Danger Around the Bend

the threat of oil trains in Pennsylvania

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DANGER AROUND THE BEND

THE THREAT OF OIL TRAINS IN PENNSYLVANIA

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Executive Summary

The increasingly common practice of transporting Bakken Formation crude oil by rail from North Dakota to points across the nation—including Pennsylvania—poses a significant risk to the health, well-being, and safety of our communities.

This risk is due to a confluence of dangerous factors including, but not limited to:

1. Bakken Formation crude oil is far more volatile and combustible than typical crude, making it an incredibly dangerous commodity to transport, especially over the nation's antiquated rail lines.

2. The routes for these trains often travel through highly populated cities, counties and neighborhoods – as well as near major drinking water sources.

3. Bakken Formation crude is often shipped in massive amounts—often more than 100 cars, or over 3 million gallons per train.

4. The nation's existing laws to protect and inform the public, first responders, and decision makers are woefully inadequate to avert derailments and worst-case accidents from occurring.

In the past few years, production of Bakken crude oil has dramatically increased, resulting in greater quantities of this dangerous fuel being transported through our communities and across the nation every day. This increase has led to more derailments, accidents, and disasters involving oil trains and putting local communities at risk. In the past 2 years, there have been major disasters in Casselton, North Dakota; Lynchburg, Virginia; Pickens County, Alabama; and most recently, Mount Carbon, West Virginia. The worst of these was the town of Lac-Mégantic, in Canada's Quebec Province. This catastrophic oil train accident took place on July 6, 2013, killing 47 people and leveling half the town.

Oil train accidents have not just taken place in other states, they have also happened closer to home. Pennsylvania has had three near misses in the last two years alone—one near Pittsburgh and two in Philadelphia. In all three cases, trains carrying this highly volatile Bakken crude derailed in densely populated areas, and in the derailment outside of Pittsburgh, 10,000 gallons of crude oil spilled.[1] Fortunately these oil train accidents did not lead to explosions or fires.

Photo: Paul Corbit Brown

Mt. Carbon, West Virginia disaster

All of these incidents point to one fact: that unless we take action to curb the growing threat of oil trains, the next time a derailment occurs an unsuspecting community may not be so lucky.

Bakken oil train routes often travel through high-density cities and neighborhoods, increasing the risk of a catastrophic accident for Pennsylvania's residents. Reviewing GIS data and statewide rail routes from Oak Ridge National Laboratory, research by FracTracker and PennEnvironment show that millions of Pennsylvanians live within the potential evacuation zone (typically a half-mile radius around the train explosion [2]). Our findings include:

- Over 3.9 million Pennsylvania residents live within a possible evacuation zone for an oil train accident.
- These trains travel near homes, schools, and day cares, putting Pennsylvania's youngest residents at risk. All told, more than 860,000 Pennsylvania children under the age of 18 live within the ½ mile potential evacuation zone for an oil train accident.
- Philadelphia County has the highest at-risk population—Almost 710,000 people live within the half-mile evacuation zone. These areas include neighborhoods from the suburbs to Center City.
- Allegheny County had the second largest population within the evacuation zone, with just over 507,000 people.

- 16 of the 25 zip codes with the most people at risk—the top percentile in the state—are located in the city of Philadelphia. (For the full list of the top 25 zip codes at risk, see Table A-1 in the Appendix).

- The top five Pennsylvania cities with the most residents at risk are: Philadelphia (709869, residents), Pittsburgh (183,456 residents), Reading (70,012 residents), Scranton (61,004 residents), and Erie (over 51,058 residents).

Besides the inherent threat of moving massive amounts of the highly volatile fuel that is fracked from North Dakota's Bakken Formation, the lack of proper safety regulations and basic right-to-know laws increases the likelihood of a catastrophic accident. Some of the biggest problems when it comes to regulating oil trains in America include:

- **The over-reliance on dangerous and dirty fossil fuels in U.S. will continue to put our health, environment and communities at risk.** As long as the nation continues its reliance on dirty, dangerous fuel sources like oil from the Bakken Formation—and transporting it from the Midwest to point across the nation—the threat of a serious accident or catastrophe will exist. We must do more to move the nation off of these polluting, dangerous fuel sources and onto clean energy alternatives that exist today and won't pose the threat of oil trains.

- **The U.S. must halt the transport Bakken crude until proven safe—instead of increasing the transport of this fuel until a catastrophic accident occurs.** Bakken crude is highly volatile and poses an extreme threat to communities, be it by oil trains or pipeline. Until the oil companies can ensure safety for local communities, this practice must be stopped.

- **The general public lacks the necessary information about oil trains traveling through their communities, in order to be able to respond to a train derailment or explosion.** Residents, community leaders and first responders are largely unaware these trains are traveling through their cities, leaving them wholly unprepared should disaster strike. It is essential that local community members, their leaders, and first responders have access to information about when these trains are traveling through their communities, how much oil they're carrying, and safety measures taken by the rail companies to protect the public.

- **Oil trains are often routed through heavily populated communities.** As the data in this report show, oil trains put millions of Pennsylvanians at risk. If trains will continue to be used as a means of oil transport, we need to ensure that they don't pass through our cities and densely populated communities.

- **Oil companies do not pay their fair share to transport oil in this dangerous fashion, leaving incentives to cut corners and put communities at risk.** Loopholes in existing laws allow oil companies to hold only minimal insurance or bonding in preparation of a worst case scenario. For example, Quebec submitted a $400 million claim following the the Lac-Megantic disaster[3]—yet the train company was insured for only $25 million, leaving taxpayers holding the bag and adding insult to injury for local residents.[4] This should not be the case—there should be mandatory insurance coverage for disasters. These oil companies should also assess fees to both cover the cost of impact on communities, as well as stricter safety violation fees.

