



**Environmental  
Protection Agency**

John R. Kasich, Governor  
Mary Taylor, Lt. Governor  
Scott J. Nally, Director

February 6, 2012

**RE: CITY OF AVON LAKE LANDFILL  
GROUND WATER  
NOTICE OF VIOLATION/REQUEST  
FOR ADDITIONAL INFORMATION**

**CERTIFIED MAIL 7011 0470 0002 3496 0798**

Mr. Thomas E. Lescher  
Service Director  
City of Avon Lake  
750 Avon Belden Rd.  
Avon Lake, Ohio 44012

Dear Mr. Lescher:

On November 28, 2011, the Ohio Environmental Protection Agency (Ohio EPA), Division of Materials and Waste Management (DMWM), Northeast District Office (NEDO) received a report prepared by HZW Environmental Consultants, LLC (HZW) entitled, "*Ground Water Quality Assessment Report*" (GWQAR), dated November 2011. The GWQAR was prepared in order to comply with OAC 3745-27-10(E)(6) which requires the owner/operator to determine the rate, extent and, concentration of waste-derived constituents in ground water.

The approximate 13-acre Avon Lake Municipal Landfill (ALML) is located at 750 Avon-Belden Road in Avon Lake, Lorain County, Ohio. According to the GWQAR, the ALML began operation in May 1973, and accepted construction debris, yard waste, and special waste (furniture, etc.) until it was closed in December 1990.

Near surface geology at the ALML consists of Pleistocene age, waved-plained clayey glacial till and clay lacustrine deposits that overlie the Devonian-aged Cleveland Shale Member of the Ohio Shale Formation. The depth to bedrock varies across the site between approximately 10 to 30 feet below ground surface (bgs). According to the GWQAR, the upper 5 to 10 feet of unconsolidated material appears to consist of re-work native fill material consisting of clay with varying amounts of sand. The uppermost portion of the Cleveland Shale at the ALML is weathered.

The GWQAR indicates that the uppermost aquifer system (UAS) at the ALML consists of weathered shale that interfaces with unconsolidated glacial till/lacustrine deposits. Two ground water zones are monitored at the ALML: A shallow Till/Shale Interface Zone that is the Upper Aquifer System (UAS) and a Deeper Shale Zone.

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The UAS at the ALML is monitored with a well network that consists of 12 monitoring wells that were installed between 1993 and 2010. Eight monitoring wells: MW-1, MW-2, MW-3, MW-4, MW-5A, MW-7, MW-8, and MW-9 monitor the upper Shale/Till Interface Zone UAS. Four monitoring wells: MW-6, MW-10, MW-11, and MW-12 monitor the deeper Shale Zone. Ground water elevation from these wells have been used to construct potentiometric maps of the two ground water zones. The GWQAR's Potentiometric Surface Map of the Till/Shale Interface Zone UAS (Figure 3) indicates that ground water flow in the UAS radiates out from the vicinity on MW-4 to the west, northwest, north and northeast. MW-4 is the only upgradient well in the Till/Shale Zone UAS. The GWQAR's Potentiometric Surface Map of the Shale Zone (Figure 4) indicates that ground water flows primarily to the southwest with components of flow to the south and southwest in the southwest portion of the ALML. MW-11 is the only upgradient well in the Shale Zone.

A cursory review of the December 6, 2011 Potentiometric Surface Map of the Shale Zone (Figure 4) in the recently submitted (January 11, 2012) Semiannual Determination of Rate, Extent, and Concentration for the second half of 2011 indicates flow patterns in the Shale Zone have changed since the submission of the GWQAR, and that MW-11 is downgradient of MW-10. Therefore, it is not clear that MW-11 is an upgradient well in the Shale Zone.

According to the GWQAR, ground water analytical results first indicated statistically significant increases in ammonia, antimony, sodium, 2,4-D, and benzene in ground water samples from one or more wells in 2002. A *Ground Water Quality Assessment Plan (GWQAP)* was initially submitted to Ohio EPA in 2003, followed by revisions in May 2004, August 2006, June 2008, December 2009, and June 2010.

### **Concentration**

While the GWQAR contains references to selected analytical results or ranges of results in Section 6.1 (Evaluation of Non VOCs), Section 6.2 (Evaluation of VOCs and Herbicides), Section 7.3 (Concentration), and Appendix H (Concentration Tables for Statistically Significant Parameters), it does not contain all field and analytical results as required by OAC 3745-27-10(E)(7).

