



# Mariner Pipeline Quantitative Risk Analysis

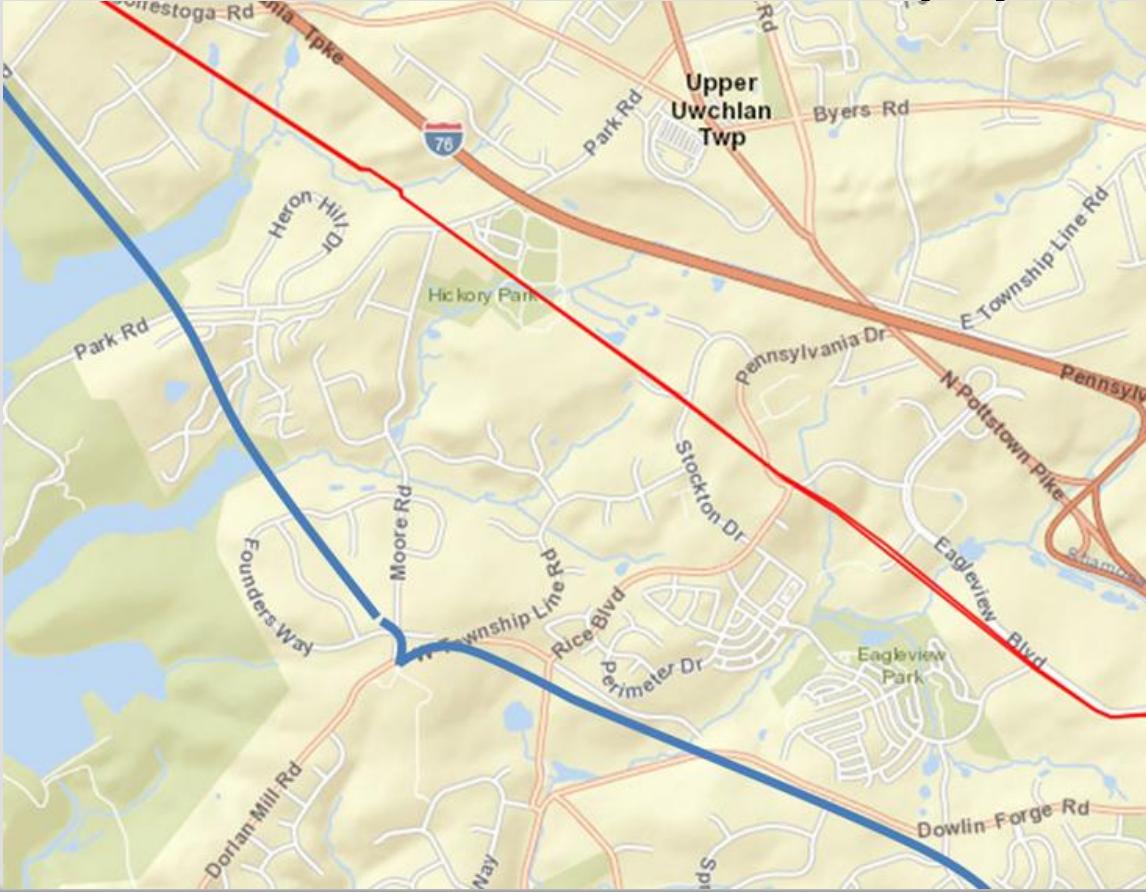
**QUEST**  
CONSULTANTS INC.®

**Chester & Delaware  
Counties, PA**

# Call to Action

- ◆ Intervene in PUC Formal Complaint and Petition for Emergency Relief  
Docket # - C-2018-3006116, P-2018-3006117
- ◆ Review & Update “ALL Hazards” Plan and Evacuation Plan
- ◆ Call on Governor Wolf to revoke the permits.

