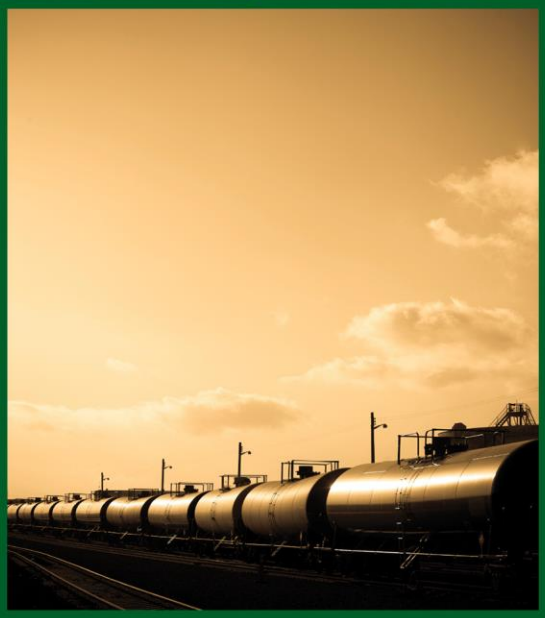
DECEMBER 1, 2015

North Dakota Crude Oil Response Preparedness Report



PREPARED FOR:
NORTH DAKOTA DEPARTMENT OF EMERGENCY SERVICES

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ABOUT WITT O'BRIEN'S

Witt O'Brien's is a global Crisis and Emergency Management, Risk Mitigation, Safety and Security consulting firm with offices in Mandan, Houston, Washington, Great Britain, and Brazil. The firm was originally founded by James Lee Witt, the well respected former Federal Emergency Management Agency (FEMA) Director. Leaders call Witt O'Brien's when faced with major crises including Hurricanes Katrina and Sandy, as well as the Deepwater Horizon incident. Witt O'Brien's has been involved in enhancing safety associated with the transport of oil for years, most recently focusing on transport by train. Witt O'Brien's works with oil and gas companies, railroads, and government agencies to enhance the safe transport of oil.

DISCLAIMER AND DISCLOSURE

This report, prepared by Witt O'Brien's, was done under contract with the North Dakota Department of Emergency Services. The opinions, findings, conclusions, and recommendations are provided solely for the use and benefit of the requesting party. Any warranties (expressed and/or implied) are specifically waived. Any statements, allegations, and recommendations in this assessment should not be construed as a governing policy or decision, unless so designated by other documentation. This report is based on the most accurate and current data available to Witt O'Brien's at the time of publication, and is therefore subject to change without notice.

ACKNOWLEDGEMENTS

Witt O'Brien's acknowledges and appreciates the cooperation of North Dakota state and local officials, tribal officials, representatives of the major railroads transporting crude oil, and others for their input and ideas. First responders, public and private sector, dedicate their time on the behalf of the rest of us and for this we are so grateful.

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EXECUTIVE SUMMARY

North Dakota has become one of the world's largest sources of crude oil. Incidents, both within North Dakota and elsewhere, associated with the transport of this resource to refineries and terminals, has led to an increased concern about safety. The North Dakota Department of Emergency Services engaged Witt O'Brien's to prepare this report.

This North Dakota Crude Oil Transportation Response Preparedness Report (the Report) was developed for the North Dakota Department of Emergency Services (NDDES) as a tool to assist North Dakota's state, local, and tribal government departments in determining the status of current incident-response preparedness for crude oil transportation incidents across the state. The geographic, administrative, and operational areas identified in the Report were qualitatively and quantitatively assessed for risks, vulnerabilities, and capabilities. Results of the assessments then provided findings and recommendations to reduce risk and vulnerability through policy change, planning, training and education, communication, and additional resources.

The Report includes assessments of three modes of crude oil transportation in North Dakota: pipeline, railroad, and roadway. Based on state and national historic events, transportation routes, volumes, distance, and frequency, railroad transportation of crude oil presents the greatest potential challenges for response preparedness activities. Motor carriers (roadway transportation) and pipelines present risks, and communities along their transportation paths have related vulnerabilities, but those vulnerabilities are limited by route, volume, and frequency compared to rail transport.

Summary of Scope of Work

A Scope of Work was provided by NDDES prior to the development of the Report. Under this Scope of Work, Witt O'Brien's was instructed to:

- Identify and engage stakeholders
- Recognize and understand the risk and vulnerabilities
- Determine the desired prevention, preparedness, and response capabilities
- Identify the gaps and areas for improvement
- Review documents and develop a final report
- Develop an action/preparedness enhancement strategy

The process of identifying the study area and stakeholders are described below.

Study Area

The Report focuses on geographic areas along crude oil transportation corridors, off the well pads, and within the state's borders. Risk and vulnerability assessments were based on national standard initial evacuation zones related to petroleum accidents with and without fire. That standard, provided in the US Department of Transportation (USDOT) Emergency Response Guide, denotes a 0.5 mile buffer zone, which was applied to pipelines, Class I railroads, and roadways that carry crude oil.

Participants and Stakeholders

Witt O'Brien's worked with NDDES to identify primary stakeholders in state government departments and in local governments along the crude oil transportation routes throughout North Dakota. State government department administrators, elected officials, and subject matter experts, as well as local emergency managers, police officers, and firefighters were engaged through in-person interviews, surveys, working sessions, phone calls, and email correspondence. Primary stakeholders provided leads for additional interviews. Guided discussions focused on crude oil as a hazard and the prevention, planning, preparedness, and response actions that state and local authorities utilize to maintain situational awareness and readiness. Additionally, railroad, pipeline, and private response contractor representatives provided details about their operations and interaction with government entities before, during, and after a crude oil transportation incident. Interviews included representatives from 76 state and local government organizations, local interest groups, and transportation industry companies operating in North Dakota.

Hazard Profile of Crude Oil

Light sweet crude oil, classified and shipped as a flammable liquid, presents a significant hazard when accidents cause ruptures, spills, and leaks. Light sweet crude oil has ignited into fire and explosions after train derailments in North Dakota and across the country, posing dangers to lives and property. Spilled oil with or without fire can create environmental hazards, contaminating soil and water, and impacting agriculture and wildlife. Water contamination can also impact drinking water and irrigation supplies that are vital to human and economic sustenance. By working to ensure that the best safety and preparedness measures are in place, North Dakotans can mitigate the potential impacts to life, property, and environment when an incident occurs.

History of Accidents in North Dakota

North Dakota has experienced crude oil transportation accidents in all three modes: pipeline, rail, and roadway. According to Pipeline and Hazardous Materials Safety Administration (PHMSA) records, from 2010 through April 3, 2015, there were 159 pipeline, railroad, and roadway, crude oil incidents resulting in 42,199 barrels of spilled crude oil in North Dakota.

Table ES-1: Crude Oil Incident Data for 2010 - April 3, 2015

	# of Incidents	Total Spilled (in Barrels)
Pipeline	33	29,494
Railroad	43	11,343
Roadway	83	1,282

Among the incidents recorded in Table 1: Crude Oil Incident Data for 2010 - April 3, 2015, the pipeline incident resulting in the greatest volume of release occurred July 29, 2013, with a release of 20,600 barrels along the Tioga to Black Slough pipeline in Mountrail County. The incident resulted in soil contamination requiring remediation and an estimated cost of $16.9 million. According to the North Dakota Department of Health (NDDoH), Division of Water Quality, the impacted material is being thermally treated on site. Storm water that collects in the excavation area is pumped through a carbon filter and then utilized in the Thermal Desorption process. As of September 8, 2015, 333,993 tons of soil had been thermally treated. The Tesoro Corporation is currently utilizing a 40-ton Thermal Desorption Unit (TDU) that processes 40 tons of material per day. They also have a 20-ton TDU and a 60-ton TDU on site but the current natural gas supply infrastructure is only sufficient to operate the 40-ton TDU. Efforts to increase natural gas supply to accommodate the 60-ton TDU and the 40-ton TDU will provide the capability to complete excavation, treatment, and backfilling in an estimated 16 months.

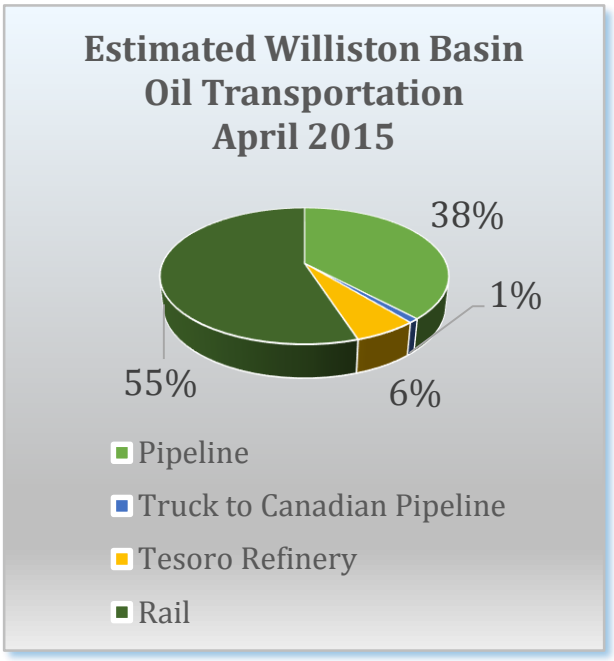
The Federal Railroad Administration (FRA) and NDDES recorded two train derailments with impacts in December 2013, and May 2015; the derailments near Casselton and near Heimdal, respectively, resulted in large oil fires. The Casselton derailment occurred when an eastbound Burlington Northern and Santa Fe (BNSF) oil unit train struck a westbound grain train that had derailed onto the eastbound tracks moments before impact. Twenty oil cars exploded and burned over a 24-hour period. The accident occurred just outside of the town of Casselton where 1,400 residents were evacuated, but there was no loss of life or property.

The Heimdal incident involved the derailment of six crude oil cars of a BNSF train. There were no explosions, but four cars caught fire. Like the Casselton accident, this derailment also occurred just outside of the community. Approximately 25 people were evacuated and were allowed to return home late the same evening. First responders credit a much-needed rain event during a spring drought as a mitigating factor in controlling fire spread.

Table 1: Crude Oil Incident Data for 2010 - April 3, 2015, includes a Highway 2 roadway transportation (tractor-trailer) accident that occurred in Mountrail County on June 21, 2013. This incident resulted in three fatalities and total damages of $185,836, the costliest accident in the given period.

Oil Production and Transportation

The April 2015 North Dakota Pipeline Authority (NDPA) Monthly Update reports that the majority of the crude oil leaving North Dakota is being transported by rail at 55%, while another 38% is being transported via pipeline.



Risk analysis shows that crude oil is transported via pipeline through 32 counties, via rail through 33 counties, and via road through 43 of North Dakota's 53 counties. It is important to note that while roads used for crude oil were analyzed based on federal and state highways and designated feeder roads within North Dakota, the majority of crude oil road transportation occurs in the drilling fields where truck routes are generally less than 50 miles.

Pipeline infrastructure development has not kept up with oil production and transportation demand. In 2007, North Dakota pipelines were capable of handling oil production and generally relied upon trucking to move crude oil from the well pads to pipeline facilities; rail transportation was not used to transport crude oil. In 2008, railroads began transporting crude oil from North Dakota, carrying just 3.5% of the total capacity, or 10,000 barrels per day. Oil production continues to outpace pipeline capacity in North Dakota, making rail transportation the primary transportation mode, transporting 55% of the total capacity.

Two Class I railroads operate in North Dakota: the Canadian Pacific (CP) and BNSF. CP and BNSF each partner with multiple regional/short-line railroads to meet statewide shipping needs. North Dakota rail transportation of light sweet crude oil is predominately via Class I railroads from the oil producing Williston Basin/Bakken Formation region of western North Dakota to one of the 115 refineries throughout the US. These two Class I railroads originate

almost all of the crude oil rail shipments in North Dakota with BNSF transporting approximately 75% of all North Dakota produced oil.[1]

The Hazard Classifications

Emergency responders use hazard identifiers to develop and maintain situational awareness for preparedness and response measures to hazardous materials incidents, which include crude oil transportation accidents. Use of the hazard classification and labeling systems, as noted below, improves response tactical considerations designed to reduce loss of life and property, as well as environmental impacts.

There are two major variables in crude oil characteristics: gravity and sulfur content. Density ranges from light to heavy and is expressed in American Petroleum Institute (API) gravity, which measures the specific gravity of crude oil in degrees (degrees API). The API gravity describes the weight of a petroleum product relative to water. Oil with greater than 10° API floats on water while oil with less than 10° API sinks in water. Knowing the gravity of oil is important for firefighting and clean-up operations. The sulfur content of crude oil determines whether the product is considered low, intermediate, and high sulfur crude. Crude is commonly termed "sweet" or "sour." Sour crude oil is high in sulfur content; sweet crude is low. Sweet crude carries a sulfur content of less than 0.5% by weight, while sour crude has a sulfur content greater than 1% by weight. Intermediate crude oil (neither sweet nor sour) has a sulfur content from 0.5% to 1%. Low sulfur crude oils tend to flow more freely at room temperature while high sulfur crudes create a bigger environmental concern when burned. First responders and clean-up crews using this knowledge can adjust strategies and tactics to reduce impacts.

Petroleum crude products are also commonly named for the location from which they were extracted. Most of the crude products transported in North Dakota originate locally. These products are often referred to as "Bakken" or "Three Forks" crude oil products. Bakken and Three Forks crude oil are produced in the same region of North Dakota but come from different shale formations. They are both typically light sweet crudes. Since both crude oils come from the Bakken field, and both have the same basic composition, and both meet industry standards as light sweet crude oil, this report refers to the transportation of Bakken crude oil inclusive of Three Forks oil as light sweet crude oil.

Light sweet crude oil poses unique challenges to first responders. This type of crude oil tends to be more volatile, meaning that it is more likely to catch fire or explode in an accident. As noted earlier, light crude also floats on water, which means it will spread quickly in moving waters and during firefighting operations. Additionally, light sweet crude

[1] Minnesota Department of Transportation, *Frequently Asked Questions*, http://www.dot.state.mn.us/ofrw/crude-by-rail/crude_faqs.html (accessed June 29, 2015).

oil contains flammable natural gases that release from the oil when it is heated. These gases can cause additional atmospheric risks for fire spread and inhalation hazards.

When responding to a crude oil transportation incident, first responders' initial indicator of what they are facing will likely be a USDOT Hazard Classification Identification Placard. USDOT placards identify most petroleum crude products as UN1267, regardless of their density or sulfur content. A hazard classification number, one through nine, located at the bottom of the placard designates the hazard class. Class 3 liquids are classified as "flammable liquids" in the Code of Federal Regulations (CFR), 49 CFR 173.120.

Crude oil products in transportation are further identified by federal PHMSA classification. In addition to identifying petroleum crude oil as a Class 3 flammable liquid, PHMSA regulations further classify the material according to its risk characteristics:

- Packing Group III (minor danger)
- Packing Group II (medium danger)
- Packing Group I (great danger)

Light sweet crude oil is classified as a Department of Transportation (DOT) Class 3 Flammable Liquid and may be classified within either Packing Group I, II, or III (depending on the specific properties of the crude being transported). Properties such as vapor pressure, initial boiling points, flashpoints, and dissolved gas content vary based on the grade of the crude oil, source of extraction, and time of year it is produced. Under 49 CFR 100-185, Hazardous Materials Regulations, shippers are required to include a basic description of the product on the shipping paper. The description must include the identification number, proper shipping name, hazard class, and packing group.

Risk and Vulnerability

Witt O'Brien's conducted a risk and vulnerability assessment of the counties in which crude oil transportation occurs through or within 0.5 mile of the county. Populations, structures, and environmentally sensitive lands within the 0.5 mile buffer were aggregated to determine vulnerability. Since crude oil transportation incidents only directly affect a portion of a transportation route, Witt O'Brien's considered a vulnerability factor of 10% of total exposed population, structure inventory, and environmentally sensitive areas for any potential incident, meaning that 10% of the total exposure might be directly exposed, or vulnerable, to a single event occurring anywhere along a transportation route. The assessment then factored potential impacts from no impacts to moderate and severe impacts, based on numbers of injuries/fatalities, damage to structures, and amount of environmentally sensitive land affected.

This methodology can be further explained when compared to weather forecasts. For example, when a weather forecast predicts a 10% chance of rain, it may only rain in 10% of the forecast geographic area, but that 10% area could be in any portion or portions of the given area.

The risk and vulnerability assessment included factors such as likelihood, or probability, that any incident will occur over a 20-year period. Risk was then determined by combining the potential impacts with incident likelihood. Forty-eight counties were assessed based on the 0.5-mile buffer to the transportation routes. The full risk assessment methodology and analysis results are provided in Section 5 through Section 8 of the Report. Section 9 of the Report provides the full list of summary results and rankings by county; the 10 highest ranked counties for increased risk are presented below.

The counties with the greatest increased risk for pipeline incidents include Barnes, Dunn, Grand Forks, McHenry, McKenzie, Mountrail, Stark, Ward, and Williams; the counties with the greatest increased risk for railroad incidents include Barnes, Cass, Grand Forks, McHenry, McKenzie, Mountrail, Stark, Ward, and Williams; and the counties with the greatest increased risk of roadway incidents include Barnes, Cass, Dunn, Grand Forks, McHenry, McKenzie, Mountrail, Stark, Ward, and Williams.

County administrations, emergency managers, local first responders, and support organizations can use the full risk assessments to prioritize local strategies and preparedness measures to identify and reduce vulnerability and potential impacts. Additionally, NDDES, other state departments, and crude oil transportation companies can use the risk findings to geographically prioritize support actions, funding, and resources to improve safety and preparedness measures.

Strategic and Operational Capabilities

Recent Changes in Rules, Regulations, and Operations

Federal, state, and local departments, as well as crude oil transportation companies with authority or responsibility over safety and response to crude oil transportation, take important steps toward reducing risk and vulnerability. Federal and state legislators regularly draft legislation to improve equipment standards and operational procedures for common carriers. Recent approved legislation includes:

State of North Dakota – Industrial Commission Order No. 25417

Industrial Commission Order 25417 requires crude oil producers in the state to condition light sweet crude oil to a vapor pressure of no more than 13.7 pounds per square inch (psi) (about that of automobile gasoline). National standards set crude oil stability at a vapor pressure of

14.7 psi. Under the order, all light sweet crude oil produced in North Dakota will be conditioned. The order requires operators to separate light hydrocarbons from light sweet crude oil in order to be transported, and prohibits the blending of light hydrocarbons back into oil supplies prior to shipment. The order became effective April 1, 2015.[2]

Senate Bill No. 2008 (15.8121.01000) – State-Run Rail Safety Pilot Program

North Dakota Senate Bill 2008 was approved on April 27, 2015, and was signed into law by the governor on April 29, 2015. It will fund a state-run rail safety pilot program to supplement federal oversight of oil train traffic. The budget will be provided by the state Public Service Commission (PSC) and will fund one additional inspector salary, one temporary employee salary, and operating costs for 2017-19. The bill also includes a railroads training program for fire departments with jurisdictions along routes traveled by oil trains. The PSC budget would provide $523,345 for the project.[3]

PHMSA-2012-0082 – Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains

This new rule (May 1, 2015) intends to reduce the frequency and impacts of rail accidents involving large volumes of flammable liquids. The changes address National Transportation Safety Board recommendations on the accurate classification and characterization of such commodities, enhanced tank car construction, and rail routing.

BNSF-Specific Crude Oil Safety Measures

A BNSF press release issued in March 2015, provided a list of BNSF-specific actions aimed to reduce risk of rail accidents. Actions that became effective in March and April 2015, include lower train speeds of 35 mph for all shale oil trains operating through municipalities with populations of 100,000 or more; a formal community outreach initiative; development of a real-time geographic information system (GIS) tracking application for state emergency responders; increased track inspections along critical waterways; and increased trackside safety technology with Hot Bearing Detectors spaced every 10 miles along critical waterways.

[2] State of North Dakota, Industrial Commission, Order No. 25417, Case No. 23084, September 23, 2014, https://www.dmr.nd.gov/oilgas/Approved-or25417.pdf (accessed June 22, 2015).
[3] Sixty-fourth Legislative Assembly of North Dakota, North Dakota Senate Bill No. 2008, January 6, 2015, http://www.legis.nd.gov/assembly/64-2015/documents/15-8141-06000.pdf?20150622211124 (accessed June 22, 2015).

Local, State, and Federal Government Roles and Responsibilities

Local Roles and Responsibility

Local first responders and government agencies are responsible for preparedness and initial response operations to a crude oil incident. Responsibilities can include, but are not limited to, determining the risk posed by crude oil, containing any released material, protecting life safety and property, and incident management.

State Roles and Responsibility

The following state agencies play instrumental roles in preparing for and responding to crude oil incidents:

- NDDES coordinates state response operations and management of resources.
- NDDoH provides technical assistance in support of protecting public and environmental health actions.
- NDDOT is responsible for state and federal highways in North Dakota.
- ND Oil and Gas Division provides technical assistance with response to crude oil incidents.
- ND State Fire Marshal provides technical assistance regarding crude oil incidents.
- ND Highway Patrol provides law enforcement and traffic control support.

