North Carolina Statewide Multimodal Freight Plan

Pipeline and Hazardous Material Profile

prepared for

North Carolina
Department of Transportation

prepared by

Cambridge Systematics, Inc.

with

IEM

February 1, 2017

report

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List of Acronyms

AFRAMAX	Average Freight Rate Assessment Maximum – Oil tanker ship with dead weight tonnage ranging between 80,000 and 120,000
bbls	Barrels
CAS	Chemical Abstract Service
CSXT	CSX Transportation – CSX Not acronym, actual name of a Class 1 US Railroad
EHS	Extremely Hazardous Substance
EIA	US Energy Information Administration
EPCRA	Emergency Planning and Community Right-to-Know Act
FAF4	Freight Analysis Framework version 4
HazMat	Hazardous Material - Any chemical in transportation, in any form, that exhibits one or more of nine hazardous properties classes: explosives, gasses, flammable liquids, flammable solids, oxidizing substances and organic peroxides, toxic and infectious substances, radioactive materials, corrosive substances, and miscellaneous.
GIS	Geographic Information System
IRS	Internal Revenue Service
LEPC	Local Emergency Planning Committee – Designated by State Emergency Response Commissions as local entities responsible for chemical emergency planning
LLC	Limited Liability Company
MBPD	Million Barrels Per Day
NAICS	North American Industry Classification System
NGL	Natural Gas Liquids – Hydrocarbons separated from natural gas including: ethane, propane, butane, isobutene, pentane, and pentane plus or natural gasoline
NPMS	National Pipeline Mapping System – Geographical mapping data maintained PHMSA
PHMSA	Pipeline and Hazardous Materials Safety Administration
SARA Tier II	Hazardous chemical inventory form used to collect chemical inventory data from chemical facilities under the authority of federal Superfund Amendments Reauthorization Act
TPQ	Threshold Planning Quantity, quantity of an extremely hazardous substance that requires reporting on the Tier II form
TSCA	Toxic Substances Control Act – Federal statute that regulates the identification and control of toxic substances
USDOT	US Department of Transportation

1.0 Introduction

The movement of Hazardous Material (HazMat) freight has an enormous impact on North Carolina's transportation infrastructure today and will have in the future. One early example will help define the scope of this HazMat profile. The fuel movement model developed for this study estimates that during 2015 the state generated nearly *two million shipments of fuel*, delivering to the state *458 million barrels of fuel* by ship, pipeline, and rail, and distributed to local markets within the state by pipeline, rail and truck. With communities growing, land-use increasingly congested and development costly, and the demands on all parts of our aging infrastructure increasing, it is important that the state consider critical investments in the transportation infrastructure that will support the safe and timely delivery of HazMat freight to local markets and to destinations outside of North Carolina.

1.1 Overview, Data and Methodology

HazMat is a complex subject because of the nature of the particular chemistry of each individual chemical on one end and how completely dependent our economy is on HazMat on the other, not to mention the public health, safety and environmental issues that are evident any time an accident occurs. Exploring this subject is further complicated by the many differing and largely incomplete data sets available on the topic collected by government agencies with different regulatory, public safety and emergency management, and economic purposes. This profile will work with a number of these different data sources to develop the context and scope of HazMat freight in the state of North Carolina. It is important to state that *none* of these data sources are complete enough to adequately or fully describe the nature, scope, volume or even the value of HazMat freight anywhere in the United States, including in North Carolina. It is however, possible to use the data that is available to take snaps shots of key parts of HazMat freight system and build models that increase our understanding of this important subject.

To begin with, it is helpful to define HazMat. HazMat includes any chemical, in any form, that has one or more hazardous properties and that is in transportation. The key properties are those that make up the nine US Department of Transportation (US DOT) HazMat classes: explosives, gasses, flammable liquids, flammable solids, oxidizing substances and organic peroxides, toxic and infectious substances, radioactive materials, corrosive substances, and miscellaneous. So many chemicals meet these definitions that it is necessary to narrow the scope to a more comprehendible scale. We will start with a wide view and progressively narrow our focus.

The Chemical Abstracts Service (CAS) registry presently contains more than 123 million unique organic and inorganic chemical substances and more than 66 million sequences, with 340,000 regulated chemicals and millions of commercially available products.[1] From among these, the US Environmental Protection Agency maintains a list of over 83,000 chemicals in the Toxic Substances Control Act (TSCA) inventory that are registered for use in industry in the United States, with about 40,000 of these typically present in commerce.[2] If a chemical is present in commerce it has to be considered freight at some point in its lifecycle and may be present anywhere on the North Carolina transportation system.

[1] Chemical Abstract Service Registry

[2] Toxic Substance Control Act Inventory, November, 2016

This leads to the first key point, due to the free commerce clause in the US Constitution *there are very few restrictions to the transportation of HazMat*. Other than some limitations for transporting some classes of HazMat on designated routes over steep terrain and through tunnels, many of these 40,000 chemicals will be present somewhere within the transportation system at all times.

The second key point is that *HazMat, in some form, is in transportation everywhere in the state all of the time*, as it is essential to our society and economy; it is ubiquitous. Many chemicals are present in common products that are used to power, clean, make, or maintain virtually everything our society needs to survive. Almost everything we drink, grow, eat, wear, and drive, fly or float, the roads we drive on and the fuel we use to get where we are going, what we use to build our homes and offices, to clean, preserve, maintain, and enable our lives is transported at some point as HazMat freight. HazMat is routinely transported in commerce in all modes of transportation. HazMat freight is transported by ship or barge, pipeline, rail, and truck. Air transport of Dangerous Goods (another name for HazMat) occurs routinely but only in limited quantities with strict packaging requirements and the shipping of many specific chemicals by air is forbidden due to inherent safety concerns.

Our dependency on HazMat is so complete that interruptions in the movement of HazMat freight will have immediate and profound consequences on the daily lives of everyone relying on the affected supply chains. Many chemicals that are commonly transported are essential for industry to make the products we all need. These base chemicals are essential because they are the building blocks for making whole families of related chemicals and products. One example in North Carolina is the Extremely Hazardous Substance (EHS) chemical ethylene oxide. The state imports large numbers of rail cars of this toxic, carcinogenic, flammable, reactive, and often unstable chemical. The reason for importing a chemical with so many hazards is because modern chemistry depends on it. In addition to its important use as a disinfectant for surgical tools, it allows industry in the state to make everything from antifreeze, to soap, makeup, and tooth paste at facilities in the Triad. There are a number of these base chemicals that are imported in the state and many of them are also EHSs.

To further narrow the focus, over 6,900 North Carolina facilities submitted Hazardous Chemical Inventory Reports (SARA Tier II) in 2013. A Tier II report is required to be submitted when a business stores one or more hazardous chemicals in volumes exceeding 10,000 pounds for most, or for EHSs the Threshold Planning Quantity (TPQ) or 500 pounds, whichever is lower. These numbers of facilities and chemicals should not be considered as exhaustive because there are many exemptions to these reporting requirements, such as, farmers are not required to report fertilizers they use, explosives are not reported in this data, nor are chemicals present in laboratories under qualified supervision, nor those used in foods or drugs. But this information helps to define and narrow the scope for this profile. These reports showed over 15,000 unique hazardous chemicals in production, use, and/or storage in North Carolina. In 2013, the average volume of chemicals held in storage exceeded 318 billion pounds over any 24-hour period of time.[3] This is not usage or throughput at these facilities it is storage, annual usage is usually many times higher.

The North Carolina Tier II data supported the identification of primary transportation routes and corresponding annual transportation volumes by mode for a selection of these important base chemicals, EHSs, and other chemicals that local first responders and emergency management officials identified as important. These first of their kind studies were conducted on behalf of the North Carolina Division of

[3] 2013, NC Tier II, Hazardous Chemical Inventory data

Emergency Management for groups of Domestic Preparedness Regions covering the entire state over the course of five years from 2008 to 2012. These studies were conducted using a demand-pull model where the presence of a study chemical at a facility meant that the demand was present and the chemical was either locally produced or pulled into the state over the transportation system. Using authority given to Local Emergency Planning Committees (LEPCs) under Section 303(d)(3) of the 1986 Emergency Planning and Community Right-to-Know Act (EPCRA), owners or operators were asked to provide volume, container, destination and origin data for all shipments of priority chemicals to or from their facilities by transportation mode.

The primary data collected by these studies is substantive and allowed for the identification of primary EHS transportation routes and related volumes for each transportation mode. The third key point is one of the important lessons learned while doing these studies. That is, *other than in several notable exceptions, North Carolina does not produce base chemicals*. Instead the state imports base chemical commodities and either consumes them or makes them into other products.

One of the exceptions is PCS Phosphate in Aurora, North Carolina. PSC Phosphate manufactures several base chemicals from the phosphate they mine and a dozen phosphate based products valued at $1.2 Billion dollars in 2015. About 60 percent of these are fertilizers used in agriculture. This business is highlighted later in the profile. This is just one example of how the states' economy is highly dependent on the movement of HazMat as freight, not just because it supports nearly everything we do, but also because HazMat is itself a class of products North Carolina exports. North Carolina is the 7th highest value producer and shipper of chemicals in the United States with a value of well over $2.3 billion dollars shipped in 2012 by the chemical manufacturing industry[4] (See Table 1.1). Yet the state is not within the top 20 shippers of HazMat overall for all economic sectors. North Carolina imported $30.88 billion dollars' worth of HazMat commodities, weighing over 63.1 billion pounds in 2012.[5]

Table 1.1 Top Ten Chemical Shipping States by Value

State	Value of Shipments (Mil $)
California	$5,873
Texas	$5,399
New Jersey	$3,486
Illinois	$2,521
Ohio	$2,521
New York	$2,502
North Carolina	$2,344
Pennsylvania	$2,303
Louisiana	$1,959

Source: 2012, United States Census, Industry Snapshot, Chemical Manufacturing (325)

[4] 2012, US Census Bureau, Economic Census, Industry Snapshot, Chemical Manufacturing (NAICS 325)

[5] 2012, US Census Bureau, Economic Census, Commodity Flow Survey, Tables 5 a and 5 b, pg. 5

This apparent conflict between these two points is not an error, it is important information. It means that North Carolina is a net consumer of HazMat for the production of goods, including other HazMat products, and imports HazMat as fuel. Again PCS Phosphate is a good example. In order to produce the fertilizer that they sell, they need to import many unit train quantities of anhydrous ammonia.

It is important to also identify what is not present in the state. Crude oil is a base chemical that has received a lot of attention nationally over the last four years because of a number of major accidents. One catastrophic event in particular gained international attention. This event occurred in Lac Megantic, Canada on July 6, 2013, where an early morning rail accident, subsequent fire and explosion led to significant loss of life and property destruction. Essentially the explosion wiped out the core of this small town. A series of similar but less harmful events followed in locations all along primary rail corridors in the United States. These events were in part due to the development of the Bakken Oil Fields in North Dakota and the massive increase in the shipment of crude oil by rail to east coast refineries that had previously received foreign crude oil by ship.

There was a concern expressed by state government officials that North Carolina may be on a rail system used to ship crude oil. According to HazMat car load counts received from both Class I railroads operating in the North Carolina (CSXT and Norfolk Southern) over the course of conducting the HazMat Transportation studies, it was confirmed that the state has no production nor shipment into or out of the state of crude oil by rail. The US Energy Information Administration (EIA) data shows no pipelines, ship/barge, or truck shipments of crude oil through the state, nor is there any refining capacity that would require crude oil to be imported. North Carolina has no refineries that process crude oil.

As of November 2016, North Carolina does have 6 bio-fuel production facilities, but very little information is available on them beyond the fact they produce about 97 million gallons of bio-fuels per year, and that several more are still under construction. This highlights the fourth key point; *nearly all fuel used for any purpose in North Carolina is imported*.

1.2 Organization of the Report

Consequently, a review of two HazMat sectors will provide significant insight into HazMat freight issues in North Carolina. These two sectors are: fuels; and selected EHS and non-EHS chemicals. Each is explored in separate sections of this profile. Section 2 discusses the distribution and transportation of fuels and Section 3 focuses on priority chemicals studied over the course of the North Carolina HazMat Transportation study series. Within each of these sections of the profile, the primary HazMat activity, and the industries and markets served are identified, the bottlenecks and deficiencies in the transportation system are evaluated, and safety concerns are identified. Current and future demand estimates are provided. Finally, existing and expected future needs are evaluated.

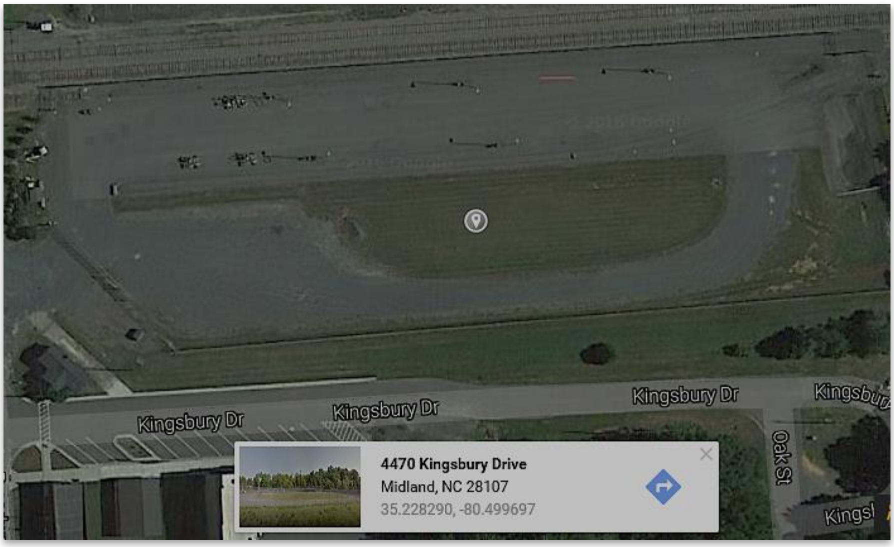
2.0 Fuels

North Carolina imports all of its petroleum based fuel and natural gas, as well as, significant quantities of bio-fuels, such as ethanol. The transportation network used for transportation of fuel consists of:

- 5,490 miles of pipeline for the movement of petroleum fuel, non-fuel products, propane, and natural gas
- 38 inland motor fuel terminals – 36 supported by pipeline, 4 also served by rail, and 2 receive ethanol exclusively by rail – all support truck loading operations (5 market areas served: Charlotte, Greensboro, Apex, Selma, and Fayetteville)
- 12 aviation fuel terminals –7 military bases, 5 supported by pipeline, 3 by rail, and 4 by truck (4 market areas served: Charlotte, Winston-Salem, Greensboro, and Morrisville)
- 2 propane terminals – one supported by pipeline and one supported by rail, both support truck loading operations (2 market areas served: Sylva in western NC and Apex in east central NC)
- 2 Transload Facilities, one in Star, NC (Figure 2.1) and the second in Midland, NC (Figure 2.2) – these facilities transfer unit train quantities of butane from rail tank cars to truck tank trailers for delivery to fuel terminals and elsewhere for fuel blending to raise the octane during winter months, serving all markets
- 6 marine petroleum terminals - receive ships and barges through the Port of Wilmington, also served by rail and trucks (1 market area served: Wilmington)
- Rail transport of petroleum fuels and bio-fuels for large volume delivery to terminals and large volume consumers not served by a pipeline or port; and
- Truck tank trailer fleets and support services to enable the transport and local delivery of all fuels but natural gas
- 6 bio-fuel production facilities in North Carolina with close to 97 million gallons per year production capacity or about 5 percent of demand – 2 are under construction

Figure 2.1 Star, NC Butane Rail to Truck Transloading Facility

Figure 2.2 Midland Transload Facility



Available data on the terminals in this network was obtained from the United States Energy Information Administration (EIA) but was inaccurate, incomplete and very basic. Information from the IRS identified many missing terminals, as did searches of Google Earth satellite images and general web searches. Terminals pay tariffs on fuel to the IRS, as such, the IRS keeps a more accurate list. Data on the shell capacity and products they support at these terminals was obtained whenever possible from on-line documents produced by the terminal operators. Additional data was obtained to fill in gaps from shareholder annual reports, Security and Exchange Commission 10K filings, construction contracts, local news articles, and by generating close estimates of shell capacities for about one third of the terminals. These estimates were based on dimensions of the tanks determined using satellite images and estimation tools.

