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"Clear Knowledge in the Over Information Age"

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To: Mr. Casey LaLonde
Township Manager
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1025 Paoli Pike
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Re: Accufacts Report on Mariner East 2 Expansion Project Affecting West Goshen Township

1. Introduction

Accufacts Inc. ("Accufacts") was asked to assist West Goshen Township ("Township") in evaluating an additional Sunoco Pipeline L.P. ("Sunoco") pipeline project identified as the Mariner 2 East Expansion Project. The Mariner East 2 Expansion Project is a proposal to install a new 20-inch, high MOP liquid transmission pipeline operating across the Township that will carry highly volatile liquids, or HVLs (propane and butane), eastward.[1] This project is for a new pipeline that supplements movement of NGLs eastward out of the Utica and Marcellus shale gas regions in Ohio and western Pennsylvania, respectively.

Accufacts provides specialized technical and safety expertise in pipeline siting, design, operation/maintenance, and regulatory requirements, especially as it relates to HVLs, a category of liquids given special definition and mention in the federal pipeline safety regulations because of their unique hazards.[2] Based on over forty years of experience, Accufacts utilized a similar approach in producing an analysis for the Township for the original Mariner East Project, an earlier conversion of an 8-inch existing vintage pipeline to

[1] Maximum Operating Pressure, or MOP, a term defined in federal pipeline safety regulations 49CFR§195.2, "means the maximum pressure at which a pipeline or segment of a pipeline may be normally operated under this part."
[2] 49CFR§195.2 Definitions.

HVL service.[3] While my analysis approach for the proposed 20-inch new pipeline is very similar to that utilized for the original Mariner East Project, there are several important differences addressed in this report. As with most HVL liquids, the fluids to be moved in the Mariner East 2 Expansion Project are pressurized to remain liquid at operating conditions within the pipeline, but upon release would generate heavier than air hydrocarbon vapor clouds that can impact large areas. It is important that the pipeline operator pay special attention to its design, installation, operation, and maintenance practices to assure the pipeline's integrity to keep the fluid within the pipeline. Federal pipeline safety regulations provide minimum levels of safety assurance. Prudent pipeline operators moving HVLs should exceed these basic requirements to assure proper control of their system. This is especially important as the potential to increase the amount of fluid that can be released increases significantly with pipe diameter.

Accufacts finds that Sunoco has incorporated additional processes in excess of minimum federal pipeline safety regulations that should assure the safety of this proposal across the Township. Accufacts' analysis and this report are primarily confined to the segments of the Mariner East 2 Expansion Project that could affect the Township. Certain additional equipment physically outside of the Township was also reviewed, such as the overall control program, mainline valves, metering, and pump stations that could impact the Township in case of a release of HVL.

The discussion and conclusions in this report are based on a careful review and analysis of the technical information provided by Sunoco to Accufacts. Accufacts is under a Nondisclosure Agreement ("NDA") with Sunoco that prevents Accufacts from disclosing certain sensitive information unless it is already in the public domain. While this limitation does not restrict Accufacts' ability to present independent critical observations, the reader should be aware of the obligation to honor the NDA, as Accufacts will not disclose certain sensitive details supporting our observations.

2. <u>Critical differences between the new 20-inch Mariner East 2 Expansion Project and the original 8-inch Mariner East existing pipeline conversion within the Township</u>.

2a) HDD will be the primary installation method for the 20-inch line across the Township.

The Mariner East 2 Expansion Project proposal crosses slightly over a mile of the Township as a new 20-inch pipeline running either mainly under or near the East Boot

[3] Accufacts Inc., "Accufacts Report on Mariner East Project Affecting West Goshen Township," March 6, 2015.

Road across the Township in or in close proximity to the existing 8-inch Mariner East Pipeline right-of-way ("ROW"). Because of the requests to horizontal directional drill ("HDD") certain road crossings, two segments, or over ninety percent of the 20-inch pipeline located within the Township, will be installed utilizing HDD that will be performed in sequence (one HDD downstream of the other). The rest (slightly over two hundred feet of pipeline) between the HDDs will utilize conventional open cut trenching pipe installation. The connecting pipe between the two HDD pulls will incorporate an above ground remotely operated valve at Boot Road within the Township (at Milepost, "MP," approximately MP 344 on the new 20-inch pipeline). Spanning the Township, the nearest upstream/downstream remotely operated valves on the 20-inch will be at the upstream Eagle pump station (~MP 335) and at Middletown Road (~MP 350), respectively. A manual valve is located at approximately MP 341.

