

# Environmental Justice and Oil Trains in Pennsylvania

ACTION United · ForestEthics · PennEnvironment Research & Policy Center

**E**veryone should have access to clean air water and soil, and to a healthy, safe, livable community. Unfortunately, these rights are often denied to minority and low-income communities, creating a disparate risk and environmental injustice for Pennsylvanians.

ACTION United, ForestEthics, and the PennEnvironment Research & Policy Center used the U.S. Environmental Protection Agency's (EPA) newly published Environmental Justice methodology to investigate the disparate threat to environmental justice communities from trains carrying crude oil through four Pennsylvania cities. In Philadelphia, Pittsburgh, Harrisburg and Reading a disproportionate number of people living in environmental justice communities reside inside the dangerous oil train blast zone. We conclude that oil train routes contribute to environmental racism in Pennsylvania.

The Pennsylvania Department of Justice, Environmental Justice Working Group defines environmental justice as:

[T]he fair treatment and meaningful involvement of all people with respect to the identification of environmental issues and the development, implementation, and enforcement of environmental policies, regulations, and laws. Fair treatment means that no group of people - including racial, ethnic, or socioeconomic groups - will bear a disproportionate share of the negative environmental impacts resulting from industrial, municipal, and commercial activities or from the execution of Federal, State and local programs and policies. The attainment of environmental justice requires the Pennsylvania Department of Environmental Protection's proactive and ongoing review of environmental and administrative

programs and policies, identification of inequities and work to assure equal consideration and protection.<sup>1</sup>

In June 2015 EPA released EJSCREEN, a mapping and screening tool that provides a "nationally consistent dataset and approach for combining environmental and demographic indicators."<sup>2</sup> ForestEthics used US EPA's new methodology, combined with oil train route information from the rail industry and US Census data, to evaluate the disparate threat from oil trains to the most vulnerable populations in four Pennsylvania cities. The blast zone map,<sup>3</sup> first compiled and published by ForestEthics in 2014, combines oil train routes with the recommended one-mile evacuation area in the case of an oil train derailment and fire.

Our results are presented in demographic maps of Philadelphia, Pittsburgh, Harrisburg and Reading. For each urban area we present two maps, one highlighting minority population data and one highlighting income and minority population data. EPA uses income and race, taken together, to identify potentially vulnerable populations. These are commonly recognized as environmental justice communities.

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**In Philadelphia, Pittsburgh, Harrisburg and Reading a disproportionate number of people living in environmental justice communities reside inside the dangerous oil train blast zone. We conclude that oil train routes contribute to environmental racism in Pennsylvania.**

The US EPA EJSCREEN Demographic Index allows us to evaluate U.S. Census block groups based on their potential vulnerability to environmental risk. Those areas in the 80-90 percentile, 90-95 percentile, and 95-99 percentile compared to the entire US population are highlighted on the maps. To summarize the information we compared the populations of the most vulnerable block groups (those in the 80-99 percentile) living inside the blast zone versus outside the blast zone. In every case, a disproportionate number of people living in those most vulnerable block groups—which we describe as environmental justice communities based on race and income – live inside blast zone. In addition, people of color comprise a greater percentage of the population inside the blast zone in each of the four cities.

**Environmental justice communities are at elevated exposure to risk from oil trains. According the EPA EJSCREEN Demographic Index (income and race) and the EPA EJSCREEN minority population data, the people who are potentially most vulnerable to environmental health threats are concentrated inside the dangerous oil train blast zone:**



Reading, PA. Photo by Peggy Hartzell

## PHILADELPHIA URBAN AREA

(city and surrounding areas):

- ▶ **Race:** More than half (58%) of people living inside the blast zone are non-white, only about a quarter (26%) of those living outside of the blast zone are non-white.
- ▶ **Vulnerability (Race and Income):** 50% of people living in environmental justice communities (the potentially “most vulnerable block groups” as defined by EPA) are within the dangerous blast zone (which makes up 12% of the land area.)

## PITTSBURGH URBAN AREA:

- ▶ **Race:** More than 31% of people living inside the blast zone are non-white, only 11% of those living outside of the blast zone are non-white.
- ▶ **Vulnerability (Race and Income):** 70% of people living in environmental justice communities (the potentially “most vulnerable block groups” defined by EPA) are within the dangerous blast zone (which makes up 18% of the land area)

## HARRISBURG URBAN AREA:

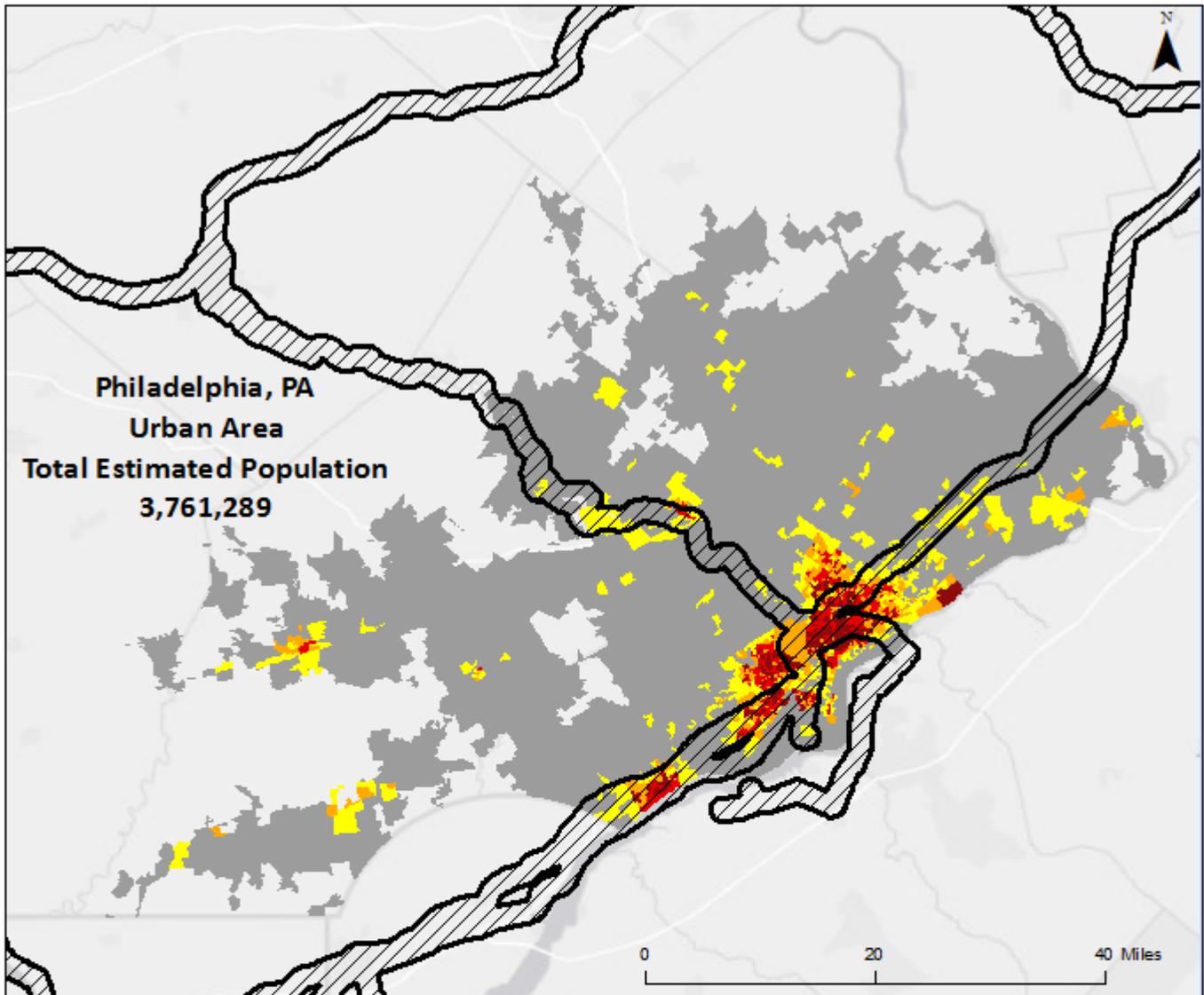
- ▶ **Race:** Over 38% of people living inside the blast zone of the Harrisburg Urban Area are non-white, while only 16% of those living outside of the blast zone are non-white.
- ▶ **Vulnerability (Race and Income):** : 86% of people living in environmental justice communities (the potentially “most vulnerable block groups” defined by EPA) are within the dangerous blast zone (which makes up 23% of the land area.)

## READING URBAN AREA:

- ▶ **Race:** Over 45% of people living inside the blast zone of Reading Urban Area are non-white, while only 14% of those living outside of the blast zone are non-white.
- ▶ **Vulnerability (Race and Income):** 96% of the people living in environmental justice communities (the potentially “most vulnerable block groups” as defined by EPA) are within the dangerous blast zone (which makes up 41% of the land area.)