The analytical data in Appendix H only goes back to December 2007. In Section 7.3 of the GWQAR (pg. 14), it states "Concentration for each of the statistically significant parameters during the past eight (8) sampling events have been provided in Appendix H. While historic data surpasses eight (8) sampling events, eight (8) sampling events is (sic) the minimum amount of events needed to conduct accurate statistics. In addition,

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the past eight (8) sampling events present current trends, rather than focusing on historical statistically significant data that is no longer significant.”

Ground water analytical data, particularly for metals concentrations, presented in the GWQAR may not be representative of ground water quality at the ALML. On September 2, 2011, Ohio EPA cited ALML for violation of OAC 3745-27-10(B)(3) for failing to install, design, develop, and sample monitoring wells; MW-1, MW-3, MW-5A, MW-6, MW-7, MW-9, MW-11, and MW-12 in a manner that allows for the collection of ground water samples that are representative of ground water quality of the unit being monitored. On November 7, 2011, the Ohio EPA, NEDO received a report prepared by HZW entitled, “*Filtered Versus Unfiltered Metals Demonstration*” (FVUMD), dated November 4, 2011. The FVUMD report is included in Appendix D of the GWQAR. The FVUMD was previously reviewed by Ohio EPA. Ohio EPA’s review of the FVUMD concluded that it did not adequately demonstrate compliance with OAC 3745-27-10(B)(3), as stated in a January 27, 2012 correspondence.

Section 7.3 of the GWQAR indicates that twelve (12) Appendix I/II parameters were determined to statistically exceed background concentrations in ground water. The 12 parameters and the wells where the exceedances occurred are listed below:

- Acetone concentrations at MW-1, MW-2, MW-3, and MW-5 have ranged from 0.0019 to 0.021 mg/L during the past eight sampling events, with all of the most recent detections being below the prediction limit (PL).

In Section 6.2 (Evaluation of VOCs and Herbicides) of the GWQAR (pg. 10) indicates that that naturally occurring acetone may be the source impacting these samples, but proving or disproving this possibility would be difficult to accomplish.

- Barium concentrations at MW-1 have consistently exceeded the PL of 0.357 mg/l during the past eight sampling events. Reported concentrations have ranged from 0.49 to 0.673 mg/L.
- Benzene concentrations at MW-1 and MW-8 have slightly exceeded the PL of 0.001 mg/L. Reported concentrations have ranged from 0.0011 to 0.0029 mg/L.

According to information on page 10 in Section 6.2 of the GWQAR, benzene has also been detected in MW-3 and MW-7 in the past. The GWQAR states: "The detection at MW-3 is considered a false positive or outlier since the detection is the only detection that has occurred at that particular well," and that "Benzene in MW-7 has not been detected since 2007 and is not believed to be statically significant any longer at that particular location." On page 1, Section 2 (Background) of the GWQAR it states "...benzene was reported in MW-6, but was believed to be naturally occurring." The GWQAR does not indicate that a 1 of M resampling in accordance with OAC 3735-27-10(D)(7)(c)(i) was performed to demonstrate that the benzene exceedance at MW-3 was a false positive. Also, the GWQAR does not indicate that demonstrations in accordance with OAC 3745-27-10(D)(7)(c)(ii) that the source of benzene in MW-3, MW-6, and MW-7 was a source other than the landfill, and that such a demonstration was approved by the Director of the Ohio EPA. Therefore, MW-1, MW-3, and MW-7 should be considered in assessment for benzene unless it can be demonstrated in accordance with OAC 3745-27-10(E)(9) that these wells can be reinstated to detection monitoring status and this reinstatement is approved by the Director of the Ohio EPA.

- Chloride concentrations at MW-1, MW-2, MW-3, MW-8, and MW-9 have consistently exceeded the PL of 330 mg/L during the past eight sampling events. Reported concentrations in these wells have ranged from 330 to 820 mg/L.

According to page 8, Section 6.1 (Evaluation of Non VOCs) of the GWQAR, recent analytical results from the four shale monitoring wells- MW-6, MW-10, MW-11, and MW-12 show high concentrations of chloride (ranging from 400 to 9,700 mg/L for the June 2011 sampling event). The GWQAR indicates that high levels of chloride may be related to nearby oil and gas exploration in the past, and "...since it cannot be distinguished whether the detected concentrations are attributed to leachate contamination or former natural oil and gas exploration, data from the shale wells have not been included in this report." The GWQAR does not indicate that a demonstration in accordance with OAC 3745-27-

10(D)(7)(c)(ii) that the source of chloride in the aforementioned four shale zone wells was a source other than the landfill, and that such a demonstration was approved by the Director of the Ohio EPA. Also, it is not clear that MW-11 is an upgradient well in the Shale Zone. Because of the elevated level of chloride in the those wells and because no comparison of the chloride concentration in ground water from the four shale zone monitoring wells to the PL or background concentration of chloride in ground water in the Shale Zone has been made, the four Shale Zone monitoring wells will be considered in assessment for chloride until demonstrated otherwise.

