33 C.S.R. 1. SOLID WASTE MANAGEMENT RULE
RESPONSE TO COMMENTS
2015 Rule Making

On June 30, 2014, the Division of Water & Waste Management (DWWM) commenced a thirty day public comment period and subsequently held a public hearing on July 30, 2014 to accept oral comments on proposed revisions to West Virginia's Legislative Rule *Solid Waste Management Rule* ("Rule"). DWWM proposed the following modifications to the Rule:

1. Developed rules relating to the disposal of drill cuttings and associated drilling waste generated from well sites at commercial solid waste facilities. The proposed rule establishes limits for unique toxins associated with drill cuttings and associated drilling wastes and requires radiation and leachate monitoring at all facilities receiving drill cuttings and associated drilling wastes.

2. Prohibit the use of shale and clay materials in the protective cover zone of landfill liner systems.

3. Prohibit the use of drill cuttings and associated drilling wastes in the first 8 feet of waste placed on the protective cover zone of waste cells. This prohibition does not include waste cells dedicated to the disposal of drill cuttings and associated drilling wastes.

DWWM accepted oral comments at the hearing and written comments through July 30, 2014. Thirteen commenters submitted written comments regarding the proposed revisions, and four commenters provided verbal and written comments. No comments were received after the submission deadline. DWWM addresses both the written and oral comments below.

Written Comments (submitted via email, mail, or hand delivery)

The following individuals submitted only written comments.

1. **COMMENTERS:** Berkeley County Solid Waste Authority by Clint Hogbin, William Madert, Jefferson County Solid Waste Authority by William Madert, Layne Diehl, Kristin Loken, Matt Kushin, Chanda Wright, John Sheely

COMMENT: Commenters request that the DEP modify the proposed rule to add language prohibiting the disposal of drill cuttings and associated drilling waste in solid waste facilities located within a karst region.

RESPONSE: As defined in 33 C S R 1, Section 2.119, drill cuttings and associated drilling wastes are regulated as solid waste. As such, the WVDEP allows such waste to be disposed of at permitted solid waste facilities within the state.

2. **COMMENTER:** John Sheely

COMMENT: Commenter requests that the DEP modify the definition of drill cuttings, and add definitions for wastes generated in the hydraulic fracturing process.

RESPONSE: The DEP appreciates the comment and has modified the definition of "drill cuttings and associated drilling waste" to clarify that such term does not include wastes generated in the hydraulic fracturing process and defined the terms "completion waste" and "production waste," which are wastes associated with the hydraulic fracturing process.

3. **COMMENTER:** Berkeley County Solid Waste Authority by Clint Hogbin

COMMENT: Commenter requests that the DEP modify the proposed rule to add language requiring solid waste facilities who are not constructing a separate cell for the disposal of drill cuttings and associated drilling waste to manage their intake of drill cuttings and associated drilling waste in a manner that will not affect the facilities ability to receive municipal solid waste as outlined in the facilities disposal permit and Certificate of Need issued by the Public Service Commission.

RESPONSE: The language in the proposed Rule does nothing to affect the long-standing law that a solid waste facility must fulfill the requirements of its Certificate of Need as issued by the Public Service Commission.

4. **COMMENTER:** Vicky Hutzler

COMMENT: Commenter requests that the DEP prohibit the disposal of drilling waste in state approved solid waste facilities.

RESPONSE: Please see Response to Comment 2 above.

5. **COMMENTER:** Hanna Law Office by Samuel F. Hanna on behalf of Republic Services

COMMENT A: Commenter believes the frequency of sampling/testing for the disposal of drill cuttings and associated drilling waste is unnecessary.

RESPONSE A: DEP's goal regarding the frequency with which samples are to be taken is to obtain a representative sample from the waste in order to make a determination regarding the proper disposal of the waste. Consideration for an alternative sampling frequency will be on a case by case basis.

COMMENT B: Commenter requests that the DEP eliminate the requirement to provide analytical results for TCLP Metals, TCLP Volatile Organic Compounds, and TCLP Semi-volatile Organic Compounds.

RESPONSE B: The Toxicity Characteristic Leaching Procedure (TCLP) was developed specifically to characterize materials for landfill disposal. The DEP believes requiring this analysis is appropriate for determining the proper disposal of this waste stream.

COMMENT C: Commenter supports the DEP's requirement that facilities that accept drill cuttings and associated drilling wastes for disposal must have on-site radiation detection equipment capable of determining dose rate and the presence of contamination on a vehicle.

RESPONSE C: Thank you for the comment and support.

COMMENT D: Commenter is concerned that the requirement to determine the combined concentration of Radium 226 and Radium 228 may cause issues at the solid waste facility. Specifically, the commenter is of the understanding that the only State approved method for determining the concentration is a test method which takes 21 days to obtain results, and raises the question of what the solid waste facilities are supposed to do with the material during this time.

RESPONSE D: The solid waste facility cannot take possession of the waste until it is approved for disposal; therefore it is the generator's responsibility to obtain combined concentration results for the waste. There is no requirement in the proposed Rule that the solid waste facility must store the vehicle while these results are obtained.

COMMENT E: Commenter states that it is unclear what the term "average local background" refers to and how often it must be determined.

RESPONSE E: The word "average" has been removed from the statement to which the commenter referred. The radiation monitoring equipment at the solid waste facility must be capable of determining the local background radiation level continually.

COMMENT F: Commenter suggests that DEP develop specific procedures that facilities should follow when loads of wastes need to be rejected due to radiological content.

RESPONSE F: Thank you for the comment and suggestion. DEP will take it under advisement going forward with the development of rules for the proper disposal of this waste stream.

6. **COMMENTER:** Waste Management, Inc. by Michael Rind and Eli Brill

COMMENT A: Commenter suggests that the definition of "drill cuttings and associated drilling wastes" is unclear and requests that DEP define drilling waste into separate categories.

RESPONSE A: Please see Response to Comment 2 above.

COMMENT B: Commenter requests that Section 5.6.c.1.B be modified to require the generator to obtain a sample from the lateral portion of each well bore unless otherwise approved by the Secretary.

RESPONSE B: The Solid Waste Management Rule regulates solid waste facilities, not solid waste generators. As such Section 5.6.c.1.B has been modified as follows:

5.6.c.1.B. The facility must obtain from the generator results from at least one composite sample from the lateral or horizontal portion of each well bore unless otherwise approved by the Secretary. The American Petroleum Institute (API) well number must be included in the profile.

COMMENT C: Commenter suggests revising the proposed sampling procedures in Section 5.6.c.1.B such that the "composite analysis can be submitted from a prior adjacent well pad with the same drill waste generating process to obtain disposal approval for the future pad".

RESPONSE C: Please see Response to Comment 5A above.

COMMENT D: Commenter believes that a site specific Radiation plan is needed to confirm compliance with West Virginia's Emergency Rule Making policies and procedures.

RESPONSE D: DWWM filed the Emergency Rule in conformance with the Administrative Procedures Act, W. Va. Code § 29A-3-15, which does not require the submittal of a site-specific radiation plan, nor does the Rule's authorizing statute require such a submittal. The public comment period and hearing was not for the Emergency Rule, but as part of the Legislative Rule Making process, as per W. Va. Code § 29A-3-5. The Commenter should contact DWWM's Office of Solid Waste with any questions and/or concerns regarding the Emergency Rule Making process.

COMMENT E: Commenter disagrees with the adoption of a 5pCi/gr threshold for acceptance of drill cuttings and associated wastes.

RESPONSE E: DEP appreciates your comment.

COMMENT F: Commenter feels that radiation testing should be performed by the generator during the waste characterization process.

RESPONSE F: Please see Response to Comment 6B above.

COMMENT G: The commenter believes the proposed rule should not be adopted as it is currently drafted, but should incorporate changes set for by their comments.

RESPONSE G: DEP appreciates your comment.

7. **COMMENTER:** IOGA West Virginia by Bob Radabaugh

COMMENT A: Commenter believes the comment period for the proposed rule should be extended.

RESPONSE A: DEP appreciates your comment; however the comment period for proposed Legislative Rules is set by statue and will not be extended.

COMMENT B: Commenter requests to clarify the definition of "drill cuttings and associated drilling wastes as follows:

"…the broken bits of solid material and drilling mud generated from horizontal drilling operations and removed from a borehole drilled by rotary, percussion, or auger methods".

RESPONSE B: Section 5.6 of the proposed Rule is titled" Requirements for the Disposal of Drilling Waste Generated from Horizontal Drill Sites," therefore, there is no need to modify the proposed definition based on this request. However, the definition has been modified as explained in Response to Comment 2 above.

COMMENT C: Representative sampling should be authorized for purposes of waste profiling where composition is expected to be homogeneous.

RESPONSE C: Please see Response to Comment 5A above.

COMMENT D: WVDEP should tailor its list of sampling parameters and analyses for purposes of waste characterization. Commenter states that oil and gas exploration and production waste, including drill cuttings is exempt from regulation as hazardous waste under Subtitle C of RCRA.

RESPONSE D: 40 C.F.R. § 261.4(b)(5) states that oil and gas exploration and production waste, including drill cuttings, is a waste stream that is excluded from hazardous waste regulation under Subtitle C of RCRA. The proposed Rule does not regulate these wastes as hazardous waste; rather the Rule proposes to allow the possible disposal of this waste in permitted solid waste landfills so long as the sampling results from the TCLP analyses do not exceed the limits of 40 C.F.R. § 261.24. Further, 33 C.S.R. 1 § 4.13.a.2 states, "Nothing must limit or affect the power of the Secretary to prohibit or require special handling requirements determined to be necessary to protect the environment or the health, safety, and welfare of the public".

COMMENT E: Commenter requests clarification of WVDEP's Basis for New Radiation Limitations.

RESPONSE E: The proposed radiation limitation was based on the West Virginia Department of Health Radiological Health Rules, 64 C.S.R. 23 § 16.

COMMENT F: Commenter suggests that the statutory deadline for the installation of radiation monitors be inserted into the Rule.

RESPONSE F: West Virginia Code § 22-15-8(h) states that, "Any solid waste facility taking drill cuttings and drilling waste must install radiation monitors by January 1, 2015"; therefore there is no need to restate this information in the proposed Rule.

8. **COMMENTER:** WVONGA by Nicholas S. DeMarco

COMMENT A: Commenter requests the DEP modify the definition of "drill cuttings and associated drill wastes".

RESPONSE A: Please see Response to Comment 2 above.

COMMENT B: Commenter believes the frequency of sampling/testing for the disposal of drill cuttings and associated drilling waste is unnecessary.

RESPONSE B: Please see Response to Comment 5A above

COMMENT C: Commenter disagrees with the requirements of Subsection 5.6.c.1.C.1 which requires the disposal facility to reject wastes that exceed the TCLP standards found in 40 C.F.R. § 261.24.

RESPONSE C: Please see Response to Comment 7D above.

COMMENT D: Commenter suggests that the proposed rule be revised to allow disposal of all cuttings that do not exceed ten microroentgens per hour above average local background. If drill cuttings trigger the radiation monitor at that level, the cuttings could be further evaluated for disposal as is done in other states.

RESPONSE D: The proposed language as written is what the commenter is recommending.

9. **COMMENTER:** Bowles Rice by Leonard B. Knee

COMMENT A: The definition of "Drill Cuttings and Associated Drilling Wastes" is overly broad and not consistent with legislative intent.

RESPONSE A: Please see Response to Comment 2 above.

COMMENT B: The liner requirements for cells dedicated to the disposal of drill cuttings and associated wastes should exceed those for cells dedicated to ordinary solid waste.

RESPONSE B: The liner requirements already established in the Rule are sufficient for the separate cell dedicated to drill cuttings, so long as the waste does not exceed the parameters set forth in the proposed amendments.

COMMENT C: The sampling requirement for each well bore from which waste will be accepted is ambiguous.

RESPONSE C: Please see Response to Comment 6B above.

COMMENT D: The proposed rule appears contradictory with respect to materials which may be used in the first eight feet of the disposal facility.

RESPONSE D: The proposed Rule is not contradictory. The proposed language allows for earthen material to be used in the first eight feet of waste of a dedicated cell for the disposal of drill cuttings and associated wastes if a facility has obtained permission to construct such a cell under subsection 5.6 of the proposed Rule. It does not allow earthen material to be used in the first eight feet of waste in any other disposal cell.

COMMENT E: The proposed rule does not prescribe a method for disposal of leachate from cells dedicated to the disposal of drill cutting or associated drilling waste. The commenter believes that the leachate should be disposed of in an approved underground injection well.

RESPONSE E: The proposed Rule requires that the leachate collection system in the dedicated cell be separated from the collection system of the rest of the facility for the purpose of obtaining samples derived only from the dedicated cell prior to it mixing with the leachate generated from the rest of the facility. This requirement would allow solid waste facilities to treat and dispose of the leachate from the dedicated cell separately if needed. No compelling reason has been shown for the need to dispose of this leachate in injection wells.

COMMENT F: Surface water bodies and groundwater monitoring wells near landfills accepting drill cuttings and associated drilling waste should be sampled for the same analytes as the leachate from cells dedicated to these wastes.

RESPONSE F: This comment is outside the scope of the proposed amendments and outside the authority of the Solid Waste Management Rule and, therefore, no response is required.

COMMENT G: The proposed rule should contain a greater daily cover requirement for cells dedicated to drill cuttings and associated drilling waste than what is required for ordinary solid waste.

RESPONSE G: The daily cover requirements already established in the Rule are sufficient for the separate cell dedicated to drill cuttings, so long as the waste does not exceed the parameters set forth in the proposed amendments.

COMMENT H: The bonds required for facilities accepting drill cuttings and associated drilling waste should be higher than those required for traditional solid waste disposal facilities.

RESPONSE H: The bond requirements established in the Rule are sufficient for the separate cell dedicated to drill cuttings.

COMMENT I: Workers and employees at facilities which accept drill cuttings and associated drilling waste should be provided additional safety training and appropriate personal protective equipment.

RESPONSE I: This comment is outside the scope of the proposed amendments and outside the authority of the Solid Waste Management Rule and, therefore, no response is required.

COMMENT J: Facilities accepting drill cuttings and associated drilling wastes should be required to make periodic reports of the amount of these wastes accepted.

RESPONSE J: Solid waste facilities are required to submit a monthly tonnage report to the DEP outlining the tonnage and type of waste disposed of at the facility. The proposed amendments do not affect that long-standing requirement.

10. **COMMENTER:** James O'reilly

COMMENT: Commenter requests that the DEP decrease the permissible picoCuries level in the proposed Rule from 5 pCi/gr to no greater than 2 pCi/gr.

RESPONSE: The DEP appreciates the comment but believes 5 pCi/gr is an appropriate parameter based on the West Virginia Department of Health Radiological Health Rules, 64 C.S.R. 23 § 16.

11. **COMMENTER:** Austin Masters Services by Kevin Kosko

COMMENT A: Please clarify the difference between "drill cuttings and associated waste" and "all wastes generated in the exploration, production and development of oil and natural gas and associated activities" if any.

RESPONSE A: Please see Response to Comment 2 above.

COMMENT B: Wastes such as tank bottom sludge, injection well filter socks, injection well filtrate, recycle facility filter cake and pipe scale, are typically much more radioactive than drill cuttings and drilling mud. Are these more radioactive waste forms exempt from regulation?

RESPONSE B: These types of wastes are not exempt from regulation; however the regulation of completion and production activities is beyond the scope of this amendment as authorized by W. Va. Code § 22-15-8. The DEP is developing regulations to manage the disposal of these types of wastes.

COMMENT C: If the intent of the revised rule is to protect the environment and limit radiation exposure to workers and the general public; regulation of drill cuttings and drill mud exclusively seems to miss the mark.

RESPONSE C: See Response B.

COMMENT D: Commenter asks what the protocol will be if the waste is found to have a combined Radium 226 and Radium 228 concentration >270 pCi/gram (in violation of DOT shipping rules) once it has been transported to the solid waste facility.

RESPONSE D: The requirements in the proposed Rule regarding the disposal of drill cuttings and associated wastes are to be considered minimum requirements. Solid waste facilities have the option to require additional information above and beyond that which is required by the proposed Rule. The solid waste facility cannot take possession of the waste until it is approved for disposal. Waste that violates DOT's shipping rules should never be transported to a solid waste facility. It is the generators responsibility to ensure that this scenario does not occur.

COMMENT E: The proposed rule does not require radium analysis prior to putting a load of TENORM waste on public roads.

RESPONSE E: The DEP does not know what the Commenter means by TENORM waste. Further, the Solid Waste Management Rule only regulates landfills, not oil and gas operations. Therefore, the comment is outside the scope of the proposed amendments and no response is required.

COMMENT F: Will the fixed radiation monitors alarm if waste exceed 5 pCi/gram above natural background levels?

RESPONSE F: The fixed monitors will measure exposure rates, not concentration. If a waste is found to exceed ten microroentgens per hour, the waste must be evaluated for combined concentration of Radium 226 and Radium 228.

COMMENT G: Will solid waste facility staff be properly trained in the operation of the radiation monitoring equipment?

RESPONSE G: The proposed Rule requires solid waste facilities disposing of drill cuttings and associated drilling wastes to submit a Radiation Monitoring Plan for review. The DEP will require proper training protocol be included in this plan.

COMMENT H: What if any restrictions will WV place on waste destined for disposal at a properly permitted out of state landfill facility?

RESPONSE H: The DEP does not regulate solid waste destined for solid waste facilities in other states.

12. **COMMENTER:** Brooke County Landfill and Wetzel County Landfill by William F. Fox, Jr., Esquire

COMMENT: Commenter does not agree with the proposed amendment to the protective cover requirements that states, "Clay and shale may not be used in the protective cover zone." Commenter states that shale material from both sites have always met the requirements of current regulations, and both facilities, "have already screened onsite shale material for 2014 construction projects at a significant financial cost to the company and the requirement to haul in a different material this is not "shale" from a quarry would cost in excess of $200,000."

RESPONSE: The DEP believes that the test used to determine the permeability of the protective cover is inadequate for this material, because it does not take into account compaction of the material. When shale is compacted, it breaks down into smaller particles, making it less permeable; therefore, the DEP does not consider this material adequate for use in the protective cover zone of a landfill liner system. This requirement does not affect the facility's ability to use shale on construction projects approved prior to the passage of this Rule.

13. **COMMENTER:** Sierra Club West Virginia Chapter by James Kotcon

COMMENT A: Commenter requests a 10-day extension on the comment period to allow time to submit additional comments.

RESPONSE A: See Response to Comment 7A

COMMENT B: Commenter agrees with the proposed amendment which prohibits the use of clay or shale in the protective cover zone.

RESPONSE B: Thank you for your comment and support.

COMMENT C: Commenter opposes the proposed modification in section 4.5.d.8, allowing drilling waste in the first 8 feet of waste placed in the dedicated cell. Commenter believes the language should be modified to state that drilling waste placed in the first 8 feet of waste should not be capable of puncturing the liner and have a permeability greater than 1 $X10^{-3}$ cm/sec.

RESPONSE C: The proposed amendment does nothing to affect the long-standing requirement that material placed in the first 8 feet of waste may not contain material capable of penetrating or puncturing the protective cover. Only drilling waste may be disposed in the dedicated cell; therefore, permeability requirements for the waste are not required.

COMMENT D: Commenter supports the proposed amendment requiring the leachate from the dedicated cell to be separate from the leachate in the municipal solid waste cells.

RESPONSE D: Thank you for your comment and support.

COMMENT E: Commenter recommends modifying proposed section 5.6.b.2 to state that the leachate collection and detection lines within the dedicated cell be designed to allow independent sampling of each.

RESPONSE E: The DEP appreciates the comment and will take it under advisement going forward with the development of rules for the proper disposal of this waste stream.

COMMENT F: Commenter recommends weekly sampling of the leachate from the dedicated cell.

RESPONSE F: Thank you for your comment.

COMMENT G: Commenter recommends modifying the proposed Rule to require the leachate from the dedicated cell to be sampled and analyzed for the constituents in Appendix I, as required for other municipal waste cells in section 4.8.d.

RESPONSE G: The proposed amendments do nothing to affect the long-standing requirements of section 4.8.d.

COMMENT H: Commenter opposes allowing for a "minor permit modification" to accept drilling wastes and suggests that the acceptance of this waste stream be done through a "major permit modification".

RESPONSE H: By definition, drill cuttings and associated drilling wastes are solid waste. The disposal of solid waste in a solid waste landfill does not constitute a major permit modification per 33 C.S.R. 1.

COMMENT I: Commenter recommends that the words, "unless otherwise approved by the Secretary" be deleted from section 5.6.c.1.B. because it is overly broad.

RESPONSE I: DEP appreciates the comment.

COMMENT J: Commenter recommends that proposed section 5.6.c.1.C be modified by deleting the words "special waste minor permit modification application" and replacing them with the words "composite sample collected pursuant to section 5.6.c.1.B". Commenter believes the waste will be buried before sampling results are obtained.

RESPONSE J: The proposed amendment does nothing to allow a solid waste facility to accept drilling cuttings and associated drilling wastes for disposal without first obtaining sampling results for the material and obtaining approval for disposal of such waste from the DEP.

COMMENT K: The commenter believes the rule should require that loads rejected by the landfills be tracked and that the well operator should be required to identify the ultimate disposal location for the waste.

RESPONSE K: The Solid Waste Management Rule regulates solid waste facilities. As such this comment is beyond the scope of the proposed amendments and the authority of this Rule and does not require a response.

COMMENT L: A new section should be added to clarify the methods of disposal for leachate when parameters such as Radium exceed Safe Drinking Water Act standards.

RESPONSE L: The Solid Waste Management Rule regulates solid waste facilities. As such this comment is beyond the scope of the proposed amendments and the authority of this Rule and does not require a response.

Oral and Written Comments

The following individuals submitted both oral and written comments.

14. **COMMENTER:** Wetzel County Solid Waste Authority (WCSWA) by Mark Cochran

COMMENT A: Commenter voiced concerns regarding heavy metals and radioactive materials in drilling waste and the possibility of those heavy metals and radioactive materials being present in landfill leachate. He voiced concerns with regard to the treatment of landfill leachate at conventional waste water treatment facilities and questioned the wisdom of doing so.

RESPONSE A: The DEP appreciates the comment and understands the Commenters concerns. Waste water treatment plants throughout the State of West Virginia are issued NPDES permits for their discharges into the waters of the State. Leachate from solid waste facilities must meet pre-treatment requirements for a particular waste water treatment plant before the treatment plant will accept their leachate. There is nothing in the proposed amendments that alters this long-standing requirement.

COMMENT B: Commenter believes facilities accepting drill cuttings and associated drilling waste should do so through a major permit modification of the facilities solid waste permit.

RESPONSE B: By definition drill cuttings and associated drilling wastes are solid waste. The disposal of solid waste in a solid waste landfill does not constitute a major permit modification per 33 C.S.R. 1.

COMMENT C: Comment questions the capability of landfill liner systems with regard to the disposal of drill cutting and associated drilling wastes.

RESPONSE C: Please see Response to Comment 9B above.

COMMENT D: Commenter supplied the DEP with a document on behalf of the WCSWA.

RESPONSE D: The DEP appreciates WCSWA submittal of the document and will take into consideration.

15. **COMMENTER:** WCSWA by Bill Hughes

COMMENT: Commenter states that the DEP has been allowing uncharacterized drilling waste to be disposed of in solid waste facilities and the proposed Rule does nothing to change this process.

RESPONSE: This comment is patently false and without merit. The Commenter has spent countless hours at the DEP office in Kanawha City obtaining information regarding the disposal of drilling waste through Freedom of Information Act Requests. DEP has provided him the information he has requested and has discussed specific special waste permits for the disposal of drilling waste issued to multiple solid waste facilities. A waste characterization form must be submitted to the DEP before a special waste permit will be considered, let alone issued for the disposal of these wastes. The proposed Rule does nothing to change the long-standing requirement that solid waste facilities submit a waste characterization form when requesting any special waste permit.

16. **COMMENTER:** West Virginia Rivers Coalition by Angie Rosser

COMMENT: Commenter stated that she believes the DEP must make every assurance in the proposed Rule that the best technology be used in monitoring including a complete set of parameters, particularly at the point of discharge into surface waters.

RESPONSE: The DEP appreciates the comment.

17. **COMMENTER:** West Virginia Mountain Party by Tom Rhule

COMMENT A: Commenter stated he had concerns regarding the bonding at landfills and believes the bonding is insufficient.

RESPONSE A: Please see Response to Comment 9H above.

COMMENT B: Commenter expressed several concerns regarding the exploration and production of oil and natural gas from horizontal well sites within the State.

RESPONSE B: These comments are beyond the scope of the proposed amendments and do not require a response.

Johnston, David L

From: DEP Comments
Sent: Sunday, July 20, 2014 3:44 PM
To: Johnston, David L
Cc: Patel, Sudhirbhai
Subject: FW: Proposed Title 33 CSR1 --- Comments from Berkeley County Solid Waste Authority

Here you go.

From: Clint Hogbin [mailto:crhogbin@gmail.com]
Sent: Sunday, July 20, 2014 3:28 PM
To: DEP Comments
Cc: 'Clint Hogbin'
Subject: Proposed Title 33 CSR1 --- Comments from Berkeley County Solid Waste Authority

July 20, 2014

To whom it may concern,

Please accept these comments from the Berkeley County Solid Waste Authority (BCSWA) in regard to the proposed Title 33 CSR1 horizontal drill cutting waste rule.

During the course of the 2014 legislative session and the subsequent special session, many legislators from Berkeley County and other Eastern Panhandle counties were advised that HB107 prohibited drill cutting waste from being placed in landfills that are situated in counties that contains karst regions. Some legislators specifically were advised that clarifications would be placed in the subsequent rule that would clearly prohibit drill cutting waste from being placed in landfills that are situated in counties that contains karst regions.

However, the BCSWA can find no such language in the proposed rule. The justification for the proposed rule change would be that landfills with special cells and those without special cells are to be subject to equal treatment with similar regulation regarding drill cuttings from horizontal wells. Therefore, we respectfully request that
that a new section be implemented in the rule as shown below:

5.6.d Karst region prohibition:

5.6.d.1 A commercial solid waste facility that is located in a county that is, in whole or in part, within a karst region as determined by the West Virginia Geologic and Economic Survey, may not accept drill cuttings and drilling waste generated from horizontal well sites.

In addition, the equal treatment justification also implies that landfills accepting the drill cuttings WITHIN their caps (in regular MSW cells) should not be permitted to reduce their

intake of regular municipal solid waste for that reason, as HB107 precludes a landfill with a special cell from reducing its municipal solid waste intake. Therefore, a second important amendment should be implemented as shown below:

5.6.d Restrictions on the acceptance of drill cuttings and drilling waste from horizontal well sites:

5.6.d.2 Any solid waste facility that has been authorized to accept drill cuttings and drilling waste, whether or not it is required to count such cuttings and waste towards its monthly tonnage cap, must manage its intake to enable it to accept all municipal solid waste that it would otherwise have been able to lawfully accept.

While horizontal drilling activity does not occur in Berkeley County, the drilling waste in being landfilled in two landfills in our region about 45 – 65 miles north of Martinsburg. Therefore, these rules are equally important to our region of the State as they are to the north central parts of West Virginia.

Should you have any additional questions or comments, please feel free to contact me at the numbers indicated below.

Thank you for the assistance –

Clint Hogbin
Chairman
Berkeley County Solid Waste Authority
304-268-5703 (Personal Cell)
304-267-9370 (BCSWA office)

Johnston, David L

From: DEP Comments
Sent: Tuesday, July 29, 2014 10:37 AM
To: Johnston, David L
Subject: FW: Title 33CSR1 proposed Marcellus rule.

From: JOHN SHEELY [mailto:wvskibum@aol.com]
Sent: Tuesday, July 29, 2014 8:46 AM
To: DEP Comments
Cc: crhogbin@gmail.com
Subject: Title 33CSR1 proposed Marcellus rule.

I respectfully request that the following be added to the proposed Marcellus rule.

5.6.d Karst Region Prohibition:

5.6.d.1 A commercial solid waste facility that is located in a county that is in whole or in part, within a karst region as determined by the West Virginia Geologic and Economic Survey, may not accept any waste generated by hydraulic fracturing or any other method of horizontal drilling.

In addition I request that the following be considered:

5.6.a Definitions

5.6.a.1 Drilling Waste is any by product of hydraulic fracturing or any other method of horizontal drilling including by not limited to drill cuttings, drilling socks/nets and waste water.

5.6.a.1.a "Drill Cuttings" means the broken bits of solid material and drilling mud removed from a borehole drilled by rotary, percussion or auger methods.

5.6.a.1.b "Drilling Socks/Nets" are devices used for filtering during process of hydraulic fracturing or horizontal drilling.

Johnston, David L

From: DEP Comments
Sent: Friday, July 11, 2014 11:35 AM
To: Johnston, David L
Subject: FW: Marcellus/Karst

From: Vicky Lee [mailto:victorially@hotmail.com]
Sent: Wednesday, July 09, 2014 10:31 AM
To: DEP Comments
Subject: Marcellus/Karst

As I have come to understand it, you are in the process of deciding whether to allow well drilling waste from fracking to be put in West Virginia landfills. This would not be a good thing for the citizens and denizens of this great state. Fracking has been shown to be potentially very harmful for the water supply. Lanfilling their chemical waste is therefore harmful to the land it proposes to fill. Let's not cover up their fracking messes. West Virginia is better than that.

Thank you,

Vicky Hutzler
57 Polo Greene Dr.
Martinsburg, WV 25401

Johnston, David L

From: DEP Comments
Sent: Tuesday, July 29, 2014 10:36 AM
To: Johnston, David L
Subject: FW: Marcellus Waste Emergency Rules

From: William Madert [mailto:billymadert@gmail.com]
Sent: Monday, July 28, 2014 6:25 PM
To: DEP Comments
Subject: Marcellus Waste Emergency Rules

WV Department of Environmental Protection,

After reviewing the emergency rules related to the management of Marcellus Drilling waste I am concerned that no further rules were created for landfills with in regions containing karst geology. I would ask that the DEP consider creating a new section in the rule the reads as follows:

5.6.d Karst region prohibition:

5.6.d.1 A commercial solid waste facility that is located in a county that is, in whole or in part, within a karst region as determined by the West Virginia Geologic and Economic Survey, may not accept drill cuttings and drilling waste generated from horizontal well sites.

Living in a karst region, I am concerned that local landfills are not designed to handle this type of waste and that the drilling waste could easily enter the water system, contaminating the water throughout the region.

Billy Madert
Jefferson County, WV
304-707-7123

Johnston, David L

From: DEP Comments
Sent: Tuesday, July 29, 2014 10:37 AM
To: Johnston, David L
Subject: FW: Emergency Rules for Marcellus Waste

From: Jefferson County SWA [mailto:jcswa@frontiernet.net]
Sent: Tuesday, July 29, 2014 9:48 AM
To: DEP Comments
Subject: Emergency Rules for Marcellus Waste

WV DEP,

After reviewing the emergency rules related to the management of Marcellus Drilling, the Jefferson County Solid Waste Authority is concerned that no further rules were created for landfills in regions containing karst geology. Not only has the Board voiced it's concerns about this type of material entering any landfill in a karst region, many residents of the area have also shared their concerns related to drilling waste in landfills. The Eastern Panhandle is an area with a high concentration of karst geology and protecting the water resources of the area has always been a top priority for citizens.

We ask that you would consider a new section in the Emergency rules:

5.6.d Karst region prohibition:

5.6.d.1 A commercial solid waste facility that is located in a county that is, in whole or in part, within a karst region as determined by the West Virginia Geologic and Economic Survey, may not accept drill cuttings and drilling waste generated from horizontal well sites.

Thank you for your time and consideration regarding these changes.