# Environmental Injustice in the Oil Train BlastZone:

## ► PHILADELPHIA, PA



### Blast Zone

 US DOT 1-mile oil train fire evacuation area

### US EPA EJ Demographic Index

(% Minority + % Low Income / 2)  
Measure of Potential Vulnerability

#### National Percentile

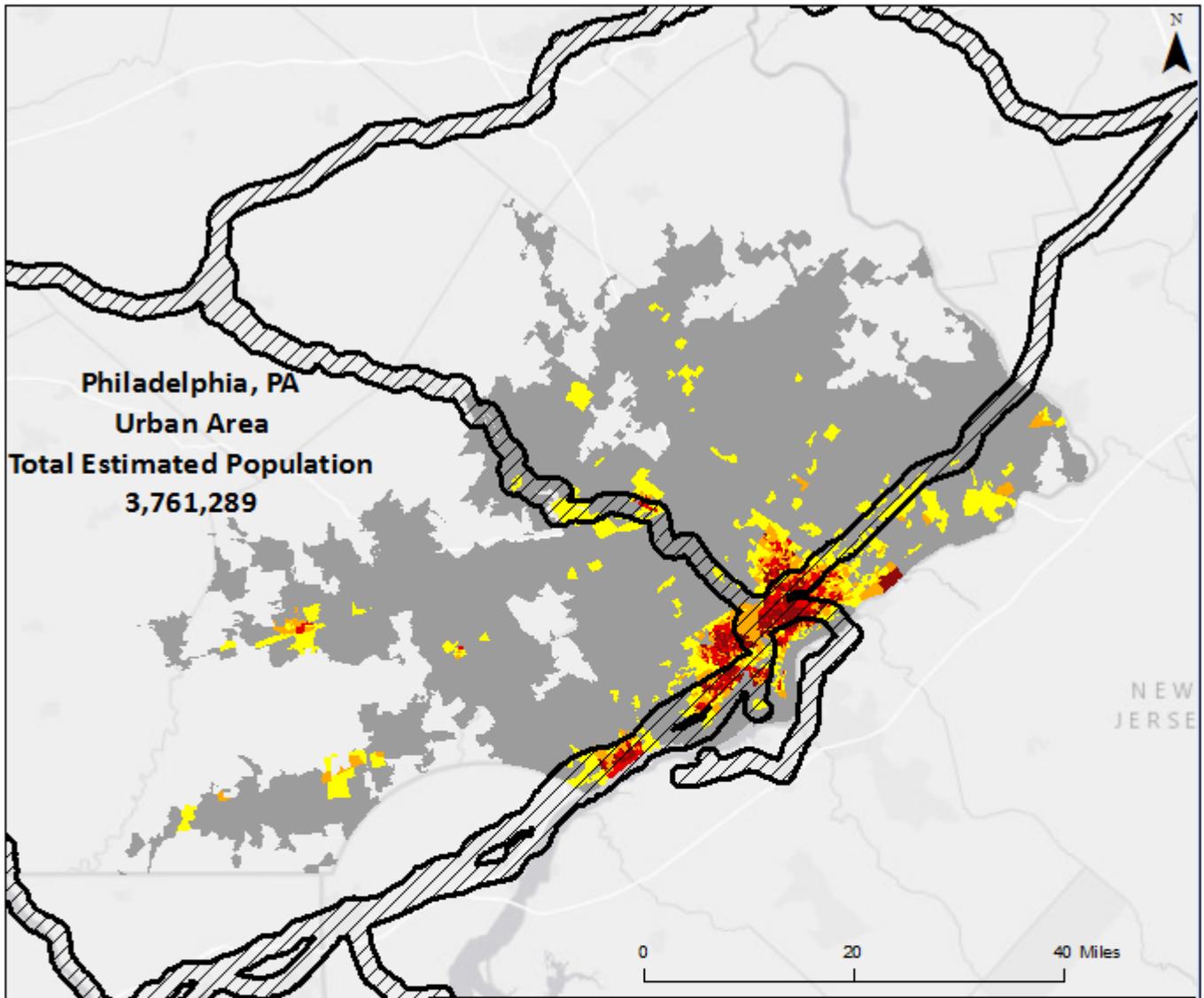
-  0 - 50th Percentile
-  50 - 80th Percentile
-  80 - 90th Percentile
-  90 - 95th Percentile
-  95 - 99th Percentile

	USEPA EJ Screen Demographic Index (National Percentile)			Area Square Miles
	80 - 90th Percentile	90 - 95th Percentile	95 - 99th Percentile	
Vulnerable Population Philadelphia, PA Urban Area	360,752	260,769	329,684	2,136
Vulnerable Population Inside the Blast Zone	128,063	141,902	209,227	262
	35%	54%	63%	12%

50% of people living in environmental justice communities (the potentially "most vulnerable block groups" as defined by EPA) are within the dangerous blast zone (which makes up 12% of the Philadelphia's land area).

# Environmental Racism in the Oil Train BlastZone:

## ► PHILADELPHIA, PA



### Blast Zone

 US DOT 1-mile oil train fire evacuation area

### Percentile for Minority Percent

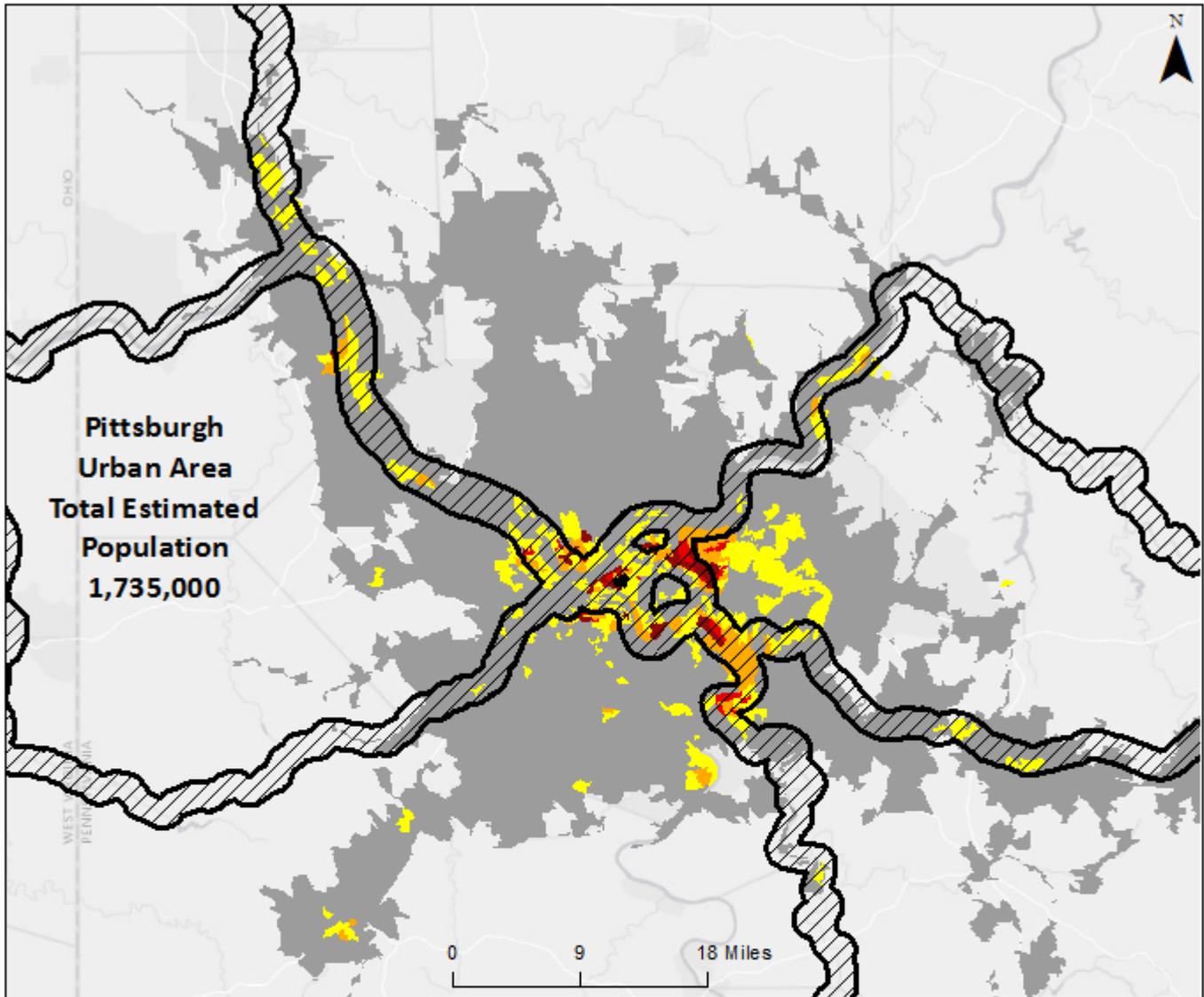
USEPA EJ Screen v2.3 (2015)  
(National Percentile)