- Magnesium concentrations at MW-1 have consistently exceeded the PL of 121 mg/l during the past eight sampling events. Reported concentrations have ranged from 134 to 190 mg/L.
- Manganese concentrations at MW-5A have exceeded the PL of 1.1 mg/l during five of the past eight sampling events. Reported concentrations have ranged from below the PL to 1.67 mg/L.
- Nitrogen/ammonia concentrations have exceeded the PL of 1.9 mg/l at monitoring wells MW-3, MW-5A, and MW-9. Concentrations at MW-3 have ranged from 18 to 30 mg/L. Concentrations at MW-5A have ranged from 42 to 90 mg/L. Concentrations at MW-9 have ranged from 1.3 to 3.2 mg/L.

According to the GWQAR, concentrations of nitrogen/ammonia in ground water at MW-2 were determined to have been historically significant, but are no longer. The GWQAR does not indicate that a demonstration in accordance with OAC 3745-27-10(D)(7)(C)(ii) that the source of nitrogen/ammonia in ground water at MW-2 was a source other than the landfill, and that such a demonstration was approved by the Director of the Ohio EPA. Therefore, MW-2 should be considered in assessment for nitrogen/ammonia unless it can be demonstrated in accordance with OAC 3745-27-10(E)(9) that these wells can

be reinstated to detection monitoring status and this reinstatement is approved by the Director of the Ohio EPA.

- Potassium concentrations in ground water have exceeded the PL of 13.3 mg/L at monitoring wells MW-3 and MW-5A. Concentrations at MW-3 have ranged from 33.2 to 61.3 mg/L, and MW-5A have ranged from 58.4 to 135 mg/L.

Section 6.1 of the *GWQAR* indicate that potassium concentrations in ground water samples at MW-2 appear to have been statistically significant from 2007 to 2010, and since that time, potassium has been detected at or below the PL in ground water samples from MW-2. The *GWQAR* does not indicate that a demonstration in accordance with OAC 3745-27-10(D)(7)(C)(ii) that the source of potassium in ground water at MW-2 was a source other than the landfill, and that such a demonstration was approved by the Director of the Ohio EPA. Therefore, MW-2 should be considered in assessment for potassium unless it can be demonstrated in accordance with OAC 3745-27-10(E)(9) that these wells can be reinstated to detection monitoring status and this reinstatement is approved by the Director of the Ohio EPA.

- Sodium concentrations have exceeded the PL of 287 mg/L at monitoring wells MW-1, MW-2, MW-3, MW-5A, and MW-9. Concentrations at MW-1 ranged from 479 to 632 mg/L. Concentrations at MW-2 ranged from 520 to 910 mg/L. Concentrations at MW-3 ranged from 392 to 558 mg/L. Concentrations at MW-5A ranged from 569 to 875 mg/L. Concentrations at MW-9 ranged from 290 to 843 mg/L.

According to the *GWQAR*, concentrations of sodium in monitoring wells MW-7 and MW-8 have exceeded the PL during the past eight sampling events and have consistently been at or near background levels. According to information on page 8 in section 6.1 of the *GWQAR*, high concentrations of sodium in ground water samples from MW-6, MW-10, MW-11, and MW-12 may be due to impacts from former oil and gas exploration activities that took place at the ALML, and "...data from the shale wells has (sic) not been included in this report." The *GWQAR* does not indicate that

demonstrations in accordance with OAC 3745-27-10(D)(7)(c)(ii) that the source of sodium in the aforementioned four shale zone wells was a source other than the landfill, and that such a demonstration was approved by the director of the Ohio EPA. Also, it is not clear that MW-11 is an upgradient well in the Shale Zone. Because no comparisons of the sodium concentrations in ground water from the four Shale Zone monitoring wells to the PL or background concentration of sodium in ground water in the Shale Zone have been made, and the elevated level of sodium in the those wells, the four Shale Zone monitoring wells will be considered in assessment for chloride until demonstrated otherwise.

- Section 7.3 (Concentration) of the *GWQAR* (pgs. 15-16) indicates that that various wells have had ground water samples with statistically significant exceedances of alkalinity, total dissolved solids (TDS), and turbidity. OAC 3745-27-10(D)(5)(a)(iii) requires statistical analyses of Appendix I parameters 1 through 66. While samples have to be evaluated for alkalinity (parameter #71), TDS (parameter #70), and turbidity (parameter #76), elevated levels of these parameters will not place wells into assessment.

