ADDENDUM #15 TO FIELD SAMPLING PLAN FOR PART 2 OF THE SUPPLEMENTAL GROUNDWATER REMEDIAL INVESTIGATION

SOUTHERN PROPERTY BOUNDARY AREA VAPOR INTRUSION INVESTIGATION

Former York Naval Ordnance Plant
1425 Eden Road, Springettsbury Township
York, Pennsylvania

Prepared for:

Harley-Davidson Motor Company Operations, Inc.

1425 Eden Road

York, Pennsylvania

October 28, 2014
(Supersedes plan dated October 2, 2014)

Prepared by:

Groundwater Sciences Corporation

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Groundwater Sciences Corporation

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Senior Associate
Groundwater Sciences Corporation

October 28, 2014
DATE

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Appendix

1 INTRODUCTION

Addendum #15 of the Field Sampling Plan for Part 2 of the Supplemental Groundwater Remedial Investigation (FSP) (Groundwater Sciences Corporation [GSC], April 2012) describes plans for investigating the potential for vapor intrusion (VI) within and near the Southern Property Boundary Area (SPBA) of the former York Naval Ordnance Plant (fYNOP) (Site). In 2005, results of a VI assessment of the SPBA, and the off-Site area to the south, concluded that the VI pathway due to volatilization of chemicals of concern (COCs) from shallow groundwater is not complete (Langan, March 2005). The findings of the VI assessment in 2005 have been proposed by the fYNOP project team to be used as part of a groundwater human health risk assessment (HHRA). The United States Environmental Protection Agency (EPA) recently reviewed the 2005 VI assessment as part of their review of the proposed approach to the HHRA. EPA concluded that the methodology and modeling approach that it previously approved for the 2005 VI assessment are no longer considered by EPA to be reliable methods to estimate the potential for VI into neighboring residences. EPA has requested more information to determine whether VI is a potential pathway for COCs from the Site into the nearby residences (email from Griff Miller, EPA to Stephen Snyder, GSC dated August 14, 2014).

As detailed in Sections 2 and 3 of this scope of work, this addendum provides a systematic program that includes investigations of groundwater in the saturated just below the water table and soil gas in the vadose zone just above the capillary zone. The vadose zone investigation also includes testing of undisturbed soil samples to characterize physical properties of soil between the water table and ground surface. Overall, the steps in the scope of this investigation are:

1. Borings will be drilled and unconsolidated material sampled in the SPBA near the southeastern property line and in the off-Site residential area to the southeast. Continuous soil samples will be collected during advancement of the well bores. A one-inch (1”) temporary well pipe/screen will be placed in the boring, and augers will be removed from the borehole. The water level in the one-inch (1”) pipe/screen will be monitored until a stabilized reading is obtained.

2. Soil samples will be selected based on the field log to complete physical characterization of all representative soil types and submitted for grain size and moisture content analyses.

3. The temporary pipe/screen will be removed, and the boring redrilled to the original depth. Then a two-inch (2”) diameter permanent well will be constructed with an open interval screening the top five feet (5’) of the water table at the time of construction. The portion of the initial boring that extends below the screened interval will be filled with bentonite and capped with one foot (1’) of sand. After installation, the monitoring well will be properly developed following Site protocols.

4. The newly installed monitoring wells will be developed and two rounds of groundwater sampling and analysis for Site-related volatile organic compounds (VOCs) will be performed to assess for the presence and lateral extent of COCs in shallow (near water table) groundwater. Prior to initiation of sampling, a round of water levels will be measured in the shallow wells and existing deeper monitoring wells to characterize shallow groundwater flow directions, along with lateral and vertical hydraulic gradients.

5. VOC analysis results, if detected, will be evaluated based on the current version of the EPA’s Vapor Intrusion Screening Level (VISL) Calculator, using the groundwater to indoor air risk calculator (GW_IA_calc). In using the VISL Calculator, it is important to note that the default groundwater to indoor air attenuation factor is 0.001, which is applicable to any soil type within the vadose zone, including coarse-grained soils such as sand. However, if laterally extensive fine-grained soils are demonstrated to be present in the study area based on the results of this investigation, the groundwater to indoor air attenuation factor will be modified to a value of 0.0005 before groundwater concentrations are entered into the spreadsheet. Following receipt of results from the two rounds of groundwater sampling, at each monitoring well the maximum concentration of each COC detected will be entered into this spreadsheet along with the temperature of groundwater observed during sampling at that well to calculate the VI cancer risk level (CR) and the VI hazard quotient (HQ) for each COC. The individual CR levels will be summed for all COCs and compared to a target cancer risk level (TCR) of 10^{-4}. The individual HQs will be summed for all COCs detected and separately for those substances that exhibit identical noncarcinogenic effects (e.g., neurotoxicity). The hazard index (HI) based on the sum of the HQs for all COCs will be compared to the target HI of 1. If this HI value exceeds the target HI of 1, the HI values calculated for each noncarcinogenic effect will then be compared to the target HI of 1.