-  0 - 50th Percentile
-  50 - 80th Percentile
-  80 - 90th Percentile
-  90 - 95th Percentile
-  95 - 99th Percentile

	Total Population	Minority Population	Percent Minority	Urban Area Square Miles	Percent Urban Area Inside of the Blast Zone
Inside the Blast Zone	987,885	545,444	58%	262	12%
Outside the Blast Zone	2,823,404	894,568	32%	1,874	
<p>With 38% of all minorities in the Philadelphia Urban Area living inside of the city's oil train blast zone, a person inside of the blast zone is over 81% more likely to be a minority than a person outside of the blast zone</p>				<p>Only 12% of the Philadelphia Urban Area is inside the blast zone, but over 38% of all minorities in the city live inside of this dangerous zone.</p>	

# Environmental Injustice in the Oil Train BlastZone:

## ▶ PITTSBURGH, PA



### Blast Zone

 US DOT 1-mile oil train fire evacuation area

### US EPA EJ Demographic Index

(% Minority + % Low Income / 2)  
Measure of Potential Vulnerability

#### National Percentile

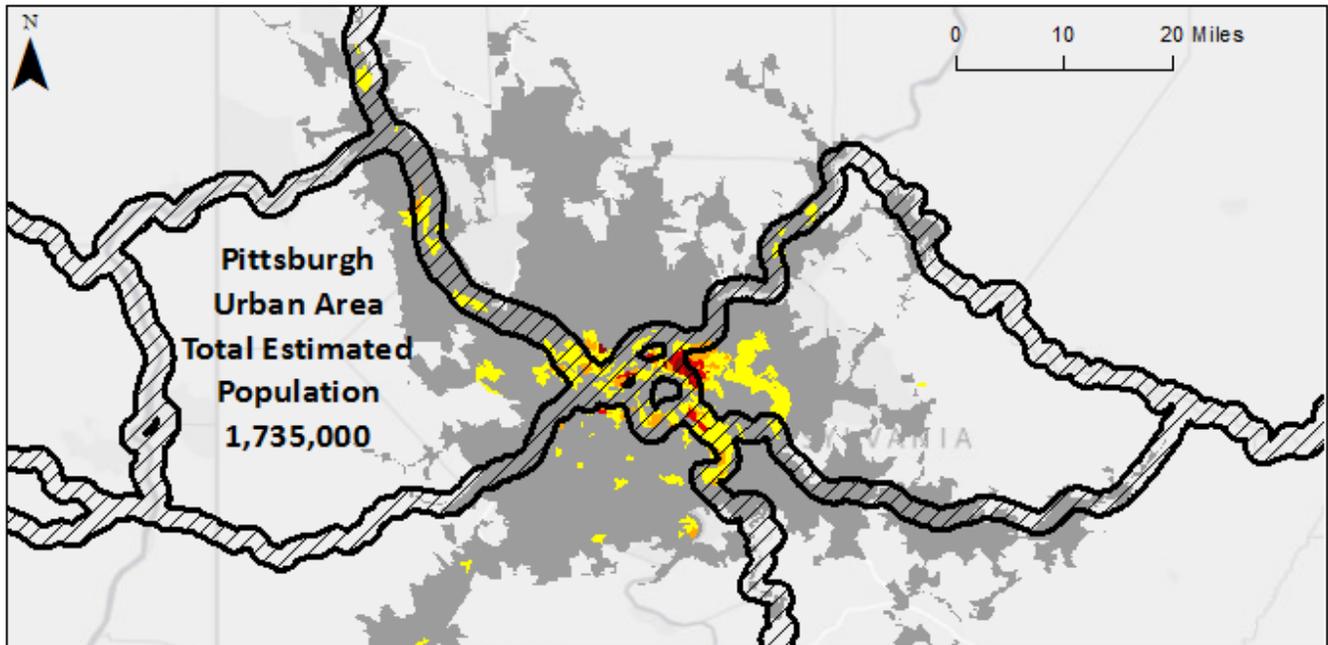
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-  95 - 99th Percentile

	USEPA EJ Screen Demographic Index (National Percentile)			Area Square Miles
	80 - 90th Percentile	90 - 95th Percentile	95 - 99th Percentile	
Vulnerable Population Pittsburgh Urban Area	67,536	24,339	30,458	1,593
Vulnerable Population Inside the Blast Zone	44,332	18,190	23,524	289
	66%	75%	77%	18%

70% of people living in environmental justice communities (the potentially "most vulnerable block groups" as defined by EPA) are within the dangerous blast zone (which makes up 18% of the Pittsburgh's land area).

# Environmental Racism in the Oil Train BlastZone:

## ► PITTSBURGH, PA

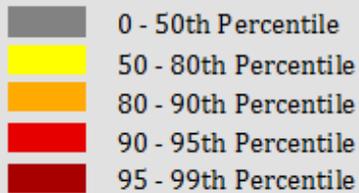


### Blast Zone

US DOT 1-mile oil train fire evacuation area

### Percentile for Minority Percent

USEPA EJ Screen v2.3 (2015)  
(National Percentile)



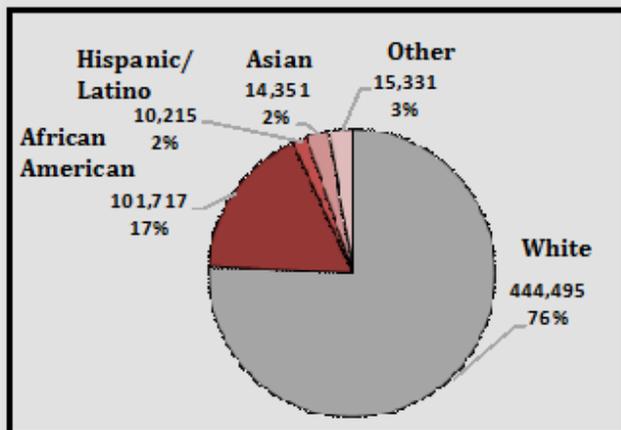
	Total Population	Minority Population	Percent Minority	Urban Area Square Miles	Percent Urban Area Inside of the Blast Zone
Inside the Blast Zone	459,846	141,163	31%	289	18%
Outside the Blast Zone	1,275,459	134,022	11%	1,304	

With 51% of all minorities in the Pittsburgh Urban Area living inside of the city's oil train blast zone, a person inside of the blast zone is over 2 times more likely to be a minority than a person outside of the blast zone.

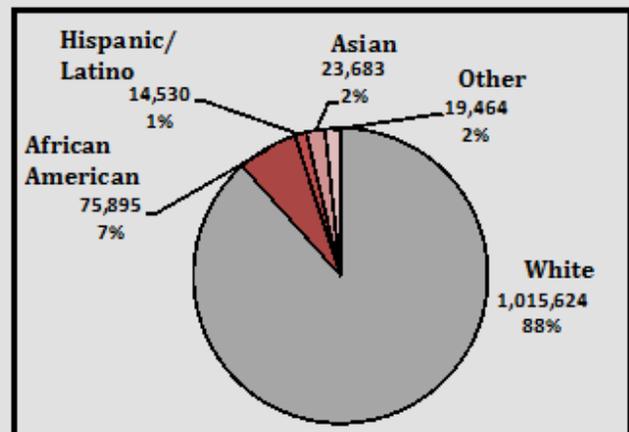
Only 18% of the Pittsburgh Urban Area is inside the blast zone, but over 51% of all minorities in the city live inside of this dangerous zone.