Sincerely,

Billy Madert
Director
Jefferson County Solid Waste Authority
PO Box 70
Ranson WV 25438
304-725-8082 office
304-707-7123 cell
www.jcswa.com

Johnston, David L

From: DEP Comments
Sent: Thursday, July 24, 2014 10:04 AM
To: Johnston, David L
Subject: FW: Proposed Marcellus Rule

Sensitivity: Confidential

From: Layne Diehl [mailto:layne@diehllaw.net]
Sent: Wednesday, July 23, 2014 3:48 PM
To: DEP Comments
Subject: Proposed Marcellus Rule
Sensitivity: Confidential

To Whom It May Concern: Please allow me the opportunity to note my support of amending the DEP Waste Management's Solid Waste Management Rule (33 CSR 1 *et seq*) to include the following language:

5.6.d Karst region prohibition:

5.6.d.1 A commercial solid waste facility that is located in a county that is, in whole or in part, within a karst region as determined by the West Virginia Geologic and Economic Survey, may not accept drill cuttings and drilling waste generated from horizontal well sites.

As a resident of the Eastern Panhandle and a mother, I worry that not including the foregoing language could create significant potential for environmental contamination in our region, not only from companies involved in hydraulic fracturing in West Virginia, but also from out-of-state.

Your consideration is greatly appreciated. –Layne Diehl

Johnston, David L

From: DEP Comments
Sent: Wednesday, July 09, 2014 10:22 AM
To: Johnston, David L
Subject: FW: Comment on the WV-DEP's Title 33CSR1proposed Marcellus rule

Another one.

From: Kristin K. Loken [mailto:krisloken@yahoo.com]
Sent: Monday, July 07, 2014 9:11 PM
To: DEP Comments
Subject: Comment on the WV-DEP's Title 33CSR1proposed Marcellus rule

I am forwarding my comment on the West Virginia Department of Environmental Protection's Title 33CSR1 Marcellus rule. It is critical that you amend the proposed rule to include a ban on fracking waste in landfills in areas that have karst geology, such as Berkeley, Jefferson, and Morgan counties.
I propose the following be added to the proposed Marcellus rule:

5.6.d Karst region prohibition:

5.6.d.1 A commercial solid waste facility that is located in a county that is, in whole or in part, within a karst region as determined by the West Virginia Geologic and Economic Survey, may not accept drill cuttings and drilling waste generated from horizontal well sites.

Please take this very seriously. Our lives and our clean water are at stake.
Kristin Loken
PO Box 337
Falling Waters, WV 25419

Johnston, David L

From: DEP Comments
Sent: Wednesday, July 09, 2014 10:22 AM
To: Johnston, David L
Subject: FW:

Comment on rule.

From: Matt Kushin [mailto:profkushin@gmail.com]
Sent: Wednesday, July 09, 2014 9:23 AM
To: DEP Comments
Subject:

Hello,

I am writing to urge the DEP to add a new section in the WV Solid Waste Management Rule to include a karst region prohibition. This is a very important prohibition given the features of karst and the heightened ability of this waste to get into the water supply in karst regions. As you know, karst is porous and water travels through it in unpredictable and far reaching ways.

A copy of such a rule that would ban karst in this region is below and I encourage you to have it added to the rules.

5.6.d Karst region prohibition:

5.6.d.1 A commercial solid waste facility that is located in a county that is, in whole or in part, within a karst region as determined by the West Virginia Geologic and Economic Survey, may not accept drill cuttings and drilling waste generated from horizontal well sites.

Thank you for your time and consideration.

Matt Kushin

Harpers Ferry, WV

Johnston, David L

From: DEP Comments
Sent: Monday, July 07, 2014 8:53 AM
To: Johnston, David L
Subject: FW: Rule to add to the Marcellus laws

From: Chanda [mailto:chandawv@gmail.com]
Sent: Sunday, July 06, 2014 6:46 PM
To: DEP Comments
Subject: Rule to add to the Marcellus laws

To whom it concerns

I suggest very strongly this rule be added to the new Marcellus waste addendum. WV-DEP's Title 33CSR1proposed Marcellus rule

new section in the rule as shown below:

5.6.d Karst region prohibition:

5.6.d.1 A commercial solid waste facility that is located in a county that is, in whole or in part, within a karst region as determined by the West Virginia Geologic and Economic Survey, may not accept drill cuttings and drilling waste generated from horizontal well sites.

Please don't allow this waste to be dumped in WV. If it is , that poisons our land and water for generations to come, with out knowing if it can ever be cleaned up. i know some of you think of this an "just another industry" when it is truly NOT.

Regards
Chanda Wright
Berkeley County WV

WASTE MANAGEMENT

625 Cherrington Parkway
Moon Township, PA 15108
800.866.4460

July 30, 2014

Randy C. Huffman
Cabinet Secretary
West Virginia Department of Environmental Protection
601 57th St. SE
Charleston, WV 25304

Scott G. Mandirola
Director of Division of Water & Waste Management
West Virginia Department of Environmental Protection
601 57th St. SE
Charleston, WV 25304

Re: Proposed Rule – 33 C.S.R. 1

Dear Secretary Huffman and Director Mandirola:

Waste Management of West Virginia (WM) offers the following comments regarding the West Virginia Department of Environmental Protection's proposed rule (currently an active emergency rule) revising the Solid Waste Management Rule, set forth in 33 C.S.R. 1.

Comments on DEPs Emergency Rule (33CRR1)

- 33 C.S.R. 1-5.6.a.1. WV's proposed rule on the regulatory definition of "drill cuttings and associated drilling wastes."

  Comment: It is unclear whether this term is meant to apply solely to rock from the lateral section of the well, or to encompass other waste streams as well (e.g., completion/recycling waste). Because different types of materials can be profiled differently based on the different analytics of concern, how this term is interpreted will affect the practical application of the rule. WM suggests that the proposed rule be revised to define drilling wastes into the separate categories of: Drill Cuttings, Drilling Fluids, Completion wastes, Plant trash, and Production wastes. Due to the unique nature and properties of the various waste streams confirmatory analysis can be performed at different frequencies.

- Section 5.6.c.1.B states the facility must obtain one composite sample from the lateral or horizontal portion of each well bore unless otherwise approved by the Secretary.

  Comment: RCRA solid waste regulations require the generators to make a waste characterization determination- not the facility so it is recommended the section be revised to require the generator to obtain a sample for WV DEP profile approval

  Comment: The horizontal portion of a well is typically drilled out in 10 days generating approximately 50 boxes. Lab analysis may take 10 days and WV State approval (without taking in account a much

greater, based on these rules, number of approvals) may take 5 days; therefore the disposal approval of a well will take longer than to drill the well itself. Additionally storing large quantities of wastes at the well sites, or staging areas awaiting disposal approvals will be far less environmentally secure than direct disposal. WM feels from a logistical standpoint, waiting to dispose of drill cuttings so that they can undergo the analysis proposed by the rule is unmanageable. Based on the general uniformity of prior sampling of cuttings over the last several years WM suggests that the proposed rule be revised such that the composite analysis can be submitted from a prior adjacent well pad with the same drill waste generating process to obtain disposal approval for the future pad. Once drilling reaches the horizontal portion of the next pad another sample can be analyzed to obtain approval on the next pad.

- 5.6.d.4. If a load of drilling cuttings or associated drilling waste is confirmed to be less than ten microroentgens per hour (10 µR/hr.) above average local background level, the waste may be disposed of in the facility. If the load of waste is confirmed to be equal to or greater than 10 µR/hr. above average local background level, the combined concentration of Radium 226 and Radium 228 must be determined. The combined concentration must be analyzed by a State approved method. If the combined concentration in the waste is less than five picocuries per gram (5 pCi/g.) above average local background level, the waste may be disposed in the facility. If the values are greater than 5pCi/gr. above average local background level, the load must be rejected.

Comment: WM believes that a site specific Radiation plan is needed to confirm compliance with WV's Emergency Rulemaking policies and procedures. Due to the complexity of these issues WM feels it prudent to submit a plan for WV State review and approval. The plan will be similar to what has been adopted in neighboring States and will fully address WV specific concerns. WM requests that the State confirm compliance with the intended rules by approval of the WM site radiation plan prior to implementation of any site specific policies and procedures.

Comment: WM agrees with the concept of using monitors to detect the presence of TENORM bearing waste in excess of 10 uR/hr, and we have substantial experience with this process over the past 15 years at our Pennsylvania Landfills. In that regard, Marcellus Shale drill cuttings almost never set off monitors (well less than 1 percent of the time), a fact that PADEP can confirm. Therefore, we do not expect to have to determine the concentration of Radium 226 and Radium 228 with any frequency on Drill Cuttings. However, on the rare occasions when drill cuttings might result in a detection in excess of 10 uR/hr above background, then it is possible that an individual load of drill cuttings will be in excess of 5 pCi/g. or perhaps even 7 pCi/g. (assuming local background of 2 pCi/gr.), but this should not be a cause of concern, based on analogous standards developed by the federal and other state agencies discussed below. We respectfully disagree with the adoption of a 5 pCi/gr number for TENORM waste acceptance particularly for drill cuttings for the reasons set forth below. We request the Department's reconsideration on this issue.

The apparent basis for the "5 pCi/g above background" number is from 40 CFR Part 192, which EPA promulgated on January 5, 1983 with respect to the cleanup of land and buildings contaminated with residual radioactive materials from inactive uranium processing sites, pursuant to the Atomic Energy Act and the Uranium Mill Tailings Radiation Control Act of 1978 (42 USC 7918). See 48 FR 590. We do not believe that situationally specific standard was intended to be applied to waste acceptance concerning the oil and gas industry's or other industry's generation of naturally occurring radioactive material or even so called "technically enhanced naturally occurring radioactive material." Limited acceptance of these materials at landfills has never been shown to be a problem. Importantly, we believe that to the extent the 5 pCi/g standard is deemed to be relevant or useful, the following facts should be considered. In considering the 5 pCi/g above background cleanup standard, assume a background of 2 pCi/g. In the case of a landfill, soil with a background of 2 pCi/g is replaced with municipal solid waste that has no background concentration of radium as would soil. Therefore, there is substantial dilution factor by this waste with respect the existing background concentrations of radium in soil. Therefore, if only 10% of a landfills waste intake was monitored TENORM waste, a dilution factor of 10 would be appropriate and the average TENORM concentration could be 50 pCi/g with the average remaining below 5 pCi/g. Similarly, if 2% of a landfills waste intake was limited to

monitored TENORM waste, then perhaps the 50x dilution factor could warrant waste acceptance of 250 pCi/g for limited loads of waste. We are not proposing that number, but merely demonstrating the impact of dilution factors with respect to adherence to a uranium mill tailing standards, and in fact, consistent with the Argonne National Laboratory discussed below, the disposal of wastes containing higher concentrations of Ra-226 should be considered on a case by case basis.

In connection with WM's request for reconsideration of 5 pCi/g above background, we wish to make the Department aware of the following four approaches and precedents that support a 50 pCi/g concentration for radium as a limit for waste acceptance:

1. US EPA Office of Drinking Water (July 1990) - published guidelines for the disposal of naturally occurring radionuclides including radium. This guidance states that adequate protection can be achieved with waste containing radium concentrations up to about 50 pCi/g with a "physical barrier of ten feet of cover of earth or non-radioactive waste." We believe the landfill with its liner systems exceed this standard.

2. State of Michigan (2007) - published disposal guidelines for waste streams containing radium published in the Department of Environmental Quality Waste and Hazardous Materials Division (EQC 1602 - Rev 3/2007) states that radium-226 contaminated materials not exceeding 50 pCi/g can be disposed of in a solid waste landfill.

3. Department of Energy (1999) - DOE Publication No. DOE/BC/W-31-109-ENG-38-8: OSTI ID:13061 - study concludes that disposal of waste material containing 50 pCi/g of radium is acceptable in a nonhazardous landfill based on several factors. The study indicated that potential radiological doses and resultant health risks for workers actively involved in landfill operations would be negligible, potential doses to individual living adjacent to the landfill during disposal and to the general population living within a 50 mile radius would be negligible, and potential doses to future industrial and recreational users of the landfill property would be negligible.

4. Argonne National Laboratory (2003), Environmental Assessment Division Study (published in the Environmental Science & Technology Journal - Vol. 37, No. 10, 2003) concluded disposal of petroleum industry TENORM wastes in MSW landfills presents a negligible risk to all potential receptors provided that the average Ra-226 concentration of the TENORM wastes are 50 pCi/g or less, TENORM waste is placed at least 10 feet below the landfill cap, and the integrity of the landfill cap is maintained into the future. The disposal of waste containing higher concentrations of Ra-226, up to a few hundred pCi/g, may also present negligible risk but should be considered on a case by case basis.

Waste Management believes these issues are best addressed on a site specific basis using appropriate risk assessment methodologies (which may include modelling). We have also operated under a system in Pennsylvania that in essence limits monitor-triggering TENORM to less than 2% of cold waste intake, with source allowances calculated based on incoming monitored levels measured in uR/hr.

In short, we believe the rule should be revised to allow site specific TENORM waste monitoring and acceptance plans, and that the 5 pCi/g above background radium cleanup standard for uranium mill tailing sites, codified at 40 CFR 192 is not applicable or appropriate to MSW Landfills acceptance on a per load basis.

As part of the required Landfill Radiation Monitoring plan promulgated by the Emergency Rule WM will be including TENORM waste tracking.

- *Section 5.6.c.1.C.1 lists the testing required for waste profiling but does not require any testing for Radium.*

  Comment: It seems that it would be logical for generators to test upfront in the waste profiling /approval process for Radium so the material could be properly characterized and managed safely even before it was received at a landfill. This is especially true for treatment residuals from the oil & gas industry (i.e., filters).

- *Section 5.6.d.1 states the facility must also have a portable radiation monitor capable of determining dose rate and the presence of contamination on a vehicle.*

  Comment: WM has been safely managing oil & gas industry waste in other States with no issues on occupational exposure. WM believes that a site specific Radiation plan is needed to confirm compliance with WV's Emergency Rulemaking policies and procedures. Due to the complexity of these issues WM feels it prudent to submit a plan for WV State review and approval. The plan will be similar to what has been adopted in neighboring States and will fully address WV specific concerns. WM requests that the State confirm compliance with the intended rules by approval of the WM site radiation plan prior to implementation of any site specific policies and procedures.

- *Section 5.6.d.4 states if the load is confirmed to be equal to or greater than 10uR/hr above background level, the combined concentration of Radium 226 and Radium 228 must be determined.*

WM believes the proposed rule should not be adopted as it is currently drafted, but should incorporate the changes set forth above to make the new requirements uniform with neighboring States and industry. We believe that the points above help define procedures to enhance documentation and, Environmental protections. These procedures will also provide a workable path forward for the WV DEP to confirm and enforce compliance.

We thank you for your consideration of these comments.

Sincerely,

Michael Rind
Director of Operations
WM Energy Services

Eli Brill
Senior Legal Consul
Waste Management

HANNA LAW OFFICE

3508 NOYES AVENUE
POST OFFICE BOX 2311
CHARLESTON, WEST VIRGINIA 25328-2311
TELEPHONE: 304-342-2137 FAX: 304-342-2130
E-MAIL: Hannalawoffice@aol.com

HOMER W. HANNA, JR.
(1926-1993)

SAMUEL F. HANNA, Managing Attorney
WV State Bar Number: 1580

MARGARET J. WILLIAMS,
PARALEGAL

July 29, 2014

JUL 30 2014

West Virginia Department of Environmental Protection
601 57th Street SE
Charleston, WV 25304

VIA HAND DELIVERY

Re: Solid Waste Management Rule 33CSR1

To Whom It May Concern:

This firm represents American Disposal Services of West Virginia, Inc. d/b/a Short Creek Landfill, Allied Waste Sycamore Landfill, LLC and Allied Waste Services of North American, LLC d/b/a Mountaineer Transfer Station. All of these entities own/operate solid waste facilities located throughout the State of West Virginia. As such, attached for your review is a letter dated July 24, 2014, from Chris Jaquet, Area Environmental Manager for Short Creek Landfill and a letter dated July 23, 2014, from Keith W. Koebley, General Manager of Republic Services of West Virginia. These two letters are being submitted as comments regarding the adoption of Solid Waste Management Rule 33CSR1 which was submitted as an emergency rule. It is my understanding that the comment period ends on July 30, 2014.

Should you have any questions, please do not hesitate to contact me.

Sincerely,

Samuel F. Hanna

SFH/mjw

Enclosure

cc: David Johnston, Technical Analyst
American Disposal Services of West Virginia, Inc.
d/b/a Short Creek Landfill
Allied Waste Sycamore Landfill, LLC
Allied Waste Services of North American, LLC
d/b/a Mountaineer Transfer Station

REPUBLIC
SERVICES

July 23. 2014

Public Information Office
West Virginia DEQ
601 57th Street. S.E.
Charleston, West Virginia

Re: WV DEP Proposed Rule 33CSR1

Dear Sir:

As a leading provider of environmental services, Republic Services has more than 30,000 people working continually to strive to create a higher standard of excellence by offering comprehensive solid waste and recycling solutions and preserving the environment. We appreciate the opportunity to comment on Proposed Rule 33CSR1. Following are our comments:

Rule 5.6.c.1.B requires that the facility must obtain at least one composite sample from the lateral or horizontal portion of each well bore unless otherwise approved by the Secretary. Respectfully, we believe that this level of sampling/testing is unnecessary and could actually be detrimental to the environment and workers who come in contact with these materials. We fully appreciate and support the concept of obtaining base line waste samples. The purpose of these samples should be to provide a representative characterization of the waste material.

It is our understanding that currently the WV DLP approves drill cuttings and drilling wastes on a generator by generator basis rather than on a well by well basis. To us the existing program makes sound environmental sense. Drill cuttings in and of themselves are unlikely to exhibit the types of contaminants that are of concern. Drill cuttings by themselves are broken bits of solid material i.e. soil and rock. The contaminants of concern are potentially introduced into the waste when drillers utilize petroleum based

drilling muds and other materials to enhance the drilling process. In general, each drilling company/generator utilizes a fairly specific proprietary set of materials to drill the wells. These materials vary little from well to well. Thus. it would seem logical and appropriate to require solid waste facilities to provide a composite sample from a particular driller/generator for review by the WV DEP. Approvals could then. as they are now, be issued for a set period of time. such as 6 months. after which the solid waste facility and the generator would need to submit another sample and have the approval re-certified/approved by the WV DEP.

As an alternative, we believe that this could also be achieved on a county by county or a well pad by well pad basis. Again. the wastes that are being characterized are, for the most part, naturally occurring broken bits of solid material and drilling mud removed from a borehole. We would not expect these materials and geologic formations from which they are produced to vary greatly from one West Virginia County to another and certainly we would not expect them to vary greatly from one borehole to another within the same well pad.

In addition, as part of the proposed process: the samples must be collected. they must be analyzed, the analysis must be submitted to WV DEQ. WV DEQ must review and approve a permit modification before a solid waste disposal facility can accept and dispose of the waste. This all of course takes time. In fact, it is our understanding that following the actual sampling and submittal to WV DEQ it may take from 3-6 weeks before an approval is received. During this time. the waste materials are often stored on the drilling site in containers. Ultimately, the safest place for these materials once generated is disposal in a solid waste landfill. We believe that it is best to limit the number of samples required to the minimum necessary to properly characterize the waste thereby minimizing the time between generation and disposal.

Rules 5.6.c.1.C. and 5.6.c.1.C.1 require that each special waste minor permit modification request must contain the following analytical results: TCLP Metals, TCLP Volatile Organic Compounds, TCLP Semivolatile Organic Compounds and TPH. We believe that not all of the parameters required are necessary to properly characterize these wastes.

We do not believe that it is necessary or appropriate to require submittal of analytical results for TCLP Volatile and Semivolatile Organic Compounds and further that requiring that these results will add significantly to the required testing time and storage time prior to disposal.

WV Code 22-15-8 (h) required the Secretary to promulgate rules to establish limits for unique toxins associated with drill cuttings and drilling wastes including. but not limited

to, heavy metals, petroleum-related chemicals, benzene, toluene, xylene. In the proposed rule WV DEP has proposed that solid waste facilities utilize the TCLP for Volatile Organic Compounds and the TCLP for Semivolatile Organic Compounds to obtain these results. We respectfully suggest that these requirements be eliminated and be replaced with a requirement to utilize the BTEX analysis test to obtain results for the mandated compounds. We suggest this for two reasons. First, BTEX results can be obtained in 1-2 days. It is our understanding that to obtain the required results for these compounds utilizing the TCLP tests will require an additional 7-9 days of laboratory work. As noted above during this testing/approval time these waste materials are being stored rather than being moved to the disposal site and safely disposed. In addition, it is our understanding that the cost for BTEX analysis is approximately $60.00/test while the TCLP tests for these compounds costs approximately $565.00.

Rule 5.6.d.1. Requires that all solid waste facilities that accept drill cuttings and associated drilling wastes for disposal must have on-site a portable radiation monitor capable of determining dose rate and the presence of contamination on a vehicle. Republic Services supports radiation detection. In fact, even though it has historically not been a requirement of the WV DEP to have fixed radiation detectors at solid waste landfills Republic has had them on-site and operating for a number of years. Frankly, we do not want our workers or are neighbors potentially exposed to these materials. In that same vein, it our policy and procedure (and we suggest that a similar policy be adopted by the WV DEQ) that should a load of waste set off an alarm, indicating the potential presence of a radiological isotope sufficiently above background to be of concern, that the truck be isolated and a third party radiological specialist be called to the site to determine the isotope that is present, determine its concentration and assist in determining the proper management of the material after that point. We do not believe that it is prudent to have workers with limited knowledge and limited experience in a very complicated issue attempt to determine these facts and perhaps in the process expose themselves and others to unhealthy levels of radiation.

Rule 5.6.d.4. requires that. "If a load of is confirmed to be equal to or greater than 10 uR/hr. above the average local background level, the combined concentration of Radium 226 and Radium 228 must be determined." We are concerned and uncertain as to what is intended with this rule. Currently, it is our understanding that the only State approved method for determining the combined concentration of Radium 226 and Radium 228 is a test method which takes 21 days to obtain results. Thus, this rule would not seem to be functional at a solid waste disposal facility at this time. Under this rule if a load is confirmed to be equal to or greater than the 10 uR/hr. above the local background level the disposal facility is **obligated** to determine the combined Radium 226 and Radium 228 concentration. What is the disposal facility supposed to do with the material for the 21 days that is required to determine this combined concentration? It would seem more

appropriate that following notification to WV DEQ and the issuance of any needed approvals to transport the waste that the waste be rejected and returned to the generator until these test results are available. If nothing else, we believe that this option should be available to the disposal facility. If and when the WV DEQ approves alternate test procedures that would provide more immediate results this provision could be reviewed.

Rule 5.6.d.4. requires that. "If the combined concentration in the waste less than 5 picocuries per gram (5pCi/gr) above average local background. the waste may be disposed in the facility." Conversely, "If the values are greater than 5pCi/gr above average local background level, the waste must be rejected." This rule is not clear on several issues and we believe incomplete in what is required if a load if waste it to be rejected.

It is not clear what the term "average local background" refers to. Is this average local background of Radium 226 and Radium 228? If so, what procedures are required to determine this "average local background" and how often must it be determined? As noted above Republic Services currently has fixed detectors in use at its facilities. As part of this process we do establish a local background, but it is not isotope specific. We would note that other States such as Ohio has established a general state-wide background number for Radium 226 and Radium 228 based upon their experience. We respectfully suggest that WV DEQ consider establishing a similar general state-wide background number to avoid any confusion on this issue.

We are concerned that this rule requires the rejection of any load that where the values are greater than 5pCi/gr above average local background level without further guidance or instruction. We are reluctant to reject loads of waste that are above acceptable disposal limits and simply put them back on the road without first making sure that they are properly licensed for transport as a radioactive material. We respectfully suggest that the WV DEQ study this issue further and develop specific procedures that facilities should follow when loads of waste need to be rejected to their radiological content.

If you have any questions or comments please feel free to give me a call.

Sincerely,

Keith W Koebley

Keith W Koebley
General Manager
Republic Services of West Virginia

Cc David Johnston, WV DFP

July 24, 2014

David Johnston
Division of Water and Waste Management
West Virginia Department of Environmental Protection
601 57th Street SE
Charleston, West Virginia 25304

Dear Mr. Johnston:

On July 18, 2014 the Republic Services Short Creek Landfill received a memorandum dated July 17, 2014 regarding the adoption of Solid Waste Management Rule (33CSR1) Emergency Rule.

In the Memorandum, you requested that facilities that cannot comply with this rule contact the Office of Waste Management within ten (10) days of receipt of the Memorandum for further assistance. This letter is in response to this request.

Attached is a summary chart which we believe summarizes the new requirements in Emergency Rule (33CSR1) for solid waste landfills that accept drill cuttings and associated drilling mud/wastes, our current compliance status and dates by when we believe that we can fully comply with the letter of this rule. Please note, that while we cannot fully comply with the letter of this rule at this time, we believe that we are compliant with the spirit and intent of the rule. For example, the Emergency Rule requires that facilities have fixed radiation detectors. We have and have had fixed detectors installed at our facility for a number of years. However, our detectors currently do not read or report the results in uR/hr. Instead, they report the results in counts per minute, which is also an accepted monitoring standard. Our detectors are currently set to sound an alarm when any vehicle containing wastes that exhibit a radiation level 5X above background pass between the detectors. We believe that this is comparable to the requirements in the Emergency Rule. It is our intent to either replace these detectors with ones that do report results in uR/hr or have the existing detectors modified so that they report radiation levels in uR/hr. We also do not currently have a portable detector on-site that is capable of determining dose rate. While the Emergency Rule is silent on when and how the portable detectors are to be used, it is our assumption that in the event of an alarm from the fixed detector the portable detector would be used to further characterize the radiation event. We will purchase a portable detector and have suggested a compliance date in the attached chart that indicates when we believe we can have this accomplished and have our employees trained on its use. In the interim, in the event of an alarm from the fixed detectors we would contact a third party radiation specialist to assist in the characterization of the material (this is our current policy). We would also note that

we will be submitting comments on the proposed rule 33CSR1 in which we further describe our thoughts on this issue as well as other aspects of the proposed 33CSR1.

In summary, while we acknowledge that we are today not totally compliant with the letter of those aspects of Emergency Rule 33CSR1 that pertain to the receipt and disposal of drill cuttings and drilling muds/wastes we do believe that we are in compliance with the spirit and intent of the Emergency Rule. In addition, we have suggested dates by when we believe we can/will be in compliance with the letter of this Rule.

If you have any questions or need any additional information on this issue please feel free to contact me.

Sincerely,

Chris Jaquet
Area Environmental Manager

CC Keith Koebley, General Manager
Mike Darnel, Short Creek Environmental Manager

Attachment (1)

WV 33CSR1 Comparison of Emergency Rule and Current Practices/Short Creek Landfill

Rule	New Requirement	Current Practice	When we could comply
5.6.b.1	Liner system requirements for separate dedicated cells	N/A wastes are co-disposed with solid waste	N/A
5.6.b.2	Dedicated cell must be designed to separate leachate from solid waste cell	N/A wastes are co-disposed with solid waste	N/A
5.6.b.3.A	Leachate collection lines must be able to be sampled	Currently Compliant	N/A
5.6.b.3.A	Leachate must be sampled for specified parameters	Currently Compliant	
5.6.c.1.A	Prior to acceptance obtain special waste modification	Current Practice	N/A
5.6.c.1.B	Must obtain one sample from lateral or horizontal portion of well	Obtain representative sample from well driller from a representative well	Immediately on new submittals. Existing approvals should remain valid until they expire.
5.6.c.1.C.1	Submit TCLP metals. Volatiles, semivolatiles, TPH and % solids	TCLP metals, TPH and % solids	Immediately on new submittals.
5.6.d.1	Must have fixed radiation detectors and portable detectors capable of determining dose rate.	Have fixed detectors do not have portable detectors capable of determining dose rate. However, in the event of alarm would call in third party	Will have portable detector in 60 days.
5.6.d.2	Fixed detector must be capable of measuring exposure rate in uR/hr	Current detectors measure relative to background but do not report results in uR/hr	We will assess our meters and determine if their readout can be changed. If so this will be done in 30 days, if not new meters will be ordered and installed in 60 days.
5.6.d.3	Detector elements must be configured to be as close as practical	Current Practice	N/A

	to the waste load		
5.6.d.3	Must set the detector to alarm if waste load is over 10 uR/hr	Detector set to alarm at a set number of times above background.	At this point we are not sure if we need new equipment or if we can adjust equipment settings /program. Will follow the timeline set to comply with 5.6.d.2.
5.6.d.4	If load is above 10 uR/hr waste must be analyzed for 226 and 228 concentration.	Currently, we would reject load that set off alarm.	This is impractical as only approved test is 21 day test. Load would be rejected.
5.6.d.5	Facility must provide incident report for alarms within 24 hours.	Currently, would not provide report within 24 hours.	Immediately with current alarm system.
5.6.d.6	Must submit a radiation monitoring plan.	N/A	Once we determine proper equipment. We could submit report within 30 days.

WEST VIRGINIA
INDEPENDENT OIL AND GAS ASSOCIATION

July 30, 2014

VIA U.S. MAIL & E-MAIL

David Johnston
Division of Water and Waste Management
West Virginia Department of Environmental Protection
601 57th Street, S.E.
Charleston, WV 25304
David.L.Johnston@wv.gov

Re: Written Comments on Legislative Rule to Amend West Virginia Solid Waste Management Rule, 33 C.S.R. 1

Dear Mr. Johnston,

The Independent Oil and Gas Association of West Virginia, Inc. ("IOGA") submits the following comments on the West Virginia Department of Environmental Protection's ("WVDEP") proposed legislative rule to amend the Solid Waste Management Rule, 33 C.S.R. 1, to establish requirements for the disposal of drill cuttings and associated drilling wastes at commercial solid waste facilities within the state ("the Proposed Rule"). Formed in 1959, IOGA is a statewide nonprofit trade association that represents companies engaged in the extraction and production of natural gas and oil in West Virginia and the companies that support these extraction and production activities. IOGA was formed to promote and protect a strong, competitive and capable independent natural gas and oil producing industry in West Virginia, as well as the natural environment of our state. Our members also have a longstanding tradition of working with WVDEP and its predecessor agencies to help regulators understand and regulate these activities in a manner that protects the environment while also promoting the economic development so crucial to West Virginia. It is in this spirit of cooperation and partnership that IOGA offers these comments on the Proposed Rule.

A. The Comment Period for the Proposed Rule Should be Extended

As an initial matter, IOGA notes that IOGA and its individual members continue to evaluate the technical aspects of the proposed rulemaking and its anticipated impact on the oil and gas industry, and may have additional comments to offer on these issues once that review is complete. As the comment period is scheduled to close today, IOGA respectfully requests an extension of for an additional 30 days to allow for the completion of this more detailed review.

B. The Scope of the Proposed Rule Should Be Clarified for Consistency

The Proposed Rule would add a new Subsection 5.6 to the Solid Waste Management Rule entitled "Requirements for the Disposal of Drilling Waste Generated from Horizontal Drill Sites." *See* 33 C.S.R. 1-5.6. Specifically, this new subsection imposes new requirements relating to (a) liner systems for cells dedicated to the disposal of such wastes, (b) waste profiling and (c) radiation monitoring. However, the key term "drill cuttings and associated drilling wastes" is subsequently defined in general terms as "the broken bits of solid material and drilling mud removed from a borehole drilled by rotary, percussion, or auger methods," without any reference to horizontal drilling operations consistent with the heading of the section and the focus of the Legislature when it amended the Solid Waste Management Act earlier this year. 33 C.S.R. 1-5.6.a.1; *see* W. Va. Code § 22-15-8(g).[1] Accordingly, for purposes of consistency and to avoid potential confusion regarding the scope and applicability of the requirements of the new subsection, IOGA requests that WVDEP clarify the definition of "drill cuttings and associated drilling wastes" as follows: "the broken bits of solid material and drilling mud <u>generated from horizontal well drilling operations and</u> removed from a borehole drilled by rotary, percussion, or auger methods."

C. Representative Sampling Should be Authorized for Purposes of Waste Profiling where Composition is Expected to be Homogeneous

The Proposed Rule requires commercial solid waste facilities to apply for and obtain a special waste minor permit modification prior to the acceptance and disposal of drill cuttings and associated drilling waste. *Id.* § 5.6.c.1.A. As part of this application, the facility must obtain "at least one composite sample from the lateral or horizontal portion of each well bore unless otherwise approved by the Secretary." *Id.* § 5.6.c.1.B. The Proposed Rule also specifies various waste analyses that must be conducted and submitted along with the permit application. *Id.* § 5.6.c.1.C. Presumably, individual operators will be expected to collect these samples and conduct these analyses prior to the disposal of their drill cuttings and associated wastes for each individual well.

