

# **Accufacts Inc.**

“Clear Knowledge in the Over Information Age”

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**Date: September 16, 2019**

**To: Mr. Casey LaLonde  
Township Manager  
West Goshen Township  
1025 Paoli Pike  
West Chester, PA 19380-4699**

**Re: Accufacts Report on the episode on the evening of 8-5-19 at the Mariner East Boot Road Pump Station (“Event”), Boot Road, West Goshen Township, PA**

## **Introduction**

Accufacts Inc. (“Accufacts”) was asked by West Goshen Township to provide an independent review of the Event involving the flare at the Boot Road Pump Station (“PS”). The pump station operates as part of the 8-inch Mariner East (“ME”) 1 pipeline transporting hazardous volatile liquids, or HVLs, from the Marcellus Shale Region of Pennsylvania to Marcus Hook, Pennsylvania. This Report is based on documents and other information provided by Sunoco Pipelines Limited Partnership (“SPLP”) under a Nondisclosure Agreement (“NDA”) with SPLP. The NDA prevents disclosure of certain proprietary information but does not preclude Accufacts from forming its own independent conclusions based on many years of operating experience, including investigating numerous incidents involving explosions.

The Event, experienced as a loud noise and resulting in nearby resident windows and homes shaking, was a backfire, a type of minor explosion, involving the PS flare. Based on the available information and testimonials of the Event, this backfire produced no damage to the PS nor to nearby homes. Backfires, however, should be avoided, because as a form of explosion their consequences can be unpredictable. The Event, based on my experience and knowledge of applicable Commonwealth and federal laws and regulations, was not reportable. After a careful review of the documents including PS Piping and Instrument Diagrams (“P&ID’s), a video of the Event, and detailed discussions with SPLP, I make the following four key observations.

## **1. The PS flare safety equipment worked as designed.**

Various levels of flare safety equipment designed into the PS operation worked as expected. It is worth noting that the PS flare was placed into initial service in late 2014 and has operated since then without incident. Following maintenance activities placing a segment of PS new piping into propane service, a propane/nitrogen sweep in part of the station piping vented mixed propane/nitrogen gas to the flare, causing a flare pilot “flame out” from lack of sufficient oxygen.<sup>1</sup> Nitrogen is noncombustible, even when mixed with certain amounts of propane. The flare system is designed to go into a rapid series of reignition sequence attempts to relight the pilot, should the pilot go out. After a limited number of reignition attempts, if the pilot does not relight within so many seconds, fuel to the pilot and hydrocarbon supply to the flare are automatically shut off. During the reignition sequence, the relighting of the pilot eventually resulted in the combustion of residual gas within the flare resulting in the “backfire.” The backfire was caused by too much purge nitrogen/propane mix within the flare before sufficient oxygen mix could be established.

This unusual and rare situation can be avoided by reducing the rate of nitrogen to the flare during maintenance pipe purging, or by shutting off hydrocarbon supplies to the flare while delaying the flare reignition relight sequence to permit sufficient oxygen mix to return to the flare. SPLP has instituted additional PS maintenance procedures to avoid snuffing out the flare pilot in the future with nitrogen.

## **2. A “backfire” is a type of minor explosion that should be avoided in prudent operations.**

In reigniting the flare pilot, a minor explosion occurred within the flare which could be heard and felt by some nearby neighbors. Explosions, in simple terms, occur when hydrocarbon combustion energy is converted to mechanical energy under certain circumstances and environments. For hydrocarbons, explosions are a specialized form of combustion that span a wide spectrum of forces and consequences. While it is accurate to characterize this Event as a “backfire,” such incidents should be avoided. Due to the inability to reliably predict explosion impacts, my experience indicates that any explosion potential, even backfires, should be avoided through a prudent combination of equipment design as well as operation and maintenance procedures. The flare is intended to be a safety device to prudently burn off certain minor HVL gases produced at the PS during operation and maintenance activities that might otherwise be released to the atmosphere.

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<sup>1</sup> To prevent a possible explosive atmosphere within the pipe, inert nitrogen is often utilized in new pipe station piping to test as well as displace oxygen before hydrocarbon is introduced and in this case the hydrocarbon was propane used to displace the nitrogen.

**3. The experiences reported by some residents near the PS suggest atmospheric overpressure was also generated that went beyond the flare and pump station.**

Residents near the pump station reported the smell of hydrocarbons and houses shaking and windows rattling during the Event, which suggests an atmospheric overpressure, not just a noise, event. The atmospheric overpressure generated in the Event appears relatively minor since, based on the documents, the videos and testimonials, no pump station equipment, including the flare, was damaged, nor was there damage to nearby residences. The Event, however, understandably received Township and public attention and both are justified in raising many questions to understand the difference between a backfire and a serious explosion with blast potential.

**4. The Event was not a major HVL release explosion or blast.**

The forces generated from the Event are on the low end of a wide spectrum of possible explosion forces and atmospheric overpressure outcomes from hydrocarbon combustion. Such combustion forces are dependent on many factors, such as the type of hydrocarbon, its release rate and actual release amount, ignition delay, and terrain/location factors. It is inaccurate to characterize the Event as similar to a major pipeline release. After a careful review of Commonwealth and federal reporting requirements, in my opinion, the Event was not reportable to the National Response Center (“NRC”), the Pipeline and Hazardous Materials Safety Administration (“PHMSA”), the Pennsylvania Public Utility Commission nor the Pennsylvania Department of Environmental Protection, considering the source, cause and amount of gas release for this unusual incident.<sup>2</sup> It is recommended, if a similar Event happens in the future, that SPLP immediately notify the Township Police, and appropriate Commonwealth and County officials responsible for emergency response.

## **Conclusion**

Based on the detailed information provided me, I conclude that the Event was preventable and should be avoided in the future. The Event was caused by an operator/maintenance error in routing too much propane/nitrogen to the flare while placing a segment of PS piping into hydrocarbon service. Modifications to the PS maintenance procedures should be implemented to prevent a reoccurrence. The incident did not rise to the level of triggering an emergency response, though I fully appreciate the Township’s and public concerns in this matter. SPLP should communicate directly to the Township and the public the actions they have taken to prevent a future occurrence.

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<sup>2</sup> See, 49CFR§195.50(a): Reporting accidents if there was a release of hazardous liquid.



Richard B. Kuprewicz,  
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