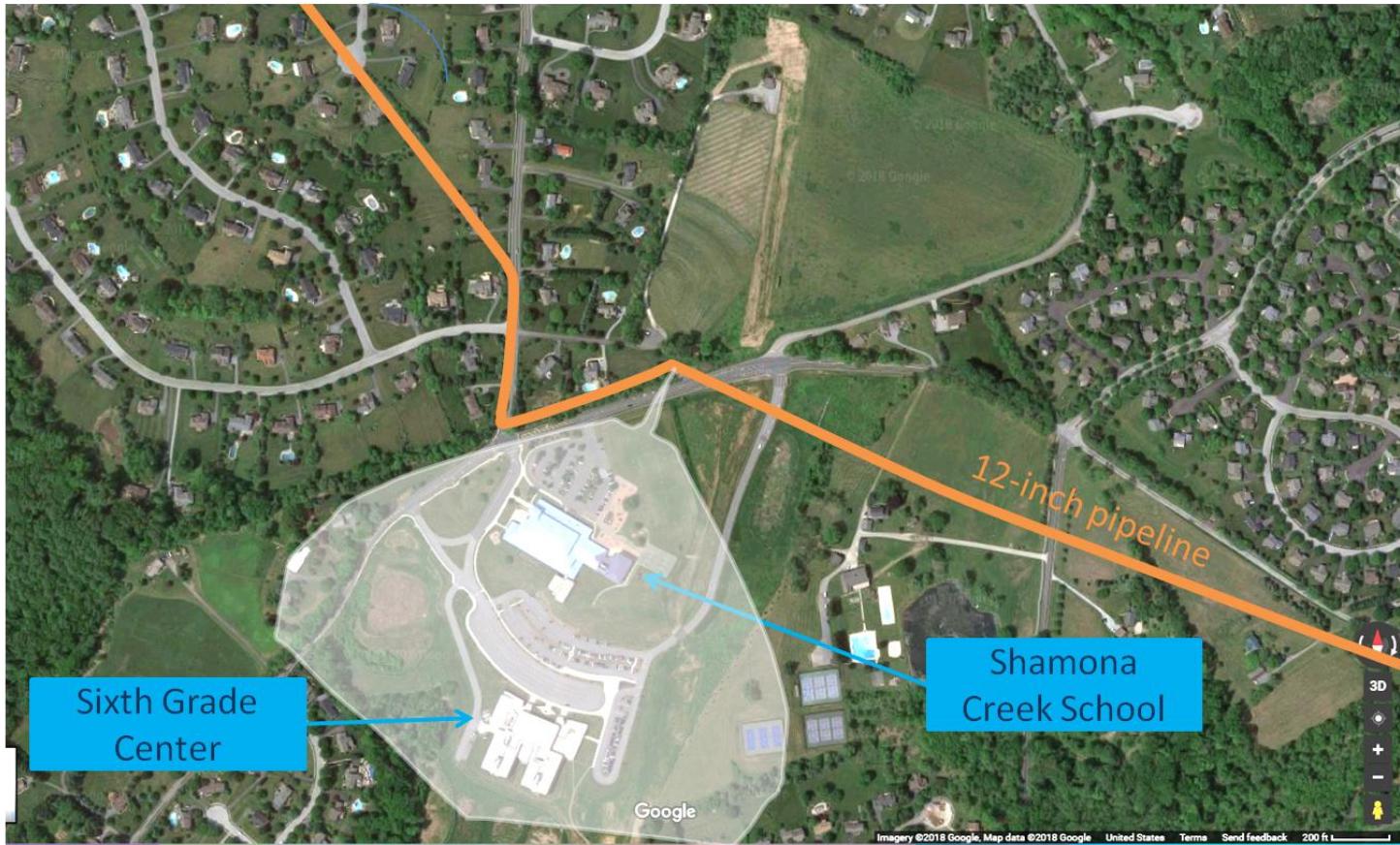
# Where does the 12-inch pipeline go?



# What does the 12-inch line mean for Shamona Creek?

- ◆ We can use the “Canary” software that we leased in connection with the risk assessment
- ◆ It was developed by Quest to calculate the consequences of leaks and ruptures
- ◆ I was part of the two-day class that received training on using the software
- ◆ I have looked at worst-case scenarios for a rupture of Shamona Creek School and Wellington senior facility

