

“Blast Zone” along the Pilgrim pipelines: Grounded in Reality? Pipeline Incidents Resulting in Fire or Explosion

Introduction Petroleum pipelines (as distinct from natural gas ones) can literally explode. How frequent are such events and how forceful? Are they ever big enough that a “blast zone” should be described along a petroleum pipeline analogous to the [blast zone](#) along oil train routes mapped by STAND (formerly Forest Ethics)? To assess the frequency of and the size of “explosions” related specifically to petroleum pipelines as opposed to natural gas lines, I used chronological logs from Wiki. One is [worldwide](#). Two others list all significant incidents in all types of pipelines in the USA and Puerto Rico from [1975-1999](#) and [2000-2016](#). The definition of significant is given on the [PHMSA web site](#).

This paper tabulates and briefly describes five big petro-pipeline explosions outside the United States since 1959 and all thirty-six within the United States since 1975, none of which was so powerful or so lethal as ones in China and Nigeria. I singled out all incidents that involved *either fire or explosion* (f/e) in a pipeline transporting crude oil or one of the following refined products: gasoline, distillates, kerosene, jet fuel, diesel fuel, aviation fuel. “Distillates” covers heating oil and “fuel oil.” I omitted highly volatile liquids such as propane, ethane, and butane. Incidents that started inside a refinery or terminal or on a rig were not counted.

The wiki list cannot be 100% complete. What list can? It contains all five of the petro-pipeline f/e incidents reviewed by the [National Transportation Safety Board](#) over a similar time span. Between 1960 and 2014 the NTSB logged 122 incidents of all kinds in all types of pipelines. Two other sources for pipeline accidents of all kinds are that of a personal injury [law firm](#) and a [map](#) by ProPublica. These can be used for cross-referencing.

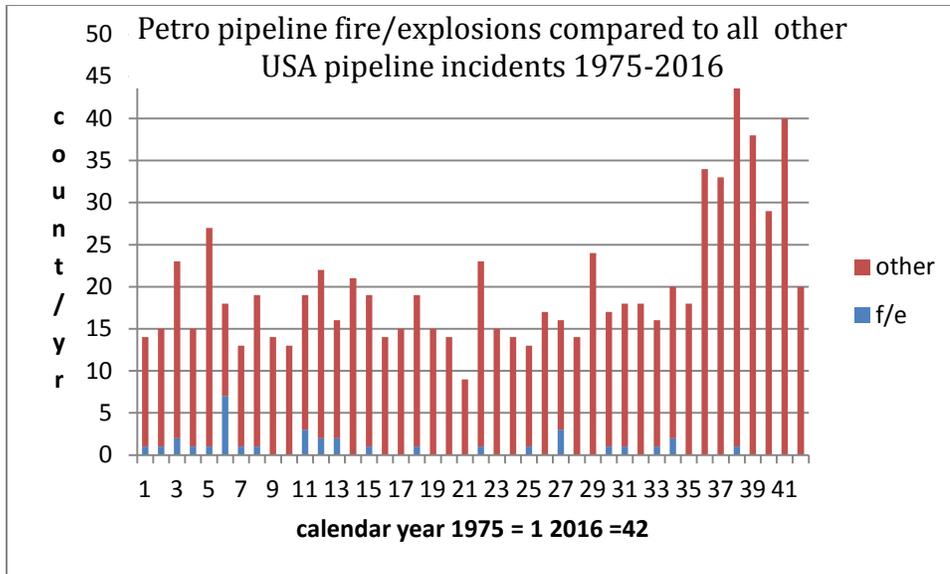
The most forceful petroleum pipeline detonation I know of occurred in the port city of Qing Dao, Shandong Province, China on 22 November 2013. A crude pipeline that had been leaking detectably for about 8 hours was being worked on. It exploded, [overturning vehicles](#) and cratering the street. Fifty –five people were killed. Investigation later attributed the blowup to

workers' use of a hydraulic hammer without spark suppression. There has been no explosion this big in the USA related to a petroleum line.

Wiki tallies other calamitous [incidents](#) worldwide. In 1959 a crude oil pipeline in Coatzacoalcos Mexico was leaking when, by a newspaper account, "suddenly an explosion was touched off" with flames 300 feet high. In 2010 San Martin ,Texmelucan, Mexico, a crude pipeline at a pumping station seemed to explode. The government reported crude oil thieves had been trying to tap it and may have triggered the blast. The word "explosion" was also used about a huge fire in a crude pipeline entering a storage tank in Dalian China in 2010. The word was applied to a hideous accident in Nairobi in 2011 in which a leaking "fuel tank" released liquid that ran into the sewers and was touched off, perhaps by a cigarette or airborne embers from a trash fire. Nigeria, sad to say, has had at least eight lethal oil pipeline leaks that turned into infernos. Most of these are ascribed to people stealing petroleum but at least one was caused by a bulldozer's hitting a pipeline. In 1998 in Jesse, Nigeria over 1000 people died in a pipeline-leak fire blamed variously on sabotage or thievery. No other petro-pipeline accident has killed so many. The most lethal one in the United States caused nine deaths.