The segregation of wastes in this manner will be a costly and highly ineffectual process, particularly to the extent that an analysis must be repeated for each well bore on a multi-well pad, where significant differences in the characteristics and composition of drill cuttings would not be expected. Furthermore, if a separate approval has to be obtained on a well-by-well basis prior to disposal, as currently proposed, IOGA has significant concerns about the timing of the approval process and the potential accumulation of wastes on-site while such approvals are pending. Indeed, IOGA understands that the approval process has taken up to a month—or more—in the past. If the increased volume of applications and approvals required under the Proposed Rule results in a further slowdown of this process, this is expected to create operational

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[1] The statutory language specifically authorizes commercial solid waste facilities not located in a county that is, in whole or in part, within a karst region to "lawfully receive drill cuttings and drilling waste generated from horizontal well sites above [their applicable] monthly tonnage limits" if certain conditions and limitations are satisfied. *Id.*

issues with respect to the accumulation and storage of drill cuttings on-site while multiple approvals are being processed.

Accordingly, to minimize the administrative burden for both operators and the agency, IOGA requests that WVDEP continue with its current practice of allowing operators to obtain disposal approvals that are "regional" in scope (i.e., covering all operations within geology recognized to be homogeneous in terms of chemical composition). If WVDEP is unwilling to continue this approach, IOGA requests, at a minimum, that WVDEP revise the waste profiling requirements of the Proposed Rule to authorize the submittal of a composite sample representative of the cuttings generated from each **well pad**, rather than requiring separate disposal approvals to be tied to individual wells.

D. WVDEP Should Tailor its List of Sampling Parameters and Analyses for Purposes of Waste Characterization

As noted above, the Proposed Rule requires analyses to be performed for certain specified parameters and submitted with each special waste minor permit modification application. *See id.* § 5.6.c.1.C.[2] With regard to those parameters listed in Section 5.6.c.1.C.1, the Proposed Rule provides that "[s]ampling results for these parameters must not exceed the limits of 40 C.F.R. § 261.24." *Id.* § 5.6.c.1.C.1. The referenced USEPA regulation establishes thresholds above which the toxicity characteristic is triggered for purposes of Subtitle C regulation under the federal Resource Conservation and Recovery Act ("RCRA"). 40 C.F.R. § 261.24.

As the agency is aware, oil and gas exploration and production waste, including drill cuttings, is exempt from regulation as hazardous waste under Subtitle C of RCRA. *See* 40 C.F.R. § 261.4(b)(5); 53 Fed. Reg. 25447 (July 6, 1988) (USEPA determination under Section 3001(b)(2)(B) of RCRA that regulation of these wastes under Subtitle C is not warranted); *see also* 33 C.S.R. 20-3.1 (adopting and incorporating by reference 40 C.F.R. Part 261). In light of this long-standing regulatory exemption, IOGA believes that the required analyses and limitations set forth under 33 C.S.R. 1-5.6.c.1.C are inapposite, and obscure and potentially confuse the regulatory status of these wastes. Indeed, nothing in House Bill 107 appears to drive WVDEP's proposed reliance on the full spectrum of TCLP metals, VOCs and SVOCs, as W. Va. Code § 22-15-8(h) requires the agency to establish limitations only for those "unique toxins associated with drill cuttings and drilling waste"—a much more limited category of parameters.[3] Likewise, HB 107 makes no suggestion that imposing TCLP limitations is

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[2] Specifically, Toxicity Characterization Leaching Procedure ("TCLP") Metals, EPA Method 1311; TCLP Volatile Organic Compounds ("VOCs"), EPA Method 8620B; TCLP Semivolatile Organic Compounds ("SVOCs"), EPA Method 8270C; and Total Petroleum Hydrocarbons, EPA Method 8015C. *Id.* § 5.6.c.1.C.1. A percent solids analysis also must be conducted pursuant to EPA Method 160.3 or 2540. *Id.* § 5.6.c.1.C.2.

[3] The statute states that these "unique toxins" include, but are not limited to, "heavy metals, petroleum-related chemicals, (benzene, toluene, xylene, barium, chlorides, radium and radon)." W. Va.

necessary or appropriate for these wastes. *See* W. Va. Code § 22-15-8(h). Accordingly, IOGA urges WVDEP to narrow its focus consistent with this statutory mandate to those constituents that are truly unique to drill cuttings and associated drilling wastes for the instant rulemaking, as well as to develop more appropriate risk-based limitations instead of deferring to TCLP limits applicable to other types of waste that are not RCRA-exempt. IOGA suggests that WVDEP continue its prior practice with respect to those sampling parameters and analyses required in connection with special waste permit modifications for oil and gas exploration and production wastes, which have proven sufficient to characterize these wastes for purposes of landfill disposal, and add to this list any additional specific parameters required under HB 107.

IOGA notes further that the Proposed Rule is silent as to what is to be done with drill cuttings in the event that the specified levels are exceeded, and requests that WVDEP provide guidance on this point. Will a commercial solid waste facility be able to obtain a waiver to allow it to accept the cuttings?

E. IOGA Requests Clarification of WVDEP's Basis for New Radiation Limitations

With regard to the radiation limitations established in Section 5.6.d.4 of the Proposed Rule, IOGA requests clarification of the basis and justification for the levels identified by the agency that will trigger load review and/or rejection. IOGA notes that these limits are quite restrictive, and questions whether an appropriate risk-based analysis has been undertaken based on the characteristics of drill cuttings in West Virginia. To the extent these limits are derived from other state laws and/or regulations that may be based on different geology, the agency should evaluate them carefully to ensure that they are appropriate for use in West Virginia.

F. Timing for Installation of Radiation Monitors

The 2014 amendments to the Solid Waste Management Act establish a deadline of January 1, 2015 for the installation of radiation monitors by commercial solid waste facilities accepting drill cuttings and drilling wastes. W. Va. Code § 22-15-8(h). IOGA notes, however, that the Proposed Rule does not include this deadline for the installation of radiation monitors. 33 C.S.R. 1-5.6.d.1. To avoid confusion, IOGA suggests that the statutory deadline be inserted into the rule text as well.

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Code § 22-15-8(h). Although this list is not intended to be exclusive, the Proposed Rule goes well beyond this mandate.

In conclusion, IOGA appreciates the opportunity offer these comments on the Proposed Rule and is hopeful that they will be given due consideration by WVDEP as the rulemaking process progresses. Should you have any questions about anything contained in these comments, please do not hesitate to contact us.

Very truly yours,

Bob Radabaugh

Chair, IOGA Environmental and Safety Committee

cc: Scott G. Mandirola, Director, Division of Water and Waste Management

July 30, 2014

Mr. Randy C. Huffman
Cabinet Secretary
West Virginia Department of Environmental Protection
601 57th St. SE
Charleston, WV 25304

Mr. Scott G. Mandirola
Director, Division of Water & Waste Management
West Virginia Department of Environmental Protection
601 57th St. SE
Charleston, WV 25304

Re: Proposed Rule – 33 C.S.R. 1

Dear Secretary Huffman and Director Mandirola:

The West Virginia Oil & Natural Gas Association ("WVONGA") offers the following comments regarding the West Virginia Department of Environmental Protection's proposed rule (currently an active emergency rule) revising the Solid Waste Management Rule, set forth in 33 C.S.R. 1. WVONGA, chartered in 1915, is one of the oldest trade associations in West Virginia, and is the only association that serves the entire oil and gas industry. Our membership consists of integrated energy companies; companies involved in oil and gas storage, transmission, distribution, production, gathering, and processing; gas marketers; service/supply companies; and companies offering consulting and professional services to the oil and gas industry. These companies operate in virtually every county in West Virginia and employ thousands of people across the state, having payrolls totaling hundreds of millions of dollars annually. Our members have cumulative investments of nearly $10 billion in West Virginia, own about 20,000 oil and gas wells and 15,000 miles of pipeline running across the state, and provide oil and natural gas to roughly 300,000 West Virginia homes and businesses.

As an initial matter, we would note that the emergency rule (which is the same as the proposed rule) adds new requirements to the management and disposal of drill cuttings in West Virginia landfills that will have a significant effect on the oil and gas industry. Where an emergency rule is promulgated in this situation in the future, we would encourage the DEP to contact us to obtain information about the industry before proceeding to emergency rulemaking.

Our members have specialized industry knowledge in creating workable regulations that we believe can benefit the agency. Had the DEP done so in this situation, we believe we could have helped the DEP to avoid several ambiguities (discussed below) that will require clarification in order to make compliance attainable and enforcement manageable.

WVONGA's concerns with the proposed rule begin with the regulatory definition of "drill cuttings and associated drilling wastes." 33 C.S.R. 1-5.6.a.1. It is unclear to WVONGA's members whether this term is meant to apply solely to rock from the lateral section of the well, or to encompass other waste streams as well (e.g., completion/recycling waste). Because different types of materials will be profiled differently, how this term is interpreted will affect the practical application of the rule. *WVONGA suggests that the proposed rule be revised so as to make clear that the term "drill cuttings and associated drilling wastes" and its definition are to be strictly construed to include only the solid material removed from the well bore during drilling operations, and will not include other waste streams associated with completion operations.*

WVONGA is also concerned about the substantive requirements of the proposed rule. The first part of these requirements pertains to the waste profiling process. Specifically, the facility is required to obtain at least one composite sample from the horizontal portion of each well bore prior to the acceptance of the drill cuttings by the disposal facility. 33 C.S.R. 1-5.6.c.1.B. The lateral section of a typical well produces approximately 550 tons of drill cuttings, which are placed in roll-off containers ("boxes") for transport to the landfill. As each box stores approximately 14 tons of drill cuttings, there are about 40 boxes of drill cuttings produced from the lateral section of one well, which must then be stored on the well site during the waste profiling process. Currently, that waste is moved offsite as it is generated during the drilling process. From a logistical standpoint, waiting to dispose of these drill cuttings so that they can undergo the analysis proposed by the rule is unmanageable. It would make more sense to require preparation of an anticipated waste profile based on known characteristics of the geologic formation in which the lateral will be drilled, and use the composite as confirmation. *WVONGA suggests that the proposed rule be revised so that the composite analysis can be submitted <u>after</u> disposal, to confirm that the waste is similar to what was profiled. Furthermore, based on the general uniformity of cuttings sampled over the past several years, we suggest that the DEP revise the rule to require sampling of only one lateral per well pad or, at a minimum, that the DEP confirm in the response to comments that it intends to exercise its discretion to relieve drillers of composite sampling requirements if it learns that such sampling from each well bore is unnecessary to properly characterize drill cuttings from well sites.*

The second requirement that we are concerned about is Section 5.6.1.C.1, which effectively requires the disposal facility to reject wastes that exceed TCLP standards found at 40 C.F.R. §261.24. While ordinarily these hazardous waste standards might be appropriate at a solid waste facility, in this case the waste is an oil and gas production waste, and is exempt from

hazardous waste regulation pursuant to 40 C.F.R. §261.4(b)(5). Therefore, there is no reason to establish an absolute cutoff for the disposal of such substances at the federal hazardous waste level. *We urge the DEP to delete the last sentence in Section 5.6.c.1.C.1.*

The third part of these requirements pertains to radiation monitoring at the landfill. The proposed rule sets forth a limit of five picocuries per gram above average local background - - a very stringent standard with no apparent scientific basis - - above which waste must be rejected by the landfill. 33 C.S.R. 1-5.6.d.4. However, the radiation alarm will be triggered at more than ten microroentgens per hour above average local background - - again, a very stringent standard with no apparent scientific basis - - at which point further testing is required. 33 C.S.R. 1-5.6.d.3. Our members are concerned about being held liable for the acceptance of waste which exceeds the rejection limit yet fails to trigger the radiation monitor, and we also believe that drill cuttings with higher radiation levels can be safely disposed at solid waste facilities. *WVONGA suggests that the proposed rule be revised to allow disposal of all cuttings that do not exceed ten microroentgens per hour above average local background. If drill cuttings trigger the radiation monitor at that level, the cuttings could be further evaluated for disposal, as is done in other states.*

For all of these reasons, the proposed rule should not be adopted as it is currently drafted, but should incorporate the changes set forth above to make the new requirements manageable for those complying with them and for those enforcing them. As the DEP works on changes to the Solid Waste Management Rule, we urge the DEP to collaborate with industry groups such as WVONGA who can offer their unique perspective and experience that might otherwise be missing from the rulemaking process.

We thank you for your consideration of these comments.

Sincerely,

Nicholas S. DeMarco
Executive Director

NSD:shb

101 South Queen Street
Martinsburg, West Virginia 25401

7000 Hampton Center
Morgantown, West Virginia 26505

511 7th Street
Moundsville, West Virginia 26041

501 Avery Street
Parkersburg, West Virginia 26101

Bowles Rice LLP
ATTORNEYS AT LAW

600 Quarrier Street
Charleston, West Virginia 25301

Post Office Box 1386
Charleston, West Virginia 25325-1386
(304) 347-1100

www.bowlesrice.com

6000 Town Center Boulevard, Suite 210
Canonsburg, Pennsylvania 15317

333 West Vine Street, Suite 1700
Lexington, Kentucky 40507

480 West Jubal Early Drive, Suite 130
Winchester, Virginia 22601

July 30, 2014

Leonard B. Knee
Telephone — (304) 347-1726
Facsimile — (304) 347-2196

E-Mail Address:
lknee@bowlesrice.com

Mr. David Johnson
Division of Water and Waste Management
West Virginia Department of Environmental Protection
601 57th Street, Southeast
Charleston, West Virginia 25304

HAND DELIVERY

Re: Comments on proposed amendments to the *West Virginia Solid Waste Management Rule, 33 C.S.R. 1*, related to disposal of drill cuttings and associated drilling waste.

Dear Mr. Johnson:

The following comments are submitted on the proposed amendments to the West Virginia Solid Waste Management Rule, 33 C.S.R. 1, *et seq.* authorized by West Virginia Code §§ 22-15-8 and 22-15-11, related to the disposal of drill cuttings and associated drilling wastes at certain landfills in West Virginia. As you know, solid waste landfills in West Virginia are covered by a complex regulatory system involving the Department of Environmental Protection, the West Virginia Public Service Commission, and county solid waste authorities. The proposed rules must work within this existing regulatory system and must not threaten or disturb the current regulatory approach to solid waste disposal in West Virginia. Moreover, it is imperative that the regulatory scheme chosen for facilities accepting these wastes adequately addresses the inherent risks associated with these materials.

1. **The definition of "Drill Cuttings and Associated Drilling Wastes" is overly broad and not consistent with legislative intent.**

In § 5.6.a.1 of the proposed rule, "Drill Cuttings and Associated Drilling Wastes" is defined as "the broken bits of solid material and drilling mud removed from a borehole drilled by rotary, percussion, or auger methods." This proposed definition takes in cuttings and wastes generated from both horizontal and vertical wells. This definition is inconsistent with the statutory provision in W. Va. Code § 22-15-8(g), which authorizes certain commercial solid waste facilities to "lawfully receive cuttings and drilling waste generated from *horizontal* well sites . . ." (emphasis added). To alleviate any confusion about the applicability of the proposed rule to waste from

conventional wells, the definition of "Drill Cuttings and Associated Drilling Wastes" in the proposed rule should say "the broken bits of solid material and drilling mud resulting from a horizontal drilling operation and removed from a borehole drilled by rotary, percussion, or auger methods." Moreover, the definition proposed is insufficiently narrow. It currently excludes wastes generally found to have the highest radiation levels, including waste from hydraulic fracturing, well completion, and production waste.

2. The liner requirements for cells dedicated to the disposal of drill cuttings and associated wastes should exceed those for cells dedicated to ordinary solid waste.

Under § 5.6.b of the proposed rule, "Liner System Requirements," the liner system for cells dedicated solely to the disposal of drill cuttings and associated wastes must meet the requirements of §§ 4.5.d and 4.5.e of the rule. These sections establish standards for liners in traditional solid waste landfills. The proposed § 5.6.b does not take into consideration the nature of the waste that will be deposited in the cells dedicated to drill cuttings and associated drilling waste. No consideration has been given to whether a municipal solid waste liner system is sufficiently protective of the environment for this kind of waste.

3. The sampling requirement for each well bore from which waste will be accepted is ambiguous.

In § 5.6.c.1.B, the proposed rule requires that the "facility must obtain at least one composite sample from the lateral or horizontal portion of each well bore unless otherwise approved by the Secretary." The word *obtain* is ambiguous. This requirement does not specify whether the facility must undertake independent sampling of the well bores, or if a facility can simply require its customers to undertake such sampling and provide the samples or sample analyses to the facility. Moreover, a composite sample taken from the well bore would be practically impossible to acquire and would not be representative of the various streams. If sampling of each well bore is to be required, the proposed rule should be clarified to make it clear that samples are to be collected by the driller or operator of the well, not the owner or operator of the solid waste disposal facility.

4. The proposed rule appears contradictory with respect to materials which may be used in the first eight feet of the disposal facility.

Section 4.5.d.8 is inconsistent with respect to the materials that may be placed in the first eight feet of the landfill. This section begins by saying that the first eight feet of solid waste placed on the protective cover must not be comprised of sludge or earthen material. However, the very next sentence of the proposed rule provides that facilities which have received approval under subsection 5.6 of the proposed rule may use drilling waste in the first eight feet. Drilling waste will consist largely of earthen material. This section should be clarified to address whether or not drill cuttings and associated drilling wastes may be used in the first eight feet.

5. The proposed rule does not prescribe a method for disposal of leachate from cells dedicated to the disposal of drill cuttings or associated drilling waste.

Section 5.6.b.2 of the proposed rule requires that "[t]he dedicated cell(s) [for drill cuttings and associated drilling waste] be designed in a manner that separates the leachate generated in the cell from the leachate in any and all municipal solid waste cells at the facility." In § 5.6.b.3.B, the proposed rule requires that the leachate from dedicated cells be sampled monthly. The proposed rule does not provide any guidance on the proper disposal of the leachate from cells dedicated to drill cuttings and associated wastes. This leachate should be disposed of in an approved underground injection well. The proposed rule should contain this requirement.

6. Surface water bodies and groundwater monitoring wells near landfills accepting drill cuttings and associated drilling waste should be sampled for the same analytes as the leachate from cells dedicated to these wastes.

The sampling requirements contained in the proposed rule address only the leachate collected at facilities accepting drill cuttings and associated drilling waste. The proposed rule ignores the potential impact of these wastes on groundwater and nearby surface water. Commercial solid waste facilities are already required to install groundwater monitoring wells. *See* W. Va. Code of State Rules § 33-1-3.8.d *et seq.* In addition to the monthly sampling of the leachate from cells dedicated to drill cuttings and associated drilling waste, these groundwater monitoring wells should be sampled monthly for the same analytes identified in Appendix V of the proposed rule. Moreover, nearby surface water bodies should also be sampled monthly and tested for the same analytes. This additional data would allow DEP to assess the impact, if any, of the dedicated cells on groundwater and surface water near a facility accepting these wastes.

7. The proposed rule should contain a greater daily cover requirement for cells dedicated to drill cuttings and associated drilling waste than what is required for ordinary solid waste.

The inherent radioactivity of drill cuttings and associated wastes from the Marcellus and Utica shales make the six-inch daily cover requirement from § 4.6.b.2.A of the rule insufficient. At a minimum, cells dedicated to drill cuttings and associated wastes should require the twelve-inch intermediate daily covering now required in § 4.6.b.2.B for cells that will be exposed to weather for thirty days.

8. The bonds required for facilities accepting drill cuttings and associated drilling waste should be higher than those required for traditional solid waste disposal facilities.

Facilities that accept drill cuttings and associated drilling wastes represent a potentially greater environmental liability to the State of West Virginia than traditional solid waste landfills. The proposed rule gives no consideration to the bond requirements for facilities accepting drill cuttings and associated drilling waste. The Director should consider the additional environmental liability posed by these facilities and impose greater bonding requirements for these facilities.

9. Workers and employees at facilities which accept drill cuttings and associated drilling waste should be provided additional safety training and appropriate personal protective equipment.

The proposed rule does not adequately address the worker safety issues that accompany disposal of drill cuttings and associated drilling wastes. In § 5.6.d.5 of the proposed rule, a facility which proposes to accept drill cuttings and associated drilling waste must submit a Radiation Monitoring Plan for approval by both DEP and the West Virginia DHHR Radiological Health Program. No other guidance is given. The proposed rule should provide that a facility's plan must address worker safety training and the use and provision of personal protective equipment for all workers with the potential for exposure to radioactive material.

10. Facilities accepting drill cuttings and associated drilling wastes should be required to make periodic reports of the amount of these wastes accepted.

The availability of adequate landfill space for proper disposal of municipal solid waste in West Virginia is an important issue. It is therefore necessary to monitor the volume of drill cuttings and associated drilling waste accepted at commercial solid waste disposal facilities in West Virginia. Landfills accepting this waste should report monthly on the amount of waste accepted, the available airspace, and the projected useful life of these cells. These data would allow DEP to accurately assess the impact of drill cuttings and associated drilling waste on the total volume of space available for solid waste disposal throughout West Virginia.

Bowles Rice hopes these comments will be given appropriate consideration as this proposed rule moves through the rulemaking process. If you should have any questions about these comments or should you want additional information about any point raised in this these comments, please contact me.

Very truly yours,

Leonard B. Knee

Johnston, David L

From: DEP Comments
Sent: Wednesday, July 30, 2014 11:04 AM
To: Johnston, David L
Subject: FW: 33CSR 1 David Johnston - Radioactive Drill Waste in Landfillsd

Importance: High

-----Original Message-----
From: Oreilly, James (oreilljt) [mailto:OREILLJT@ucmail.uc.edu]
Sent: Tuesday, July 29, 2014 3:58 PM
To: DEP Comments
Subject: 33CSR 1 - David Johnston - Radioactive Drill Waste in Landfillsd
Importance: High

To DEP.Comments@wv.gov
Attn: David Johnston, WVa DEP - 33CSR1 - July 29, 2014
From: Prof. James O'Reilly, Division of Public Health Sciences, Department of Environmental Health, College of Medicine, University of Cincinnati, james.oreilly@uc.edu, 513 708-5601
Re: Proposed Rule, 5.6(d)(1)Radioactive Waste – Gas Drilling Cuttings in Waste Landfills This will request that the Department decrease the permissible picoCuries level in proposed 5.6(d) from 5 pCi/gr to no greater than 2 pCi/gr. This also supports the requirements for the installation of sensitive and sufficient detection gear for reliable truck-level monitoring of the drill cuttings in a truck shipment of drill waste.
1. The protection of downstream populations from toxins in landfill leachate is a universal objective of professionals in the public health community and the environmental community. The "precautionary principle" teaches that we as members of the general public and parents of water-consuming children should be assured that government will protect against unreasonable health risks. Bone absorption of radioactive materials by young children has significant long term risks. Exposure to radioactive waste material including leachate-impacted drinking water downstream should be minimized to the extent it is technologically feasible to do so. Therefore the more stringent measureable standard, 2, is more protective of public health than the proposed 5.
2. Persistent bioaccumulation of radioactive waste in concentrated sludge from gas drilling operations produces undesireable quantities of radium and strontium byproducts, with substantial variations of the radioactivity in the waste depending on geologic conditions, and variability of the ways in which the fractionation of shale has exposed the radioactive material to the produced water/flowback that carries the waste to the surface.
3. Some in industry argue that tightening acceptance criteria at landfills will produce levels of rogue, illegal dumping such has occurred in North Dakota. To argue this way is to admit their corporate strategy is to imperil the long term public health, and that looser protection would deliver an economic level at which they would be happy to operate today. The voters and consumers have already considered how credible the waste industry is in West Virginia.
4. Squarely face the claims of economic burden, and please reject them. Use the best technology now, not later. Use the safest course of landfill monitoring, not the cheapest. I urge the DEP to reject claims that an increase in radioactive leachate in effluent from landfills is to be accepted as a desirable trade-off for claims of more short-term employment in low-wage transient jobs. I urge the DEP to protect the environment, as its very name suggests, even though LLC drilling companies which are reportedly funded by the state oil companies of Norway, China and France would prefer not to spend any additional money to protect people in West Virginia. Let the bright minds of Wall Street and London shale gas investors come up with a wellhead-centered means of dealing responsibly with disposal of the contaminants they dig up with the drill waste's radioactivity. The drillers' LLCs will be long gone by the time that an increase in human bone concentration levels of strontium or radium among West Virginia children is precisely known. The irony is that economic

arguments are being made by companies which are legally designed to "dissolve" under corporation law, while the byproduct of their drilling will not dissolve its radium content for many thousands of years.
5. In my textbooks for Thomson-Reuters, "State & Local Government Solid Waste Management", "Superfund & Brownfields Cleanup", "RCRA & Superfund Practice" and 'Toxic Torts Practice Guide", I urge the protection of the public and especially the downstream consumer. I have been engaged by Thomson-Reuters to produce a 2015 text on Gas Fracking Policy & Legal Issues. During the course of my research I have gathered information that suggests state governments have not regulated the drilling wastes from fracking to an extent that protects the downstream users from leachate effects. I also have observed that landfill planners assume a waste compression will allow years more waste to be placed into an existing landfill – but the landfills that accept rock waste will never compress and will never be within the presumptive landfill re-filling rates. This means more landfills will be needed as the rock waste fills the existing sites. That is a bigger concern than the issue in this rulemaking, but it is one that DEP landfill life-time planners must consider. The less rock waste you allow, the less the lifespan will be fore-shortened for the existing landfill sites.

Thank you for considering these comments, and please tighten, not loosen, the radioactivity that will be tolerated by your Department of Environmental Protection.

Prof. James T. O'Reilly
James.oreilly@uc.edu

Johnston, David L

From: DEP Comments
Sent: Wednesday, July 30, 2014 11:05 AM
To: Johnston, David L
Subject: FW: Comments/Questions 33CSR1

From: Kevin Kosko [mailto:kevinkosko@austinmasterservices.com]
Sent: Wednesday, July 30, 2014 11:00 AM
To: DEP Comments
Subject: Comments/Questions 33CSR1

The revised rule defines regulated material in section 5.6.a.1 as:

Drill Cuttings and Associated Drilling Wastes are defined as, "the broken bits of solid material and drilling mud removed from a borehole drilled by rotary, percussion, or auger methods".

Section 5.6.d.1. states, "All Solid Waste Facilities that accept drill cuttings and associated drilling waste for disposal must install fixed radiation detection equipment at the entrance to the facility. All wastes generated in the exploration, production and development of oil and natural gas and associated activities must be evaluated by this equipment".

Please clarify the difference between "drill cuttings and associated waste" and "all wastes generated in the exploration, production and development of oil and natural gas and associated activities" if any.

Wastes such as tank bottom sludge, injection well filter socks, injection well filtrate, recycle facility filter cake and pipe scale exempt are typically much more radioactive than drill cuttings and drilling mud. Are these more radioactive waste forms exempt from regulation?

A very plausible scenario exists where a load of injection well filter socks alarm the gate radiation monitor. These filters are not "drill cuttings and associated wastes". What will be done with the load?

COMMENT - If the intent of the revised rule is to protect the environment and limit radiation exposure to workers and the general public; regulation of drill cuttings and drill mud exclusively seems to miss the mark. The USEPA website http://www.epa.gov/radiation/tenorm/oilandgas.html provides the following information about TENORM concentrations in typical E&P generated waste.

Tank Bottom Sludge - Average Radium Concentration 75 pCi/g, Maximum Radium Concentration 27,000pCi/g
Pipe Scale - Average Radium Concentration 480 pCi/g, Maximum Radium Concentration 400,000pCi/g
Brine Pit Sludge - Average Radium Concentration 270 pCi/g, Maximum Radium Concentration 1100 pCi/g

In second likely scenario; a load of tank bottom sludge alarms the portal, is scanned with a hand-held radiation meter, is found to exceed 10uR/hr, is sampled and the results indicate >270pCi/g for Ra-226. The load is subsequently found to be in violation of DOT shipping rules and cannot be sent back to the pad.

Who is responsible for properly storing the waste while it is at the landfill? Will proper storage requirements be promulgated in future rulemaking or associated guidance for waste that triggers an alarm and is subsequently found to exceed 10uR/hr above local background? What are the options for disposal of this higher activity waste?

COMMENT - Proposed rulemaking does not require radium analysis prior to putting a load of TENORM waste on public roads. Allowing waste of unknown radioactive concentration on public highways may not be a good idea. Consideration should be given to sampling and/or otherwise determining the TENORM concentration of each waste container prior to transportation.

Section 5.6.d.2. requires that, "The fixed detector must be capable of measuring exposure rates from ten microroentgens per hour (10 µR/hr) to greater than fifty milliroentgens per hour (>50 mR/hr.). The instrument must be maintained and calibrated according to manufacturer specifications.

Additionally, section 5.6.d.2. states that, "The detector elements must be configured to be as close as practical to the waste load and in an appropriate geometry to monitor the waste.

Will the fixed radiation monitors alarm if waste exceeds 5pCi/g above natural background (concentration limit that waste is rejected per section 5.6.d.4)? If not, what is the approximate average radium 226/228 concentration (in pCi/g) required to trigger an alarm if the waste is in a typical steel container (7 mil steel) and the detector is "configured to be as close as practical to the waste load" ?

Will the hand-held radiation detectors be operated by ANSI qualified health physics technicians? If not will there be any training required for individuals collecting dose rate data that will be used to make decisions regarding disposition of waste that alarmed the fixed radiation monitor?

COMMENT - Fixed radiation monitors may do little or no good if they are not properly maintained and sensitive enough to actually see radionuclide concentrations of concern.

What if any restrictions will WV place on waste destined for disposal at a properly permitted out of state landfill facility?

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SIERRA CLUB
FOUNDED 1892

SIERRA CLUB
WEST VIRGINIA CHAPTER
P.O. Box 4142
Morgantown, WV 26504

July 30, 2014

WV Department of Environmental Protection
601 57th St., S.E.,
Charleston, WV, 25304

Re: Comments on amendments to 33-CSR-1-Solid Waste Management rule

Please accept the following comments on behalf approximately 2000 members of the West Virginia Chapter of Sierra Club. **We also request a 10-day extension on the comment period to allow time to submit additional comments**, as we anticipate more technical details to emerge.

1. We concur with the change in section 4.5.d.6.A.3 which prohibits the use of clay or shale in the protective cover zone. This section should be retained to assure adequate permeability of the zone.
2. We oppose the modification in section 4.5.d.8, allowing drilling waste in the first 8 feet of waste placed in the dedicated cell. The section should be modified to require that any drilling waste placed in this zone is incapable of puncturing the liner, has a permeability greater than 1×10^{-3} cm/sec, and is sized to prevent clogging of the leachate collection system.
3. We support the requirement in 5.6.b.2 that leachate from dedicated cells must be kept separate from the leachate in municipal solid waste cells.
4. We support the requirement in 5.6.b.3 that leachate collection and detection lines must be installed in a manner that allows for sampling, but recommend that this section be revised to clarify that samples from the leachate collection and detection lines be designed to allow independent sampling of each.
5. The requirement in section 5.6.b.3.B for monthly sampling is inadequate. These dedicated cells may be receiving material from diverse geologies and diverse drilling sites. If a contaminant were introduced into the leachate collection system, it could be allowed to drain for a month before it could be detected. We recommend that weekly sampling be required.

6. While frequent sampling of the constituents in Appendix V is essential, the section should be modified to require that leachate also be sampled and analyzed for the constituents in Appendix I, as required for other municipal waste cells in section 4.8.d. Appendix V omits many key parameters such as TDS, TPH, Total Phenolics, and others. In addition, the rule should specify that total leachate volume and flow rate from the leachate collection and detection systems be recorded daily.

7. We oppose the provision in section 5.6.c.1.A allowing for a "minor permit modification" pursuant to section 4.13 to accept drilling wastes. We recommend that the pre-siting requirements in section 3.4 and the application requirements of section 3.7 be required for any such cell. These cells are specifically intended to accept tonnages far in excess of what was envisioned for the original municipal waste landfill, and the public notice and application requirements are needed to provide DEP with the information needed for such a modification. Furthermore, the permit fees for a major modification should be required, to assure that DEP is able to recover at least a portion of the administrative costs of adequately processing and evaluating such a permit modification.

