



February 22, 2018

Mr. Matthew Gordon
Sunoco Logistics, L.P.
535 Fritztown Road
Sinking Spring, PA 19608

Re: Hydrogeological Re-Evaluation Report
Review Comments No. 2
Arch Bishop/South Chester Road, Horizontal Directional Drill Location (S3-0541)
PA DEP Permit Nos. E15-862 and E23-524
Westtown and Edgmont Townships
Chester and Delaware Counties

Dear Mr. Gordon:

This is in regard to your January 2, 2018, responses to the Department of Environmental Protection's (DEP) December 22, 2018, letter concerning your supplemental Horizontal Directional Drill (HDD) analysis submitted for Arch Bishop/South Chester Road Crossing, S3-0541, E15-862, and E23-524, posted on DEP's Mariner East 2 pipeline portal's webpage on November 27, 2017.

DEP has reviewed your response, and the updated Re-Evaluation Report (Report), and has the following comments and questions:

1. The initial 7-page narrative of this HDD analysis appears to make interpretations which are not included in any of the attached professional geologist-signed/sealed reports. This section of the Report needs to be signed and sealed by the Pennsylvania-Licensed Professional Geologist who wrote it and made these interpretations.
2. Sunoco's Report states that the HDD "could affect individual well use during active drilling for wells located within 150 linear ft." Sunoco needs to explain why it focuses only on wells located within 150', and must address whether other water supplies outside of 150' could be affected. Please provide justification sealed by a Pennsylvania-Licensed Professional Geologist that wells outside of the 150' profile will not be impacted.
3. With regard to water supplies that might be impacted by these HDD activities, Sunoco must address those impacts in an acceptable manner. Sunoco has the option to enter into written agreements with all private water supply owners whose water supplies may be impacted by this Drill, regardless of their location from the Drill, as part of

this reevaluation, and in advance of commencing the HDD. Under the agreements, Sunoco must provide short and long-term replacement potable water supplies adequate in quantity and quality for the purposes served, to the satisfaction of all potentially affected water supply owners. The agreements should provide for Sunoco to conduct water quality and quantity testing of each potentially affected water supply prior to, during, and after the HDD activities. Sunoco needs to provide proof of these agreements to DEP with a response to this letter.

In the alternative, if Sunoco chooses not to pursue these agreements with the private water supply owners, it must provide a discussion of actions to be taken by Sunoco to prevent water supply impacts from occurring. Sunoco needs to demonstrate how, in the absence of the agreements described above, Sunoco will avoid impacts to all water supplies. Sunoco's approach should include the utilization of technical and nontechnical measures to avoid and minimize such impacts, including, but not limited to, the conversion of the HDD to a trench installation, use of other trenchless construction methods, the use of American National Standards Institute/National Sanitation Foundation (ANSI/NSF) Standard 60 approved gels or other approved additives that could prevent such impacts from the Drill, or some combination of all of the above. To the extent Sunoco proposes to use any ANSI/NSF 60 certified HDD additives, consistent with Special Condition NN contained in DEP Permit Nos. E23-524 and E15-862, Sunoco will only be able to use the additives in the manner indicated in the certification of the proposed additive. The manner in which the proposed additive is to be used, as indicated in its ANSI/NSF 60 certification, should be submitted with your response. In addition, Sunoco should indicate whether it will be following all conditions included as part of the additive's certification or, if not, provide an explanation as to why it is not and why that deviation is acceptable.

4. The Report discusses potential changes in water *quality*, but also needs to discuss potential changes to water *quantity*, as the potential exists for the HDD bore to adversely impact the yield of private water supply wells. Please describe how this will be done consistent with applicable provisions of the latest versions (February 6, 2018) of the Inadvertent Return Assessment, Preparedness, Prevention and Contingency Plan, and the Operations Plan (January 2018).
5. DEP requests that Sunoco provide the following information related to the project's potential effect on well production zones and water supplies:
 - a. An analysis of private water supply well production zones and how the proposed HDD activities will interact with them (listing the depths of wells and pumps is insufficient).
 - b. A map showing all the private water supplies in the correct, surveyed locations.

