfill site and/or any subsequent rule/law adoption that allows the downblended material to be disposed/used onsite.

**Related Solid Waste Facility Prohibitions**

The Early Stakeholder Outreach Fact Sheet indicates that no rules are required to implement statutory requirements under Revised Code §3734.02(Q), prohibiting acceptance of TENORM without representative analytical results. OEC, however, disagrees. It is important to codify specific and consistent testing criteria based on accepted sound science. As explained above, Ohio should follow DOE protocol for the testing of all radioactive or possibly radioactive material as well as leachate and groundwater. This necessitates the promulgation of rules to require statistical sampling of the materials at the drilling sites and a 21-day hold for lab gamma spectrographic testing at a DOE certified lab.

**CONCLUSION**

The General Assembly unfortunately handicapped the state Agencies’ proper and effective regulation of radioactive material by adopting a definition of regulated TENORM that attempts to exempt most radioactive material from Ohio’s oil and gas operations. Nevertheless, Ohio EPA has a duty to the law to regulate this material and a duty to the landfill workers, neighbors of landfills, and individuals and biota downstream of wastewater discharges accepting leachate from landfills accepting this waste to do so in the most protective manner possible. This duty can be carried out if Ohio EPA’s regulations require:

- strict adherence to proper DOE testing protocols for characterization of radium-226 and 228 prior to shipment of the drilling wastes to landfills,
• mandatory leachate testing for radioactivity at a frequency not less than twice per month using DOE testing protocols;

• mandatory testing of groundwater for radioactivity in all groundwater monitoring wells around a site disposing of TENORM less than 5 pCi/g on a semi-annual basis using DOE testing protocols;

• establishment of a state-wide background level of the US EPA-recognized 2 pCi/g background;

• and acceptance and monofilling of only material less than 5 pCi/g above the 2 pCi/g background.

Thank you for the opportunity to comment. If you have any questions, feel free to contact me at Tdougherty@theOEC.org or 614.487.7506.

Sincerely,

[Signature]

Trent A. Dougherty, Esq.
Managing Director of Legal Affairs

CC: Ohio Department of Natural Resources – Division or Oil & Gas Resources Management
CC: Dr. Julie Weatherington-Rice, PhD, CPG, CPSS,
CC: Linda Aller, CPG, R.S.