In summary, after adjusting the groundwater to indoor air attenuation factor as appropriate for soil gradation and entering the measured groundwater temperature, for each monitoring well the maximum concentration of each COC detected in groundwater will be entered into the GW_IA_calc spreadsheet to calculate the VI cancer risk level (CR) and the VI hazard quotient (HQ) for each COC. The individual CR levels will be summed for all COCs and compared to a target cancer risk level (TCR) of 10^{-4}. The individual HQs will be summed for all COCs and separately for those substances that exhibit identical noncarcinogenic effects (e.g., neurotoxicity) and the resultant hazard indices (HIs) will be compared to the target HI of 1. If these comparisons indicate that neither the TCR nor the target HI has been exceeded, no further action is required.

6. A second boring will be drilled at each off-site monitoring well location concurrent with the tasks described in steps #1 to #5 above for the dual purposes of collecting undisturbed soil samples and installing vapor probes as described below. The borings will be completed in the area of all off-site well locations concurrently with the tasks above (rather than waiting until after receiving the VOC concentration analytical results and comparing them to the CR and HI) in order to avoid additional disruption in the residential area. However, testing of these soil samples for physical characteristics and sampling of near source soil gas (NSSG) at these vapor probes will only be completed at each monitoring well location within the residential area at which VOC concentrations observed in shallow groundwater exceed a CR of 10^{-4} or a HI of 1. The second soil boring will be drilled adjacent to the first, off-set ten (10) to fifteen (15) feet, dependent upon access and utilities. This boring will be completed for two purposes:

    a. One to three undisturbed soil samples will be collected from each of these borings using a Shelby tube. The zone(s) sampled will be selected to evaluate textural changes observed by the field geologist logging the soil samples from the original boring drilled to install the monitoring well and the results of gradation and moisture content analyses performed on those samples. If the thresholds for triggering physical soil analysis are exceeded at a particular well, the undisturbed samples from the second soil boring will be sent to a specialized soils laboratory and analyzed for the parameters listed on **Table 1**. The results of these physical tests of undisturbed samples will be used to better understand factors affecting the fate and transport of COCs in the capillary and vadose zones above the water table.

b. A soil vapor probe will be installed in each boring within a depth of approximately five feet (5’) above the estimated top of the capillary zone as described further in this work plan. If the thresholds for triggering NSSG are exceeded at a particular well, two rounds of NSSG samples will be collected and analyzed for the COCs detected at that location in groundwater. The results of any NSSG samples will then be entered into the SG_IA_calc spreadsheet of the VISL Calculator to calculate the CR and HQ associated with each COC detected after modifying the sub-slab soil gas to indoor air attenuation factor from the default value of 0.1 to 0.03. In each case, the cumulative CR and HI will be evaluated as described above for the groundwater results.

   This is a conservative approach to screening NSSG data as it does not account for attenuation that would occur within the vadose zone between the top of capillary zone and the bottom of a building slab. Therefore, an exceedance of the cumulative TCR of 10^{-4} or an HI of 1 at any one location is not an indicator of an unacceptable risk level. However, where NSSG values do not exceed these risk and hazard limits for SSSG screening, it is appropriate to conclude that no further action is necessary to evaluate potential VI.

7. Based on these multiple lines of evidence (i.e., groundwater concentrations at the water table, depth to the water table, thickness of the capillary zone, NSSG concentrations above the capillary zone, soil types and physical characteristics from the water table to ground surface, and screening of groundwater and NSSG concentrations using the VISL Calculator to identify location(s) at which the TCR of 10^{-4} or an HI of 1 is exceeded in groundwater and NSSG, as described above), as appropriate and necessary, an action plan to further address the potential for VI will be prepared and submitted to the EPA and PADEP for review and concurrence.

Details regarding the scope of work for steps #1 through #5 are provided in Section 2 of this addendum. Details regarding the scope of work for steps #6 and #7 are provided in Section 3 of this addendum.

2 GROUNDWATER INVESTIGATION

The groundwater investigation will involve the drilling of an initial boring at each of approximately fifteen (15) selected locations, five (5) within the fYNOP property along the southeastern boundary and ten (10) within the residential area southeast of that property line (Figure 1). The purpose of this initial boring at each location is to install a monitoring well to determine the depth to the water table, the direction of groundwater flow and the concentrations of COCs in shallow groundwater. The scope of the vadose zone investigation described in Section 3 will include the drilling of a second boring at each of the ten (10) initial boring locations within the residential area to collect undisturbed soil samples and install vapor probes for soil gas sampling. To avoid the need for two drilling mobilizations, both borings will be drilled at each of the ten (10) locations in the residential area during the same mobilization; however, soil characterization samples and NSSG samples will only be collected and analyzed under certain circumstances as part of this systematic program.

2.1 Installation, Development and Sampling of Monitoring Wells

Approximately fifteen (15) shallow wells will be installed as shown on **Figure 1**, both on Harley-Davidson property near the southeastern property line adjacent to the residential area, and off-site within that residential area, in the public rights-of-way if possible. In accordance with the Public Information and Involvement Plan (PIIP, revised February 2013), Harley-Davidson will contact and provide notice to Springettsbury Township, the affected community residents or businesses, and Harley-Davidson’s employees prior to the proposed off-site drilling.

Well installation may begin on Harley-Davidson’s property while arrangements are made for property access permission and clearance at the off-site locations. A highway occupancy permit (HOP) will be obtained from Springettsbury Township prior to drilling and construction of wells within the public right-of-way. It is anticipated that a traffic control plan and safety precautions will be required, and specified by the HOP.