8. We recommend that the words "unless otherwise approved by the Secretary" be deleted from section 5.6.c.1.B. This loophole is overly broad, and will lead to virtually every well seeking such an exemption, which means that the requirement will either be automatically waived for everyone who requests it, or it will overburden the agency with excessive administrative work to verify each such request. Most well drillers are analyzing these samples for at least some parameters anyway, so the requirement that such an analysis be required for every well is not unduly burdensome, and provides important protection for the landfill operator and the community.

9. As currently written, section 5.6.c.1.C implies that, either a separate minor permit modification would be submitted for each new well, or that the landfill has such results for all wells from which it is likely to accept wastes. I recommend that section 5.6.c.1.C be modified by deleting the words "special waste minor permit modification application" and replacing them with the words "composite sample collected pursuant to section 5.6.c.1.B". As currently written, by the time a truck load of waste shows up at the landfill, the samples are taken and analyzed, and the results obtained, that waste will have been long buried, and its location lost. The sampling and analyses must be the responsibility of the well driller, and those results should be available before the truck leaves the well site. It is unrealistic to ask the landfill operator to protect the workers, the community or the environment if such sampling and analysis is not done in advance of when the waste shows up at the landfill.

10. It is appropriate that loads exceeding safe radiation levels be rejected, but the rule is silent about what happens to such waste, other than that the landfill would not keep it. The rule should require that such loads be reported to DEP, and that the well operator be required to identify the ultimate disposal location, so that safe disposal is assured and "midnight dumping" is avoided.

11. A new section should be added to clarify the methods of disposal for leachate when parameters such as Radium exceed Safe Drinking Water Act standards. Disposal of such leachate at most POTWs is not appropriate as most of these do not have methods for removing radioactive elements from waste water. Radioactive elements have half-lives

of thousands of years, so disposal of these wastes in a landfill merely delays, but does not prevent, their release into drinking water sources.

Thank you for the opportunity to comment.

Sincerely,

James Kotcon, Chair
Energy Committee

WETZEL COUNTY LANDFILL
RT. 1, BOX 156A
NEW MARTINSVILLE, WV 26155

WILLIAM F. FOX, JR., ESQUIRE
General Counsel

484-398-6500
Facsimile: 267-933-6049
bill.fox@jpmascaro.com

Reply to: 2650 Audubon Road
Audubon, PA 19403

July 30, 2014

Kristin A. Boggs, Esquire
General Counsel
West Virginia Department
Of Environmental Protection
601 57th Street S.E.
Charleston, WV 25304

Re: June 30, 2014 Emergency/Legislative Rule Regarding
Drill Cuttings and Associated Drilling Waste
Addendum to 7/28/14 letter from William Fox - Protective Cover

Dear Ms. Boggs:

On June 30, 2014, you, on behalf of the West Virginia Department of Environmental Protection, published a Notice of Emergency Rule regarding drill cuttings and associated drilling waste ("drill cuttings"), which Emergency Rule was approved by the Secretary of State on July 10, 2014, and took effect immediately. Wetzel County Landfill and Brooke County Landfill currently have cell construction in progress which would make it unrealistic to comply with part of the following rule related to the protective cover zone of the cell (change underlined):

4.5.d.6.A.3. Be constructed of soil or earthen materials to ensure that the hydraulic leachate head on the composite liner does not exceed one (1) foot at the expected flow capacity from the drainage area except during storm events. Clay and shale may not be used in the protective cover zone;

Wetzel County Landfill and Brooke County Landfill have utilized onsite screened protective cover for many years in an effort to beneficially reuse cut material from cell construction. This material can be classified as a shale material, which by definition, is a fine-grained sedimentary rock containing a mix of fine-grained clay minerals and silt materials prevalent in the site's vicinity. The onsite crusher and screener operation that has been utilized screens the majority of the fines out of the shale to produce a material that conforms with the following existing 33SCR1 rule in its entirety:

5.4.b.4. The leachate collection and protective cover zone must:

5.4.b.4.A. Create a flow zone between the compacted soil liner and solid waste more

permeable than 1 x 10-3 cm/sec based on laboratory and field testing. The leachate collection zone, including the piping system, must be designed and placed on a minimum slope of two percent (2%) to facilitate efficient leachate drainage and prevent ponding on the composite liner;

5.4.b.4.B. Be at least eighteen (18) inches thick;

5.4.b.4.C. Be constructed of soil or earthen materials to ensure that the hydraulic leachate head on the composite liner does not exceed one (1) foot at the expected flow capacity from the drainage area except during storm events;

5.4.b.4.D. Be comprised of clean soil or earthen materials that contain no debris, plant material, rocks, material with sharp edges or other solid material larger than one-quarter (¼) inch in diameter;

5.4.b.4.E. Be graded, uniformly compacted, and smoothed;

The protective cover has always met the requirements of 33CSR1 5.4.b.4A-E and will continue to meet these requirements. The statement *"Clay and shale may not be used in the protective cover zone"* in the emergency rule could be loosely interpreted and would prohibit the use of our onsite material for current and future construction.

Wetzel County Landfill and Brooke County Landfill have already screened the material onsite for 2014 construction at a significant financial cost to the company and the requirement to haul in a different material that is not "shale" from a quarry would cost in excess of $200,000. It would also add over 1000 triaxle trucks transporting this stone on state roads for a material that essentially performs identical (per 33CSR1 5.4.b.4). This material has been shown in lab testing to meet the requirements and has been previously approved by the WVDEP.

Wetzel County Landfill and Brooke County Landfill would request relief from this requirement to use shale rock in 2014 construction and moving forward as there is no engineering justification and would allow the facilities to beneficially reuse material onsite.

Thank you for your consideration in this matter.

Very truly yours,

William F. Fox, Jr.

WFF/cab
Via Federal Express and Email

cc: Scott G. Mandirola, Director, Division of Water and Waste Management
Pasquale N. Mascaro
Ryan Inch, P.E.
Jon March, P.E.
Terry Gadd, Environmental Compliance
Wetzel County Landfill

BROOKE COUNTY LANDFILL

RD#2, BOX 410
COLLIERS, WV 26035

WILLIAM F. FOX, JR., ESQUIRE
General Counsel

484-398-6500
Facsimile: 267-933-6049
bill.fox@jpmascaro.com

Reply to: 2650 Audubon Road
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July 30, 2014

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Thank you for your consideration in this matter.

Very truly yours,

William F. Fox, Jr.

WFF/cab
Via Federal Express and Email

cc: Scott G. Mandirola, Director, Division of Water and Waste Management
Pasquale N. Mascaro
Ryan Inch, P.E.
Jon March, P.E.
Terry Gadd, Environmental Compliance
Brooke County Landfill

Public comment hearing
33 CSR 1 Series 1 Solid Waste Management Draft Rule

Wednesday 30 July 201
Mark Cochran

In preparation for today's public comment opportunity, the WCSWA engaged two environmental consulting firms to prepare technical questions and comments regarding the Draft Rules. Downstream Strategies of Morgantown addressed primarily water and air issues and Bennett & Williams of Columbus, Ohio, addressed issues primarily concerned with landfill design. We are presenting to you the results of the work of these two firms. I believe these two works are concise yet comprehensive. B & W takes me about twenty minutes to read, Downstream Strategies a bit longer

I would like to speak to a few things that stick out to me in these works. Both of these works speak to something I believe should concern us all: Because drilling waste is currently being deposited in West Virginia landfills, and because this drilling waste contains heavy metals and radioactive materials in unknown quantities, and because this drilling waste contributes to landfill leachate, and because landfill leachate is treated in conventional wastewater treatment systems which are not designed and not capable of removing heavy metals and radioactive materials, and because wastewater treatment facilities discharge their effulent into the surface waters of the state, we as a citizenry and we as a state are permitting the lawful discharge of these contaminants into the state's surface waters. I believe we should question the wisdom of such a circumstance.

In the Downstream Strategies work, on pages 16 & 17, the issue of minor permit modifications and major permit modifications is addressed. As pointed out in the text, many of the criteria necessary for a major permit modification are encountered when a landfill accepts drilling waste. Would not a major permit modification be appropriate for landfills that increase their monthly tonnage intakes by a factor of two or three or more?

In the Bennett & Williams work, questions are raised about the capability of leachate and liner systems designed for municipal waste disposal to be adequate for disposal of drilling waste that has a density of two to three times that of municipal waste. Will these systems be robust enough to handle the extra weight. Do new engineering criteria need to be developed for the increased weight of drilling waste?

I urge you to review these two works.

I thank you for the opportunity to speak.

Mark Cochran
3304 Dooling Run Road
New Martinsville, WV
26155
304-455-5508

WEST VIRGINIA RIVERS COALITION

3501 MacCorkle Ave. SE #129 · Charleston, WV 25304 · (304) 637-7201 · www.wvrivers.org

July 30, 2014

Randy Huffman, Secretary
WV Department of Environmental Protection
601 57th Street, SE
Charleston, WV 25304

RE: Comments on Solid Waste Management Rule 33CSR1

The shale gas drilling boom in West Virginia has presented the state with the hefty challenge of balancing the economic opportunities of gas development with protection of the natural environment and its land, air and water resources we rely on to survive.

One of the most challenging aspects accompanying the recent surge of unconventional gas drilling is managing the massive volume of waste generated from these operations. Not only is there simply a lot of it to deal with, but we know the waste includes heavy metals and radiological elements that pose a risk to human health.

The volume of waste is only expected to increase in coming years – as of this spring West Virginia has around 2300 Marcellus wells[1], and the Department of Energy projects that we will see upwards of a pace of 900 Marcellus wells per year by 2020[2]. Management of drilling waste in West Virginia is one of the most serious and significant environmental issues of our time. And we need be very thoughtful and cautious in how we proceed.

For the West Virginia Rivers Coalition, we focus our concerns on how drilling waste management, handling and disposal practices pose a threat to water quality. A leading concern is that there are simply many unknowns in the characterization of drilling waste and the effectiveness of leachate treatment prior to its discharge into a receiving stream.

It is known that Naturally Occurring Radioactive Materials such as Radium 226 is found in drilling waste and is water soluble[3]. It is in the leachate that leaves landfills accepting drilling waste[4], gets treated, and then is discharged into a receiving stream. For the Wetzel County Sanitary Landfill, that receiving stream is the Ohio River – which is a drinking water source for over five million people. The key concern to this is that we don't

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[1] West Virginia Geological and Economic Survey. Marcellus Wells-Completed Episodes. *Selected References about Devonian Shales.* [Online] April 2, 2014. http://www.wvgs.wvnet.edu/www/datastat/devshales.htm.
[2] National Energy Technology Labratory. *Projecting the Economic Impact of Marcellus Shale GasDevelopment in West Virginia: A Preliminary Analysis Using Publicly Available Data.* US Department of Energy. 2010. DOE/NETL- 402033110.
[3] Resnikoff, Marvin, Alexandrova, Ekaterina and Travers, Jackie. *Radioactivity in Marcellus Shale.* 2010.
[4] Data from leachate monitoring reports submitted by Meadowfill Landfill and Wetzel County Sanitary Landfill to WVDEP, 2011-2013

know enough about the effectiveness of treatment. We don't know all of the pollutants we are adding to receiving streams and rivers, and how what we are adding impacts the overall pollutant carrying capacity of receiving waters over time. These practices are in essence an experiment, and the rivers and people of West Virginia are the subjects of this experiment.

The lead author of a 2013 WVDEP-sanctioned study concluded: "At present little is known about the risks associated with the solid wastes from hydraulic fracturing in the Marcellus. Characterization of their inorganic, organic and radioactive contaminants is at present, incomplete. A systematic study including worker, environmental and community risks is needed."[5]

Ideally, we would have like to have seen an investment in such systematic studies before subjecting the public to this "experiment" in drilling waste management. But it's seemingly too late for that. The DEP and the Legislature are moving us ahead in this experiment.

This solid waste rule needs to take every measure to make sure this is not an experiment gone wrong. Just mention of the letters "MCHM" quickly remind us of how terribly things can go wrong when there are unknowns about contaminants that can or are entering our water supplies.

At this point, DEP must make every assurance in these rules that the best technology be used in monitoring, and that monitoring includes a complete set of parameters, particularly at the point of discharge into surface waters. We cannot cut corners when it comes to protecting our water and our health. We cannot look to "quick fixes" that suit the gas industry's needs without thinking about long-term accumulative health and environmental impacts.

Today I reviewed comments submitted on this rule from Professor James O'Reilly with the University of Cincinnati's College of Medicine. He is the author of multiple textbooks dealing with solid waste management, and this excerpt from his comments reveals insight into the dynamics of weighing economic burdens on industry versus public health. In his comments dated July 29, 2014 he urges DEP to:

"Squarely face the claims of economic burden, and please reject them. Use the best technology now, not later. Use the safest course of landfill monitoring, not the cheapest. I urge the DEP to reject claims that an increase in radioactive leachate in effluent from landfills is to be accepted as a desirable trade-off for claims of more short-term employment in low-wage transient jobs. I urge the DEP to protect the environment, as its very name suggests, even though LLC drilling companies which are reportedly funded by the state oil companies of Norway, China and France would prefer not to spend any additional money to protect people in West Virginia. Let the bright minds of Wall Street and London shale gas investors come up with a wellhead-centered means of dealing responsibly with disposal of the contaminants they dig up with the drill waste's radioactivity. The drillers' LLCs will be long gone by the time that an increase in human bone concentration levels of strontium or radium among West Virginia children is precisely known. The irony is that economic arguments are being made by companies which are legally designed

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[5] *Practical measures for reducing the risk of environmental contamination in shale energy production.* Ziemkiewicz, Paul, Quaranta, John D and McCawley, Michael. 7, 2014, Environmental Science: Process & Impacts, Vol. 16, pp. 1692-1699.

to "dissolve" under corporation law, while the byproduct of their drilling will not dissolve its radium content for many thousands of years."

It's time to expect more of industry to come up with long-term sustainable solutions that are proven to be environmentally sound and protective of human health. As I said earlier, this problem will not go away, it will only increase. Our request is that the DEP, the Legislature and the drilling companies operating in this state will put West Virginia forward as a national model for innovative technology and practices that reduce toxic waste and plan prudently for long-term safe management. HB 107 and these rules do not get us there, and I am very concerned about our state's handling of this issue – again, one of the most significant environmental issues of our time.

In the meantime until we get to that place we need to be in expanding our thinking about the problem, West Virginia Rivers Coalition supports the technical comments and questions submitted by the Wetzel County Solid Waste Authority and Professor James O'Reilly.

We will be paying close attention to the requirement in HB 107 for the DEP to conduct an investigation and submit a report to the Legislature that examines hazardous characteristics of leachate collected at facilities receiving drilling waste, and its potential negative impacts on surface and groundwater resources. This rule must be revised to ensure that the DEP is able to conduct a thorough and accurate evaluation pursuant to this requirement.

Thank you for the opportunity for these comments to be considered.

Angie Rosser
Executive Director

Wetzel County Solid Waste Authority

P.O. Box 61 New Martinsville WV 26155 Phone: 304-455-5262
Chairman: William J. Hughes Coordinator: Terri L Tyler

7/30/2014

West Virginia Department of Environmental Protection
601 57th Street, SE
Charleston, WV 25304
Attn: Randy Huffman

Re: Public Comments on WV 33CSR1

Randy Huffman, Cabinet Secretary;

The passage of WV HB 107 required that the WVDEP promulgate emergency and legislative rules to establish limits and regulations for the unique toxins associated with the drilling waste from shale gas extraction. These include items such as heavy metals, radioactive waste and petroleum wastes. The WVDEP has released its proposed emergency rules which went into effect during July 2014. These proposed rules are now out for public comments, It is to these issues that the Wetzel County Solid Waste Authority would now like to speak. We offer these reports and comments to be considered for changes and modifications to the draft rule.

The WV 33CSR1, the Solid Waste Management Rule, is 176 pages long and literally has been decades in the making. The variables within it are complex, highly technical and require a range of professionals with civil and chemical engineering knowledge. Geologists and hydrology experts with public water quality training are required. The recent inclusion of the radioactive waste known to be present in the shale drill cuttings and in landfill leachate from black shale waste material has now required the attention of those familiar with the fate, transport, and disposal of these special waste products and their potential impact on the waters of the state.

When WCSWA sought out professional assistance, it was obvious that no one firm had the entire prerequisite experience and knowledge for the array of complex issues. The two reports here were done by Bennett & Williams of Columbus, Ohio and Downstream Strategies of Morgantown, West Virginia. One firm was asked to examine the civil engineering and landfill design and operations topics along with the unique problems associated with the chemical and radiological nature and volume of the shale waste. The other was asked to focus considerable attention on the effect of such a large increase in the waste flow; the produced landfill leachate and its potential effects on the state surface waters and long term effects on the waters of our state.

When WCSWA was evaluating some consultants, we could find professionals in landfill design and operations. However we also needed someone with radioactive waste disposal experience. That was also available. We could not find anyone experienced with broad based, multi-state, large scale disposal of massive quantities of radioactive wastes into Municipal Solid Waste landfills.

It seems that at no time ever, since nuclear waste products started being generated, has any state or federal government ever allowed disposal of very large quantities of uncharacterized radioactive waste into Municipal Solid Waste landfills.

Some shale formations currently being exploited, the Marcellus being a good example, have long been identified by their elevated radioactive gamma signatures. There is limited information about how human exposure to this type of radiation might occur when placed in Municipal Solid Waste landfills.

The dose or "amount" of this radiation in drilling waste streams is still not properly characterized – by anybody. Even if the dose were low and comparable to other waste streams that exhibit low radioactivity, such as certain medical wastes, the sheer volume being generated merits serious attention. Especially since Municipal Solid Waste landfills, by design, interact with both natural surface water and groundwater systems, we must not miss this opportunity to appropriately design systems that can manage drilling waste in perpetuity. Unlike other Municipal Solid Waste which slowly degrades by natural processes, the heavy metals and radionuclides in drilling wastes persist for at least tens of thousands of years.

It is only now, due to the recent shale gas expansion, that multiple states have experienced the widespread proliferation of radioactive waste now being generated from the shale gas extraction business.

This is a large experiment into uncharted territory without any template or models or maps to help us to make prudent choices with regard to the long-term environmental and public health implications. This is a leading edge problem of our own making. We need to proceed with the utmost prudence. Some of our decisions might be irreversible.

The chemical laws of nature, the rules of nuclear physics, and the permanent human need for clean potable water will not be altered whether we act in uninformed haste or with prudent and reasoned deliberations. Just having good intentions combined with our temporary ignorance of immutable natural laws will not be tolerated by nature or forgiven by many generations to come. Mother Nature will have the final say.

Thank you for your time and consideration in this matter.

The members of the Wetzel County Solid Waste Authority

William J. Hughes, Chairman

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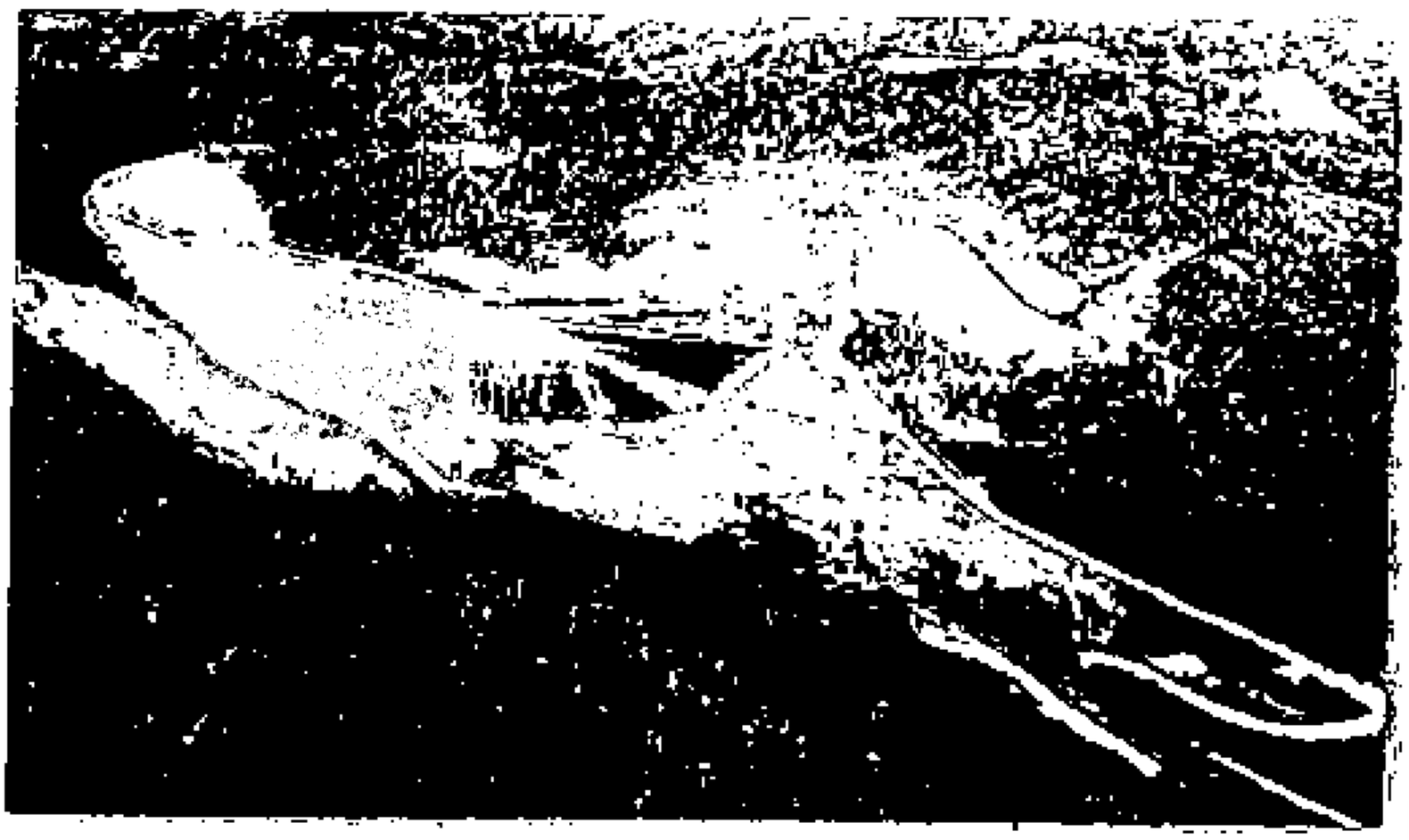
Downstream Strategies Report

Comments on Proposed Changes to the West Virginia Solid Waste Management Rule 33CSR1

Marc Glass, Principal
Kendra Hatcher, Project Scientist

Downstream Strategies

295 High Street
Suite 3
Morgantown, WV 26505
www.downstreamstrategies.com



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Wetzel County Solid Waste Authority

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Downstream Strategies
building capacity for sustainability

Comments on Proposed Changes to the West Virginia Solid Waste Management Rule 33CSR1

Marc Glass and Kendra Hatcher

ABOUT THE AUTHORS

Marc Glass, Principal, Monitoring and Remediation Program, Downstream Strategies. Mr. Glass is a Principal at Downstream Strategies, LLC where he manages the Environmental Monitoring and Remediation Program. Projects involve field monitoring of air, surface water, groundwater, soil, and indoor environments. His work has focused on investigating the environmental fate and transport of petroleum hydrocarbons, chlorinated solvents, heavy metals, polychlorinated biphenyls, and other environmental contaminants. Mr. Glass is a West Virginia Licensed Remediation Specialist and has managed environmental projects characterizing and remediating above and underground storage tank, bulk petroleum storage, manufacturing, metals refining, and other hazardous wastes sites.

Kendra Hatcher, M.S., Staff Environmental Scientist, Downstream Strategies. Ms. Hatcher has worked on a variety of water resources issues, ranging from analyzing spatial characteristics of international river basins to measuring local water quality. She has wide experience in field-based data collection and data management, including water chemistry and flow monitoring of surface waters. She has also used GIS technologies for over nine years to analyze and manage spatial data related to natural resources and the environment.

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ABBREVIATIONS

HVHF	High volume hydraulic fracturing
MSW	Municipal solid waste
NORM	Naturally occurring radioactive materials
NPDES	National Pollutant Discharge Elimination System
POTW	Publically operated treatment works
RCRA	Resource Conservation and Recovery Act
WCSL	Wetzel County Sanitary Landfill
WVDEP	West Virginia Department of Environmental Protection
WWTP	Waste water treatment plant
USEPA	United States Environmental Protection Agency

1. INTRODUCTION

This report has been prepared at the request of the Wetzel County Solid Waste Authority to assist in its preparation for a public hearing regarding proposed changes to the West Virginia Solid Waste Management Rule[1] ("Rule"). The proposed changes to the Rule have already been temporarily put in place under an Emergency Rule, which was enacted on July 27, 2014. Because the Emergency Rule went into effect during the public comment period for the proposed changes, this report may reference the "Rule" and "Emergency Rule" interchangeably.

The proposed changes to the Rule deal largely with accommodating an increasing waste stream generated during unconventional development of hydrocarbon resources—commonly known as high volume hydraulic fracturing (HVHF)—by which well borings are advanced both vertically and horizontally to frequently achieve common total boring lengths of up to 12,000 feet (1). Due to a number of undesirable conditions created by managing large volumes of drill cuttings at or near the site of origin, such as unstable fill areas and environmental concerns, the 2011 Natural Gas Horizontal Well Control Act required the disposal of drill cuttings and associated drilling mud, collectively referenced as drilling waste, generated from any horizontal natural gas well, to be disposed of in an approved solid waste facility[2] unless specific permission is obtained from the surface owner to manage waste onsite.

Although drilling wastes have historically been allowed to be disposed in permitted West Virginia municipal solid waste (MSW) landfills, the result of the recent oil and gas industry expansion and newer policies is that at least since 2011, landfill tonnage reports indicate many hundreds of thousands of tons of drilling wastes, generated both in West Virginia and other states, have been placed in West Virginia MSW landfills.

Since 2011, several solid waste facilities accepting drilling waste have come close to, or in some cases greatly exceeded their permitted monthly tonnage limitations. To rectify the apparent contradiction of requesting that generators dispose of drilling waste in solid waste landfills while simultaneously causing landfill operators to exceed monthly tonnage limitations by accepting these wastes, the WVDEP issued a July 26, 2013 memorandum to solid waste landfill permittees clarifying the West Virginia Department of Environmental Protection (WVDEP) policy for compliance options (2).[3] Operators were provided with two options:

(1) Class B facilities could apply to expand to a Class A facility in order to increase monthly tonnage limits from 9,999 tons to 30,000 tons, or
(2) Class A or Class B facilities could construct a specific cell or cells for accepting only drilling wastes, in which case the disposal of drilling wastes would not count toward a facility's monthly tonnage limitation.

On March 14, 2014, H.B. 107 was enacted to amend Article 15 of WV Code, §22-15-8 and §22-15-11 which implements the new policy regarding monthly tonnage limitations and also required that WVDEP develop rules:

> "... to establish limits for unique toxins associated with drill cuttings and drilling waste including, but not limited to heavy metals, petroleum related chemicals, (benzene, toluene, xylene, barium, chlorides, radium and radon) and establish the procedures the facility must follow if that limit is exceeded: Provided, That said rules shall establish and set forth a procedure to provide that any detected radiation readings above any established radiation limits will require that the solid waste landfill immediately

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[1] 33 Code of State Rules (CSR) 1.
[2] W. Va. Code §22-6A-8(g)(2)/
[3] A previous memo from February 21, 2013 set earlier deadlines for the submission of applications for minor permit modifications and construction of the special waste cells.

cease accepting all affected drill cuttings and drilling waste until the secretary has inspected said landfill and certified pursuant to established rules and regulations that radiation levels have returned to below the established radiation limits. Any truck load of drill cuttings or drilling waste which exceeds the radiation reading limits shall not be allowed to enter the landfill until inspected and approved by the Department of Environmental Protection."

2. DRILLING WASTE

In this report, we focus our discussion on drilling waste from the Marcellus Shale because it represents the greatest portion of drilling wastes currently being generated. Neither the existing rule nor the Emergency Rule exclude landfills from accepting drilling wastes from other shale formations or any other source of drilling waste.[4] This is significant, because West Virginia and surrounding states are likely in the early stage of development of not only the Marcellus Shale, but also other formations such as the Utica Shale. The following sections provide a brief overview of anticipated drilling waste volumes and the associated constituents that may persist as contaminants in the environment.

2.1 Waste volume

The Marcellus formation is a Middle Devonian shale found at various depths and thicknesses throughout its extent. In West Virginia and Pennsylvania, it is typically found between 5,000 and 8,000 feet below the surface, with thickness between about 50 to more than 350 feet (3). Accessing these depths by drilling translates to approximately 500 tons of rock cuttings plus drilling mud for a typical 12,000-foot horizontal Marcellus well (1). While this figure calculates the anticipated weight of rock cuttings, personal communications with WVDEP indicate an average 1,000 tons of drilling waste generated per Marcellus well (4).

As of March 2014, 2,322 Marcellus wells have been developed in West Virginia alone (5). The sheer quantity of waste makes management in MSW landfills a challenging issue, particularly as the waste stream is anticipated to increase significantly over the next several years. A 2010 projection prepared by the United States Department of Energy (USDOE) National Energy Technology Laboratory (NETL) estimated that the pace of drilling for Marcellus Shale gas would increase substantially and grow to approximately 900 wells per year by 2020, with an increasing trend for horizontal wells and a declining trend for vertical wells (6).

2.2 Environmental contaminants in drilling waste

The composition of the drilling waste stream may present an even greater management challenge to MSW landfills than the sheer volume.

Drilling wastes will, at a minimum, consist of drill cuttings from the overburden geology from the vertical portion of the wellbore, organic-rich layers from the shale formation, and components of the muds and chemicals used to lubricate the drilling tools and assist with the return of drill cuttings to the surface.

The broken bits of the geological formations in the drill cuttings include naturally occurring salts, metals, reduced minerals, and organic-rich geology. The exact nature and concentration of constituents will depend on local geological conditions and may vary considerably over distance, and potentially even within the same well bore. The reduced minerals from the cuttings may oxidize when exposed to air and water near the surface to produce acidic, metals-rich leachate (7). Once oxidized by interactions above the ground surface, both metals and radionuclides may become much more water soluble, especially under acidic conditions. The naturally occurring radioactive material (NORM) ^{226}Radium, a product of the ^{238}Uranium decay series, is soluble in water and chemically behaves similarly to calcium, strontium, and barium (7). As such, it can be found in the formation water that returns to the surface during the drilling process, drill cuttings, drilling mud, scale and sludge build-ups, fluids from spills, treatment residuals, and other waste products at concentrations exceeding the background environmental levels.

Drilling waste is a chemically complex mixture of fluid and solid organics, salts, minerals, metals, and radionuclides. Metals and radionuclides do not degrade significantly in the environment or with time. As

[4] 33 CSR 1

components of drilling waste mixtures, their environmental mobility may be enhanced over natural conditions.

With regard to the shale itself, which will be a substantial portion of the drill cuttings generated for any horizontal boring, Middle Devonian Marcellus Shale is recognized from other geologic formations in gamma ray wireline logs by its high radioactivity (8). This radioactivity is a result of the naturally occurring radioactive materials (NORMs) uranium and thorium and their decay products, including ^{226}Radium (9). These radioactive elements are brought to the surface with the return of drilling mud, and are then considered to be TENORM, or Technologically Enhanced Naturally Occurring Radioactive Material (10). However, absent a consistent federal program for management of these wastes, it is currently being managed on a state-by-state basis (10). Drill cuttings and produced water are currently exempt from the Resource Conservation and Recovery Act (RCRA) Subtitle C hazardous waste regulations, although it is still subject to regulation under Subtitle D, which applies to solid waste regulation at landfills (10).

As reported by the United States Environmental Protection Agency (USEPA), disposal of these waste that contain gamma emitting radionuclides, which would including drilling waste, in landfill burial sites will require assessments of both gamma radiation emissions and radionuclide concentrations in solids and liquids (11). ***No such comprehensive assessment of drilling wastes placed in municipal waste landfills has yet to be completed.*** As such, we are very much in the experimental phase with managing drilling waste.