### Pittsburgh Urban Area Racial Demographics (Population and Percentage)

#### Inside the Blast Zone

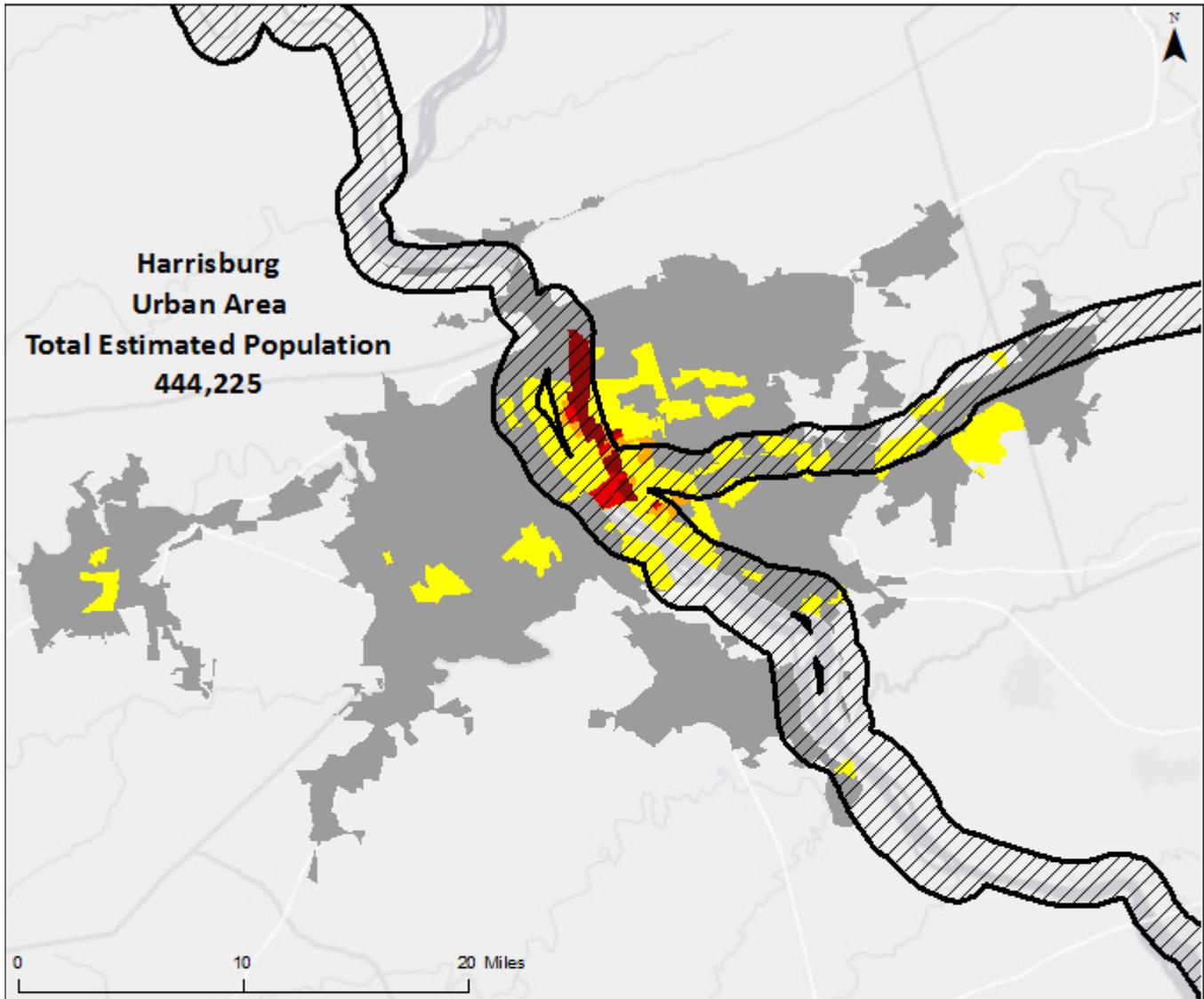


#### Outside the Blast Zone



# Environmental Injustice in the Oil Train Blast Zone:

## ▶ HARRISBURG, PA



### Blast Zone

 US DOT 1-mile oil train fire evacuation area

### US EPA EJ Demographic Index

(% Minority + % Low Income / 2)  
Measure of Potential Vulnerability

#### National Percentile

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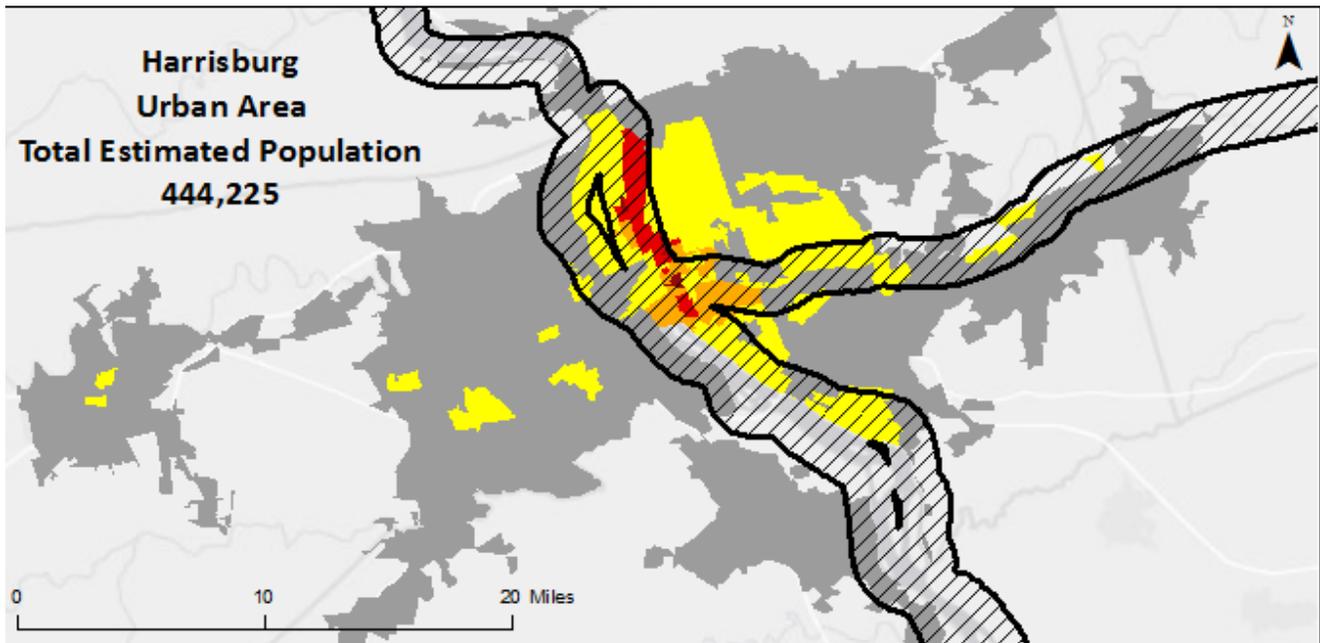
	USEPA EJ Screen Demographic Index (National Percentile)			Are a Square Miles
	80-90th Percentile	90-95th Percentile	95-99th Percentile	
Vulnerable Population Harrisburg Urban Area	19,905	6,183	12,163	460
Vulnerable Population Inside the Blast Zone	15,875 80%	5,409 87%	11,069 91%	104 23%

There are an estimated 37,441 people in the Harrisburg Urban Area who are living in block groups potentially more vulnerable to environmental risk than 80% of the United States, and over 86% of those people live inside of the oil train Blast Zone.

Only 23% of the Harrisburg Urban Area is inside the blast zone, but 86% of the people living in the city's most vulnerable block groups are within this dangerous zone.

# Environmental Racism in the Oil Train BlastZone:

## ▶ HARRISBURG, PA

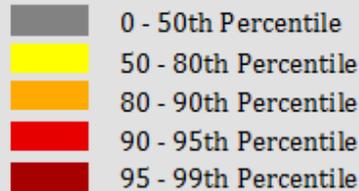


### Blast Zone

US DOT 1-mile oil train fire evacuation area

### Percentile for Minority Percent

USEPA EJ Screen v2.3 (2015)  
(National Percentile)



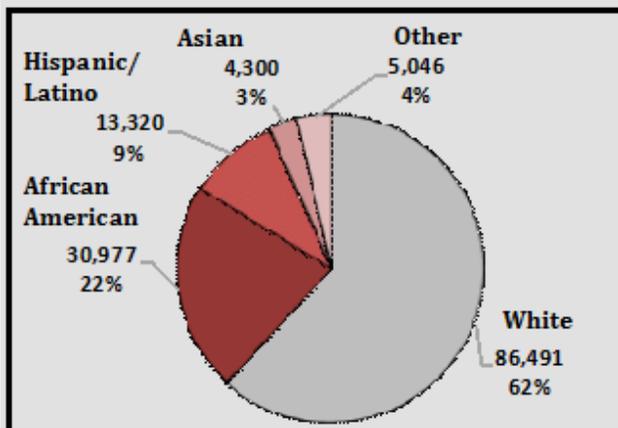
	Total Population	Minority Population	Percent Minority	Urban Area Square Miles	Percent Urban Area Inside of the Blast Zone
Inside the Blast Zone	140,135	53,644	38%	104	23%
Outside the Blast Zone	303,889	49,386	16%	356	

With 52% of all minorities in the Harrisburg Urban Area living inside of the city's oil train blast zone, a person inside of the blast zone is over 2 times more likely to be a minority than a person outside of the blast zone

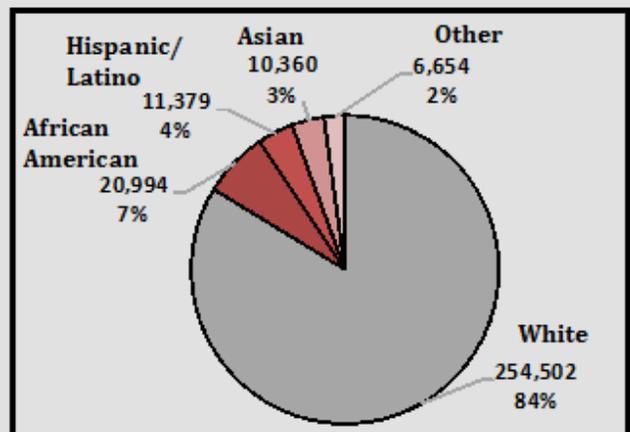
Only 23% of the Harrisburg Urban Area is inside the blast zone, but over 52% of all minorities in the city live inside of this dangerous zone.