Federal Roles and Responsibilities

The federal government provides oversight to hazardous materials transportation, which include crude oil. Agencies with responsibilities for crude oil transportation safety include the following:

- USDOT has the authority to regulate hazardous material transportation under the Hazardous Materials Transportation Act, through the Federal Rail Safety Act, and through related rulemaking. Most of the regulations addressed through the USDOT are developed under the PHMSA, the FRA, and the Federal Motor Carrier Safety Administration (FMCSA).
    - PHMSA's mission is to protect people and the environment from the risks of hazardous materials transportation by establishing national policy, setting and enforcing standards, educating, and conducting research to prevent incidents.
    - FRA ensures secure movement of hazardous freight via railroads through regulations on design, manufacture, and repair of equipment; cars, locomotives, and track used to carry hazardous materials; and information on the movement of these materials.

    - FMCSA has authority over federal commercial vehicle laws and regulations, including those for hazardous materials transport, on US roadways, and focuses on preventing commercial motor vehicle-related fatalities and injuries.
- US Department of Homeland Security (USDHS) coordinates sector-specific plans designed to protect the nation's critical infrastructure.
- US Department of Interior (USDOI) Natural Resource Damage Assessment and Restoration Program is responsible for restoring natural resources damaged as a result of oil spills or hazardous substance releases into the environment.
- US Environmental Protection Agency's (USEPA) main role is the enforcement of rules for oil storage facilities to prepare and implement Spill Prevention, Countermeasures, and Control (SPCC) Plans. The USEPA also manages the National Response Center (NRC).
    - The NRC is a 24-hour-a-day, seven-day-a-week communications center that receives notifications on hazardous material and oil spill incidents, and immediately relays each report to the pre-designated Federal On-Scene Coordinator (FOSC). It also provides emergency response support to the FOSCs.

Private Sector Roles and Responsibilities

Private-sector railroads, pipelines, and motor carriers are responsible for their equipment, tanks, tracks, lines, vehicles, personnel, and training, as well as compliance with hazardous material packaging and placarding.

Railroad, pipeline, and motor carrier companies often have contracts with private services for hazardous materials response, incident mitigation, and cleanup. The Oil Pollution Act of 1990 (OPA-90) establishes that the owner or operator of a facility/vessel from which oil is spilled is liable for costs associated with the containment and cleanup of the spill, including any damages that may have occurred. In the event a responsible party is unknown or refuses to pay, an Oil Spill Liability Trust Fund has been established that can provide up to $1 billion per incident.

OPA-90 requires private companies to test their plans and maintain the equipment necessary to respond to a spill. During a three-year cycle, an operator must test its plan annually against the 15 preparedness components that are listed in the National Preparedness for Response Exercise Program, which was developed to meet the intent of section 4202(a) of OPA-90. At least one year in the three-year cycle, a company's exercise must test a worst-case discharge scenario.

If a facility or transportation unit experiences an incident during storage or transfer of crude oil resulting in a spill, that facility's operator is required to make notifications and activate resources to respond. Notifications must be made to the NRC at the federal level, as well as NDDES, NDDoH, and ND Oil and Gas Division, which make notification to response agencies including requested NDDES supported Regional Response Teams and the NDDoH

Environmental Health Section at the state level. Emergency response plans may also direct the operator to notify private-sector spill response contractors and other support resources.

The major private sector spill response companies in North Dakota, collectively known as Sakakawea Area Spill Response (SASR), operate as a joint company to share resources providing a full complement of spill response capabilities. Equipment and resources are divided between two area spill response consortiums, one response contractor, one cooperative, one exploration and production operator, a refinery, a pipeline/truck/rail terminal operator, and a pipeline operator. Additional resources may be available but were not provided for this report.

Findings and Recommendations

The report details 39 findings and 59 related recommendations to address gaps in current practices, capabilities, regulations, or standards. The findings and recommendations were identified by subject matter experts in consultation with state and local stakeholders, including industry representatives. They are organized by the functions of federal, state, local, and private industry stakeholders as related to their capabilities in crude oil transportation: incident prevention, preparedness, and response. Summaries of the findings are recommendations are provided below. More details regarding findings and recommendations are provided in Section 10, page 113, of the Report.

Prevention

1	**Finding:** Most counties and cities in North Dakota do not sufficiently or specifically address the risks and vulnerabilities related to crude oil transportation or mitigation measures that can reduce risk. **Recommendation 1.A:** In counties where crude oil is transported by pipeline, rail, or truck, local and tribal governments could foster improved resilience for crude transport hazards by addressing them in hazard mitigation plans, including a full profile of the hazard, local capability assessments, risk and vulnerability assessments, and defined mitigation and protection strategies. **Recommendation 1.B:** Counties and municipalities, with support from the state, should consider identifying, mapping, and assessing the vulnerability of the critical infrastructure located within 0.5 mile of crude oil transportation routes (pipeline, rail, and road). Local jurisdictions may also want to include mapping of demographic factors to determine social vulnerability[4] for planning and risk communication purposes.

[4] Social vulnerability refers to social or demographic characteristics, such as income, disability, or age, among others, that research shows tend to make people more vulnerable to hazard impacts or less able to cope when a hazard occurs. Cutter, S., Boruff, B., and Shirley, W.L. (2003). Social vulnerability to environmental hazards. *Social Science Quarterly*, *84*(2), 242-261.

2	**Finding:** Local emergency managers express concerns about portions of their jurisdictions being cut off by stationary trains that block railroad crossings. **Recommendation 2.A:** NDDOT should conduct a survey of local communities to determine the most impacted grade crossings, then make assessments on how to best remedy the problem. **Recommendation 2.B:** Local officials should consider working with state and federal officials to enforce the ND 10 minute rule provided in the ND Century Code 49-11-19. **Recommendation 2.C:** Local responders should pre-plan alternate emergency response routes that utilize other grade crossings. If none are available or practical, local officials may consider developing emergency grade crossings outside of train staging areas.
3	**Finding:** Unmarked and illegal makeshift rail crossings are safety concerns for both government officials and railroad operators. **Recommendation 3.A:** Local community officials should consider working with county road departments, NDDOT, railroad operators, and private road owners to install railroad crossing signs, lights, arms, bells, rumble strips, and/or other safety devices on unmarked private crossings to remind motorists to practice caution. **Recommendation 3.B:** Local government road departments, local and state law enforcement, and state and federal railroad inspectors should consider monitoring roads that parallel rail lines for illegal makeshift crossings, notifying railroad operators, and denying vehicle access to those crossings. **Recommendation 3.C:** Local leaders also could work with the railroad operators through community outreach programs and whistle-stop programs to educate the public on rail-crossing safety.
4	**Finding:** The state's 8-1-1 system has program gaps that leave risk of digging-related pipeline accidents. **Recommendation 4.A:** State and local authorities should develop strategies to enhance the 8-1-1 education and outreach program to improve property owner knowledge of and compliance with procedures before digging and to increase awareness of potential consequences related to digging near pipelines. **Recommendation 4.B:** The state should consider review and regular monitoring of the 8-1-1 system database to determine if its pipeline data is up to date and whether there are options to the request ticketing procedure that will expedite marking utilities.
5	**Finding:** Many city and county officials believe that train speeds through their communities are too high. **Recommendation 5.A:** State agencies and railroad operators should work together to develop educational materials that summarize current speed limits for High-Hazard Flammable Trains, as well as other cargo and passenger trains through open areas, communities, and urban areas. **Recommendation 5.B:** Local officials should consider surveying operating speeds in their jurisdiction to determine if trains are operating at or under required speeds. They could also conduct transportation studies to assess whether safe operating speeds should be adjusted to reduce risk in developed areas of their jurisdictions.
6	**Finding:** There is little coordination between state and local law enforcement, and tribal law enforcement regarding road safety related to trucking. **Recommendation 6.A:** State, tribal, and local law enforcement should work together to develop multi-jurisdictional roadside commercial vehicle checkpoints at state-tribal borders.

7	**Finding:** Illegal dumping of crude oil production byproducts, including saltwater and radioactive filter socks, continues to be a problem in drilling fields. **Recommendation 7.A:** NDDMR, NDDOT, and NDDoH, North Dakota Highway Patrol (NDHP), and local law enforcement departments should consider monitoring the frequency of illegal dumping in the trucking areas and prevent the activity through regulation and enforcement. **Recommendation 7.B:** A possible solution for illegal saltwater dumping currently considered by NDDMR is to require a sign-off process for loading and unloading of saltwater at the well site and the disposal site so that all wastewater is accounted for on both ends of the hauling operation. **Recommendation 7.C:** NDDMR may consider proposing criminal penalties to the ND Legislature for illegal dumping of crude oil drilling byproducts, including saltwater and radioactive filter socks.
8	**Finding:** The state lacks a central database to track intrastate and interstate pipeline installations. **Recommendation 8.A:** The state should consider assigning to one state department the responsibility for maintaining a central database of all operational, under-construction, planned, and proposed pipelines (including gathering, transmission, and distribution lines) in the state. **Recommendation 8.B:** The state should consider legislation that requires sharing of private sector crude oil transportation data with state and local emergency managers, and public safety leaders for the purposes of community protection.
9	**Finding:** The FRA One Time Movement Approval (OTMA) does not require railroads to report the movement of damaged rail cars to state or local authorities. **Recommendation 9.A:** The state should consider or support policy requiring that damaged cars in transit be clearly labeled alongside the USDOT placard so first responders can be alerted to additional risks during an incident. North Dakota could also consider developing policy or legislation or regulation requiring crude oil carriers to notify state authorities of OTMA shipments in the state prior to any movement of a damaged rail car.

Preparedness

10	**Finding:** Not all local response organizations have planning or response support documents that cross-reference railroad mile markers and grade crossing identifiers; in those that do, many responders are not familiar with them. **Recommendation 10.A:** Local emergency managers should work with the FRA, NDDOT, and railroad owners to develop and maintain a local database and printed reference sheets for field use listing or displaying street crossings, railroad mileposts, and USDOT crossing identifiers (see Table 40, Section 10 of the Report).
11	**Finding:** Crude oil storage and transportation companies do not regularly attend Local Emergency Planning Committee (LEPC) meetings. **Recommendation 11.A:** LEPCs should consider inviting and seeking attendance by crude oil transportation companies, and transportation companies should send representatives to LEPC meetings as often as possible.

12	**Finding:** Some LEPCs have limited active membership and participation in the community's emergency response planning, particularly related to crude oil transportation response preparedness. **Recommendation 12.A:** Local emergency managers should consider reviewing the ND LEPC handbook and seek support of the State Emergency Response Commission (SERC) to develop better participation of local public safety, community leaders, and companies that produce, store, or transport hazardous materials, in order to develop or enhance current hazardous materials transportation incident plans through active LEPC involvement. **Recommendation 12.B:** The SERC may consider polling local emergency managers to determine which counties need assistance enhancing LEPC membership, participation, and activity. **Recommendation 12.C:** The SERC may consider developing a crude oil transportation incident response planning committee to develop guidance and work with LEPCs to develop local incident specific response plans and capabilities.
13	**Finding:** Facilities meeting the requirements for storage and handling of hazardous materials as outlined in the USEPA Risk Management Plan Rule must maintain a risk management plan and update it every five years. **Recommendation 13.A:** LEPCs and local emergency responder departments should consider reviewing local facility risk management plans at least annually to determine if community development or environmental changes/conditions have newly assumed risks and vulnerabilities related to potential facility incidents, then update local emergency response plans accordingly.
14	**Finding:** Many local volunteer first responders need better communications training related to general radio use and the use of NDDES interoperable communications channels utilized on the radios, known as Bank 5. **Recommendation 14.A:** NDDES and local emergency managers should consider scheduling the NDDES web-based and hands-on training and exercise programs in rural areas of the state to familiarize local responders with basic emergency and non-emergency radio operations, including the use of Bank 5.
15	**Finding:** Many local emergency managers must split their time and focus on other job assignments. **Recommendation 15.A:** County and community leaders should consider identification or development of revenue to support a full-time emergency manager in each county, or consider resource sharing among neighboring counties to create a full-time emergency manager position that serves a larger community or region. **Recommendation 15.B**: Local and state emergency management leaders should consider researching and seeking grants that support emergency management positions in all North Dakota counties and tribal nations.
16	**Finding:** Many local first responders are not adequately trained to manage or respond to a large crude oil incident. **Recommendation 16.A:** The state, North Dakota Firefighters Association (NDFA), and the crude oil transportation industry should work together to identify, fund, and offer specialized hazardous materials response training to all local, state, and tribal responders. These partners should consider providing training that meets the appropriate response level criteria of National Fire Protection Association (NFPA) 471: Recommended Practice for Responding to Hazardous Materials Incidents.
17	**Finding:** Not all local jurisdictions have written evacuation and shelter plans. **Recommendation 17.A:** NDDES, NDDHS and NDDoH could enhance local public safety operations by providing assistance with the development of local evacuation and sheltering plans.

18	**Finding:** Local emergency managers and first responders currently have insufficient coordination and relationships with pipeline, rail, and motor carrier companies. **Recommendation 18.A:** The state and local jurisdictions should consider working together to identify and engage crude oil transport industry representatives so that communication and coordination processes are established in advance of an incident. **Recommendation 18.B:** Private and public sector partners with a role in crude oil transportation and related preparedness and response activities should consider developing and maintaining communication forums through local, regional, or state meetings and conferences, LEPC meetings, or joint training opportunities provided by the state and industry.
19	**Finding:** Local firefighting foam capabilities are not sufficient to fight large-scale crude oil spills. **Recommendation 19.A:** NDDES and the NDFA should consider working together to establish a standard for firefighting foam for municipal fire department operations at a crude oil spill, and assist local fire departments and partner resources with designing a path that brings all responders to the same standard. NDDES should also consider purchasing and strategically placing firefighting foam and application tools around the state for rapid deployment. **Recommendation 19.B:** The NDFA should consider conducting a study to determine how much firefighting foam is required to maintain operations on a crude oil spill with and without fire. **Recommendation 19.C:** Based on results of the recommended study in 17.B, NDDES should consider purchasing and strategically placing adequate supplies of firefighting foam and application tools for rapid deployment.
20	**Finding:** Local emergency operations plans, annexes, incident response plans, and standard operating procedures/guidelines do not currently address crude oil transportation incidents adequately and, in some instances, not at all. **Recommendation 20.A:** State departments including NDDES and NDDoH should consider working with local emergency managers to develop crude transportation incident response annexes.
21	**Finding:** Local emergency managers have little access to information regarding trucking industry operations or safety compliance. **Recommendation 21.A:** The state should consider developing a database of approved motor carrier operators in North Dakota and provide access to local responders.
22	**Finding:** Gaps in regional planning and coordination related to crude oil transportation response preparedness could diminish effectiveness and efficiency when an incident requires response from multiple local jurisdictions. **Recommendation 22.A:** NDDES regional coordinators should consider working with local emergency managers and first responders to develop and maintain regional crude oil transportation incident response capabilities, written mutual aid agreements, and multi-jurisdiction coordination strategies.
23	**Finding:** No single state department currently maintains a centralized, comprehensive database of crude-oil incident response equipment and resources. **Recommendation 23.A:** NDDES should consider development of a comprehensive database of applicable federal, state, and local equipment and resources, their location, availability, and procedure for activation, deployment, and mobilization.
24	**Finding:** The state does not maintain a database of qualified oil spill response contractors. **Recommendation 24.A:** The state should consider support or passage of policy, law, or regulation that requires all private contractors operating in North Dakota to provide a list of qualifications, equipment, and means of safe collection, transport, and disposal of crude oil products involved in a spill.

25	**Finding:** Federal, state, and industry training and readiness information is often difficult to locate and access. **Recommendation 25.A:** NDDES and state agency and association partners should consider development of a comprehensive, one-stop web portal to provide access to training opportunities, grants, and other preparedness and response resources.
26	**Finding:** North Dakota has no legal mechanism for collecting actionable information on the transportation of crude oil through the state. **Recommendation 26.A:** North Dakota should consider development or support of policy or legislation that would require crude oil producers and carriers to provide timely, up-to-date, information on the volume, characteristics, and locations of crude oil moving in the state.
27	**Finding:** Federally required oil train traffic notifications from the railroads to the state have too great a range of traffic volume for effective planning purposes. **Recommendation 27.A:** The state should consider asking the FRA to require railroads to notify the SERC in advance of scheduled shipments with a smaller range of traffic volume (e.g. no more than a 10 train per week range variance), or when a 10% or greater change in traffic volume is scheduled to occur.

Response

28	**Finding:** Local first responder staffing limitations constrain operational capabilities. **Recommendation 28.A:** Local jurisdictions and NDDES should consider funding opportunities to support staffing and training of first responders as a preparedness and operational priority. **Recommendation 28.B:** The state could explore supporting additional regional resources that provide a broader complement of emergency services.
29	**Finding:** Local first responders need real-time access to cargo manifest data for rail and road shipments. **Recommendation 29.A:** State and local authorities should consider working with industry to provide first responders the required training and security clearances to utilize industry-developed mobile applications that track cargo manifest information and to enable each responding jurisdiction to have access to and training on those applications.
30	**Finding:** First responders need to be more familiar with using the Emergency Response Guidebook (ERG) and Safety Data Sheets (SDS). **Recommendation 30.A:** NDDES should consider a mandate that all first responders (fire, police, and Emergency Medical Service (EMS)) attend an annual training/refresher course in hazardous materials response. **Recommendation 30.B:** NDDES should consider working with state and local first responders to provide for availability of the most recently published ERG and to require the ERG be stored and readily available in all response vehicles.
31	**Finding:** Few local jurisdictions maintain Standard Operating Guidelines for crude oil transportation incidents. **Recommendation 31.A:** Local response groups should consider developing a Crude Oil Transportation Incident Standard Operating Guidelines that provide specific tactics and responsibilities designed to protect responders while expediting operations.
32	**Finding:** Regional Response Team roles, responsibilities, and capabilities are not clearly understood by local first responders and emergency managers. **Recommendation 32.A:** NDDES and the Regional Response Teams (RRTs) should consider steps to improve educational outreach to local response organizations detailing the roles and responsibilities of the RRTs, including how they will interface with the incident management team, operational teams, and other responding resources.

33	**Finding:** Local expectations regarding NDDoH response time to assist with evacuations are not realistic. **Recommendation 33.A:** NDDoH could better educate and inform local responders about the activation and deployment process for NDDoH assets, including registered volunteer health professionals, and the mobilization and staging of equipment.
34	**Finding:** Hospitals and emergency medical services in North Dakota have not kept pace with the increase in potential need for trauma care. **Recommendation 34.A:** Hospitals should consider identifying and seeking trauma care funding through federal programs such as the Patient Protection and Affordable Care Act (PPACA). The state could also explore avenues to increase funding to institute better capabilities for emergency medical services and emergency rooms at regional and local hospitals.
35	**Finding:** Public notification systems may not adequately reach all impacted populations. **Recommendation 35.A:** State and local governments should consider developing community education programs that highlight the importance of opting in to emergency local emergency notification systems. Outreach programs to transient workers could be developed and delivered on a monthly basis at temporary housing facilities around the state. **Recommendation 35.B:** The state should consider further development and expansion of the Integrated Public Alert and Warning System (IPAWS) through local Public Safety Answering Points (PSAPs) and State Radio so that notification of local emergencies can be automatically provided by local jurisdictions to cell phone users via Wireless Emergency Alerts (see Table 41, Section 10 of the Report). **Recommendation 35.C:** The state should consider working with rural areas and tribal reservations where IPAWS does not reach community members (wireless "dead zones") to identify funding support to install outdoor warning sirens that will alert communities of an emergency, directing them to radio, television, or emergency alert radios for more information.
36	**Finding:** Certain critical firefighting assets are not easily attainable via existing USDHS grant programs. **Recommendation 36.A:** The state, North Dakota Firefighters Association and LEPCs should consider asking the USDHS to update the authorized equipment list to include crude oil firefighting equipment and supplies.
37	**Finding:** North Dakota toxic-plume modeling capabilities are limited by equipment and staffing resources. **Recommendation 37.A:** NDDES and NDDoH should consider development of effective and accessible airborne contaminant plume modeling capability to assist first responders.
38	**Finding:** State emergency notifications may not reach all tribal residents. **Recommendation 38.A:** NDDES and the tribes should consider working together to improve shared communications through current emergency notification systems so that tribal officials can alert their responders and populations of incidents that may affect their communities. Tribal emergency managers should consider a protocol to make notification to NDDES State Radio of incidents that may affect areas off of tribal lands.
39	**Finding:** The emergency management software used by the state is not utilized to provide real-time needs for public health and medical services operations coordinated through NDDoH. **Recommendation 39.A:** The state should consider research to identify operational tools that can be integrated with the state's emergency management software to provide a real-time common operating picture to enhance situational awareness in support of tactical and operational decision making.

Next Steps

NDDES will develop a Preparedness Enhancement Strategy based on risks, vulnerabilities, findings, and recommendations provided in this report. This plan will be supplemental to the Report, providing strategies and a path forward toward a safer and better prepared North Dakota.

TABLE OF CONTENTS

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1 INTRODUCTION

This "North Dakota Crude Oil Transportation Response Preparedness Report" (the Report) was developed for the North Dakota Department of Emergency Services (NDDES) as a tool to assist North Dakota's state, local, and tribal government departments in determining the status of current incident-response preparedness capabilities for crude oil transportation across the state, as they then chart a path toward improving these capabilities.