- **America's rail system is ailing, and rail lines that have been out of service for years are now springing back into use following the Bakken oil boom.** Trains traveling on dilapidated rail lines and bridges increases the likelihood of an oil train derailment. To make matters worse, outdated train cars that are proven to be unable to deter accidents or explosions are often used to transport the crude on oil trains. Outdated train cars need to be retired, the railways these trains travel on should be repaired and be regularly inspected, and a safe speed limit for all trains carrying Bakken crude should be implemented.

This report shows that we must protect Pennsylvania's communities from the growing threat of oil trains carrying explosive crude from the Bakken Formation. Through the implementation of commonsense policy solutions, we can help to protect the millions of Pennsylvanians at risk and gradually move away from dirty and dangerous fossil fuels, towards a clean energy future.

Photo: (left) Wikimedia (right) Flickr

Lac-Mégantic, Quebec oil train disaster

The growing practice of shipping volatile oil from North Dakota's Bakken formation by rail is putting Pennsylvania's—and America's—communities at untold risk.

This risk has become all too apparent with the recent CSX oil train disaster near Mt. Carbon, West Virginia on February 16, 2015. In that recent accident, the train derailed, exploded, and then burned for days while contaminating the neighboring Kanawha River which supplies drinking water for downstream communities, and burned a home to the ground.[8]

And with dramatic uptick in oil train traffic, the threat of a major accident to our neighborhoods and communities will only increase.

Sadly, the story of Mt. Carbon's train derailment and explosion are all too familiar: numerous accidents and oil train catastrophes have taken place in the past few years, horrifically demonstrating the danger these trains pose. Between 2012 and 2014, 8 major accidents and 250 safety incidents involving oil trains occurred in North America.[9]

These figures include the worst oil train accident that has occurred to date took place in the Canadian town of Lac-Mégantic in the Province of Quebec on July 6, 2013. At 1:15 am, a train carrying 60 railcars of highly volatile and explosive Bakken Formation oil broke free of its moorings and rolled downhill into the town. The train cars derailed in the dead of night and exploded into a massive, catastrophic fireball. Firefighters and first responders weren't able to get within ½ mile of the explosion.[10] All told, it took more than 1,000 firefighters from 30 towns and over 1 million gallons of water to put out the explosion. When the fire was finally extinguished, 47 people had lost their lives.[11]

"For several minutes we tried to convince ourselves that it wasn't true. But what happened to us was a nightmare. When we removed our hands from our eyes, the horror was still there and the worst was yet to come," said Roy Laroche, Lac-Mégantic resident, recalling the horrific oil train crash.[12]

At the same time, Pennsylvania has seen numerous near misses when it comes to oil train derailments and accidents. In January 2014, a train derailed while traveling on a bridge over the Schuylkill River and I-76 in Philadelphia. Seven train cars dangled over the river, and the interstate was shut down for several hours.[13] Yet less than a month later, a Bakken crude oil train derailed in Vandergrift, Pennsylvania, located 36 miles northeast of Pittsburgh. One of the

21 train cars that derailed crashed into a metal processing plant, and 10,000 gallons of crude oil spilled.[14] Most recently, a freight train containing crude oil traveling to an oil refinery in south Philadelphia derailed on January 31, 2015. Fortunately no leak, fire or explosion resulted.[15] And the risk from oil trains in Philadelphia appears to be growing: more than 65 cases of oil train cars traveling to Philadelphia have been reported to have faulty, leaking, or absent safety components.[16]

Lack of protective policies leaves Pennsylvania's communities at risk

From the explosion in Casselton, North Dakota to the catastrophic oil train accident in Quebec to the many near misses in Pennsylvania and the most recent disaster in West Virginia, it is clear that oil trains put our communities at risk for death, injury, and destruction.

In the past few years, the number of trains carrying oil from the Bakken Formation throughout Pennsylvania has increased dramatically. The daily oil production in North Dakota has increased nearly 14-fold since 2012, leading to more oil being transported across the country daily.[17] And with more train traffic comes more risk of accident.

Besides the inherent threat of transporting highly volatile oil by rail, the lack of commonsense policies to protect the public increases the risk for future oil train explosions or derailments in Pennsylvania and elsewhere.

For example, one of the most egregious examples of policy shortfalls is the fact that oil and rail companies are not required to inform local neighborhoods or municipalities about the oil trains traveling through their communities. This makes it impossible for local officials and first responders to prepare for accidents. Access to information about oil train routes and risks is a core premise of the general public's ability to hold a thoughtful discussion about how to tackle this pressing issue.

Another challenge is America's dilapidated infrastructure—and the lack of initiative by policymakers to fully address this problem. America's rail lines are in deplorable conditions, and poor infrastructure can lead to derailments, triggering explosions and significant damage. The nation's infrastructure is in such disarray that the American Society for Civil Engineers gave it the grad of a D+.[18] This score includes America's railways, and rails that were long abandoned have sprung back into use to accommodate the oil boom of the past five years. [19]

To add insult to injury, when oil train disasters have happened, it's possible that the local communities could shoulder the brunt of the cost. Quebec submitted a claim for the Lac-Mégantic oil train disaster to cover $400 million in damages[20]—but the train company responsible only had liability insurance of $25 million. Even worse, the train company filed for bankruptcy following the accident, leaving the victims without any financial assistance or payment for damages or loss of life.[21] If rail and oil companies must be prepared to be insured or bonded to cover the full cost of a worst case disaster, they are more likely to take further precautions in order to protect their bottom line.

The infrastructure used to transport volatile crude oil is inadequate. The Federal Railroad Association admits its inspectors are able to inspect less than one

BAKKEN CRUDE:
How we get it and why we ship it

Bakken crude oil comes from drilling in the Bakken Formation, located in North Dakota. It contains deposits of both oil and natural gas, which can be accessed by hydraulic fracturing, or "fracking." Until recent technological developments, the oil contained in the formation was too difficult to access to yield large production. But advances in this extraction technology since 2007 have transformed the area into a major oil producer—North Dakota now ranks second in the U.S. for oil production.[5] The vast expansion of wells over the last 4 years (from 470 wells to over 3,300 today) means that there is more oil to transport to the market, both domestically and abroad.[6] This increase is especially concerning considering that the U.S. Department of Transportation stated in early 2014 that Bakken crude oil may be more flammable than traditional crude, therefore making it more dangerous to transport by rail. [7]

percent of America's railroad system.[22] This number is unacceptably and outrageously too low. Higher level of inspections and overall improvements to America's railway systems needs to be a priority moving forward.