The disaggregated county level Freight Analysis Framework version 4 (FAF4) used for other parts of this study was missing any information on the shipments of refined petroleum fuels. This required the development of a fuel model to attempt to understand the transportation of fuel in North Carolina.

2.1 Fuel Model

A mass-balance logic model was developed based on the terminal shell capacities to derive the expected flows of refined petroleum fuels by mode within the state using the central assumption that the terminals hold no more than two weeks of fuel; all delivered to local markets. Other assumptions in the model include:

- Pipeline demand is at 100 percent capacity based on their implementation of shipping histories as a means of allocating resources to client terminals
- Other modes of importing fuel into the state have excess capacity and are more flexible, but because they cost more, they are avoided when the pipeline can meet a demand, they include the marine terminals and railroad supported terminals
- All petroleum fuel is imported into the state moves to local markets and consumers – one-way flow

- Markets outside of North Carolina are served by North Carolina terminals, but to an unknown degree without FAF4 data to represent these market relationships
- All movement will use the most efficient transportation mode whenever possible to save cost
- Bio-fuels are 10 percent of petroleum fuel (Bio-Diesel and Ethanol)
- Ethanol and bio-diesel may come from in state or outside sources but at unknown quantities
- Ethanol is not shipped in any pipeline, it is generally carried long distances by ship, barge, and rail, and trucks support local delivery
- Tanker ships are estimated at no larger than 1,215,000-barrel capacity AFRAMAX class due to draft limitations at the marine terminal docks
- Rail and tanker truck capacities were fixed at the high end nominal levels (meaning that the shipment counts are likely low)
- All transmix[6] fuels are collected and returned to the refinery by truck for reprocessing accounting for about .5 to 1 percent of the pipeline capacity
- Fuel received at marine terminals predominately serves the local market but can be more widely distributed based on demand
- Does not include natural gas because it generates very little freight outside of the pipeline and distribution systems (Proposed expansions by Dominion on this system will link seven counties in the state to shale gas sources in southwestern Pennsylvania)

2.2 Fuel Volumes by Mode in 2015 and Projections to 2045

The fuel model supports a conservative estimate with a mass balance of over 94 percent of the combined peak capacity of the three fuel pipelines of 1,877,000 barrels per day. It is expected that some Virginia markets are also served by the terminal in Greensboro, and South Carolina markets are also served by the terminal in Charlotte. The model does not include or account for natural gas. It allows for some local increases in delivery due to temporary surges in demand. The model drops the mass balance to 73 percent of the total state-wide capacity when the marine terminals are included beyond local demand.

Table 2.1 displays the results of the model. It is estimated that in 2015 nearly two million fuel shipments were made into and within the state over all modes of the state's transportation system, distributing near 459 million barrels of fuel to local consumers annually. Based on EIA data for 23 years of North Carolina fuel

[6] Transmix is the fuel in the pipeline that mixes at the boundary between different products during shipment.

consumption, the IEM analysis projects a 23 percent reduction in demand for motor fuel out to 2045, reducing demand for motor fuel to 352 million barrels annually in North Carolina.[7]

Table 2.1 Total Estimated Refined Petroleum Fuel Shipments In North Carolina by Mode in 2015

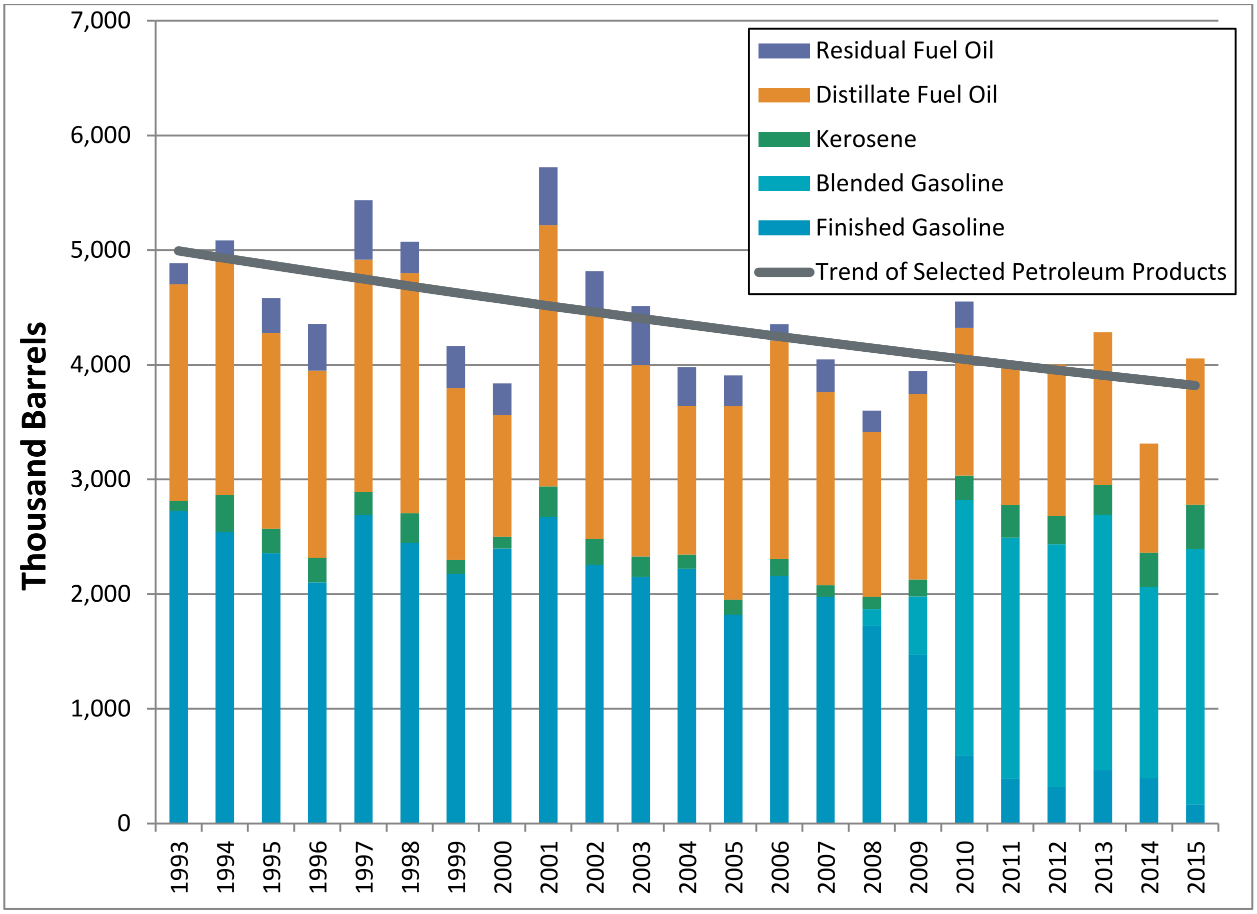
		Into Terminals		Out of Terminals	
Mode	**Percent**	**Barrels**	**Shipments**	**Barrels**	**Shipments**
Pipeline	62	283,435,932	-	-	-
Ship	31	143,622,565	118	-	-
Rail	7	30,522,539	30,508	-	-
Truck	< 1	1,386,690	6,299	414,701,130	1,924,950
Air *				44,266,596	N/A
Totals		**458,967,726**	**36,925**	**458,967,726**	**1,924,950**

Notes: Includes Gasoline, Diesel, Bio-Fuels, Propane, Aviation Fuel and Additives. Does not include Natural Gas.
* 44,266,596 barrels of jet fuel is used to fuel aircraft with no outbound shipments

Figure 2.3 shows the annual stock quantity of selected petroleum products in terminals of North Carolina per EIA data. Notice that diesel stock quantity decreased significantly since 1993. Based on the trend of the selected petroleum products stock quantity, the motor fuel use in North Carolina is projected to decrease by 23% from 2015 to 2045. Note that annual stock quantity is the sum of the stock quantity on last day of each month. Divide annual stock quantity by 12 gives an estimate of the expected stock quantity at any time of the year. Large reductions in distillate fuel oil and residual fuel oil account for a significant part of this reduction. Distillate fuel oil is mostly diesel and aviation fuels. There has been a significant reduction in diesel fuel usage in North Carolina, likely due to trucks refueling in neighboring states with lower fuel taxes. Residual fuel oil includes the heavier hydrocarbons that remain in the distillation process after the lighter hydrocarbons are removed. It usually used for industrial applications and steam generation. North Carolina has not used residual fuel oil since 2010. It is likely that the industries that used this fuel have converted to natural gas as a fuel source.

[7] US Energy Information Administration, North Carolina Refinery, Bulk Terminal, and Natural Gas Plant Stocks of Selected Petroleum Products, from 1993 to 2015

Figure 2.3 Annual Stock Quantity of Selected Petroleum Products in North Carolina



2.3 Pipelines

Pipelines move more than two thirds of all the crude oil and refined products in the United States. Based on the estimates described in the previous section, the pipeline system in North Carolina moves 62 percent of petroleum based fuels to five local market areas. They are generally the most economical and safest way to transport large quantities of refined petroleum products or natural gas over land. Several recent exceptions to the otherwise exceptional safety record highlight North Carolina's dependence on pipeline deliveries of fuel. These exceptions include a rupture and spill on a section of the Colonial Pipeline in Alabama that occurred in September of 2016, and an explosion and fire about a mile away from the first event about a month later in October of 2016. Within one week of the first event there were widespread shortages in the state, and within two weeks, most gas stations were out of fuel. Despite these events the pipeline system remains the most reliable means of delivering the needed 283 million barrels of fuel to the state per year.

North Carolina has a significant pipeline network. The state sits mid-route on several major pipelines that transport refined petroleum products from the US Gulf Coast to destinations along the northeastern United States, is the terminus of a major Natural Gas Liquids (NGL) or propane pipeline also from the Gulf Coast, and has numerous refined product and natural gas distribution terminals across the state. The next section describes the physical and operational characteristics of the pipeline network in North Carolina. The data analyzed for this pipeline profile was taken from the National Pipeline Mapping System (NPMS) GIS Layer, and Freight Analysis Framework version 4 (FAF4).

2.3.1 Pipeline System Description

There are approximately 5,490 miles of product pipelines in North Carolina, see **Error! Reference source not found.**2.4. About 0.7 percent of these pipelines are abandoned (37 pipeline miles), 1.9 percent are retired (107 pipeline miles), and 1.7 percent are inactive/idle (93 pipeline miles). The remaining 95.7 percent (5,252 pipeline miles) are active/in-service carrying liquids and gases, such as refined product, and natural gas. Table 2.2 2.2 shows the range of pipeline sizes and the corresponding lengths in miles. Note that the inactive/idle pipelines are maintained to a degree that can be brought back into service in the future, whereas the retired pipelines are not maintained but not yet permanently abandoned. The pipeline sizes range from relatively small lines with less than five inches in diameter to very large lines with up to 28 inches in diameter. Among the 5,252 miles of active pipelines, about 4,240 pipeline miles (80.7 percent) are small pipelines less than five inches of diameter. About 2 percent of the network (107 pipeline miles) consists of very large pipelines with over 25 inches in diameter. The rest range between 5 and 25 inches in diameter.