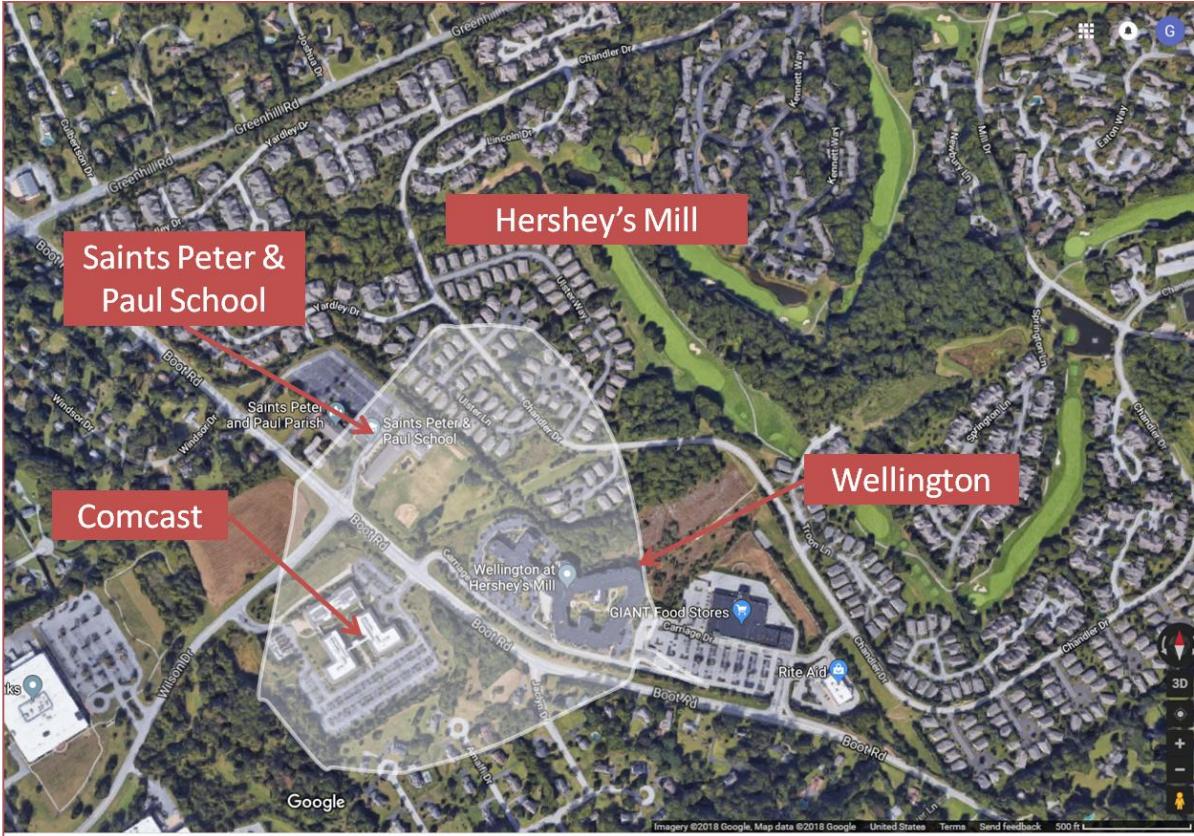
# Shamona Creek: a worst-case scenario



# In the worst case (full rupture):

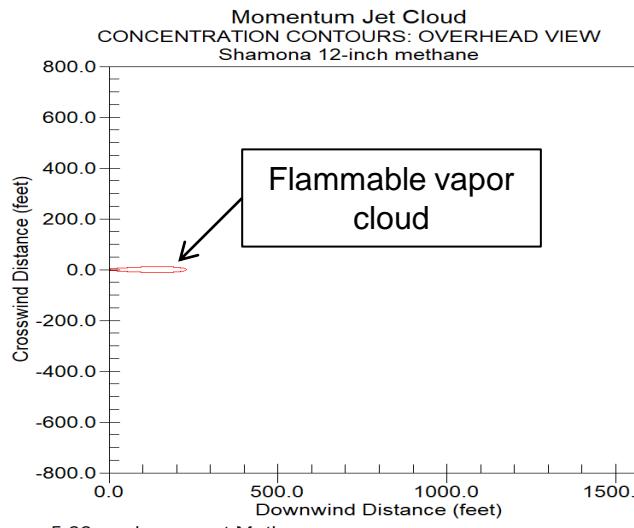
- ◆ A gas vapor cloud would form whose flammable area would extend 1500 feet from the rupture, with a width of 1640 feet
- ◆ Anyone outdoors in the cloud when it ignites would not survive
- ◆ Being indoors may help, depending on how much gas infiltrates the building
- ◆ The ensuing jet fire would hamper rescue efforts and would last for many hours