The rail cars that are currently used to transport Bakken crude are inherently proven to be unsafe. DOT-111 cars have historically been used, but these cars are known to frequently rupture or puncture in the case of derailments. To respond to this issue, the U.S. DOT recommended a phase out of using these type of train cars in July, 2014.[24] However, the supposedly "safer" cars, the CPC 1232, have failed at least four times, including the recent disaster in Mt. Carbon, West Virginia.[25] The distinct lack of train cars that can safely transport Bakken crude via rail needs to be addressed.

> "It may not happen today or tomorrow, but one day a town or a city is going to get wiped out.[28]"
>
> -Larry Mann, rail safety expert and principal author of the Federal Railroad Safety Act.

It is crucial to regulate the speed at which these trains filled with volatile Bakken crude go. According to the Federal Railroad Administration, it is extremely difficult to prevent a crude oil spill when cars go over 30 mph.[26] The train that derailed near Mt. Carbon, West Virginia was going 33 mph—well under the speed limit of 50 mph.[27] This issue coupled with the absence of truly safe train cars presents a frightening threat to Pennsylvania communities where these trains are traveling.

PA communities at greatest risk

Given the recent oil train explosion in Mt. Carbon, West Virginia, PennEnvironment and FracTracker reviewed the threat that a similar accident poses to residents of Pennsylvania. Using data from the Oak Ridge National Laboratory, the U.S. Census Bureau and GIS mapping, FracTracker and PennEnvironment found that nearly 4 million Pennsylvanians live within the potential evacuation zone for an oil train accident. For our data, we used the ½ mile evacuation zone as set out by first responders in West Virginia, the Casselton, North Dakota accident and Lac-Megantic, Canada catastrophe. At the same time, our research uncovered the Pennsylvania counties, municipalities, and even neighborhoods that have the most residents living within this ½ mile evacuation zone. Our study found the following :

Photo: Flickr

A Bakken crude oil train

- **3,940,794 Pennsylvanians live within the half mile evacuation zone** of an oil train disaster in the Commonwealth.
- Sixteen **(16) of the 25 most at-risk zip codes** are found in the **city of Philadelphia**.
- Over **860,000 Pennsylvania children** live within in these evacuation zones.

Five counties in Pennsylvania have almost 2 million people living in the potential evacuation zone. This includes:

1. Philadelphia County: **709,955**
2. Allegheny County: **507,172**
3. Montgomery County: **285,224**
4. Delaware County: **177,829**
5. Berks County: **150,154**

For a list of the top 10 counties and populations at risk in Pennsylvania, see Table A-2 in the Appendix.

Oil trains carrying Bakken crude oil travel all across Pennsylvania, rumbling through our cities and highly populated areas. **The five Pennsylvania cities with the most people living in a potential evacuation area are:**

1. Philadelphia, **709,869**
2. Pittsburgh, **183,456**
3. Reading, **70,012**
4. Scranton, **61,004**
5. Erie, **51,058**

More than one million people are at risk from these five cities alone. For a list of the top 25 municipalities and populations at risk in Pennsylvania, see Table A-3 in the Appendix.

The city of Philadelphia has the highest population

living in the potential evacuation zone of an oil train disaster.

- **Over 700,000 people are at risk**, including almost 170,000 children.
- **16 zip codes in the top percentile for at-risk areas** in the state are located across the city of Philadelphia.
- Almost every person **(98.6%)** living in the Philadelphia **zip code of 19142 (southwest Philadelphia), lives in the evacuation zone of an oil train disaster.**

In communities across Pennsylvania, **hundreds of thousands of children are at risk:**

- **167,224** in Philadelphia County
- **91,436** in Allegheny County
- **64,172** in Montgomery County
- **42,515** in Delaware County
- **39,643** in Berks County

Neighborhoods across Pennsylvania are at risk. **These are the top 10 neighborhoods at risk in the Commonwealth,** and the number of people who live in the evacuation zone in each.

Zip	Location	# people	% of residents
19143	West Philadelphia	53,016	82%
19134	Northeast Philadelphia	48,200	79%
19120	Olney	45,513	67%
19140	Huntington Park	38,471	71%
19104	University City/ Mantua	32,332	62%
19601	Reading	30,280	92%
18702	Wilkes-Barre	29,277	73%
19142	Southwest Philadelphia	29,181	99%
19136	Holmesburg	28,541	70%
19132	Philadelphia's Allegheny neighborhood	19132	74%

Photo: Flickr

A DOT-111 train car

Within Pennsylvania's **major metropolitan areas, the highest at-risk zip codes** include:

City	Zip	Section	# people
Philadelphia	19143	West Philadelphia near the University of Penn	53,016
Reading	19601	Norhtern Reading, near the airport	30,208
Wilkes-Barre	18702	Eastern Wilkes-Barre	29,277
Pittsburgh	15213	Oakland Neighborhood	22,451
Scranton	18504	Scranton-northwestern area of Scranton	15,426
Erie	16503	Eastern end of the City of Erie	14,665
Allentown	18103	Southern neighborhoods of Allentown	17,751
Harrisburg	17104	Southern neighborhoods, city of Harrisburg	16,701
York	17403	South-central York	15,088
Altoona	16601	Central Altoona	15,692
Easton	18042	Central and southern Easton	24,115
Bethlehem	18018	Western Bethlehem	19,675
Lancaster	17601	Northern Lancaster, including Silver Spring	14,366
Johnstown	15906	Northern Johnstown	8,280

While transporting Bakken Formation oil is inherently dangerous, improving local, state and federal policies are crucial to avoiding future oil train disasters.