Figure 2.5 Active **Product Pipelines by Diameter**

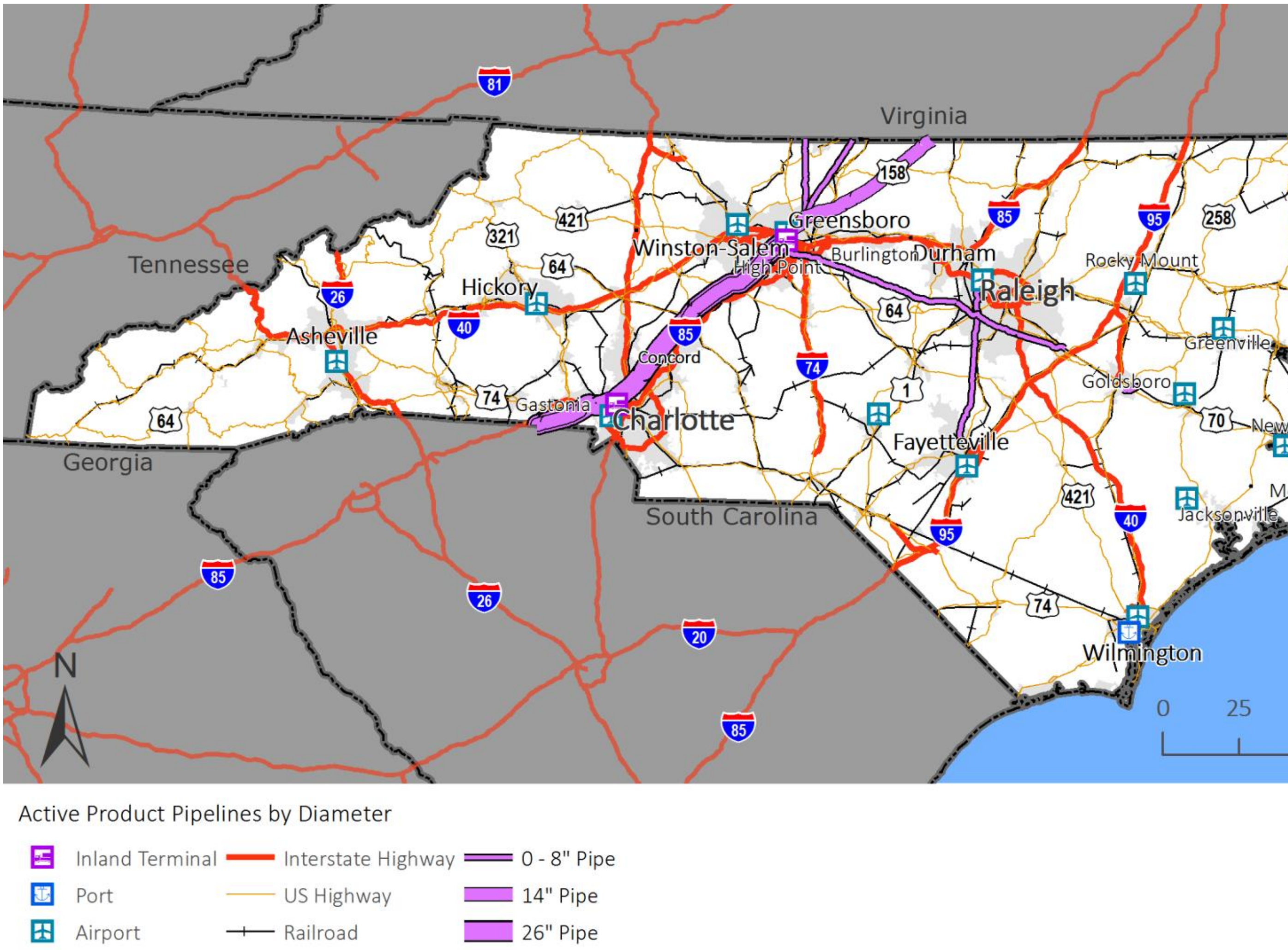
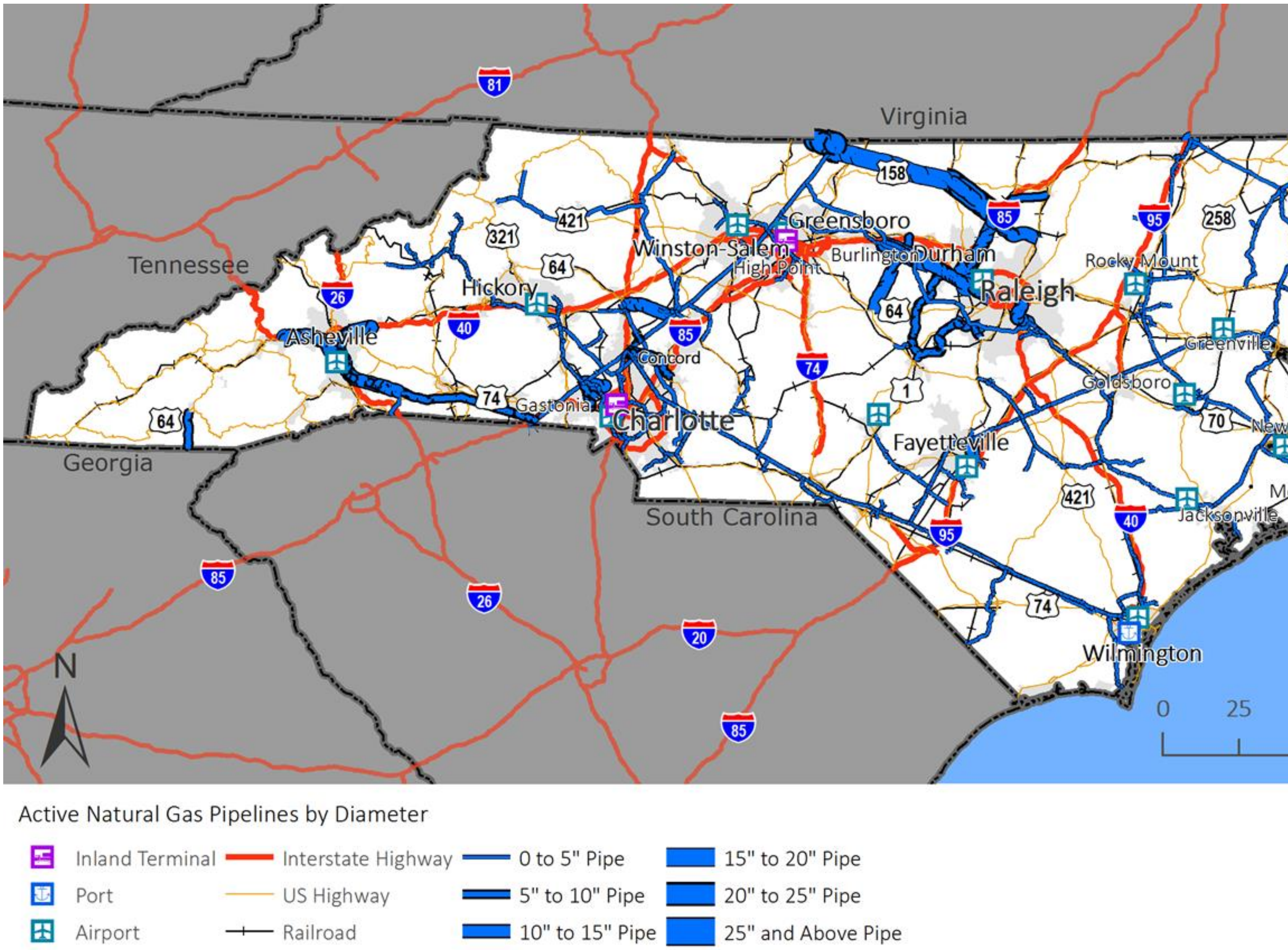


Figure 2.6 Active Natural Gas Pipelines by Diameter



2.5 displays a map of the North Carolina pipeline network with the lines that are in service by pipeline diameter. **Error! Reference source not found.**2.6 and 2.7 are maps of the active natural gas and liquefied petroleum gas (propane) pipeline systems respectively. **Error! Reference source not found.**2.8 displays other active gas pipelines near Greenville and Durham, NC, that carry specialized chemicals over short distances, and Figure 2.9 displays the projected flow of refined petroleum fuel by pipeline in North Carolina.

Table 2.2 Active Pipeline Diameters

Diameter (inches)	Miles
< 5	4,240
(5 to 10)	459
(10 to 15)	361
(15 to 20)	76
(20 to 25)	9
> 25	107

Total	**5,252**

Source: National Pipeline Mapping System (NPMS).