### Harrisburg Urban Area Racial Demographics (Population and Percentage)

#### Inside the Blast Zone

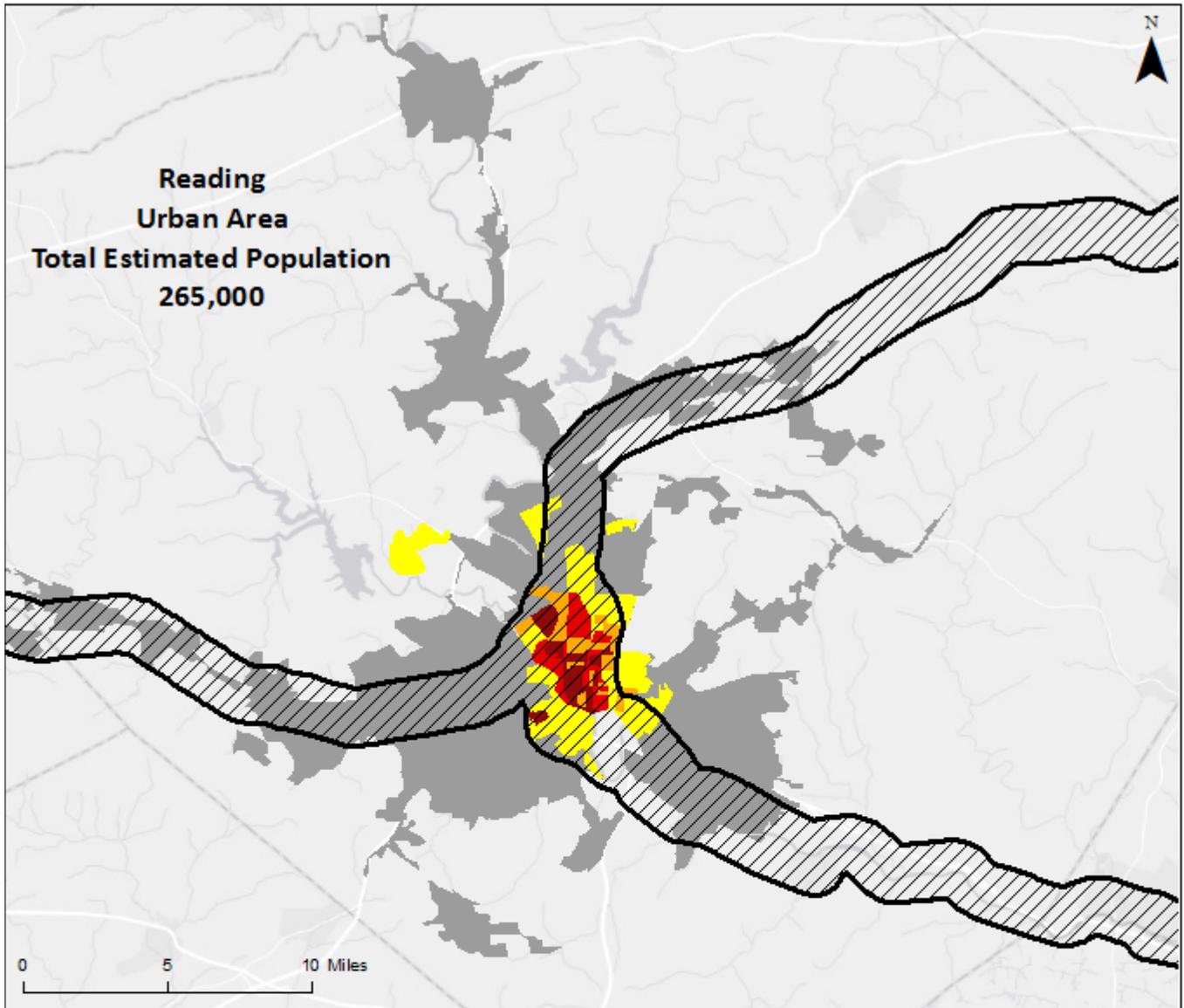


#### Outside the Blast Zone



# Environmental Injustice in the Oil Train BlastZone:

## ► READING, PA



### Blast Zone

 US DOT 1-mile oil train fire evacuation area

### US EPA EJ Demographic Index

(%Minority+ %Low Income /2)  
Measure of Potential Vulnerability

#### National Percentile

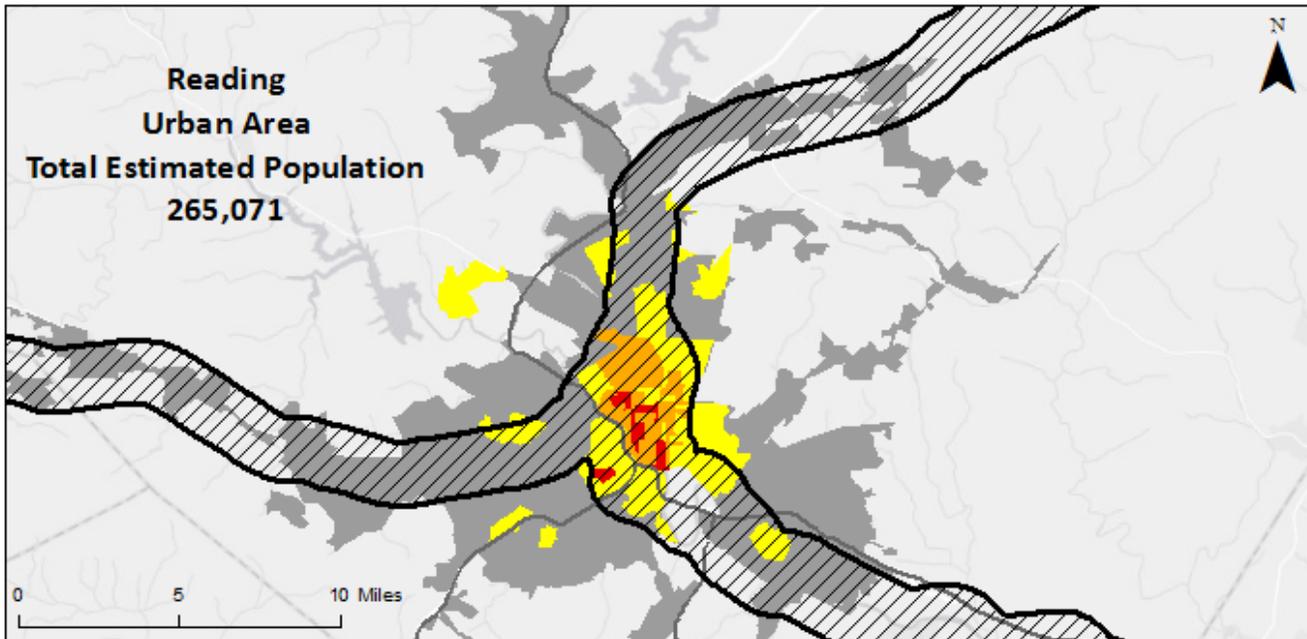
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-  80 - 90th Percentile
-  90 - 95th Percentile
-  95 - 99th Percentile

	USEPA EJ Screen Demographic Index (National Percentile)			Area Square Miles
	80-90th Percentile	90-95th Percentile	95-99th Percentile	
Vulnerable Population Reading Urban Area	26,802	18,431	25,469	180
Vulnerable Population Inside the Blast Zone	25,628 96%	18,431 100%	25,469 100%	74 41%

98% of people living in environmental justice communities (the potentially "most vulnerable block groups" as defined by EPA) are within the dangerous blast zone (which makes up 41% of the Reading's land area).