Over the long term, PennEnvironment believes we must ban dangerous oil trains, and get America off of oil and polluting fossil fuels. Until this is achievable, PennEnvironment recommends the following policy recommendations to help protect local communities from the rapid increase of oil train travel in Pennsylvania and across the nation:

1. Get off oil and move towards clean and renewable energy sources

At the end of the day, the best way to remove the risk from oil trains is to get America off of oil as quickly as possible. This means promoting and bringing more clean energy online, and accelerating policies to reduce America's oil consumption. We can move towards this goal through a variety of policies, which can be read about extensively in Environment America Research and Policy Center's report Getting off Oil. Some of these policies include:

• Use a variety of tools to encourage the deployment of vehicles operating on electricity, including federal light-duty fuel economy/global warming emission standards, financial incentives, programs to expand electric vehicle infrastructure, and minimum sales requirements for automakers, so that 22 percent of new light-duty vehicles sold in 2030 are electric vehicles.

• Require a 10 percent reduction in the life cycle global warming impact of transportation fuels by 2020 and (at least) a 15 percent reduction by 2030.

• Provide incentives and other support for the installation of energy efficiency improvements in existing homes and commercial buildings, sufficient to achieve a 30-50 percent energy savings per building at 75 percent of American homes and commercial buildings.

2. Ban oil trains carrying Bakken crude

• Until Bakken crude can be proven inherently safe for local communities through which it is transported, the dangerous practice of oil train transportation across Pennsylvania and the nation must be stopped.

3. Information about oil trains must be easily available to the public, decision makers, and first responders

• Pennsylvania residents have a right to know about the threats facing their communities. Trains carrying highly volatile oil are virtually traveling through their backyards, putting families at extreme risk. The right to know is a core part of our democratic process, and the public should have access to this information. This information is especially crucial for our communities' local leaders and first responders, considering all the dangers of transporting the oil itself.

• Information available to the general public must include the trains' routes, when oil trains will travel through the area, how many cars the train is pulling, and how much crude oil the trains are carrying.

• The threshold for oil companies to report Bakken crude travel via rail in the U.S. is currently set far too high: only trains carry 1 million gallons or more are required to inform national and state officials under current federal regulations —this amount is far too high because communities are still at great risk for trains carrying less than 1 million gallons. Moreover, fire departments and first responders often lack the capacity to properly deal with a blaze caused by more than 9,000-10,000 gallons of Bakken crude oil —the best they can do is evacuate the area and wait for the fire to burn down to a manageable size. PennEnvironment calls for the the reporting threshold to be lowered to 5,000 gallons, so that first responders and local elected officials can prepare appropriately.

While energy and rail companies have said that sharing this information poses a security threat, this explanation appears misleading. The U.S. Department of Transportation has stated that they found "no basis to conclude that the public disclosure of the information [about oil train routes] is detrimental to transportation safety."

4. We must reroute trains carrying Bakken crude around heavily populated areas.

• The National Transportation Safety Board recommends that crude oil trains should avoid heavily populated areas. Specifically, we need to prevent any crude oil rail travel from occurring within one mile of densely populated areas.

5. Oil trains should not be permitted to travel through Pennsylvania until there is an approved emergency response plan for the entire train route.

• An emergency response plan must be drafted by the rail and oil companies for the entire train route. This plan must obtain input and be approved by first responders, and state and local government officials, and shared with the public. The plan must include a robust process for public input and review so that community members can have their voices heard. And the general public must have access to this emergency response plan once finalized.

6. Oil train companies need to pay their fair share

• All oil trains travelling through Pennsylvania should be required to have insurance and bonding to fully cover the worst case scenario of accident for their train travel through the Commonwealth. We need to ensure that the companies putting our communities at risk are held fully financially responsible in case of future accidents—not leaving victims holding the bag.

• Pennsylvania should assess fees on oil trains in order to cover the costs of providing emergency response plans, necessary equipment for first responders in preparation for a worst case scenario, and for the development of the emergency response plan in order to safeguard the public from oil trains. This fee system is the only way to properly ensure that there is adequate emergency response capacity and that the taxpayers don't burden the cost. Such an upfront transportation fee must be part of the cost of doing business for oil companies.

• Mandatory safety violation fees. Given the shoddy track record of energy and train companies when it comes to avoiding accidents and protecting the public, state and federal officials must implement mandatory minimum fines for safety violation of oil train transport. These fines should cover issues such as leaking train cars, unsafe infrastructure, trains that are missing or have faulty safety equipment, derailments, or speed violations. For repeat and chronic offenders, U.S. DOT and PennDOT should halt their rail activity of Bakken oil through the Commonwealth until a time when the company proves it can do so in compliance with basic laws and regulations.

7. To make oil train traffic as safe as possible, it is crucial for the rail companies to make additional operational safety and oversight improvements, both on the railways and the trains themselves.

• It is crucial to make infrastructural improvements and updates for America's crumbling and outdated railway system. Federal and state officials, along with the companies that own the rail lines, must make funding and improving rail infrastructure a top priority to avoid future oil train accidents.

• Less than one percent of America's Railway system is inspected annually by the Federal Railroad Administration. Clearly the U.S. Department of Transportation must mandate stricter oversight and greater rates of inspections for oil trains and America's rail system.

• Trains carrying Bakken crude need stricter safety standards in place, including requiring a crew of atleast two people for each train, as well as audio and video surveillance in the train engine to ensure rules are followed.

• Oil trains must adhere to reduced speed limits that help to significantly decrease the possibility of a derailment, accident or explosion. An across-the-board speed limit of 25 mph should be made mandatory by the U.S. DOT, a recommendation that is supported by their own Pipeline and Hazardous Materials Safety Administration.

Conclusion

As this report shows, transporting volatile oil from North Dakota's Bakken Formation is growing at a rapid pace, has a concerning track record of recent accidents and near misses, and puts cities, neighborhoods, and millions of people in Pennsylvania—and across the nation—at risk.