Section 7.3 excludes discussion of significantly significant concentrations of three additional parameters, antimony, nickel, and carbon disulfide in ground water at a number of monitoring well locations that indicate that those monitoring wells should be in assessment for those parameters as well. Those additional parameters and associated wells that should be in assessment are listed below:

- According to Section 6.1 of the *GWQAR* (pg. 9): "Antimony in MW-5A, iron in MW-7, and nickel in MW-8 are historically significant; however, these exceedances are most likely attributed to poor development techniques in that the verified exceedances were highest when the monitoring wells were first installed. Over time, antimony, iron, and nickel concentrations in MW-5A, MW-7, and MW-8, respectively, have become more consistent and primarily below the PL."

Although solid waste rules require analysis of ground water for iron, OAC 3745-27-10(D)(5)(a)(iii) requires statistical analyses of only Appendix I Parameters 1 through 66. Elevated concentrations of iron (parameter #77) will not place a well into assessment.

The GWQAR does not indicate that demonstrations were made in accordance with OAC 3745-27-10(D)(7)(c)(ii) that the source of antimony in MW-5A and Nickel in MW-8 were a source other than the landfill and that such demonstrations were approved by the director of the Ohio EPA. Therefore, MW-5A and MW-8 should be considered in assessment for antimony and nickel, respectively, unless it can be demonstrated in accordance with OAC 3745-27-10(E)(9) that these wells can be reinstated to detection monitoring status and this reinstatement is approved by the Director of the Ohio EPA.

- According to Section 6.2 of the GWQAR (pg. 11): "Carbon disulfide detections have only been reported in MW-9 during three (3) sampling events, one of which the concentration was reported as 'an estimated concentration or 'J' coded value. All three (3) detections were reported for summer sampling events. MW-9 has historically been documented as having a 'rotten egg' odor, which is typical for a well undergoing natural degradation activities. Carbon disulfide is a by-product of this degradation and is most likely the source for the low level detections. In addition, monitoring wells upgradient of MW-9 have never detected carbon disulfide, which is an indication that the detections are specific to the location of MW-9. Based on these data, carbon disulfide will not be considered statistically significant."

The above quoted passage does not indicate the process by which carbon disulfide is naturally occurring at the landfill. More importantly, the GWQAR does not indicate that a 1 of M resampling in accordance with OAC 3735-27-10(D)(7)(c)(i) was performed to demonstrate that the carbon disulfide exceedances at MW-9 were false positives. Also, the GWQAR does not indicate that demonstrations in accordance with OAC 3745-27-10(D)(7)(c)(ii) that the source of carbon

disulfide at MW-9 was from a source other than the landfill, and that such a demonstration was approved by the Director of the Ohio EPA. Therefore, MW-9 should be considered in assessment for carbon disulfide unless it can be demonstrated in accordance with OAC 3745-27-10(E)(9) that these wells can be reinstated to detection monitoring status, and this reinstatement is approved by the Director of the Ohio EPA.

The Ohio EPA considers concentrations of the parameters: acetone, alkalinity, antimony, barium, benzene, carbon disulfide, iron, chloride, magnesium, manganese, nickel, nitrogen/ammonia, potassium, sodium detected above their respective PL or background concentrations in ground water samples from monitoring wells at the ALML to be waste-derived constituents.

#### **Rate**

According to section 7.1 (Rate) of the *GWQAR*, Woodward-Clyde determined hydraulic conductivities in the vicinity of five of the monitoring wells at the ALML. The five monitoring wells are MW-1, MW-2, MW-3, MW-4, and MW-5. MW-1, MW-2, MW-3, and MW-4 are located in the Till/Shale Interface Zone UAS. MW-5 is located entirely in Till, and data from it should not be utilized to determine rate. Reported hydraulic conductivities in the vicinities of monitoring wells located in the Till/Shale Interface Zone UAS ranged from  $2.7 \times 10^{-4}$  cm/sec at MW-4 to  $7.6 \times 10^{-7}$  cm/sec at MW-2. No hydraulic conductivity data is presented for the deeper Shale Zone. Section 7.1 only presents hydraulic conductivity data and a determination of rate is never presented.

Because data presently indicates that ground water in both the Till/Shale Interface Zone UAS and the deeper Shale Zone have statistically significant exceedances of background concentrations of chemical parameters, rates need to be calculated for both zones of the UAS.

The simplest estimate of rate is seepage velocity. Seepage velocity can be derived from the most basic of ground water hydrology equations-Darcy's equation. Seepage velocity can be calculated by the equation:

$$V = KI/n_e$$

Where  $V$  = seepage velocity  
 $K$  = hydraulic conductivity  
 $I$  = hydraulic gradient  
 $n_e$  = effective porosity

Other site specific data is needed in order to calculate rate including, at a minimum, hydraulic gradient and effective porosity.