Boring locations will be marked in the field using white spray paint prior to utility line identification through the PA ONE Call system, and the Harley-Davidson “Subsurface Protocol and Utility Clearance, Work Instruction (WI) YS2.03.300” will be followed prior to the commencement of any drilling activities on-site. The “Checklist for Off-Site Well Siting” (**Appendix A**) will be completed for each boring location. Drilling and sampling procedures will proceed in accordance with the project's Health and Safety Plan (GSC, May 2012, revised August 2014). The borings for monitoring well installation will be completed to depths of about 30 to 40 feet below ground surface (bgs), to intercept the shallow water table. Each boring will be hand-dug or vacuum excavated to a minimum depth of five feet (5') bgs as an additional precaution to identify and avoid subsurface utilities not identified and marked through the PA ONE Call and Harley-Davidson "Subsurface Protocol and Utility Clearance WI YS2.03.300."

The borings will be advanced by Eichelbergers, Inc. of Mechanicsburg, Pennsylvania using a Geoprobe® or conventional hollow stem auger drill rig equipped with a minimum 4 ¼-inch inner diameter (I.D.) hollow-stem augers. Soil sampling will be conducted in accordance with Subsection 4.2.4.5 of the FSP (p. 38) excepting that screening with an organic vapor analyzer will not be conducted, as no soil samples will be sent for analysis of VOCs. Continuous soil samples using a three-inch (3") split spoon will be collected from each boring, and will be logged by a geological scientist. Representative samples and soil intervals indicating a change in composition will be sent to F.T. Kitlinski & Associates, Inc. of Harrisburg, Pennsylvania for moisture content and particle size (sieve and hydrometer ASTM D 422) analyses.

A one-inch (1") temporary well pipe/screen will be placed in the boring, and augers will be removed from the borehole. The temporary pipe and boring will be protected with covers, traffic barriers or cones, as appropriate and as required by the HOP. The water level in the one-inch (1") pipe/screen will be monitored until a stabilized reading is obtained. This will result in an accurate determination of the water table in order to construct a permanent well that will characterize the shallow portion of the saturated zone just below the water table, which is important to the analysis of vapor intrusion potential.

A two-inch (2") I.D. well will be installed in each borehole using schedule 40 PVC riser pipe and PVC well screen with 0.01-inch slots. The bottom of the screened interval will target a depth of no more than five feet (5') below the water table and extend no less than five feet (5') above the water table, based on observations made during drilling, the water level measured in the temporary one-inch (1") pipe, and the expected range in historic water table fluctuations from existing adjacent wells. Refer to subsection 4.2.4.4 of the FSP (pp. 35-37) for well construction and development procedures.

Steel protector pipes (six-inch [6”] diameter well casings) will be installed around the wells located on the Harley-Davidson property and drive-over manhole covers will be used to protect the off-Site wells where stickup steel protector pipes cannot be used. Refer to Appendix B of the FSP for a schematic drawing of a typical drive-over cover. For wells placed within the right-of-way of the township road, this work plan/addendum will be modified, if necessary, to comply with Springettsbury Township requirements. Horizontal coordinates and vertical elevations of the monitoring wells will be surveyed by a Pennsylvania-licensed surveyor as described in subsection 4.2.4.4 of the FSP (p. 38).

Each well will be developed by Eichelbergers, Inc. to promote the exchange of water between the formation and the well screen following FSP procedures in Subsection 4.2.4.4 (p.37). Beginning approximately 14 days after well development, two rounds of water quality sampling will be performed separated by a minimum of three weeks. The sampling will be performed in accordance with subsection 4.2.4.7 of the FSP (pp. 40-43) and the QAPP. Prior to purging and sampling, water levels in all new wells and selected adjacent existing wells will be measured in a synoptic round.

Drill cuttings and all investigation-derived waste will be containerized and immediately labeled as “Non-hazardous, IDW Container,” noting generator/project name, contents, date of generation, location of generation, and container number as described in subsection 4.2.5 of the FSP and in Harley-Davidson’s Waste Disposal Work Instructions (YS2.03.637). The containers will be transferred to an on-site location designated by Harley-Davidson and will be disposed or reused in accordance with regulatory requirements after characterization analysis is completed by TestAmerica. Development fluids and sampling purge water that can be effectively treated at the on-Site groundwater treatment system will be transferred to the groundwater treatment system per prior approvals.

2.2 Data Analysis and Interpretation

A water table contour map will be constructed from each synoptic round of equilibrated water levels to establish the shallow groundwater gradient and direction of shallow groundwater flow. The water table data will also be compared with potentiometric elevations for deeper existing groundwater monitoring wells to assess vertical gradients within the SPBA and the off-Site residential area to the south. Chemical concentration contour maps will be prepared for each COC in groundwater with the lowest contour representing the groundwater medium-specific concentration (MSC) of 5 µg/L.