# Worst case at Wellington



# Methane (natural gas) vs. Propane (NGL) View from above (12-inch pipeline rupture)

## METHANE



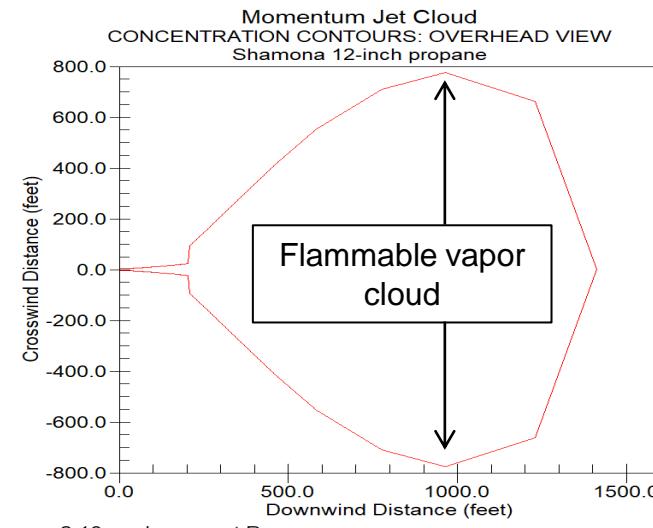
CANARY by Quest

casename=Shamona-12--methane  
windspeed = 2.0 mph

F stability

Mon Nov 12 17:11:44 2018

## PROPANE



CANARY by Quest

casename=Shamona-12--propane  
windspeed = 2.0 mph

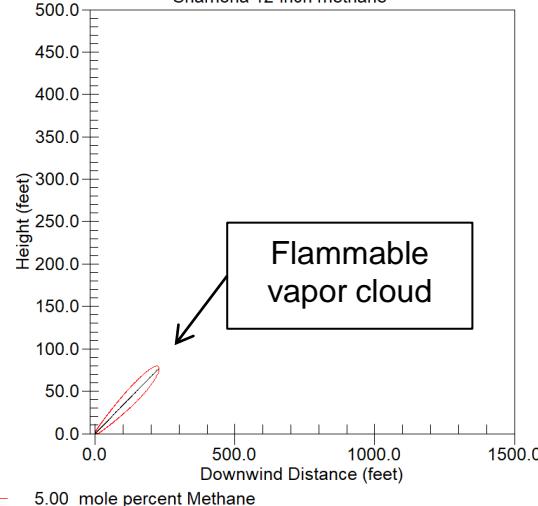
F stability

Mon Nov 12 17:00:55 2018

# Methane (natural gas) vs. Propane (NGL) View from the side (12-inch pipeline rupture)

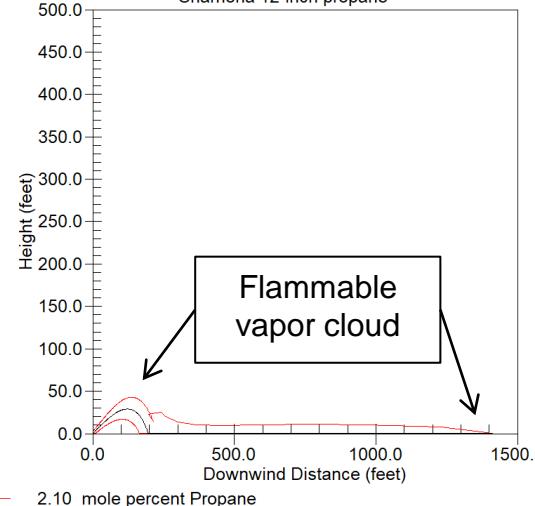
## METHANE

Momentum Jet Cloud  
CONCENTRATION CONTOURS: SIDE VIEW  
Shamona 12-inch methane



## PROPANE

Momentum Jet Cloud  
CONCENTRATION CONTOURS: SIDE VIEW  
Shamona 12-inch propane



CANARY by Quest

casename=Shamona-12--methane  
windspeed = 2.0 mph  
F stability  
Mon Nov 12 17:11:44 2018

CANARY by Quest

casename=Shamona-12--propane  
windspeed = 2.0 mph  
F stability  
Mon Nov 12 17:00:55 2018

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# Want to look at these slides again?