The only way to truly protect the public from transporting this dangerous energy source is to get America off oil as quickly as possible. We must also halt the use of oil trains in Pennsylvania and across the country immediately.

Yet in the short term, it is crucial that federal, state and local officials implement a set of commonsense policy handles to attempt to avoid the gravest threats of an oil train accident in Pennsylvania.

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This report analyzes the cities, neighborhoods, and populations who are most at risk in the event of a Bakken oil train crash. It provides the population estimates of residents living within a half mile of the evacuation zone (the recommended evacuation distance in the event of a crude oil rail car explosion) around freight lines where these trains could travel in the Commonwealth of Pennsylvania. This data was compiled by FracTracker Alliance.

Active freight lines in Pennsylvania

This data was obtained through the Oak Ridge National Laboratory (ORNL). Their Center for Transportation Analysis' Railroad Network was used to find the active freight lines in Pennsylvania. Per the source at ORNL, there would be no restrictions on trains on these track segments regarding the transport of crude oil. This was altered in one way—it includes all train segments within three miles of Pennsylvania's border, because trains just outside of the state boundary are also within the half-mile distance in some cases.

Populations at Risk in Pennsylvania, by county, municipality, and zip code

1. Counties

County outlines in Pennsylvania were derived from a national counties file, which is published by the U.S. Census Bureau. The FracTracker Alliance restricted this data to Pennsylvania, and removed the portion that rendered over water, notably Lake Erie.

The populations at risk were derived from 2010 Census data and 2014 train data from ORNL. The populations listed are within a half-mile of trains in Pennsylvania by county. Calculations were made by FracTracker Alliance using 2010 Census Tract (CT) level data, train locations, and county shape files. All area calculations were performed in Albers Equal Area—Great Lakes projection. The process for generating the population estimates were as follows:

1. Form a half mile buffer around active freight lines in and near Pennsylvania;
2. Clip CT data to buffer generated in step 1, resulting in a new layer (CT-clip);
3. Determine the ratio of square miles of fragments in CT-clip to the full CT polygons;
4. Multiply ratio in step 3 by population data in CT file;
5. Forge a union between CT-clip and county layer;
6. Select and export records with data from both layers;
7. Calculate population of the new fragments by repeating steps 3-4;
8. Fragments were then merged by county. Population is the sum of these fragments, within any given county.
9. The population ranges were determined by the "Natural Breaks" method.

2. Municipalities

Municipal outlines in Pennsylvania were derived from a national counties file, which is published by the U.S. Census Bureau. The FracTracker Alliance restricted this data to Pennsylvania, and removed the portion that rendered over water, notably Lake Erie.

The populations at risk were derived from 2010 Census data and 2014 train data from ORNL by FracTracker Alliance. The populations listed are within a half-mile of trains in Pennsylvania by municipality. This layer was created in the same manner as the county layer, above, but with municipal-level data in place of county-level data.

3. Zip codes

This file includes zip code tabulation areas (ZCTA) in Pennsylvania, as published by the U.S. Census Bureau. These are areal representations of actual United State Postal Service zip codes, which, strictly speaking, are a collection of linear postal routes.

The populations at risk were derived from 2010 Census data and 2014 train data from ORNL by FracTracker Alliance. The populations listed are within a half-mile of trains in Pennsylvania by zip code. This layer was created in the same manner as the county layer, above, but with zip code.

Table A-1: The top 25 PA zip codes with the largest populations living in the possible evacuation zone

Zipcode	Neighborhood	Percent at risk (total)	Total Population in zip code	People living in a possible evacuation zone	Children (under the age of 18) living in a possible evacuation zone
19143	West Philadelphia	81.75%	64,849	53,016	13,361
19134	Northeast Philadelphia, Port Richmond neighborhood	79.44%	60,675	48,200	15,634
19120	North Philadelphia, Olney	66.83%	68,104	45,513	13,309
19140	North Philadelphia, Huntingdon Park	71.07%	54,133	38,471	11,005
19104	West Philadelphia, University City and Mantua	62.41%	51,808	32,332	4,306
19601	Reading	91.76%	32,998	30,280	9,541
18702	Wilkes Barre	72.66%	40,295	29,277	6,056
19142	Southwest Philadelphia	98.60%	29,595	29,181	9,137
19136	Holmesburg	70.22%	40,647	28,541	5,776
19132	North Philadelphia, Allegheny neighborhood	73.84%	36,268	26,780	6,745
19013	Center City	75.94%	35,130	26,679	7,293
19131	Wynnefield, Fairmount	59.85%	43,172	25,837	5,472
19145	Southwest Philadelphia, Packer Park neighborhood	53.39%	47,261	25,231	6,603
19111	Oxford Circle, Fox Chase	39.56%	63,090	24,959	5,791
19401	Norristown	57.78%	41,753	24,124	6,282
18042	Kingston	58.01%	41,570	24,115	5,573
17701	Williamsport	53.98%	44,661	24,108	4,743
18704	Kingston, Forty Fort	75.75%	31,206	23,639	4,540
19124	Juniata, Frankford in Philadelphia	35.02%	66,691	23,353	7,539
15213	Oakland, Pittsburgh	72.79%	30,844	22,451	988
19116	Sumerton, near Bustleton	67.20%	33,112	22,250	4,078
19460	Phoenixville	54.69%	40,154	21,960	5,044
19146	Grays Ferry, Point Breeze	62.52%	35,113	21,951	4,600
15601	Greensburg, Westmoreland Cty	36.81%	59,483	21,895	3,764
19141	Ogontz, Fern Rock	69.76%	31,376	21,888	5,370