The five major components of the Report are:

- Description of the current situation, including history and trends
- Jurisdictional roles in preparedness and response to crude oil transportation incidents
- Risk and vulnerability assessment for each county where crude oil transportation occurs
- Needs and areas for improvement, with findings and recommendations
- An enhancement strategy for response preparedness at the state, local, and tribal levels across the state (development to follow after NDDES' review of the initial draft Report)

1.1 Report Development

Witt O'Brien's worked with NDDES to identify stakeholders along crude oil transportation routes throughout North Dakota. The Witt O'Brien's project team engaged identified stakeholders through in-person interviews, surveys, working sessions, phone calls, and email correspondence.

In addition, the project team conducted extensive research and analysis into the risks and vulnerabilities that crude oil transportation poses in North Dakota. Witt O'Brien's worked to capture the actual and the desired level of prevention, preparedness, and response capabilities as expressed by local, state, federal, and tribal government responders and leaders, as well as private industry stakeholders involved in crude oil transportation in North Dakota.

1.2 Report Organization

The report is divided into five sections, each addressing pipeline, railroad, and roadway, respectively. Detailed section descriptions are found below.

1.2.1 Background

The Background section presents historical and current data for each mode of transportation. A summary of the geography of pipeline, rail, and road transportation of crude in the state, recent transportation incidents, and regulatory changes are presented in this section.

1.2.2 Classification of the Hazard

The Classification of the Hazard section provides a discussion of the hazard posed by crude oil transportation. Understanding the challenges presented by crude oil transportation is enhanced through an understanding of crude oil's various compositions and the associated challenge in classifying crude oil products.

1.2.3 Crude Oil Transportation Risk and Vulnerability Assessment

The Risk and Vulnerability Assessment provides an analysis of the risks and vulnerabilities associated with crude oil transportation within each mode. The project team applied a combination of qualitative and quantitative analyses to determine risk, including associated impacts and likelihood of crude oil transportation incidents. These analyses provide the foundation for findings regarding prevention, preparedness, and response needs, and includes recommendations to enhance North Dakota's capabilities to prevent incidents and protect communities and residents from the impact of crude transportation incidents.

1.2.4 North Dakota Emergency Prevention, Preparedness, and Response Capability Assessment

The North Dakota Emergency Prevention, Preparedness, and Response Capability Assessment is a summary of state and local government departments' readiness to prevent, prepare for, and respond to railroad, roadway, and pipeline accidents involving crude oil.

1.2.5 Findings and Recommendations

The Findings and Recommendations section summarizes the key findings from the previous sections and provides recommendations for enhancing capabilities for safety, preparedness, and response for crude oil transportation within North Dakota. The Findings and Recommendations section includes topics such as policy for prevention and response, and coordination to improve emergency response capabilities at all levels of government.

1.3 Stakeholder Roles and Responsibilities

This section introduces the general roles and responsibilities of the various levels of government and private sector stakeholders. Additional details about the roles that individual agencies, departments, and private sector stakeholders fill can be found in Section 4, North Dakota Emergency Prevention, Preparedness, and Response Capability Assessment.

1.3.1 Federal

The federal government provides oversight of the movement of hazardous materials, including transportation of crude oil. Agencies such as the Federal Railroad Administration (FRA), Pipeline and Hazardous Materials Safety Administration (PHMSA), and the US Department of Homeland Security (USDHS) partner with other federal agencies, states, and local governments on issues of security, infrastructure design and integrity, and emergency response.

1.3.2 State

The State of North Dakota provides regulatory oversight, in alignment with federal requirements, and response roles to the crude oil industry. Regulatory functions are performed by agencies such as the Public Service Commission (PSC) and the Industrial Commission. State agencies, such as NDDES and ND Department of Health (NDDoH), have responsibilities for preparedness and response activities to protect human health and safety, property, and the environment in North Dakota.

1.3.3 Local

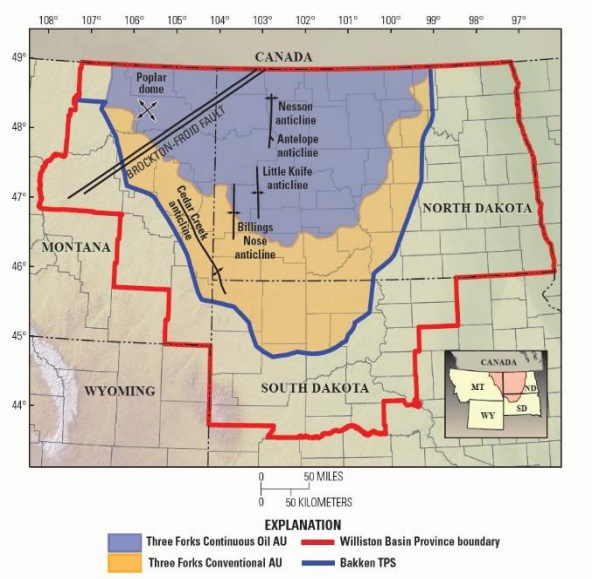
Local emergency management entities are primarily responsible for response operations for crude oil transportation incidents that occur within their jurisdictional boundaries. Initial response will be made by local emergency responders, including emergency managers, fire departments, law enforcement, public works, and emergency medical services. The responsibility for response operations creates the need for ongoing preparedness efforts to build capabilities to respond effectively.

1.3.4 Private Industry

The regulatory structure for transport by rail, pipeline, and road recognizes the practical and legal responsibilities of the shipping company in safety of crude oil shipments, as well as in preparedness and response operations. Common carrier transportation companies that cross the US and Canadian border must adhere to both countries' regulatory requirements. Multiple individual companies are involved in crude oil transportation in the state.

2 BACKGROUND

Figure 1: Bakken Formation within the Williston Basin



content, sweet crude oil.

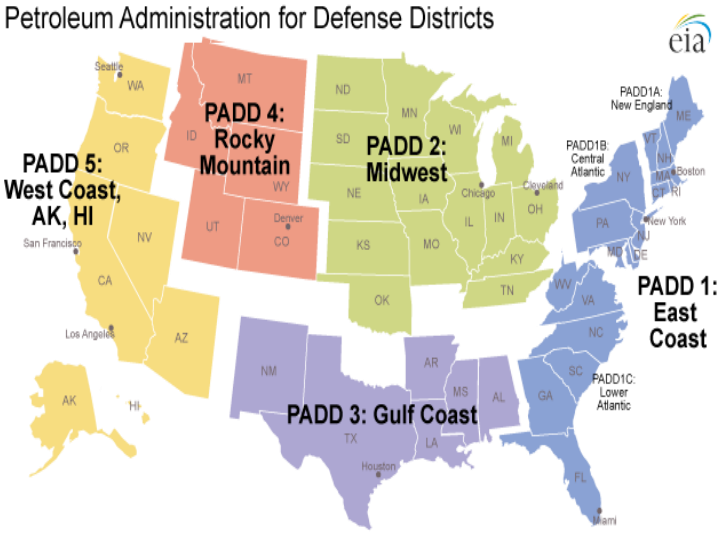
The US Energy Information Administration (USEIA) has delineated Petroleum Administration for Defense Districts (PADD) for regional assessment of petroleum supplies (see Figure 2: Petroleum Administration for Defense Districts). The USEIA data for PADD2 provides a snapshot of where Bakken extracted light sweet crude oil is moving.

Table 2: Movements by Tanker, Pipeline, Barge and Rail from PADD2 provides a snapshot of the movement from PADD2 annually, from 2010 to 2014.[6]

The Williston Basin occupies portions of North Dakota, South Dakota, Montana, Saskatchewan, and Manitoba (see Figure 1: Bakken Formation within the Williston Basin[5]).

The Bakken Shale Formation is an oil-bearing strata that occupies about 200,000 square miles of the subsurface of the Williston Basin. The Bakken Formation is one of many hydrocarbon producing formations in the Williston Basin. Geologists have known about the shale formation for many years. Advancements in technology and rising oil prices in the spring and summer of 2008 caused many companies to explore opportunities in North Dakota. Crude extracted from the Bakken Shale is shipped to refineries across the country. The formation yields a low sulfur

Figure 2: Petroleum Administration for Defense Districts



[5] Demas, Alex, US Department of the Interior, US Geological Survey, USGS Releases New Oil and Gas Assessment for Bakken and Three Forks Formations, May 2, 2013, http://www.usgs.gov/blogs/features/usgs_top_story/usgs-releases-new-oil-and-gas-assessment-for-bakken-and-three-forks-formations/ (accessed June 22, 2015).

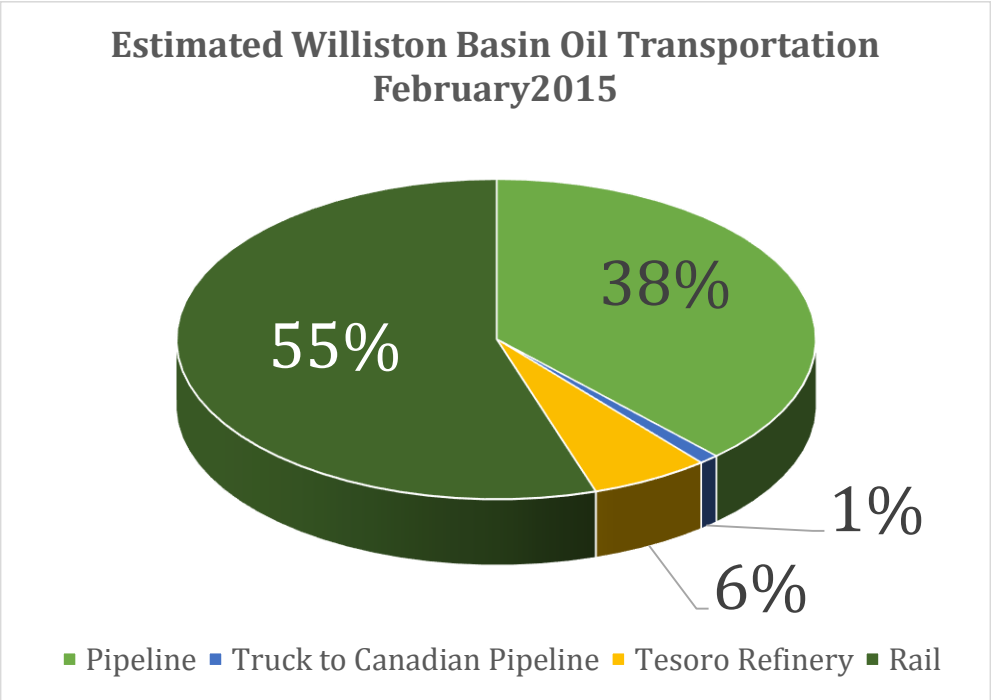
[6] US Energy Information Administration, Movements by Tanker, Pipeline, Barge, and Rail Between PADD Districts, May 28, 2015, http://www.eia.gov/dnav/pet/pet_move_ptb_dc_R20-R10_mbbl_m.htm (accessed June 22, 2015).

Table 2: Movements by Tanker, Pipeline, Barge and Rail from PADD2

(Annual-Thousand Barrels)	PADD 1 East Coast	PADD 3 Gulf Coast	PADD 4 Rocky Mountain	PADD 5 West Coast (includes AK, HI)
2010	6,087	56,597	22,494	447
2011	7,851	86,890	27,587	1,609
2012	25,503	176,871	33,807	7,918
2013	87,455	272,378	25,727	32,391
2014	142,104	306,687	40,552	50,930

The April 2015 North Dakota Pipeline Authority (NDPA) Monthly Update reports that slightly more than half (55%) of the crude oil leaving North Dakota is being transported by rail, while another 38% is being transported via pipeline (depicted in Figure 3: Estimated Williston Oil Transportation[7]).

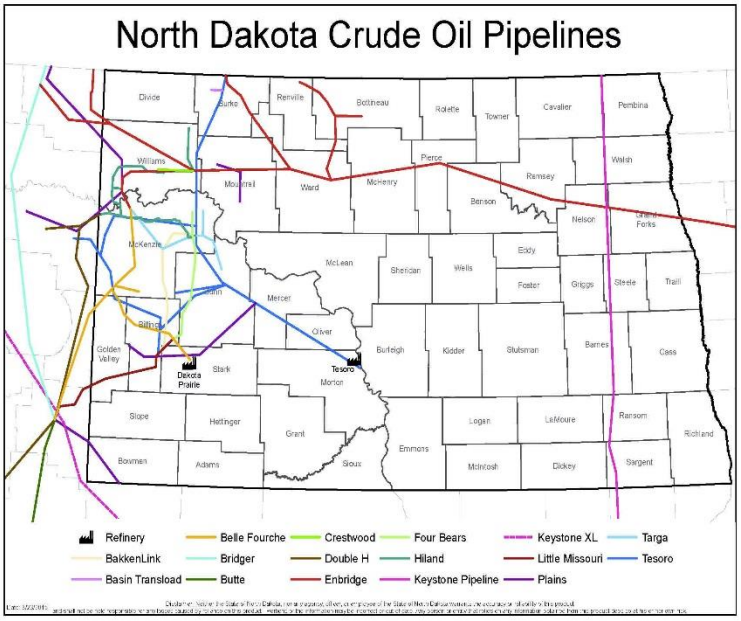
Figure 2: Estimated Williston Oil Transportation



[7] Kringstad, Justin, North Dakota Pipeline Authority, Monthly Update, April 14, 2015, https://ndpipelines.files.wordpress.com/2012/04/ndpa-monthly-update-april-14-2015.pdf (accessed June 22, 2015).

2.1 Pipeline Background

Figure 3: North Dakota Crude Oil Pipelines



There are two general types of energy pipelines: liquid petroleum pipelines and natural gas pipelines. Within the liquid petroleum network there are crude oil lines, refined product lines, highly volatile liquids lines, and carbon dioxide lines.[8] Although liquid petroleum pipelines carry a variety of products, the scope of this report is focused on crude oil transportation through liquid petroleum pipelines. Figure 4: North Dakota Crude Oil Pipelines provides a location overview for the crude oil pipeline network in North Dakota. Interstate pipelines carry product across state lines, while intrastate pipelines carry product within state boundaries. In 2013, 74% of North Dakota's crude oil pipelines were interstate pipelines (see Table 3: Crude Oil Pipeline Miles and Tanks).

Table 3: Crude Oil Pipeline Miles and Tanks[9]

Calendar Year	Interstate Miles	Intrastate Miles	Total Miles	Miles of Gathering	Breakout Tanks
2013	1,899.7	653.1	2,552.8	412.2	76
2012	1,854.8	119.0	1,973.8	281.6	36
2011	1,727.0	45.5	1,772.4	373.3	42
2010	1,499.9	23.5	1,523.4	232.0	30

The USDOT PHMSA has regulatory responsibility for inspecting and enforcing pipeline safety regulations for interstate and intrastate pipelines that carry hazardous liquids (crude oil) in North Dakota. The North Dakota Industrial Commission's Department of Mineral Services, Oil and Gas Division, has safety and siting jurisdiction for gathering pipelines as part of oil well permitting. North Dakota PSC has the responsibility to establish and enforce rates or charges and regulations

[8] Pipeline 101, How do pipelines work?, http://www.pipeline101.com/how-do-pipelines-work (accessed June 22, 2015).

[9] North Dakota Public Service Commission, Jurisdiction: Pipelines, http://psc.nd.gov/jurisdiction/pipelines/ (accessed June 22, 2015).

by common pipeline carriers for receiving, gathering, transporting, loading, delivering, and incidental storage of crude petroleum purchased or sold in North Dakota.[10]

The exceptional growth of crude oil exploration and product continues to exceed the pipeline infrastructure capacity. This increased need to expand pipeline infrastructure is relatively recent. Until 2007, pipelines were capable of meeting transportation demands of oil production in the state. In 2008, pipeline capacity began to be insufficient, leading producers to turn to the railroad industry to augment transportation needs. As of April 2015, pipeline is responsible for only 38% of the transport capacity (see Figure 3: Estimated Williston Oil Transportation) compared to 55 % for rail. As production continues to outpace pipeline capacity in North Dakota, rail transportation continues to fill the gap and now carries the majority of the transport capacity from North Dakota.

2.1.1 Pipeline Incidents

According to PHMSA records, there were 15 crude oil pipeline incidents in North Dakota between 2002 and 2009 totaling 1,344 barrels of spilled product. Approximately 850 barrels were recovered.[11] PHMSA has recorded 33 crude oil pipeline incidents for the period from 2010 to present (current through April 3, 2015), totaling 29,492 barrels in North Dakota. Approximately 11,579 barrels were recovered.[12] Examples of the most costly pipeline incidents, as reported to the PHMSA, since January 2010 include:

Tesoro – Tioga to Black Slough Mountrail County: On September 29, 2013, along Tesoro's High Plain's Pipeline Segment from Tioga to Black Slough in Mountrail County, a leak reported by the public released an estimated 20,600 barrels of crude oil, of which 5,856 barrels were recovered. The interstate pipeline segment was shut down until November 2013. The leak caused soil damage requiring long-term remediation. Total damages caused by the leak were approximately $17 million. Metallurgical analysis determined that the 10/32" hole resulted from an electrical discharge, most likely caused by lightning. According to NDDoH Division of Water Quality, the impacted material is being thermally treated on site. Storm water that collects in the excavation area is pumped through a carbon filter and then utilized in the thermal desorption process. As of September 8, 2015, 333,993 tons of soil had been thermally treated. The Tesoro Corporation is currently utilizing a 40-ton Thermal Desorption Unit (TDU)

[10] US Department of Transportation, Pipeline Hazardous Materials Safety Administration, Hazardous Liquid Accident Data Jan 2002 – Dec 2009, http://phmsa.dot.gov/staticfiles/Pipeline Hazardous Materials Safety Administration/DownloadableFiles/Files/Pipeline/data/accident_hazardous_liquid_jan2002_dec2009.zip (accessed June 22, 2015).

[11] US Department of Transportation, Pipeline Hazardous Materials Safety Administration, Hazardous Liquid Accident Data Jan 2010 – Present, http://phmsa.dot.gov/staticfiles/Pipeline Hazardous Materials Safety Administration/DownloadableFiles/Files/Pipeline/data/accident_hazardous_liquid_jan2010_present.zip (accessed June 22, 2015).

[12] US Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Pipeline Safety: Potential for Damage to Pipeline Facilities caused by Flooding, River Scour, and River Channel Migration, Federal Register 80, no 68, April 9, 2014, 19114, http://www.gpo.gov/fdsys/pkg/FR-2015-04-09/pdf/2015-08148.pdf (accessed June 22, 2015).

that processes 40 tons of material per day. They also have a 20-ton TDU and a 60-ton TDU on site, but the current natural gas supply infrastructure is only sufficient to operate the 40-ton TDU. Efforts to increase natural gas supply to accommodate the 60-ton TDU and the 40-ton TDU will provide the capability to complete excavation, treatment, and backfilling in an estimated 16 months.

Enbridge Pipelines (North Dakota) LLC – Pembina County: On January 8, 2010, the Enbridge Control Center noticed a sudden drop in pressure. The leak, located in Neche, Pembina County, released an estimated 3,000 barrels. The leak required no long term remediation. The pipeline was shut down until January 13, 2010. Total damages exceeded $4 million. Metallurgical investigation concluded that the failure was the result of a fatigue crack. According to NDDoH, remediation was completed in July, 2010.

Enbridge Pipelines (North Dakota) LLC – Minot, Ward County: On November 13, 2012 a release was discovered in by Enbridge Pipelines, Minot, Ward County. The release was identified during a daily inspection. A total of 3,200 gallons of oil was released. Metallurgical assessment determined the cause was internal corrosion. Total cost exceeded $2.4 million. According to NDDoH, remediation was completed in March, 2015.

Belle Fourche Pipeline Company – Alexander, McKenzie County: On December 9, 2011, in Alexander, McKenzie County, a contractor struck a Belle Fourche pipeline along the Bicentennial to Alex 8" pipeline with a probing device, releasing crude oil. The leak released 1,000 barrels and required soil remediation. Total cost for remediation was $59,525 but did not include excavation in areas that could compromise the pipeline. According to NDDoH's Spill Investigation Program, supplemental site excavation to remediate impacted materials directly adjacent to and underneath the pipeline began on September 10, 2015, under the direction and control of Belle Fourche. NDDoH will collect confirmation samples to verify clean-up if satisfactory and complete.

2.2 Changes Affecting the Pipeline Industry

2.2.1 Federal Regulation

PHMSA Docket No. PHMSA-2010-0026: Pipeline Safety: Miscellaneous Changes to Pipeline Safety Regulations

A federal rule promulgated by PHMSA (amending 49 CFR 195) will require that hazardous liquid pipeline operators make submissions (including geospatial data regarding locations, attribute data and metadata, public contact information, and a transmittal letter) to the National Pipeline Mapping System. These provisions were previously part of an advisory bulletin (73 Federal Register 44800). The rule change also addresses qualifications for welders used on

pipelines and other administrative changes. This ruling became final on March 11, 2015, and became effective October 1, 2015.