However, several studies have analyzed samples of drilling wastes in the field and provide a sufficient body of evidence to suggest some of the environmental implications for MSW landfills.

In 2013, the West Virginia Water Research Institute conducted a WVDEP-sanctioned water and waste stream study. Both liquid and solid samples of drill cuttings and muds were collected and analyzed from the ***vertical*** portion of the well bore (12). The authors noted the following results:

> "With the exception of arsenic, mercury, nitrate and selenium, the average concentrations of the primary and secondary drinking water parameters in drilling muds were in excess of all of the inorganic drinking water standards. They also exceeded the drinking water standards for benzene and surfactant (MBAS). Drilling muds contained very high concentrations of sodium, potassium and chloride. TPH (diesel range) was present in all drilling muds. Concentrations ranged from 23 to 315 mg/L." (12)

With regard to radiation levels, the authors further noted:

> "Background levels of radiation ranged from 0.005 millirems per hour (mrem/hr) to 0.013 mrem/hr. Sample levels of radiation ranged from 0.009 mrem/hr to 0.016 mrem/hr. The standard for contamination is typically twice background. A review of the individual background levels of radiation indicated that this criterion was not exceeded." (12)

It is again significant to note that ***none*** of these samples were collected from the lateral or horizontal portion of the well bore.

In a later article, the lead author of the 2013 WVDEP-sanctioned study presented an expanded conclusion based on the same data:

> "At present little is known about the risks associated with the solid wastes from hydraulic fracturing in the Marcellus: spent drilling mud, drill cuttings and filtrates/precipitates from flowback. Characterization of their inorganic, organic and radioactive contaminants is at present, incomplete. A systematic study including worker, environmental and community risks is needed." (1)

More comprehensive assessments are currently underway by USEPA, the Pennsylvania Department of Environmental Protection (PADEP), a cooperative effort between the Pennsylvania Independent Oil and Gas

Association (PIOGA) and Marcellus Shale Coalition (MSC), and USDOE. However, none of these studies are complete and results have not been made publicly available. Therefore, an accurate characterization and understanding of the environmental fate and transport mechanisms for drilling wastes, particularly in MSWs, is simply unknown.

3. OBSERVED TRENDS IN LANDFILL LEACHATE DATA

To gain perspective on drilling waste contaminant trends in leachate, we reviewed a limited set of landfill leachate data for two West Virginia landfills that have been accepting large quantities of drilling wastes. Multiple landfills across West Virginia currently legally accept drilling wastes. Since 2011, WVDEP has required that MSW landfill permittees accepting drill cuttings analyze their leachate effluent for certain parameters to help evaluate the environmental performance of MSWs in retaining contaminants associated with drilling wastes. We conduct a limited analysis of leachate data reported from 2011 to 2013 for each site we reviewed.

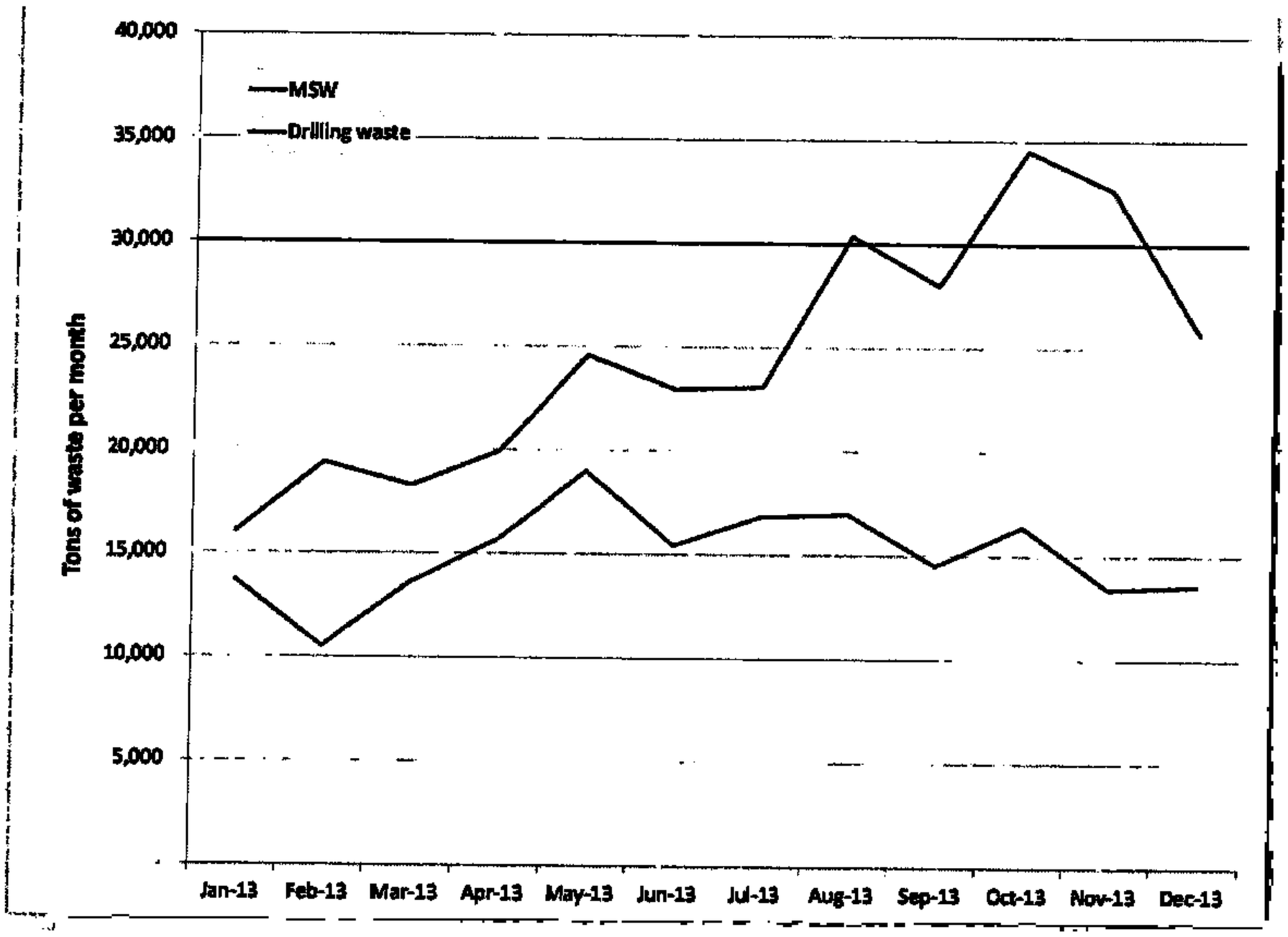
One landfill, Meadowfill Landfill, Inc. ("Meadowfill"), has, since 2011, placed an increasing portion of the drilling waste it receives in a permitted cell dedicated for drilling waste. Here, after pretreatment and storage, leachate is discharged to a Publicly Operated Treatment Works (POTW) facility, where it undergoes further treatment prior to discharging to Simpson Creek. The other facility, the Wetzel County Sanitary Landfill (WCSL), has no dedicated cell and has always intermixed drilling waste with MSW. Treated leachate is discharged directly into the Ohio River.

3.1 Meadowfill Landfill, Inc.

Meadowfill is located in Harrison County, just north of Bridgeport, West Virginia. Meadowfill is a Class A permitted facility and can accept 30,000 tons of waste per month.

It applied in 2011 to construct a dedicated cell for drilling wastes under a minor permit modification, which has been in use since 2012. Prior to the completion of the dedicated cell, drilling wastes were placed in the active areas of the landfill and intermixed with the other MSW. This practice continued, at least through 2013, but at a much lower rate than prior to construction of the dedicated drilling waste cell. The reported volume of drilling waste disposed of in the dedicated cell was larger than the tonnage for all other municipal wastes for every month in 2013, as presented in Figure 1. From August through December 2013, drilling waste disposal into the dedicated cell was approximately double the tonnage for all other municipal wastes combined.

Figure 1: Meadowfill monthly tonnage data



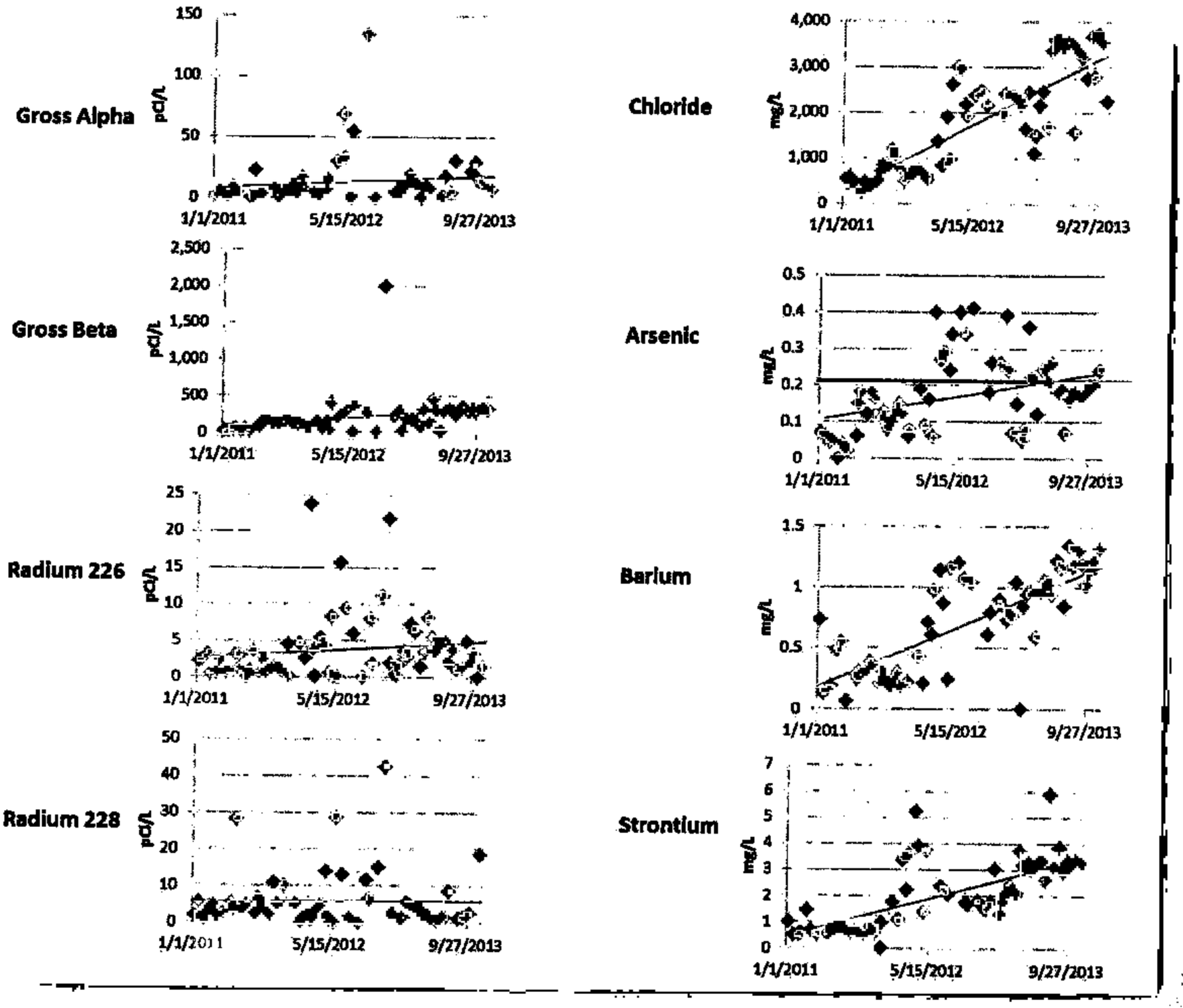
Source: Meadowfill Landfill, Inc. monthly tonnage reports submitted to WVDEP according to 33CSR1 (4.12.b), 2013. The red horizontal line indicates the permitted monthly tonnage limit for the landfill.

All leachate from Meadowfill, including the leachate from the dedicated drilling waste cell, is collected in a leachate pre-treatment holding pond. The resulting pond effluent is piped to a POTW, the City of Bridgeport Waste Water Treatment Plant (WWTP). Meadowfill discharges, on average, 1.5 million gallons per month to the WWTP— equivalent to approximately three Olympic-sized swimming pools. While proposed changes to the Rule will require separate monitoring for leachate from the dedicated drilling waste cells, samples from 2011 through 2013 were collected after the two leachate streams mixed. Therefore, our review utilizes sampling data representing the combined leachate from the MSW cell and dedicated drilling waste cell. Although leachate will undergo some level of additional treatment prior to discharge to surface waters and it is not used as a source of drinking water, for reference we provide comparison to maximum contaminant levels (MCLs) in federal drinking water standards, where they are available.

As shown in Figure 2 below, radiological parameters in pre-treated leachate show clear increasing trends at Meadowfill. A distinctly steeper trend is noted for the more soluble ^{226}Radium as compared to ^{228}Radium. Both radium isotopes are primarily alpha and beta emitters, which also show increasing trends in leachate. There are several months where concentrations of ^{226}Radium and ^{228}Radium ***individually*** exceeded the MCL for combined ^{226}Radium and ^{228}Radium of 5 pCi/L.

Figure 2 also shows increased leachate concentrations for several inorganic parameters consistent with drilling wastes. In Meadowfill, chloride, arsenic, barium, and strontium showed distinct upward trends for 2011 through 2013. Benzene also follows this trend, but is not graphed here.

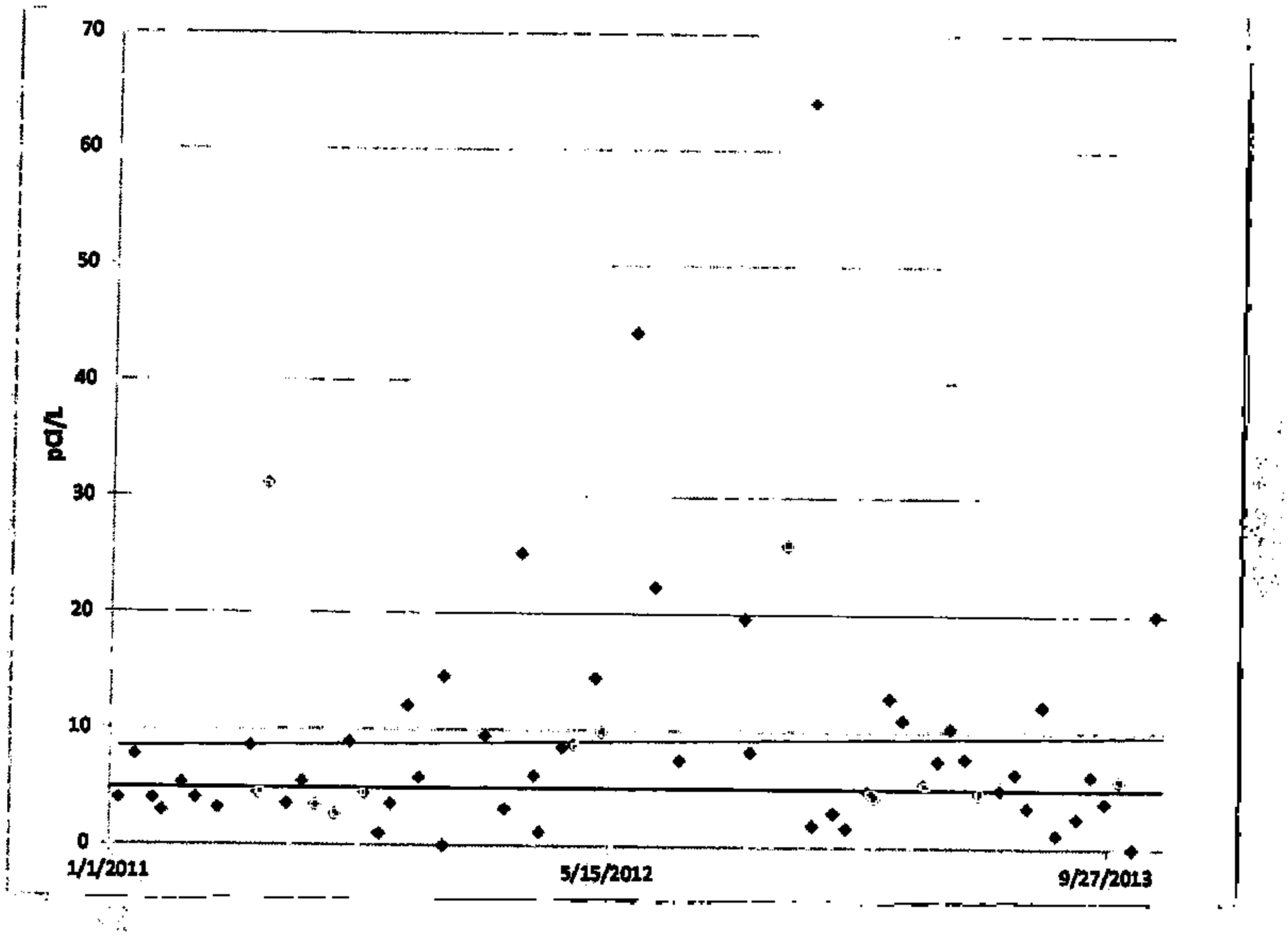
Figure 2: Results from select parameters from leachate analysis at Meadowfill Landfill



Source: Data summarized from leachate monitoring reports submitted to WVDEP, 2011-2013. Red lines on the graphs indicate MCLs from USEPA 2012 Edition of the Drinking Water Standards and Health Advisories (13). Black lines indicate data trend lines..

As depicted in Figure 3, leachate at Meadowfill exceeded the MCL for combined ^{226}Radium and ^{228}Radium of 5 pCi/L during certain months.

Figure 3: Results from ^{226}Radium and ^{228}Radium combined at Meadowfill Landfill

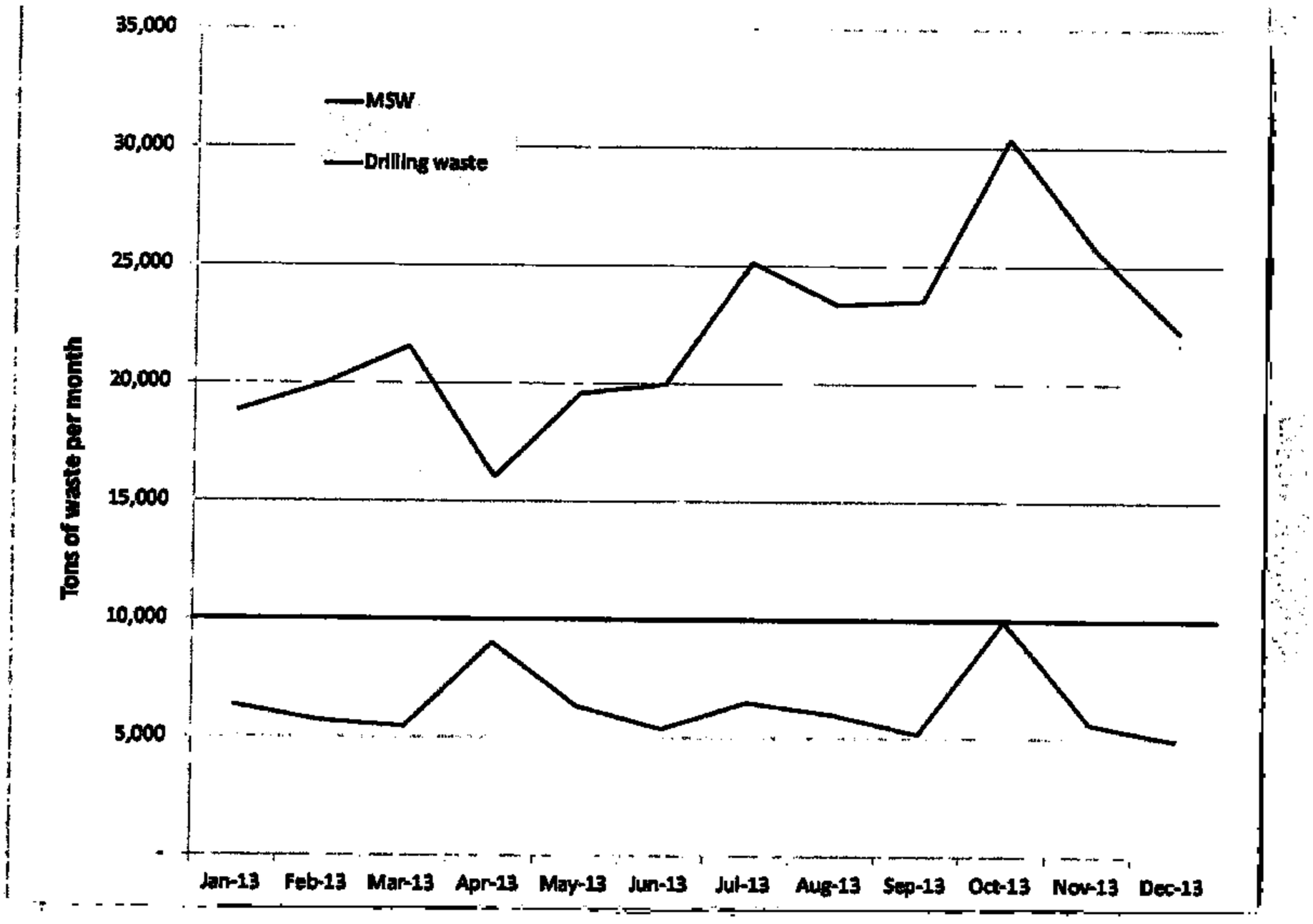


Scurce: Source: Data summarized from leachate monitoring reports submitted to WVDEP, 2011-2013. Red lines on the graphs indicate MCLs from USEPA 2012 Edition of the Drinking Water Standards and Health Advisories (13). Black lines indicate data trend lines.

3.2 Wetzel County Sanitary Landfill

WCSL is located near New Martinsville, West Virginia. It is a Class B permitted facility, and can accept 9,999 tons per month. WCSL is in the process of obtaining approval for the construction of dedicated drilling waste cell. In 2013, monthly tonnage limits were exceeded by at least double for every month, due to drill cuttings.

Figure 4: Wetzel County monthly tonnage data

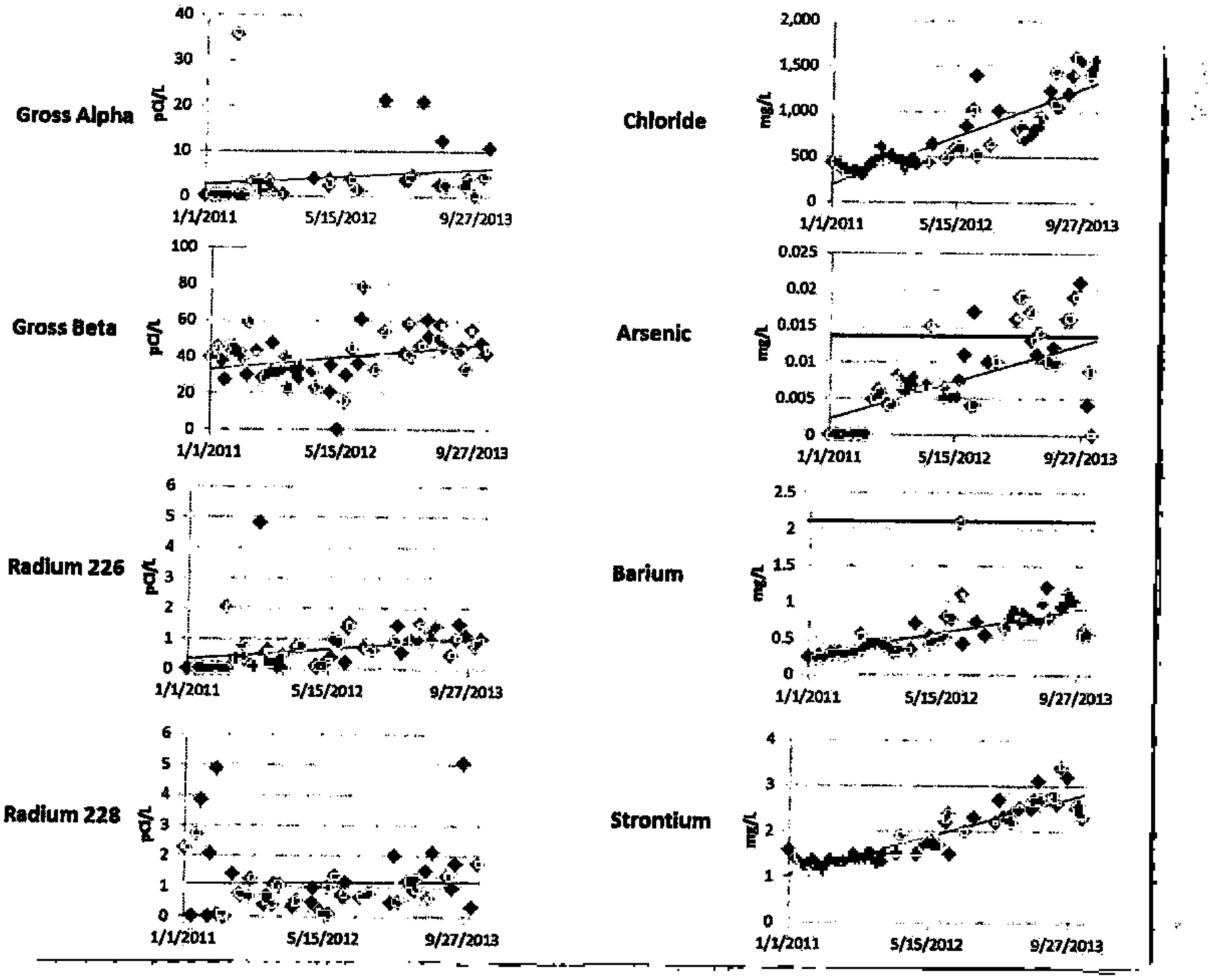


Source: Wetzel County Sanitary Landfill monthly tonnage reports submitted to WVDEP according to 33CSR1 (4.12.b), 2013. The red horizontal line indicates the permitted monthly tonnage limit for the landfill.

WCSL treats all leachate on site prior to discharging the treated leachate directly into the Ohio River. The treatment process directs all collected leachate through an ozone reactor, a primary and secondary aeration basin, a primary and secondary clarifier, and an ultraviolet disinfection unit before entering the river.

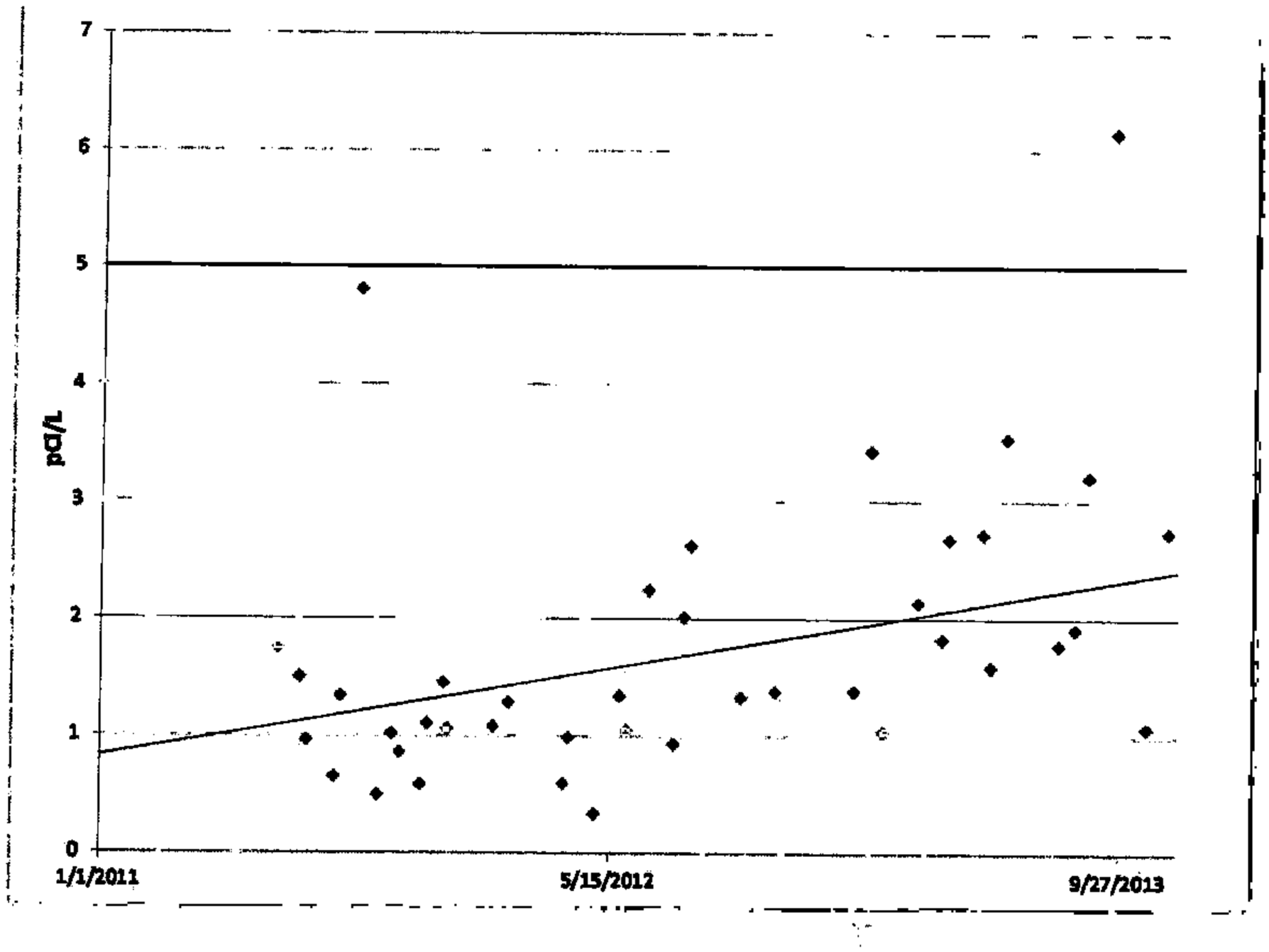
Leachate sampling results show increasing trends from 2011 through 2013 for several parameters associated with drilling waste (Figure 5). Specifically, chloride, arsenic, and barium showed increasing trends. Chloride values tripled during the 2011 through 2013 monitoring period. Gross alpha, gross beta, and ^{226}Radium also showed increases. There were no individual ^{226}Radium or ^{228}Radium values reported above 5 pCi/L at WCSL during this period, but there was one exceedance of the MCL when ^{226}Radium and ^{228}Radium were combined (Figure 6).

Figure 5: Results from select parameters from leachate analysis at WCSL



Source: Source: Data summarized from leachate monitoring reports submitted to WVDEP, 2011-2013. Red lines on the graphs indicate MCLs from USEPA 2012 Edition of the Drinking Water Standards and Health Advisories (13). Black lines indicate data trend lines.

Figure 6: Results from ^{226}Radium and ^{228}Radium combined at WCSL



Source: Data summarized from leachate monitoring reports submitted to WVDEP, 2011-2013. Red lines on the graphs indicate MCLs from USEPA 2012 Edition of the Drinking Water Standards and Health Advisories (13). Black lines indicate data trend lines

3.3 Difficulties in tracking contaminants in leachate

It is currently not possible to evaluate the effectiveness of the leachate treatment systems for either of the landfills we reviewed because appropriate data are not collected. It is currently not possible to evaluate if leachate treatments systems are effective at removing drilling waste contaminants before they are discharged to the environment because the parameters required for leachate monitoring prior to treatment are not also required for NPDES permits that monitor discharges from treatment systems.

As shown in our review of leachate data, there is legitimate concern that concentrating large quantities of Marcellus Shale drilling wastes is already increasing the concentration of contaminants in leachate that must then be managed.

Metals and radionuclides may not degrade significantly in the environment or with time, and their environmental mobility may be altered by interactions within drilling waste mixtures. These and other drilling waste components, such as chlorides, are not typically removed or efficiently recovered during conventional treatment methods at POTWs. Even at industrial treatment facilities, a portion of drilling waste contaminants may persist in the effluent after treatment and be discharged to the environment. A relevant example of this occurred in Pennsylvania, where a study of river sediments ***downstream*** of an industrial brine treatment facility that accepted drillings wastes found ^{226}Radium concentrations at levels nearly 200 times above

upstream and background samples (14). This was true even though the treatment process was reported to have reduced ^{226}Radium levels by more than 90% from the original waste stream (14). This clearly demonstrates the need to monitoring both fluid effluents and sediments in water bodies that receive contributions from drilling waste streams.