### **Lateral Extent**

Section 7.2.1 (Lateral Extent) of the *GWQAR* indicates that permission to install additional monitoring wells on adjacent properties to the north owned by Harwin Development LLC (storage condominiums) and Ahern Real Estate Co. LLC (Irish-American Club) and the adjacent property to the south owned by the Norfolk Southern Railway was attempted by the City of Avon Lake. Harwin Development and Ahern Real Estate replied and denied permission to install additional monitoring wells. Norfolk Southern Railway failed to respond to the aforementioned request. Section 7.2.1 of the *GWQAR* concludes (pg. 13) "Therefore, the current monitoring well network consisting of twelve (12) monitoring wells defines the lateral extent of leachate and/or leachate derived constituents in ground water."

The *GWQAR* does not indicate that an attempt was made to contact the owners of the property located adjacent and northwest of the extent of the landfill and downgradient of MW-7. According to information on the Lorain County Auditors page, the aforementioned property is owned by Thomas and Kathleen Wasserman. The Potentiometric Map of the Till/Shale Interface Zone UAS (Figure 3) indicates ground water flow in the vicinity of MW-7 is towards the northwest. Data in the *GWQAR* indicates that MW-7 is in assessment for benzene and sodium.

The *GWQAR* does not indicate why an additional assessment well was not placed on the ALML property in the Till/Shale Interface Zone UAS and downgradient of MW-9 (refer to Figure 3 of the *GWQAR*). Data in the *GWQAR* indicates that MW-9 is in assessment for ammonia, sodium, chloride, and carbon disulfide.

### **Vertical Extent**

Four wells, MW-6, MW-10, MW-11, and MW-12 monitor the Shale Zone at the ALML. The four monitoring wells have terminal depths ranging from 60 feet bgs (MW10) to 30 feet bgs (MW-6). As previously mentioned, analytical results from these four wells indicate high concentrations of sodium and chloride that the owner/operator claim are the impact of oil and gas exploration activities on or near the ALML property.

Eight wells, MW-1, MW-2, MW-3, MW-4, MW-5A, MW-7, MW-8, and MW-9 monitor the Till/Shale Interface zone UAS at the ALML. These eight monitoring wells have terminal depths ranging from 40 feet bgs (MW-5A) to 18 feet bgs (MW-1). All of the downgradient Till/Shale Interface UAS wells are in assessment for one or more parameters.

The conclusion of Section 7.2.1 (Vertical Extent) of the *GWQAR* is based on the screened intervals, vertical extent of leachate and/or leachate derived constituents and has been defined as 8 to 40 feet bgs.

As previously commented, the *GWQAR* does not indicate that demonstrations in accordance with OAC 3745-27-10(C)(ii) that the source of sodium and chloride in the four shale zone wells was a source other than the landfill, and that such a demonstration was approved by the Director of the Ohio EPA. It is not clear that MW-11 is an upgradient well. Therefore, MW-6, MW-10, MW-11 and MW-12 should be considered in assessment for chloride unless it can be demonstrated in accordance with OAC 3745-27-10(E)(9) that these wells can be reinstated to detection monitoring status and this reinstatement is approved by the Director of the Ohio EPA. Therefore, the vertical extent of contamination is at least to a depth of 60 feet bgs in the shale aquifer, and has not been fully delineated.

The following violations were identified during the review of the Ground Water Quality Assessment Report:

- 1. The facility owner/operator Avon Lake Municipal Landfill is in violation of OAC Rule 3745-27-10(A)(5) requiring that a qualified ground water scientist shall certify, in accordance with OAC Rule 3745-27-09 any reports and data submitted in accordance with OAC 3745-27-10.**

The submitted *GWQAR* has not been certified by a qualified ground water scientist in accordance with OAC Rule 3745-27-10(A)(5). In order to return to compliance, the owner/operator must provide a statement by a qualified ground water scientist certifying the *GWQAR* in accordance with OAC Rule 3745-27-09.