HDD entails installing pipe below ground utilizing directional drilling techniques from the surface at two locations spanning a site. HDD involves first directional drilling from the surface a small diameter pilot bore hole and then performing subsequent reaming passes that can be either in one or both directions, that allow the original directional pilot hole to be expanded in diameter via successive reaming passes, expanding the hole diameter depending on the soil conditions. The final directional drill reaming pass must be larger than the pipe to be installed. Pipe is eventually pulled through the final bore with a mixture of mud/bentonite to reduce friction and pulling forces that could possibly damage the pipe or its coating during the final pull. Depending on various parameters, to avoid pipe kinking, etc., the arc of the bore and pipe curvature will place the pipe fairly deep along most of the span, as pipe can only be made to bend or deflect along a limited curve, depending on such factors as pipe diameter, thickness, strength, etc.

HDD technology has been utilized for over forty years with considerable advances in directional drilling for larger pipeline diameters with greater span lengths, as well as bore location guidance, having been especially improved in the last twenty years. The HDD installation of a 20-inch pipeline should not be overly challenging provided the pipeline operator has worked with the Township and other infrastructure agencies such as gas companies that might be near the HDD, to assure there are no other underground structures that might interfere with the HDD, or that might hinder the future safe operation of the pipeline (e.g., via cathodic protection, or CP, stray current interference). One advantage of routing pipeline under roadways is that, if placed at proper depths and suitably evaluated by the pipeline operator, third party surface threat activities that could impact the pipeline are significantly reduced as compared to a more conventional pipeline right-of-way utilizing open cut trenching. Proper depth below grade in this location will also be important to assure protection of the pipe during its operation. Accufacts is well experienced in the various advantages of pipeline installation under roadways in areas of

high population density where conventional pipeline ROWs may be impractical or unwise.

2b) Federal minimum hydrotesting regulations are appropriate for the new 20-inch pipeline.

It has been well known for decades that certain transportation or construction techniques associated with new pipe, can introduce some types of crack anomaly imperfections that can grow to failure with time during operation. Accufacts has reviewed documents provided by Sunoco at our request related to the 20-inch pipe manufacturing, inspection, and transportation quality administration and quality control methods for this pipe. This information has enabled Accufacts to render an opinion that the new 20-inch pipe does not contain crack threat risks associated with transportation induced cracking of new pipe. The pipe also does not contain crack risk associated with more vintage pipe such as older either low frequency (LF-ERW) or early high frequency (HF-ERW) pipe, that can exhibit axial crack rupture failure with time for various reasons. The type of coating utilized on the 20-inch line also essentially eliminates the likelihood of selective seam corrosion that can generate cracking ruptures, if a cathodic protection system required under federal regulation to complement the pipe coating is effective.

Given the lack of crack risks for the new pipe, the minimum federal hydrotest strength test pressure of at least 125 percent of MOP is sufficient to verify the integrity of the 20-inch pipeline for its service.[4] Sunoco has provided the proposed hydrotest pressure test parameters for the segment crossing the Township, and Accufacts finds this initial "new pipe" service test proposal sufficient and acceptable to appropriately validate the integrity of the pipe segment for its service. Sunoco further exceeds minimum federal pipeline safety regulations by including the maximum and minimum hydrotest parameters, not only as a minimum percentage of MOP, but also as a percent specified minimum yield strength, or % SMYS, range. Percent SMYS is a term defined in federal pipeline safety regulations and is an important integrity management parameter utilized in evaluating pipeline failure mechanics and pipeline fitness for service.

Briefly commenting on inline inspection or ILI "smart pig" tools, Sunoco should be able to run appropriate ILI tools over time that are technically capable of addressing possible corrosion or third party damage potential threats as 20-inch diameter pipe is well suited for such pig tools used to periodically evaluate the integrity of mainline pipe, if prudently managed.

[4] 49CFR§195.304 Test pressure.

In addition, a critical inspection related to nondestructive testing (i.e., x-ray, gamma ray, or ultrasonic inspection) of girth welds, the welds joining pipe segments together during construction, is important. Federal minimum liquid transmission pipeline safety regulations require that "During construction, at least 10 percent of the girth welds made by each welder during each welding day must be nondestructively tested over the entire circumference of the weld."[5] For various reasons, there have been a series of girth weld failures on new pipelines as well as many older pipelines. Since hydrotesting does not truly test the quality of girth welds, I believe that during pipeline construction, especially for HVL pipelines, a pipeline operator should nondestructively test all girth welds and many pipeline operators do so, and retain certain inspection records for the life of the pipeline. Sunoco will nondestructively test all girth welds on the Mariner East 2 Expansion Project, prudently exceeding federal minimum pipeline safety regulations in this important area.

2c) No pump station for the 20-inch is required nor located within the Township.