Figure 2.4 North Carolina Active Pipeline Network by Commodity

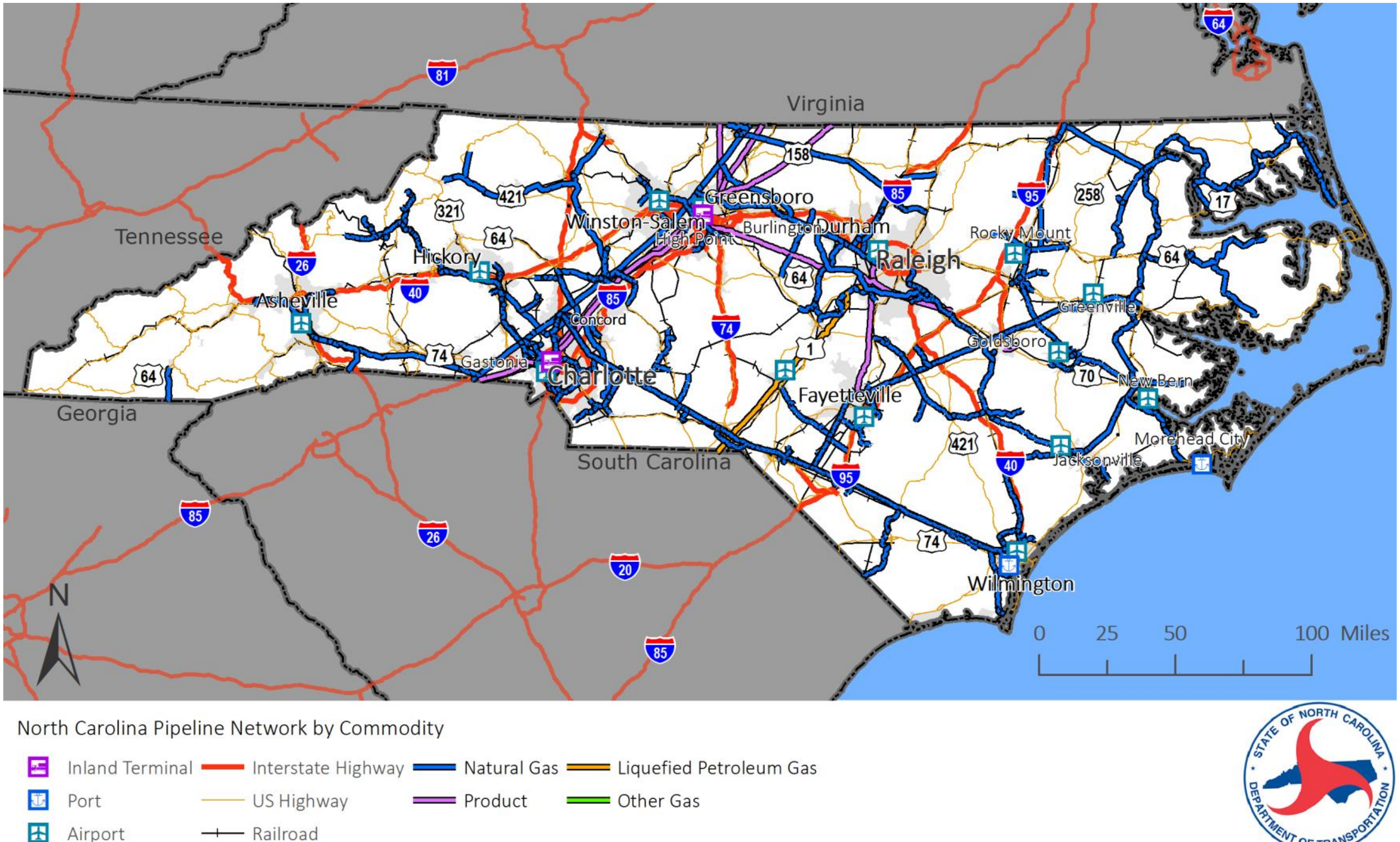


Figure 2.5 Active Product Pipelines by Diameter

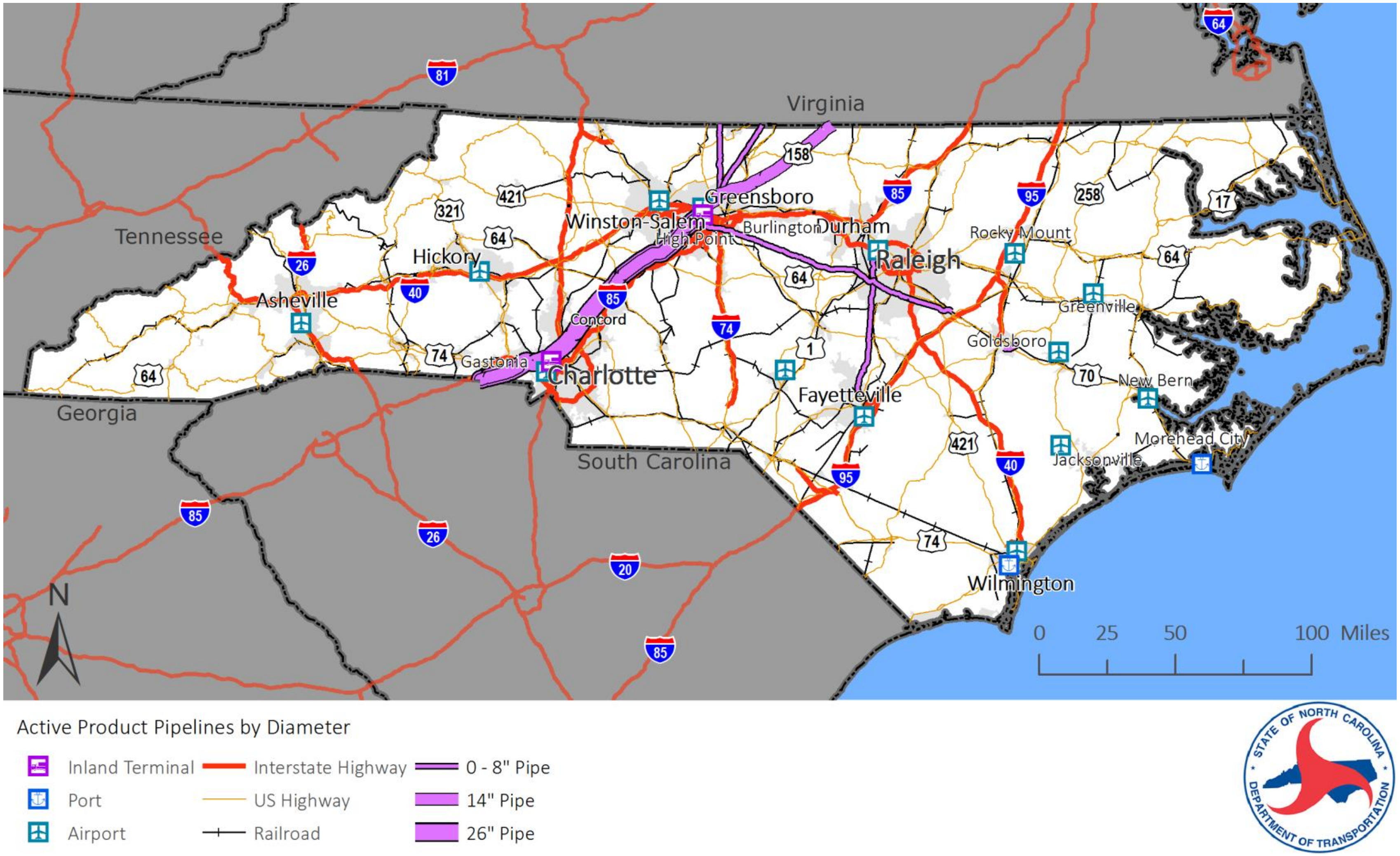


Figure 2.6 Active Natural Gas Pipelines by Diameter

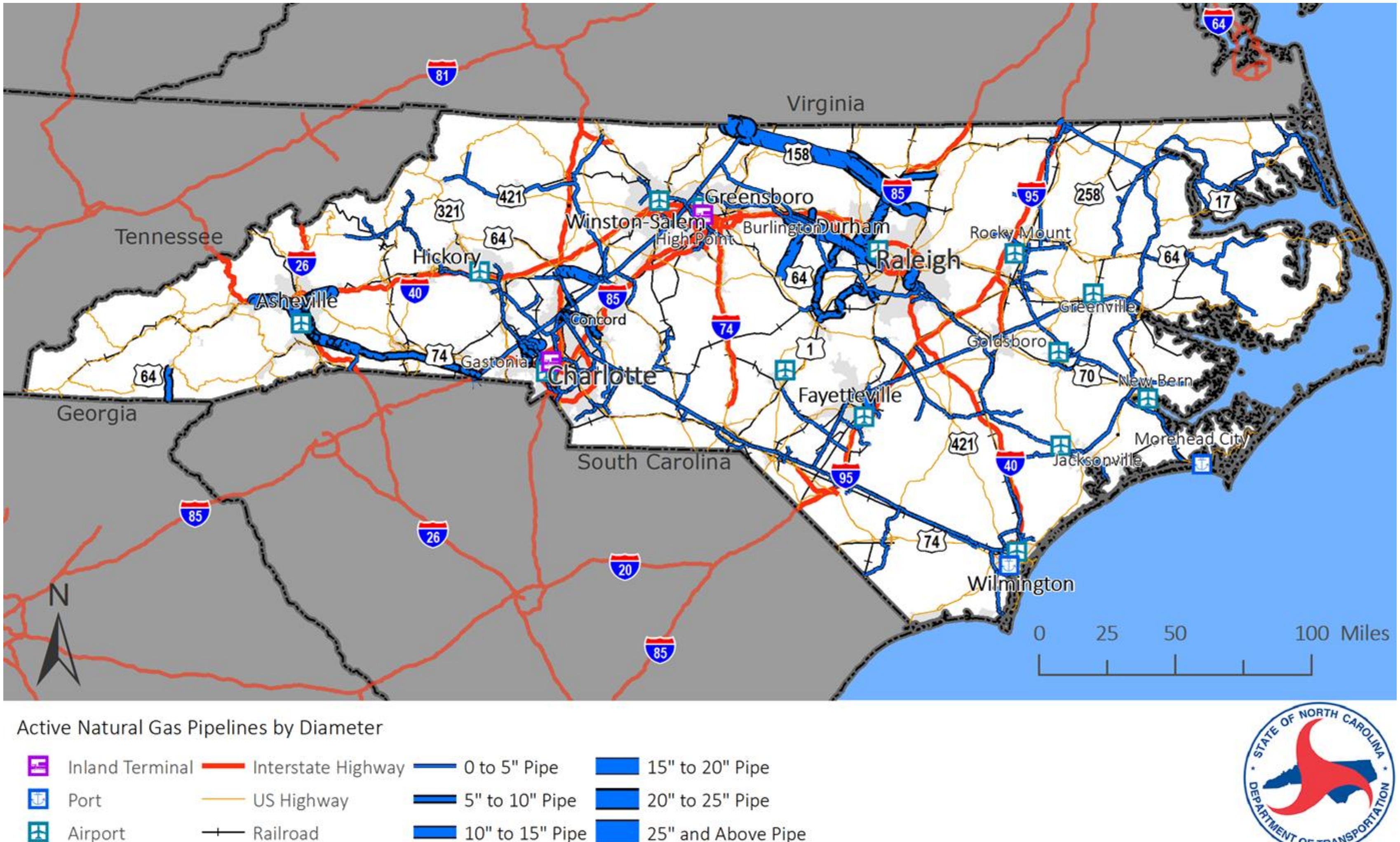


Figure 2.7 Active Liquefied Petroleum Gas Pipelines

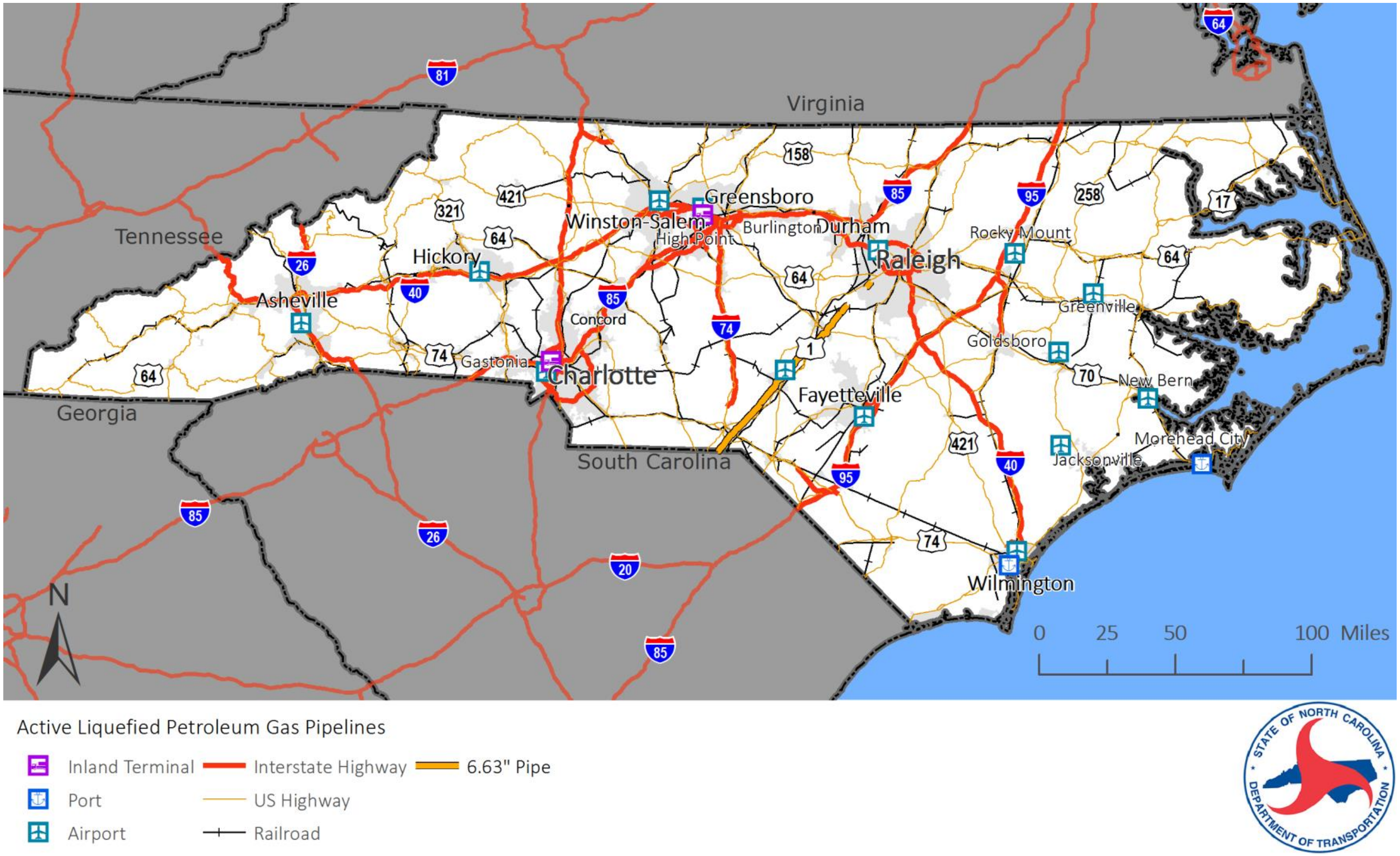


Figure 2.8 Other Active Gas Pipelines

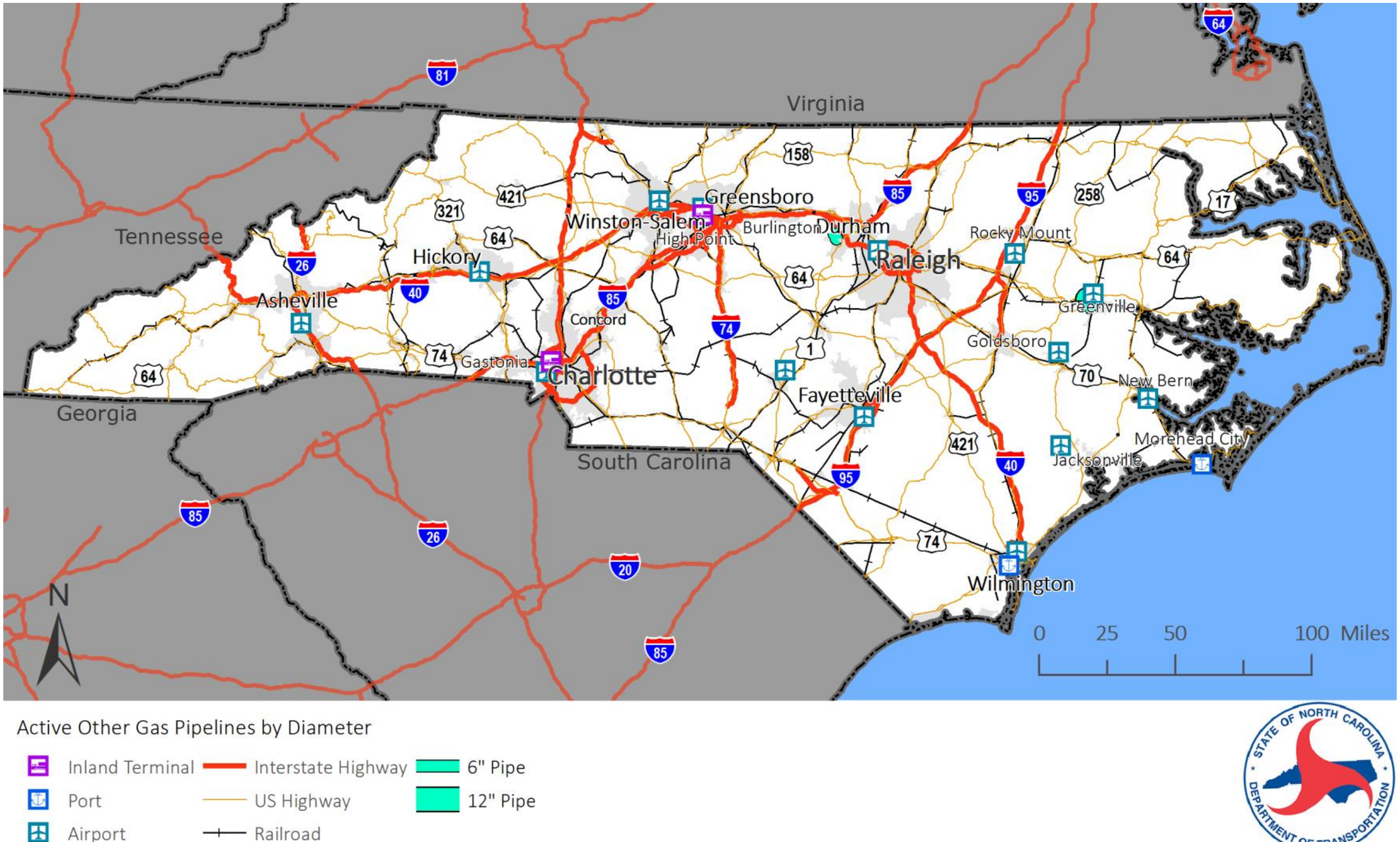
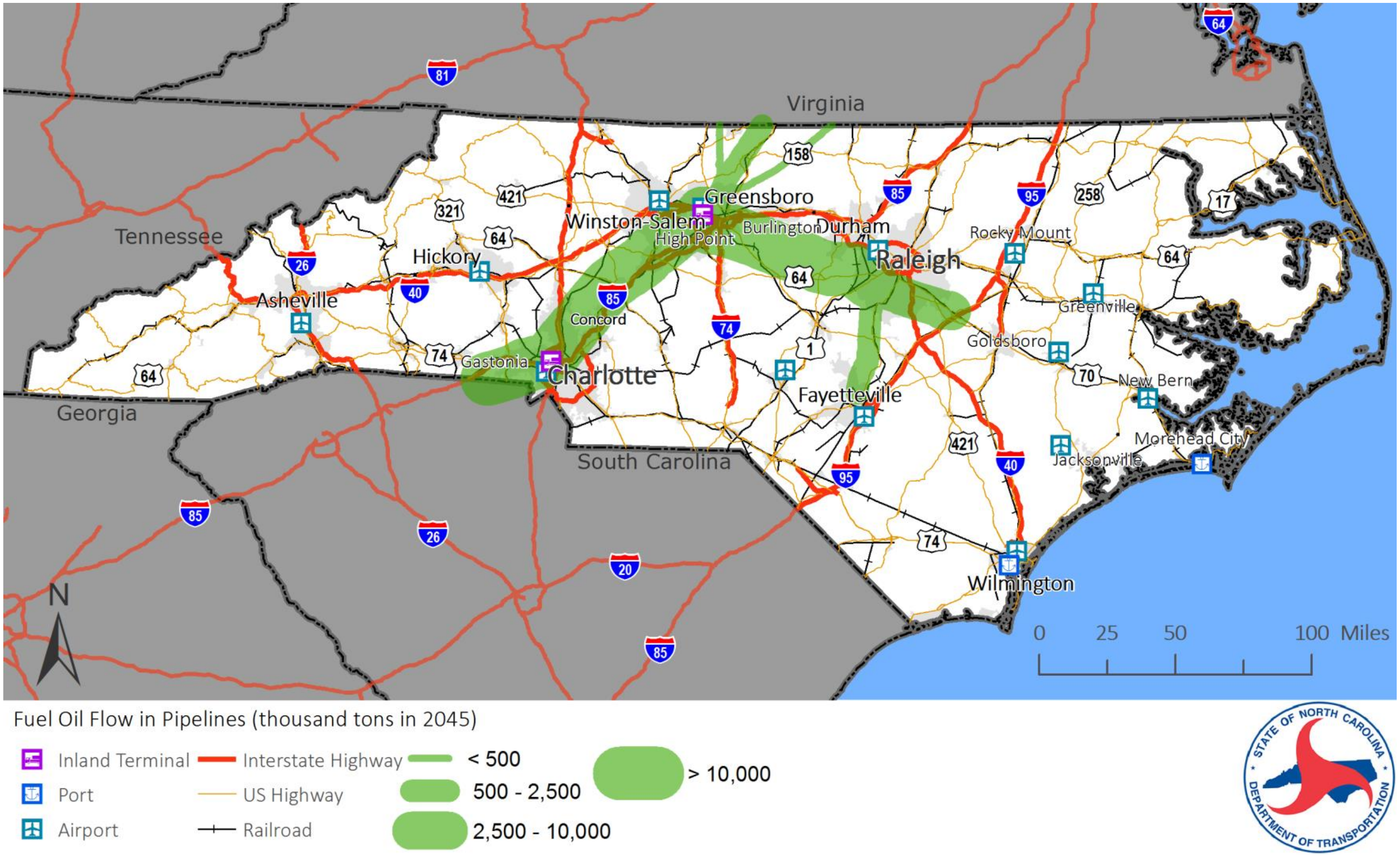


Figure 2.9 Other Commodities by Pipeline - Refined Petroleum Fuel, 2045 Tons



Note: Refined petroleum fuels include all motor fuels, jet fuels, and heating oils.