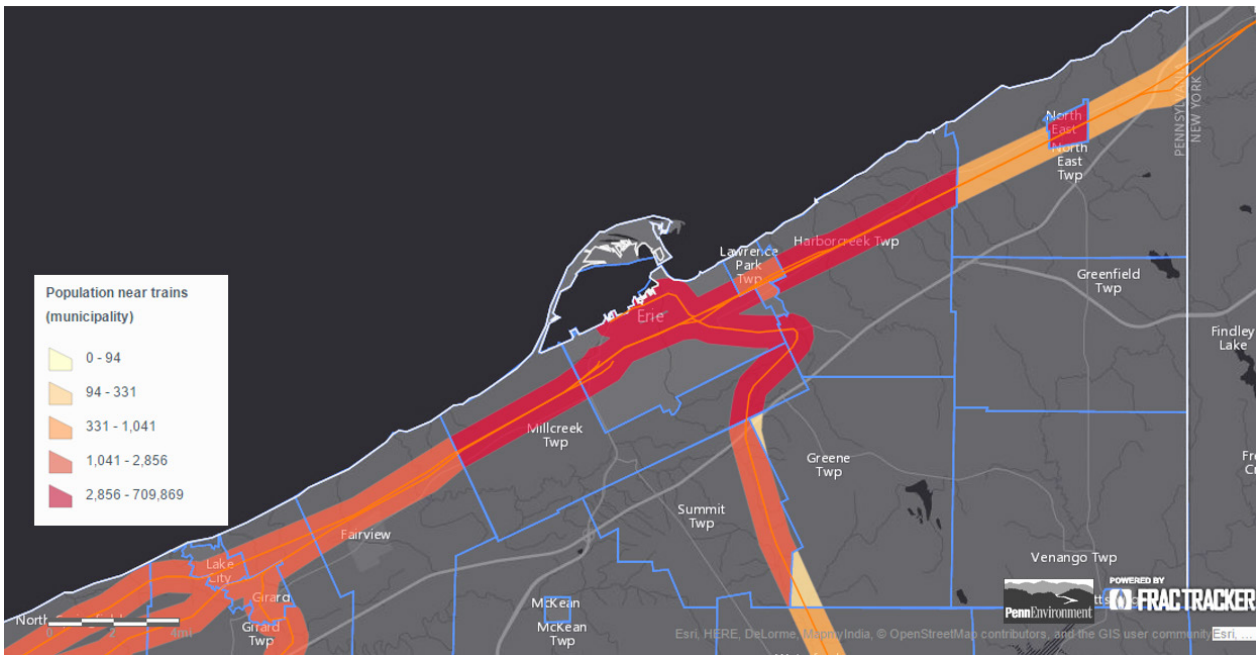
Table A-2: The top 10 PA counties with the largest populations living in the possible evacuation zone

City	People living in a possible evacuation zone	Children (under the age of 18) living in a possible evacuation zone
Philadelphia	709,955	167, 224
Allegheny	507,172	91,436
Montgomery	285,224	64,172
Delaware	177,829	42,515
Berks	150,154	39,643
Bucks	146,213	31,502
Luzerne	134,851	27,407
Chester	115,551	28,428
Westmoreland	111,218	22,346
Lancaster	106729	24,596

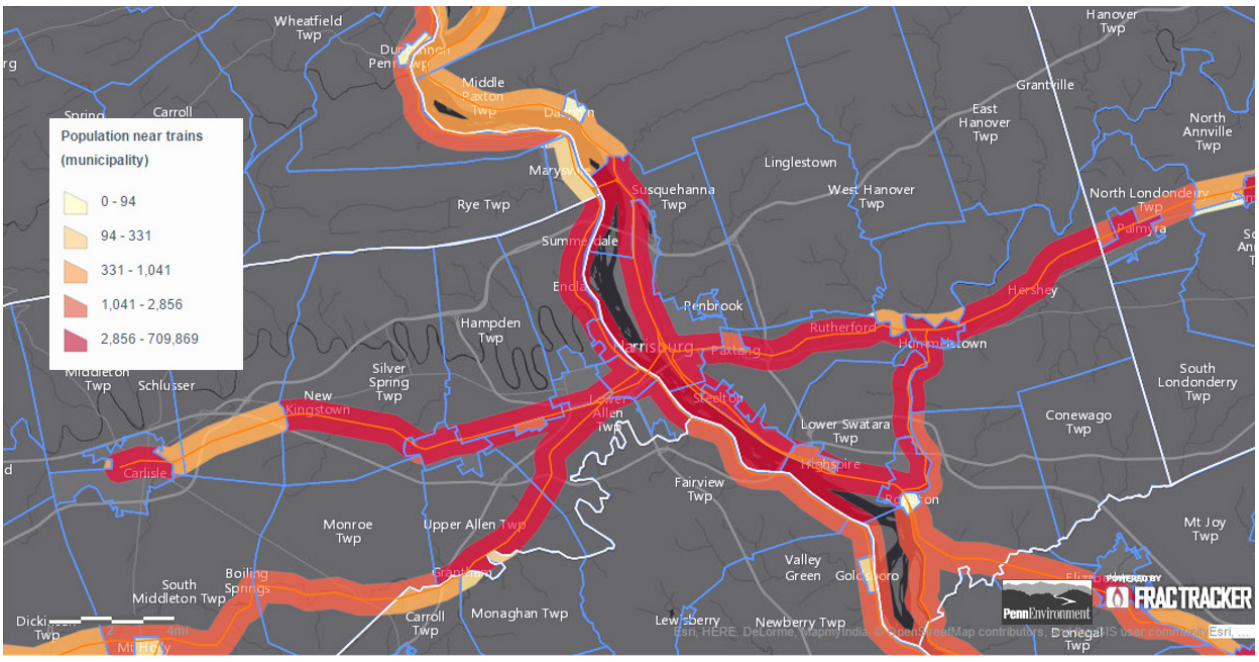
Table A-3: The top 25 PA municipalities with the largest populations living in the possible evacuation