PHMSA Docket Number PHMSA-2015-0105: Pipeline Safety: Potential for Damage to Pipeline Facilities Caused by Flooding, River Scour, and River Channel Migration

On April 2015, PHMSA issued an advisory bulletin regarding potential pipeline damage from river scour and channel migration in severe flooding situations.[13] The bulletin updates a series of similar advisories on this issue; the most recent had been published after the January 2015 spill of more than 28,000 gallons of crude oil into the Yellowstone River near Glendive, Montana. The pipeline was compromised after more than 100 feet of pipeline was exposed on the river bottom.[14]

2.2.2 North Dakota State Legislature Bills

In the state Legislative Assembly, several bills addressing pipelines and pipeline safety were under consideration in 2015, and some were signed into law. House Bill 1358, which was signed by the governor on April 20, 2015, includes amendments to the North Dakota Century Code to require filing of engineering designs for underground gathering pipelines with the State Industrial Commission, and to set standards for inspection certificates. The law also requires operators of underground gathering pipelines, carrying crude oil or water produced from oil production, to post a bond.

Another bill signed by the Governor on April 13, 2015, Senate Bill 2271, is an emergency measure that creates a pipeline restoration and reclamation pilot program in the North Dakota Department of Agriculture (NDDA) and appropriates monies from the existing abandoned oil and gas well plugging reclamation fund to support the program.

House Bill 1068, signed into law on April 20, 2015, allows access by the Three Affiliated Tribes to the geographic information system database of pipelines located within the boundaries of the Fort Berthold Reservation; it requires that the North Dakota Industrial Commission consider federal and tribal jurisdictional issues when creating policy.

At the time of this report, there are no additional current North Dakota state legislative initiatives related to pipeline safety or preparedness.

[13] US Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Pipeline Safety: Potential for Damage to Pipeline Facilities caused by Flooding, River Scour, and River Channel Migration, Federal Register 80, no 68, (April 9, 2014), 19114, http://www.gpo.gov/fdsys/pkg/ -2015-04-09/pdf/2015-08148.pdf (accessed June 22, 2015).

[14] Association of American Railroads, Class I Railroad Statistics, May 26, 2014, https://www.aar.org/Documents/Railroad-Statistics.pdf (accessed June 22, 2015).

2.3 Railroad Background

With current crude production exceeding North Dakota's pipeline infrastructure capacity, the railroad industry has filled the supply chain gap. North Dakota has two Class I railroads: CP and BNSF. Class I railroads are the nation's largest freight railroads, defined as having 2013 operating revenues of $467.0 million or more. The American Association of Railroads (AAR) expected this amount to increase to approximately $475.8 million for 2014.[15]

CP and BNSF each partner with multiple regional/short-line railroads to meet statewide shipping needs. Light sweet crude oil is predominately transported via rail from the oil producing Williston Basin/Bakken Formation region of western North Dakota to one of the 115 refineries throughout the US. The two Class I railroads originate almost all of the crude oil rail shipments in North Dakota with BNSF transporting approximately 75% of all North Dakota produced oil.[16]

Crude oil is transported via rail through 33 of North Dakota's 53 counties. Counties with crude-by-rail traffic include: Barnes, Benson, Billings, Burke, Burleigh, Cass, Eddy, Foster, Golden Valley, Grand Forks, Griggs, Kidder, McHenry, McKenzie, McLean, Mercer, Morton, Mountrail, Nelson, Oliver, Pierce, Ramsey, Ransom, Renville, Richland, Sheridan, Stark, Steele, Stutsman, Traill, Ward, Wells, and Williams.

Transload facilities are another important component of crude-by-rail transportation. These privately owned, rail-based facilities load crude oil from trucks and intrastate pipelines to storage tanks, and then onto trains. According to the USEIA, 20 such facilities currently operate in North Dakota.[17] These facilities are located in the western half of the state in the area of the Bakken Formation. Loading capacities of the individual facilities vary from 10,000 to 200,000 barrels per day.[18] Total capacity at rail loading facilities across North Dakota has grown dramatically from 95,000 barrels per day in 2010 to 1,260,000 million barrels per day in 2014 (see Table 4). Additionally, North Dakota has two operational petroleum refineries that receive, store, and refine light sweet crude oil: one in Bismarck and a new diesel refinery in Dickinson.

[15] US Energy Information Administration, US States: State Profiles and Energy Estimates, 2015, http://www.eia.gov/state/maps.cfm?v=Petroleum (accessed June 22, 2015).

[16] Minnesota Department of Transportation, *Frequently Asked Questions*. http://www.dot.state.mn.us/ofrw/crude-by-rail/crude_faqs.html

[17] North Dakota Pipeline Authority, US Williston Basin Crude Oil Export Options, February 26, 2015, https://ndpipelines.files.wordpress.com/2012/04/wb-export-options-2-26-151.jpg (accessed June 22, 2015).

[18] Canadian Pacific, *Connecting you to the Bakken Shale*, http://www.cpr.ca/en/our-markets-site/Documents/bakken.pdf (accessed June 22, 2015).

Table 4: North Dakota Rail Loading Facility Oil Transport System Capacity

Calendar Year	Crude Oil Transport, Capacity (barrels per day)
2014	1,260,000
2013	1,150,000
2012	740,000
2011	245,000
2010	95,000

2.3.1 Canadian Pacific Railway with Regional and Short-Line Partners[19]

The CP mainline runs through the middle of the state from the northwest corner at Flaxton to the southeast corner at Hankinson. Also, a segment of CP rail connects New Town to the mainline at Drake. Regional partners of CP operating in North Dakota include Dakota, Missouri Valley & Western (DMVW), and Northern Plains Railroad (NPR). DMVW has rail lines that follow the Canadian border from Flaxton to Montana and in the southeast, forking outside of Hankinson to both Max and South Dakota. Crude oil is shipped on various rail segments owned by NPR between Thief River Falls, Minnesota, and Kenmare, North Dakota.

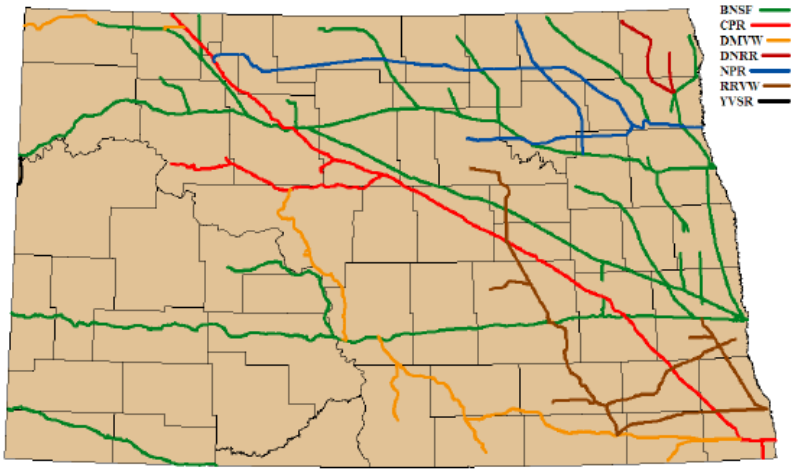
2.3.2 Burlington Northern and Santa Fe Railway with Regional and Short-Line Partners

BNSF has multiple rail routes that transport crude throughout North Dakota. Two main routes are roughly parallel and cross the state from east to west. The southern BNSF line follows along Interstate 94. The northern BNSF line runs between Grand Forks in the east and Trenton in the west, paralleling US Highway 2 for much of the journey. Additionally, multiple shorter segments connect to these two east-west routes. One travels between Jamestown and Minot, along US Highway 52. Another connects Grand Forks with Fargo before continuing south into Minnesota. Another route utilized by BNSF to transport oil connects Bismarck with Beulah. BNSF regional rail partners include: Mohall Central Railroad from Lakota to Sarles in the north, and Red River Valley & Western Railroad Company from Jamestown to both Woodworth and Maddock to the north. Figure 5 depicts the rail network in North Dakota.[20]

[19] BNSF Railway, *Willison Basin/Bakken Shale: Crude by Rail*, https://www.bnsf.com/customers/oil-gas/interactive-map/pdfs/BNSF-OG-Wiliston-Map.pdf (accessed June 22, 2015).

[20] North Dakota Department of Transportation, North Dakota State Rail Plan, December 2007, https://www.dot.nd.gov/divisions/planning/docs/railplan.pdf (accessed June 22, 2015).

Figure 5: North Dakota Rail Network



2.3.3 Railroad Incidents

There have been two significant crude by railroad transportation accidents in North Dakota in the past two years. However, a perspective view of the total US and Canadian incidents involving light, sweet crude oil indicates that the two North Dakota accidents are part of a larger national concern for transportation safety. Summaries of significant North American crude by rail incidents occurring since January 2013 in the United States and Canada are provided below in chronological order. It is worth noting that, according to a review of media reports, all four of the most recent accidents (from March 2015 to May 6, 2015, at the end of the list) involved Casualty Prevention Circular (CPC)-1232-compliant tank cars. These cars include safety upgrades voluntarily adopted by the industry four years ago. An estimated $7 billion has been spent to put 57,000 of these cars into service, according to the Railway Supply Institute.[21]

Lac Mégantic, Quebec—"On July 5, 2013, a train with 72 loaded tank cars of crude oil from North Dakota moving from Montreal, Quebec, to St. John, New Brunswick, stopped at Nantes, Quebec, at 11:00 pm. The operator and sole railroad employee aboard the train secured it and departed, leaving the train on short line track with a descending grade of about 1.2%. At about 1:00 AM, it appears the train began rolling down the descending grade toward the town of Lac-Mégantic, about 30 miles from the US border. Near the center of town, 63 tank cars derailed, resulting in multiple explosions and subsequent fires. There were 47 fatalities and extensive damage to the town. 2,000 people were evacuated. The initial determination was that the

[21] Fritelli, John, Andrews, Anthony, Parfomak, Paul, Pirog, Robert, Ramseur, Jonathon, and Ratner, Michael, US Library of Congress, Congressional Research Service, US Rail Transportation of Crude Oil: Background and Issues for Congress, R43390, 2014, https://www.fas.org/sgp/crs/misc/R43390.pdf (accessed June 22, 2015).

braking force applied to the train was insufficient to hold it on the 1.2% grade and that the crude oil released was more volatile than expected."[22]

Aliceville, Alabama— "On November 8, 2013, a train hauling 90 cars of crude oil from North Dakota to a refinery near Mobile, AL, derailed on a section of track through a wetland near Aliceville, AL. Thirty tank cars derailed and some dozen of these burned. No one was injured or killed. The derailment occurred on a short line railroad's track that had been inspected a few days earlier. The train was travelling under the speed limit for this track."[23]

Casselton, North Dakota— "On December 30, 2013, an eastbound BNSF Railway train hauling 106 tank cars of crude oil struck a westbound train carrying grain that shortly before had derailed onto the eastbound track. Some 34 cars from both trains derailed, including 20 cars carrying crude oil, which exploded and burned for over 24 hours. About 1,400 residents of Casselton were evacuated but no injuries were reported."[24]

Plaster Rock, New Brunswick—"On January 7, 2014, 17 cars of a mixed train hauling crude oil, propane, and other goods derailed likely due to a sudden wheel or axle failure. Five tank cars carrying crude oil caught fire and exploded. The train reportedly was delivering crude from Manitoba and Alberta to the Irving Oil refinery in Saint John, New Brunswick. About 45 homes were evacuated but no injuries were reported."[25]

Philadelphia, Pennsylvania—"On January 20, 2014, 7 cars of a 101-car CSX train, including 6 carrying crude oil, derailed on a bridge over the Schuylkill River. No injuries and no leakage were reported, but press photographs showed two cars, one of them being a tanker, leaning over the river."[26]

Vandergrift, Pennsylvania—"On February 13, 2014, 21 tank cars of a 120-car train derailed outside Pittsburgh. Nineteen of the derailed cars were carrying crude oil from western Canada, and four of them released product. There was no fire or injuries."[27]

Lynchburg, Virginia—"On April 30, 2014, 15 cars in a crude oil train derailed in the downtown area of Lynchburg. Three cars caught fire, and some cars derailed into a river along the tracks. The immediate area surrounding the derailment was evacuated. No injuries were reported."[28]

[22] Ibid.
[23] Ibid.
[24] Ibid.
[25] Ibid.
[26] Ibid.
[27] Ibid.
[28] Ibid.

Timmons, Ontario—On February 13, 2015, 29 cars of a 100-car Canadian National (CN) Railway train carrying diluted bitumen crude oil derailed in a remote area 50 miles south of Timmins, Ontario, spilling oil and catching fire. The train was headed from Alberta to Eastern Canada.[29]

Mount Carbon, West Virginia—On February 16, 2015, 27 tank cars of a 109-car train derailed. 19 cars released crude oil and caught fire, leaking oil into a Kanawha River tributary and burning a nearby house. An estimated 1,100 people were evacuated and two injuries were reported.[30]

Galena, Illinois—On March 5, 2015, a 105-car train (103 cars of light sweet crude oil and two buffer cars with sand) derailed three miles south of Galena. Twenty-one cars were damaged, 10 of which released crude oil and ignited. No injuries or fatalities were reported, but local officials requested a voluntary evacuation to a one-mile radius because of the incident's proximity to a propane tank. Nine residents evacuated for approximately 40 hours.[31]

Hornepayne, Ontario—On March 5, 2015, a CN freight train derailed in a remote area of northern Ontario; the company reported no injuries or fire. A company spokesman said the scene was about 100 kilometers east of Hornepayne; 16 cars derailed at 6:30am. The derailed cars were residue tank cars that contained crude oil or gasoline, but no sign of any leaks or spillage of product were apparent.[32]

Gogama, Ontario—On March 7, 2015, a CN train carrying crude oil derailed near the northern Ontario community of Gogama with multiple cars on fire and some leaking oil into a waterway. There were no injuries reported from the derailment, which was CN's second in the region in just three days, and third in less than a month. The railway said a bridge over a waterway had been damaged and that five tank cars landed in the water, with some on fire. CN said the crude oil on the train originated in Alberta, destined for Eastern Canada, and that the tank cars were the newer American Association of Railroad CPC-1232-compliant design; these tank cars have been regarded to be better protected against damage than older types.[33]

Heimdal, North Dakota—At approximately 7:30am on May 6, 2015, a BNSF train derailed east of the unincorporated community of Heimdal in Wells County. According to NDDES, six cars

[29] Global News, *No Injuries After CN Train Derails in Northern Ontario*, March 5, 2015, Print.

[30] US Department of Transportation, Federal Railroad Administration Office of Safety Analysis, *Accident Detail Report*, http://safetydata.fra.dot.gov/officeofsafety/publicsite/Query/incrpt.aspx (accessed June 22, 2015).

[31] Ibid.

[32] Huffington Post, *Crude Oil Train Derailment in Ontario, Canada Is Third in Less Than a Month*, March 7, 2015, Print.

[33] US Department of Transportation, Pipeline Hazardous Materials Safety Administration, *Hazardous Materials: Rail Petitions and Recommendations to Improve the Safety of Railroad Tank Car Transportation*, Federal Register 80, No.89, May 8, 2015, 26644, http://www.regulations.gov/#!docketDetail;D=Pipeline Hazardous Materials Safety Administration-2012-0082 (accessed June 22, 2015).

derailed, of which four caught fire but did not explode. Approximately 25 people were evacuated but allowed to return to their homes by 9:00pm the same evening. A BNSF spokesman said 107 unjacketed CPC-1232 compliant tank cars were carrying crude oil, along with two buffer cars loaded with sand between the crude cars and locomotives. Big Slough, an intermittent waterway that drains into the James River, was impacted by oil, but containment booms were put in place that were able to contain the oil. Additional containment dikes also were built around the derailment site. The derailment did not cause any injuries, fatalities, or structural losses.[34]

2.4 Changes Affecting the Railroad Industry

2.4.1 Recently Adopted Rules and Legislation

State of North Dakota: Industrial Commission Order No. 25417

Industrial Commission Order 25417 requires crude oil producers in the state to condition light sweet crude oil to a vapor pressure of no more than 13.7 pounds per square inch (psi) (about that of automobile gasoline). National standards set crude oil stability at a vapor pressure of 14.7 psi. Under the order, all light sweet crude oil produced in North Dakota will be conditioned. The order requires operators to separate light hydrocarbons from light sweet crude oil in order to be transported, and prohibits the blending of light hydrocarbons back into oil supplies prior to shipment. The order became effective April 1, 2015. [35]

ND Senate Bill No. 2008 (15.8121.01000) – State-Run Rail Safety Pilot Program[36]

Senate Bill 2008 was approved on April 27, 2015, and signed into law by the governor on April 29, 2015. It will fund a state-run rail-safety pilot program to supplement federal oversight of oil train traffic. The budget will be provided by the state PSC and will fund one additional inspector salary, one temporary employee salary, and operating costs for 2017-19. The bill also includes a railroads training program for fire departments with jurisdiction along routes traveled by oil trains. The PSC budget will provide $523,345 for the project.

[34] Wilz, Greg (North Dakota DES Director), Roehrich, Tammy (Wells County, North Dakota, Emergency Management). Interview. May 13, 2015.

[35] State of North Dakota, Industrial Commission, Order No. 25417, Case No. 23084, September 23, 2014, https://www.dmr.nd.gov/oilgas/Approved-or25417.pdf (accessed June 22, 2015).

[36] US Department of Transportation, Federal Railroad Administration, *Emergency Order No. 30, Notice No. 1: Emergency Order Establishing Operating Speed of 40 mph in High-Threat Urban Areas for Certain Trains Transporting Large Quantities of Class 3 Flammable Liquids*. 2015, http://www.fra.dot.gov/eLib/Details/L16319. http://www.transportation.gov/briefing-room/emergency-order (accessed June 22, 2015).

PHMSA-2012-0082 – Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains[37]

This new federal rule[38] intends to reduce the frequency and impacts of rail accidents involving large volumes of flammable liquids. The changes address NTSB recommendations on the accurate classification and characterization of such commodities, enhanced tank car construction, and rail routing. The final rule is effective July 7, 2015.

Under this rule, tank cars constructed after October 1, 2015, that are used to transport flammable liquids as part of a High Hazard Flammable Train (HHFT) would be required to meet specific design requirements or performance criteria (e.g., thermal, top fittings, and bottom-outlet protection; tank-head and shell puncture resistance). A HHFT is a train that includes 20 or more loaded tank cars of a Class 3 flammable liquid in a continuous series, or 35 or more loaded tank cars of a Class 3 flammable liquid total in the train.[39]

PHMSA received comments through September 30, 2014, on the redesign of railcar DOT Specification 117 to replace DOT 111 series railcars.

The rule requires existing rail tank cars that are used to transport flammable liquids as part of a HHFT to be retrofitted to meet the adopted performance requirements, except for top fittings protection. Railroads operating cars that are not retrofitted may choose to retire, repurpose, or operate them under the new speed restrictions for up to five years, based on packing group assignment of the lading.[40]

The rule also requires one of these options for new tank cars constructed after October 1, 2015, if those tank cars are used as part of HHFT. In addition, for all three options, PHMSA provides the following timelines for tank cars used as part of HHFT:

1. For Packing Group I, DOT Specification 111 tank cars are not authorized after October 1, 2017;
2. For Packing Group II, DOT Specification 111 tank cars are not authorized after October 1, 2018; and

[37] US Department of Transportation, *DOT Announces Final Rule to Strengthen Safe Transportation of Flammable Liquids by Rail*, http://www.dot.gov/briefing-room/final-rule-on-safe-rail-transport-of-flammable-liquids (accessed June 22, 2015).

[38] US Department of Transportation, Pipeline Hazardous Materials Safety Administration, *Hazardous Materials: Rail Petitions and Recommendations to Improve the Safety of Railroad Tank Car Transportation*, Federal Register 80, No.89, (May 8, 2015), 26644, http://www.regulations.gov/#!docketDetail;D=Pipeline Hazardous Materials Safety Administration-2012-0082 (accessed June 22, 2015).

[39] Ibid.

[40] Sixty-fourth Legislative Assembly of North Dakota, North Dakota Senate Bill No. 2008, January 6, 2015, http://www.legis.nd.gov/assembly/64-2015/documents/15-8141-06000.pdf?20150622211124 (accessed June 22, 2015).

3. For Packing Group III, DOT Specification 111 tank cars are not authorized after October 1, 2020.

BNSF-Specific Crude Oil Safety Measures

A BNSF press release issued in March, 2015, provided a list of BNSF-specific actions aimed to reduce risk of rail accidents. Actions that became effective in March and April 2015, include lower train speeds of 35 mph for all shale oil trains operating through municipalities with populations of 100,000 or more; formal community outreach initiative; development of a real-time geographic information system (GIS) tracking application for state emergency responders; increased track inspections along critical waterways; and increased trackside safety technology with Hot Bearing Detectors spaced every 10 miles along critical waterways.[41]

2.4.2 Federal Emergency Orders

FRA Emergency Order No. 30, Notice No. 1 – Operating Speed in High-Threat Urban Areas for Trains Transporting Certain Flammable Liquids[42]

On April 17, 2015, the FRA issued an Emergency Order to require that trains transporting large amounts of Class 3 flammable liquid through designated highly populated areas adhere to a maximum authorized operating speed limit. Affected trains must not exceed 40 miles per hour in high threat urban areas, as defined in 49 CFR 1580.3.

Docket No. DOT-OST-2014-0067 – Petroleum Crude Oil Railroad Carriers[43]

This notice, issued May 7, 2014, is an Emergency Restriction/Prohibition Order from USDOT pursuant to 49 United States Code (USC) 5121(d). The order went to all railroad carriers that transport, in a single train in commerce within the US, at least 1 million gallons or more of Class 3 light sweet crude oil. USDOT now requires the railroads to provide notification to State Emergency Response Commissions (SERCs) when trains meeting this criteria move through that SERC's state. Notification must identify each county through which the trains will operate.