Because of pipeline hydraulics associated with the greater pipe diameter, the 20-inch pipeline will not require a pump station within the Township. The last upstream pump station on the 20-inch system is located some miles upstream of the Township and can supply flow to the pipeline's final destination in the Twin Oaks (Marcus Hook) facility. A new remotely operated emergency flow mainline pipeline shutdown valve operated via the central control room will, however, be installed within the Township just east of US Highway 202 on a portion of the pipeline installed by conventional installation (between the HDDs).

3) <u>Operation of the proposed Mariner East 2 Expansion 20-inch Pipeline affecting the Township.</u>

Components of the pipeline other than the mainline pipe in the Township play an important role in the operation of the HVL pipeline as it could affect the Township. These include: 1) upstream pump stations and mainline pipe beyond the Township, 2) certain mainline valves and their actuation, and 3) to a lesser extent, the elevation profile of the pipeline. Many of the main issues identified below were discussed in detail in Accufacts' report on the original Mariner East Project.[6] While I run the risk of repeating myself, the following major issues that were important for the original Mariner East project are just as, if not more, important, for the new 20-inch pipeline:

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[5] 49CFR§195.234 Weld: Nondestructive testing.

[6] Accufacts Inc., "Accufacts Report on Mariner East Project Affecting West Goshen Township," March 6, 2015.

3a) Pipeline Mainline Valve Remote Actuation

Given the diameter and capacity of the pipeline, the specific placement of valves and their possible remote actuation is not an exact science. Sunoco is proposing to add one remotely operated 20-inch valve within the Township to segment the pipeline. Accufacts has reviewed the pipeline elevation profile and surge analysis provided by Sunoco that also identified various additional pump stations, and other mainline valve locations along the pipeline outside of the Township and their actuation (remote versus manual). Because of the much greater inventory associated with a larger diameter pipeline that could be released in the event of pipeline failure, it is important that Sunoco's priority focus first on maintaining pipeline integrity of the 20-inch pipeline, while assuring that valve placement and closure does not unduly endanger the mainline from rapid overpressure from surge. Accufacts has reviewed the surge analysis and sensitivity cases for the proposed valve installations and finds them appropriate. From my perspective, mainline valving plays a secondary (though a nevertheless important role) in the 20-inch pipeline's overall safety.

3b) Automatic and Remote Pipeline System Shutdown

Sunoco has indicated that upon certain trigger events, usually indicative of a possible pipeline rupture, the Mariner East 2 Expansion pipeline and pump stations will be automatically shut down, and the stations and segments of the mainline automatically isolated by various remotely operated mainline valves closing using a process similar to that utilized on the original Mariner East project. It is worth noting that not all valves on the mainline system will be remotely operated. A separate system-wide safety approach also covers hydraulic transients such as those that can occur during startup and shutdown, and product changes. The control room operator can also manually initiate an automatic shutdown of the pipeline system.

3c) "Leak Detection" Systems

As discussed in the Accufacts previous report concerning the Mariner East 8-inch pipeline, there are basically two types of pipeline releases: leaks and ruptures. Because of the complexity of hydrocarbons and pipeline operation, it is very difficult to design and install a leak detection system that can remotely identify all forms of pipeline releases. Accufacts advises that pipeline operators first focus on remotely identifying pipeline ruptures, and then attempt to improve on technology to possibly identify the much harder to recognize leaks. It is a significant challenge to reliably identify rupture releases, and technology has not yet been developed to dependably identify pipeline leaks. Regarding "leak detection," it is my understanding that the Mariner East 2 Expansion Project will first incorporate an advanced computer/automatic system that scans and monitors the pipeline and pump stations for certain parameters that are indicative of a possible pipeline rupture, and automatically initiates a full pipeline system

shutdown and isolation, including pump station isolation and remote mainline valve closure, following a special required sequence. Information provided by Sunoco indicates a rational and progressive approach in trying to achieve pipeline rupture release detection with automated shutdown response without excessive false alarms.

To complement the automatic shutdown system focused on possible larger pipeline releases, the pipeline will also incorporate a separate non-automatic "leak detection" software package that is intended to assist the control room operator in identifying possible pipeline leaks as well as rupture. To further enhance the effectiveness of this software leak detection system, the pipeline is to be normally operated liquid full, or non-slack line. This separate leak monitoring approach requires the control room operator to interpret presented information of a possible release in a special format, decide if a possible release indication is real, and manually initiate a system-wide shutdown if warranted. This second leak detection monitoring system relies on control room operator intervention, but is intended to supplement the automatic shutdown intended for larger releases.

3d) The Critical Role of the Control Room Operator

While pipeline automation plays an important role in controlling and monitoring certain aspects of a pipeline operation, and can play a timely safety role in automatically shutting down and isolating a pipeline system, the control room operator nonetheless still serves an important function in pipeline operation. The control room operator is responsible for managing various operating parameters, as well as monitoring and responding to various computer signals, including responding to alarms, in their hierarchy of importance. A well designed computer system that initiates certain actions such as automatic shutdown and mainline valve closure can react faster than a human monitoring various aspects of a pipeline system. Such complexity should not override the ability of the control room operator to initiate a shutdown if he feels it is warranted.