# Environmental Racism in the Oil Train BlastZone:

## ► READING, PA



**Blast Zone**  
 US DOT 1-mile oil train fire evacuation area

**Percentile for Minority Percent**  
 USEPA EJ Screen v2.3 (2015)  
 (National Percentile)

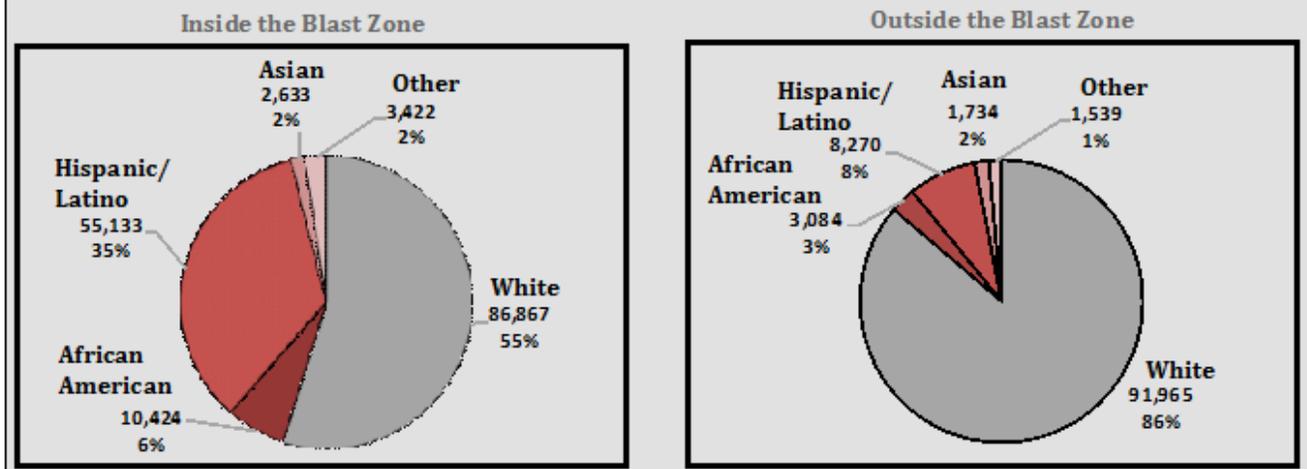
- 0 - 50th Percentile
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- 80 - 90th Percentile
- 90 - 95th Percentile
- 95 - 99th Percentile

	Total Population	Minority Population	Percent Minority	Urban Area Square Miles	Percent Urban Area Inside of the Blast Zone
Inside the Blast Zone	158,479	71,612	45%	76	42%
Outside the Blast Zone	106,592	14,627	14%	104	

With 83% of all minorities in the Reading Urban Area living inside of the city's oil train blast zone, a person inside of the blast zone is over 3 times more likely to be a minority than a person outside of the blast zone.

Only 42% of the Reading Urban Area is inside the blast zone, but over 83% of all minorities in the city live inside of this dangerous zone.

### Reading Urban Area Racial Demographics (Population and Percentage)



## RECOMMENDED ACTION

**N**ational and state officials are required by federal law to ensure that oil train routing, regulations, and review of any proposed oil train-related infrastructure projects address and minimize the disparate threat to the most vulnerable citizens.

Environmental Justice Executive Order 12898<sup>4</sup> requires that federal and state agencies that take federal funds consider environmental justice in decisions about health and public safety. Likewise, Title VI of the 1964 Civil Rights Act prevents federal funds from being used to encourage racial discrimination. Yet the Department of Transportation and other federal rail safety agencies have developed new oil train rules that fail to consider disparate risk from oil trains to environmental justice communities.

Federal, state and local officials must take immediate action to address the flawed and discriminatory safety protections and permits that allow oil trains to exacerbate already-serious cumulative health and safety hazards in our most vulnerable communities. There is great urgency because every oil train brings with it the potential for catastrophe and a guarantee of increased air pollution exposure—including diesel particulate matter and fugitive emissions from tank cars—with chronic health outcomes.

Based on the severe potential environmental health, safety, and climate impacts of oil trains in Pennsylvania, and the environmental injustice and racism documented in this report, ACTION United, ForestEthics, and the PennEnvironment Research & Policy Center recommend the following actions:

- 1. An immediate moratorium on oil imports into Pennsylvania by train and an immediate halt to the permitting of proposed projects that would enable new or expanded use of oil trains in Pennsylvania.**
- 2. The US EPA Office of Civil Rights and US Department of Justice Division of Civil Rights must enforce federal statutes prohibiting racial discrimination in the protection of people from oil trains. These agencies must investigate and correct the oil train-related public disclosure, public participation, monitoring, standard setting, and permitting actions that contribute to the environmental and racial injustice observed in the oil train blast zone.**

- 3. The Wolf Administration must assess the disparate impacts of oil train routes on environmental justice communities and work with the Pennsylvania Department of Environmental Protection to establish appropriate protections to ensure these communities are no longer disproportionately impacted. That includes advocating for new legislation at the state and federal level to rectify the situation.**

- 4. Office of Emergency management meetings in all neighborhoods surrounding oil trains routes to discuss evacuation plans in case of derailment or emergency.**

## EXTREME OIL ON THE RAILS

The increase in oil train traffic nationally over the past seven years has been rapid and poorly regulated. In 2008 the oil industry moved 9,500 carloads of crude oil. In 2014 approximately 500,000 carloads of crude moved on US tracks. In 2013, more crude oil spilled from trains than in the previous 30 years combined.<sup>5</sup>

In the first five months of 2015, five major oil train disasters resulted in spills and fires that burned for days forcing evacuations, polluting waterways, and putting rail workers and emergency responders at risk. These incidents, in West Virginia, Illinois, North Dakota, and two in Ontario, were all in rural, relatively unpopulated areas. However, each of these trains passed through heavily populated areas before derailling and exploding. Each would have passed through many more cities and towns, and over critical water supplies, before reaching its final destination.

The oil and rail industries have turned Pennsylvania's railways into deadly crude oil superhighways. In 2015, the PennEnvironment Research & Policy Center released the Danger Around the Bend report highlighting near misses and growing concern about the threat from oil trains<sup>6</sup>:

- ▶ 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.
- ▶ Yet less than a month later, an 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.

- ▶ On January 31, 2015, a freight train containing crude oil traveling to an oil refinery in south Philadelphia derailed, fortunately, no leak, fire or explosion resulted.
- ▶ On November 13, 2015, five crude oil train cars derailed outside Philadelphia in King of Prussia.
- ▶ 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.

Railways connect population centers, and our nation's cities grew around rail lines. Moving oil by train means that hazardous oil train routes now cross through the largest cities and the downtowns of many smaller cities and towns. Increased oil train traffic is a threat to all Pennsylvanians, but poses the greatest risk to environmental justice communities that already live with elevated health and safety risk from industrial spills, fires and explosions, as well as chronic air and water pollution.

On May 4, 2015, the US Department of Transportation released new regulations for trains hauling liquid hazardous materials, including crude oil.<sup>7</sup> These rules included new tank standards, but a long partial phase-out of older hazardous cars, inadequate speed limits, deficient tanker shells, and continuing secrecy that leaves communities at risk of catastrophe. These rules allow unnecessary harm and will not protect public health and the environment. They also fail to consider the disproportionate impacts on environmental justice communities residing in the blast zone.

## Explosion and Pollution: The Acute and Chronic Threat from Oil Trains

The fatal oil train derailment, spill and fire in Lac-Mégantic, Quebec, on July 6, 2013 was a wakeup call to the severe threat from oil trains carrying toxic, explosive crude oil. At least 47 people lost their lives and an entire downtown was incinerated in a fire that lasted for days. Both North Dakota Bakken and Canadian tar sands crude oil have been

involved in many rail explosions and spills.

Much of the crude oil currently carried through Pennsylvania by rail is also North Dakota Bakken. In January 2014, the US Pipeline and Hazardous Materials Safety Administration (PHMSA) issued a safety alert to, "notify the general public, emergency responders and shippers and carriers that recent derailments and resulting fires indicate that the type of crude oil being transported from the Bakken region may be more flammable than traditional heavy crude oil."<sup>8</sup>

The other crude typically carried by rail is tar sands, or diluted bitumen, from Alberta, Canada. Tar sands are an asphalt-like substance mined from rock that requires the addition of light petroleum diluent so that it can be loaded into tank cars. Once mixed with diluents, the resulting mixture (called "diluted bitumen" or "dilbit") is extremely toxic and highly corrosive, flammable and explosive.<sup>9</sup> If this bitumen oil spills into a nearby waterway, it will sink and cause chronic pollution problems for aquatic ecosystems.

### ***Chronic Pollution, Cumulative Health Impacts, and Disruption***

Even without the threat of fire, oil trains create hazardous air pollution from diesel exhaust and emit volatile organic compounds (VOCs) that are known to cause smog pollution. This air pollution is especially hazardous in environmental justice communities that already suffer a significantly higher burden of airborne toxics and accompanying respiratory disease.

To make matters worse, the antiquated tank cars currently used to move crude oil are known to leak—and were not designed to carry volatile chemicals or contain chemicals at high pressure. These rail cars (referred to as the DOT 111 and CPC 1232 tank cars) vent carcinogens and other toxic gases into the atmosphere, and frequently lose liquid product through valves and covers. These fugitive emissions present chronic health threat to communities in the blast zone.