[41] BNSF. Specific Crude Oil Safety Measures Implemented by Railroads (2014 & 2015). Print.

[42] US Department of Transportation, *Emergency Order: Emergency Restriction/Prohibition*, 2014, http://www.transportation.gov/sites/dot.gov/files/docs/Emergency%20Restriction%20-%20Prohibition%20Order%20(Docket%20DOT-OST-2014-0025).pdf (accessed June 22, 2015).

[43] US Department of Transportation, Federal Railroad Administration, *Notice of Safety Advisory 2015-02/Pipeline Hazardous Materials Safety Administration 2015-0118, Hazardous Materials: Information Requirements Related to the Transportation of Trains Carrying Specified Volumes of Flammable Liquids*, http://phmsa.dot.gov/staticfiles/Pipeline Hazardous Materials Safety Administration/DownloadableFiles/Files/fra_phmsa_info_sa_4_17_15_2015_04_16_181411.pdf (accessed June 22, 2015).

2.4.3 Federal Safety Advisories

FRA Safety Advisory 2015-02/PHMSA 2015-0118, Notice 15-11, Hazardous Materials – Information Requirements Related to Certain Trains Carrying Flammable Liquids[44]
On April 17, 2015, FRA and PHMSA issued this notice to remind railroads operating HHFTs, trains comprised of 20 or more loaded tank cars with a Class 3 flammable liquid in a continuous block, or any train with 35 or more loaded tank cars of a Class 3 flammable liquid across the entire train (as well as the offerors of the materials being transported), that specific requested information may be required by PHMSA and/or FRA personnel during the course of an investigation immediately following an accident.

FRA Safety Advisory 2015-01 – Inspections and Standards for Certain Trains Transporting Flammable Liquids
On April 17, 2015, the FRA issued this advisory recommending enhancements to the mechanical safety of the cars in trains transporting large quantities of Class 3 flammable liquids. This advisory recommends that railroads use highly qualified individuals to conduct the brake and mechanical inspections, and recommends a reduction to the impact threshold levels the industry currently uses for wayside detectors. These threshold levels measure wheel impacts to ensure the tank cars' wheel integrity.

PHMSA-2015-0099, Notice 15-7 – Hazardous Materials: Emergency Response Information Requirements[45]
On April 17, 2015, PHMSA issued this notice to remind hazardous materials shippers and carriers of their responsibly to ensure that current, accurate, and timely emergency response information must be immediately available to emergency response officials regarding shipments of hazardous materials, and that such information must be maintained on an ongoing basis.

FRA Safety Advisory 2014-01/PHMSA-2014-0049; Notice 14-07 – Recommendations for Tanks Cars Used for the Transportation of Petroleum Crude Oil by Rail[46]

This safety advisory provides notice to companies that ship bulk quantities of Class 3 light sweet crude oil within the US. It encourages offerors and rail carriers to take additional

[44] US Department of Transportation, Pipeline Hazardous Materials Safety Administration, *Notice 15-7 – Hazardous Materials: Emergency Response Information Requirements*, 2015-0099, April 17, 2015, http://www.phmsa.dot.gov/staticfiles/Pipeline Hazardous Materials Safety Administration/DownloadableFiles/Files/Pipeline Hazardous Materials Safety Administration_Notice_15_7_Emergency_Response_Info_Requirements.pdf (accessed June 22, 2015).

[45] US Department of Transportation, Federal Railroad Administration. *Safety Advisory 2014-01/Pipeline Hazardous Materials Safety Administration-2014-0049; Notice 14-07 – Recommendations for Tanks Cars Used for the Transportation of Petroleum Crude Oil by Rail*, http://www.fra.dot.gov/eLib/details/L05222 (accessed June 22, 2015).

[46] *Bakken Crude Stabilization Act of 2015*, HR1679, 114th Congress, Congressional Record, https://www.congress.gov/bill/114th-congress/house-bill/1679?q=%7B%22search%22%3A%5B%22HR+1679%22%5D%7D (accessed June 22, 2015).

precautionary measures to enhance the safe shipment of light sweet crude oil by rail. The advisory urges offerors and carriers to select and use the railroad tank car designed with the highest level of integrity that is reasonably available within their fleet.

2.4.4 One-Time Movement Authorization Revision

FRA has the authority to issue one-time approvals for the movement of compromised or damaged railcars that no longer conform to Hazardous Materials Regulations (49 CFR 171-180). FRA publishes the Hazardous Materials Guidance 127 (HMG-127), which provides the procedures to be followed by the regulated community to obtain approvals to move such cars (known as "noncompliant bulk packages").

HMG-127 establishes a "standing approval" for certain minor flaws. That means, in most cases, shippers can move tank cars with defective safety valves, dented metal, leaky heating coils (for heavy crude), or bad bottom outlet valves without formal FRA approval. Revision to this authority (Revision 4) issued October 7, 2014, include:

- Development of a flowchart to assist in determining the appropriate one-time movement approval (OTMA) category for a specific defect
- Clarification that OTMA approval is also required to move an empty non-conforming USDOT specification railcar
- Expansion of the use of a standing approval, provided that an accurate and complete notification is submitted, and that the defect is specifically allowed

2.4.5 Bills in the 114th Congress of Relevance

Congress has the power to enact legislation that authorizes and guides railroad safety regulations. Regulations are then created and administered by respective federal administrations and departments. The following items are proposals currently introduced in Congress that have the potential to impact the crude by rail industry in North Dakota. These bills are estimated to have a reasonable chance of passing, but it is unclear whether either will ultimately be approved by Congress. Additional relevant bills with estimated lesser chances of being approved are listed in Appendix A.

S. 546 – Railroad Emergency Services Preparedness, Operational Needs, and Safety Evaluation (RESPONSE) Act of 2015

The RESPONSE Act of 2015, developed by Senator Heidi Heitkamp (D-ND), would establish a subcommittee – the Railroad Emergency Services Preparedness, Operational Needs, and Safety Evaluation Subcommittee – under the National Advisory Council. The subcommittee would be responsible for evaluating the following topics:

- Quality and application of training for local emergency first responders related to rail hazardous materials incidents, with a particular focus on small communities near railroads
- Effectiveness of funding levels related to training local emergency responders for rail hazardous materials incidents, with a particular focus on small communities
- Integrating commodity flow studies, mapping, and access platforms for local emergency responders, and increasing responders' access to existing or emerging communications technology
- Need for emergency response plans for rail similar to existing law related to maritime and stationary-facility emergency response plans for hazardous materials
- Need for a rail hazardous-materials incident database
- Better access to relevant, useful, and timely information for local emergency responders, both for training purposes and in the event of an incident

The subcommittee would develop recommendations to improve emergency responder training and resource allocation for hazardous materials incidents involving railroads, and it would determine the most appropriate agencies and offices for the implementation of the recommendations. On March 4, 2015, the Committee on Homeland Security and Governmental Affairs reported the RESPONSE Act of 2015 favorably without amendment.[47] A companion bill, HR 1403, has also been introduced in the House of Representatives.[48]

S. 650 – Railroad Safety and Positive Train Control Extension Act

This bill would extend the positive train control system implementation deadline from end of 2015 to end of 2020. By the deadline, each Class I railroad carrier and each entity providing intercity or commuter rail passenger transportation must present a plan to USDOT to implement a positive train control system on certain tracks. On March 25, 2015, the Committee on Commerce, Science, and Transportation considered S. 650; the committee reported the bill favorably with amendment in the nature of a substitute.[49]

H.R. 2577 – 2016 Transportation, Housing and Urban Development, and Related Agencies Appropriation Bill

This budget appropriation bill includes funding for the Department of Transportation. The bill invests in critical infrastructure programs that will improve road and rail crude oil

[47] S *RESPONSE Act of 2015*, S 546, 114th Cong., *Congressional Record,* https://www.congress.gov/bill/114th-congress/senate-bill/546?q=%7B%22search%22%3A%5B%22%5C%22s546%5C%22%22%5D%7D (accessed June 22, 2015).

[48] *HR RESPONSE Act of 2015*, HR 1403, 114th Cong., *Congressional Record*, https://www.congress.gov/bill/114th-congress/house-bill/1043/text (accessed June 29, 2015)

[49] *Crude-By-Rail Safety Act,* S 859, 114th Cong., *Congressional Record*, https://www.congress.gov/bill/114th-congress/senate-bill/859?q=%7B%22search%22%3A%5B%22S+859%22%5D%7D (accessed June 22, 2015).

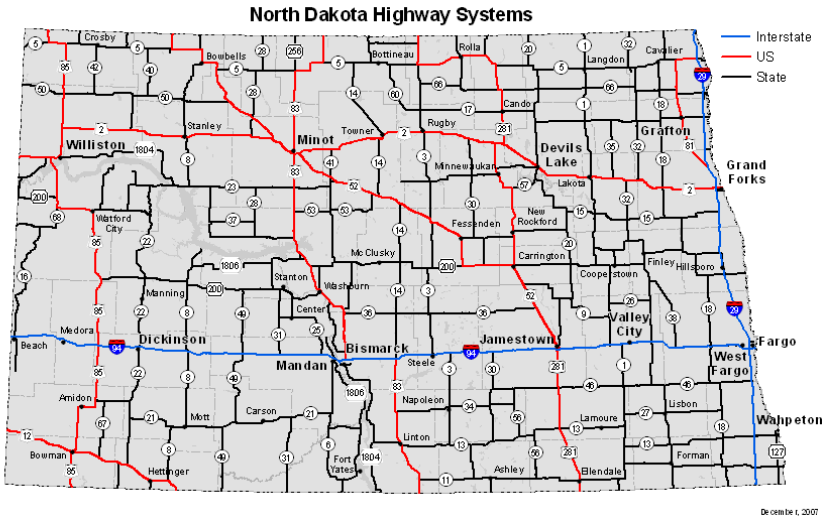
transportation safety. The legislation contains funding for the various transportation safety programs and agencies within the Department of Transportation including:

- $226 million for rail safety and research programs to fund inspectors and training to help ensure the safety of passengers and local communities;
- $6.5 million in funding for a highway rail-grade crossing safety initiative;
- $837 million in total budgetary resources for the National Highway Traffic Safety Administration (NHTSA), an increase of $6.5 million over the fiscal year 2015;
- $572 million for the Federal Motor Carrier Safety Administration; and
- $227 million for the Pipeline and Hazardous Materials Safety Administration, an increase of $6.9 million over the fiscal year 2015, to help address safety concerns including the transport of energy products.[50]

2.5 Roadway Background

Crude oil transportation by roadway continues to be the vital link from well pads to storage and transload facilities where oil is then loaded and transported by railcars or pipelines. Over-the-road transportation of crude oil in North Dakota is predominantly limited to the Bakken region, as long distance hauling of crude oil is not accepted as an economical option. Although not the primary mode of crude oil interstate transportation, short-haul road transfer of crude products has increased. Figure 6 depicts the roadway network in North Dakota.

Figure 6: North Dakota Highway System[51]



[50] *2016 Transportation, Housing and Urban Development Bill*, HR 2577, 114th Cong., *US House of Representatives Committee on Appropriations*, http://appropriations.house.gov/news/documentsingle.aspx?DocumentID=394177 (accessed June 29, 2015)

[51] US Government Accountability Office, Oil and Gas Transportation, GAO 14-667, http://www.gao.gov/assets/670/665404.pdf (accessed June 22, 2015).

2.5.1 Roadway incidents

Tank trucks and transportation on roadways account for only about 2.5% of crude oil transported in the US annually. Therefore, this mode has not received as much attention as the railroad industry. In addition, because of inherent limitations on how much a single tank truck can carry, an incident involving crude oil on the roadway is generally more easily contained than one on the railroads. Unlike transportation by rail and pipeline, which are used for long-haul operations, transportation by truck is used by oil companies for short hauls from production to transfer sites. Tank trucks provide flexibility and practicality, transporting the crude oil from extraction sites and refineries, to pipelines and rail terminals, which tend to be in close proximity. The greatest risk in transporting crude oil on US roadways is the impact on the public, who must use the roadways alongside tank trucks.

Reported highway incidents involving crude oil have increased in recent years.[52] Roadway crashes are generally reported to local, county, and state law enforcement officers. The North Dakota Highway Patrol (NDHP) accumulates crash statistics for the state and produces a crash statistics annual report. In the report, commercial vehicle crashes are reported, but the type of cargo is not. This data collection and reporting methodology is consistent with other states, but it limits understanding of roadway risks involving crude oil.

A full understanding of the crash statistics involving truck tractors specifically carrying crude oil is difficult to discern. There is no agency currently tracking crude-only transportation truck tractor involved crashes. Despite that limitation, data is available that indicates an overall increase in truck tractor crashes. The total number of all truck tractor related crashes tripled from 2008 to 2013, according the 2013 North Dakota Crash Summary.[53]

Table 5: Crash Severity for Truck Tractor Involved Crashes

	2008	2009	2010	2011	2012	2013
Fatal Crashes	6	7	7	6	5	14
Injury Crashed	92	109	179	252	315	271
Property Damage Only Crashes	381	395	533	700	844	903
Total Crashes	482	584	806	1,050	1,155	1,214

[52] US Energy Information Administration, *Glossary*, http://www.eia.gov/tools/glossary/index.cfm?id=C#crude_oil (accessed June 22, 2015).

[53] North Dakota Department of Transportation, *2013 North Dakota Crash Summary*. 2014, http://www.dot.nd.gov/divisions/safety/docs/crash-summary.Pdf (accessed June 22, 2015).

While general statistics regarding crude oil truck tractor crashes is not available, PHMSA requires that incidents which occur during the course of transportation in commerce, and meet the following criteria, be reported:

- As a direct result of a hazardous material:
  - A person is killed;
  - A person receives an injury requiring admittance to a hospital;
  - The general public is evacuated for one hour or more;
  - A major transportation artery or facility is closed or shut down for one hour or more; or
  - The operational flight pattern or routine of an aircraft is altered.
- A situation exists of such a nature (e.g., a continuing danger to life exists at the scene of the incident) that, in the judgment of the person in possession of the hazardous material, it should be reported to the National Response Center (NRC) even though it does not meet the additional criteria.[54]

An analysis of the Hazardous Materials Incident Database shows that between 1995 – 2014 there were 120 highway incidents in North Dakota resulting in a total of 1,346 barrels of crude product released, equivalent to an annual average of 67.25 barrels released a year. In the period from 2008 to 2013, PHMSA's Incident Reports Database shows a dramatic increase from 1 reportable incident in 2008, to 14 reportable incidents in 2013. (See Table 6: PHMSA Incident Database Crude Oil in Transit)

Table 6: PHMSA Incident Database Crude Oil in Transit

	2008	2009	2010	2011	2012	2013
Total Incidents	1	0	3	2	7	14

2.5.2 Operator Overview

Under federal law, each truck must display a USDOT 1267 placard, which signifies the truck is carrying petroleum crude oil.

2.5.3 Infrastructure Safety Concerns

Factors that play a role in the roadway conditions in North Dakota include traffic volume and weather. In western ND, truck traffic increased 60% in 2011, and 37% in 2012, more than

[54] US Department of Transportation, Pipeline Hazardous Materials Safety Administration. *Guide for Preparing Hazardous Materials Incident Reports*, 2004, http://phmsa.dot.gov/pv_obj_cache/pv_obj_id_E48DC74FFC5E921568E9E899FA06C94EA17B4200/filename/reporting_instructions_rev.pdf (accessed June 22, 2015).

doubling in two years.[55] Truck traffic accounts for about 22% of the total traffic on the state system, and 22% of the total traffic on the ND interstate system.[56] More specifically concerning crude oil transportation, in the four counties where production is concentrated, about 75% of product is transported by truck.[57] As of September 2013, 44% of the state's total crude oil production was delivered to storage and transload facilities by tank truck. This equates to an average of 2,000 trips per day, amounting to 36 million vehicle miles traveled per year (VMT). Many of the roads used for crude oil transport were built to handle approximately 600 loads a day. The existing state and local road infrastructure was not designed to support the current volume of large, heavy vehicles. The volume of traffic, coupled with gross vehicle weights exceeding 80,000 pounds,[58] is leading to excessive road deterioration.

"Severe weather can impede truck travel, which may lower oil production in the state. Once on-site storage tanks at production sites are full, production stops until the trucks can move again. For example, in November 2012, North Dakota crude oil production fell slightly from the October level to 735,000 barrels per day because of weather-induced transportation problems caused by an unusually heavy snowstorm.[59]

2.5.4 Changes Affecting the Roadway Industry

Federal requirements regarding how much rest cargo truck drivers (including oil tanker drivers) must get between on-duty stretches have recently been scrutinized. In 2013, federal regulations limited how often drivers could restart their on-duty period. Under then-existing federal regulations, drivers could restart their 60- or 70-hour duty limit after taking an off-duty period of at least 34 consecutive hours that include two periods from 1:00am to 5:00am. The 2013 changes limited re-starts to one per week (168 hours), measured from the beginning of the previous restart. However, a December 2014 appropriations bill, passed by Congress and signed by the President, suspended enforcement of the 2013 provision. Driver rest requirements are designed to address driver alertness and human error issues behind the wheel. These issues tend to be focused on long-haul drivers rather than short-haul routes. However, North Dakota crude oil haulers may fall under this regulation when making multiple round trips. After study and review, further revisions may be proposed and implemented.

[55] North Dakota Department of Transportation, *North Dakota Transportation Handbook,* December 2014, https://www.dot.nd.gov/divisions/exec/docs/transportation-hdbk.pdf (access June 22, 2015).
[56] Ibid.
[57] US Energy Information Administration, *North Dakota oil production reaches new high in 2012, transported by trucks and railroads*, 2013, http://www.eia.gov/todayinenergy/detail.cfm?id=10411 (accessed June 22, 2015).
[58] An average gallon of crude oil weight 7.21 pounds. The fully loaded weight would include the product and the weight of the vehicle equipped and ready for operation, (unladen weight).
[59] US Energy Information Administration, *North Dakota oil production reaches new high in 2012, transported by trucks and railroads*, 2013, http://www.eia.gov/todayinenergy/detail.cfm?id=10411 (accessed June 22, 2015).

In 2014, PHMSA withdrew a notice of proposed rulemaking that would have placed additional regulation on loading and unloading operations of cargo tank motor vehicles. The proposed regulations focused on reducing human error in loading and unloading operations. They would have required risk assessment, operating procedures, annual evaluation of qualifications of loading/unloading personnel, and recordkeeping regarding risk assessment and procedures. After comments from the industry, the agency opted for guidance, additional study of human factors in spill incidents, and an educational campaign in place of additional regulations. This proposal could see additional action in the future.

Currently, North Dakota's interest in road transportation of crude oil focuses on reducing damage to, and bolstering highway infrastructure. The North Dakota Department of Transportation (NDDOT) and counties place load restrictions on roadways each spring to protect roads from damage during thaw. These restrictions are based on weather conditions and vary from year to year. Up to date roadway restrictions (e.g., height and weight) are available from NDDOT and are generally based on seasonal and construction conditions, or other issues. There are no proposals for hazardous material route restrictions.

Several bypass and bridge projects designed to support increased truck traffic and to move crude transport traffic around town centers have been undertaken; some are complete or nearing completion, including the replacement of the Lewis and Clark Bridge near Williston. This projects is slated for completion in 2016.

Hauling and illegal dumping of the waste saltwater generated by hydraulic fracturing is also an issue in trucking. Currently, the state does not have a tracking process for production wastewater, and the North Dakota Department of Minerals and Resources (NDDMR) has reported that it is considering options for tracking of production saltwater. Requiring a sign-off process when a hauler receives wastewater and when it is dumped is one option under discussion. In the future, NDDMR may recommend legislation to license all saltwater haulers and to require a global positioning system with location and weight information for each truck. As was reported to a legislative committee, fines are not necessarily a significant deterrent, but criminal penalties could be.

In December 2014, the FMCSA published a notice announcing its intent to establish a rulemaking committee to negotiate and develop regulations concerning entry-level driver training for commercial motor vehicles (CMVs) operating in interstate or intrastate commerce. The committee will include representatives of organizations or groups with interests that are affected significantly by the subject matter of the proposed regulations. The purpose of the committee is to implement portions of Moving Ahead for Progress in the 21st Century Act (MAP-21). In February 2015, the Entry-Level Driver Training Advisory Committee was established to complete a negotiated rulemaking regarding individuals who want to operate CMVs.

3 CLASSIFICATIONS OF THE HAZARD

Emergency responders use hazard identifiers to develop and maintain situational awareness of preparedness and response measures to hazardous materials incidents, which include crude oil transportation accidents. Use of the hazard classification and labeling systems, as noted below, improves response tactical considerations that are designed to reduce loss of life and property, and environmental impacts.

The term "crude oil" generally refers to "a mixture of hydrocarbons that exists in liquid phase in natural underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities."[60] Within this broad definition, crude oil composition can vary from thin, lightweight, and volatile, to thick, semi-solid, and heavy. Crude oil also varies in flammability, volatility, toxicity, and API gravity, thus varying in the types of risk crude oil poses as it is transported.