2.3 Screening Groundwater Concentrations

The results of groundwater sampling will be evaluated using the EPA's Vapor Intrusion Screening Level (VISL) Calculator (May 2014) to calculate the cumulative CR and HI associated with maximum concentrations of all COCs constituting a VI concern detected at each monitoring well location. To accomplish this, the maximum concentrations of the COCs will be entered into the groundwater to indoor air risk calculator spreadsheet (GW_IA_calc). However, the risk levels generated by this spreadsheet are based on a groundwater to indoor air attenuation factor of 0.001 that is based on an assumption of coarse-textured soils in the vadose zone. An attenuation factor of 0.0005 is more appropriate where laterally extensive fine-grained soil has been determined to occur beneath the study area. Available information on the texture of soils in the study area suggests some layers may be characterized as "fine-grained". Therefore, where it is confirmed that laterally extensive fine-grained soil is present within the vadose zone beneath the study area, the groundwater to indoor air attenuation factor will be modified from the default value of 0.001 to 0.0005.

Following receipt of results from the two rounds of groundwater sampling, for each monitoring well the maximum concentration of each COC detected will be entered into this spreadsheet along with the temperature of groundwater observed during sampling at that well to calculate the VI CR and the VI HQ for each COC. The individual CR levels will be summed for all COCs and compared to a TCR of 10^{-4}. The individual HQs will be summed for all COCs detected and separately for those substances that exhibit identical noncarcinogenic effects (e.g., neurotoxicity). The HI based on the sum of the HQs for all COCs will be compared to the target HI of 1. If this HI value exceeds the target HI of 1, the HI values calculated for each noncarcinogenic effect will then be compared to the target HI of 1.

In summary, after adjusting the groundwater to indoor air attenuation factor as appropriate for soil gradation and entering the measured groundwater temperature, for each monitoring well the maximum concentration of each COC detected in groundwater will be entered into the GW_IA_calc spreadsheet to calculate the VI CR and the VI HQ for each COC. The individual CR levels will be summed for all COCs and compared to a TCR of 10^{-4}. The individual HQs will be summed for all COCs and separately for those substances that exhibit identical noncarcinogenic effects (e.g., neurotoxicity) and the resultant HIs will be compared to the target HI of 1. If these comparisons indicate that neither the TCR nor the target HI have been exceeded, no further action is required or will be taken. However, for any monitoring well location(s) within the residential area at which VOC concentrations observed in shallow groundwater exceed a CR of 10^{-4} or a HI of 1, vadose zone investigations, including testing of undisturbed soil samples for physical characteristics and sampling of NSSG at vapor probes, will be completed.

3 VADOSE ZONE INVESTIGATION

As noted above, the vadose zone investigation will be conducted at locations selected on the basis of the results of the groundwater studies. These investigations will include the testing of undisturbed soil samples collected during the drilling of the second boring at each location and the sampling of NSSG at soil vapor probes also installed in the second boring drilled at each location.

Because of Harley-Davidson's desire to minimize the impact of drilling on its neighbors and to avoid delays caused by winter weather, the second boring will have been drilled at each monitoring well location before the groundwater investigations are completed. Determination of the soil sampling intervals, height of the capillary zone and depth of the vapor probe will be based on the geological scientist's log of the first boring and results of soil gradation and moisture content analyses from the first borings. If the first or second groundwater sample from the adjacent groundwater well exceeds the acceptable risk or hazard levels as described above, NSSG samples will be collected from the installed probes adjacent to those wells and analyzed for the COCs detected in groundwater, and undisturbed soil samples collected from the second boring at each such location will be analyzed as described below.

3.1 Collection and Physical Testing of Undisturbed Soil Samples

At each monitoring well location where either the TRC or the target HI was exceeded in groundwater, one to three undisturbed samples of soil that had been collected from the second boring at each location in the residential area will be tested for various physical characteristics. These samples will have been collected between the top of the capillary zone and ground surface using a Shelby tube, appropriately sealed, labeled and packaged for shipment in accordance with industry standards and preserved for future testing pending the outcome of the groundwater investigation and screening. The zone(s) sampled will be distributed to evaluate textural changes observed by the field geological scientist logging the samples and from gradation and moisture content analyses performed on samples from the initial boring at each location. These selected undisturbed samples will be sent to a specialized soils testing laboratory (Daniel B. Stephens of Albuquerque, N.M.) and analyzed for the parameters listed on **Table 1** of this document. The results of this testing will be used to characterize soil properties that affect the fate and transport of

COCs in the vadose zone and to provide a basis for assessing the magnitude of their effects on NSSG concentrations observed in the investigation area.

3.2 Installation of Soil Vapor Probes and Soil Gas Sampling

Soil vapor probes will be installed by Eichelbergers, Inc. using hydraulically-driven direct-push drilling techniques with a truck-mounted drill rig. The probes will be advanced to a depth targeting the lower portion of the vadose zone with the goal of extending the vapor probe borehole to a depth of less than five feet (5') from the top of the estimated capillary zone. The probes will be advanced using Geoprobe® 1-inch (1") outer diameter (O.D.) / ½-inch inner diameter (I.D.) steel rods. After the rods are advanced to the targeted depth, a 6-inch (6") long stainless steel screen (Geoprobe® implant model AT86SW25 or similar) attached to ¼-inch O.D. Telfon® tubing will be threaded into a dedicated Geoprobe® steel implant anchor/drive point at the base of the rods. The steel rods will be removed and the annulus between the soil vapor probe screen/tubing and the borehole will be backfilled with filter sand to approximately six inches (6") above the top of the screen. The remaining borehole annulus will be backfilled with a bentonite slurry seal. A Swagelok® compression fitting will be used to cap the soil vapor probe. Each vapor probe installation will be completed at the ground surface with a protective drive-over manhole cover. Upon completion of the boring, the surface will be appropriately restored to preexisting conditions and meet the conditions of the HOP. The steel rods will be rinsed with potable water and steam-cleaned between uses.