Findings The graph below, made from the two USA lists on wiki covering 1975 into 2016, shows the annual count of petro-pipeline fire/explosions (blue) and (in red) of all other pipeline incidents (including natural gas lines with and without f/e). Data for 2016 go up to Sept 10, but are reported here as for a whole year without adjustment. Natural gas pipeline incidents without and with fires /explosions made up more than half of the grand total.

Over the 42 years there were 836 incidents reported, of which 36 (4.3%) were fire/explosion (abbreviated f/e) related to a petro-pipeline. The annual average for all incidents in all pipelines was 19.9; that for f/e related to petro-pipeline was 0.83 per year. Ten (29%) of petro-pipeline fire/explosions were in crude oil lines. In 2014 the [56375](#) miles of crude oil pipelines made up about 38% of the 146038 petro-pipeline miles in the US.



The 36 incidents of fire/explosion in a US petro-pipeline are listed in the Table 1 below.

Location	State	Pipeline name	Date	Type	Into water?	Type	Deaths
New Lenox	IL	Enbridge	3/3/2012	crude	N	1	
Colon	MI	Amoco	12/5/2008	gasoline	N	1	
McCook	TX	Hesco	2/14/2008	distillates	N	2	
Clearbrook	MN	Enbridge line 3	11/13/2007	crude	N	2	
Lufkin	TX	Sunoco	8/11/2005	crude	N	1	
Walnut Creek	CA	Kinder-Morgan	11/9/2004	gasoline	N	1	5
Mannheim	PA	Exxon-Mobil	7/24/2001	gasoline	N	2	
Taylor County	TX	Potosi	5/24/2001	"oil"	N	1	
Bottineau	ND	Dome	4/1/2001	gasoline	N	2	
Bellingham	WA	Olympic	6/10/1999	gasoline	Y	2	3
Grand Haven	MI	Wolverine	9/26/1996	petroleum	N	1	
Leitchfield	KY		3/11/1992	crude	N	2	
San B'dino	CA	Calnev	5/25/1989	products	N	2	2
Odessa	TX		4/18/1987	crude	N	2	
Corsicana	TX	Mobil	3/12/1987	"oil"	N	2	
Mounds View	MN	Williams	7/8/1986	products	N	2	2
Elmhurst	IL	Amoco	5/14/1986	gasoline	N	2	
Mercer Co	NJ		1/31/1986	gasoline	Y	2	
Indianapolis	IN	Marathon Oil	8/2/1985	gasoline	Y	2	3
Midwest	WY	Seminole	7/23/1985	jet fuel	N	2	1
Dallas	TX	Explorer	6/19/1985	gasoline	N	1	
Albany	GA	Colonial	6/15/1982	# 2 fuel	N	1	1

Goldsmith	TX	Phillips 66	9/15/1981	gasoline	N	1	
Berwick	LA	Texas Pipeline	1/2/1980	crude	N	2	
Bayamon	PR	Pipelines of PR	1/30/1980	products	Y	2	1
Marcus Hook	PA	Sunoco	3/7/1980	gasoline	N	3	
Roseville	MN	Williams	4/16/1980	gasoline	N	2	
Piney Point	MD		9/12/1980	oil	N	2	1
San Ysidro	NM	Texas NM Oil	10/22/1980	crude	N	1	1
Las Vegas	NV	Calnev	12/22/1980	jet fuel	N	2	
Toledo	OH	Sun	4/21/1979	gasoline	N	2	
Hackberry	LA	Strategic Pet R	9/22/1978	crude	N	2	1
Lakewood	CA		8/15/1977	petroleum	N	2	
Pump Sta. 8	AK	Trans-Alaska	7/8/1977	crude	N	2	
Los Angeles	CA	Standard of CA	6/1/1976	gasoline	N	1	9
Lima	OH	Mid-Valley	1/17/1975	crude	N	2	1

Table 1. Incidents of fire or explosion in a petro-pipeline in USA 1975-Sept 2016. Locations and dates are from the two lists in wiki referenced above.