Proposed changes to the Rule require the monitoring of leachate from the designated drilling waste cells prior to any treatment for a number of parameters, including several metals, organics, semivolatile organics, gross alpha/gross beta, ^{226}Radium, ^{228} Radium, and ^{90}Strontium (Table 1). However, the same parameters are not required for monitoring under the NPDES permit. At WCSL, the NPDES permit requires monitoring of the effluent from the landfill leachate treatment system before discharging to the Ohio River.

As an industrial user, Meadowfill effluent from the leachate pretreatment and storage pond is monitored before it goes to the City of Bridgeport WWTP. The City of Bridgeport WWTP NPDES permit requires monitoring at the WWTP outfall to Simpson Creek. Because WVDEP classifies the construction of dedicated drilling waste cells as a minor permit modification, there is no regulatory driver for corresponding changes to WWTP NPDES permit. The current NPDES permits require a much more limited set of testing parameters than the leachate sampling (Table 1) under the proposed Rule, and therefore there is no requirement to test for many of the contaminants in drilling waste leachate before discharge to surface waters. Most notably, there is no monitoring for radionuclides once leachate leaves the landfills.

HB107 has amended W.Va. Code §22-15 8(j) to read:

> "On or before July 1, 2015, the secretary shall submit an investigation and report to the Joint Legislative Oversight Commission on Water Resources and the Legislature's Joint Committee on Government and Finance which examines: (1) The hazardous characteristics of leachate collected from solid waste facilities receiving drill cuttings and drilling waste, including, but not limited to, the presence of heavy metals, petroleum related chemicals (benzene, toluene, xylene, etc.) barium, chlorides, radium and radon; (2) the potential negative impacts on the surface water or groundwater resources of this state associated with the collection, treatment and disposal of leachate from such landfills;"

It is unclear how WVDEP will be able to evaluate potential negative impacts on surface water, as required by W.Va. Code §22-15 8(j), under the Emergency Rule if the NPDES permit does not require monitoring for all of the parameters required in the legislation for current leachate treatment systems at landfills or POTWs.

Table 1: Comparison of monitoring parameters in drilling waste leachate stream

Parameter	Leachate monitoring from dedicated cells required by CSR13	WCSL leachate treatment NPDES outfall	Meadowfill leachate to WWTP	NPDES outfall from City of Bridgeport WWTP
Flow		✓	✓	✓
BOD-5 day		✓	✓	✓
BOD, % removal				✓
Suspended solids, % removal				✓
Total dissolved solids				✓
pH				✓
Total suspended solids	✓	✓	✓	✓
Chloride	✓	✓		
Aluminum	✓	✓		
Arsenic	✓	✓	✓	✓
Total recoverable cadmium	✓	✓	✓	✓
Copper	✓	✓	✓	✓
Cyanide	✓	✓	✓	✓
Hexavalent chromium	✓	✓	✓	✓
Iron		✓		
Lead		✓	✓	✓
Manganese		✓		
Mercury	✓	✓	✓	✓
Nickel	✓	✓	✓	✓
Selenium		✓		
Silver	✓	✓	✓	✓
Zinc	✓	✓	✓	✓
Dissolved oxygen		✓		✓
Fecal coliform		✓		✓
Sulfate	✓			✓
Ammonia nitrogen	✓			✓
Nitrogen nitrate	✓	✓		
Nitrogen nitrite	✓			
Nitrogen, Kjeldahl total			✓	
Fluoride	✓			
Benzene	✓			
Phthalate esters	✓			
Barium	✓			
Antimony	✓			
Dibromochloromethane	✓			
Boron	✓			
Chlorobenzene	✓			
Beryllium	✓			
Gross alpha	✓			
Gross beta	✓			
Radium 226	✓			
Radium 228	✓			
Strontium	✓			
Strontium 90	✓			
Lithium	✓			
Total nitrated hydrocarbons	✓			
Fluoranthene	✓			
Bis(2-ethylhexyl)	✓			
Phthalate	✓			
Chromium	✓			
Vanadium	✓			
1,2-Dichlorobenzene	✓			

Parameter	Leachate monitoring from dedicated cells required by CSR33	WCSL leachate treatment NPDES outfall	Meadowfill leachate to WWTP	NPDES outfall from City of Bridgeport WWTP
1,3-Dichlorobenzene	✓			
1,4-Dichlorobenzene	✓			
a-Terpineol		✓		
Benzoic acid		✓		
p-Cresol		✓		
Phenol		✓		
Priority pollutants		✓		
Volatile organics		✓		
Base neutrals		✓		
Acid extractables		✓		
Pesticides		✓		
Acute toxicity-pimephales promelas		✓		
Acute toxicity-daphnia magna or pulex		✓		

4. SPECIFIC COMMENTS ON THE PROPOSED RULE

4.1 Minor or major modification?

Given the significant increases in total waste volumes and the types of contaminants present in drilling wastes, a review of Subsection 3.18 of the Rule makes it difficult to contemplate how WVDEP has allowed landfills, for several years, to accept drilling waste in traditional MSW cells without requiring a major permit modification. Accepting large volumes of drilling wastes would be expected to stress landfill environmental management systems for air, landfill gas, leachate, groundwater, stormwater, and numerous other systems. WVDEP has not required major permit modifications to allow landfills to accept these increased amounts of drilling waste, even when dedicated cells are created.

There are several activities pertaining to drilling wastes that WVDEP has permitted as minor modifications under the previous and Emergency Rules. Minor permit modifications have been issued to:

- allow operators to accept drilling wastes from individual generators and to
- allow landfill operators to construct dedicated cells for accepting drilling wastes.

While it appears appropriate to allow landfills to accept drilling wastes from individual generators under a minor permit modification, the construction of dedicated cells to continuously receive waste volumes that required modification of facility tonnage limitations is an activity that would appear to fit squarely within the criteria that the Rule presents as causes for a major permit modification:

- The performance, efficiency, or longevity of the liner system or the final cover (cap) will be decreased;
- The efficiency or performance of the leachate management system will be decreased;
- The efficiency or performance of a gas management system will be decreased;
- The efficiency or performance of the surface water control system will be decreased;
- A decrease in the quality or quantity of data from any environmental monitoring system will occur;
- The permitted disposal surface area boundary will be increased;
- A remedial action to protect groundwater is necessary;
- The permit is to be transferred to a new permittee; or
- Other similar modifications as determined by the Secretary. "Similar Modification" means those modifications that have a significant potential impact upon the environment, human health and safety, and those parameters set out in W. Va. Code §22-15-8. Similar modifications also include those modifications that have a significant potential impact upon the operation and management of a commercial solid waste facility. (33 CSR 1 §3.18.b.2)

A major permit modification would allow a more thorough process to better evaluate engineering design and the stresses created by the huge volume of drilling wastes on landfill environmental management systems for air, landfill gas, leachate, groundwater, stormwater, and numerous other systems.

Subsections 3.18.b.1 presents the criteria for a minor modification:

> "Minor Modification. -- Permits may be modified by the Secretary at any time except for major modifications as listed in paragraph 3.18.b.2 of this rule. Minor modification does not require the preparation of a draft permit or the completion of the public notice procedures." (33 CSR 1 §3.18.b.1)

> "A minor modification may be approved by the Secretary for a permittee proposing to increase the volume of solid waste accepted at the facility by an ***amount of ten percent (10%) or less*** upon application in alternate years, unless such an increase requires a change in the classification of the facility." (33 CSR 1 §3.18.b.1.A., emphasis added)

The limited review of tonnage reports we performed from 2011 through 2013 would already appear to require a major permit modification. At Meadowfill, for example, total annual waste tonnage increased by 44% from 2012 to 2013.

Regardless, as we enter the later phase of the public comment period for the currently proposed changes to the Rule, now enacted under the Emergency Rule, we address our specific comments below.

4.2 Drilling waste characterization

4.2.1 *Questions about representative sampling of drilling waste streams*

Section 5.6.c.1.B of the Rule proposes that the receiving landfill must obtain at least one composite sample from the lateral or horizontal portion of each well bore unless otherwise approved by the Secretary:

> The facility must obtain at least one composite sample from the lateral or horizontal portion of each well bore unless otherwise approved by the Secretary. The American Petroleum Institute (API) well number must be included in the profile.

It is commendable that WVDEP intends for waste characterization samples to be collected from the lateral or horizontal portion of the wellbore, because drilling wastes generated from this geologic interval may represent a significant portion of the "unique toxins associated with drill cuttings and associated drilling wastes" cited by WVDEP in the Emergency Rule. This is especially true for NORM, petroleum hydrocarbons, and certain inorganic constituents.

WVDEP should also require separate waste characterization samples to be collected from the vertical portion of the wellbore for each API number, because drilling wastes generated from these geologic intervals may have different characteristics relevant to waste management.

The proposed rule requires samples for each well, as identified by API number. As WVDEP compiles information submitted for multiple wells on the same well pad, it will eventually be able to determine whether drill cuttings generated from the same well pad are reasonably uniform. If so, then it would be reasonable for WVDEP to revisit this rule and allow samples to be taken on a per-pad, rather than a per-well, basis for each minor permit modification. This approach could also be applied to larger geographic areas or specific geologic formations once sufficient data is generated.

Currently, drill cuttings are submitted by generators to MSW landfills under a minor permit modification of the landfill permit for disposal of special wastes. In order for landfills to receive this modification, generators are required to complete the WVDEP Waste Characterization Form, which includes a section to apply for this minor permit modification. The characterization process outlined on the form relies on generator certification that the wastes are or are not hazardous, and a recommended sampling frequency and the relevant laboratory analyses required. The number of samples recommended for all special wastes on a weight-per-sample basis is provided in a summary table on the form (Table 2), although WVDEP provides latitude to reduce the total number of samples if the wastes are very uniform or to add samples if they are variable.

Table 2: Number of samples recommended by WVDEP Waste Characterization Form

Waste amount	Analyze one sample per:
First 3,000 tons	300 tons
Next 6, 000 tons	600 tons
Each additional 1,000 tons	1,000 tons

Source: WVDEP Waste Characterization Form, May7, 2004.

Using the initial approach recommended on the WVDEP Waste Characterization Form, the estimated 1,000 tons (1) of drilling waste generated for a typical horizontal Marcellus well would require three composite samples.

How many composite samples will WVDEP require generators to submit for each Special Waste Minor Permit Modification?

We examined one minor permit modification issued for WCSL to accept drill cuttings from an unspecific generator. The modification states that the WVDEP Office of Solid Waste had reviewed information provided by that generator and determined that drill cuttings are not a hazardous waste under RCRA. We were unable to review the laboratory analysis submitted along with the Minor Permit Modification Application. The number of samples analyzed is also not confirmed. The permit modification allows WCSL to accept 50,000 tons of drill cuttings per year, roughly equivalent to the drilling waste generated from 50 typical horizontal Marcellus wells. The permit lasts for two years and requires annual samples to be analyzed for TCLP metals, TPH, and percent solids.

If the initial approach recommended on the WVDEP Waste Characterization Form was used, we calculate that 56 samples would be required for a permit modification for 50,000 tons of drilling waste. This equates to slightly more than one sample per well and a single minor permit modification.

If the approach in the Rule was used to collect one sample for each API number (from the lateral or horizontal portion of the well bore), then for 50 wells, this would equate to one sample per well and 50 minor permit modifications.

This exercise illustrates that more guidance is needed from WVDEP so that generators and landfill operators understand clearly how many samples are required for each minor permit modification.

Composite sampling may mischaracterize drilling wastes through the sample collection process itself.

How many subsamples will WVDEP require for each composite sample of drilling waste?

Does WVDEP provide guidance to generators and/or landfill permittees regarding approved methods for composite sample collection?

Are qualifications or training required for individuals collecting composite samples so that WVDEP is assured that sampling is representative?

Will generators be required to develop quality assurance/quality control plans for drilling waste characterization sampling?

4.2.2 *Questions with drilling waste characterization analyses*

The Emergency Rule includes a specific set of parameters that WVDEP will require for permitting of drilling waste disposal prior to delivery to the receiving MSW landfill:

> "At a minimum the following analyses must be submitted with each special waste minor permit modification application:
>
> Toxicity Characterization Leaching Procedure (TCLP) Metals, EPA Method 1311; TCLP Volatile Organic Compounds, EPA Method 8260B; TCLP Semivolatile Organic Compounds, EPA Method 8270C; and Total Petroleum Hydrocarbons (TPH), EPA Method 8015C. Sampling results for these parameters must not exceed the limits of 40 CFR § 261.24." (33 CSR 1 §5.6.c.1.C.1)

Table 3 presents the parameters that have specified limits in 40 CFR § 261.24.

Table 3: Parameters with specified limits under 40 CFR § 261.24

Parameters		
Arsenic	2,4-D	Methoxychlor
Barium	1,4-Dichlorobenzene	Methyl ethyl ketone
Benzene	1,2-Dichloroethane	Nitrobenzene
Cadmium	1,1-Dichloroethylene	Pentrachlorophenol
Carbon tetrachloride	2,4-Dinitrotoluene	Pyridine
Chlordane	Endrin	Selenium
Chlorobenzene	Heptachlor (and its epoxide)	Silver
Chloroform	Hexachlorobenzene	Tetrachloroethylene
Chromium	Hexachlorobutadiene	Toxaphene
o-Cresol	Hexachloroethane	Trichloroethylene
m-Cresol	Lead	2,4,5-Trichlorophenol
p-Cresol	Lindane	2,4,5-Trichlorophenol
Cresol	Mercury	

Source: 40 CFR § 261.24

Analysis for total petroleum hydrocarbons (TPH) is a collective measure for a large group of carbon compounds in a sample, some of which are included in 40 CFR § 261.24. TPH does not have a specified limit in 40 CFR § 261.24. As a collective measurement, TPH analysis will not provide results for individual compounds and therefore, there is no way to compare TPH results to the specified limits in in 40 CFR § 261.24. For example, benzene, cresol, nitrobenzene, and several other parameters would be included a TPH analysis result if they were present in drilling waste, but there is no way to compare their individual concentrations to the limits of 40 CFR § 261.24.

The toxicity characteristics leachate procedure (TCLP) is a laboratory extraction method used to simulate leaching of contaminants in a landfill. Results provide a value to determine if a waste would be classified as a characteristic hazardous waste under 40 CFR Part 261 Subpart C. As such, TCLP analysis does not report the total concentration of a parameter in a waste stream, only the amount anticipated to leach from the waste in a landfill.

WVDEP has already required that permittees monitor leachate on a monthly or semi-monthly basis for a specific list of parameters if drilling wastes are disposed (Table 1). This list includes, among other things, measures of radioactive particle activity and several radioactive isotopes: gross alpha, gross beta, ^{226}Radium, ^{228}Radium, total strontium, and total ^{90}Strontium. However, incoming drilling waste streams are not characterized for radionuclides. It is unclear how WVDEP would gain information about drilling waste if

appropriate parameters are not analyzed. It would appear that this knowledge would be highly valuable to future waste management decision-making.

Will WVDEP provide justification that radionuclide contaminants would not be monitored in drilling wastes prior to obtaining a special waste permit to dispose of drilling wastes at a landfill?

Will WVDEP consider adding analysis for uranium, thorium, radium, and their decay products and measures of alpha, beta, and gamma activity to the analysis required to be submitted with each Special Waste Minor Permit Modification?

Wastes that are measured at pH levels below 2 or above 12.5 are classified as a Characteristic Hazardous Waste under 40 CFR Part 261. Because WVDEP is already attempting to determine other toxicity characteristics of drilling wastes listed under 40 CFR Part 261 by requiring TCLP analysis, ***will WVDEP explain why corrosivity and ignitability characteristics of drilling wastes are not also required under proposed subsection 5.6.c.1.C. of the Rule?***

Does WVDEP allow other special waste streams to enter MSW landfills without testing for these characteristic hazards when the waste stream has not been previously characterized?

4.3 Leachate monitoring

The management of leachate figures prominently in the Rule and is addressed throughout. In subsection 4.5.d.1.A.3, which addresses liners, an effective leachate treatment capability is required. As discussed in previous sections, under current monitoring practices for at least two West Virginia landfills, there is no way to confirm if the treatment systems are effectively treating drilling waste leachate because drilling waste parameters are not monitored in the effluent of on-site treatment systems and POTWs. We assume these landfills to be reasonable examples of the drilling waste management practices in West Virginia, because both are situated squarely in regions generating significant volumes of drilling waste.

Will WVDEP promulgate additional changes to the Rule that require monitoring of NPDES discharges from on-site leachate treatment systems and receiving POTWs, at a minimum, for the parameters proposed in the Rule for leachate monitoring?

Will WVDEP require monitoring of sediments in receiving streams below leachate treatment system discharges, whether treatment is performed on-site at the landfill or treated off-site at POTWs?

Has WVDEP prepared cost estimates, calculations, or evaluated potential scenarios to ensure that bonding requirements or other permittee financial resources are sufficient to complete remediation associated with drilling waste, even during and after post-closure?

Has WVDEP required, or do they intend to require, that landfill operators submit additional bonding to secure potential financial obligations associated with cleanup of drilling wastes?

Will WVDEP make financial resources available to landfill operators if cleanup or treatment of drilling wastes is indicated through leachate monitoring?

Figure 7 presents the list of drilling mud additives disclosed to WVDEP in a well work permit issued for a shale gas well in West Virginia.

Figure 7: Disclosed list of chemical additives used during drilling

Common water based additives for mud drilling: NaCl *(CAS No. 7647-14-5)*, KCl *(CAS No. 7447-40-7)*, barite *(CAS No. 13462-86-7 & 14808-60-7)*, starch *(CAS No. 9005-25-8)*, PAC *(CAS No. 9004-32-4)*, xanthum gum *(CAS No. 11138-66-2)*, PHPA *(CAS No. 64742-47-8)*, polysaccharide *(CAS No. 11138-66-2)*, sulfonated asphaltic material *(CAS No. 269-212-0 & 238-878-4)*, aluminum silicate *(CAS No. 37287-16-4)*, gilsonite *(CAS No. 12002-43-6)*, graphite *(CAS No.14808-60-7 & 7782-42-5)*, shale stabilizer *(CAS No. 67-48-1 & 7732-18-5)*, fluid loss control polymers *(CAS No. 9004-34-6)*, viscosity control polymers *(CAS No. 11138-66-2 & 107-22-2)*, soda ash *(CAS No. 497-19-8)*, sodium bicarbonate *(CAS No. 144-55-8)*, NaOH *(CAS No. 1310-73-2, 7647-14-5, & 7732-18-5)*, lime *(CAS No. 1305-62-0)*, gypsum *(CAS No.778-18-9)* , citric acid *(CAS No. 77-92-9)*, biocide *(CAS No. 52-51-7 or 7732-18-5 + 67-56-1 + 141-43-5)*, $CaCO_3$ *(CAS No. 471-34-1)* , cellulose fibers *(CAS No. 14808-60-7)*, nut plug *(CAS No. 9004-34-6 & 14808-60-7)*, cross-linking polymers *(CAS No. 107-22-2 & 11138-66-2)*, other LCMs, surfactants *(CAS No. 64-17-5)* , ROP enhancer/lubricant *(CAS No. 8002-13-9)*, beads, corrosion inhibitor *(CAS No. 7732-18-5)*, aluminum stearate *(CAS No. 300-92-5)*, defoamer *(CAS No. 246-771-9)*.

Source: WW-9 Addendum to Horizontal 6A Well Work Permit, submitted by Stone Energy Corporation to WVDEP, issued August 29, 2013, for API Well Number 45-10302920.

Has WVDEP reviewed well work permit applications, conducted sampling, or conducted a literature review to confirm drilling mud additives such that appropriate leachate monitoring parameters have been required to detect these contaminants?

Potassium is typically a substantial component of drilling muds and is fairly mobile in the environment. Although not usually a concern in terms of toxicity, these characteristics make it a good indicator parameter of environmental transport mechanisms for other drilling waste contaminants in leachate, groundwater, and surface water.

Will WVDEP consider adding potassium to the list of required parameters for leachate monitoring?

4.4 Radiation monitoring

In the proposed changes to the Rule, subsection 5.6.d indicates that fixed radiation detection equipment must be installed at the entrance to the facility and that all drilling waste must be evaluated by this equipment. This type of monitoring system has not previously been required at West Virginia landfills.

Will WVDEP provide landfill operators with information for fixed monitoring equipment that is approved by its manufacturer to reliably detect at 10 µrem/hour above background?

In subsection 5.6.d.4, WVDEP references a rejection threshold for drilling waste loads that contain 5 pCi/g above average local background level for ^{226}Radium and ^{228}Radium combined. This threshold will apply only to confirmatory testing results conducted after fixed radiation detection equipment determines levels at 10 µrem/hour above background.

Does WVDEP have guidance available to assist landfill operators with establishing average local background for radioactive isotopes in soil?

USEPA uses health-based screening criteria of 5 pCi/g for the single isotope ^{226}Radium in surface soil and a non–health-based screening level of 15 pCi/g for ^{226}Radium in subsurface soil at uranium mill cleanup sites. These screening levels differ from the rejection threshold proposed by WVDEP in two ways. They are not added to natural background and they do not combine the ^{226}Radium and ^{226}Radium isotopes.

Could WVDEP provide an explanation of how the radiation rejection criterion for incoming loads of drilling waste was developed?

4.5 Groundwater monitoring

Subsection 4.11.a should be amended for any facility receiving drilling waste to ensure that all analysis required for leachate monitoring in the Emergency Rule are also included in the Phase 1 detection monitoring program for groundwater.

4.6 Air and gas monitoring

Proposed subsection 5.6.d.6 will require that facilities prepare a radiation health program and radiation monitoring plan.

Will WVDEP require monitoring for radon gas in the landfill gas management system?

Will WVDEP require monitoring of radiological parameters in fugitive dust near drilling waste solidification and waste placement areas?

It has been reported through personal communications with WVDEP staff that landfills may perform solidification of incoming waste streams on-site and that this designated area must be constructed such that all leachate is collected in the facility leachate collection system. This can and does include solidification of drilling wastes (15). In such areas, there is a potential for the generation of airborne dust if appropriate dust suppression methods are not used.

Will WVDEP require modifications to existing landfill air permits and monitoring programs to address metals and radionuclides introduced by drill cutting waste streams?

4.7 Stormwater

As discussed, drilling wastes may be mechanically handled at MSW landfill sites prior to placement, particularly if solidification is performed on site. Therefore, there is a potential that facility stormwater collection features may be affected by airborne particulates generated during the solidification and waste handling process. Over time, airborne contaminants may be deposited and accumulate within facility stormwater infrastructure and ultimately be discharged through the stormwater management system.

Stormwater at Meadowfill Landfill, for example, is managed with five sediment control basins. There were previously three outlets, but they have since been modified to flow in series such that there is now a single NPDES outlet discharging into Smiths Run, which flows to the West Fork River.

Stormwater at WCSL is managed with three sedimentation basins and two NPDES outlets. These outlets discharge into an unnamed tributary of Peach Fork Creek, which then flows to the Ohio River.

The set of monitoring parameters for these stormwater outlets is limited:

- flow,
- total suspended solids,
- BOD_5,
- COD,
- nitrogen-nitrate,
- chloride,
- zinc, and
- oil and grease.

Will WVDEP require revision of stormwater monitoring parameters in the NPDES permit to account for potential influences from drilling waste fugitive dust?

5. CONCLUSIONS AND RECOMMENDATIONS

We appreciate this opportunity to provide comments to the Wetzel County Solid Waste Authority on proposed changes to the Rule. In the time available, we have attempted to provide analysis and comments on specific areas that we hope will be useful to the Authority as it prepares comments regarding the proposed changes.

To facilitate the public comment process, we have organized key points and comments from our review below:

1. As shown in our review of data, drilling wastes contaminants show increasing trends in landfill leachate.
2. Could WVDEP explain how they intend to evaluate potential negative impacts on surface water, as required by W. Va. Code §22 15 8.(j), under the Emergency Rule if all of the parameters required in the legislation are not monitored in the NPDES permits for current leachate treatment systems at landfills or POTWs?
3. Will WVDEP continue to allow construction of dedicated drilling waste cells under a minor permit modification?
4. A Major Modification would appear to provide a better process for the construction of dedicated cells to evaluate landfill engineering design and the environmental management systems for air, landfill gas, leachate, groundwater, and stormwater. Can WVDEP please clarify why construction of dedicated drilling waste cells is not performed under a Major Permit Modification?
5. WVDEP should also require separate waste characterization samples to be collected from the vertical portion of the wellbore for each API number, because drilling wastes generated from these geologic intervals may have different characteristics relevant to waste management.
6. The proposed rule requires samples for each well, as identified by API number. As WVDEP compiles information submitted for multiple wells on the same well pad, it will eventually be able to determine whether drill cuttings generated from the same well pad are reasonably uniform. If so, then it would be reasonable for WVDEP to revisit this rule and allow samples to be taken on a per-pad, rather than a per-well, basis for each minor permit modification. This approach could also be applied to larger geographic areas or specific geologic formations once sufficient data is generated.
7. How many composite samples will WVDEP require generators to submit for each Special Waste Minor Permit Modification?
8. How many subsamples will WVDEP require for each composite sample of drilling waste?
9. Does WVDEP provide guidance to generators and/or landfill permittees regarding approved methods for composite sample collection?
10. Are qualifications or training required for individuals collecting composite samples so that WVDEP is assured that sampling is representative?
11. Will generators be required to develop quality assurance/quality control plans for drilling waste characterization sampling?
12. Will WVDEP provide justification that radionuclide contaminants would not be monitored in drilling wastes prior to obtaining a special waste permit to dispose of drilling wastes at a landfill?
13. Will WVDEP consider adding analysis for uranium, thorium, radium, and their decay products and measures of alpha, beta, and gamma activity to the analysis required to be submitted with each Special Waste Minor Permit Modification?
14. Will WVDEP explain why corrosivity and ignitability characteristics of drilling wastes are not also required under proposed subsection 5.6.c.1.C. of the Rule?
15. Can WVDEP explain why TPH analysis is required to obtain a minor permit modification for disposal of drilling wastes if there is limit for this parameter in 40 CFR § 261.24? Does WVDEP intend to monitor for the individual components included in TPH analysis?

16. Does WVDEP allow other special waste streams to enter MSW landfills without testing for these characteristic hazards when the waste stream has not been previously characterized?
17. Will WVDEP promulgate additional changes to the Rule that require monitoring of NPDES discharges from on-site leachate treatment systems and receiving POTWs, at a minimum, for the parameters proposed in the Rule for leachate monitoring?
18. Has WVDEP prepared cost estimates, calculations, or evaluated potential scenarios to ensure that bonding requirements or other permittee financial resources are sufficient to complete remediation associated with drilling waste, even during and after post-closure?
19. Has WVDEP required, or do they intend to require, that landfill operators submit additional bonding to secure potential financial obligations associated with cleanup of drilling wastes?
20. Will WVDEP make financial resources available to landfill operators if cleanup or treatment of drilling wastes is indicated through leachate monitoring?
21. Will WVDEP require monitoring of sediments in receiving streams below leachate treatment system discharges, whether treatment is performed on-site at the landfill or treated off-site at POTWs?
22. Has WVDEP reviewed well work permit applications, conducted sampling, or conducted a literature review to confirm all additives to drilling muds such that appropriate leachate monitoring parameters have been required to detect these contaminants?
23. Will WVDEP consider adding potassium to the list of required parameters for leachate monitoring?
24. How will WVDEP evaluate radon in landfill groundwater monitoring programs?
25. Will WVDEP provide landfill operators with information for fixed monitoring equipment that is approved by its manufacturer to reliably detect at 10 µrem/hour above background?
26. Does WVDEP have guidance available to assist landfill operators with establishing average local background for radioactive isotopes in soil?
27. Could WVDEP provide an explanation of how the radiation rejection criterion for incoming loads of drilling waste was developed?
28. Subsection 4.11.a should be amended for any facility receiving drilling waste to ensure that all analysis required for leachate monitoring in the Emergency Rule are also included in the Phase 1 detection monitoring program for groundwater.
29. Will WVDEP require monitoring for radon gas in the landfill gas management system?
30. Will WVDEP require monitoring of radiological parameters in fugitive dust near drilling waste solidification and waste placement areas?
31. Will WVDEP require revision of stormwater monitoring parameters in the NPDES permit to account for potential influences from drilling waste fugitive dust?
32. How will WVDEP evaluate radon in landfill groundwater monitoring programs?
33. How will WVDEP evaluate potential impacts from heavy metals, petroleum related chemicals (benzene, toluene, xylene, etc.) barium, chlorides, radium and radon in stormwater?
34. The Rule does not make reference to use of a manifest system for tracking drilling wastes from the well site to the disposal location will be performed? Does WVDEP intend to implement a manifest system for tracking of drilling wastes?

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Bennett & Williams
Report

BENNETT & WILLIAMS
ENVIRONMENTAL CONSULTANTS, INC.

98 COUNTY LINE ROAD WEST • SUITE C • WESTERVILLE, OHIO 43082
TELEPHONE: (614) 882-9122 • FAX: (614) 882-4260 • 1-800-635-3810

July 23, 2014

Wetzel County Solid Waste Authority
227 Main St.
New Martinsville, WV 26155
Attn: Bill Hughes

Re: Technical Comments on 33 CSRI Series 1
Solid Waste Management Draft Rule
Regarding the Disposal of Shale Oil and Gas
Drilling Wastes

Dear Mr. Hughes:

Per the request of the Wetzel County Solid Waste Authority, the firm of Bennett and Williams Environmental Consultants Inc. has undertaken a technical review of the West Virginia Department of Environmental Protection Draft Rules regarding the solid waste management of shale oil and gas drilling wastes. This review was undertaken in coordination with Downstream Strategies, Morgantown, West Virginia. Bennett and Williams has extensive experience in the construction of, management of, monitoring of and closure and remediation of various types of landfills from Superfund sites to hazardous wastes, solid municipal wastes, construction and demolition debris wastes and industrial wastes. Our more than 30 years of practical experience includes landfills in many states, including but not limited to West Virginia, Virginia, and Ohio.

We have read the 33 CSRI draft rule and per your request, we have noted locations in the text where language could be added or amended to further clarify these shale oil and gas drilling wastes and their characteristics and limitations. Before discussing locations where the text could be modified, we find it is necessary to discuss the overarching considerations that need to be addressed to successfully manage wastes resulting from shale oil and gas drilling activities.

Overarching Considerations

What Wastes will be accepted?

The first consideration is to determine just what wastes are going to be included in the special monofill cells being built at participating solid waste landfills. Beginning with the first drill bit entering the earth, there are rock cuttings from the vertical part of the borehole that is drilled with rotary drilling techniques (air or mud) selected based on anticipated drilling conditions. The cuttings returned to the surface are a mixture of the

rock formations above the selected target shale formations, typically the Marcellus and the Pt. Pleasant/Utica shales and their related formations. The rock cuttings are returned to the surface mixed with air, drilling muds and natural formation water. As the targeted formation is reached, typically an oil-based drilling mud is used to make the turn and drill the laterals. As the drill cuttings are removed, formation water is returned along with the cuttings and the muds. These materials are wet and may contain significant volumes of liquids of undetermined chemistry. After the wells are constructed, the laterals are hydraulically fractured with water, proppants, and a variety of chemical additives. Sludges may be formed as part of the process, particularly when liquids are filtered and the solids are left behind in filter socks or when solids settle out in tanks or pits. Liquids from the hydraulic fracturing and then production water (brines) are returned up the wells and production water will continue to be produced until the well is closed and abandoned. The pipes that make up the internal well casings have mineral scale deposits that are left behind. Much of this material contains heavy metals, hydrocarbons and radiological metals in varying amounts. Which portions of this waste stream is the WV DEP going to allow to be buried in the solid waste monofills? Will the landfills accept sludges? Will the landfills accept drilling cuttings that are mixed with drilling fluids? Must the drilling cuttings be "washed" before they will be accepted? Will the landfill accept production piping with scales? Just what will be accepted for disposal? The draft rules do not fully address a segregation of the waste stream, nor do they specify the eventual repositories for the portions of the waste stream that may not be acceptable for the solid waste monofills. There needs to be significantly more clarification on this topic included in these draft rules.