City	People living in a possible evacuation zone	Children (under the age of 18) living in a possible evacuation zone
City of Philadelphia	709,869	16,7212
Pittsburgh	183,456	25,776
Reading	70,012	22,120
Scranton	61,004	12,390
Erie	51,058	13,161
Allentown	44,035	12,632
Wilkes-Barre	33,733	6,664
Harrisburg	31,791	8,862
Abington township	28,826	6,630
City of York	28,700	8,658
City of Chester	26,759	7,261
Lower Merion township	26,107	5,527
Altoona	25,777	6,118
Bethlehem	25,264	4,980
Williamsport	22,674	4,461
City of Lancaster	22,667	4,735
Norristown borough	21,778	5,944
Ridley township	20,307	4,416
Cheltenham township	18,311	3,813
Easton	17,304	3,911
Johnstown	17,113	3,642
Bensalem township	16,596	3,248
City of Lebanon	16,154	4,257
Upper Merion township	15,901	3,157
Chambersburg borough	15,337	3,563

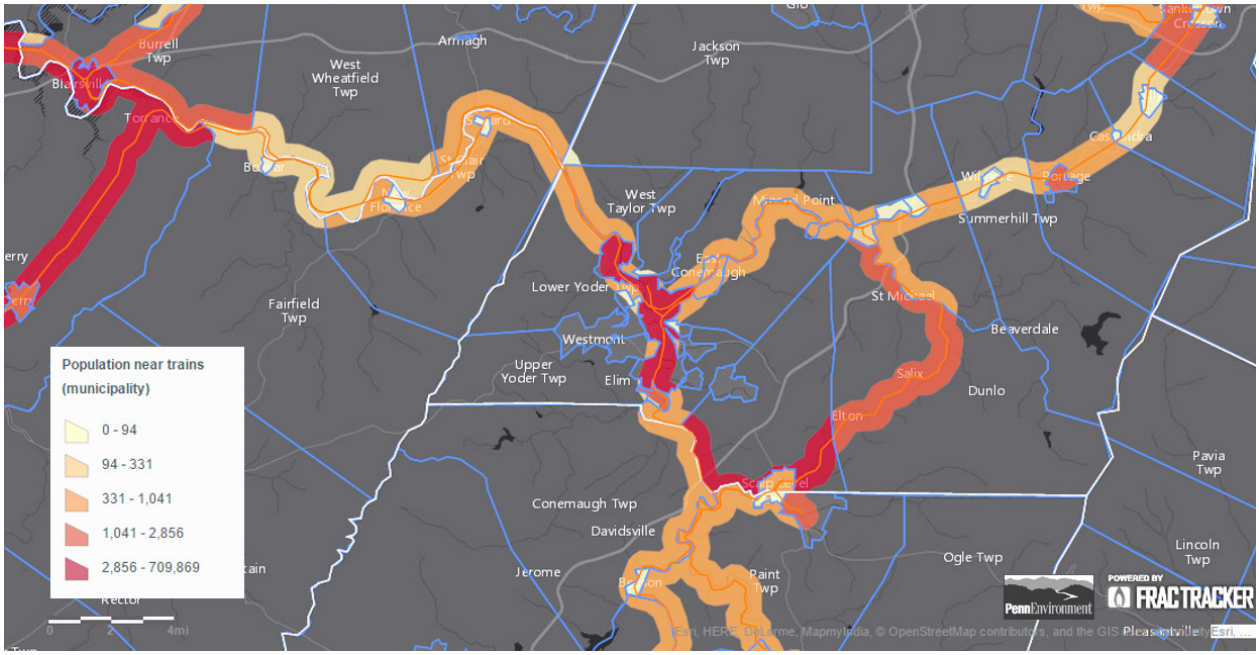
Map A-4: Erie residents living in the possible oil train evacuation zone



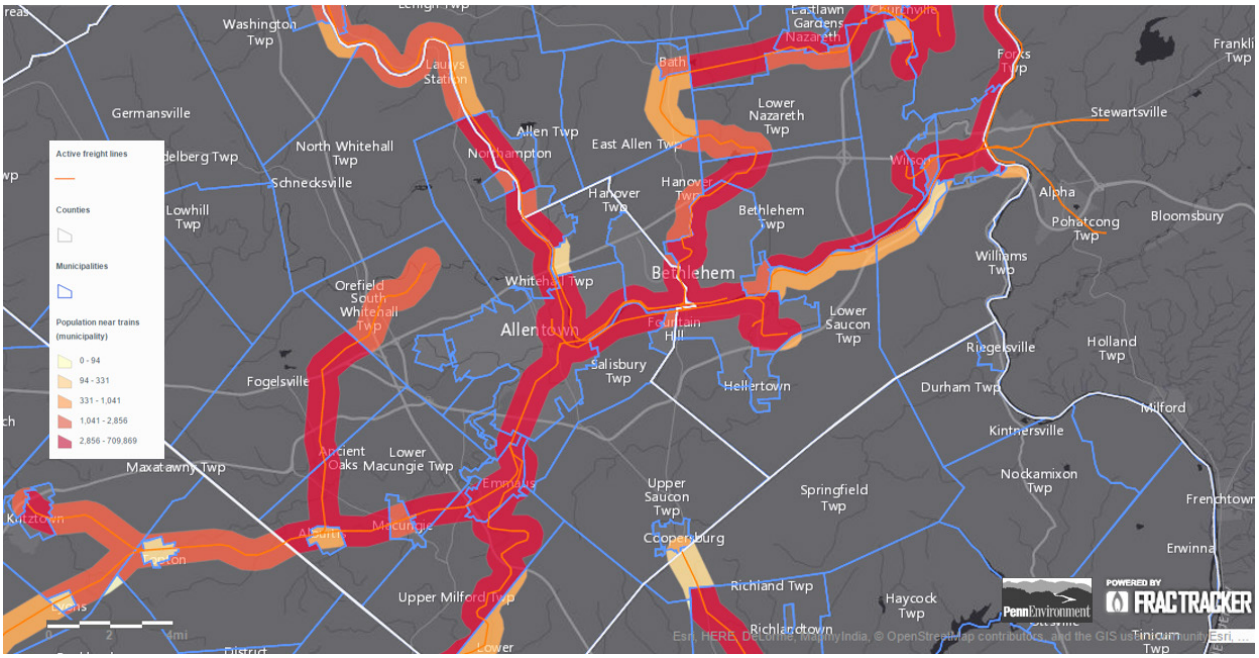
Map A-5: Harrisburg residents living in the possible oil train evacuation zone