The variability in types of crude raises challenges for the transport of crude oil products in North Dakota. Understanding what these terms mean helps policymakers, planners, and responders determine likely consequences should a transportation incident occur, and prepare for an appropriate response. There are multiple classifications of crude oil products and national standards for labeling and identifying each. Proper container labeling can provide insight into the type of product in transit, but labels may not provide enough information for responders to determine the best operational response. Additionally, transportation companies carry shipping papers, such as manifests, bills of lading, and safety data sheets. Shipping papers provide details about the products in transit, including:

- Proper shipping name of the material
- Hazard class and four-digit identification number
- Total quantity of materials
- Number and type of packages
- Packing group
- Emergency response telephone number
- Shipper (origination)
- Consignee/buyer (destination)

Shipping papers are held by the vehicle operator in the cab of a truck and on the locomotive engine of a train based on regulatory requirements and industry practices. Pipelines maintain documentation in their operational offices.

[60] US Energy Information Administration, *Crude Oils Have Different Quality Characteristics*, *Today in Energy*, http://www.eia.gov/todayinenergy/detail.cfm?id=7110 (accessed June 22, 2015).

3.1 Industry Descriptions: Gravity, Sweetness, and Origin

There are two major variables in crude material characteristics: gravity and sulfur content.

- Gravity ranges from light to heavy.[61] It is expressed in American Petroleum Institute (API) gravity, which measures the specific gravity of crude oil in degrees. The API gravity describes the weight of a petroleum product relative to water (greater than 10° API floats on water and less than 10° API sinks in water).
- The sulfur content of crude product determines whether the product is considered low, intermediate, or high sulfur crude. It is commonly referred to as "sweet" or "sour" crude oil. Sour crude oil is high in sulfur content; a sweet crude is low in sulfur. Sweet crude carries a sulfur content of less than 0.5% by weight, while sour crude has a sulfur content greater than 1% by weight. Intermediate crude oil (neither sweet nor sour) has a sulfur content from 0.5% to 1%.

Crude oils that are light (higher API gravity) and sweet (low sulfur content) are typically more desirable for refiners because they have fewer impurities and are easier (and therefore less expensive) to process. Heavier crudes (those with lower API gravity) and sour crudes (high sulfur content) require more complicated refining processes to make them into retail products such as gasoline.

Petroleum crude products are also commonly named for the location from which they were extracted. Most of the crude products transported in North Dakota originate locally. These products are often referred to as "Bakken" or "Three Forks" crude oil products. Bakken and Three Forks crude oil are produced in the same region of North Dakota, but come from different shale formations. They are both typically light sweet crudes. Since both crude oils come from the Bakken field, and both have the same basic composition, this report refers to the transportation of Bakken crude oil inclusive of Three Forks oil as light sweet crude oil.

Light sweet crude oil poses unique challenges to transporters and emergency response organizations. This type of crude oil tends to be more volatile than heavier crudes, meaning that it is more likely to catch fire or explode in an accident. Light crude also floats on water, which means it will spread quickly in moving waters and during firefighting operations. Additionally, light sweet crude oil possesses natural gases that release from the oil when it is heated. These flammable natural gases, such as propane and ethane, can cause additional atmospheric risks for fire spread and inhalation hazards because propane gas is heavier than air and collects near the ground.[62]

[61] National Fire Protection Agency, *704 Frequently Asked Questions on NFPA 704*, http://www.nfpa.org/Assets/files/AboutTheCodes/704/704_FAQs.pdf (accessed June 22, 2015).
[62] US Department of Transportation, *Emergency Response Guidebook,* Guide 115, Propane. 2012, Print.

3.2 USDOT Placards

Figure 7: DOT Hazard Classification Identification Placard

When responding to a crude oil incident, responders' initial indicator of what they are facing will likely be USDOT Hazard Classification Identification Placard, which is used on transportation containers. USDOT placards identify most petroleum crude products as UN1267, regardless of their density or sulfur content. A number, one through nine, located at the bottom of the placard designates the hazard class. Class 3 liquids, as depicted in Figure 1, are classified as "flammable liquids" under 49 CFR 173.120.

3.3 PHMSA Classifications

Crude products in transportation are further identified by federal PHMSA classification. In addition to treating petroleum crude oil as a Class 3 flammable liquid, PHMSA regulations further classify the material according to its risk characteristics:

- Packing Group III (minor danger)
- Packing Group II (medium danger)
- Packing Group I (great danger)

Light sweet crude oil is classified as a DOT Class 3 Flammable Liquid. Additionally, it may be classified within either Packing Group I, II, or III (depending on the specific properties of the crude being transported).

Properties such as vapor pressure, initial boiling points, flashpoints, and dissolved gas content vary based on the grade of the crude oil (light versus heavy), source of extraction (different well sites), and time of year it is produced (crude may contain a higher concentration of dissolved gases during cold weather).

3.4 USEPA Classifications

The US Environmental Protection Agency (USEPA) has recognized that detail beyond industry classification of crude oil by geographical source and USDOT labeling is needed for responders. USEPA classifications describe general toxicity, physical state, and changes that occur with time and weathering:

- Class A: Light, Volatile Oils: Class A oils are highly fluid, often clear, spread rapidly on solid or water surfaces, have a strong odor, high evaporation rate, and are usually flammable. They penetrate porous surfaces such as dirt and sand, and may be persistent in such a

matrix. They do not tend to adhere to surfaces. Flushing with water generally removes them. Class A oils may be highly toxic to humans, fish, and other organisms. [63] Most refined products and many of the highest-quality light crudes are included in this class. Light sweet crude oil fits within this category.

- Class B: Non-Sticky Oils: Class B oils have a waxy or oily feel. Class B oils are less toxic and adhere more firmly to surfaces than Class A oils, although they can be removed from surfaces by vigorous flushing. As temperatures rise, their tendency to penetrate porous substrates increases and they can be persistent. Evaporation of volatiles may lead to a Class C or D residue. Medium to heavy paraffin-based oils fall into this class.
- Class C: Heavy, Sticky Oils: Class C oils are characteristically viscous, sticky or tarry, and brown or black. Flushing with water will not readily remove this material from surfaces, but neither does it readily penetrate porous surfaces. The density of Class C oils may be near that of water, and they often sink. Weathering or evaporation of volatiles may produce solid or tarry Class D oil. Toxicity is low, but wildlife can be smothered or drowned when contaminated. This class includes residual fuel oils and medium to heavy crudes.
- Class D: Non-Fluid Oils: Class D oils are relatively non-toxic, do not penetrate porous substrates, and are usually black or dark brown in color. When heated, Class D oils may melt and coat surfaces, making cleanup very difficult. Residual oils, heavy crude oils, some high paraffin oils, and some weathered oils fall into this class.

[63] US Department of Transportation, *Pipeline Hazardous Materials Safety Administration,* https://primis.phmsa.dot.gov/comm/MarkersBrief.htm (accessed June 22, 2015).

4 NORTH DAKOTA EMERGENCY PREVENTION, PREPAREDNESS, AND RESPONSE CAPABILITY ASSESSMENT

This section describes the capabilities, roles, and responsibilities of federal, state, local, and private sector partners involved in the prevention of, preparedness for, and response to crude oil transportation incidents in North Dakota.

4.1 Industry Infrastructure Maintenance and Safety Measures

Industry infrastructure maintenance and safety measures are key to reducing the risk of transportation accidents. The pipeline, rail, and road industries work independently and under federal and state regulations to improve safety, protecting the lives, property, and environment around which they operate, and protecting their business investments.

4.2 Pipeline Safety Awareness

PHMSA and the pipeline industry promote pipeline safety through a variety of outlets, including the 8-1-1 Call Before You Dig program, the Stakeholder Communications program, and the Pipeline and Informed Planning Alliance.

The 8-1-1 program is a national call center that routes callers to a local call center. Anyone with plans to dig is asked to use this system to provide their digging location and contact information. Utilities with potential infrastructure in the area will be notified of the intent to dig and will send a locator to mark the approximate location of underground utility lines. The process usually requires two to three days. Callers are encouraged to confirm with 8-1-1 that utility operators have responded to the request prior to digging.

Pipeline markers and warning signs are located at frequent intervals along transmission and liquid pipeline rights-of-way. They are typically located where a pipeline intersects a road, railway, or waterway, as well as other points along the route. Markers identify the type of product transported in the line and provide the name of the pipeline operator and a telephone number to call in the event of an emergency.[64]

[64] US Department of Transportation, Pipeline Hazardous Materials Safety Administration, *Pipeline Safety Stakeholder Communications. Community Toolbox*, June 05, 2015, http://primis.phmsa.dot.gov/comm/Index.htm (accessed June 22, 2015).

The Stakeholder Communications program is part of the PHMSA website that hosts a variety of topics related to damage prevention, pipeline awareness, emergencies, regulation, inspection, and enforcement. Within the website, the topics are tailored to nine interest groups with specific information and assistance provided through linked pages.[65]

Image Credit: PHMSA

The Pipeline and Informed Planning Alliance serves as an outreach and technical advisory service to government officials, community planners/developers, and transmission pipeline operators to help manage and mitigate risk.

4.3 Pipeline Monitoring Technology

Pipeline monitoring systems typically rely on point-sensing technologies to estimate locations of events, but proper positioning of the sensors to adequately monitor the pipeline can be challenging. Most existing sensor-based technologies only provide notice that a damaging event has occurred, allowing an operator to react to an incident and activate its emergency response plan.

Newer technology, known as Distributed Acoustic Sensing (DAS), utilizes fiber optic cable as a sensor designed to provide advance warning of events leading up to an incident. When attached to a standard fiber optic cable, DAS equipment creates an acoustic array every 33 feet along the fiber. The sounds received from the fiber are analyzed and converted into a simple graphical display showing the operator what is happening along individual lengths of the fiber. For example, the sensor system can detect the difference between mechanical digging and a person walking. It can also pick up the sound of leaks from gas pipelines. This provides monitoring for a developing problem or threat along the pipeline.

The most advanced DAS-based solutions are designed to perform acoustic sensing for pipeline condition monitoring and leak detection on the same strand of fiber, making them ideal for retrofit projects with existing cable installations. These systems can also cover up to 60 miles of cable between power and network connections.[66]

[65] Felding, Aaron, *Pipeline Security: New Technology for Today's demanding Environment*, Pipeline and Gas Journal, (US Department of Transportation, May 2012), Volume 239. Number 5. Print.

[66] US Department of Transportation, Pipeline Hazardous Materials Safety Administration, *Fact Sheet: In-Line Inspections (Smart Pig),* https://primis.phmsa.dot.gov/comm/FactSheets/FSSmartPig.htm (accessed June 22, 2015).

4.3.1 Pipeline Inspection Gauges

Smart Pipeline Inspection Gauges (smart pigs) are used in oil and gas pipelines to clean and inspect pipes for the purpose of preventing leaks. The pigs are inserted into a pipe and move, or run, with the flow of crude oil (or other pipeline commodities), and then are removed further down the pipe to collect and analyze data.

The smart pig uses internal means to record its own movement using odometers, gyroscope-assisted tilt sensors, and other technologies. The smart pig records positional data so that the distance it moves, along with any bends in the pipeline, can be interpreted later to note the exact path taken and the location of potential problems.

After the run has been completed, the positional data is combined with the pipeline evaluation (pipe condition) data from the pig to provide a location-specific defect map and characterization, revealing the location, type, and size of each pipe defect.[67]

4.3.2 Hydrostatic Testing

Hydrostatic pressure tests are conducted on new pipelines or associated process equipment used in crude oil or natural gas gathering and production systems before they begin operations to demonstrate the physical integrity of the piping system and associated process equipment. The tests consist of filling the system with hydrostatic test water and holding it under pressure for a certain period of time. Pressures are typically conducted at 125% of the planned maximum allowable operating pressure. The duration of the hydrostatic pressure tests may vary, depending on the system being tested.[68]

4.4 Railroad Safety

The most recent three crude oil train derailments involved CPC-1232 compliant USDOT Class 111 tank cars, which include safety upgrades voluntarily adopted by the industry in 2011. An estimated $7 billion has been spent to put 57,000 of these cars into service, according to the Railway Supply Institute.

According to the AAR, national oil shipments by rail jumped from 9,500 carloads in 2008 to 500,000 in 2014, driven largely by the boom in the Bakken oil patch of North Dakota and Montana. National pipeline capacity limits force 70% of crude oil to move by rail; recent NDPA estimates show 55% of

[67] Melancon, Burkin, Powell, Daniel, and Winters, R, *Guidelines When Conducting Hydrostatic Pressure Tests And Management of Extended Dwell Times Through Dry/Wet Lay-Ups*, 2011, Print.
[68] Operation Lifesaver, Inc., *US Highway-Rail Grade Crossing Collisions*, 2015, Print.

North Dakota crude oil is transported by rail. Reports of oil leaks and other releases from tank cars also have increased, from 12 in 2008 to 186 in 2014, according to USDOT data.

4.4.1 Trackside Safety Technology

Trackside safety technology include tools and systems designed to remotely monitor and alert system operators to changes in train activity and conditions. There are a variety of trackside safety technologies that have been, or will be installed on freight lines in the near future. These include:

- Wheel-crack sensors to detect wheel cracks and damage
- Wayside detectors that identify defects on passing rail cars
- Automatic stop/start systems to control train movement
- Global positioning systems to track train position, direction, and speed
- Centralized traffic control to manage train schedules and movement
- Automatic route setters that ensure trains maintain routes without the need for intervention by a signaler
- Train describers that ensure that the identity of each train is displayed on a signal box panel

These systems improve train and railway safety. For example, centralized traffic control allows the supervisor and control center to handle the traffic, routing, and timetables. This allows optimum control and improved on-time and track traffic usage. The automatic route setter allows for better coordination and provides the traffic center more visibility and control of train locations, speed, and potential rail sharing conflicts.

4.4.2 Track Crossing Safety

Track-crossing safety is an issue recognized by most local and state officials as well as railroad operators. Grade crossing collisions occur approximately every three hours in the US. According to USDOT data for North Dakota, there were 28 grade crossing collisions in 2014, and 27 in 2103. Those 55 collisions resulted in 7 deaths and 23 injuries.[69]

North Dakota has 4,695 open public and private grade crossings.[70] Public roads with grade crossings have warning signs to alert motorists that they are approaching a rail crossing. The

[69] US Department of Transportation, Federal Railroad Administration Office of Safety Analysis, *Table 8.01: Query by Location,* http://safetydata.fra.dot.gov/officeofsafety/publicsite/crossing/XingLocResults.aspx?state=38&countycity=&railroad=&reportinglevel=ALL&radionm=County&street=&xingtype=%&xingstatus=1&xingpos=1 (accessed June 22, 2015).

[70] North Dakota Department of Transportation, *North Dakota State Rail Plan*, December 2007, https://www.dot.nd.gov/divisions/planning/docs/railplan.pdf (accessed June 22, 2015).

crossings themselves have either passive or active warning devices to alert motorists to watch for approaching trains. Passive devices typically include crossbucks and signs. Active devices typically include automated flashing lights and crossing gates.[71]

In North Dakota, state and federal highways with average annualized daily traffic of 100 or more vehicles that cross Class I railroad tracks at grade have active warning devices. Other crossings may have active devices based on review of the hazards present at the location.[72]

Rail companies and local public safety officials work with programs like Operation Lifesaver. Operation Lifesaver is non-profit organization providing public education programs in all 50 states. Operation Lifesaver's programs work to ensure the public is aware of the rules of the road and to always practice caution when using unmarked private crossings and active or passive marked crossings on public roads. Active warning systems, where installed, are maintained by the owner of the tracks.

In addition to public safety awareness and training, technology is an additional tool being employed to increase public awareness of grade crossings. On June 29, 2015, the FRA announced a partnership with Google that will integrate FRA's geographic information system data, providing the location of public and private railroad crossings into Google's navigation and mapping products.[73] This partnership will provide navigational warnings to drivers and passengers when approaching a crossing.

4.4.3 Train Braking Systems

Freight trains utilize the same braking technology that was developed in the 1930s, which has proven to be generally reliable. The system is composed of a brake cylinder, brake shoes, a dual air reservoir, and a control or air brake valve. This system is dependent upon air pressure being generated from the engine and must be at least 70 to 90 psi to operate properly. Air pressure is distributed through the brake pipe. This pipe runs the entire length of the train and supplies the air to the brakes on all cars. As a failsafe design, a drop in brake pressure will cause a brake application on each car. Restoration of brake pressure allows the brakes on each car to release.

There are several ways a train engineer can apply the brakes. Power braking is one form that engineers utilize to slow the train down without moving the throttle. Dynamic braking slows the train down by using the locomotives. Emergency braking is performed by releasing air

[71] Ibid.

[72] Commercial Vehicle Safety Alliance, *North American Standard Inspection Levels*., http://www.cvsa.org/programs/nas_levels (accessed June 22, 2015).

[73] U.S. Department of Transportation, *Google, FRA team up for safety; will add rail crossing data to maps,* June 29, 2015, http://www.transportation.gov/fastlane/fra-google-team-to-incorporate-rail-data-in-maps (accessed June 30, 2015).

pressure from the brake line which allows all of the brakes on the train to fully engage at nearly the same time.

4.4.4 Lower Train Speeds

PHMSA recently issued the final ruling, Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for HHFTs, which implements speed reduction rules in certain defined urban areas.[74] These rules limit the speed of crude oil unit trains to 40 mph in high-population areas. Class I railroad companies, including BNSF and CP, also have taken steps to assign slower speeds in high-risk areas. In addition, both BNSF and CP have publicly stated they have initiated voluntary speed restrictions.

4.4.5 Train Loads

Proper train loading is another safety measure to reduce the likelihood of a derailment or incident. Railroad companies are expected to address proper distribution of loaded and unloaded cars, when trains are assembled to help prevent derailment; if an unloaded car is placed before a loaded car, and the brakes are applied, the loaded car may run into the unloaded car, causing it to jackknife. In contrast, when loaded cars are placed in front of unloaded cars, the emergency braking application does not put undue pressure on the cars, and they remain on the rails. The makeup of a train with loaded and unloaded cars is also important in differing terrains such as hills or mountains.

4.4.6 Tank Car Standards and Risk

Recent changes in rail car standards should eventually decrease the risk of fire and explosion. The new USDOT 117 railcar has a thicker steel covering (9/16 inch), thermal protection, full-height head shields (1/2 inch), and enhanced bottom-outlet valves. The thicker steel heads and shells are intended to increase the strength and thus prevent puncture during a crash or derailment. The thermal jacket is designed to withstand heat and reduce the risk of tank failure by fire impingement. The enhanced bottom outlet valve is also designed to withstand impact from a crash or derailment, reducing the risk of leaks and spills.

The new standard for cars carrying crude oil will start with cars constructed after October 1, 2015. All existing cars transporting crude oil with the Packing Group I designation will have to be retrofitted to meet the new standards. Under a new USDOT rule, railways have three years to retrofit or retire existing cars if they are to be used to haul crude oil.

[74] US Department of Transportation, Pipeline Hazardous Materials Safety Administration, *Docket No. Pipeline Hazardous Materials Safety Administration-2012-0082 (HM-251), Hazardous Materials: Enhanced Tank Car Standards and Operational Controls of High Hazard Flammable Trains*, http://www.transportation.gov/sites/dot.gov/files/docs/final-rule-flammable-liquids-by-rail_0.pdf (accessed June 22, 2015).

4.5 Roadway Safety

There are several roadway-related risks implicit in the transportation of crude oil. For example, the roads over which oil is passing were constructed to minimum standards that were not sufficient for trucks weighing 80,000 lbs. or more. These roadways are already showing signs of wear; ruts in the lanes and cracks in the pavement are obvious when driving in the state. Additionally, state, local, and tribal law enforcement agencies' staffing levels have not increased sufficiently to meet traffic safety demands that include commercial motor vehicle compliance and traffic safety patrols.

A reported 145,410 barrels of crude oil travel yearly on North Dakota roads (2013), which is twice the volume of crude oil traffic in 2008. An average of 2,000 trucks carry crude oil daily in the state; each truck weighs approximately 80,000 pounds fully loaded. There are currently no designated or restricted hazardous materials routes in North Dakota. Because many of the rural roads in North Dakota were constructed to withstand 58,000 pounds, the integrity of these roadways in oil production areas will experience accelerated deterioration because of the weight and amount of truck traffic.

The NDHP has 148 sworn officers and 50 civilian employees to cover services in North Dakota's 70,762 square miles. There are a total of 106,673 miles of trails, streets, and roads in the state. These include 7,378 miles of road in the state highway system. 3,692 of those are part of the national highway system, 571 miles of which are interstate highway. NDHP Motor Carrier Division is tasked with commercial vehicle inspections, safety audits, compliance reviews, motor carrier permitting, size, and weight enforcement; it has nine personnel. NDHP has nine fixed sites and 13 weigh-in-motion sites for sizing and weighing tank trucks. NDHP utilizes mobile scale units in most counties. NDHP conducted 13,720 motor carrier inspections in 2013 (1,863 Level I, 2,324 Level II and 9,285 Level III):

- Level I: North American Standard Inspection – An inspection that includes examination of driver's license; medical examiner's certificate and Skill Performance Evaluation (SPE) Certificate (if applicable); alcohol and drugs; driver's record of duty status as required; hours of service; seat belt; vehicle inspection report(s) (if applicable); brake systems; coupling devices; exhaust systems; frames; fuel systems; lighting devices (headlamps, tail lamps, stop lamps, turn signals and lamps/flags on projecting loads); securement of cargo; steering mechanisms; suspensions; tires; van and open-top trailer bodies; wheels, rims and hubs; windshield wipers; emergency exits and/or electrical cables and systems in engine and battery compartments (buses); and Hazardous Materials/Dangerous Goods (HM/DG) requirements as applicable. HM/DG required inspection items will be inspected by certified HM/DG inspectors.
- Level II: Walk-Around Driver/Vehicle Inspection –These inspections include all items found in Level I inspections but the walk-around driver/vehicle inspection will include only those items, which can be inspected without physically getting under the vehicle.