In a process called shrinkage, one oil company calculated a loss of one percent of volume from oil tank cars on a journey from North Dakota to the Gulf Coast due to "off gassing" through pressure relief valves and leakage.<sup>10</sup> At this rate a 100-car, three-million-gallon train, may lose as much as 30,000 gallons of volatile, cancer-causing chemicals as it

rolls down the tracks past homes and schools on the way to refineries – the problem may be compounded where oil trains idle on their routes or at loading and unloading. New federal requirements announced in May 2015 will do nothing to improve containment of volatile air pollutants.

In an October 2014 environmental review in California for a Phillips 66 oil train unloading project, San Luis Obispo County admits that the proposed project will create “significant and unavoidable”<sup>11</sup> levels of air pollution, including toxic sulfur dioxide and cancer-causing chemicals. The review cites increased health risks -- particularly for children and the elderly -- of cancer, heart disease, respiratory disease, and premature death.

In 2012, more than 180 health experts from Whatcom County, Washington studied the potential health impacts from increased train traffic. This research was based on studies from major medical journals and found:<sup>12</sup>

#### **Diesel particulate matter from diesel exhaust and fugitive emissions from passing and idling trains, and increased road traffic due to delays at road crossings, is associated with**

- ▶ Impaired pulmonary development in adolescents;
- ▶ Increased cardiopulmonary mortality and all-cause mortality;
- ▶ Measurable pulmonary inflammation;
- ▶ Increased severity and frequency of asthma attacks, ER visits, and hospital admissions in children;
- ▶ Increased rates of myocardial infarction (heart attack) in adults;
- ▶ Increased risk of cancer.

#### **Noise pollution exposure from train traffic causes**

- ▶ Cardiovascular disease, including increased blood pressure, arrhythmia,
- ▶ Stroke, and ischemic heart disease;
- ▶ Cognitive impairment in children;
- ▶ Sleep disturbance and resultant fatigue, hypertension, arrhythmia, and increased rate of accidents and injuries;
- ▶ Exacerbation of mental health disorders such as depression, stress and anxiety, and psychosis.

#### **Frequent long trains at rail crossings will mean**

- Delayed emergency medical service response times;
- Increased accidents, traumatic injury and death.

## **DATA AND METHODS: Mapping Environmental Injustice in the Blast Zone**

Interpreting the Environmental Justice and Environmental Racism in the Blast Zone maps:

- ▶ The **urban areas** shown are the 2010 U.S. Census Bureau's representation of densely developed territory, and encompass residential, commercial, and other non-residential urban land uses. They comprise a densely settled core of census tracts and/or census blocks that meet minimum population density requirements, along with adjacent territory containing non-residential urban land uses as well as territory with low population density included to link outlying densely settled territory with the densely settled core. There are two types of urban areas defined by the Census Bureau, Urban Clusters (UCs), which have between 2,500 and 50,000 people and Urban Areas (UAs) which have 50,000 or more people. Harrisburg, Pittsburgh, Reading and Philadelphia are all Urban Areas with 50,000 or more people.
- ▶ The **blast zone** shown is the one-mile evacuation area that the US Department of Transportation recommends in the case of an oil train derailment, spill and fire. While one mile is a guideline for initial response to a multi-car accident with fire, the toxic cloud from the December 2013 Casselton, ND, oil train disaster required a five-mile evacuation zone downwind.<sup>13</sup>
- ▶ In the Environmental Justice Maps, **potentially vulnerable populations** are defined using the US EPA EJSCREEN Tool Demographic Index for US Census Block Groups. The Demographic Index is a combined average of a block group's percent low income and percent minority. Higher Demographic Index values reflect a calculation that incorporates higher percent minority and/or a higher percent of low-income residents for a population, used in combination as a proxy for potential vulnerability to environmental risk for a population.

► In the Environmental Racism maps, **minority population** counts are taken from the US EPA EJSCREEN data, which is based on U.S. Census and American Community Survey (ACS) data for U.S. Census block groups. A block groups' minority population is defined as the number or percent of individuals in a block group who list their racial status as a race other than white alone and/or list their ethnicity as Hispanic or Latino.

► To identify the **racial makeup of urban areas inside and outside of the Blast Zone**, American Community Survey (ACS) data from the U.S. Census Bureau was used. From the ACS, we used the 2012-ACS 5-Yr Avg. B03002 Table for Hispanic or Latino Origin by Race. From the B03002 table, we estimated population counts for the categories Hispanic-Latino Origin, and from the Non-Hispanic Latino Origin population data we estimated White Alone, Blacks Alone, Asian Alone, American Indian Alone, Native Hawaiian-Pacific Islander Alone, Other races Alone, and Two or More Races. In our pie charts, American Indian, Native Hawaiian-Pacific Islander, Other races and Two or More Races are grouped together as 'other' (this was done for clarity of presentation only).

► **Population estimates** for both potentially vulnerable populations and for racial categories within each urban area and inside and outside of the blast zone are calculated by referencing 2012-ACS-5Yr Avg. Block Group data to 2010 U.S. Census Block level data. This is done to capture population distribution using the highest resolution 2010 U.S. Census Block level data. Data and methods are detailed at the end of this report.

### **Route selection and data**

The Blast Zone map uses data from Oak Ridge National Laboratory's publicly available rail map data set [10]<sup>14</sup>, their railroad network. There are many more possible rail lines than shown on the map. A three-step process was used to identify the most likely routes oil trains will travel:

1. Base routes were identified in the article All Oiled Up<sup>15</sup> in the March 2014 issue of Trains Magazine. The article, by rail freight expert Fred Frailey, shows the most likely rail routes used for oil trains.
2. We compared estimates in the Frailey article with Oil Change International's map of known oil train offloading

terminals.<sup>16</sup> We then connected major routes to known terminals. Where multiple connecting routes are possible we preferentially chose the Category 1 rail line owned by the railroad operating the main trunk line. Where multiple routes were possible with no Category 1 line, we chose the most direct route.

3. After publication of the Blast Zone [www.blast-zone.org] website we have used first person accounts and feedback from site users to add rail routes. Any individual providing a first person account was asked to verify that they had seen the appropriate 1267 HAZMAT placard, and verify that they were observing crude oil unit trains. Often, individuals responded with unsolicited photographs of trains and their placards. Of the more than 100 additions and revisions we have received, only about five percent indicated areas that incorrectly showed oil train routes.

A fourth step, comparing our results against Commonwealth of Pennsylvania oil train route mapping<sup>17</sup> also served as an informal spot-check on this method. Pennsylvania maps are largely incomplete, since they fail to disclose non-Bakken crude oil unit trains, as well as trains with less than 1 million gallons of Bakken crude.

### **Calculating populations**

To provide the most accurate counts that are currently feasible for our population estimates, we use an approach based on the U.S. EPA EJScreen approach that uses 2010 U.S. Census block internal points. This method estimates the fraction of the Census block group population that is inside the buffer by using block-level population counts from Census 2010. These blocks provide higher resolution data on the distribution of population than block groups. Each block has an internal point defined by the Census Bureau, and the entire block population is counted as inside or outside the blast zone or the urban area depending on whether the block internal point is inside or outside. This assumption typically introduces relatively little error because blocks are so small relative to a typical buffer, so a small fraction of the total buffer population is in blocks that span an edge of the buffer. Also, any blocks along the edge of a buffer whose populations are close to 0 or 100% inside the buffer will be well represented by this assumption.

We first integrate urban areas and the blast zone with the 2012 ACS 5-Yr Block Group data available from the EPA

EJ Screen\_v23 spatial database. This breaks the Block Group data into smaller features where either the urban area or the blast zone boundary intersects a block group feature. We estimate population for every feature in our new dataset, both those that were intersected and those that were not.

Each feature contains some number of 2010 Census block points, and the sum of those points is a block level estimate of population for that feature. This is our best estimate of the feature's population, but it is neither the most current, nor does it allow us to access the other information available in the EJ Screen\_v23 spatial database or in the 2012 ACS dataset because both of those datasets are block group level, and not block level. To carry our 2010 block level estimate to the 2012 ACS data, we use a method introduced in the Technical Document for the US EPA EJ Screen Tool. We divide the 2010 Census block population for each feature by the 2010 Census block group population for the block group the feature and the block level points reside within. This gives a factor that is the fraction of the 2010 Census Block Group population for that feature. We then apply that factor by multiplying the 2012-ACS 5Yr Avg block group data we are using for racial and vulnerable population estimates. The result is a population estimate for each feature in our dataset that is based on 2010 Census block-level distribution of population.

### **Identifying Racial Composition of Communities**

To identify the racial composition of communities, the 2012-ACS 5-Yr Avg. B03002 Table for Hispanic or Latino Origin by Race was used. Within the US Census and the ACS, Hispanic and Latino origin information is not taken as a separate racial category, so a person can have Hispanic or Latino origin and be of multiple races, according to the Census. For our purpose of estimating population composition by race, anyone of Hispanic or Latino Origin from the ACS data was included in the Hispanic Latino community. The other racial communities were taken from the ACS data for the Non-Hispanic and Latino Origin population.