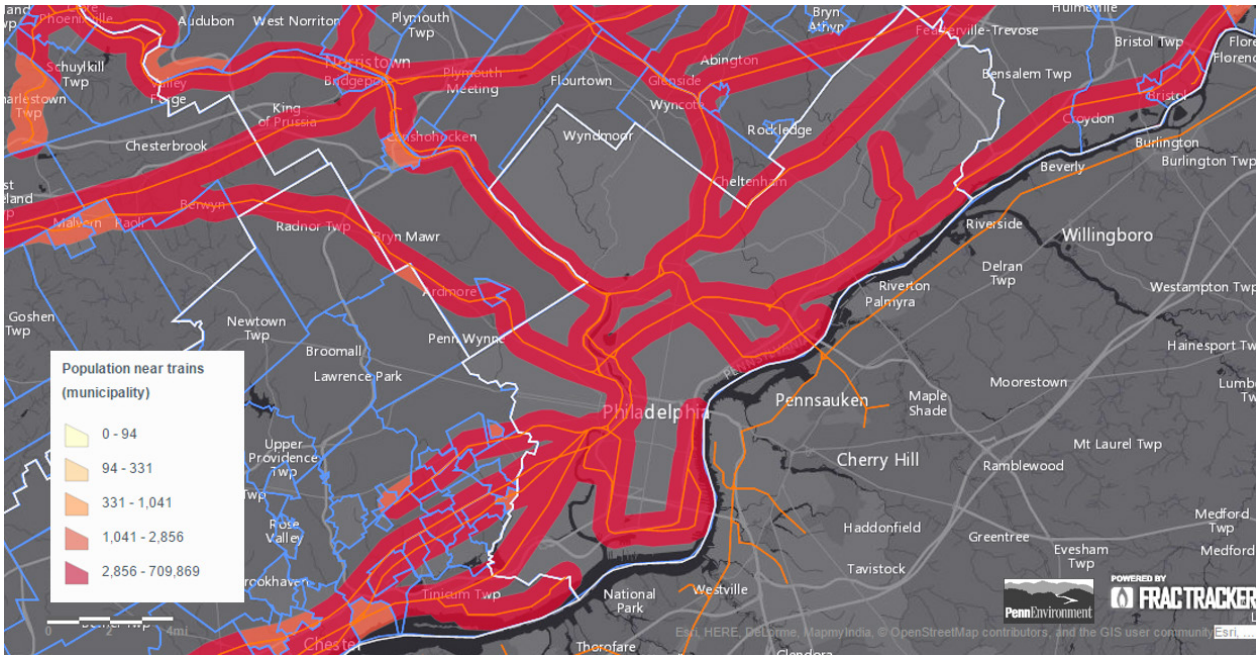
Map A-6: Johnstown residents living in the possible oil train evacuation zone



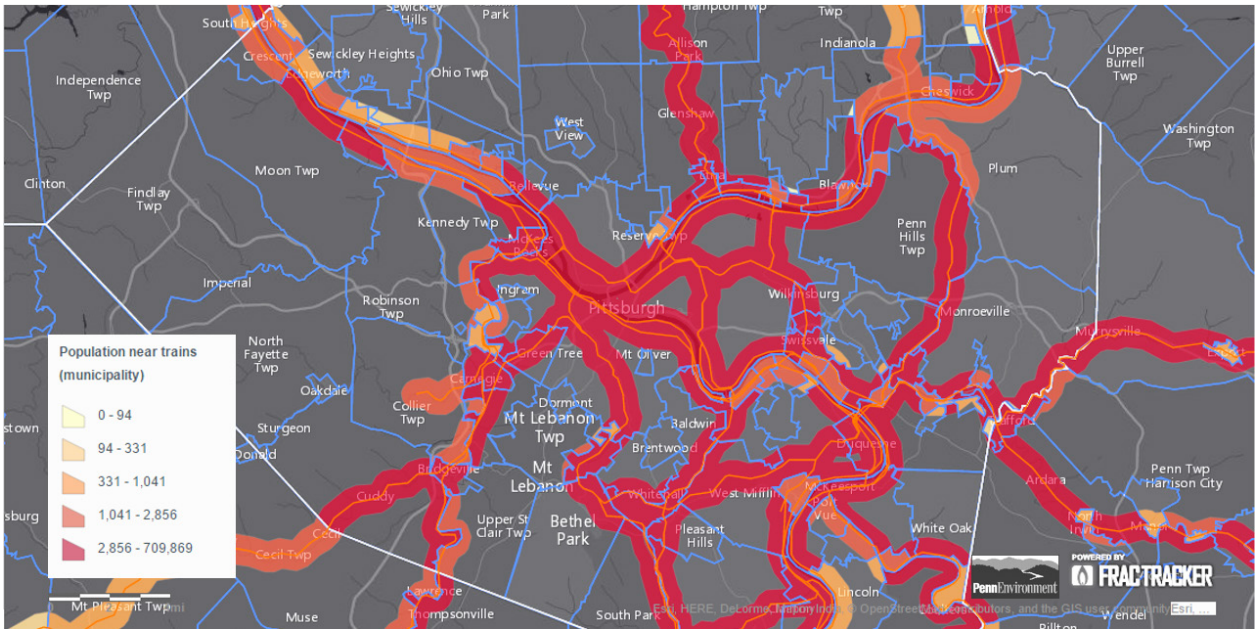
Map A-7: Lehigh Valley residents living in the possible oil train evacuation zone



Map A-8: Philadelphia residents living in the possible oil train evacuation zone



Map A-9: Pittsburgh residents living in the possible oil train evacuation zone



Map A-10: Scranton and Wilkes-Barre residents living in the possible oil train evacuation zone