- 2. The facility owner/operator Avon Lake Municipal Landfill is in Violation of OAC Rule 3745-27-10(E)(6) requiring the determination of rate, extent, and concentration of migration of waste-derived constituents.**

#### **A. Rate**

According to section 7.1 (Rate) of the *GWQAR*, Woodward-Clyde determined hydraulic conductivities in the vicinity of five of the monitoring wells at the ALML. The five monitoring wells are MW-1, MW-2, MW-3, MW-4, and MW-5. MW-1, MW-2, MW-3, and MW-4 are located in the Till/Shale Interface UAS zone. MW-5 is located entirely in Till, and data from it should not be utilized to determine rate. Reported hydraulic conductivities monitoring wells located in

the Till/Shale Interface Zone UAS ranged from  $2.7 \times 10^{-4}$  cm/sec at MW-4 to  $7.6 \times 10^{-7}$  cm/sec at MW-2. No hydraulic conductivity data is presented for the deeper Shale Zone. Section 7.1 of the GWQAR only presents hydraulic conductivity data, and a determination of rate is never presented. Hydraulic conductivity is a measure of the permeability of a porous medium, and alone not an adequate or appropriate estimation of rate.

In order to return to compliance, the owner operator must determine the migration rate of waste-derived constituents in both the Till/Shale Interface Zone UAS and the Shale Zone. Calculation of seepage velocity based on site specific parameters including hydraulic conductivity, hydraulic gradient, and effective porosity is an appropriate method of determining rate of migration. Contrary to what is presented in the GWQAR, concentrations of sodium and chloride in ground water in Shale Zone monitoring wells indicate that those wells are in assessment (Refer to Violation 2). Therefore, rates of migration of waste-derived constituent must be determined for both the Till/Shale Interface UAS and deeper Shale Zone.

#### **B. Extent**

The GWQAR does not indicate that an attempt was made to contact the owner of the property located adjacent and northwest of the extent of the landfill and downgradient of MW-7. According to information on the Lorain County Auditors page, the aforementioned property is owned by Thomas and Kathleen Wasserman. The Potentiometric Map of the Till/Shale Interface Zone UAS (Figure 3) indicates ground water flow in the vicinity of MW-7 is towards the northwest. Data in the GWQAR indicates that MW-7 is in assessment for benzene and sodium.

In order to return to compliance, the owner operator must contact Thomas and Kathleen Wasserman, the reported owner of the property located adjacent and northwest of MW-7, to request permission to install at least one monitoring well in the Till/Shale Interface Zone UAS to assess the extent of waste-derived constituents.

#### **C. Concentration**

Concentrations of certain parameters have been improperly excluded from the assessment database for some monitoring wells. The following data needs to be included in the ground water assessment database:

- MW-3, MW-6, and MW-7 should be considered in assessment for benzene unless it can be demonstrated in accordance with OAC 3745-27-10(E)(9) that these wells can be reinstated to detection monitoring status and this reinstatement is approved by the Director of the EPA.
- Ground water sampling results from the four shale wells MW-6, MW-10, MW-11, and MW-12 indicate elevated concentrations of chloride (400 to 9,700 mg/L in June 2011 samples). The GWQAR indicates (pg. 8) that high levels of chloride may be related to nearby oil and gas exploration in the past, and "...since it cannot be distinguished whether the detected concentrations are attributed to leachate contamination or former natural oil and gas exploration, data from the shale wells have not been included in this report." The GWQAR does not indicate that a demonstration in accordance with OAC 3745-27-10(D)(7)(c)(ii) that the source of chloride in the aforementioned four shale zone wells was a source other than the landfill, and that such a demonstration was approved by the director of the Ohio EPA. It is not clear that MW-11 is an upgradient well in the Shale Zone. Furthermore, because no comparison of the chloride concentration in ground water from the four shale zone monitoring wells to the PL or background concentration of sodium in ground water in the Shale Zone has been made, and the elevated level of chloride in the those wells, the four Shale Zone monitoring wells will be considered in assessment for chloride until demonstrated otherwise.
- MW-2 should be considered in assessment for nitrogen/ammonia unless it can be demonstrated in accordance with OAC 3745-27-10(E)(9) that these wells can be reinstated to detection monitoring status and this reinstatement is approved by the Director of the Ohio EPA.
- MW-2 should be considered in assessment for potassium unless it can be demonstrated in accordance with OAC 3745-27-10(E)(9) that these wells can be reinstated to detection monitoring status and this reinstatement is approved by the Director of the Ohio EPA.