Codes for type of accident: 1 means struck, ignited immediately; 2 means leak ignited later. This categorization is mine. The hyperlinks are nearly all from the wiki compilation.

Twenty-three (70%) of the petro-pipeline fire explosions I classified as “2” meaning *leak ignited later*. In the majority of these the explosion /fire was thought to have been touched off during repair work on an already-known leak, with a latency from minutes to two weeks. Leaving out one possible act of sabotage (code 3), all the others I classed as “1” meaning *struck, ignited immediately*. Most of the 1 category involved earthmoving equipment like a bulldozer or backhoe, though there were two cases in which passenger vehicles struck a pipeline fixture.

The causes of the leaks in the 2 category were similar to the causes of leaks that did not lead to fire/explosion. Weld failures (girth or longitudinal) and corrosion (internal or external) were the most common explanations. In one case a derailed train (not oil train) probably damaged the pipeline. Human error was a factor in a few of the 2 incidents and in all the 1 ones. In a minority of the incidents the volume or crude or products lost was estimated. I did not record these.

There were 31 deaths in the 42 years. The persons killed were most often workers. The highest number of fatalities resulted from an accident in Los Angeles in 1976 in which a front-end loader doing street repairs hit a gasoline pipe on [Venice Blvd](#). Walnut Creek CA in 2004 saw the second-

highest number of deaths from a petro-pipeline explosion A backhoe hit a gasoline line. An “explosive fireball” followed with five deaths.

Perhaps the most notorious petro-pipeline fire/explosion incident in the USA was on June 10 1999 in Bellingham WA. A gasoline pipeline ruptured when a pressure relief valve failed. Gasoline ran into Whatcom creek and reportedly “exploded.” Two ten-year old boys who had a butane lighter “in their possession” had been playing on the befouled creek. Investigation concluded they had ignited the blaze. Both lads died later; an 18 year old trout fisherman overcome by fumes drowned. In [Mounds View MN](#) in 1986 (July 8) unleaded gasoline spewed onto the street from a broken 8-inch line at 4:20 AM. Minutes later an auto came on the street. There was an “explosion-like noise.” The driver and her seven year old daughter were killed.

I could find no incidents involving twin parallel petro-pipelines like the proposed Pilgrim Pipelines. Pipelines are often close to each other at refineries and storage terminals. Enbridge Line 2 has parallel lines under Lake Michigan. I do not know how many miles there are of close-together parallel lines in the country.

A striking feature of this case series is that in the last ten years total significant incidents have increased greatly (averaging 29.3 per year counting 2016 as whole year compared to 17/yr in the earlier epoch 1975-2006). Fire/explosions in petro-pipelines (averaging 0.4/yr), by contrast, have been 50% less frequent than over the previous 32 years.

Though natural gas was not my topic here, scanning these lists makes it clear that leaks in natural gas lines are more powerfully explosive than those in petro-lines. Any closeness during construction or repairs is extremely dangerous. There are several places along the proposed Pilgrim route in NYS where natural gas pipelines are near the proposed route.

Discussion. This review of petro-pipeline fires and explosions worldwide with focus on the USA shows that

- Explosions, averaging almost one a year over the last 42 years, are not rare.
- No incident anywhere released energy fast enough to damage structures (except maybe

windows) more than 300 yards away

- In the last ten years the rate of fire/explosions has gone down sharply. This may well indicate improved methods, e.g. better “dig safely” standards; more training for heavy equipment operators; better use of Supervisory Control And Data Acquisition (SCADA) to detect leaks; greater skill in repairing leaks without causing fire.
- The rate of total significant incidents has risen fast in recent years. This cannot be explained by added mileage; from 2001 to 2014 total petro-pipeline mileage increased by only 3.6% from [154877](#) miles. This trend needs a lot of attention from opponents of pipelines.

Conclusion in re the concept of a blast zone along the proposed route of the Pilgrim pipelines. I don't think that even in a worst case scenario would an explosion in a single petro-pipeline like one line of the proposed Pilgrim pipelines' two have impact as far from the pipeline as those from a “bomb train” are projected to, namely a mile. I am not enough of an engineer to project the effect of one line's exploding and causing the adjacent one to blow up too. *This should be addressed in the scoping process.* Certainly I think that if a crude oil or refined products pipeline is leaking even at a low rate, everyone within a half mile radius should be evacuated until repairs by skilled experts are completed. If the leak is in one line of a twin pair, the evacuation radius should be bigger. Thus, for the Pilgrim pipelines *plural* the concept of a “blast zone” is not an exaggeration.

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<http://www.reuters.com/article/us-usa-pipelines-colonial-analysis-idUSKCN1200FQ>