SUNOCO PIPELINE
An ENERGY TRANSFER Company

535 Fritztown Road
Sinking Spring, PA 19608

August 30, 2019

Via Electronic Mail
Mr. Scott R. Williamson
Program Manager, Waterways & Wetlands Program
Pennsylvania Department of Environmental Protection
Southcentral Regional Office
909 Elmerton Avenue
Harrisburg, PA 17110-8200

**Re: Supplemental Discussion on Losses of Circulation and IR Potential**
**June 10, 2019 SPLP Data Request Response to Item 1**
**PA DEP HDD Re-Evaluation Report- Request for Additional Information**
**Appalachian Drive 16–inch Horizontal Directional Drill Location (S2-0240-16)**
**Permit No. E21-449**
**Middlesex Township, Dauphin County**

Dear Mr. Williamson:

In compliance with the Corrected Stipulated Order dated August 10, 2017, a Re-Evaluation Report of the above-referenced horizontal directional drill (HDD) was submitted to the Pennsylvania Department of Environmental Protection (Department) on March 4, 2019. In a letter dated April 23, 2019, the Department requested further information, to which SPLP responded on June 10, 2019. In response to a conference call with Department staff on August 21, 2019, the Department requested additional information on the potential for Losses of Circulation (LOC) or Inadvertent Returns (IRs) during progress of the proposed 643-foot (ft) Guided Bore under the Norfolk and Southern Railroad. As an enhancement to the responses to Item 1 "a – c", SPLP submits the following discussion for your consideration.

**Item 1b:**

As discussed in the response to Item 1b, the pilot hole will be completed using a midsize Uni 250 x 400 or DD-110 drilling rig using a 9.25–inch air hammer or equivalent.

This type of pilot hole progression is performed using an oscillating flat-faced tool head that pulverizes the subsurface materials as it advances. The oscillating hammer face is energized by high volume air compressors generating 3,000 – 7,000 cubic feet of air per minute (cfm), through a 4-inch diameter smooth-sided drill rod. Exhaust of the pulverized materials back to the point of entry is by air entrainment from the tool face exhaust ports back through the annulus created by the difference in diameter between the tool face and drill rod. In this case, the annulus extends approximately 2.5-inches outside the drill rod circumference. The "cuttings" which are pulverized soil, weathered rock, or rock, are controlled by a foam creating additive injected in the air stream, or by water saturation/suppression at the point of entry.

IRs resulting from this type of pilot hole progression are possible. IRs occur as a result of "clogging" (Loss of Air Circulation) within the annulus, which causes the compressed air to seek alternate pathways for pressure relief. Clogging of the annulus during an air hammer pilot drill can result from the effects of groundwater saturating and binding the subsurface materials as they are blown back through the annulus, or by the effects of gravity (causing fallout or settling of materials), with or without the presence of groundwater.

The proposed 16-inch Guided Bore profile has minimal radius of curvature. There is 23 ft of elevation change between the north point of entry and the bottom of the profile, and 13 ft of elevation change from the bore exit to the bottom of the profile. No groundwater was encountered at or near the profile depth in geotechnical cores B-01 and SB-03; therefore, groundwater is not expected to have an effect during progress of this pilot hole. Gravity effects on cuttings with a maximum of 23 ft of elevation difference are easily overcome by the minimum 3,000 cfm air flow rate. The air flow rate will be adjusted as necessary as the pilot hole is advanced to maintain returns back to the point of entry. Based on these data factors, SPLP concludes that the IR potential during the pilot phase of this Guided Bore is low to none.

**Item 1c:**

As stated in SPLP's response to Item 1c, the drilling methodology proposed to complete the reaming phase of this guided bore is mud-rotary.