It is further worth noting that Accufacts has investigated several liquid pipeline ruptures where a control room operator decision to shut down a pipeline was delayed while supervisory authority was sought to approve such a shutdown, increasing response time. Sunoco has incorporated a procedure that gives the control room operator direct authority to shut down and isolate a pipeline without supervisory approval if a release is suspected. Restart of the pipeline under such circumstances, requires approval that follows a procedure meant to verify a release has not occurred. Accufacts views these procedures as a positive and prudent control room practice.

3e) The Importance of Emergency Response Plans

Pipeline operators are required under federal pipeline regulation to have emergency response plans to deal with the emergencies associated with pipeline releases. Such procedures focus on protecting people first and then property, establish who is in control and how control is handed off during various stages of a release, what type of command structure is utilized for such emergencies such as the Incident Command Structure (or ICS) that has proven to be highly effective in pipeline releases, and how communication is maintained with first responders who are usually the first to arrive at a release site. It is important that all key pipeline personnel be trained in their various roles and responsibilities in the event of a pipeline release emergency, especially pipelines moving HVL that can have serious consequences.

During an emergency involving a release, the control room plays a critical role as the emergency contact actually controlling and monitoring the pipeline to assure that appropriate equipment has been properly shut down and automatic control valves have closed. The control room also serves to maintain liaison with local emergency responders until hand-off to company onsite field incident command personnel can occur. The control room thus is a critically important initial contact with local emergency responders to assure everyone is properly communicating/coordinating during the important initial stages of a possible pipeline release, a time with much confusion.

Under federal pipeline safety regulations, the pipeline operator is required to notify and coordinate with emergency first responders during pipeline emergencies.[7] The control room should have a list of local emergency contacts, including "other public officials." Local first responders and these officials should also have company emergency contacts and, for obvious reasons as identified above, the important pipeline control room emergency contact number(s). Because of various changes that may occur in organizations, local official contact numbers can be frustratingly difficult to keep current, but the control room contact number should usually never change. Federal pipeline safety regulations place the responsibility to keep emergency contacts with Township officials squarely on the pipeline operator for very good reasons.[8]

4) <u>The Pipeline Operator should keep the Township informed of future ILI assessment results.</u>

Given the HDD installation and location of the 20-inch under/along the East Boot Road right-of-way within the Township, Accufacts would advise that the pipeline operator keep the Township informed of future ILI smart pig run results within the Township. The ILI

[7] 49CFR§195.402 Procedural manual for operations, maintenance, and emergencies.
[8] 49CFR§195.402(e)(7).

technologies have a high degree of reliability for the general corrosion and possible limited third party damage that might occur in this location. The Township can serve as a proactive agent in assisting the pipeline in avoiding certain threats, such as foreign crossing activities along the pipeline right-of-way that might interfere with the pipeline's safe operation over time, or the safe operation of other infrastructure in these locations that the pipeline might interfere with (such as CP stray current interference).

5) Accufacts' Conclusions

As discussed above, the federal minimum hydrotesting requirements should be appropriate for assuring new pipe integrity for the 20-inch pipeline given that Sunoco protocols are in place to avoid cracking threats as discussed above. Proper communication among parties should also permit the two HDDs for the Mariner 2 East Expansion Project 20-inch pipeline to occur within the Township without endangering existing infrastructure, including the existing 8-inch Mariner East pipeline currently in operation. Accufacts finds that Sunoco exceeds federal girth weld inspection requirements by requiring that all girth welds be 100% radiologically inspected. Such nondestructive inspection during construction provides the gold standard in assessing girth weld integrity as current ILI smart pig technology is not yet capable of reliably assessing girth welds as well as radiological field assessments during construction.

It is also Accufacts' opinion that Sunoco, on the 20-inch Mariner East 2 Expansion pipeline segment that could affect the Township, is exceeding federal pipeline safety regulations in utilizing additional integrity management approaches, prudent pump station design, mainline valve placement and actuation, pipeline monitoring, as well as control room procedures, automatic release detection safety systems, and emergency notification protocols that reflect the level of respect that transporting HVL should require in a prudent pipeline operation. While these efforts cannot guarantee prevention of a release, they reflect a safety attitude that applies up to date steps to avoid a release and respect for the consequences a material release could produce, especially rupture. Accufacts concludes that the Mariner East 2 Expansion Project meets or exceeds the prudent technical approaches commensurate with the safe transportation of HVL.

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President,
Accufacts Inc.