They will be posted tomorrow on Dragonpipe Diary



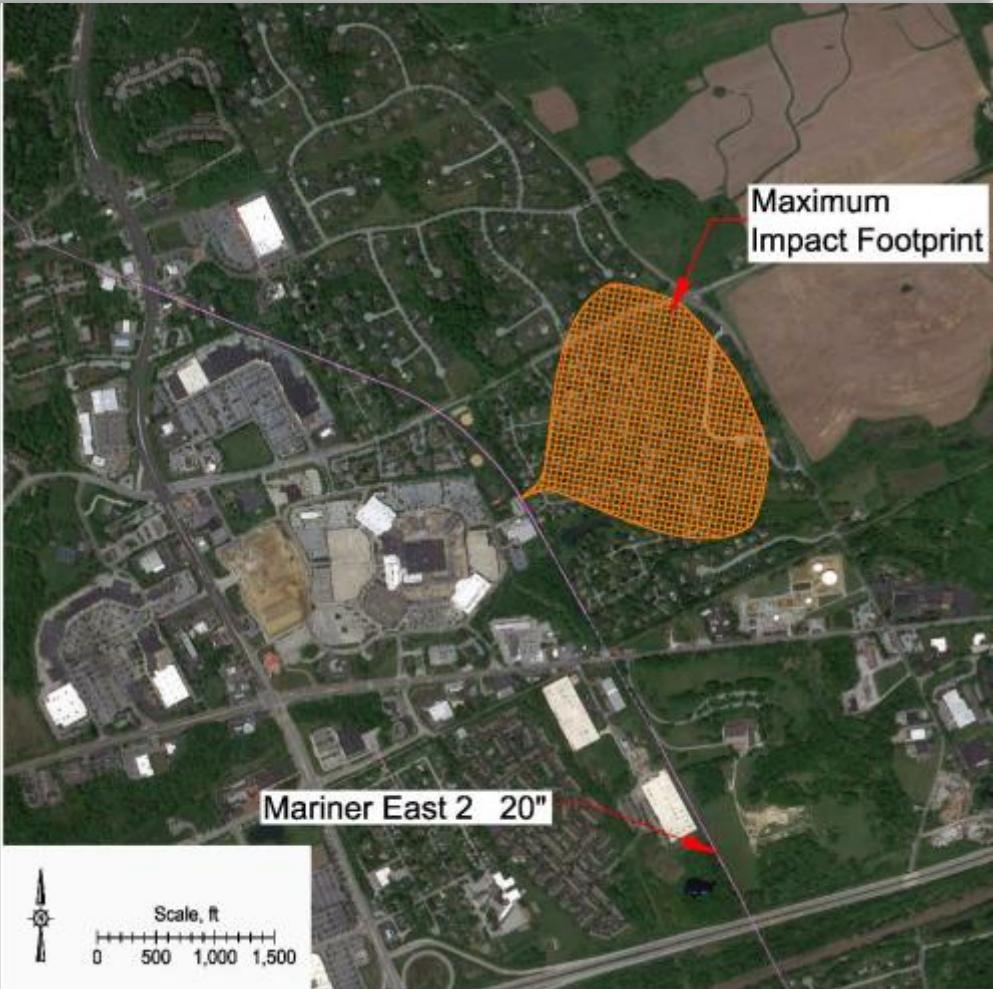
[www.dragonpipedairy.com](http://www.dragonpipedairy.com)