- Level III: Driver/Credential Inspection –As a minimum, Level III inspections must include, where required and/or applicable, an examination of the driver's license; medical examiner's certificate and Skill Performance Evaluation (SPE) Certificate; driver's record of duty status; hours of service; seat belt; vehicle inspection report(s); and HM/DG requirements. Those items not indicated in the North American Standard Level III Driver/Credential Inspection Procedure shall not be included on a Level III inspection.[75]

The Three Affiliated Tribes (Mandan, Hidatsa, and Arikara) have adopted a Civil Motor Vehicle Code as a result of an increase in commercial vehicle traffic. This code provides the tribal law enforcement agencies and law enforcement officers the sovereign power to stop, investigate, detain, and civilly cite any individual including non-tribal members suspected of violating tribal or state motor vehicle laws.[76] NDHP, county, and local law enforcement officers have no power to enforce state laws against enrolled tribal members. Conversely, tribal authorities have no jurisdiction over drivers who are not enrolled members of the tribe.

In federal regulations, 49 CFR 180E provides a standard for tank trucks, including those operating in North Dakota; federal regulations are maintained by Federal Motor Carrier Safety Administration (FMCFA). Tank trucks must be placarded with 1267 when carrying crude oil.

4.6 Roles and Responsibilities

4.6.1 Private Sector

In a transportation oil spill, the carrier is known as the responsible party (RP) and must directly provide hazardous materials response resources, environmental monitoring and protection, as well as remediation capabilities to remove the spilled product and return environment to pre-incident conditions. They may also be responsible for cost recovery of public resources including equipment, labor, and materials costs. The RP may incur fines and fees assessed by regulatory agencies if it is found that the incident was caused by non-compliance with rules and regulations.

Federal laws and regulations address oil spill incidents with varying requirements based on transportation mode and location. The regulatory structure for transport by rail, pipeline, and road assigns the practical and legal responsibility for the safety of crude oil shipments to the private-sector shipping company. Industry safety standards set by the railroad companies themselves for rail transportation are sometimes more stringent than US federal regulations.

[75] Mandan Hidatsa Arikara Department of Transportation, *Civil Motor Vehicle Code*, https://mhadot.com/regulation/civil-motor-vehicle-code (accessed June 22, 2015).

[76] Cornell University School of Law, *Preemption*, https://www.law.cornell.edu/wex/preemption (accessed June 22, 2015).

Rail lines that cross the US/Canadian border must adhere to both countries' regulatory requirements. Non-transportation-related storage facilities must follow USEPA regulations.

In general, private-sector railroads, pipelines, and motor carriers are responsible for their equipment, tanks, tracks, lines, vehicles, personnel, and training, as well as compliance with hazardous material packaging and placarding. Regarding incident response, 49 CFR 130 states that railroads must maintain either a basic response plan or a comprehensive response plan, if each of the tank car(s) used holds more than 1,000 barrels of oil. Comprehensive plans are subject to FRA approval, must comply with the National Contingency Plan and relevant Area Contingency Plans (ACPs), and provide for training and exercise to address a worst-case spill or release; basic plans require only identification of the manner of response, response personnel and equipment that will be available, and contact information. The DOT-111 tank cars most frequently used today each carry about 700 barrels, so they do not require a comprehensive plan.[77]

Crude oil is frequently transported in "unit trains," trains made up of all cars transporting crude oil, which can transport 70,000 barrels or more per train. Given the use of unit trains, the NTSB has recommended lowering the threshold to require comprehensive plans, so as to cover more railroad shipments. Railroads may have contracts with companies for hazardous materials response, incident mitigation, and cleanup; these provisions must be detailed in their plans.

The Oil Pollution Act of 1990 (OPA-90) establishes that the owner or operator of a facility/vessel from which oil is spilled is liable for the cost associated with the containment and cleanup of the spill, including any damages that may have occurred. In the event a RP is unknown or refuses to pay, an Oil Spill Liability Trust Fund has been established that can provide up to $1 billion per incident.[78] OPA-90 also requires that private companies test their plans and maintain the equipment necessary to respond to a spill. During a three-year cycle, a facility must test its plan annually against the 15 preparedness components that are listed in the National Preparedness for Response Exercise Program, which was developed to meet the intent of section 4202(a) of OPA-90. At least one year in the three-year cycle must test a facility's worst-case discharge scenario.[79]

If a facility or transportation unit experiences an incident during storage or transfer of crude oil resulting in a spill, that facility's operator is required to make notifications and activate resources to respond. Notifications must be made to the NRC at the federal level and NDDES, which makes notification to response agencies including requested Regional Response Teams

[77] Fritelli, John, Andrews, Anthony, Parfomak, Paul, Pirog, Robert, Ramseur, Jonathon, and Ratner, Michael, US Library of Congress, *Congressional Research Service, US Rail Transportation of Crude Oil: Background and Issues for Congress*, R43390, 2014, https://www.fas.org/sgp/crs/misc/R43390.pdf (accessed June 22, 2015).

[78] *Oil Pollution Liability and Compensation*, US Code 33 §2701, et seq, *Oil Pollution Act of 1990*, US Code 33§1321, et seq.

[79] *Oil Pollution Act of 1990 33 US Code* §1321; §4202 and §1321.

(RRT) and the Environmental Health Section of NDDoH. Emergency Response Plans may also dictate notification to private-sector spill response contractors and other support resources.

Private facilities and transportation companies will be guided by their emergency response plans in an incident involving the storage or transportation of crude oil. Emergency response plans should take into account the chemical properties of crude oil and the potential effects of accidental releases from a facility, as well as potential consequences during transportation. The content of these plans will be familiar to agencies at the federal and state level that have regulatory authority; however, these plans and related response capabilities and gaps are not always shared with local response and emergency management organizations. Lack of communication and coordination of respective response roles and capabilities across sectors creates gaps in response that negatively impact safety of responders and the public.

The AAR has developed an "AskRail" smartphone application that allows trained hazardous materials first responders to query rail car contents at railroad accidents. Access to the mobile application requires railroad industry-approved training before access is granted, but approved users will have real-time access to rail car contents. This access will provide essential information regarding the stability, volatility, or reactivity of products involved in a railroad accident.

The known private sector spill response companies operate as a joint company, known as Sakakawea Area Spill Response, sharing resources in North Dakota and provide the following capabilities: one response contractor, one cooperative, one exploration and production operator, a refinery, a pipeline/truck/rail terminal operator, and a pipeline operator (all of this is divided between two area spill response consortiums,). Additional resources may be available, but were not provided for this report because most private sector spill response companies consider their equipment capabilities proprietary information.

Table 7: Private Sector Spill Response Equipment Capabilities

Equipment Type	Quantity
Containment boom	18,780 feet
Vacuum trucks	8
Miscellaneous vacuum units	6
Skimmers	10
Boats	9

4.6.2 Federal-State Government Relationship

Federal powers to promulgate and enforce crude oil transportation and security regulations derive primarily from the Commerce Clause (Article 1, Section 8) of the US Constitution. The Commerce Clause gives Congress the power to regulate commerce among the states, with tribes

and with foreign nations. Federal regulations that address transportation, found in Title 49 of the CFR, are illustrations of this power. The Commerce Clause prohibits states from passing legislation that discriminates against or excessively burdens interstate commerce.

The Supremacy Clause (Article 6, Section 2) of the US Constitution provides that the laws of the United States are the supreme law of the land, which means that federal law takes precedence over state laws, and that federal law preempts, or invalidates, any state law that conflicts with the exercise of federal power. In many instances, Congress empowers federal regulatory agencies to set national minimum standards, but does not define such minimums as preempting state regulations that would impose more stringent standards. The US Supreme Court typically prefers interpretations that avoid preempting state laws, especially those passed in an effort to improve current practices that threaten the environment and the general public.[80],[81]

When a federal agency determines that regulatory action is necessary and appropriate, it develops and publishes a proposed rule in the Federal Register, soliciting comments from the public.[82] All comments, including those from private companies that the proposed rule might affect, are taken into consideration and addressed before a regulatory action is finalized.

On occasion, federal changes to standards and regulations fail to keep up with an industry's rapid growth. In these cases, states may face the need to pass laws or create regulations to protect public health and safety, a role traditionally considered reserved for the states and "the people" by the 10th Amendment of the US Constitution. In these cases, the state's actions could still be vulnerable to federal preemption if and when federal agencies exercise their regulatory authority on a matter under federal authority, such as interstate transportation.

4.6.3 Federal Roles and Responsibilities

Several federal agencies have jurisdiction or responsibilities over aspects of the crude oil transportation industry. While some responsibilities are clearly defined and directly impact the industry, others are indirect and more subtle. The summaries below provide an overview of federal department responsibilities related to crude oil transportation safety and incident response preparedness, listed in alphabetical order by department or agency name.

[80] Cornell University School of Law, *Topic*: *Supremacy Clause*, et. al, https://www.law.cornell.edu/supct/cases/topics/tog_supremacy_clause.html (accessed June 22, 2015).

[81] Executive Office of the President, Office of Information and Regulatory Affairs, *Regulations and the Rulemaking Process*, 2015, http://www.reginfo.gov/public/jsp/Utilities/faq.jsp (accessed June 22, 2015).

[82] US Department of Homeland Security, Energy Sector-Specific Plan. An Annex to the National Infrastructure Protection Plan, 2010, Print.

4.6.3.1 US Department of Transportation

The USDOT has the authority to regulate hazardous material transportation under the Hazardous Materials Transportation Act, through the Federal Rail Safety Act, and through related rulemaking. The Hazardous Materials Transportation Act provides the authority to ensure safe and secure shipments of hazardous materials. Regulations are developed by PHMSA, which is part of USDOT. PHMSA's regulations cover classification, packaging, emergency communication, security plans, risk assessments, training, and modal-specific requirements for materials.

Regulations for Oil Spill Prevention and Response Plans[83] (49 CFR 130) describe the planning requirements for prevention, containment, and response that the USDOT applies to transportation of oil by motor vehicle and rolling stock. This section of federal regulations describes the minimal planning components required by transport carriers; it further requires that those transporting oil in quantities greater than 1,000 barrels (42,000 gallons) must have a current comprehensive written plan, and it prescribes the minimal plan contents needed to satisfy the requirement. Hazardous materials regulations for carriage via public highway are addressed in 49 CFR 177, prescribing procedures used by USDOT's PHMSA in carrying out duties regarding roadway safety.

4.6.3.2 US Department of Homeland Security

Under a variety of statutes and executive orders, the USDHS is vested with primary responsibility for assuring security of the nation's critical infrastructure. Transportation and energy infrastructure are recognized as critical infrastructure (Presidential Policy Directive 21-Critical Infrastructure Security and Resilience) because of their national security and economic importance. USDHS' role in transportation and energy infrastructure protection related to rail and roadway is largely guidance- and planning-based (other agencies have regulatory authority). Because USDHS includes the Transportation Security Administration (TSA) and the US Coast Guard (USCG), its responsibilities in air transportation and waterway infrastructure protection include regulatory and enforcement activities, as well as critical infrastructure guidance.

USDHS coordinates sector-specific plans designed to protect the nation's critical infrastructure. The Energy and Transportation Systems sectors have identified goals related specifically to crude oil infrastructure. The Energy Sector-Specific Plan, which

[83] US Department of Transportation, Pipeline Hazardous Materials Safety Administration, Pipeline Inspections 101, http://phmsa.dot.gov/pipeline/inspections (accessed June 22, 2015).

is part of the National Infrastructure Protection Plan, identifies the following goals related specifically to crude oil infrastructure:

- Use sound risk-management principles to implement physical and cyber measures to enhance preparedness, security, and resilience.
- Conduct comprehensive emergency, disaster, and continuity of business planning, including training and exercises, to enhance reliability and emergency response.
- Clearly define and clarify critical infrastructure protection roles and responsibilities among all federal, state, local, and private sector partners, and work to create efficiency and improved coordination throughout the partnerships.
- Strengthen partner and public confidence in the sector's ability to manage risk and implement effective security, reliability, and recovery efforts.[84]

The Transportation Systems Sector is responsible for safeguarding surface transportation by ensuring that cargo being carried is safe and will not pose a threat to public safety. USDHS, in collaboration with USDOT, developed 24 Security Action Items (SAIs) after field reviews and vulnerability analyses of railroad operations. These SAIs are voluntary measures intended to address three critical areas: system security, access control, and en-route security. The TSA actively monitors the level of SAI implementation by railroads.

The TSA has a Surface Transportation Security Inspection workforce program, which deploys 175 inspectors from 54 field offices to perform surveys and conduct inspections of freight rail operations throughout the nation. These inspectors focus on seven specific SAIs, which were selected because of their direct impact on transportation security. The efforts of the inspectors are focused on the areas of highest risk in the freight rail industry. The inspection program is responsible for verifying implementation of voluntary security measures, conducting vulnerability assessments, and conducting regulatory compliance inspections. The inspectors also act as local liaisons to rail carriers and other government agencies for emergency planning and response.

Since 2004, the USDHS has maintained infrastructure protection field operations through its Protective Security Advisor (PSA) program. PSAs are trained subject matter experts in critical infrastructure protection and vulnerability mitigation. Regional directors are supervisory PSAs, responsible for the activities of eight or more PSAs and geospatial analysts, who ensure critical infrastructure protection

[84] US Department of the Interior, *Natural Resource Damage Assessment and Restorations Programs*, April 2015, http://www.doi.gov//restoration/about/index.cfm (accessed June 22, 2015).

programs and services are delivered to state, local, territorial, tribal, and private-sector owners and operators. Regional directors and PSAs are located throughout the country and can deploy to emergencies and disasters. During an incident, they frequently work within state and local emergency operations centers (EOCs), and at the Federal Emergency Management Agency (FEMA) Joint Field Office to:

- Advise USDHS and other government and private sector representatives on interdependencies, cascading effects, and damage assessments concerning impacts on critical infrastructure.
- Help owners, operators, law enforcement personnel, and state and local officials to prioritize and coordinate re-entry and recovery activities.

4.6.3.3 US Department of Interior

The US Department of the Interior (USDOI) Natural Resource Damage Assessment (NRDA) and Restoration Program focuses on remediation of natural resources compromised as a result of oil spills or hazardous material releases. In partnership with the affected state, tribal and federal trustee agencies, the NRDA Restoration Program conducts damage assessments for determining restoration requirements that address the public's loss of natural resources.[85]

The NRDA Restoration Program determines whether public natural resources have been damaged or destroyed as a result of a hazardous substances or oil release, and then identifies actions and funding needed to restore impacted resources. The NRDA Restoration Program is authorized by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), OPA-90 and the Clean Water Act. Once the damages are assessed, the NRDA Restoration Program negotiates legal settlements or other legal actions against the responsible parties for the spill or release. Funds from these settlements are then used to restore the impacted resources. The funds may also be used for damage assessments in future incidents.[86]

4.6.3.4 Pipeline and Hazardous Materials Safety Administration

PHMSA's mission is to protect people and the environment from the risks of hazardous materials transportation by establishing national policy, setting and enforcing standards, education, and conducting research to prevent incidents. It also

[85] US Department of Transportation, Pipeline Hazardous Materials Safety Administration, *Oil Spill Prevention and Response Plans*, Code of Federal Register, title49, part 130, (1996), http://www.gpo.gov/fdsys/pkg/CFR-2011-title49-vol2/pdf/CFR-2011-title49-vol2-part130.pdf (accessed June 22, 2015).;US Department of Interior, *Mission – What we do and how we do it.* http://www.doi.gov/restoration/about/index.cfm (accessed June 22, 2015).

[86] US Department of the Interior, *Restoration,* http://www.doi.gov//restoration/restoration/index.cfm (access June 22, 2015).

works to prepare the public and responders to reduce consequences if an incident occurs.

PHMSA's 139 federal inspection and enforcement staff, and more than 300 state inspectors, are responsible for regulating almost 3,000 companies that operate 2.6 million miles of pipelines, 118 liquefied natural gas plants, and 6,970 hazardous liquid breakout tanks nationwide. PHMSA pipeline safety personnel spend an average of 78 percent of their time conducting safety-related activities, including inspections and incident investigations, enforcement, and public outreach, according to the agency. In 2014, PHMSA pipeline safety personnel initiated 1,071 inspections of pipeline operators.

Through PHMSA oversight programs, serious pipeline incidents have decreased by 37% since 2009. PHMSA has been authorized an additional 98 inspection and enforcement positions for 2015.[87]

The federal government has primary jurisdiction over interstate commerce of crude oil. Regulations in 49 CFR 100-177, prescribe procedures used by PHMSA in regulating pipeline safety under 49 USC 60101 et seq. (pipeline safety) and 33 USC 1321 (water pollution control). They define terms and prescribe procedures for regulating pipeline safety; the following subchapters are applicable to federal pipeline governance:

- Subchapter A – Hazardous Materials and Oil Transportation
- Subchapter B – Oil Transportation
- Subchapter C – Hazardous Materials Regulation
- Subchapter D – Pipeline Safety

49 CFR 178-180 provides regulatory requirements for rolling stock safety. The following subchapters are applicable to crude oil transportation by roadway in North Dakota:

- Subchapter C – Hazardous Materials Regulations
    - Part 177 – Carriage by Public Highway prescribes requirements that are applicable to the acceptance and transportation of hazardous materials by private, common, or contract carriers by motor vehicle
    - Part 180 – Qualifications of Cargo Tanks defines the tank truck specifications for tank trucks carrying hazardous materials, including crude oil.

[87] Fritelli, John, Andrews, Anthony, Parfomak, Paul, Pirog, Robert, Ramseur, Jonathon, and Ratner, Michael, US Library of Congress, *Congressional Research Service, US Rail Transportation of Crude Oil: Background and Issues for Congress*, R43390, 2014, https://www.fas.org/sgp/crs/misc/R43390.pdf (accessed June 22, 2015).

PHMSA is the USDOT operating administration responsible for promulgating regulations implementing the Hazardous Materials Transportation Act. As authorized by the Clean Water Act (33 USC 1321), PHMSA has implemented regulations which require railroads to formulate comprehensive response plans to be implemented in the event of an oil spill. Those regulations are provided in 49 CFR 130.31.

4.6.3.5 Federal Railroad Administration

The Federal Rail Safety Act empowers the Federal Railroad Administration (FRA) to ensure secure movement of hazardous freight via railroads. This includes regulations on design, manufacture, and repair of equipment, cars, locomotives, and track used to carry hazardous materials, as well as information on the movement of these materials.

FRA's jurisdictional responsibilities for response are two-fold. It has been delegated the authority by PHMSA to enforce hazardous materials regulations affecting rail transportation. This responsibility includes the general oversight and approval of the oil spill response plans developed by each railroad engaged in oil transport. In addition, the FRA performs a significant role related to incident reporting and performing rail incident investigations. USDOT regulations require that a railroad must immediately notify the NRC upon learning of the occurrence of certain rail incidents (49 CFR 225.9, 49 CFR 172). Upon receiving notification of a railroad incident, the FRA may dispatch field inspectors to perform incident investigations. It is the policy of the FRA to investigate rail transportation incidents that result in the death of a railroad employee or the injury of five or more persons. Other incidents are investigated when it appears that an investigation would substantially serve to promote railroad safety (49 CFR 225.31(a)).

The FRA has an Office of Rail Safety which promotes and regulates rail safety. A force of about 500 federal inspectors conduct investigations and inspections.[88] The FRA also relies on approximately 180 state inspectors.[89] According to an interview with the North Dakota PSC, there are two FRA inspectors in the state with an estimated five additional regional inspectors who augment inspections of bridges and crossings. These FRA inspectors are responsible for an estimated 3,700 miles of track.[90]

[88] Szabo, Joseph, US Department of Transportation, *State inspectors help FRA improve rail safety*, August 27, 2015, http://www.dot.gov/fastlane/state-inspectors-help-fra-improve-rail-safety (accessed June 22, 2015).

[89] US Department of Transportation, *Federal Motor Carrier Safety Administration*. Code of Federal Register, title 49, part 113 1999, http://www.gpo.gov/fdsys/pkg/USCODE-2010-title49/pdf/USCODE-2010-title49-subtitleI-chap1-sec113.pdf (accessed June 22, 2015).

[90] North Dakota Department of Transportation, *North Dakota State Rail Plan*, December 2007, https://www.dot.nd.gov/divisions/planning/docs/railplan.pdf (accessed June 22, 2015).

Additionally, if an accident is significant enough, the NTSB may collaborate in the investigation and issue safety recommendations.