Are the landfill cells designed to carry the extra weight of the shale wastes?

There is no discussion on the weight, the specific gravity or density of the shale oil and gas drill cuttings and their comparison to the weight of typical compacted municipal solid waste. Cell liners, leachate collection pipes and leak detection systems are designed to support a certain weight of the overlying materials by volume, a specific gravity or density of the waste stream. The in situ rocks have a specific gravity of approximately 2.5 to 3 g/cm^3. When they are broken up, the resulting drill cuttings and slurries may be lighter, but without studying the waste stream, it is not possible to determine how much lighter. Typical non-compacted municipal solid waste has a specific density of less than 1 g/cm^3. Water has a specific density of 1 g/cm^3. Will these shale oil and gas drilling wastes be too heavy for the design weight of the cells? If so, the leachate collection piping could be crushed, resulting in an inability for the leachate to be removed (Keatley, 2009). Similarly, the cell liner could be overcompacted, resulting in settlement, deformation of the geosynthetic liner and liner failure. Should the cells be redesigned to address the additional weight? Should the height of the cells be restricted to allow for the additional weight of the materials without compromising the integrity of the cell structure? If this research has already been undertaken by WV DEP, the results of this research should be included in the draft rule so modifications to cell designs can be anticipated and undertaken if/where they are needed.

How are the landfills going to verify the radioactive levels of the shale wastes?

What devices are envisioned to test the radioactivity of the materials entering the landfill? The draft rules mention in Section 5.6.d.1 the use of stationary devices and handheld measuring devices that are supposed to detect total radiation levels of 10uR/hr and a total radium level of 5 pCi/g. We know of no equipment currently available, either stationary or handheld that can detect such a low level of radioactivity. The radioactivity values included in the rules are correct. These values are the break between "clean" and "in need of remediation" for US EPA Brownfields cleanup standards. The challenge is the real time measurements. Pennsylvania has been using stationary detectors at their landfills since before the beginning of the shale gas and oil drilling boom. These detectors were installed originally to intercept hot loads of medical wastes and work very well for that purpose. However, Pennsylvania has found these types of detectors to be unreliable for detecting low levels of radiation in shale oil and gas drilling wastes. Even though Pennsylvania has found that the stationary equipment only responds to much higher levels of radiation, they are turning away truckloads of radioactive wastes on a regular basis. Pennsylvania is undertaking a one year study to determine the reliability of their monitoring equipment. The study, however, goes far beyond just verification of the usefulness of stationary monitoring and could serve as a template for West Virginia to better understand the radioactive legacy from shale oil and gas drilling wastes in the state. Information on this study can be accessed at http://files.dep.state.pa.us/OilGas/BOGM/BOGMPortalFiles/RadiationProtection/2013-End-of-Year-TENORM-Study-Report_FINAL_1-17-14.pdf.

An informal discussion with a technical representative for one of the companies that manufacture stationary monitoring equipment confirmed that their equipment was never meant to reach the lower level of detection for shale oil and gas drilling wastes that Pennsylvania had assumed was possible. This information supports the initial Pennsylvania findings. Handheld monitoring equipment measures total gamma or beta levels and cannot be used to separate the elements and isotopes generating the radiation. These monitoring devices are designed for use at nuclear reactors and other high-level radioactive sites as early warning detectors. The standard for determination of radiological components and levels of radioactivity are laboratory analyses using laboratory protocols certified by the US Department of Energy (DOE). The laboratory protocol for radium of all isotopes in all forms (solids, sludges, slurries, and liquid) is a 21-day holding time in a sealed glass jar and then counting on a gamma spectrometer. The Pittsburgh, Pennsylvania laboratory of Pace Analytical Services, who are currently performing the West Virginia landfill leachate radiological analyses, is certified by US DOE to perform these radiological analyses. We know of only one "quick" reading process that has some level of accuracy, an "In Situ Object Counting System" that is actually inserted into containers of homogenous materials to determine levels of radium. This type of equipment is calibrated using waste samples that have laboratory US DOE certified sample results. The equipment must be recalibrated on a regular basis and still contains a significant margin of error. One such system installed in Youngstown, Ohio has a level of error that can range up to 11.99 pCi/g, which is over twice as high as the level required in the draft rules. However, there is a recognized need for better

equipment and it is our understanding that research and development of new technology is continuing.

How are the shale wastes solidified, with what and where?

Even "solid" shale oil and gas drilling wastes will contain some amounts of liquids. The volume of liquids may make the materials too wet to pass the paint filter test. Typically, these wastes are mixed or solidified with other materials to make them drier and more stable. Where is this solidification process taking place? Does it occur before the wastes are delivered to the landfills or at the landfill facilities? What materials are being approved to be used for the solidification process? Will the determination of radioactive levels of the waste streams be conducted before or after the solidification process takes place? If organic materials such as saw dust or wood chips are used for this process, they will degrade over time and cause settling in the landfill cells. If combustible coal ash is used, it must be remembered that coal ash contains typically three to ten times the level of radioactive and heavy metals that were initially found in the coal (USGS, 1997, Botoman and Stith, 1978, 1981, 1986, 1988). Therefore, many of the constituents of concern in the shale oil and gas drilling wastes (heavy metals and radiological metals) will be increased in the cells from the addition of the coal ash. Shale oil and gas drilling wastes, which were below the radiological threshold, may be mixed to levels above the threshold by the addition of coal ash. Has the WV DEP undertaken a study to determine how the addition of materials to solidify the shale oil and gas drilling wastes change the chemistry of the landfilled waste stream? If so, that information needs to be reflected in these draft rules. If only certain materials are permitted to be used for the solidification, then they need to be listed in the draft rules.

Are all shale wastes subject to testing?

Black organic shales and coals, by definition, contain heavy and radioactive metals. The US Environmental Protection Agency, the National Academy of Science and the American National Standards Institute consider all portions of the shale oil and gas waste stream to be Technologically Enhanced Naturally Occurring Radiological Materials (TENORM) and subject to the radiological clean-up standards of CERCLA and RCRA, 5 pCi/g combined radiums. There is no recommendation of mixing or downblending wastes of higher levels to achieve the 5 pCi/g levels. In fact, downblending in most radiological management programs is prohibited. The WV DEP Solid Waste Management draft rules are silent on the subject of TENORM and Naturally Occurring Radiological Materials (NORM) and their management. Should we interpret this to mean that West Virginia is following the National definitions and requiring all shale oil and gas drilling wastes to be subject to testing? If so, that is a commendable position for the State to have taken and is in keeping with the current efforts in Pennsylvania where all waste streams are tested, regardless of what portion of the waste stream they represent.

How will wind-blown dust be managed?

Because of the fine-grained nature of shale and the fine-grained nature of drilling muds, a significant portion of the shale oil and gas drilling wastes are fine-grained, clay or silt-sized particles. The larger-sized shale rock cuttings will quickly weather to the natural clays and silts of the parent materials. As such, when the waste materials dry out, they are easily transported by wind. However, unlike the typical windblown wastes and dust at a typical solid waste municipal landfill, these dusts contain heavy and radioactive metals as well as hydrocarbons and other constituents of concern that can have a negative effect on the landfill workers, the surrounding community, the environment, the airshed, the watershed and ultimately the groundwater in the area. West Virginia is only too well aware of the potential contamination of surface and groundwater resources by windblown contaminants, having had to address the migration of perfluorooctanoic acid (C-8 or PFOA) from the DuPont Washington Works facility. A portion of the groundwater contamination of the Little Hocking (Ohio) Water Association's wellfield was from windblown contamination that later was carried by precipitation recharge down into the aquifer. In addition to the natural clay and silt-sized materials, it is possible that fine-grained silica sand and its dust, frequently used to prop open the shale fractures, may be part of the shale oil and gas drilling waste stream. These dusts can represent significant health risks to the workers at the landfills and the surrounding community and environment. How will the workers be protected from these potentially health-impacting dusts? What practices will be instituted to insure that these wastes are not allowed to dry out and be transported by wind from the landfill? If the working faces of the active monocells are kept moist with sprayed water, how will this additional volume of water affect the volume and chemical concentrations of the resulting leachate? What testing has the WV DEP undertaken to understand the nature of these potentially windblown dusts? How will they be managed? The draft rules are silent on this issue. Clarification is needed.

How will radon gas be managed?

The management of the landfill gases is another issue that needs to be discussed. Active solid waste landfill gas collection systems are designed to capture and thermally reduce or destroy methane and other forms of volatile and semi-volatile compounds. Shale oil and gas drilling wastes are radioactive and they also produce radon gas. Radon gas moves through the cells and into the gas collection system or leaks out of the landfill with methane but, because it is a noble gas, unlike methane and the other organic gases, radon does not burn in the flare used on a gas collection system. Radon gas also passes through filtration systems because it is inert. But the exposure of radon gas has a significant public health consideration; it is the second leading cause of lung cancer after smoking in the United States. The average indoor radon level for Wetzel County is 3.8 pCi/L in air (http://county-radon.info/WV/Wetzel.html) and the remediation level is 4 pCi/L. What studies has the WV DEP or other State Agencies undertaken to determine the volumes of radon gas that is or will be emanating from the landfill monocells? What levels of radon already exist in the buildings surrounding the landfills that are accepting shale oil and gas drilling wastes? What measures should the landfill operators take to manage the release of radon gas into the airshed? What health precautions should be

undertaken to insure that the workers are not exposed to injurious levels of radon gas? The draft rules are silent on this topic and it needs to be addressed.

Landfill leachate, are there treatment challenges?

At this point in time, there are several solid waste landfills accepting shale oil and gas drilling wastes. Most of the facilities transport their leachate to a publicly owned wastewater treatment plant (POTW). That is not the case for the Wetzel County landfill, which treats their leachate on site at a packaged treatment plant. We have undertaken a preliminary review of the leachate chemistry for the Meadowfill facility, which helps us to understand the typical chemistry of the shale drilling waste leachate. A quick scan of the data since 2011 show total dissolved solids concentrations as high as 13,000 mg/L (Figure 1.) A review of the chloride values for the same period of time show total values approaching 4,000 mg/L (Figure 2). There are also heavy metals and radioactive metals in the leachate. Wastewater exhibiting these characteristics can be difficult to treat in a typical POTW unless they are significantly diluted or undergo industrial pre-treatment. Heavy and radioactive metals are typically accumulated in the sewage sludges or pass through the plant without treatment. How much leachate is typically being generated? Are the POTWs aware of the chemistry of these leachates? Are they requiring that the leachates go through an industrial pre-treatment program? Do they have adequate additional sewage waste streams to dilute the leachate? How will this chemistry affect the packaged treatment plant at the Wetzel County Solid Waste Landfill? Is it equipped to treat these types and levels of contamination in the leachate waste stream? Will the chemistry of these leachates cause the POTWs or the packaged treatment plants to exceed their NPDES permits? Have the NPDES permits been upgraded to include radioactive element limits, especially radium? Is it possible to see the results of the WV DEP study that answers these very important questions?

Why were the US EPA Safe Drinking Water Finished Water 900 methods chosen for radiological testing of the leachate?

Pace Analytical Laboratory in Pittsburgh, Pennsylvania is using the US EPA Safe Drinking Water 900 Series methodology for testing radiological concentrations. This methodology was designed for testing finished drinking water that did not require additional filtration. The Drinking Water 900 Series is not the testing protocol approved by US DOE for solids, sludges, slurries and liquids, which would include leachate. Not only are these the wrong tests, but also the samples do not appear to be held for a long enough period to achieve ingrowth equilibrium. Similarly, the counting times are not long enough to achieve reliable radiological results. The Pace laboratory has been certified by the US DOE Idaho Testing Laboratory to conduct the more appropriate US DOE certified testing procedures for these materials. Has Pace modified the 900 Method series of testing to analyze the leachate, which is expected to have significantly higher concentrations of dissolved solids as well as heavy and radioactive metals? If so, how has the testing protocol been modified? A review of holding times show that it is not uncommon for the radium samples to be held for less than the 21-day hold time to allow for 98 percent ingrowth of the radiums to bismuth and lead so the samples can be run on the laboratory's gamma spectrometer. Radium-226 and -228 are very weak gamma

emitters. They are primarily alpha and beta emitters. It takes 21 days to reach an approximate 98 percent ingrowth to the gamma producing daughter products of bismuth and lead to achieve a reliable radium determination. In addition to allowing for proper ingrowth, it is also critical to continue the count for long enough to achieve a reliable reading.

In reviewing the Meadowfill data, we have identified readings where the amount of radioactive material present was actually a negative number (e.g., Strontium-90, -0.392 +/- 0.734 pCi/L). Such a reading is physically impossible. There is either no count at all, which will be reported as 0, or there is a count which will be reported as a positive number. The existence of an uncertainty value, the +/- amount that is high, in this case, higher than the reported number, indicates that the counting time was far too short to generate data that is useful. Another example of a count for a sample that has been held for too short a period of time and then counted for too short a time is the 9/1/2011 results for Radium-228 of 2.34 +/- 3.12 pCi/L. Figure 3 shows gross beta data for 2011 to 2013 and includes the deviation bands of the uncertainty values, an excellent example of these analyses problems over time. In spite of the use of the wrong testing methodology, the wrong hold times, and the wrong counting times, some of the data indicate that there can be a significant volume of radioactive materials in the leachate. The total alpha and beta readings are orders of magnitude higher than the levels that trigger speciation for drinking water standards yet there do not appear to be any elemental and isotopic speciation of the total alpha and beta readings. Why not?

While the data being reported for the radiological elements provides information to fill in a report, it is typically not useful. It appears to be underreporting the radiological elements found in the leachates and, therefore, the radiological nature of the shale gas and oil waste stream. In spite of this chronic underreporting, some significant information has been revealed. One example is the 12/19/2013 sample of Stronium-90 that showed a reading of 8.67 +/- 1.58 pCi/L. Stronium-90 is a manmade radioactive isotope that is part of the Uranium-235 decay chain from nuclear reactors or atomic weapons. It did not enter the environment in measurable amounts until the end of WWII and the period of atomic bomb testing in the 1950s. Assuming the shale oil and gas drilling wastes are from deep within the earth and that they contain only natural materials, there should be no Strontium-90 isotopes at all in the leachate, or at the most, only trace amounts that enter the system through precipitation. If this is a valid reading, we can postulate two ways that the Strontium-90 could have found its way into the leachate from Meadowfill. Uranium, besides being radioactive, is also a very hard and dense metal. It is used as the metal jacket on armor piercing shells for combat. Halliburton holds a patent to use spent uranium to perforate the lateral casings of shale gas and oil wells. It is possible that this measurement is derived from wastes that include some of this spent uranium. It is also possible that manmade nuclear wastes are being mixed with the shale oil and gas drilling wastes. To continue to monitor for this potential waste stream, radium-223 and its bismuth and lead daughter products should be added to the list of radium isotopes being monitored. Much more care is needed to accurately understand the radioactive nature of the leachate waste stream. This is not simply an exercise to fill in a blank, this is vital documentation of the presence or absence of radiological materials that can have a significant health impact on the landfill workers, the surrounding area and in the case of

the leachate, the transport of water-soluble radium to surface and ground waters where it can be transferred into the food chain.

Specific comments relating to the Draft Rules

This section addresses specific sections of 33CSRI. In some situations, language could be included to better define the properties of shale oil and gas drilling wastes and their potential impacts on solid waste landfills. In other cases, additional clarification would be helpful.

§33-1-2. Definitions.

It would be helpful to include a definition of this new waste stream in this section, including a discussion of the portions of the waste stream that will be accepted.

3.1.g. Air Pollution

Should there be mention of the radon gas that will be formed from the shale drilling wastes in this section? If not here, where should it go?

3.8.h.1. Industrial Wastes.

Why are the shale drilling wastes not considered industrial wastes and placed in industrial waste landfills instead of in more general solid waste municipal waste landfills?

3.11. Landfill Liners.

There is no discussion in this section about the possible need for modification of the liner system to account for the additional weight of the shale oil and gas drilling wastes. Should a discussion about this condition be placed here? If not here, where should it go?

3.13.o. Financial Assurance for Post-Closure Care.

Because drilling wastes will continue to generate leachate with radioactive and heavy metals for thousands of years after the landfill is closed, how will the funding of post-closure care be modified to reflect this **much** longer period of responsibility (as opposed to a 30-year post closure care period for a solid waste landfill)? Who will be the responsible parties to maintain the landfill site in perpetuity?

3.16.c.6. Soil Monitoring Plan.

Should this section be amended to include monitoring for fugitive dust from the shale drilling wastes or should that amendment be in Section 3.16.c.7 Nuisance Control Plan that currently includes "dust"? How will the relevant section be amended?

4.4.c.11. Methods for disease vector, dust, and odor control;

Should there be a modification here discussing the control of dust from the shale drilling wastes? If not, where will that directive be inserted into the rules?

4.4.c.15.A.6. (record keeping)

Should there be a modification of post-closure plans and monitoring to address the waste characteristics of the shale waste stream? If that information is not inserted here, where will it be inserted?

4.4.d. Design

Should there be a modification here for liners, leachate collection systems and monitoring to address the shale waste characteristics? If not here, where will it be located?

4.5.d. Liners.
4.5.d.1.C. A liner system must consist of the following elements:

Because the shale waste materials are expected to be heavier than standard compacted municipal waste materials, would this be the appropriate location for a discussion on the modification of the liners and leachate collection system to insure they have the engineered strength to hold up these heavier materials? If not here, where will it be inserted in the rules?

4.5.d.4.A.5.(e) The pipe must be capable of supporting anticipated loads without failure based upon facility design;

The shale drilling waste is expected to be heavier than the typical compacted municipal solid waste for which the cells were designed. This additional weight may have a negative impact on pipe strength and performance and well as synthetic liner strength. Pipes, when overloaded, will deform and eventually break. Should there be a discussion of this problem here? Would it be sufficient to include information on the bulk density/specific gravity of the shale drilling wastes and a table of the crush strengths of various pipes? What other ways can this issue be addressed?

4.5.d.6.A. The leachate collection and protective cover zone must:

How are these components going to be modified to protect them from the additional weight of the shale drilling wastes?

4.5.d.6.A.7.(a) The slope, sizing, and spacing of the piping system must ensure that liquids drain efficiently from the leachate collection zone;

Should there be a modification in this section to address the additional weight of the shale drilling wastes? If not, why not?

4.5.d.8. Liner System Initial Placement of Solid Waste.

Drilling wastes consist of fractured rocks, which may have sharp corners and result in the damage of the protective cover over the leachate collection system. The first lifts over the cover of the leachate collection system should consist of materials that cannot damage the protective cover.

4.6. General Operational Requirements.
4.6.a.1.B. Provisions must be made to confine windblown material within the active disposal area;

Should there be a discussion here about the unique nature of windblown dust from the shale drilling wastes in the open cells, specifically on the working faces of the cells? The worker health issues are significantly different for shale drilling wastes than most typical municipal solid wastes, more on the order of asbestos wastes. Where will considerations for the need to monitor the dust and the possible requirement of respirators be placed in these rules?

4.7.a. Acceptable Wastes

Shale drilling wastes need to be specified as an acceptable waste in this section. It should have its own category because its properties are so different from other wastes.

4.8.a.5. Leachate may be collected, treated on-site, and then discharged into a receiving stream.

The chemistry of the shale drilling wastes is such that it may not be possible to treat the leachate on site to the extent that it can be discharged to a receiving stream. Landfill cells containing shale drilling wastes may have leachate chemistry that falls outside the acceptable limits for treatment by an on-site system. Should additional wording be included in this section to address conditions when and where this waste stream should be discharged?

4.8.a.6. Spray irrigation

Leachate from shale drilling wastes must be tested for salinity as well as the presence of heavy and radiological metals if it is being considered for land application by spray irrigation. The salt content of the leachate may be too high to support freshwater vegetation. This practice could cause a build-up of salinity in the soil that would effectively sterilize the soil, killing any plant material that needs fresh water to survive and creating soil conditions that would prevent seed germination. The areas so affected would need to be leached of the contaminating salts and other contaminants before plant materials typical of those growing in West Virginia could return to the sprayed location.

4.8.c.2.C.2.(a) Tank maintenance

The chemistry of the shale drilling waste leachate needs to be researched for corrositivity. Extra care and monitoring of leachate collection tanks may be necessary to detect early failures.

4.8.c.3. Surface Impoundment Requirements.

The chemical nature of these wastes may make them unsuitable for holding in surface impoundments. A review of the chemical nature of the leachate needs to be conducted to assure that it is compatible with the liners and other supporting infrastructure of the surface impoundments. A review of the Meadowfill leachate data indicates that it is toxic in nature so any surface impoundment must be fenced and screened to prevent incursion into the impoundment by wildlife. Surface impoundments of the leachate should not be considered a primary method of leachate storage.

4.10. Landfill Gas Management.

Radon is a noble gas which will move with all the other landfill gases, but will not be destroyed by burning or treatment. It is heavier than air and will lay in low areas around the landfill unless it is disturbed by wind. It is the second most common cause of lung cancer in the US after smoking. How will landfill gas management efforts be modified to address the issue of radon gas?

4.11.a. Groundwater Monitoring Program.

This section should include language that adds key shale drilling waste leachate parameters to the testing list. Wherever possible, key chemical parameters should be linked to chemical parameters in the leachate for which there is already baseline data.

4.11.b.2. (no title)

The list of testing parameters given for coal combustion by-products facilities is a good starting point for monitoring chemistry for shale drilling wastes. The test list should also include radiologic parameters such as thorium, uranium, the various radium isotopes and radon gas.

4.13.b. Asbestos Wastes

One of the major concerns about asbestos wastes is the release of dust. These wastes are double bagged to prevent the release of asbestos dust. Dust from shale drilling wastes may also have health implications. The shale drilling waste dusts are also cancer and lung disease hazards, both the natural rock itself and the silica sands used to prop open the fracture sites in the in situ bedrock. In addition, other materials introduced into the drilling and production program at various points may be hazardous if released as dust. Is WV DEP considering implementing a shale drilling waste management strategy mirroring the management of asbestos to reduce the risk of windblown hazardous dust from the shale drilling wastes at the landfills? If not, why not?

4.13.c. Liquids.

Are liquids or slurry shale drilling wastes going to be allowed in the landfills and if so, will they be subject to the regulations of this section?

4.13.h. Sludges and Sewage Sludge.

Will sludges from shale drilling waste be permitted? Will they follow these management requirements?

5.4. Requirements for the Operation of Class D-1 and Class D Solid Waste Facilities.

Will shale drilling wastes be permitted to be disposed in these facilities? If so, what testing will be required and what concentrations will be acceptable for disposal of the wastes?

5.6.a.1. "Drill Cuttings and Associated Drilling Wastes" means the broken bits of solid material and drilling mud removed from a borehole drilled by rotary, percussion, or auger methods.

Does this list include sludges, liquids, filter socks, or pipe scale? Are they excluded and, if so, where are they sent for disposal?

5.6.b.1. "*Liner system requirements for separate cell(s) dedicated solely to the disposal of drill cuttings and associated drilling waste must meet the requirements of subdivisions 4.5.d and 4.5.e of this rule.*"

Are there any requirements for addressing the additional weight of the materials? If not, why not?

5.6.b.3. "*The leachate collection and detection lines must be installed in a manner that allows for sampling of the leachate from the dedicated cell.*"

Are there any design requirements to address the additional weight of the shale drilling wastes? If not, why not?

5.6.c.1.B. "*The facility must obtain at least one composite sample from the lateral or horizontal portion of each well bore unless otherwise approved by the Secretary. The American Petroleum Institute (API) well number must be included in the profile.*"

The lateral or horizontal section of the well can be as long as four miles in length. Is WV DEP planning to develop a statistically reliable number of composite samples per linear unit of horizontal section of each well? If so, what will be the ratio of composite samples to each 100 feet of horizontal boring? If not, how will it be possible to determine that enough samples have been taken?

5.6.c.1.C. (no title)

This section addresses the analyses that must be submitted with each special waste minor permit modification application. Included are TCLP and TPH (in Section 5.6.c.1.C.1) and percent solids (5.6.c.1.C.2). This list does not include testing for radiological properties in the shale drilling waste materials. We recommend that laboratory tests meeting the US DOE protocol for radiological determinations be used as the testing mechanism. This requires a 21-day hold to allow the ingrowth of radium daughter isotopes to determine the radium isotopic levels in the shale drilling wastes. What happens if the samples exceed the required testing limits? Will the shale drilling wastes be rejected or will they be downblended? If so, how and with what?

5.6.c.1.C.2. Percent Solids, EPA Method Number 160.3 or 2540.

If the shale drilling wastes do not meet these criteria, how will they be managed at the site?

5.6.d. Radiation Monitoring

We know of no fixed radiation detection equipment or portable radiation monitoring equipment capable of successfully monitoring shale drilling wastes to as low as 10 uR/hr. This level is lower than Pennsylvania's and they are conducting a year-long study to determine why they cannot meet their lower

limits. During a conversation with staff of one of the manufacturers of the stationary equipment used in Pennsylvania, we learned that the original equipment was purchased and calibrated for medical wastes, not shale drilling wastes. These stationary fixed detectors were never designed for the detection of the radiological decay products found in shale drilling wastes. We know of no other units on the market that can perform as so designated.

5.6.d.4. "*If a load of drilling cuttings or associated drilling waste is confirmed to be less than ten microroentgens per hour (10 μR/hr.) above average local background level, the waste may be disposed of in the facility. If the load of waste is confirmed to be equal to or greater than 10 μR/hr. above average local background level, the combined concentration of Radium 226 and Radium 228 must be determined. The combined concentration must be analyzed by a State approved method. If the combined concentration in the waste is less than five picocuries per gram (5pCi/gr.) above average local background level, the waste may be disposed in the facility. If the values are greater than 5pCi/gr. above average local background level, the load must be rejected.*"

From this section, are we to assume that there will be no downblending of wastes? If the load is rejected, where will it be directed? What constitutes a "State approved method" of determining the levels of radium-226 and -228? Is the WV DEP planning to use the US EPA standard background level of 2 pCi/g for radium-226 and -228?

6.1.d.2.C. Disposal location of asbestos and any other waste specified by the Secretary.

Should shale drilling wastes be listed here? If not, why not?

6.3. Post-Closure Care Requirements.

Will landfills with shale drilling wastes be restricted to a 30-year post closure oversight or will the oversight continue for the life of the radioactive decay chains? If the post-closure period is only for 30 years, who will take responsibility of the landfill after that time and how will they be funded?

APPENDIX V
Leachate Sampling Parameters for Facilities Accepting Drill Cuttings and Associated Drilling Waste

After reviewing the data from the Meadowfill site, we suggest that the following tests be added to Appendix V: thorium, uranium-238, uranium-235, radium-223, speciation of the total alpha and total beta measurements and total radon.

Summary

We appreciate this opportunity to provide these technical comments to the Wetzel County Solid Waste Authority. We hope that they will prove useful as the Authority develops their public comments on these draft rules. If you have further questions or need any additional information, please feel free to contact us.

Respectfully submitted,
BENNETT AND WILLIAMS
ENVIRONMENTAL CONSULTANTS, INC.

Julie Weatherington-Rice

Julie P. Weatherington-Rice, PhD, CPG, CPSS
Sr. Scientist and Project Coordinator

JR/jwr
Attachments (4)

I:Projects:2014:14-04:7-23-14 Comments on Rules

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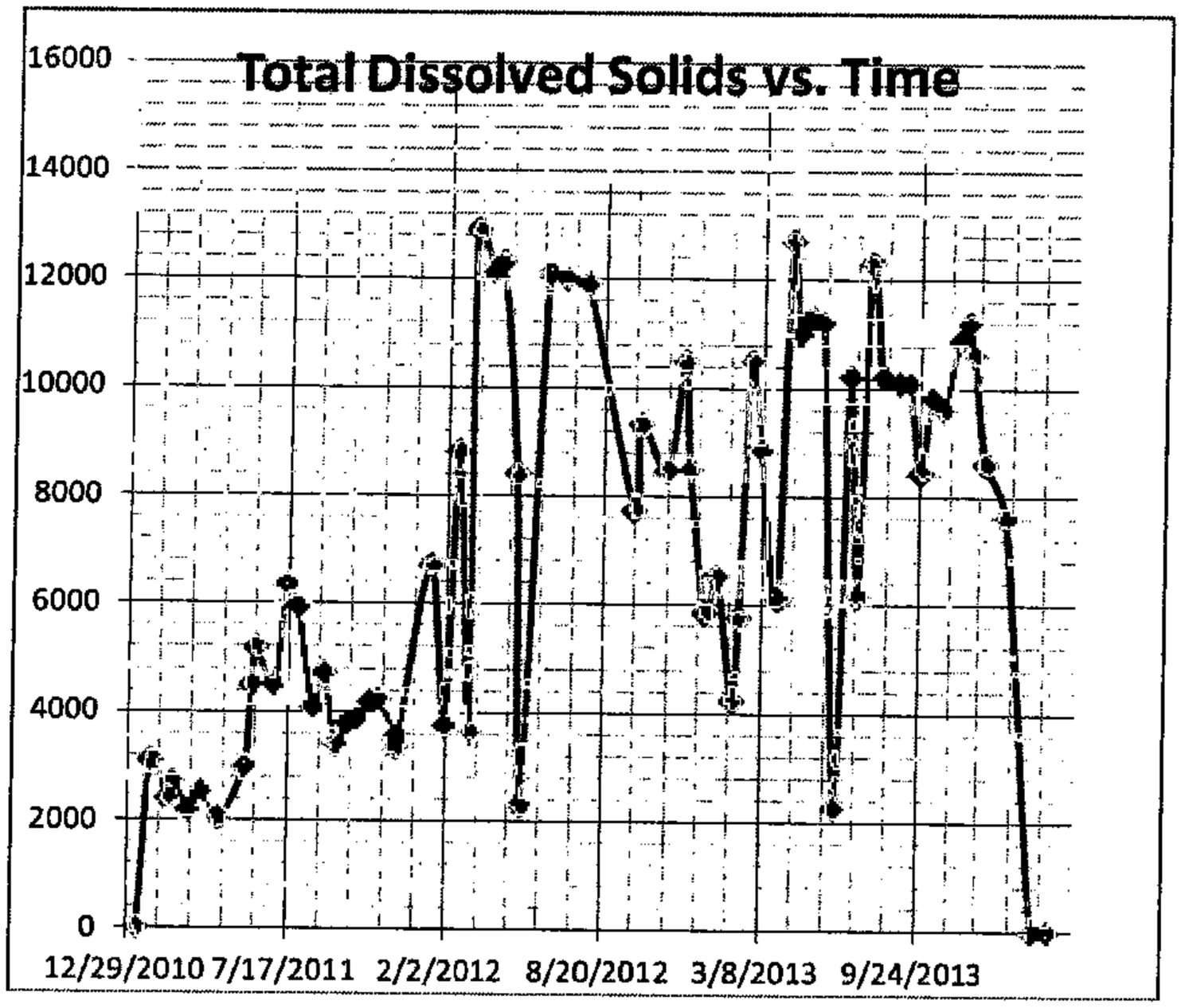

Figure 1. Graph of Total Dissolved Solids, Meadowfill Landfill, 2011-2013, prepared by Rachel Warren, The Ohio State University, Dept. of Food, Agricultural and Biological Engineering, from data supplied by WV DEP.