# Appendix

# Impact Zone (or Footprint)

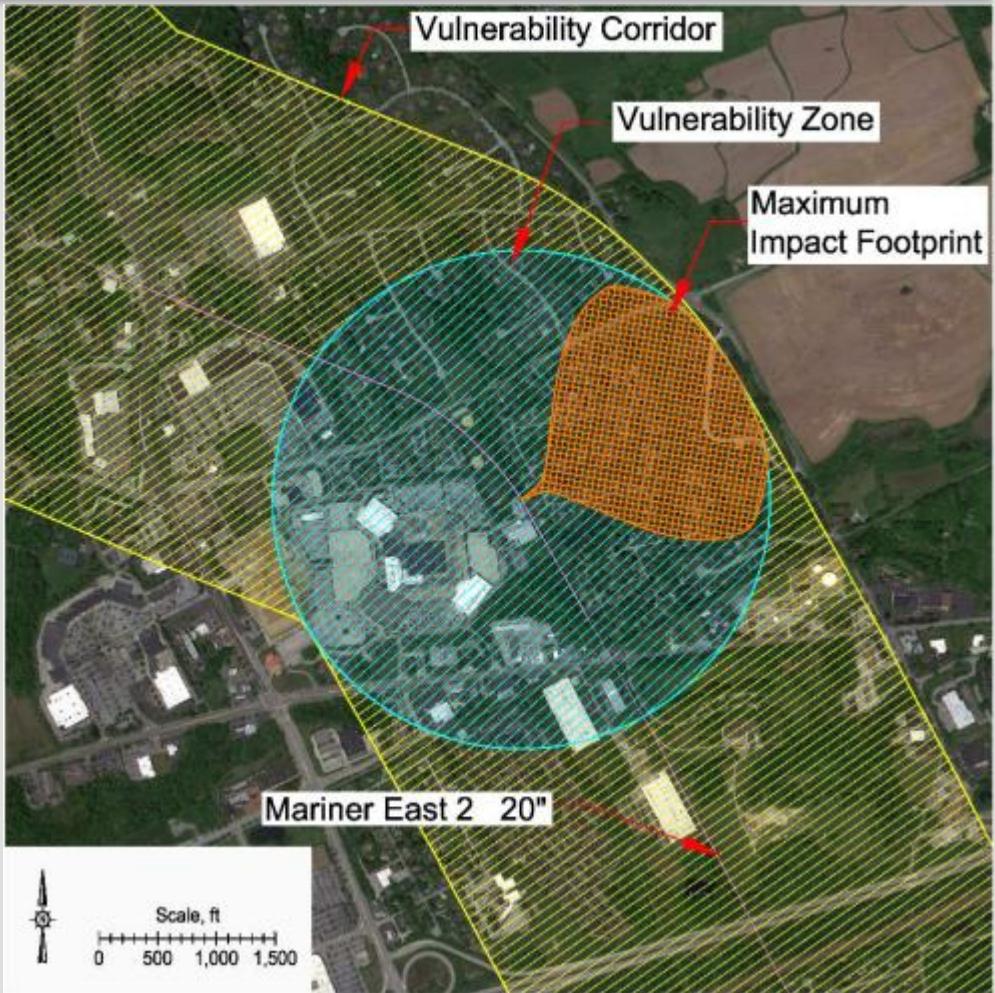
The area over which a given incident outcome is capable of producing undesirable consequences

Chester County Library Area



# Vulnerability Zone

The area within the circle created by rotating an impact zone around its points of origin.



# Key Findings

- ◆ Modeled consequences of a release of hazardous, highly volatile liquids extend up to 2,135 feet from pipeline
- ◆ Valve sites and pump stations carry a heightened likelihood of release. Unacceptable risk exists at these sites compared to international criteria
- ◆ HDD entry and exit points are locations of a heightened likelihood of a release
- ◆ Two pipelines doubles probability of an accident, three triples, etc.
- ◆ Even the smallest possible leak in an NGL transmission pipeline can result in fatal fire or explosion.

# Key Findings

- ◆ These pipelines (based on industry-wide failures of pipelines carrying highly volatile liquids, and not considering Sunoco's industry-worst leak record) are likely to average a leak every 2 or 3 years, statewide.
- ◆ For the three specific locations studied in detail, the study shows exactly which homes and buildings are in harm's way, and how serious their risks are.
- ◆ Wooded areas serve to increase the surface area of a gas cloud and act to worsen the consequences of a vapor cloud explosion. In cases modeled using CANARY, the presence of trees increased the blast radius beyond what it would have been without trees.