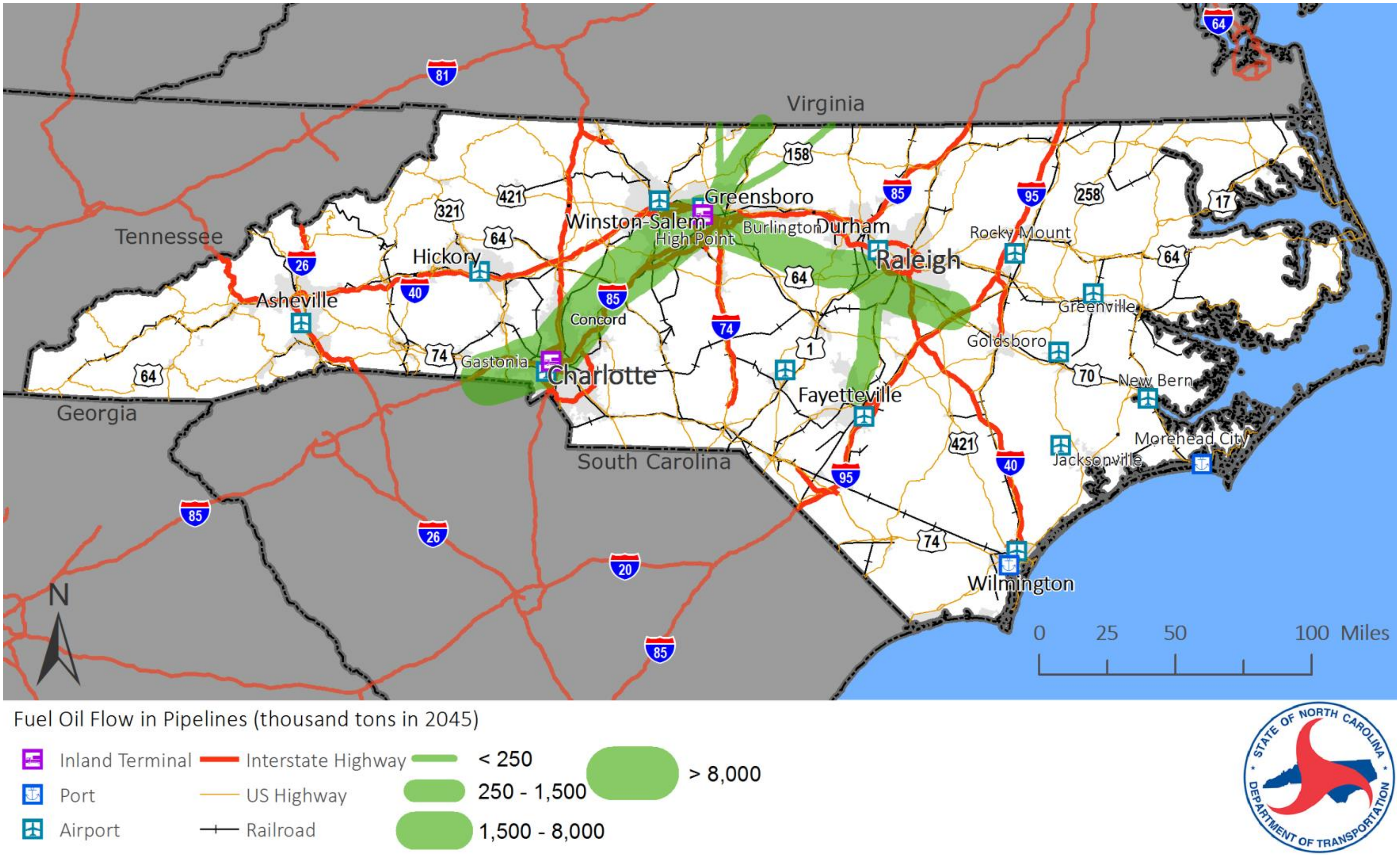
According to US Pipeline and Hazardous Materials Administration (PHMSA) data, FAF4 data, pipeline/terminal operators, and EIA gasoline sales data, refined petroleum fuel is transported in North Carolina through pipeline as shown in Table 2.3 Fuel to and from North Carolina by Pipeline2.3. The demand is expected to decrease by 26 percent from 2012 to 2045. A total of 27 million tons of fuel is expected to be transported into North Carolina in 2045 as shown in Figure 2.10. Within this group of fuels is a large amount of aviation fuel that is consumed at the major airports in Charlotte, Morrisville and Fayetteville, all of which connect to the Colonial Pipeline system. Gasoline is mainly transported to facilities in Greensboro, Charlotte, Selma, and Fayetteville for blending with ethanol and butane and distribution by truck. Additionally, about 60 percent of the fuel demand in the mid-Atlantic and lower northeastern states is met by the Colonial and Plantation pipelines with fuel transported from southern Gulf states through Greensboro, North Carolina serving as the primary hub.

Table 2.3 Fuel to and from North Carolina by Pipeline

From	To	2012 Thousand Tons	2045 Thousand Tons
South Carolina	Charlotte, NC	36,443	26,968
Charlotte, NC	Greensboro, NC	24,700	18,278
Greensboro, NC	Raleigh, NC	22,602	16,725
Raleigh, NC	Selma, NC	8,355	6,183
Raleigh, NC	Fayetteville, NC	2,672	1,977
Greensboro, NC	Virginia	2,147	1,589

Source: FAF4, PHMSA hazardous liquid annual data, EIA gasoline sales data and pipeline/terminal operators.

Figure 2.10 Refined Petroleum Fuel Flow in Pipelines, 2045 Tons



2.4 Non-Fuel Petroleum Products

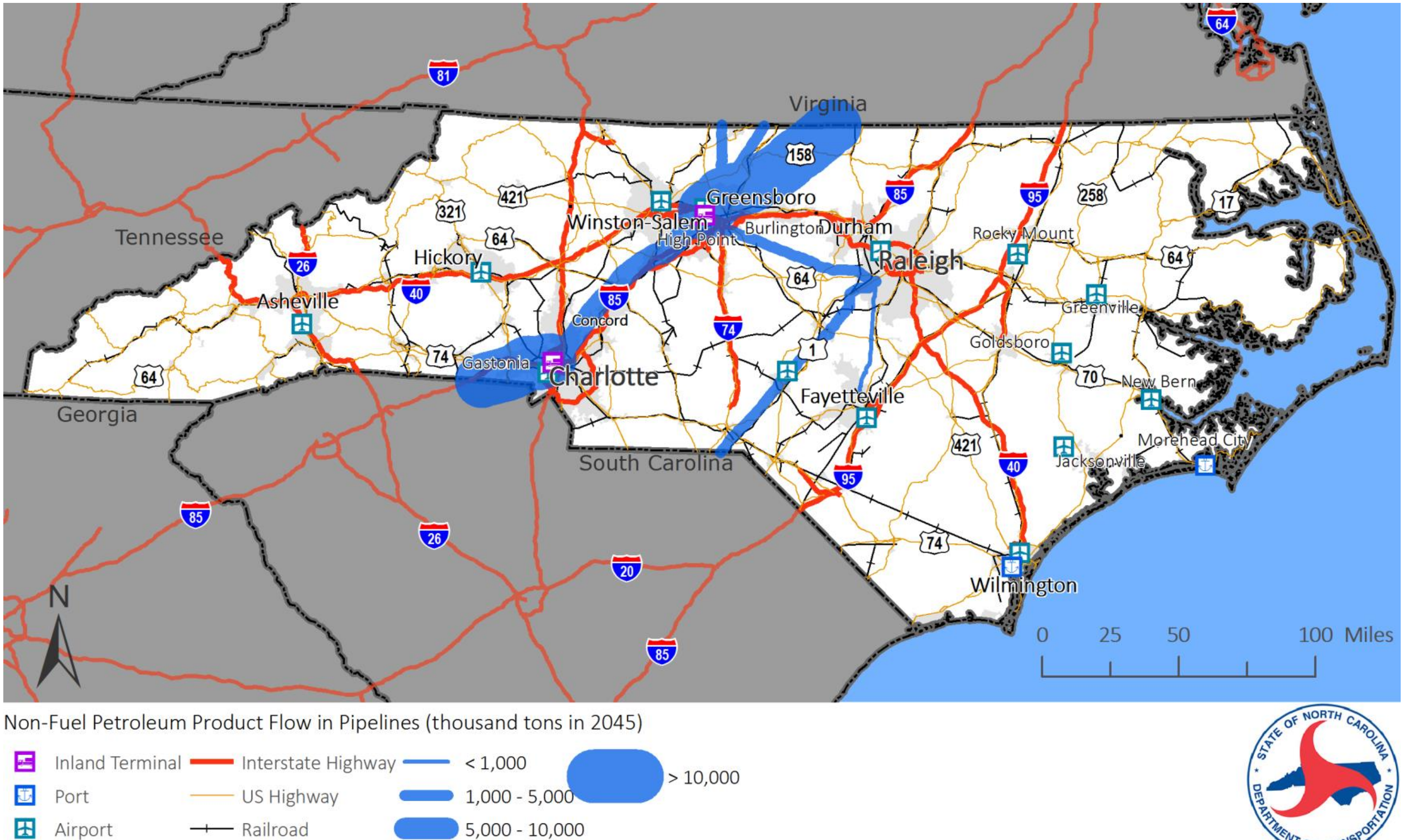
The "non-fuel petroleum products" are commodities with SCTG code of 19 in FAF4 dataset, and is officially named as "other coal and petroleum products not else classified". This commodity type does not include crude petroleum, gasoline, aviation turbine fuel, ethanol (including kerosene and fuel alcohols), or fuel oils (including diesel, bunker C and biodiesel). It does include lubricating oils and greases, gaseous hydrocarbons (including liquefied natural gas, liquefied propane, liquefied butane), and other coal products and products of petroleum refining, and natural asphaltic minerals, not elsewhere classified. Table 2.4 and Figure 2.11 provides a summary of non-fuel petroleum products flowing in North Carolina by pipeline.

Table 2.4 Non-Fuel Petroleum Product to and from North Carolina by Pipeline

From	To	2012 Thousand Tons	2045 Thousand Tons
Greensboro, NC	Charlotte, NC	4.8	5.1
Greensboro, NC	Greensboro, NC	3.6	6.3
Charleston, SC	Charlotte, NC	2,394.9	6,308.0
Charleston, SC	Greensboro, NC	1.2	5.0
Greenville, SC	Charlotte, NC	6,501.6	6,970.4
Greenville, SC	Greensboro, NC	4,722.4	8,370.6
Greenville, SC	Rest of NC	1.8	2.0
Rest of SC	Charlotte, NC	794.4	773.4
Rest of SC	Greensboro, NC	2,506.7	4,034.8
Richmond, VA	Charlotte, NC	145.1	284.7
Richmond, VA	Greensboro, NC	55.0	178.6
Virginia Beach, VA	Charlotte, NC	1.9	0.8
Virginia Beach, VA	Greensboro, NC	34.9	23.0
Washington D.C.	Charlotte, NC	91.8	115.8
Washington D.C.	Greensboro, NC	541.6	1,129.9
Washington D.C.	Rest of NC	0.1	0.2
Rest of VA	Charlotte, NC	607.8	401.8
Greensboro, NC	Richmond, VA	2,311.7	4,720.6
Greensboro, NC	Virginia Beach, VA	1,092.5	2,614.6
Greensboro, NC	Washington D.C.	3,378.8	8,109.6
Greensboro, NC	Rest of VA	4,213.3	8,921.5

Source: Freight Analysis Framework Version 4 (FAF4)

Figure 2.11 Non-Fuel Petroleum Product Flow in Pipelines, 2045 Tons



2.4.1 Chemical Pipelines

As shown in Table 2.5 2.5, there are basic chemicals transported within North Carolina through pipeline. These types of commodities only appear in short pipelines at the ports of Wilmington and Morehead City between the terminals and tank farms. These chemical are shipped to and from foreign countries to the ports by ships. Because information on these short pipelines is not available via the NPMS data, shipment of these chemicals are not mapped.

Table 2.5 Basic Chemical Product To and From North Carolina by Pipeline

From	To	2012 Thousand Tons	2045 Thousand Tons
Rest of NC	Rest of NC	269.5	350.2
Rest of NC	Europe	0.4	1.0
Rest of NC	Africa	0.0	0.1
Rest of NC	SW & Central Asia	0.1	5.3
Rest of NC	Eastern Asia	3.8	12.9
Rest of NC	SE Asia & Oceania	0.5	1.6
Rest of America	Rest of NC	64.4	177.3
Europe	Rest of NC	33.8	74.5
Africa	Rest of NC	10.5	43.3
SW & Central Asia	Rest of NC	16.0	155.2
Eastern Asia	Rest of NC	1.2	6.9

Source: Freight Analysis Framework Version 4 (FAF4).

2.4.2 Pipeline Operators

The pipeline data from NPMS listed 18 pipeline operators in North Carolina. Table 2.6 shows these pipeline operators, their pipeline miles and primary commodity carried. These are some of the key highlights:

- Piedmont Natural Gas Co Inc. operates the longest miles (about 2,724 miles or 51.9 percent) of the pipelines in North Carolina. It operates the longest natural gas pipeline in the state, followed by Public Service Co of North Carolina, Transcontinental Gas Pipe Line Company, Frontier Energy, and Cardinal Operating Company, LLC.

- Colonial Pipeline Co. operates the second longest miles (about 609 miles or 11.6 percent) of the pipelines in North Carolina. It operates the longest product pipeline in the state, followed by Plantation Pipe Line Co and Dixie Pipeline Company LLC.

- All other operators operate no more than 50 miles of pipeline each.

Table 2.6 Major Pipeline Operators in North Carolina

Pipeline Operator	Primary Commodity Carried	Miles	%
Piedmont Natural Gas Co Inc.	Natural Gas	2,724	51.9%
Colonial Pipeline Co	Product	609	11.6%
Public Service Co of North Carolina	Natural Gas	599	11.4%
Transcontinental Gas Pipe Line Company	Natural Gas	587	11.2%
Plantation Pipe Line Co	Product	317	6.0%
Frontier Energy	Natural Gas	137	2.6%
Cardinal Operating Company, LLC	Natural Gas	104	2.0%
Dixie Pipeline Company LLC	Liquefied Petroleum Gas	90	1.7%
City of Monroe Natural Gas Dept.	Natural Gas	44	0.8%
City of Toccoa Natural Gas System	Natural Gas	13	0.3%
East Tennessee Natural Gas, LLC	Natural Gas	8	0.2%
Buckeye Development & Logistics, LLC	Liquefied Petroleum Gas	6	0.1%
Douglas Pipeline Co	Other Gas	3	0.1%
Duke Energy Asheville Combustion Turbine	Natural Gas	3	0.1%
Fayetteville Gas Producers, LLC	Natural Gas	2	0.0%
Pine Needle Operating Company, LLC	Natural Gas	2	0.0%
Pitt Landfill Gas, LLC	Other Gas	2	0.0%
Columbia Gas Transmission, LLC	Natural Gas	1	0.0%
Total Miles		**5,252**	**100%**

Source: National Pipeline Mapping System (NPMS).