- Two Till/Shale Interface Zone UAS wells (MW-7 and MW-8) should be considered in assessment for sodium unless it can be demonstrated in accordance with OAC 3745-27-10(E)(9) that these wells can be reinstated to detection monitoring status and this reinstatement is approved by the Director of the Ohio EPA. Also, ground water sampling results from the four shale wells MW-6, MW-10, MW-11, and MW-12 indicate elevated concentrations of sodium (290 to 5,300 mg/L in June 2011 samples). The GWQAR indicates (pg. 8) that high levels of sodium may be related to nearby oil and gas exploration in the past, and "...since it cannot be distinguished whether the detected concentrations are attributed to leachate contamination or former natural oil and gas exploration, data from the shale wells have not been included in this report." The GWQAR does not indicate that a demonstration in accordance with OAC 3745-27-10(D)(7)(c)(ii) that the source of sodium in the aforementioned four shale zone wells was a source other than the landfill, and that such a demonstration was approved by the director of the Ohio EPA. It is not clear that MW-11 is an upgradient well in the Shale Zone.
- Furthermore, because no comparisons of the sodium concentrations in ground water from the four shale zone monitoring wells to the PL or background concentration of sodium in ground water in the Shale Zone has been made, and the elevated level of sodium in the those wells, the four Shale Zone monitoring wells will be considered in assessment for chloride until demonstrated otherwise.
- MW-5A and MW-8 should be considered in assessment for antimony and nickel, respectively, unless it can be demonstrated in accordance with OAC 3745-27-10(E)(9) that these wells can be reinstated to detection monitoring status and this reinstatement is approved by the Director of the Ohio EPA.
- MW-9 should be considered in assessment for carbon disulfide unless it can be demonstrated in accordance with OAC 3745-27-10(E)(9) that these wells can be reinstated to

detection monitoring status and this reinstatement is approved by the Director of the Ohio EPA.

- 3. The facility owner/operator Avon Lake Municipal Landfill is in Violation of OAC Rule 3745-27-10(E)(7) requiring that a ground water quality assessment report include all data generated as part of the implementation of the ground water quality assessment plan.**

According to the GWQAR, ground water analytical results first indicated statistically significant increases in ammonia, antimony, sodium, 2,4-D, and benzene in ground water samples from one or more wells in 2002. A GWQAP was initially submitted to Ohio EPA in 2003, followed by revisions in May 2004, August 2006, June 2008, December 2009, and June 2010.

While the GWQAR contains references to selected analytical results or ranges of results in Section 6.1 (Evaluation of Non VOCs), Section 6.2 (Evaluation of VOCs and Herbicides), Section 7.3 (Concentration), and Appendix H (Concentration Tables for Statistically Significant Parameters), it does not contain all field and analytical results as required by OAC 3745-27-10(E)(7).

The analytical data in Appendix H only goes back to December 2007. In Section 7.3 of the GWQAR (pg. 14), it states "Concentration for each of the statistically significant parameters during the past eight (8) sampling events have been provided in Appendix H. While historic data surpasses eight (8) sampling events, eight (8) sampling events is (sic) the minimum amount of events needed to conduct accurate statistics. In addition, the past eight (8) sampling events present current trends, rather than focusing on historical statistically significant data that is no longer significant."

The GWQAR does not include historic ground water sampling field data including but not limited to ground water elevations. Ground water elevation data is limited to what is presented on the potentiometric maps (Figures 3 and 4), geologic cross-sections (Figures 6, 7, and 8), the 1994 Woodward-Clyde "Revised Ground Water Flow Investigation Report" (Appendix A), and monitoring well logs (Appendix C).

In order to return to compliance, the owner operator must provide all data including all field and analytical results generated from implementation of the original GWQAP in 2003. Ohio EPA recommends summary tables be used for data presentation.

Additional information is needed in order to determine compliance with the following rules:

**1. Compliance with OAC Rule 3745-27-10(E)(6), requiring a determination of extent of waste-derived constituents in ground water cannot be determined at this time.**

**A. Extent of Waste-Derived Contamination in the Vicinity of MW-9**

The *GWQAR* does not indicate why an additional assessment monitoring well was not placed on the ALML property in the Till/Shale Interface Zone UAS and downgradient of MW-9 (refer to Figure 3 of the *GWQAR*). Data in the *GWQAR* indicates that MW-9 is in assessment for ammonia, sodium, chloride, and carbon disulfide.

**B. Extent of Waste-Derived Contamination in the Shale Zone**

The *GWQAR* does not indicate why additional monitoring wells were not placed in the Shale Zone UAS to determine the extent of sodium or chloride contamination, or demonstrated in compliance OAC 3745-27-10(E)(9)(b) that the source of sodium and chloride contamination in the shale is from a source other than the landfill and that the director approved reinstatement of the detection monitoring program for the wells in the deeper Shale Zone. In that the owner/operator has indicated that they believe that sodium and chloride contamination in the Shale Zone are due to an alternate source, Ohio EPA recommends the later alternative.

**C. Potentiometric Map for Shale Zone**

A cursory review of the December 6, 2011 Potentiometric Surface Map of the Shale Zone (Figure 4) in the recently submitted (January 11, 2012) *Semiannual Determination of Rate, Extent, and Concentration* for the second half of 2011 indicates flow patterns in the Shale Zone have changed since the submission of the *GWQAR*, and that MW-11 is downgradient of MW-10. Therefore, it is not clear that MW-11 is an upgradient well in the Shale Zone.