Soil gas samples will be collected only from the soil vapor probes that are adjacent to monitoring wells in the residential area at which either the TCR or target HI have been exceeded in groundwater. In such instances, two rounds of NSSG sampling will be conducted at a minimum of forty-five days apart. The soil gas samples will be collected into 1-liter SUMMA®-type canisters by connecting the compression fitting at the top of the vapor probe to a short section of ¼-inch O.D. Telfon® tubing fitted with an in-line Swagelok® valve. The other end of the tubing will be connected to an in-line particulate filter and flow controller, which in turn will be attached to a 1-liter stainless steel evacuated SUMMA®-type canister. After the sample train and canister are connected, one volume of the soil vapor probe and associated tubing will be removed using a disposable syringe attached to the in-line Swagelok® valve. Collection of the soil gas samples will be integrated over an approximately one hour sampling period, at a sample collection rate not to exceed 200 milliliters per minute. The flow controllers will be calibrated by the laboratory to target a final sample canister vacuum of approximately five inches (5”) Hg.

Any samples will be collected by GSC personnel and submitted to Test America of Burlington, Vermont, where they will be analyzed in accordance with USEPA Method TO-15 for VOCs detected in the co-located groundwater samples. The sample trains and canisters will be provided by Test America. The canisters will be Certified Clean by Test America to the analytical reporting limits of the TO-15 compounds. GSC will perform leak testing of the soil gas collection assembly during collection of the soil gas samples. The leak testing will be performed by placing a shroud over the above ground sample tubing and valves, sample train, and sample canister and injecting ultra-high purity helium as a tracer gas in the area beneath the shroud. The presence of the helium within the shroud will be confirmed during the sample collection period using a helium gas meter. In addition to VOCs, the soil gas samples will be analyzed by Test America for the helium tracer gas using method ASTM D1946. A soil gas sampling protocol listing the steps to be performed by GSC during collection of the soil gas samples is provided in **Appendix B**.

3.3 Screening Near-Source Soil Gas Results

The results of these NSSG samples will be entered into the SG_IA_calc spreadsheet of the VISL Calculator to calculate the CR and HQ associated with each COC detected after modifying the sub-slab soil gas to indoor air attenuation factor from the default value of 0.1 to 0.03. In each case, the cumulative CR and HI will be evaluated as described above for the groundwater investigation results. This is a conservative approach to screening NSSG data as it does not account for attenuation that would occur within the vadose zone between the top of capillary zone and the bottom of a building slab. Therefore, an exceedance of the cumulative TCR of 10^{-4} or an HI of 1 at any one location is not an indicator of an unacceptable risk level. However, where NSSG values do not exceed these risk and hazard limits for SSSG screening, it is appropriate to conclude that no further action is necessary to evaluate potential VI.

4 PREPARATION OF ACTION PLAN

Following the completion of the groundwater and vadose zone investigations and the screening of related concentration data, locations at which the TRC or target HI has been exceeded in both groundwater and NSSG will be identified. For these locations, an action plan to further address the potential for VI will be prepared and submitted to the EPA and PADEP for review and concurrence. The development of this action plan will rely, in part, on the following multiple lines of evidence:

- groundwater concentrations at the water table,
- depth to the water table,
- thickness of the capillary zone,
- NSSG concentrations above the capillary zone,
- soil types and physical characteristics from the water table to ground surface, and
- screening of groundwater and NSSG concentrations using the VISL Calculator to identify location(s) at which the TCR of 10^{-4} or an HI of 1 is exceeded in groundwater and NSSG.

5 REFERENCES

Groundwater Sciences Corporation, April 2012, Field Sampling Plan (FSP) for Part 2 of the Supplemental Groundwater Remedial Investigation.

Groundwater Sciences Corporation, June 2012, Revised August 2014, Quality Assurance Project Plan (QAPP) Former York Naval Ordnance Plant.

Groundwater Sciences Corporation, May 2012, Revised August 2014, Health and Safety Plan (HASP) Former York Naval Ordnance Plant.

Langan Engineering & Environmental Services, March 2005, Indoor Vapor Pathway Screening Assessment (Draft), Supplemental RI Report, Harley-Davidson Motor Company Operations, Inc., York, Pennsylvania.

Public Information and Involvement Plan (PIIP), revised February 2013.