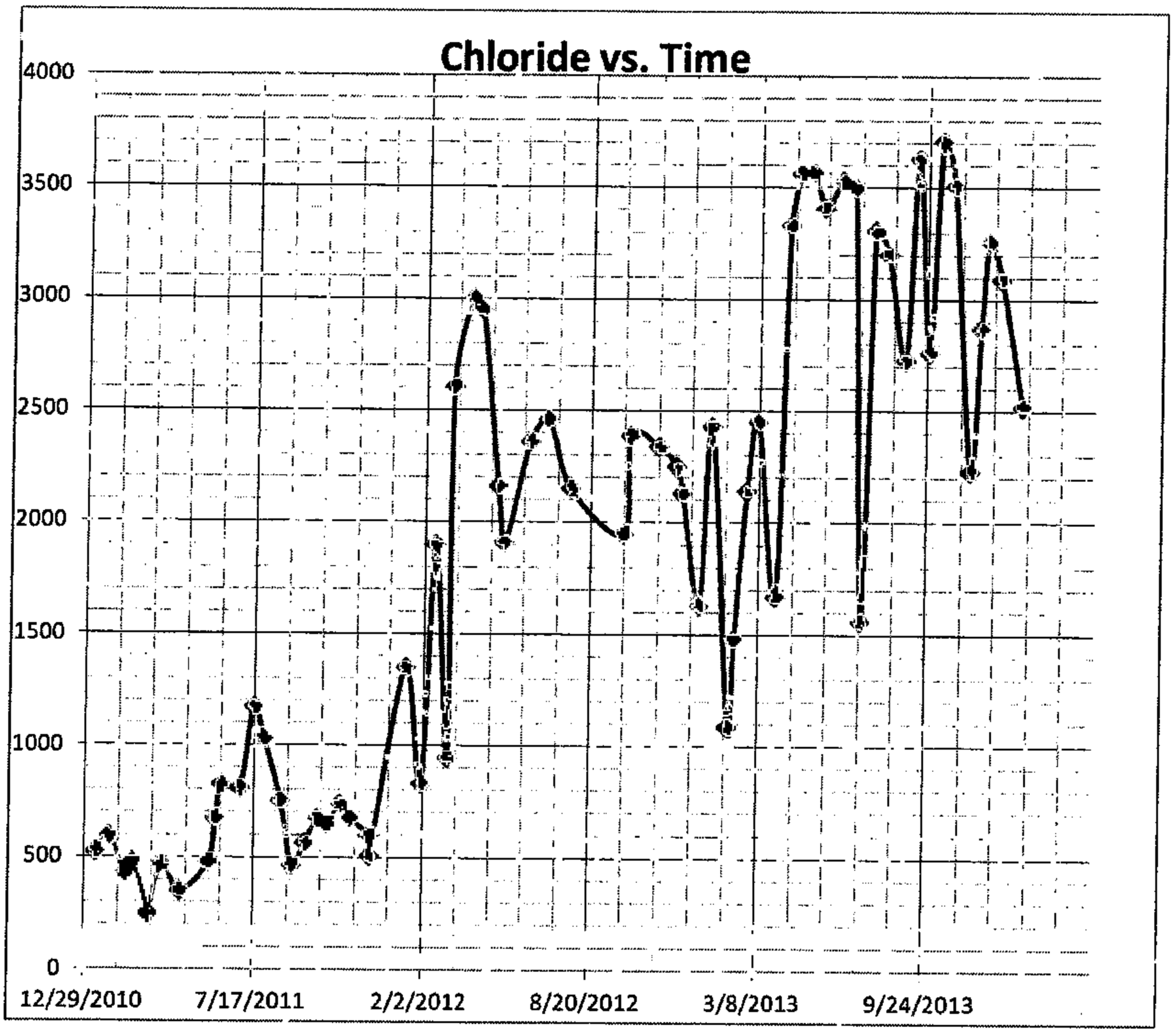

Figure 2. Graph of Chloride, Meadowfill Landfill, 2011-2013, prepared by Rachel Warren, The Ohio State University, Dept. of Food, Agricultural and Biological Engineering, from data supplied by WV DEP.

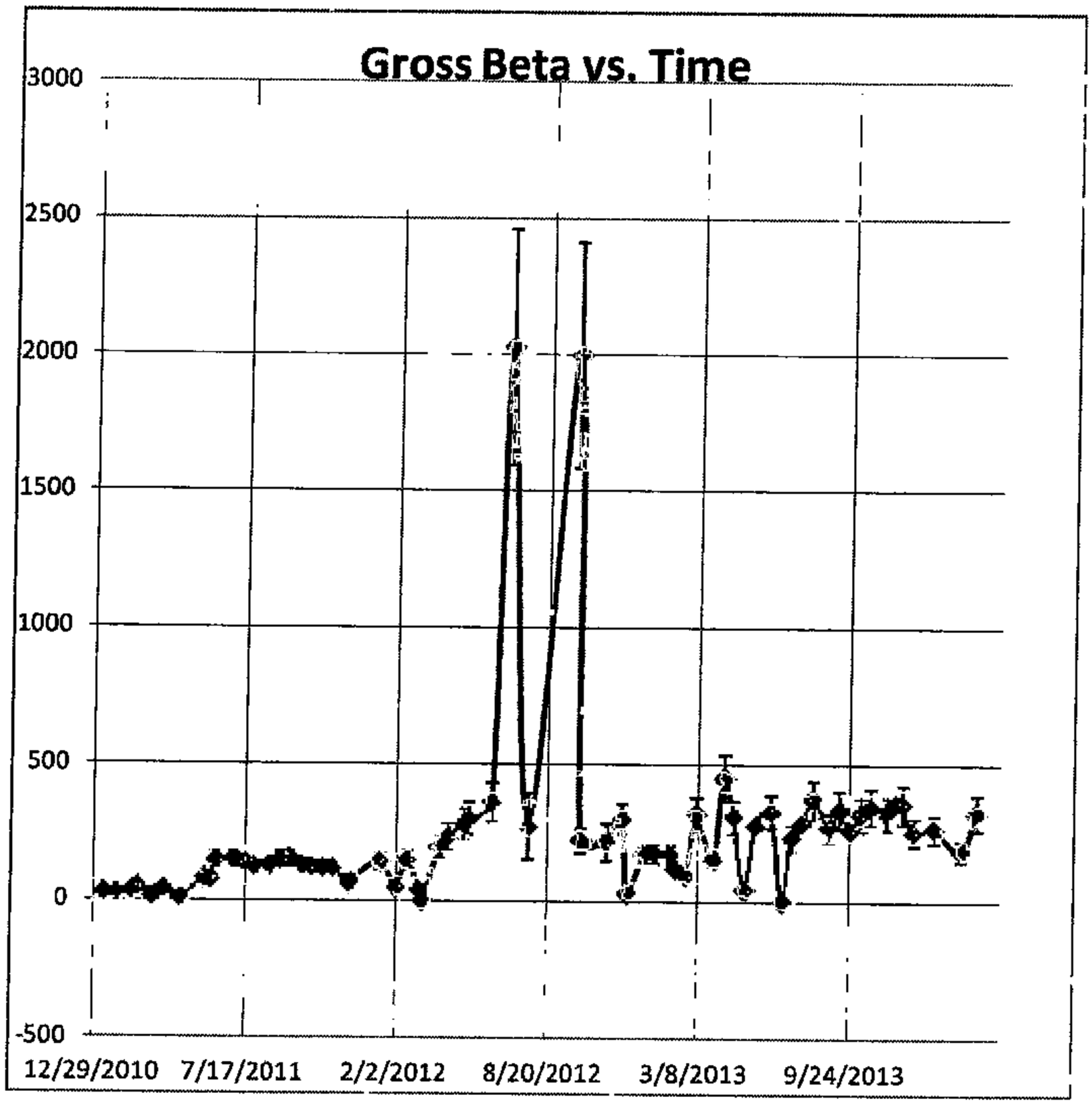

Figure 3. Graph of Gross Beta, Meadowfill Landfill, 2011-2013, prepared by Rachel Warren, The Ohio State University, Dept. of Food, Agricultural and Biological Engineering, from data supplied by WV DEP.

JULIE P. WEATHERINGTON-RICE

Bennett & Williams

EDUCATION

BS EARTH SCIENCES EDUCATION - The Ohio State University, 1974
MS GEOLOGY & MINERALOGY - The Ohio State University, 1978
Ph.D. Soil Science and Geographic Information Systems - School of Natural Resources - The Ohio State University, March 2004.
ADJUNCT ASSISTANT PROFESSOR – Food, Agricultural, and Biological Engineering, The Ohio State University, appointed June, 2004.
ADJUNCT ASSISTANT PROFESSOR – Science Department, Pontifical College Josephinum, 2008-2011.

Dissertation topic:

Fracture occurrence and ground water pollution potential in Ohio's glacial and lacustrine deposits: A soils, geologic, and educational perspective.

Completed (Published) Related Papers:

Christy, A.D., and J. Weatherington-Rice. 2000. Field workshop on subsurface fractures in glacial till and their environmental implications: An educational experience for professionals and decision-makers. *Ohio Journal of Science* 100(3/4):94-99.

Malone, R.W., S. Logsdon, M. J. Shipitalo, J. Weatherington-Rice, L. Ahuja, L. Ma. 2003. Tillage effect on macroporosity and herbicide transport in percolate. *Geoderma* 116:191*215.

Malone, R. W., J. Weatherington-Rice, M. Shipitalo, N. Fausey, L. Ma, L. Ahuja, R. D. Wauchope, Q. Ma. 2004. Herbicide leaching as affected by macropore flow and within-storm rainfall intensity variation: a RZWQM simulation. *Pesticide Management Science* 60:277-285 .

Weatherington-Rice, J., A.D. Christy, and J. L. Forsyth. 2000. Ohio's Fractured Environment. *Ohio Journal of Science* 100(3/4):36-38.

Dissertation Papers published in the April 2006 Special Issue of The Ohio Journal of Science:

Weatherington-Rice J, Angle MP, Christy AD, and Aller L. 2006. DRASTIC Hydrogeologic Settings Modified for Fractured Till: Part I. Theory. *Ohio J Sci* 106(2):45-50.

Weatherington-Rice J, Angle MP, Christy AD, Gerhing R, and Aller L. 2006. DRASTIC Hydrogeologic Settings Modified for Fractured Till: Part II. Field observations. *Ohio J Sci* 106(2):51-63.

Weatherington-Rice J, Bigham J. 2006. Buried Pre-Illinoian-Aged lacustrine deposits with "green rust" colors in Clermont County, Ohio. *Ohio J Sci* 106(2):35-44.

Weatherington-Rice J, Hall G. 2006. Fracture and gully formations in glacial fill: Field observations at the WillowCreek Landfill, Portage County, Ohio and at historic earthen dam failure sites in the US. *Ohio J Sci* 106(2):27-34.

Other Related Papers published in the April 2006 Special Issue of The Ohio Journal of Science:

Weatherington-Rice, J., Hottman, A., Murphy, E. M., Christy, A.D., and M Angle. 2006. Fractured tills, Ohio's ground water resources, and public policy considerations addressed by DRASTIC maps. *Ohio J Sci* 106(2)64-73.

Weatherington-Rice, J., Christy, A. D., and M. P. Angle. 2006. Further explorations into Ohio's fractured environment: Introduction to *The Ohio Journal of Science's* second special issue on fractures in Ohio's glacial tills. *Ohio J Sci* 106(2):4-8.

Other Related Papers Published, in Draft and in Press (May, 2013)

Kim, E. K., Kang, Y. W., Christy, A. D., and J. Weatherington-Rice, 2010, Laboratory Method for Predicting Boundary Conditions of Soil Textures that Support Fracture Development, *Applied Eng. In Agric.* 26(6): 973-982

Kim, E. K., Kang, Y. W., Christy, A. D., and J. Weatherington-Rice, 2011, Ternary Diagram Modeling of Soil Texture Data for Predicting Subsurface Fracturing in Glacially Related Fine-Grained Materials, *Transactions of the American Society Agricultural & Biological Engineers* 54(4): 1325-1331.

Kim, E. K., Kang, Y. W., Christy, A. D., and J. Weatherington-Rice, 2011, Predicting Preferential Flow of Pollutants via Fractures Using Field and Laboratory Soil Texture Data. ASABE Paper No. 1111335. St. Joseph, Mich: ASABE.

Kim, E. K., Kang, Y. W., Christy, A. D., and J. Weatherington-Rice, 2011, Predicting Fractures Using Field and Laboratory Soil Texture Data for Glacially-related Materials. *Trans. ASABE 54(4).*

FIELDS OF SPECIAL COMPETENCE

Geomorphology, stratigraphy and hydrogeology and mapping (both soils and geologic) with special emphasis on Pleistocene geomorphology, physical and chemical properties of materials (both soils and parent) and ground water movement investigations with GIS systems applications; Ground-Water Protection; Aquifer Characterization and Modeling; Wellfield Development; Solid, Hazardous, and Radioactive Waste Landfill Siting studies. Land Use Planning, including River Basin and Watershed Evaluations and Raparian Corridor Evaluations and Restorations; Sole Source Aquifer Designations; Wellhead Protection; Regional Planning; Stormwater Management; Landslide and Sedimentation Evaluations; Strip-Mine Reclamation. Presentations and training sessions on Ohio Geology; Ground Water Protection; Landfill Siting Criteria, Fractured Till, Stormwater Delivery and Management, Applications of GIS (data and mapping) to Water and Land-Use Planning Projects, Earth Science and Water Education, and related subjects.

EXPERIENCE

Typical Projects with Responsible Charge:

Tuscarawas River Buried Valley Combined Sole Source Aquifer Petition

Compiling the technical information needed to create a Safe Drinking Water Act Sole Source Aquifer petition to the US EPA. This region, all or parts of 13 counties, has both bedrock and glacially-derived prolific ground water resources. There are approximately 550 community and non-community public water supplies in the region, most of who are on ground water. Replacement of these public water supplies will be extremely costly and difficult. Sole Source Aquifer designation will be used by local leaders and communities to stress the importance of protecting a virtually irreplaceable resource for the region.

Carrollton, Ohio

Research and preparation of report materials to better define the source water protection area for the Village's two well fields. The Village wells are located between two historically mined coal seams, one of which is serving as a flooded underground reservoir for the Village's wells. Other potentially contaminating land uses in the area include roads, a rail line through the Wynn Well Field, the planned reopening of the lower, Middle Kittanning Coal seam for underground mining and Utica Shale gas drilling on the uplands around the well fields. This is the only sustainable ground water supply in the area available to the Village. All replacement options will be prohibitively expensive. Carrollton is within the proposed Tuscarawas River Buried Valley Combined Sole Source Aquifer area.

Valleycrest Superfund Landfill, Dayton, Ohio

Research of the geology and hydrogeology of the area to determine hydrogeologic flow paths for contaminant travel, review and comments on the Potentially Responsible Party (PRPs) clean-up and closure documents for the site including review and analysis of the computer models developed by the PRPs, coordination and meetings with US EPA, Ohio, EPA, the City of Dayton and neighborhood groups. Presentations at public meetings and at public hearings as final remediation plans are developed for the site. Funded by a series of ongoing US EPA TAG grants awarded to a local community group to aid in education and involvement of the community as the clean-up goes forward.

This historic sand and gravel quarry in the Old North Dayton neighborhood became an unregulated dump and then landfill, in the 1960s. The unlined pits took industrial wastes, construction wastes, coal ash, and municipal type wastes until operations were terminated. The landfill has still not been closed. Over 42,000 barrels of toxic and hazardous wastes were removed from the landfill in the 1990s as part of the clean-up efforts. Most of the drums had rusted through and were empty when removed. The landfill sites within the one-year time-of-travel wellhead protection area for Dayton's Miami River well field and just outside the one-year time-of-travel for the protection area of Dayton's Mad River Well Field.

Plum Brook Ordnance Works Clean-up

This project involved determination of the geology and hydrogeology of the area as it related to contaminant transport, review and comments on technical documents prepared as part of the clean-up efforts including analysis of ground water models, presentation at quarterly meetings, and public education of community members at the Plum Brook Ordnance Works site in Erie County, Ohio. The project was funded by a four-year US Department of Defense TAPP Grant.

The US Army Corps of Engineers, Huntington District, is undertaking the third clean-up of the World War II Plum Brook Ordnance Works site beginning in the early 1990s. Completion of the clean-up is expected by 2025. This site, originally more than 9,000 acres in size, was operated as a TNT manufacturing plant for armaments for World War II. Because of the potential for explosion, small manufacturing areas were set up all over the grounds and finished ammunition was stored in underground bunkers until it could be shipped out by rail. The original decommissioning in the 1950s simply consisted of bulldozing and burning the buildings. Significant contamination remained in the soils and ground water including potentially still explosive TNT and its raw materials. This current clean-up will be sufficient to reuse the property for housing or farming, the highest level of Brownfields clean-up standards possible, thus returning 9,000 acres of usable land to the people of Erie County.

LINDA ALLER

Bennett & Williams

EDUCATION

BA GEOLOGY - The Ohio State University, 1977

Graduate courses in Hydrogeology at The Ohio State University Columbus, Ohio; Ohio University, Athens, Ohio; and Wright State University, Dayton, Ohio.

Numerous continuing education courses have been completed related to groundwater modeling, groundwater management, aquifer analysis, safety at hazardous disposal sites, risk assessment, remote sensing and geographic information systems.

FIELDS OF SPECIAL COMPETENCE

Hydrogeology; Water Supply Investigations; Stratigraphy; Drilling and Sampling Technology; Evaluation and Assessment of Hydrogeologic Settings with regard to Potential for Pollution and Contaminant Migration; Facility Siting; Water and Soil Treatment and Remediation; Project Management; Community Relations; Technical Training Programs.

SUMMARY OF EXPERIENCE

For over 25 years, Ms. Aller has been actively involved in both the management and technical aspects of groundwater supply, protection and investigations. She has worked extensively with local, state and federal officials and legislators providing technical information on policies and regulations that affect groundwater. She chaired the committee that developed regulations for domestic wells in the state of Ohio and served as chairman of Ohio's public groundwater task force. She is recognized for her knowledge of Ohio geology and has served as a gubernatorial appointee to the Ohio Geological Advisory Committee and the Sanitarian Registration Board.

Ms. Aller has lectured throughout the United States and internationally on all aspects of groundwater occurrence and potential for pollution and on groundwater clean-up technologies. She has conducted training programs on many topics including groundwater and radionuclide contamination. She has helped develop a prototype expert system on underground storage tanks. She has also created slide shows that have been translated into two foreign languages and that are used to educate people throughout the world about groundwater location and development.

Ms. Aller has published state-of-the-art documents on evaluating groundwater pollution that are being used extensively by federal, state and local governments and private concerns to prioritize clean-up, monitoring and capital expenditures. Additional state-of-the-art publications include design and construction practices

for groundwater monitoring wells, ways to locate abandoned wells and methods to ensure mechanical integrity of injection wells. She has prepared specifications for well design and wellhead protection programs. She has also conducted field investigations to troubleshoot groundwater contamination incidences and to evaluate groundwater quality.

RELATED PROJECT EXPERIENCE

City of Canton	Project manager for developing source water protection plans for three wellfields operated by the City, including groundwater models to redefine flow zones and one and five-year time of travel, participation in a committee to develop the management portion of the plan, and updating potential pollution sources within the source water protection areas. Also conducted field investigations of existing and abandoned oil and gas wells within source water protection areas to verify absence or presence and status of wells.
Confidential Client Northeastern Ohio	Provided litigative support in groundwater contamination investigation of private wells with explosive concentrations of methane located in the vicinity of an oil and gas well that had been plugged. Provided hydrogeological analysis, sampling and analysis of pathways for gas migration.
US Nuclear Regulatory Commission Chicago, Illinois	Conducted training program for regional personnel relating to groundwater flow, monitoring well design, and sample collection specifically as it relates to radionuclides.
Ohio Environmental Council	Provided technical assistance and evaluation of proposed laws relating to the definition of TENORM in the state of Ohio specifically as it related to handling and disposal of fluids and from oil and gas drilling activities.
State of Ohio Northern Ohio	Supervised geotechnical and hydrogeologic investigation to define the extent of subsurface contamination at a former stamping manufacturing plant. Chemicals of concern included hydrocarbons, PCBs and volatile and semi-volatile compounds. Defined stratigraphy; identified pathways of contamination; installed monitoring network; evaluated remedial technologies to determine feasibility and cost-effectiveness

	in geologic scenarios; and provided recommendations and cost estimates on remedial alternatives.
Confidential Client Southwestern Ohio	Provided litigative support in groundwater contamination investigation of private wells impacted by TCE plume from nearby manufacturing facility. Provided hydrogeological analysis, sampling, groundwater flow rate assessment, and plume definition. Evaluated remedial technologies for stabilizing and cleaning up plume.
Confidential Client Southwestern Ohio	Provided litigative support in groundwater contamination investigation of private wells impacted by ethylene glycol from deicing practices at regional airport. Investigation involved defining the impact, collecting samples for laboratory analysis and proving hydrogeologic route for entry of the contaminant into the wells through fractured bedrock via a contaminated stream.
Confidential Client Southwestern Ohio	Provided litigative support in surface soil contamination investigation of metals migration from adjacent manufacturing facility onto property used as an organic farm. Investigation involved collection of samples for laboratory analyses and defining the route of migration of the elevated metals concentrations onto the property.
Little Hocking, Ohio	Provided technical assistance and litigative support regarding the presence and routes of migration of an unregulated contaminant from a nearby manufacturing facility to a public wellfield; provide technical comments and oversight on field activities relating to investigation of groundwater, soil, air, biota, and vegetative concentration of contamination; performed technical review and prepared comments on NPDES application and siting and permitting of a new specialized water treatment plant.
Confidential Client Southwestern Ohio	Provided litigative support in investigation of contamination of private wells by surface infiltration from nearby stream that contained ethylene glycol from de-icing agents used at an airport. Collected samples and determined route of contaminant migration.

Ann D. Christy, Ph.D., P.E.

Associate Professor
Department of Food, Agricultural, and Biological Engineering
The Ohio State University, 590 Woody Hayes Drive, Columbus, Ohio 43210-1057
Telephone: 614-292-3171, Fax: 614-292-9448, E-mail: christy.14@osu.edu

Education

Ph.D. Environmental Systems Engineering, 1991. Clemson University, Clemson, SC.
M.S. Biomedical Engineering, 1985. The Ohio State University, Columbus, OH.
B.S. Agricultural Engineering, 1983. The Ohio State University, Columbus, OH.

Employment History

Associate Professor, Department of Food, Agricultural, and Biological Engineering, The Ohio State University, Columbus, OH (2001-present).

Provost Faculty Fellow, Office of Academic Affairs, The Ohio State University, Columbus, OH (2009-2012: *a three-year 50% appointment to help guide the quarter-to-semester transition at the university level, along with college and departmental level leadership)*

Interim Associate Dean for Undergraduate Education and Student Services, College of Engineering, The Ohio State University, Columbus, OH (2008-2009: *a 9-month 50% appointment to provide leadership to the college's undergraduate education and student services consisting of staffed programs for recruiting, freshman orientation, student advising, curriculum, honors and scholars programs, career services, outcomes assessment, non-departmental engineering course offerings).*

Assistant Professor, Department of Food, Agricultural, and Biological Engineering, The Ohio State University, Columbus, OH (1996-2001).

Senior Associate Engineer / Shareholder / Board of Directors member, Bennett and Williams Environmental Consultants Inc., Westerville, OH (1999-present part-time).

Senior Engineer, Killam Associates Consulting Engineers, Millburn, NJ (1992-1995 full time, 1996-1999 part-time).

Lecturer, Continuing Education Division, Tri-County Technical College, Pendleton, SC (1989-1992 part-time).

Professional Registration and Certifications

- Registered Professional Engineer, State of Ohio (1996-present)
- ABET Engineering Accreditation Commission (ABET-EAC) program evaluator (2009 – present)
- American Council for Construction Education (ACCE) program evaluator (2010-present)
- OSHA Certifications: Health and Safety for Hazardous Waste Site Operations, Excavation and Trench Safety, Permit Required Confined Space Operations

Classroom Teaching Experience

- Introduction to Food, Agricultural, and Biological Engineering (FABENG 225)
- Modeling and Design of Biological Systems (FABENG 625)
- Environmental Controls for Agricultural Structures (FABENG 645, 5820)
- Design of Waste Management Systems (FABENG 650)
- Engineering Thermodynamics (FABENG 2120)
- Biomass Conversion to Bioenergy (FABENG 5540)
- Science and Engineering for Life – On Earth and in Space (FABENG 694 Group studies for high school science teachers)
- Professional Development (FABENG 695, 3140)
- Sustainable Housing for Informal Settlements in South Africa (an OSU Study Abroad program, FABENG 697.01)
- Capstone Design (FABENG 723, 724, 725)
- Departmental / Graduate Seminar (FABENG 850)

Extension Experience

- State Extension Specialist for "Barn Again in Ohio" with a focus on educational programming supporting the rehabilitation and reutilization of historic agricultural buildings including over 50 barn workshops / conferences serving over 4000 participants, 4 editor-reviewed journal articles, 3 extension factsheets, hundreds of phone calls and email inquiries (2002 – present).

PUBLICATIONS

Peer-reviewed journal articles

1. Rismani-Yazdi, H., S.M. Carver, A.D. Christy, Z. Yu, K. Bibby, J. Peccia, and O.H. Tuovinen. 2013. Suppression of methanogenesis in cellulose-fed microbial fuel cells in relation to performance, metabolite, and microbial population. *Bioresource Technology 129(1): 281-288.*

2. Chen, Q., A.D. Christy, M.E. Owens, D. Bortz, W. Greene, and B. King. 2012. Two-plus-two construction management programs and articulation agreements. *International Journal of Construction Education and Research.* 8(1): 4-25.

3. Rismani-Yazdi, H., A.D. Christy, S.M. Carver, Z. Yu, B.A. Dehority, and O.H. Tuovinen. 2011. Effect of external resistance on bacterial diversity and metabolism in microbial fuel cells. *Bioresource Technology 102(1): 278-283.*

4. Kim, E.K., Y.W. Kang, A.D. Christy, and J. Weatherington-Rice. 2011. Ternary diagram modeling of soil texture data for predicting subsurface fracturing in glacially related fine-grained materials. *Trans. ASABE* 54(4): 1325-1331.

5. Kim, E.K., Y.W. Kang, A.D. Christy, and J. Weatherington-Rice. 2010. Laboratory method for predicting boundary conditions of soil textures that support fracture development. *Applied Engineering in Agriculture* 26(6): 973-982.

6. Abadie, A., A.D. Christy, J. Jones, J. Wang, and M. Lima. 2009. Longitudinal survey of female faculty in biological and agricultural engineering. *Transactions of the ASABE* 52(4): 1397-1405.

7. Rismani-Yazdi, H., S.M. Carver, A.D. Christy, O.H. Tuovinen. 2008. Cathodic Limitations in Microbial Fuel Cells: An Overview. *Journal of Power Sources* 180(2): 683-694.

8. Rismani-Yazdi, H., A.D. Christy, B.A. Dehority, M.Morrison, Z. Yu, and O. H. Tuovinen. 2007. Electricity Generation from Cellulose by Rumen Microorganisms in Microbial Fuel Cells. *Biotechnology & Bioengineering 97(6): 1398-1407.*

9. Christy, A.D., and M. Lima. 2007. Teaching creativity and multidisciplinary approaches to engineering problem-solving. *International Journal of Engineering Education* 23(4): 636-644.

10. Weatherington-Rice, J., A.D. Christy, M. Angle, and L. Aller. 2006. DRASTIC Hydrogeologic Settings Modified for Fractured Till: Part 1. Theory. *Ohio Journal of Science 106(2): 45-50.*

11. Weatherington-Rice, J., A.D. Christy, M. Angle, R. Gehring, and L. Aller. 2006. DRASTIC Hydrogeologic Settings Modified for Fractured Till: Part 2. Field Observations. *Ohio Journal of Science 106(2): 51-63.*

12. Kim, Eun Kyoung, and A.D. Christy. 2006. Use of soil texture analysis to predict subsurface fracturing in glacial tills and other unconsolidated materials. *Ohio Journal of Science 106(2): 22-26.*

13. Weatherington-Rice, J., Ava Hottman, Earl Finbar Murphy, Ann D. Christy, and Michael Angle. 2006. Fractured tills, Ohio's ground-water resources, and public policy considerations addressed by DRASTIC maps. *Ohio Journal of Science 106(2): 64-73.*

14. Weatherington-Rice, J., A.D. Christy, and M. Angle. 2006. Further Explorations into Ohio's Fractured Environment: Introduction to *The Ohio Journal of Science's* Second Special Issue on Fractures in Ohio's Glacial Tills. *Ohio Journal of Science 106(2): 4-8.*

15. Engelmann, Claudia J. K., Andrew D. Ward, Ann D. Christy, and E. Scott Bair. 2002. Application of the BASINS database and NPSM model on a small Ohio watershed. *Journal of the American Water Resources Association* 38(1): 289-300.

16. Myers, M.J., A.D. Christy, and O.H. Tuovinen. 2000. Design of a laboratory scale bioreactor for treating landfill waste. *Applied Engineering in Agriculture* 16(6): 747-756.

17. Klingman, M.H., and A.D. Christy. 2000. Development of a continuous system for sanitizing whole apples with aqueous ozone. *Transactions of the ASAE* 43(6): 1989-1996.

18. Weatherington-Rice, J., A.D. Christy, and J. L. Forsyth. 2000. Ohio's Fractured Environment. *Ohio Journal of Science* 100(3/4): 36-38.

19. Christy, A.D., and J. Weatherington-Rice. 2000. Field workshop on subsurface fractures in glacial till and their environmental implications: An educational experience for professionals and decision makers. *Ohio Journal of Science* 100(3/4): 94-99.

20. McMahon, M., and A.D. Christy. 2000. Root growth, calcite precipitation, and gas and water movement in fractures and macropores: A review with field observations. *Ohio Journal of Science* 100(3/4): 88-93.

21. Christy, A.D., L. A. McFarland, and D. Carey. 2000. The use of test pits to investigate subsurface fracturing and glacial stratigraphy in tills and other unconsolidated materials. *Ohio Journal of Science* 100(3/4): 100-106.

22. Fausey, N., G. Hall, J. Bigham, B. Allred, and A.D. Christy. 2000. Properties of the Fractured Glacial Till at the Madison County, Ohio, Field Workshop Pit Site. *Ohio Journal of Science* 100(3/4): 107-112.

23. Christy, A.D., M. Lima, and A.D. Ward. 2000. Implementing real-world problem solving projects in a team setting. *National Association of Colleges and Teachers of Agriculture Journal* 44(3): 72-77.

24. Cauble, S., A.D.Christy, and M. Lima. 2000. Toward plugging the leaky pipeline: Biological and agricultural engineering female faculty in the United States and Canada. *Journal of Women and Minorities in Science and Engineering* 6(3): 229-249.

25. Lima, M., A.D. Christy, M. Owens, and J.C. Papritan. 1999. The use of student portfolios to enhance learning and encourage industrial ties in undergraduate education. *National Association of Colleges and Teachers of Agriculture Journal* 43(3): 51-54.

26. Christy, A.D. and M. Lima. 1998. The use of student portfolios in engineering instruction. *Journal of Engineering Education* 87(2): 143-148.

Chapters in edited books

1. Zwierschke, Kerry Hughes and Christy, Ann D. 2010. Anaerobic Bioreactor Landfills. In Encyclopedia of Agricultural, Food, and Biological Engineering, 2nd edition (Dennis R. Heldman, editor), London, UK: Taylor and Francis. pp. 42-45. (Peer reviewed).

2. Hughes, K.L., and A.D. Christy. 2003. Bioreactor Landfills. In Encyclopedia of Agricultural, Food, and Biological Engineering (Dennis R. Heldman, editor). London, UK: Taylor and Francis. pp. 104-107. (Peer reviewed).

Papers in proceedings

1. Christy, Ann D. 2013. "Student portfolios for assessing ABET a-k outcomes." *Proceedings of the 2013 ASEE North Central Section Conference*. 12 p. (Peer reviewed)

2. Yost, A.E., A.D. Christy, L. Zhao, and O.H. Tuovinen. 2012. Impact of Increased Surface Area Cathodes Using Nanostructures in Microbial Fuel Cells for Electricity Production. ASABE Annual Meeting Paper No.12-1337011. St. Joseph, Mich: ASABE. 13p.

3. Kim, E.K., Y.W. Kang, A.D. Christy, and J. Weatherington-Rice. 2011. Predicting preferential flow of pollutants via fractures using field and laboratory soil texture data. ASABE Paper No.11-11335. St. Joseph, Mich: ASABE. 11p.

4. Christy, A.D. 2011. Engaging Students to Prepare them for the Engineering Profession and Reflect upon their Undergraduate Career. *American Society of Agricultural and Biological Engineers Annual Meeting*. ASABE Paper No.11-11605. St. Joseph, Mich: ASABE. 8p.