2.4.3 Intermodal Connections

Figure 2.12 shows the location of major intermodal petroleum product terminals for pipelines in North Carolina. Tables 2.7 to 2.9 show their names, addresses, commodities and capacities. There are 38 fuel, propane and aviation terminals and the pipelines supporting these terminals are operating at or near capacity mainly transporting fuels (gasoline, diesel, aviation fuel), at an estimated rate of 283 million barrels per year. Below is the breakdown for the terminal clusters by city:

- There are ten fuel terminals in Selma, NC. They all are connected to the pipeline system operated by Colonial. It is estimated a total 66 million barrels of commodities (mainly gasoline and diesel fuel) are transported to Selma, NC by pipelines. Gasolines are blended there with bio-fuel, which are transported into the terminal by 9,498 rail cars each year. The processed products are shipped out from these terminals by 336,340 trucks each year.

- There are twelve fuel terminals in Charlotte, NC. They are connected to the pipelines operated by Colonial and/or Plantation. It is estimated a total 93 million barrels of commodities are transported to Charlotte, NC by pipelines. Gasolines are blended there with bio-fuel, which are transported in by 13,341 rail cars each year. The processed products are shipped out from these terminals by 426,580 trucks each year.

- There are seven fuel terminals in Greensboro, NC. They are connected to the pipelines operated by Colonial and/or Plantation. It is estimated a total 83 million barrels of commodities are transported to Greensboro, NC by pipelines. Gasolines are blended there with bio-fuel, which are transported in by 11,892 rail cars each year. The processed products are shipped out from these terminals by 382,621 trucks each year.

- There are six marine fuel terminals in Wilmington, NC. They supported by and estimated 118 AFRAMAX class size shiploads per year. It is estimated a total 131 million barrels of commodities are transported to Wilmington, NC by ships. Gasolines are blended there with bio-fuel, which are transported in by ship at approximate quantity of 13 million barrels. The processed products are shipped out from these terminals by 662,771 trucks each year.

- There is one terminal is Apex, NC. It is supported by a connection to the Colonial Pipeline System. It is estimated a total of 4.8 million barrels of commodities are shipped to Apex by pipeline each year. Gasolines are blended there with bio-fuel which are transported in by 2,260 truck shipments each year. The processed products are shipped out from this terminal by 24,863 trucks each year.

- Another Apex terminal supports only propane. It is served by the Dixie Pipeline. It is estimated a total of over 11 million barrels of propane are shipped to Apex by pipeline each year. Propane is loaded onto shipped out from this terminal by 50,587 trucks per year.

- There is one terminal in Fayetteville, NC. It is supported by a connection to the Colonial Pipeline System. It is estimated a total of 21.1 million barrels of commodities are shipped to the Fayetteville terminal by pipeline each year. Gasolines are blended there with bio-fuel which are transported in by 2,220 truck shipments each year. The processed products are shipped out from this terminal by 24,420 trucks each year.

- There is an ethanol terminal in Denton, NC. It is supported with 1,342 rail car per year (17 unit trains) of ethanol deliveries by rail. Ethanol is shipped out by 4,369 trucks each year.

Figure 2.12 Major Intermodal Terminals for Pipeline in North Carolina

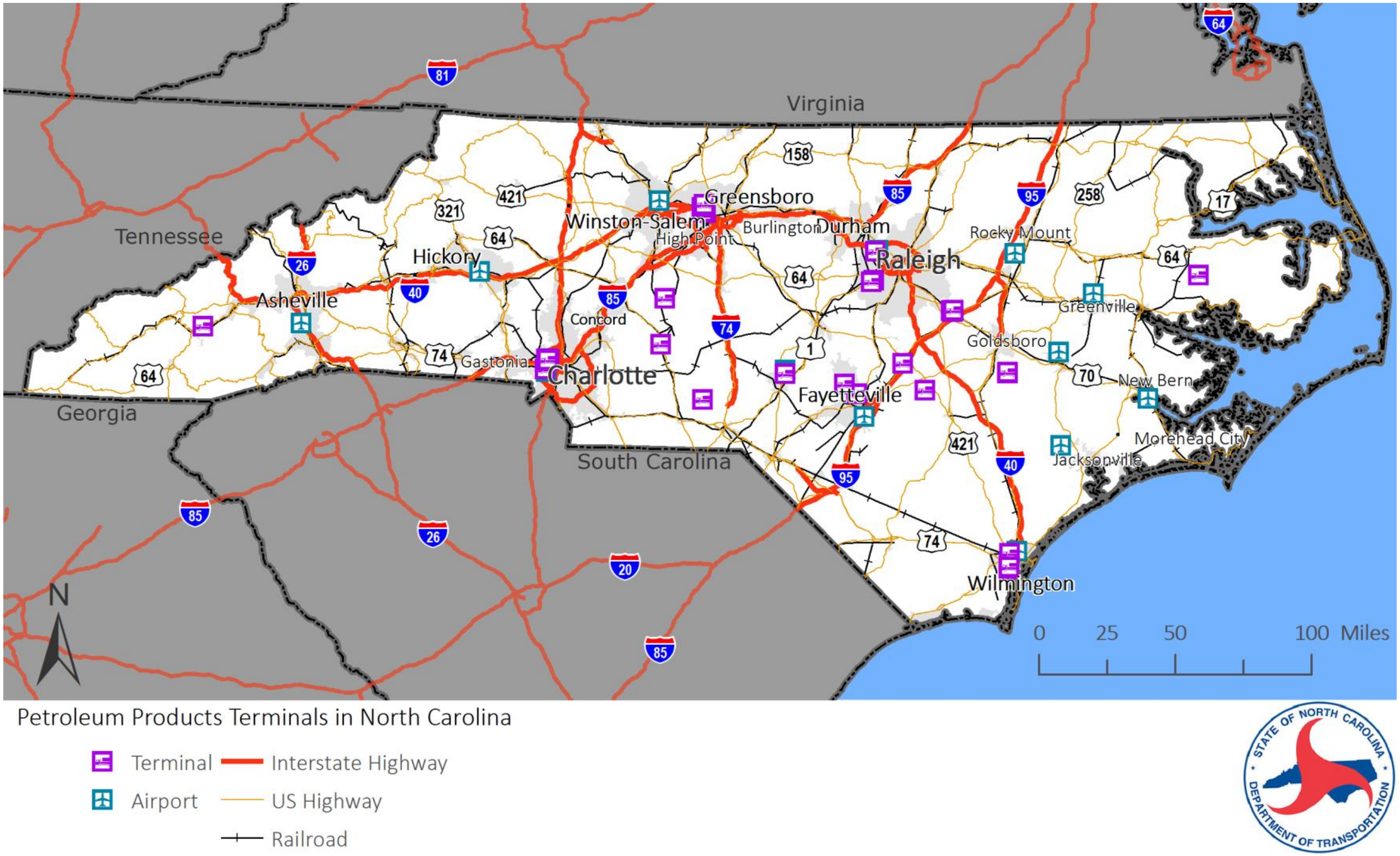


Table 2.7 Fuel Terminals

Name	Address	Commodity	Shell Capacity (bbls)	Notes
Kinder Morgan Southeast Terminal Selma 4	4086 Buffalo Rd, Selma, NC 27576	Gasoline, Diesel, Ethanol	160,000	Ethanol Blending, Dye Injection
Marathon Petroleum Company Selma	3707 Buffalo Rd, Selma, NC 27576	Gasoline, Ethanol	151,300	Listed as BP, ethanol
Kinder Morgan Southeast Terminal Selma 2	2100 West Oak Street, Selma, NC 27576	Diesel, Ethanol	70,000	Ethanol Blending
Kinder Morgan Southeast Terminal Selma 1	2200 W Oak St, Selma, NC 27576	Gasoline, Diesel, Ethanol	332,000	Ethanol Blending, Truck Refueling, Additive Injection, Dye Injection
ARC Terminals Holding Co Selma	2999 West Oak Street, Selma, NC 27567	Gasoline, Distillates, Ethanol, Biodiesel	171,000	
TransMontaigne Product Services Selma - N	2427 W Oak St, Selma, NC 27576	Diesel, Gasoline	529,000	
Marathon Petroleum Company Selma MOC 1	2555 W Oak St, Selma, NC 27576	Gasoline	312,000	
Citgo Petroleum Corp Selma	4095 Buffalo Rd, Selma, NC 27576	Gasoline, Diesel	250,000	
Kinder Morgan Southeast Terminal Selma 3	4383 Buffalo Road, Selma, NC 27576	Gasoline, Diesel, Ethanol	190,000	Ethanol Blending, Additive Injection, Dye Injection
Magellan Pipeline Co LP Selma	4414 Buffalo Rd, Selma, NC 27576	Diesel Fuel, Gasoline, Ethanol	186,300	
Motiva Enterprises LLC Raleigh Blending Terminal	2232 Ten-Ten Road, Apex, NC 27539-8115	Gasoline	186,300	Ethanol Blending Facility
Motiva Enterprises LLC Fayetteville	992 Shaw Mill Road, Fayetteville, NC 28311	Gasoline, Diesel, Ethanol	185,000	
Magellan Pipeline Co Charlotte 1	7145 Old Mt. Holly Rd., Charlotte, NC 28214	Gasoline, Diesel, Ethanol	155,000	
Kinder Morgan Southeast Terminal Charlotte 3	7325 Old Mt. Holly Rd, Charlotte, NC 28214	Diesel and Ethanol	145,000	Ethanol Blending, Additive and Dye Injection
Marathon Petroleum Co Charlotte	8035 Mt Holly Rd, Charlotte, NC 28214	Gasoline	145,000	
TransMontaigne Product Services Charlotte Paw Creek	7615 Old Mt Holly Rd, Charlotte, NC 28214	Gasoline, Diesel	327,667	
Citgo Petroleum Corp Charlotte	7600 Mt Holly Rd, Charlotte, NC 28214	Gasoline, Diesel	240,000	
Eco-Energy Distribution Services LLC Charlotte	7720 Mount Holly Road, Charlotte, NC 28214	Gasoline, Ethanol, biodiesel	130,000	
Kinder Morgan Southeast Terminal Charlotte 2	6801 Freedom Dr, Charlotte, NC 28214	Gasoline, Diesel, Jet A, Ethanol	376,000	Ethanol Blending, Additive and Dye Injection

Name	Address	Commodity	Shell Capacity (bbls)	Notes
Motiva Enterprises LLC Charlotte NC Motiva South	6851 Freedom Drive, Charlotte, NC 28214	Gasoline	180,000	
Magellan Pipeline Co LP Charlotte 2	7924 Mt. Holly Road, Charlotte, NC 28214	Gasoline, Diesel, Ethanol	325,000	
Motiva Enterprises LLC Charlotte	410 Tom Sadler Road, Charlotte, NC 28214	Gasoline, distillate, jet and bio fuels	200,000	
Marathon Petroleum Co LLC Charlotte - East	7401 Old Mt Holly Road, Charlotte, NC 28214	Gasoline, diesel, ethanol	350,000	
Kinder Morgan Southeast Terminal Charlotte 1	502 Tom Sadler Road, Charlotte, NC 28214	Gasoline, Diesel	658,000	Dye Injection
JT Russell & Sons Inc. - Denton	18846 NC-8, Denton, NC 27239	Ethanol and Asphalt	36,000	Eco-Energy Distribution Services LLC High Rock is partner
Kinder Morgan Southeast Terminal Greensboro 2	6376 Burnt Popular Road, Greensboro, NC 27409	Gasoline, Diesel, Ethanol	631,000	Ethanol Blending, Additive and Dye Injection
Motiva Enterprises LLC Greensboro Blending Terminal	101 South Chimney Rock Road, Greensboro, NC 27409	Gasoline	215,000	
Magellan Terminals Holdings LP Greensboro 1	115-S Chimney Rock Rd., Greensboro, NC 27409	Diesel, Gasoline, Ethanol	215,000	
TransMontaigne Products Services Inc Greensboro	6907 B West Market Street, Greensboro, NC 27409	Diesel, Gasoline	479,000	
Center Point Terminal LLC Greensboro	6900 West Market Street, Greensboro, NC 27409	Diesel, Gasoline, Biodiesel, Distillate, Jet Fuel	684,000	
Kinder Morgan Southeast Terminal Greensboro 1	6907 West Market Street, Greensboro, NC 27409	Gasoline, Diesel, Ethanol, Jet A	735,000	Ethanol Blending, Additive and Dye Injection
Magellan Pipeline Co LP Greensboro 2	7109 W. Market St., Greensboro, NC 27409	Diesel, Gasoline, Ethanol	631,000	
Buckeye Terminal LLC Wilmington	1312 Front Street, Wilmington, NC 28401	Diesel, Gasoline	572,000	
Kinder Morgan Terminal Wilmington LLC Woodbine Street	1710 Woodbine St, Wilmington, NC, 28402	Chemicals, Petroleum, Asphalt	821,529	Additive Injection, Blending, Heating
Kinder Morgan Terminal Wilmington LLC River Road	3340 River Road, Wilmington, NC 28412	Chemicals, Veg Oils, Petroleum	313,000	
Kinder Morgan Terminal Wilmington LLC N 6th Street	2005 North Sixth Street, Wilmington, NC 28401	Petroleum and Specialty Chemicals	1,100,000	
Apex Oil Company Inc. Wilmington	3314 River Road, Wilmington, NC 28412	Asphalt, Liquid Asphalt, Distillate, Biodiesel, Aviation Gasoline	1,485,000	

Name	Address	Commodity	Shell Capacity (bbls)	Notes
Colonial Terminals Wilmington	1002 S Front Street, Wilmington, NC 28401	Caustics, Acids, Petroleum, Specialty Chemicals, Solvents, Alcohols	730,239	Blending, Heating, Truck Scales

Source: Pipeline Operators, US Energy Information Administration (EIA), US Internal Revenue Service, and other sources

Table 2.8 Propane Terminals

Name	Address	Commodity	Shell Capacity (bbls)	Notes
Enterprise Products Aberdeen - Operating LLC Sylva NGL	2805 Skyland Drive, Sylva, NC 28779	Propane, NGL	6,667	Rail Terminal
Enterprise Products Aberdeen NGL	1674 Roseland Rd, Aberdeen, NC 28315	Natural Gas Liquids (Propane, Butane, Isobutane, Pentane, Ethane, etc.)	-	No tanks, just monitoring
Dixie Pipeline Enterprise Products HGL	1497 Central Dr, Southern Pines, NC 28387	Propane	-	No apparent storage
Dixie Pipeline Apex Tank (Enterprise Products)	1521 E Williams St, Apex, NC 27539	Propane	426,190	NGL 36 MBPD Pipeline Capacity

Source: Pipeline Operators, US Energy Information Administration (EIA), US Internal Revenue Service, and other sources

Table 2.9 Aviation Terminals

Name	Address	Commodity	Shell Capacity (bbls)
Pope Air Force Base	Gena Street, Pope Field, NC, 28308	Jet Fuel	630,000
Seymore Johnson AFB	1510 Wright Brothers Ave, Goldsboro, NC 27531	Jet Fuel	94,500
North Carolina Air National Guard	4930 Minuteman Way, Charlotte, NC 28208	Jet Fuel	5,700
Camp McKall Army Base	Hoffman NC, 28347	Jet Fuel	3,500
US Coast Guard - Elizabeth City	1664 Weeksville Rd, Elizabeth City, NC 27909	Jet Fuel	5,500
US Marine Corps - Camp Lejeune (New River)	White St AS-201, Jacksonville, NY 28540	Jet Fuel	28,000
US Marine Corps - Cherry Point	Highway 101, Cherry Point, NC 28533	Jet fuel	76,000
Raleigh-Durham Airport Authority (Worldwide Flight Services)	2800 West Terminal Blvd, Morrisville, NC 27560	Aviation Fuel	153,000
Aircraft Service International, Inc.	6502 Old Dowd Rd., Charlotte, NC 28219	Jet Fuel	350,000

Name	Address	Commodity	Shell Capacity (bbls)
Signature Flight Support	1060 PTI Drive, Greensboro, NC 27409	Jet Fuel	1,800
Landmark Aviation	3821 N. Liberty St., Winston-Salem, NC 27105	Jet Fuel	1,500

Source: Pipeline Operators, US Energy Information Administration (EIA), and other sources

2.4.4 Bottlenecks and Deficiencies

There are two clear bottlenecks and one major deficiency in the transportation infrastructure for fuels in North Carolina.