- c. A description of the following: if there is short tripping of the tooling during the HDD, what are the chances of a plunger-effect occurring during either the drilling or reaming phases or during pipe pullback, and could this affect private water supplies?
 - d. Water quality sample results of the private water supplies that may be affected.
 - e. Water quantity test results (pump yield tests) of the private water supplies that may be affected.
6. There are reported intersections of fracture traces with the planned HDD bore path within close proximity to residential supply wells. The HDD alignment crosses six fracture traces mapped as part of reevaluation, but these fracture traces are not discussed as they relate to well locations and proximity to bore path. Further discuss these fracture traces, map them on present day aerial photos, evaluate them for potential problem areas, and provide this information, including the results of the evaluation, to DEP.
7. More information is needed to provide an adequate site-specific reexamination of the bedrock geology, in addition to the information provided.
8. Sunoco needs to address how it will ensure that the HDD can be steered accurately, given the subsurface profile, and, if such is not possible, what measures it will take to prevent Inadvertent Returns (IRs), groundwater flowback, and water supply impacts if the Drill veers from its intended path.
9. Additional evaluation of the overburden strength needs to be provided, including grain size analyses, a narrative discussion of all data related to the overburden, and how this data was used in the overall reevaluation. Provide a detailed description of the processes and procedures that will be implemented if void spaces are encountered during drilling activity.
10. The Report indicates that groundwater levels indicate potential for “excessive groundwater discharges.” Evaluation of water levels needs to be performed prior to initiating the HDD bore to provide information regarding potential diminution of flow issues and the ability to determine if any future potential impact is related to head differentials or plugging of a potential water-bearing zone. Given the developed nature of this area and proximity of residential groundwater supply wells, further discussion is warranted regarding this topic. Potential actions could include the following:
 - a. Review “Groundwater Resources of Delaware County, Pennsylvania” (Plate 1, Water Resources Report 66; Balmer & Davis, 1996) for more recent and specific geologic and hydrogeologic information pertaining to the potential yields of residential supply wells in the area.

- b. Project water well depths, casing depths and water-level depths (based on a water-level survey) on cross sections/profile views.
 - c. Identify zones of fractures or fracture trace intercepts on the profile views, along with residential water supply well locations.
 - d. Plan for temporary supply replacements, as the bedrock is highly fractured, even at depth, and residential water supply wells are located as close as 47 feet from the planned bore path. To limit potential impact on residential water well users, there should be a well-conceived response plan in place and ready to execute. Please describe how such a plan will be done to be consistent with applicable provisions of the latest versions (February 6, 2018) of the IR Assessment, Preparedness, Prevention and Contingency Plan, and the Operations Plan.
11. Considering that this plan is to address a specific HDD bore at a specific location, additional details need to be included in addition to the information already provided. Specifically, Sunoco needs to provide information on items such as pilot bore and reaming diameters, annular pressures, mud viscosities, action levels, and specific IR response actions.
12. The Report states that loss control materials (LCM) can be used to manage the loss of fluids during the pilot hole phase. As bedrock is generally highly fractured to 55 or more feet below the existing ground surface, the use of LCMs during drilling appears appropriate. Provide an explanation of where and how Sunoco plans to use LCMs during drilling. Please describe how this will be done consistent with applicable provisions of the latest versions (February 6, 2018) of the IR Assessment, Preparedness, Prevention and Contingency Plan, and the Operations Plan.
13. The discussion also states that loss of fluids may be managed by grouting. Grouting of highly fractured zones of rock or fracture traces as a preventative measure may be prudent, whereas, grouting after an IR already occurs may not be desirable. Provide a conceptual description of the proposed grouting program and its timing, and describe how such a program could be implemented consistent with applicable provisions of the latest versions (February 6, 2018) of the IR Assessment, Preparedness, Prevention and Contingency Plan, and the Operations Plan.

14. IR prevention typically includes linking the respective proposed HDD geometry with site-specific geotechnical data. This approach will allow the HDD designer and driller to understand what specific HDD station ranges will be most vulnerable to IRs. We have the following questions regarding the linking of the proposed HDD geometry and the site-specific geotechnical data for this specific bore:
 - a. Construction plans appear to call for a minimum of 10 feet of separation from adjacent utilities. Has the possibility of IRs via weak subsurface soil backfill zones or blasted/fractured rock at existing utility trenches (if present) been considered? If so, explain how it has been considered and how this was taken into account in Sunoco's construction plans.
 - b. The top-of-rock level appears to be 22 feet below ground surface at Boring B6-1W and there is likely shallow depth-of-cover over the HDD bore at the existing Sunoco pipeline crossing (Station 1+06) as well as at Wickerton Road (Station 1+75). The Report explicitly states that casing is being provided for the pilot hole at the SE entry, but does not state the same for the NW entry. This needs to be clarified.
 - c. Has a preliminary station number been assigned where the casing will terminate? Provide this information.
15. Page 2 of the Terracon Report states: "When laboratory soil testing results are available, we will submit a complete data report for the subject crossing." This Report appears to be preliminary, and an update may be available by now. Provide any final report(s) from Terracon.
16. Borings B6-1W and SB-05/B6-IE are more than 6,300 feet apart and terminate below the HDD path. Borings SB-01 through SB-04 both terminate above the HDD path. Exploratory boring spacing to the depth of the proposed HDD is typically much closer than provided in this instance. In addition, the test boring locations do not appear to correspond with fracture traces as identified by GES. Additional subsurface information in these areas is necessary to understand (and mitigate) potential IR risks. Provide a geophysical survey to help interpolate between boring points, and in delineating/characterizing the fractures identified by GES.
17. The top-of-rock level was documented to be as deep as 68.3 feet in exploratory boring SB-03. Rock was not sampled to quantify weathering in SB-03. The test boring results suggest that the rock is differentially weathered. If rock is near this depth between Stations 60+00 and 65+10, then the HDD cover may consist of only soil. Considering that this plan is to address a specific HDD bore at a specific location, provide additional information on the sufficient depth of soil cover versus maximum