### **Identifying Potentially Vulnerable Populations**

In our maps **potentially vulnerable populations** are defined using the US EPA EJSCREEN Tool Demographic Index for US Census Block Groups. The Demographic Index is a combined average of a block group's percent low income and percent minority. Higher Demographic Index values reflect a calculation that incorporates higher percent minority and/or a higher percent of low income residents for a population, used in combination as a proxy for potential vulnerability to environmental risk for a population.

#### **Calculation:**

$$\text{Demographic Index} = (\% \text{ minority} + \% \text{ low-income}) / 2$$

#### **USEPA EJ Screen Definitions for minority and low income:**

- ▶ **Low-Income:** The number or percent of a block group's population in households where the household income is less than or equal to twice the federal "poverty level."
- ▶ **Minority:** The number or percent of individuals in a block group who list their racial status as a race other than white alone and/or list their ethnicity as Hispanic or Latino. That is, all people other than non-Hispanic white-alone individuals. The word "alone" in this case indicates that the person is of a single race, since multiracial individuals are tabulated in another category – a non-Hispanic individual who is half white and half American Indian would be counted as a minority by this definition.

#### **USEPA EJ Screen Definition for National Percentile:**

The EJ Screen Tool data provides a national percentile for Demographic Index values for each block group in the dataset. A percentile in EJSCREEN tells us roughly what percent of the US population lives in a block group that has a lower value (or in some cases, a tied value). This means that 100 minus the percentile tells us roughly what percent of the US population has a higher value. This is generally a reasonable interpretation because for most indicators there are not many exact ties between places and not many places with missing data. More precisely, the exact percentile for a given raw indicator value is calculated as the number of US residents of block groups with that value or lower, divided by the total population with known indicator values.

The percentile value for the Demographic Index allows us to compare the “vulnerability” of block groups in Harrisburg, Pittsburgh, Philadelphia and Reading with block groups across the nation. In this study we define high vulnerability at  $\geq$  80th percentile. Meaning the Demographic Index value for a block group is equal to or greater than 80% of block groups across the nation.

### *The ½ mile (800m) and 1 mile (1,600m) “blast zone” buffers*

As represented on various maps and the blast-zone.org website, the ½ mile (800 meter) and 1-mile (1,600 meter) oil train incident and fire evacuation zones are simplified versions of what in practice is a highly complex set of potential responses by first responders and other safety personnel. In practice, these evacuation and impact zones may be much smaller (a single tipped car with no puncture in Seattle led to no evacuation) and much larger (the Casselton, ND explosion and ensuing toxic cloud led to a five mile evacuation zone to the south and east of the incident in the dead of winter.)

Various agencies including the Department of Transportation’s Pipeline and Hazardous Materials Safety Administration have issued initial response guidelines codified in the Emergency Response Guidebook. For an incident involving a single oil tank car (whether truck or train), the primary set of responses is codified under response protocol 128 for petroleum crude oil, or UN hazmat code 1267. That guideline recommends initial evacuation range of 800 meters for a single burning car.

The 800 meter zone of evacuation and impact could be the result of multiple scenarios: high volumes of tar sands crude spilled and the toxic inhalation hazard it represents, or per the PHMSA guide a single burning tank car that doesn’t impinge on other cars. Likewise, the 1,600 meter zone of evacuation and impact is recommended for multiple burning cars, leading to risk of a boiling liquid expanding vapor explosion (BLEVE).

However, additional response protocols may be called for with crude oils with high levels of hydrogen sulfide, a deadly toxic inhalation hazard (TIH), or extremely high vapor pressures and high percentages of explosive gases during commonly experienced temperatures of transport. Examples of oils needing additional response protocols may

include tar sands-derived (Canadian Heavy) oils, condensates, and Bakken shale oils.

The 800 meter and 1,600 meter evacuation and impact zones also fail to take into account geography. Incidents involving pour points into waterways, such as the 1999 Olympic pipeline disaster in Bellingham, WA, can result in a plume of toxic smoke more than two miles long.

### **Coverage limitation**

We focused our limited resources on analysis of communities in Pennsylvania’s major urban centers crossed by oil train routes. A strength of this choice is its focus on high-density populations where catastrophic and chronic hazards in the blast zone, if manifest, will harm the greatest number of people. A limitation is that detailed analysis for communities in low-density rural areas, smaller cities and towns is left to future work. Every community should have access to environmental justice information—and such future work might shed additional light on questions such as why environmental justice communities are disproportionately concentrated in the oil train blast zone.

### **Additional Data References:**

- ▶ U.S. Census Bureau Cartographic Boundary Shapefiles -- Urban Areas [https://www.census.gov/geo/maps-data/data/cbf/cbf\\_ua.html](https://www.census.gov/geo/maps-data/data/cbf/cbf_ua.html)
- ▶ U.S. Environmental Protection Agency (EPA), 2015. EJSCREEN SPATIAL DATA (EJSCREEN\_v23.gdb) <ftp://newftp.epa.gov/EJSCREEN/>
- ▶ U.S. Environmental Protection Agency (EPA), 2015. EJSCREEN Technical Documentation [http://www2.epa.gov/sites/production/files/2015-05/documents/ejscreen\\_technical\\_document\\_20150505.pdf](http://www2.epa.gov/sites/production/files/2015-05/documents/ejscreen_technical_document_20150505.pdf)
- ▶ 2012 TIGER Line Polygon Feature Classes of Block Groups by State and County; <ftp://ftp2.census.gov/geo/tiger/TIGER2012/BG/>
- ▶ 2012 TIGER Line Polygon Feature Classes of Places (Cities, Towns, Etc.) by State; <ftp://ftp2.census.gov/geo/tiger/TIGER2012/PLACE/>
- ▶ 2008-2012 5-Year Average Selected Demographic and

Economic Data from the American Community Survey (2012-ACS 5-Yr Avg); [ftp://ftp.census.gov/geo/tiger/TIGER\\_DP/2012ACS](ftp://ftp.census.gov/geo/tiger/TIGER_DP/2012ACS)

- ▶ CTA North American Railroad Network Lines; <http://www-cta.ornl.gov/transnet/RailRoads.html>
- ▶ Open Street Map Rail Data; <http://download.geofabrik.de/north-america.html>
- ▶ All Oiled Up: A Special Report by Fred Frailey; <http://trn.trains.com/issues/2014/march-2014>



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***Published February 2016***

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## ENDNOTES

1. <http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-44332/02%205000-BK-DEP3038.pdf>
2. <http://www2.epa.gov/ejscreen/what-ejscreen>
3. [www.blast-zone.org](http://www.blast-zone.org)
4. [http://www3.epa.gov/environmentaljustice/resources/policy/exec\\_order\\_12898.pdf](http://www3.epa.gov/environmentaljustice/resources/policy/exec_order_12898.pdf)
5. <http://www.mcclatchydc.com/news/nation-world/national/economy/article24761968.html>
6. <http://pennenvironment.org/page/pae/danger-around-bend>
7. <https://www.transportation.gov/briefing-room/final-rule-on-safe-rail-transport-of-flammable-liquids>
8. [www.phmsa.dot.gov/pv\\_obj\\_cache/pv\\_obj\\_id\\_8681A938B81B71A0E897AC2B9E38B8242DC70000/filename/1\\_2\\_14%20Rail\\_Safety\\_Alert.pdf](http://www.phmsa.dot.gov/pv_obj_cache/pv_obj_id_8681A938B81B71A0E897AC2B9E38B8242DC70000/filename/1_2_14%20Rail_Safety_Alert.pdf)
9. <http://priceofoil.org/2015/03/02/transporting-tar-sands-dangerous-shale-oil/>
10. <https://rbnenergy.com/crude-loves-rock-n-rail-brent-wti-bakken-netbacks>
11. [www.slocounty.ca.gov/Assets/PL/Santa+Maria+Refinery+Rail+Project/Phillips+66+Company+Rail+Spur+Extension+Project+\(Oct+2014\)/Phillips+SMR+Rail+Project+Public+Draft+EIR.pdf](http://www.slocounty.ca.gov/Assets/PL/Santa+Maria+Refinery+Rail+Project/Phillips+66+Company+Rail+Spur+Extension+Project+(Oct+2014)/Phillips+SMR+Rail+Project+Public+Draft+EIR.pdf)
12. <http://www.coaltrainfacts.org/whatcom-docs-position-statement-and-appendices-appendixA>
13. <http://www.startribune.com/as-oil-train-burns-2-300-residents-of-casselton-n-d-told-to-flee/238070771/>
14. <http://www.cta.ornl.gov/transnet/RailRoads.html>
15. <http://trn.trains.com/issues/2014/march-2014>
16. <http://priceofoil.org/rail-map/>
17. <http://www.pema.pa.gov/Documents/1/Pennsylvania.pdf>