Fuel Pipeline System Capacity

The first and most obvious bottleneck is more of a vulnerability. It concerns the pipelines are operating at or near maximum capacity. While there appears to be some additional capacity to import fuel via the marine terminals at the Port of Wilmington, this would only be sufficient for emergency needs and surge capacity as there would be a higher cost to transport fuel to markets around the state. Over the mid to long- term this additional cost would be passed on to consumers as increased fuel prices. Consequently, the state is highly dependent on the pipelines. When there is a supply disruption, as was experienced during the two recent Colonial pipeline events in Alabama, the state has few options except to suffer the economic and social impacts that a prolonged fuel shortage will cause.

Fuel Terminal Access and Multimodal Connectivity

The second bottleneck concerns the linkages between the fuel terminals and all other modes of transport. They are weak at best. All of the inland and marine terminals are only supported with two lane roads as connections to main arterial roads, highways, and the interstate system. Not all of the fuel terminals have full access to rail lines to obtain ethanol by rail. This may not seem to be important except when you consider:

- Every railcar that can deliver ethanol to a terminal replaces three or more deliveries by truck tank trailer
- The nearly two million truck tank trailer loads leaving these terminals per year is nearly two million opportunities for a serious accident and HazMat event as these trucks turn or merge into traffic

The Charlotte group of terminals, for example, are estimated to ship out nearly 92.4 million barrels of fuel per year in more than 426,500 truck trailers loads at an average rate of 1,169 per day, or close to 50 truck trailer loads per hour, every day all year. These connections between modes are the main bottleneck.

New terminals are being built in isolated areas with access to rail and local roads. The JR Russel & Sons ethanol terminal in Denton, NC for example, is located 14 miles from Interstate 85. To get to the interstate, trucks must travel over sections of three state highways and two local roads. Local officials are concerned for the safety of the residents.

Another example is the Dixie propane facility in Apex, NC. This facility receives propane from the dedicated propane pipeline and ships out an estimated 11 million barrels of propane per year with more than 50,000 truck tank trailer loads, 138 shipments per day, or almost 6 per hour. During some periods of the day this may not seem like a big problem, but during rush hour times it is a major safety concern for the facility and local officials. Trucks leaving the facility have to stop at a gate, from that point to where they need to begin to turn into traffic is about 18 feet. This is not enough space to accelerate and safely merge a large fully loaded semi-truck into traffic on State Highway 55, especially when carrying HazMat. (See Figure 2.13)

Figure 2.13 Dixie Terminal in Apex, NC

Field Fuel Blending

The deficiency concerns fuel blending. Gasoline is not one chemical, it is more of an engineered fuel. A mixture of chemicals with different properties are blended together in precise combinations and ratios during the fall and winter, and spring and summer and to obtain the different grades of fuel matched to the seasonal temperature variations. Additives are included in the mixture to help keep engine components from fowling, as a lubricant, a corrosion inhibitor, to increase octane, and meet environmental standards. Ethanol and butane are two of the most important chemicals that are included in these blends. Ethanol ranges from 0 up to 85 percent of the blend. Butane ranges from 2 up to 10 percent of the blend.

Some of the terminals in the state have automatic blending systems built into their truck loading racks, but others do not. Both butane and ethanol are primarily shipped into the state in rail tank cars. These tank cars can be delivered directly to only 3 of the inland terminals who are equipped to receive them. The ones that do not have rail facilities have to pay for delivery of ethanol and butane by truck tank trailers to the terminal or meet them in the middle somewhere and blend directly into the tanker trucks before they deliver fuel to the gas stations. This situation gives rise to the transload facilities in Star and Midland, NC. These transload facilities transfer ethanol and butane from rail tank cars into truck tank trailers. Often this field blending is done in back lots, without adequate safety processes and systems, and no community awareness.

Rail connections need to be established with all fuel terminals in the state that distribute gasoline. Field blending of gasoline needs to be discouraged.

2.5 Safety

In addition to the significant safety issues discussed in the previous section concerning field blending of gasoline, these activities are usually opportunistic and ad-hock providing community first responders, and emergency management officials little opportunity to plan for or prepare an adequate response. Beyond that, the citing of these activities is often poor, exposing the population in many communities and especially sensitive populations, such as schools, day cares, hospitals, and similar facilities, to unnecessary risk.

Use of side rails to store rail cars of Butane, propane and ethanol in close proximity to Star and Midland, NC and elsewhere in the state, while lawful and advantageous to them, again exposes the population to unnecessary risk. The terminals need to develop rail car storage facilities adequate to support their needs.

North Carolina needs to promote and enhance the safe operation of all of the pipeline systems in the state. Local utility identification and marking (811) and safety programs that seek to prevent violations of pipeline easements are important, especially as development demands begin to encroach due to rapid development. Local government land-use planners need to be aware of all pipeline easements and demonstrate respect for the serious public safety risk presented by a breach or fire anywhere on a pipeline system. They need to recognize that during an event it will be necessary to isolate the event area within a 150-foot radius and may be necessary to evacuate within a half-mile radius. It is prudent to not allow some sensitive populations like hospitals and prisons to be built within a half-mile of a pipeline[8]. There is no way a major hospital, large school, prison or major event location can be evacuated quickly enough to save everyone from harm during a rapidly evolving HazMat event, it is best not to build these types of facilities within a half-mile of any HazMat facility.

2.6 Existing and Expected Future Needs

Three existing priority needs have been identified, they are:

- Enhancing the connections between all modes of transportation at all terminals;
- Planning for public protective actions at the community level out to a half-mile for all terminals; and
- Engaging local land-use planners and public officials in an effort to prevent encroachment on the terminals and pipeline easements.

Developing additional pipeline capacity may be a future need if fuel demand exceeds expectations or if the pipelines become less reliable and a need is identified to develop some redundancy and resiliency within the pipeline infrastructure.

[8] US DOT Emergency Response Guidebook, Guide 128, Evacuation Distance for Fire

3.0 Selected Extremely Hazardous Substances and non-Extremely Hazardous Substances

The State of North Carolina, Division of Emergency Management, conducted a series of regional HazMat Transportation studies over five years from 2008 to 2012. These studies identified priority Extremely Hazardous Substance (EHS) corridors covering the entire state of North Carolina. Each study year a process was followed to work with key stakeholders to identify and rank study chemicals that represented the most significant hazard to the community, reducing the focus down from hundreds or thousands of candidate chemicals to the 10 to 14 priority study chemicals that had the greatest potential for a community scale risk.

3.1 Overview of Flows

Detailed shipping data was then obtained directly from shippers or facilities that reported these priority chemicals. This security sensitive and proprietary information was used to complete the studies and now has been desensitized for use in this profile. The data behind five sets of EHS corridors maps generated for previous studies have been merged into two state-wide maps representing the total shipping volumes of the most common study chemicals over the five study years. The following 13 EHS chemicals are represented on the EHS Flow Map: Anhydrous Ammonia, Chlorine, Formaldehyde, Hydrogen Fluoride, Hydrogen Chloride, Sulfuric Acid, Sulfur Dioxide, Bromomethane, Hydrogen Peroxide, Cycloheylamine, Vinyl Acetate Monomer, Phenol, and Ethylene Oxide. Four Non-EHS chemicals were also common to most of these studies that are represented on the Non-EHS Flow Map, including: Phosphoric Acid, Toluene Diisocyanate, Butane, and Toluene. The combined volume of these chemicals by highway and railway transportation modes are presented on

Figure 3.1 Extremely Hazardous Substance Flows

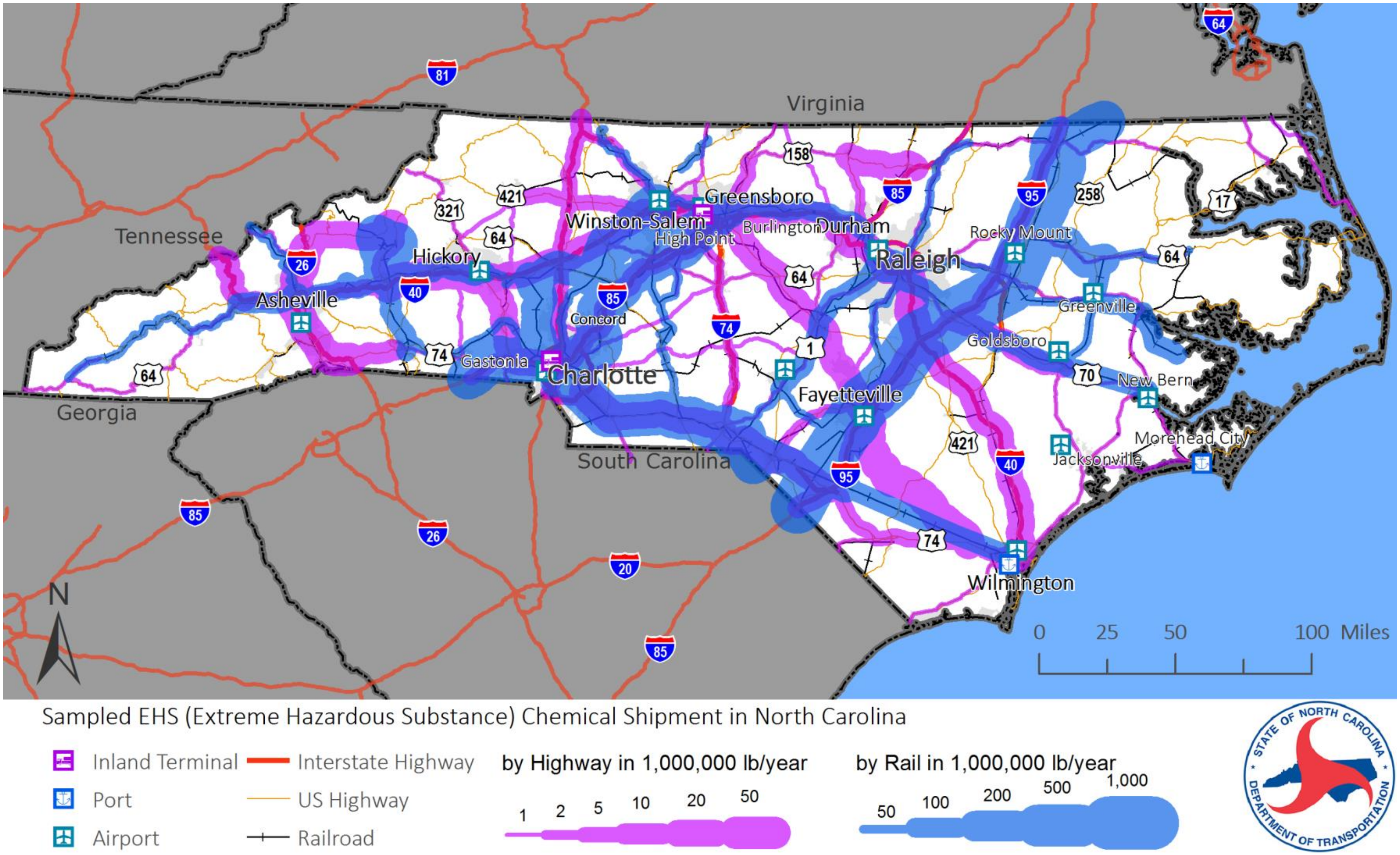
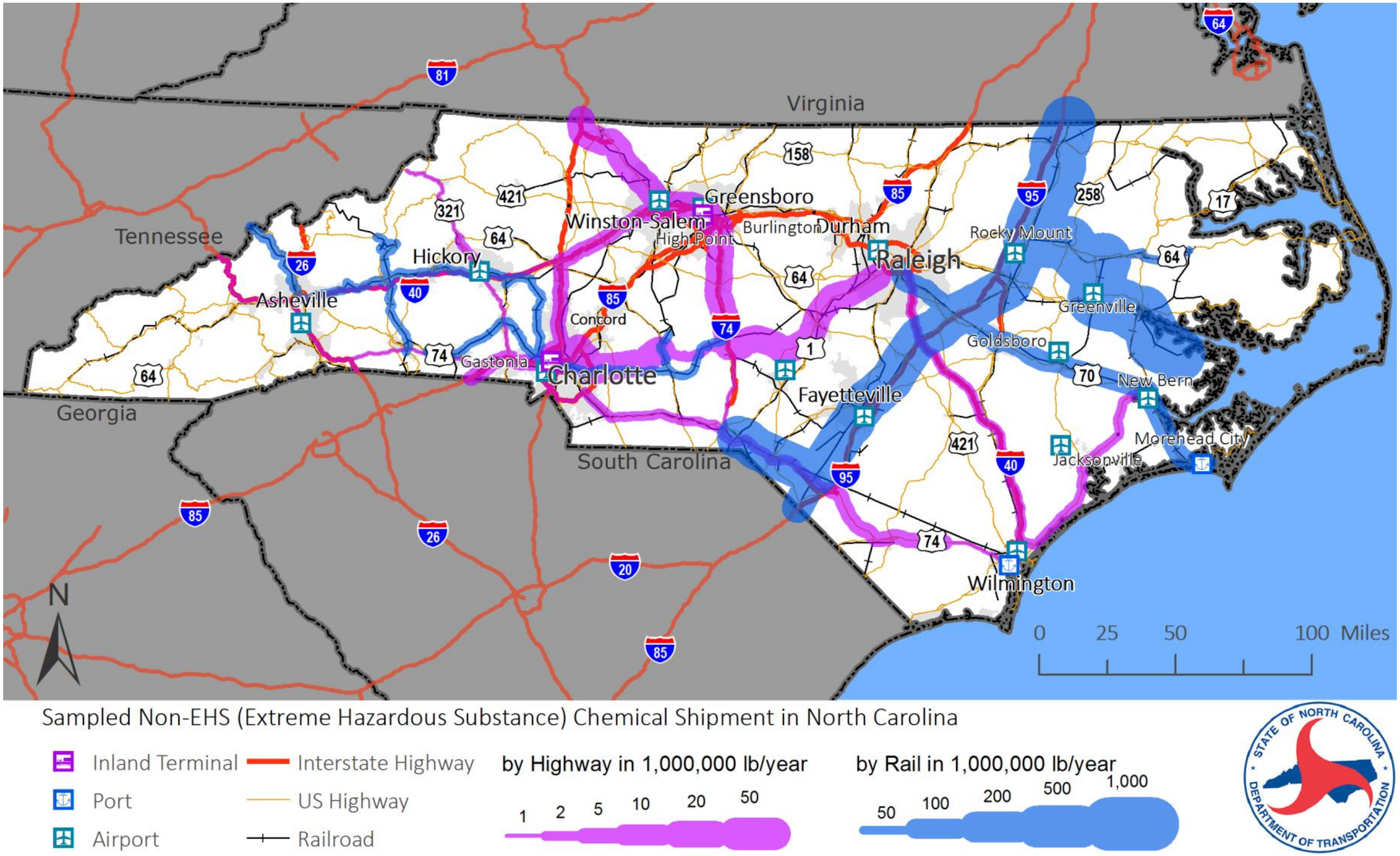