Email from Griff Miller to Stephen Snyder, August 14, 2014

Table

Table 1

Undisturbed Samples Soil Analyses

Analysis	Method
Hydraulic Properties Package (HPP)	
Saturated hydraulic conductivity	ASTM D2434M: rigid wall method
Initial gravimetric and volumetric water content	ASTM D2216/ ASTM D7263
Dry bulk density	ASTM D7263
Calculated total porosity	ASTM D7263
Moisture Characteristics (5-7points⊕)	ASTM D6836/ ASTM D6836M/ MOSA[1] Chp.25
Calculated Unsaturated Hydraulic Conductivity	ASTM D6836/ van Genuchten 1980[2]/ van Genuchten, et. al. 1991[3]
Particle size analysis (Soil)	
Standard Sieves & Hydrometer	ASTM D422

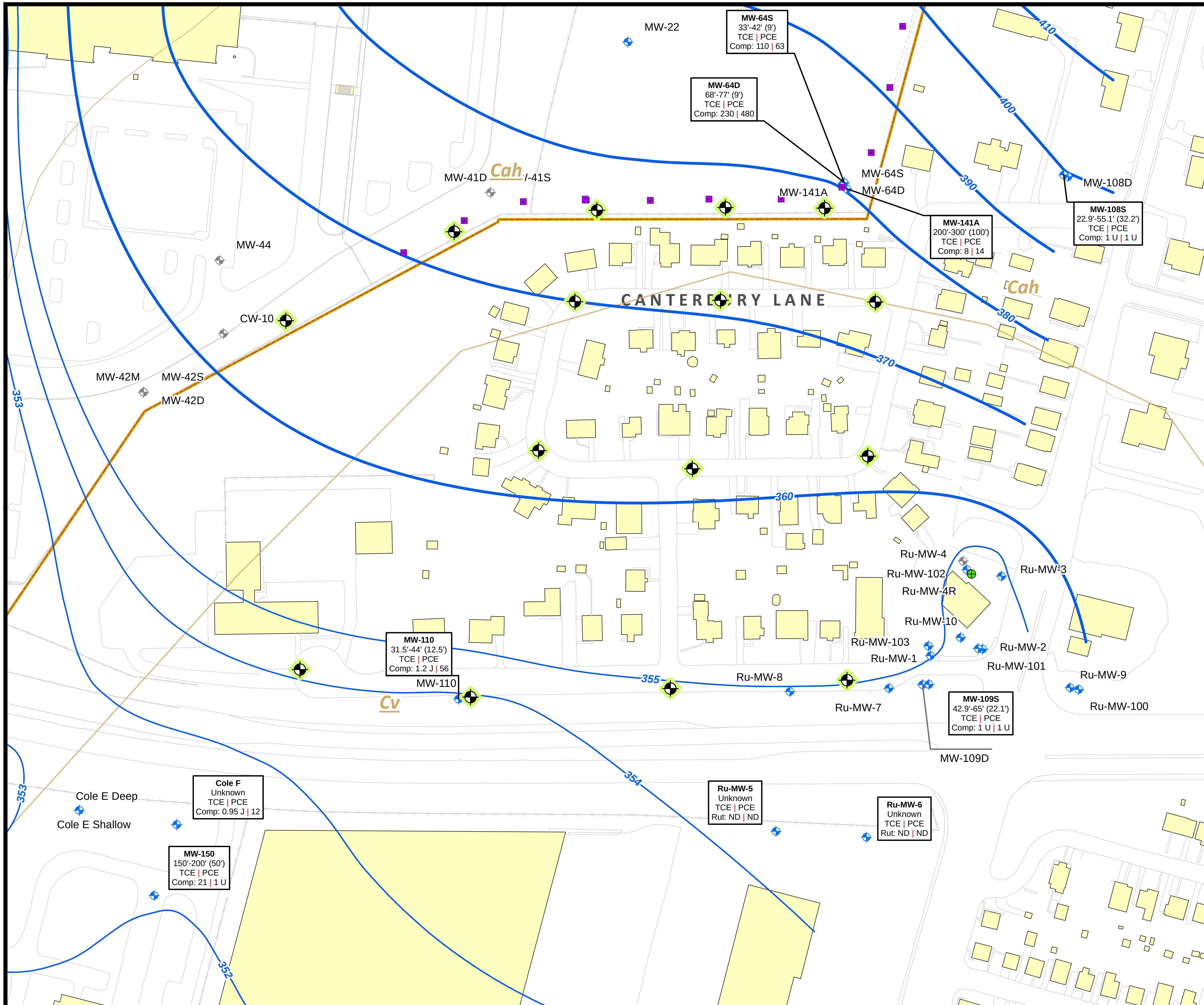
⊕Typical points measured: 1-saturated point (0 tension); 1-3-hanging column points (-0-200 cm tension), 1-3-pressure plate points (-0.25 - 0.5 Bars); 1-2-WP-4 points (-8-200 Bars); 1-Relative Humidity Box point (-850 Bars). ASTM D6836M is followed to obtain the hanging column point and ASTM D6836 is followed to obtain the pressure plate and dewpoint potentiometer points. Methods of Soil Analysis, Chapter 261 is followed to obtain the Relative Humidity Chamber point. M=Modified apparatus

[1]Methods of Soil Analysis, Part 1. 1986. A. Klute, ed. American Society of Agronomy, Madison, WI

[2]van Genuchten, M.T. 1980. A closed-form equation for predicting the hydraulic conductivity of unsaturated soils. SSSAJ 44:892-898