Typically, IRs occurring during the reaming phase of an HDD or Guided Bore using mud flow circulation recovery of cuttings are associated with the physical entry of the reaming tool at shallow depths to the land surface while subsurface materials are being cut to flow back to the entry pit, or conversely when the tool is near the point of exit and the fluid volumes result in saturation and potential settling of the overlying overburden above the reaming tool while exiting. These IRs occur within a narrow range of the entry or exit points varying slightly as the result of other profile design factors, subsurface physical characteristics, and subsurface integrity. LOCs and IRs occurring during the reaming phase are rare outside of, and between, the entry and exit of an HDD or Guided Bore because they require the influence of significant physical factors to induce an event. Such factors include extreme gravity effects or unstable subsurface materials that could result in the portion of the boring behind the reaming tool becoming blocked with cuttings, which in turn could result in clogs within the annulus, reduced circulation of drilling fluids, and induction of secondary effects including settling of the overburden and possibly an IR.

For this Guided Bore profile, the potential for an IR event during the reaming phase is negligible considering that SPLP mandates the implementation of HDD Best Management Practices to Guided Bores as stated in the conclusion of the Re-Evaluation Report. As provided in the enhanced response to Item 1b above, the potential effects of gravity on the free flow return of cuttings is negligible. Hydraulically, the 23 ft of elevation from entry to profile bottom equates to 230 pounds of differential pressure. With a minimum fluid flow rate of 350 gallons per minute at a reduced pump pressure of 1,000 pounds per square inch at the pump, the gravity differential will have no effect. Based upon the

geotechnical data, the strata being reamed is competent and does not exhibit unstable characteristics that could contribute to the annular space behind the reaming tool becoming clogged with drill cuttings and/or potential settling of the overlying bedrock material. Only one interval of bedrock (15 to 20 ft bgs) in Boring B-01 has a rock quality designation (RQD) below 50. Further, with the northern entry point and the southwestern exit point being 7 and 13 feet bgs, respectively, the potentially weaker bedrock interval will be encountered when the reamer bit is located near the entry/exit points and any LOCs/IRs would be identified rapidly to allow countermeasures to be immediately taken. Therefore, SPLP concludes that the risk of an IR during the reaming phase is negligible.

Since LOCs occurred during the pilot phase drilling of the 20-inch pipeline, it has been confirmed that the subsurface is susceptible to the loss of drilling fluids. However, SPLP's experience with multiple HDDs and Guided Bores on the Pennsylvania Pipeline Project clearly shows that the occurrence of IRs and LOCs during the pilot hole phase is not a reliable indicator of the likelihood for these same issues to occur during the reaming phase. In fact, there have been many instances where LOCs and IRs occurred during the pilot phase, but no LOCs or IRs occurred during the reaming phase. This is due to what the drilling industry calls the "packing off" of the HDD or bore annulus during the reaming process. During reaming, the volume of cuttings generated is exponentially greater than the volume of cuttings produced during the pilot phase. The volume and density of the cuttings in the drilling fluid return flows are significantly higher, and this change in consistency results in the sealing, or "packing off", of fractures while reaming is in progress which does not occur during the pilot phase. Further, the Boring B-01 RQD values ranged between 98 and 100 for the majority of the 16-inch Guided Bore profile. Based upon the geotechnical data from the bore area and the observed "packing off" of the annular space during the ream, SPLP concludes the likelihood of discernable LOCs occurring during the reaming phase of the proposed Guided Bore is low.

SPLP submits that we have been, and are, in complete compliance with the agreed terms and analysis requirements of the Order, as agreed to by the Department, and that no further analysis is required for the Department to consent to the start of this HDD. SPLP therefore requests that the Department approve of the Re-Evaluation Report for the Appalachian Drive Crossing Horizontal Directional Drill (S2-0240-16) as soon as possible.

Sincerely,

Larry J. Gremminger, CWB
Vice-President – Environmental, Health & Safety
Energy Transfer Partners
Mariner East 2 Pipeline Project

Pertaining to the practice of geology and information conveyed.


8/30/2019

Douglas J. Hess, P.G. Date
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Skelly and Loy, Inc.
Director of Groundwater and Site Characterization
Geo-Environmental Services