# Key Findings

- ♦ There is a threshold rate of release below which the operator is unable to detect a leak is occurring. This threshold release rate is large enough that it could produce very serious consequences including injuries, death, or property damage.
- ♦ Should there be a leak or rupture of a particular segment that IS identified by the operator, it will take many minutes (even under best possible circumstances) to close block valves. Even with block valves closed, highly volatile liquids will continue to vent from the breach until the failed segment is substantially emptied.
- ♦ Should county emergency services departments be informed of a leak, they intend to operate their “reverse 911” systems to notify residents via phone of the need to self-evacuate or other instructions. However, the federal pipeline regulator advises against the use of telephones and cell phones, warning “these can ignite airborne gases.”

# Sunoco's changing plans

- ◆ Several HDD sites were either abandoned or changed to open trench, so work on 20-inch and 16-inch pipeline is not complete
- ◆ Sunoco decided (after the risk assessment was completed) to use an old 12-pipe to bypass incomplete parts of ME2
- ◆ So where does the 12-inch line go and what can we say about its risks?

# About Quest Consultants Inc.

- ◆ Formed in 1989
- ◆ Process safety engineering consultants, specializing in consequence and risk analysis of hydrocarbons
- ◆ Clients include PHMSA and other government entities, oil and gas industry
- ◆ Also provide training for consequence and risk analysis

# A Historic Community Initiative

- ◆ One simple, unanswered question asked by thousands
- ◆ Specific concerns regarding seniors, children, most vulnerable
- ◆ Joint effort by community members, community groups, and municipalities
- ◆ Individuals involved in procurement with backgrounds in engineering, risk management, environmental advocacy, emergency management, health care, law and earth science
- ◆ Crowdsourcing of funding, grants, municipal contributions
- ◆ Since onset of the Citizens Risk Assessment, two other risk assessments have been initiated, creating a more comprehensive analysis

# What this study includes:

- ◆ Individual risk of fatality from an ignited vapor cloud
- ◆ Hazard Analysis
- ◆ Frequency Analysis
- ◆ Consequence Analysis: Application of Quest's proprietary software, CANARY by Quest®, for calculations of exposure areas to fire or explosion effects that have a potential for fatal impacts (injury impacts and property damage were not evaluated)
- ◆ Risk Calculation and Assessment

# What this study doesn't include:

- ◆ **Individual risk vs. population risk.** The report does not distinguish between risk to a single person and risk to a group (e.g. a school or a mall).
- ◆ **Injuries or burns.** An accident would cause many injuries, including life-changing burns, but these are not studied.
- ◆ **Operator record**
- ◆ **Flat terrain assumed.** The software does not take pooling in low-lying areas into account.
- ◆ **Other risks not studied:** calm winds (which could result in bigger explosions), toxic smoke from fires triggered by an explosion, asphyxiation hazard.

# Frequency Analysis

- ♦ PHMSA database for HVL pipeline releases
- ♦ HCRD for aboveground equipment
- ♦ In Chester & Delaware Counties, 1 release every 79 years per Mariner pipeline (35 miles)
- ♦ If ME1 + ME2 + ME2X: 1 release every 26 years
- ♦ For ME1 + ME2 + ME2X in all of Pennsylvania: 1 release about every 2.8 years (1,000 miles)

# Consequence Analysis

- ◆  $\frac{1}{4}$ ,  $\frac{3}{4}$ , 2, and 6-inch holes, plus pipeline rupture
- ◆  $\frac{1}{4}$  inch (leak) worst case for ME2/propane
  - Maximum 120 foot flammable cloud (flash fire)
- ◆ Rupture (20 inch) worst case for ME2/propane
  - Maximum 2,130 foot flammable cloud (flash fire)
  - Maximum 1,010 feet for burns from jet fire

# Site-Specific Risk

- ◆ Location-specific **individual** risk calculated for
  - Near Glenwood Elementary School (valve site)
  - Near Delaware-Chester Counties line (HDD to open trench)
  - Near Chester County Library in Exton
- ◆ Accounts for
  - Buried pipe vs. HDD, valve stations
  - Impacts to individuals, continuous occupancy
- ◆ Does not account for population in the area