[3]van Genuchten, M.T., F.J. Leij, and S.R. Yates. 1991. The RETC code for quantifying the hydraulic functions of unsaturated soils. Robert S. Kerr Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Ada, Oklahoma. EPA/600/2091/065. December 1991

Figure



LEGEND

- Approximate Location of Proposed Shallow Groundwater Wells
- MIP Stations (Langan, 2003)
- Abandoned Collection Well; Abandoned Well
- Monitoring Well
- Recovery Well
- Groundwater Contour Depression (Feet AMSL)
- Groundwater Contour (Feet AMSL)
- Contact
- Cah — Antietam & Harpers Formation, undiv.
- Cv — Vintage Formation
- Ck — Kinzers Formation
- Cl — Ledger Formation
- Harley-Davidson Property Boundary
- Railroad
- Road (Paved)
- Road Curb
- Road (Unpaved)
- Walkway
- Fenceline
- Existing Building to Remain
- Demolished
- Demolished/Slab Removed

NOTES:

Groundwater contours were constructed using water level measurements from December 12, 2012.

Comp:2013 comprehensive sampling event.

Rut: 2012 special Reuters sampling event.

Chemistry results are in ug/L.

N W E S

Scale (feet)

0 37.5 75 150

Figure 1

Former York Naval Ordnance Plant

1425 Eden Road, York, PA 17402

Field Sampling Plan for Groundwater RI (Part 2)
Addendum 15
Shallow Groundwater Investigation

DRAWN BY: AM/JB	CHECKED AND APPROVED BY: SMS	DATE: 8/21/2014

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GROUNDWATER SCIENCES CORPORATION

Appendix A

Checklist for Off-Site Well Siting
Pertaining to the
Health and Safety Plan for Site Investigation and Remediation Activities and
Field Sampling Plan for Part 2 of the Supplemental Groundwater Remedial Investigation
Former York Naval Ordnance Plant
1425 Eden Road, Springettsbury Township
York, Pennsylvania

TO BE COMPLETED FOR EACH OFF-SITE WELL LOCATION

Instructions: Using the check box, check off each task item as it is completed. When all the tasks have been completed, sign the checklist and attach the drawing from item #7 and the Harley-Davidson utility clearance form to the checklist. Route the package of information to Sharon Fisher, Rodney Myers, Steve Snyder and Ralph Golia. Ralph Golia's signature must appear on the checklist prior to commencement of initial construction of the well, including vacuum excavation of the well. The attending scientist must have a copy of the package for initial well construction activities.

List of Tasks

☐	1.	Review the signed property access agreement.
☐	2.	Identify and obtain legal plat descriptions for properties of interest.
☐	3.	Conduct formal surveying of property boundaries and any identified right-of-ways (ROWs), easements or utilities that may be peripheral or near the proposed new well location(s).
☐	4.	Stake the corners of property boundaries, identified ROWs, easements or utilities that are in proximity to the proposed new well location(s).
☐	5.	Stake and survey the proposed well location(s).
☐	6.	Complete a PA One Call utility clearance.
☐	7.	Provide a CAD drawing, GIS drawing or illustration showing the surveyed property boundaries, proposed well(s), ROWs, and/or easements, and known underground/above ground utilities, and route to team for review and approval. The team shall consist of Steve Snyder, Rodney Myers, Sharon Fisher, and Ralph Golia.
☐	8.	Perform the Harley-Davidson utility clearance utilizing Work Instruction YS2.03.300 Subsurface Protocol and Utility Clearance, and complete the associated form YS2.03.300.01. The site inspection conducted during the H-D utility clearance will include a representative of the property owner or a member of the fYNOP team who has spoken to/met with the property owner representative.

Name of Preparer (print) ____

Signature of Preparer ____

Date Signed ____

Signature of Ralph Golia, AMO ____

Date Signed ____

Appendix B

APPENDIX B

Soil Gas Sampling Protocol Using SUMMA®-type Canisters

This document is a standard operating procedure (SOP) for the setup and collection of soil gas samples from soil vapor probes. This SOP is intended to be a general directive for collection of soil gas samples using SUMMA®-type air canisters equipped with flow metering valves. Reference guidance documents for this SOP include:

- Air Toxics Ltd. Environmental Analytical Laboratory, Guide to Air Sampling and Analysis, Fourth Edition, 2003.

- U.S. Environmental Protection Agency: Environmental Response Team, Standard Operating Procedures, SUMMA Canister Sampling, SOP 1704, Rev. #0.1, July 27, 1995.

Sampling Documentation, Equipment and Materials Checklist

- Sampling Field Data Sheet (attached at the end of this SOP)
- Chain of Custody Form – *provided by laboratory*
- 1-liter, stainless steel, pre-evacuated SUMMA®-type air canisters – *provided by laboratory*
- Vacuum pressure gage and integrated single-use 1-hour flow metering valve – *provided by laboratory*
- Single-use in-line particulate filter – *provided by laboratory*
- Two 9/16-inch open-end wrenches
- Utility knife
- Two feet of 3/8-inch outer diameter (O.D.)/1/4-inch inner diameter (I.D.) Teflon® tubing
- 3/8-inch O.D./1/4-inch I.D. Stainless steel T-fitting w/ valve
- Disposable polyethylene syringe
- 5-gallon PVC bucket or plastic bag to serve as shroud
- Compressed gas cylinder of Ultra-High Purity helium with regulator
- Portable helium meter (Dielectric technologies Model MGD-2002, or equivalent)
- Wristwatch
- Digital camera

Preparation of Sampling Equipment Setup

Preparation of sampling equipment and collection of soil gas samples should be completed in the following steps.