Ohio EPA has the following recommendation regarding the Ground Water Quality Assessment Report:

1. Ohio EPA recommends the inclusion of isoconcentration maps to better demonstrate that the extent of waste-derived contaminant parameters has been adequately delineated.

Ohio EPA has the following statements regarding the Ground Water Quality Assessment Report:

1. Ohio EPA strongly disagrees that it is likely that the source of acetone is naturally occurring at the ALML.

The statement in Section 6.2 of the GWQAR (pg. 10) that "...aerial deposition during times when volatilization may be greatest due to warm temperatures" is contradictory. The GWQAR does not give any evidence that the source of acetone is other than waste derived. Ohio EPA agrees that the presence of acetone in ground water samples may be due to lab contamination; however, this has not been demonstrated in accordance with 3745-27-10(E)(9)(b) (refer to Violation #3 on pg. 14). All references to the natural occurrence of acetone should be removed from the GWQAR.

2. Ohio EPA disagrees that carbon disulfide is naturally occurring at the ALML.

Section 6.2 (Pg. 11) states: "MW-9 has historically been documented as having a "rotten egg" odor, which is typical for a well undergoing natural degradation activities. Carbon disulfide is a byproduct of this degradation and is most likely the source for low level detections." Please note that degradation products of waste-derived constituents are also waste-derived constituents. The above quoted passage does not indicate the process by which carbon disulfide is naturally occurring at the ALML. The natural occurrence of carbon disulfide has not been demonstrated in accordance with 3745-27-10(E)(9)(b) (refer to violation #3). All references to the natural occurrence of carbon disulfide should be removed from the GWQAR.

3. Statistical analyses of the parameters, alkalinity, total dissolved solids, and turbidity is not required, although a comparison of these parameters to background concentrations must be made. Elevated alkalinity, total dissolved solids, and/or turbidity is (are) not a trigger for assessment.

Section 7.3 of the GWQAR (pgs. 15-16) indicates that that various wells have had ground water samples with statistically significant exceedances of alkalinity, total dissolved solids (TDS), and turbidity. OAC 3745-27-10(D)(5)(a)(iii) requires statistical analyses of Appendix I parameters 1 through 66. While samples have to be evaluated for alkalinity (parameter #71), TDS (parameter #70), and turbidity (parameter #76), elevated levels of these parameters will not place wells into assessment.

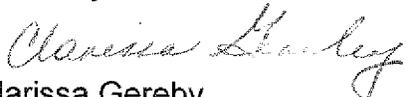
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4. The Ohio EPA considers the parameters: acetone, alkalinity, antimony, barium, benzene, carbon disulfide, iron, chloride, magnesium, manganese, nickel, nitrogen/ammonia, potassium, sodium, detected above their respective PL or background concentrations in ground water samples from monitoring wells at the ALML to be waste-derived constituents.
5. There are several references in the GWQAR to "leachate contamination" or "leachate-derived contamination." Please note that sanitary landfill rules more broadly regulate waste-derived constituents, not only leachate.
6. While elevated levels of iron, alkalinity, will not place wells into assessment, they are considered to be waste-derived constituents and must be addressed either in future compliance monitoring or corrective measures.

Within 14 days of receipt of this letter, please provide documentation to this office including the steps to be taken to abate the violations cited above. Within 45 days of the receipt of this letter, please submit a revised Ground Water Quality Assessment Report to this office. If you have any technical questions regarding this review, please do not hesitate to contact Albert Muller at (330) 963-1211. Please submit all future correspondence to Clarissa Gereby, Ohio EPA, Division of Solid and Infectious Waste Management, Northeast District Office 2110 East Aurora Road, Twinsburg, Ohio 44087.

Nothing in this letter shall be construed to authorize any waiver from any requirements of applicable state solid waste laws or regulations. This authorization shall not be interpreted to release the City or others from responsibility under ORC Chapters 3704, 3714, 3734, or 6111, the Federal Clean Water Act, the Resource Conservation and Recovery Act, the Toxic Substances and Control Act or the Comprehensive Environmental Response, Compensation and Liability Act, or from other applicable requirements for remedying conditions resulting from any release of contaminants from the facility to the environment.

Sincerely,



Clarissa Gereby  
Environmental Specialist  
Division of Materials and Waste Management

CG/cl

cc: Fleming Mosely, Lorain City Health Department  
Al Muller, DDAGW, NEDO  
Suzanne Eden, HzW Environmental Consultants, LLC  
File:[Sowers/Land/Avon Lake/GRO/18] DMWM #4161