allowable mud pressure for portions of the HDD where the HDD path may not penetrate rock.

18. The Report states “No geophysical studies were recommended or performed for the reevaluation of HDD S3-0541 as the alignment is not in a karst area.” Geophysical surveys should not be limited to karst environments, as they may be useful and provide valuable data in this instance. Specifically, a geophysical survey needs to be provided to help interpolate between geotechnical boring points (as noted in previous comment), identifying areas of soft soils, and in delineating/characterizing the fractures identified by GES.
19. The Report indicates that Sunoco will monitor downhole pressures, viscosities, mud loss, and nearby water wells. However, there are no specific values or action levels such as how often mud loss is calculated, or what viscosity would be maintained during the bore, or at what point an IR contingency plan would be implemented (i.e., if there is X pressure increase or X mud loss, an IR contingency plan would be started). Define and document the specific viscosities and action values and pressures to facilitate prompt actions during the HDD bore.
20. The IR contingency plan seems to be limited to adding LCM. The Report needs to: (1) specifically note that drilling would stop in the event of an IR; and (2) include an outlined plan for addressing drilling mud on the surface.
21. The rock quality designation (RQD) is reported to range from 60–80, but a review of the core information suggests there is notable weathered rock and the lower competent rock includes several fractures. Based on the geotechnical data, designate in the Report the depth at which full mud pressure can be used to power the motor without blowing out the low RQD weathered rock on top.
22. Although the drilling practices are intended to minimize the risk of an IR occurring, there is a possibility that an IR could reach the ground surface. Given the highly developed nature of this area and the close proximity of the HDD to residential water supply wells, provide “specific” standard practices for containing and controlling an IR, and note that IR response materials/equipment will be maintained in readiness at the drilling site. The IR response materials/equipment may include, but are not be limited to:
 - d. Materials to contain any IR that reaches the ground surface, including materials such as straw bales, sand bags, plywood or planking, silt fence, or other materials to create temporary berms or prevent movement of surfaced drilling fluids.

- e. If monitoring or surface observations indicate an IR has occurred, drilling operations will be immediately paused to verify the location and extent of the IR, and to prevent additional fluid surfacing.
 - f. The IR will be contained using best practices and materials to prevent migration of fluid from the immediate area and into sensitive habitats.
 - e. Contained drilling fluid will be conveyed back to the drill rig mud supply using pumps and hoses, buckets, wet or dry vacuums, or other appropriate means. Please describe how this will be done consistent with applicable provisions of the latest versions (February 6, 2018) of the IR Assessment, Preparedness, Prevention and Contingency Plan, and the Operations Plan.
23. The terms pressure, fluid pressure, drilling pressure, mud pressure, etc., may refer to either the injection pressure of the drilling fluid (mud) inside the drill string or to the pressure outside the drill string but within the borehole. Most HDD drillers measure the injection pressure of the mud/drilling fluid within the drill string and do not measure the pressure of the bore outside the drill string but within the borehole. Clarify in the Report which pressure values are being monitored as part of this proposed HDD bore.

We look forward to your responses to address the above questions and concerns. If you have additional questions, please contact Mr. John Hohenstein in the Southeast Regional Office at 484.250.5171.

Sincerely,



Domenic Rocco, P.E.
Acting Environmental Program Manager
Regional Permit Coordination Office

cc: Mr. Wardrop, P.G. – GES
Mr. Hohenstein, P.E. – DEP
Chester County Conservation District
Delaware County Conservation District
Re 30 (GJS18WAW)51-15