A. Place SUMMA®-type canister adjacent to subsurface soil vapor probe.

B. Record SUMMA®-type canister serial number on Sampling Field Data Sheet and Chain-of-Custody form.

C. Assign sample identification on canister ID tag, and record on Sampling Field Data Sheet and Chain-of-Custody form. The sample identification should include the soil vapor implant number and the sample date.

D. Confirm canister valve is closed and remove threaded plug from canister valve fitting.

E. Install pressure gage and flow metering valve on canister valve fitting and tighten. If pressure gage has additional fitting, install threaded plug onto his second fitting and tighten.

F. Open and close canister valve.

G. Record pressure gage on Sampling Field Data Sheet and Chain-of-Custody form. Gage pressure must read a vacuum of greater than 25 inches Hg. Replace canister and repeat steps A through G if gage pressure reads less than 25 Hg.

H. Remove threaded plug from gage fitting and store for later use.

I. Install particulate filter onto flow metering valve input and tighten.

J. Connect subsurface soil vapor probe to end of particulate filter using 3/8-inch outer diameter/1/4-inch inner diameter Teflon® tubing with in-line T-fitting and valve. Tighten fittings at soil vapor probe end and at end of particulate filter.

K. Open in-line valve at T-fitting and remove approximately one volume of air within soil vapor probe and collection tubing using disposable polyethylene syringe. Close in-line valve at the T-fitting.

L. Take digital photograph of canister set up and surrounding area.

Soil Gas Sample Collection

A. Open canister valve to initiate soil gas sample collection. Record local time on Sampling Field Data Sheet and Chain-of-Custody form.

B. Cover sample collection tubing and canister with shroud (PVC bucket or plastic bag) and begin injection of UHP helium into the air space beneath the shroud. Insert probe end of helium meter into the air space beneath the shroud to confirm the presence of helium.

C. Periodically check canister gage pressure and periodically check the helium concentration in the air space beneath the shroud during the 1-hour sample collection period.

Termination of Soil Gas Sample Collection

A. At end of 1-hour sample collection period record gage pressure on Sampling Field Data Sheet and Chain-of-Custody form.

B. Record local time on Sampling Field Data Sheet and Chain-of-Custody form.

C. Remove shroud and close canister valve.

D. Disconnect Teflon® tubing and remove particulate filter and pressure gage / metering valve from canister.

E. Reinstall thread plug on canister fitting and tighten.

F. Remove canister from sample collection area and place thread cap on end of soil vapor probe.

Preparation for Soil Gas Sample Shipment to Analytical Laboratory

A. Pack canister in shipper container, note presence of threaded plug on canister fitting.

B. Complete Chain-of-Custody form and place requisite copies in shipping container.

C. Close shipping container and affix custody seal to container closure.

Meteorological Data

At the end of each soil gas sampling event meteorological data will be downloaded from a local weather station. The weather station should provide hourly readings of atmospheric pressure, wind direction, wind velocity, precipitation, and temperature.

GROUNDWATER SCIENCES CORPORATION

Soil Vapor Field Data Sheet

GENERAL INFORMATION

Project Number:_______________

Sample Location/SV Point ID:_________________________ Site:____

Vapor Point Completion: Permanent / Temporary / Other:____________ (circle one)

Physical Point/Sample Location Condition:____

PURGING

Date: __________ Personnel: ____________ Air Temp: _______ Skies: ________ Wnd Spd/Drctn: _________________

TD: ________ (ft) Required Purge Vol: (TD x C F (below)) _____________ (ml)

Method: __________________ Start Time: __________ Stop Time: ___________ Volume Purged: _____________ (ml)

Comments: ____

Conversion Factors *(point diameter (ID) – milliliters per foot of well):*$(r^2 \pi) \times 196.65 =$ *ml/ft (r = radius of point in inches)*

3/16" – 5.43 ml/ft **1/4" – 9.65 ml/ft** **3/8" – 21.7 ml/ft**

SAMPLING

Sample ID:

Sample Type: (circle one) Vapor Point Substructure

Personnel: ____________ Air Temp: _______ Skies: ________ Wnd Spd/Drctn: _______________

CANISTER NUMBER:____________ **REGULATOR NUMBER**:____________ Canister Size:____________

Noticeable Odor: YES / NO Description of Odor:____

Field Screening: PID / FID / Other / NA Reading: __________ (ppmv) Duplicate Sample Collected: YES / NO

START DATE: ____________ START TIME: ____________ START VACUUM: ___________ (in/Hg)

STOP DATE: ____________ STOP TIME: ____________ STOP VACUUM: ___________ (in/Hg)

Sampler's Signature: ___________________________________

LABORATORY INFORMATION

Laboratory: ____________________________ Turnaround Time (TAT): ____________ Number of Containers: _______

Date Shipped or Delivered: ____________ Method of Delivery to Laboratory: ____________________________________

Analyses Requested: ____

____

ADDITIONAL NOTES