Figure 3.2 Non-Extremely Hazardous Material Flows



3.1 and 3.2 respectively. These maps do not show door-to-door shipments but stay on major transportation corridors, and do not break out the chemicals individually.

It is evident on both maps that these EHS and Non-EHS HazMat chemicals are present on nearly every major highway, all of the interstate highway system, the entire length of both Class I railroads, and many of the short line railroads in significant volumes. Volumes of over a billion pounds per year or more are represented on some parts of the transportation system. Charlotte, Winston-Salem, Raleigh, and Wilmington are major HazMat hubs. These 17 chemicals are representative of both the significant hazard and volume of the many thousands of chemicals that are on the North Carolina transportation system. It is important to also recognize that massive quantities of HazMat are moved by barge and ship also, especially concentrated at the two ports in the state. Other significant concentrations of HazMat in transportation are found at truck parking areas, and rail yards and side rails that are present in many communities across the state.

Figure 3.1 Extremely Hazardous Substance Flows

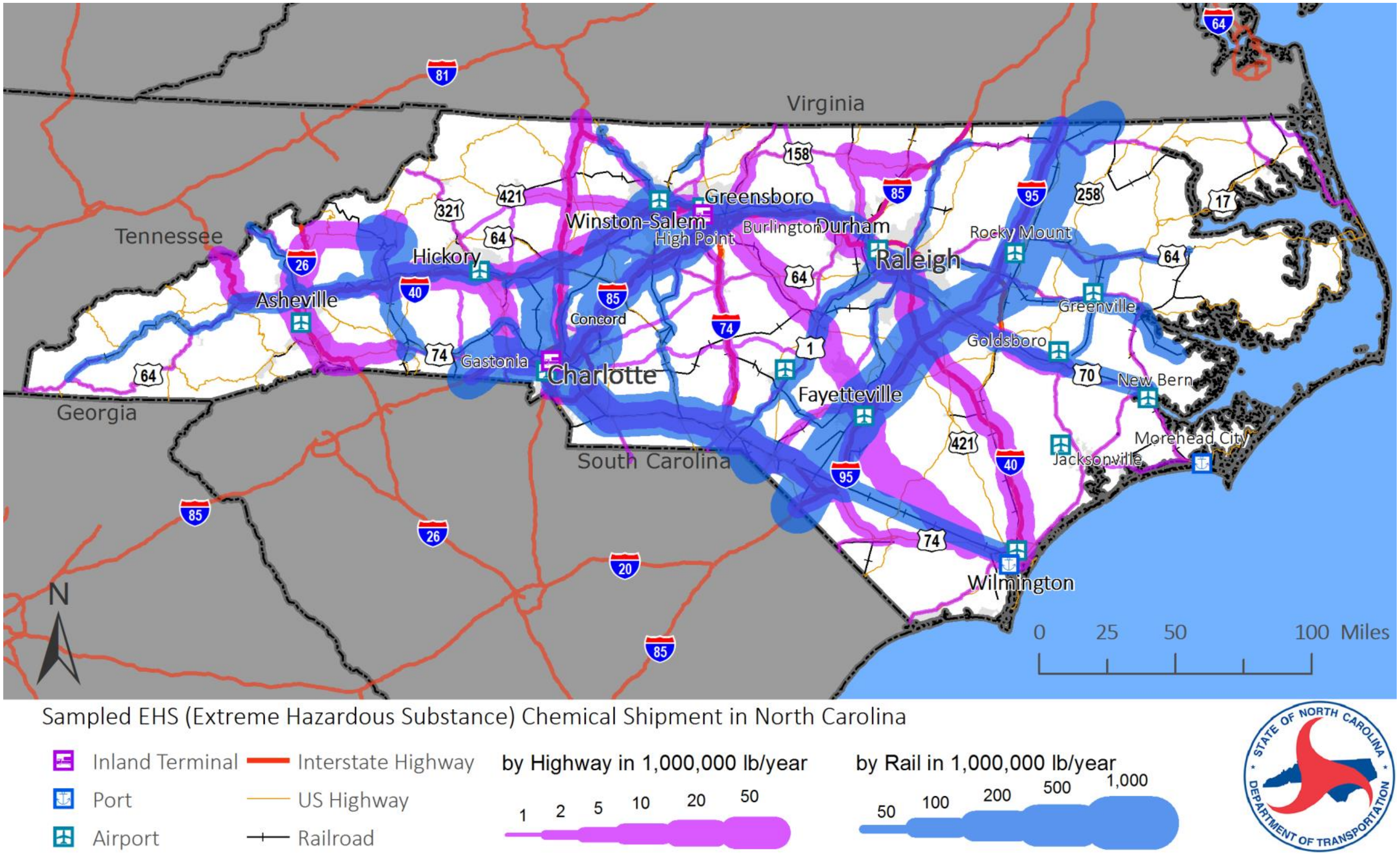
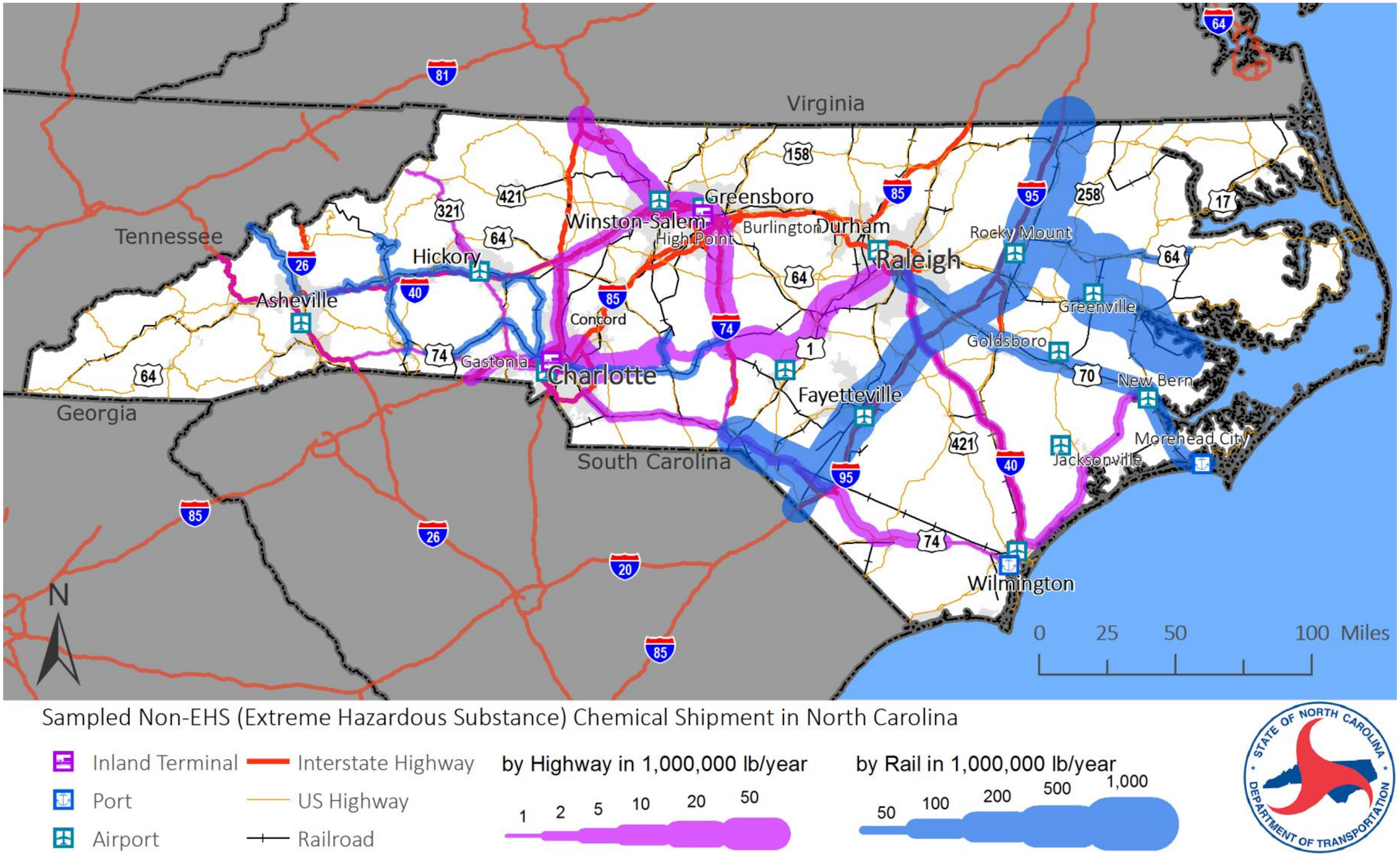


Figure 3.2 Non-Extremely Hazardous Material Flows



Highlight - PCS Phosphate

PCS Phosphate is an open pit mine that annually produces 1.2 million tons of phosphoric acid, 0.3 million tons of purified acid, 0.1 million tons of phosphate feed and a dozen other chemicals vital to agriculture and a number of industries throughout the country. They: import and ship large volumes of gaseous, liquid, and dry HazMat products using the state's rail, highway and port transportation systems; operate a 31-mile railroad spur that connects the facility to the Norfolk Southern and CSXT railways; export large volumes of HazMat and import many unit train quantities of anhydrous ammonia and other chemicals; and chemically react the phosphoric acid with ammonia to produce differing grades of fertilizer.

PCS operates a terminal on Radio Island located near the mouth of the Newport River at Morehead City, North Carolina. They ship product from the mine and processing plant facilities via barges navigating the Pamlico, Core, and Back sounds to fill ships at this terminal with phosphate products for export with 26 percent going off shore and a total value of $1.2 Billion dollars in 2015. This operation has been hindered by sedimentation into the channel supporting their terminal, causing them to only partially load ships to prevent grounding and other safety concerns. This repeated and ongoing condition has a direct and significantly negative impact on their profitability and competitiveness, as the fixed costs per shipment remain the same but the amount of product moved per ship is greatly reduced.

3.2 Bottlenecks and Deficiencies

Three key areas of needs and deficiencies were identified:

- The navigation channel into Morehead City adjacent to Radio Island at the mouth of the Newport River is filling with sediment and deposition of sand and is a bottleneck to the transport of HazMat by ship in that area. This is causing PCS Phosphate to only partially load ships to prevent grounding and other safety concerns. This repeated and ongoing condition has a direct and significantly negative impact on their profitability and competitiveness, as the fixed costs per shipment remain the same but the amount of product moved per ship is greatly reduced. PSC Phosphate is concerned about the safety of their shipping operations and profitability. They suggest the Corps of Engineers enhance the channel that nature seems to favor, rather than continuing to dredge in an area of ongoing deposition.

- The concurrent use of the two Class I railroad mainlines for passenger, freight, and HazMat service in North Carolina, as elsewhere in the United States, is a deficiency. Not only do these trains have different maximum allowable speeds over the same track, but they also have different infrastructure needs that are not compatible with each other. It is not advisable to collocate passenger, freight, and HazMat support infrastructure at one location.

- Areas within the transportation system where there is especially high HazMat transportation risk include: communities with heavy land-use development involving large numbers of sensitive populations and environmental receptors or large recreation or public event facilities alongside major transportation corridors; unsecured rail yards, side rails within major communities, at-grade railroad crossings and freeway ramps.

3.3 Existing and Expected Future Needs

It is important for local and state government to prevent incompatible land-uses, especially those involving HazMat, to be able to protect the public. In some cases, there is a failure to maintain a separation between incompatible land uses because the authorities are not engaged with the HazMat community, and there is not an understanding of the significant hazards that HazMat can bring into a community nor that a community can create hazard by bringing people into close proximity to HazMat facilities and corridors. The citing of especially sensitive populations, such as schools, day cares, hospitals, and similar facilities, adjacent to HazMat facilities and transportation corridors is almost commonplace within North Carolina and the United States overall.

Use of side rails to store rail cars of HazMat within cities exposes the population to unnecessary risk. Local government land-use planners need to be aware of all HazMat sources in their community, including the locations of these side rails and rail yards and demonstrate respect for the serious public safety risk they represent. They need to recognize that during an event that it will be necessary to isolate the area within a 3,000-foot radius[9] and it may be necessary to evacuate out a number of miles. It is not a question of if a HazMat event will occur but when and how bad will it be. It is prudent to not allow some sensitive populations like hospitals and prisons to be built within a 3,000-foot radius of identified EHS transportation corridors.

Three urgent current and future needs have been identified in this profile. They are:

- All parties to work through the Local Emergency Planning Committee (LEPC) in their county to develop land-use planning policies that prevent incompatible land-uses relative to HazMat storage, use or transportation.
- Communities should eliminate as many at-grade railroad crossing as possible.
- Railroads should consider not using side rails within city limits to store HazMat rail cars.

[9] 2016 US Department of Transportation, Emergency Response Guidebook, Table 3 for a large Chlorine release