The FRA's operational divisions oversee specific rail-related functions, including the following:

- The Hazardous Materials Division ensures that hazardous materials tank cars are secure and properly maintained.
- The Motive Power and Equipment Division ensures compliance with federal standards for locomotives, passenger, and freight cars, and components such as air brakes.
- The Operating Practices Division handles operating issues, including employee qualifications, training, and testing. Other operating issues under the purview of this division include occupational safety, health standards, and hours of service.
- The Signal and Train Control Division ensures compliance with federal regulations for signal and train control systems, as well as highway-rail grade crossing systems.
- The Track Division addresses track condition and standards. Their efforts include reports and guidance on track maintenance, conditions, standards-development, and compliance manuals.

4.6.3.6 Federal Motor Carrier Safety Administration

Pursuant to the Motor Carrier Safety Improvement Act of 1999, FMCSA was established within USDOT to prevent commercial motor vehicle-related fatalities and injuries. FMCSA has authority over federal commercial vehicle laws and regulations, including those for hazardous materials transport, on US roadways. Title 49, Subtitle B, Chapter III (Federal Motor Carrier Safety Regulations) describes programs and procedures used by the USDOT FMCSA.

- Part 350 provides information on the Motor Carrier Safety Assistance Program (MCSAP). The MCSAP is a federal grant program which provides financial assistance to states to reduce the number of accidents and hazardous materials incidents involving commercial motor vehicles
- Part 355.25 (Adopting and Enforcing Compatible Laws and Regulations)[91] states that no state can enforce laws that are incompatible with the provisions of the Federal Motor Carrier Safety Regulations

[91] US Department of Transportation, Federal Motor Carrier Safety Administration, *Compatibility of State Laws and Regulations Affecting Interstate Motor Carrier Operations*, Code of Federal Register, title 49, part 355, 2001,

- Part 385.301 (Requirements for Motor Carrier in Interstate Operations)[92] states that a motor carrier must, after successfully completing commercial driver's license (CDL) requirements within his/her state, register with FMCSA and obtain a USDOT number

4.6.3.7 US Environmental Protection Agency

The mission of the USEPA is to "Protect human health and the environment." USEPA is involved with crude oil transportation through its responsibilities over environmental protection from hazardous materials spills, particularly at fixed sites. The USEPA promulgates oil storage facility regulations including those addressing aboveground tank systems like those at Major Oil Storage Facilities. USEPA's main role is in the enforcement of the rules for oil storage facilities to prepare and implement Spill Prevention, Countermeasures, and Control (SPCC) Plans. The requirements for these plans are provided in 40 CFR 112. The owner or operator of the facility must develop and implement an SPCC Plan that describes oil handling operations, spill prevention practices, discharge or drainage controls, and the personnel, equipment, and resources at the facility that are used to prevent oil spills from reaching navigable waters or adjoining shorelines. The USEPA also manages the NRC, which is described in 4.6.3.8 below.

USEPA has authority over hazardous materials through three federal laws: the Clean Air Act, the Emergency Planning and Community Right-to-Know Act (EPCRA), and the Superfund Amendments and Reauthorization Act. The Clean Air Act requires that any facility that stores or handles hazardous materials over a certain amount and as listed in the USEPA Risk Management Plan Rule[93], must develop and implement a risk management program that is submitted for review by USEPA. These plans must be updated every five years for each facility and include assessments of potential chemical release scenarios, information on incident prevention and emergency response, and a five-year history of incidents at the facility. These program reports are also submitted to USDHS, which uses them to determine which facilities to classify as "high risk" or "high consequence."

http://www.gpo.gov/fdsys/pkg/CFR-2011-title49-vol5/pdf/CFR-2011-title49-vol5-part355.pdf (accessed June 22, 2015).

[92] *US Safety Fitness Procedures*, Code of Federal Regulations, title 49, part 385 (2011), http://www.gpo.gov/fdsys/pkg/CFR-2011-title49-vol5/xml/CFR-2011-title49-vol5-part385.xml (accessed June 22, 2015).

[93] US Environmental Protection Agency, Risk Management Plan Rule, *List of Regulated Substances under the Risk Management Plan Program*, http://www2.epa.gov/rmp/list-regulated-substances-under-risk-management-plan-rmp-program (accessed July 22, 2015)

The EPCRA requires states and municipalities to develop SERCs and local emergency planning committees (LEPCs). SERCs are responsible for establishing procedures for managing and processing requests for information collected under EPCRA, reviewing local emergency response plans, designating local emergency planning districts, appointing LEPCs, and supervising LEPC activities.[94] The LEPCs are responsible for developing emergency response plans for the potential release of hazardous substances. Local facilities are required to assist the LEPC in developing these plans and to provide needed information. LEPCs also collect safety data sheets on the substances stored at local facilities and ensure that they are distributed to the appropriate local authorities. Finally, facilities must submit annual inventories of hazardous materials to the LEPC and to the USEPA.

CERCLA mandates that USEPA take immediate action in the event of a chemical release that poses an imminent threat to public health and safety. In conjunction with the passage of the act, Congress broadened and strengthened the emergency response capabilities of the National Contingency Plan. Mandated as one of the Special Forces under the NCP, USEPA's Environmental Response Team (ERT) functions in an advisory capacity to USEPA On-Scene Coordinators (OSCs), Remedial Project Managers, Site Assessment Managers, USCG OSCs, other federal, state, and local officials, and foreign governments concerned with hazardous waste sites, spills, and other environmental threats. In addition, the ERT provides training to first responders, such as local firefighters and other emergency personnel, on aspects of emergency spill response and readiness.

4.6.3.8 National Response Center

The NRC was established in 1974 as a 24-hour-a-day, seven-day-a-week communications center that receives notifications on hazardous material and oil spill incidents under the following authorities:

- Clean Water Act of 1968
- Comprehensive Environmental Response
- CERCLA 1980
- National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR Part 300.125(a)

The NRC is also the notification center for all incidents (actual or potential) involving oil and other hazardous substances – chemical, biological, radiological, nuclear, and explosive materials (CBRNE). Reporting of such incidents is done by government

[94] US Environmental Protection Agency, *State Emergency Response Commissions*, http://www2.epa.gov/epcra/state-emergency-response-commissions (accessed June 22, 2015).

agencies, responders, industry, the public, and anonymous calls via a toll-free number. Notification to the NRC can also be made via the USCG website. This service is known as One Call and is utilized by the USCG and USEPA to notify state OSCs. The NRC provides notification services to numerous federal department and agencies.

The NRC is staffed by USCG personnel who maintain a 365-day-per-year telephone watch. NRC Watch Standers enter telephonic reports of pollution incidents into the Incident Reporting Information System and immediately relay each report to the pre-designated FOSC. The NRC also provides emergency response support to the FOSCs and has the ability to quickly place them in direct contact with expert technical support centers such as the Agency for Toxic Substances and Disease Registry, the Centers for Disease Control and Prevention (CDC) under the US Department of Health and Human Services, and the Chemical Transportation Emergency Center (known commonly as CHEMTREC).

4.6.4 State

Depending on the incident, multiple state agencies may have roles and responsibilities. State law establishes state agencies' responsibilities and authorities generally. The Hazardous Materials (hazmat) Incident Annex to the State Emergency Operations Plan (SEOP), provides direction to North Dakota's state agencies and local governments. The following section notes key state laws and identifies agencies with responsibilities and roles for preparedness, response, and/or recovery activities involving crude oil incidents.

4.6.4.1 North Dakota State Legislature

The North Dakota Legislature and executive agencies with responsibility related to crude oil transportation have long been working to improve policy, administration, and regulation in the state. The risks are regularly reviewed, updated, and addressed through proposed legislation, rulemaking, staffing augmentation, and safety enhancements. While much of the responsibility for interstate commerce via common carriers falls under federal jurisdiction, the state has proposed and imposed its own initiatives to address risk. See Sections 2.2, 2.4, and 2.5.3 of this Report for recent legislative actions.

4.6.4.1.1 North Dakota Century Code

North Dakota Century Code is the compilation of all statutes passed by the North Dakota Legislative Assembly. Within the Century Code, the following Titles are directly applicable to crude oil transportation in the state:

North Dakota Century Code, Title 24 -Highways, Bridges, and Ferries: Title 24 governs highway, bridge, and ferry transportation within North Dakota, including railroad crossings.

- Chapter 24-01-17 – Grade crossing elimination[95]
- Chapter 24-09 – Railroad Crossings[96]

North Dakota Century Code, Title 38 - Mining and Gas and Oil Production:
Title 38 governs Chapter 38-08 is the North Dakota Industrial Commission's main source of regulatory authority over the oil and gas industry. Within Title 38, the following Chapters are applicable:

- Chapter 38-08 – Control of Gas and Oil Resources
- Chapter 38-09 – Exploration and Production on Publicly Owned Lands

North Dakota Century Code, Title 39: Motor Vehicles. Title 39 governs roadway transportation within North Dakota. Within Title 39, the following chapters are applicable:

- Chapter 39-10-43 – Certain vehicles must stop at all railroad grade crossings. (Special Vehicles and Exempt Crossings) [97]
- Chapter 39-10-67 – Moving heavy equipment at railroad grade crossing (Slow and Low Vehicles) [98]
- Chapter 39-12-03 – Limit Use of Vehicles on Highways[99]
- Chapter 39-12-05 – Weight Limitations for Vehicles on Interstate System[100]
- Chapter 39-12-07 – Peace Officers May Weigh Vehicle to Determine Load[101]

North Dakota Century Code, Title 49 - Public Utilities: governs railroad regulations and property. The state has jurisdiction over intrastate pipeline transportation. Within Title 49, the following Chapters are applicable:

- Chapter 49-01 – Public Safety Commission

[95] North Dakota Century Code § 24-01-17, *Grade Crossing Elimination.*

[96] North Dakota Century Code § 24-09, *Railroad Crossings*.

[97] *North Dakota Century Code, 39-10-43, Certain vehicles must stop at all railroad grade crossings. (Special Vehicles and Exempt Crossings).*

[98] North Dakota Century Code, § 39-10-67, *Moving heavy equipment at railroad grade crossing*.

[99] North Dakota Century Code § 39-12-03, *Limit Use of Vehicles on Highways.*

[100] North Dakota Century Code § 39-12-05, *Weight Limitations for Vehicles on Interstate System.*

[101] North Dakota Century Code § 39-12-07, *Peace Officers May Weight Vehicle to Determine Load*.

- Chapter 49-02 – Powers of Commission Generally
- Chapter 49-04 – Duties of Public Utilities
- Chapter 49-19 – Common Pipeline Carriers
- Chapter 49-22 – Energy Conversion and Transmission Facility Siting Act
- Chapter 49-23 – One-Call Excavation Notice System
- Chapter 49-10.1 – Railroad Regulation by Public Service Commission[102]
- Chapter 49-10.1-08 – Tampering, altering, or damaging railroad property – Penalty[103]

4.6.4.2 Pipeline Technology Working Group

In support of preparedness operations in the state, a Pipeline Technology Working Group was established in 2013. Governor Jack Dalrymple charged the working group with researching current and future technologies for pipeline leak detection. The working group consisted of private-sector pipeline operators, energy-industry leaders, university scientists, and state and federal officials. It completed a comprehensive assessment of pipeline leak detection technologies through research and evaluation of available technical data. The Pipeline Technology Working Group's findings include the identification of the various detection systems, as well as the known pros and cons for each.

The Pipeline Technology Working Group notes that although there are a large number of leak detection methods available, current methods rely heavily on the utilization of the human eye, relying on human resources that may already be over-stretched.

The state working group also notes that a top priority for pipeline operators is to reduce incidents caused by third parties. The Common Ground Alliance, an underground utility safety advocacy group, has developed a document that describes incident-prevention best practices. This document can be shared with third parties, and it is intended to reduce damage to pipelines. This document is publicly available and can be utilized to assist in training and awareness efforts to prevent pipeline incidents.

The North Dakota One Call Program is designed for everyone from contractors to homeowners to be able to place a single phone call to locate underground utilities. This system was developed to stop damage to utility lines and prevent the accidental

[102] North Dakota Century Code § 40-10.1, *Railroad Regulation by Public Service Commission.*

[103] North Dakota Century Code, § 49-10.1-08, Tampering, altering, or damaging railroad property – *Penalty*.

discharge of hazardous materials. The One Call Program can be accessed by dialing 8-1-1 or through the Internet Ticket Processing (ITIC) program.[104] The North Dakota One Call Program is a free service and is processed as quickly as possible.

4.6.4.3 North Dakota Public Service Commission

The PSC is a constitutional agency with statutory authority over railroads and pipeline safety. Although the PSC has a narrow jurisdiction over railroads, the public often associates it with railroad regulation. The PSC fields a large number of public inquiries concerning railroad issues. These contacts involve matters such as fencing along rail rights-of-way, the sale of land along abandoned lines, blocked crossings, and lease rates on property owned by railroads. The PSC attempts to help citizens who have questions or concerns involving railroads by answering questions or referring them to appropriate authorities.

The PSC has limited statutory responsibilities over pipelines in North Dakota, including the establishment and enforcement of rates or charges, and regulations by common pipeline carriers for receiving, gathering, transporting, loading, delivering, and incident storing of crude petroleum, coal, or gas purchased or sold in North Dakota. It also is responsible for enforcement of safety requirements for intrastate distribution and transmission of natural gas.

Following a crude oil incident, PSC coordinates technical assistance to the State Emergency Operations Center (SEOC) or requesting agencies, through the Gas Pipeline Safety Inspection staff, for incidents involving release from gas transmission or distribution systems. Additionally, PSC provides investigative services.

4.6.4.4 North Dakota Industrial Commission

The North Dakota Industrial Commission's role in managing, "on behalf of the state, certain utilities, industries, enterprises and business projects established by state law."[105]

4.6.4.4.1 Department of Mineral Resources – Oil and Gas Division

The NDDMR Oil and Gas Division regulates the drilling and production of oil and gas in North Dakota. Its mission is to encourage and promote the

[104] North Dakota One Call, *ITIC & IMAP*, http://www.ndonecall.com/itic-imap/ (accessed June 22, 2015).

[105] North Dakota Industrial Commission, *About,* http://www.nd.gov/ndic/ic-about.htm (accessed June 22, 2015).

development, production, and utilization of oil and gas in the state in a manner that prevents waste, maximizes economic value, and protects the rights of landowners, royalty owners, producers, and the public to realize the greatest possible good from vital natural resources.[106]

NDDMR is responsible for regulating drilling and production, including monitoring what goes into and comes out of the ground. Department inspectors oversee construction and maintenance at drill sites, including compliance with new oil-conditioning rules promulgated through the Industrial Commission.

NDDMR also assists emergency response planning partners with planning and mitigation. NDDMR is not part of response operations and has no response resources or capabilities.

After a crude oil hazardous material incident, North Dakota Oil and Gas Division provides technical assistance to assist with cleanup and reclamation work of crude oil.

4.6.4.4.2 Pipeline Authority

The North Dakota Industrial Commission is the NDPA. The Pipeline Authority facilitates development of pipeline facilities to support transportation of energy-related commodities, including crude oil.

4.6.4.5 North Dakota Department of Emergency Services

A core responsibility of the NDDES is to work with local, state, federal agencies, and private entities to coordinate and prepare for response operations associated with natural, human-made, and technological disasters in the state. In addition to the natural and technological hazards that have the potential to impact the state, the production of oil presents additional challenges. NDDES has the responsibility and authority to manage emergency events that overwhelm the local capabilities of cities and counties, requiring the assistance of state personnel, equipment, and resources. NDDES recognizes the authority of the local jurisdictions and will only provide assistance during an emergency event when requested by local authorities.

NDDES is responsible for the management and continued development of the North Dakota SEOP. This plan provides overall guidance for the direction, coordination, and

[106] North Dakota Department of Mineral Resources, Oil and Gas Division, *Oil and Gas Welcome Page*, https://www.dmr.nd.gov/oilgas/ (accessed June 22, 2015).

control of emergency operations at the state level, working in coordination with the local jurisdictions. The SEOP identifies preparedness and response responsibilities and outlines implementation of the Incident Command System (ICS) for incidents in North Dakota. Included as a supporting document to the SEOP, NDDES has developed a Hazardous Materials Incident Annex. This annex identifies personnel, equipment and resources specific to the needs of a hazardous materials incident, including crude oil incidents. It is in effect when the governor issues a declaration, or when NDDES, in coordination with other state agencies, determines that a hazardous materials incident has occurred or is imminent.

NDDES provides a broad range of training and exercise opportunities to state, local, and tribal departments and other associated organizations that have responsibilities in emergency management and response efforts. A Multi-Year Training and Exercise Plan (2015-17) has been developed by NDDES. This training plan identifies the foundation of trainings related to the National Preparedness Goal and Core Capabilities, and its relation to the identified hazards and actual events that have occurred in North Dakota.

During development of the training plan, a training-and-exercise planning workshop was held to discuss and determine the state's goals for the next two years. The working group evaluated potential hazards for the state and provided a ranking of hazards to prioritize the state's response capabilities and needs. In addition, a listing of potential training topics was created to determine the top 10 training priorities of the state. The training plan includes detail regarding the capability, mission area, description, rational for inclusion of the topic, and related trainings and exercises.[107] A training calendar is posted online. These training sessions are open to local jurisdiction participation, and additional organization and entity participation is highly encouraged.

A variety of other state departments, including the NDDoH, NDDA, Division of Homeland Security (NDHLS), ND Game and Fish, ND Fire Marshal, and Highway Patrol (NDHP) are identified as response partners for hazardous materials incidents. For example, the NDDoH is responsible for addressing the environmental impacts from an oil incident in the state as well as public health emergency management and response.

Hazardous materials response incidents will be managed first by the local jurisdiction, through the local EOC, and supported by state resources as requested. When the incident reaches the level of a state operation, coordination of state emergency management operations will take place in the SEOC.

[107] North Dakota Department of Emergency Services, *Multi-Year Training and Exercise Plan*, December 2014.

In its description of state resources, the State Hazmat Incident Annex also outlines the structure of a typical hazardous materials response/recovery cleanup operation. A flow chart is included in the plan that outlines decisions and actions from the initial notification of the incident, to the notification of NDDES (if necessary), and local and state responsibilities. In support of state response operations, the state's RRTs can be requested and deployed to assist with hazardous materials incidents. The RRTs' mission specifically addresses response operations to hazardous materials incidents that exceed the capabilities of the local responders. RRTs are located in various locations across the state and consist of both technical teams and operations teams. In addition, Emergency Response Operations Teams (EROT) and Emergency Response Technician Teams (ERTT) have been identified for hazardous materials responses. Although these teams have the resources and training to respond to a hazardous materials incident, their response capabilities are potentially hindered by time and distance from an event. The RRTs are housed in the eight largest cities in the state; most of the crude oil transportation routes pass through rural areas that are remote to the larger cities.

To assist with local emergency management operations, the state has implemented a Regional Response Coordinator Program. This program was developed to address gaps in response capabilities for CBRNE incidents in the state. The program consists of four regional coordinators, each geographically responsible for counties that are in the northwest, southwest, northeast, and southeast quadrants of the state. The regional coordinators work with local jurisdictions and the NDDES office to support preparedness, mitigation, response, and recovery operations initiated and managed by the local jurisdictions. The regional coordinators also assist local jurisdictions with locating and allocating necessary resources.

The SERC, the administering body of the state's Hazardous Chemical Preparedness Response Program, is responsible for providing overall coordination of the Local Emergency Planning Committees (LEPCs). Each county in the state has been designated as a planning district, and each county's LEPC takes the lead in hazardous materials preparedness and emergency planning efforts. The responsibilities of the LEPC include keeping the public informed of activities and accomplishments; developing an emergency notification system; developing, maintaining, and exercising an EOP; establishing a system for data/information management; and managing training of LEPC members and manpower resources designated in the plan. Membership of the LEPC is required to include all government and non-government entities that have roles and responsibilities associated with emergency management and response operations. The LEPC should meet on a regular basis to discuss current and continued planning efforts within the county.[108] The majority of counties in the

[108] North Dakota Department of Emergency Services, *Local Emergency Planning Committee Handbook*, 2014.

state have an active LEPC with a broad range of membership and participants from various emergency management and response entities. County LEPCs are typically coordinated through the county emergency management office.[109]

NDDES supports four regional hazardous materials RRTs that are operated by local fire departments and are strategically positioned across the state. Each region has two components, an operations team and technician level team, operated independently and strategically separated to better serve the regions. In the Northeast Region, Devils Lake operates the operations level team and Grand Forks operates the technician level team. The Southeast Region has an operations team in Jamestown and a technician team in Fargo. The Southwest Region has an operations team in Dickinson and a technician team in Bismarck. The Northwest Region has an operations team in Williston and a technician team in Minot. Each RRT may respond independently or in support of each other. They may respond within their home jurisdictions without deployment approval by NDDES. However, if emergency response is requested outside of their home jurisdictional boundaries, the RRT must be deployed by NDDES.

There are varied expectations regarding what the RRTs can and will do on scene. Many local emergency managers believe that the RRTs will serve as the primary response team to provide tactical operations at the incident, while others believe that the RRTs will support local operations through limited equipment, staffing, and functional capabilities.

Through federal and state grant sources, NDDES has assisted local responder agencies with equipment needs. The following list provides a summary of the quantity and types of materials purchased to support and enhance hazardous materials emergency response capabilities in the state through these grants.[110] A full inventory of local equipment was not available for this report.

[109] Stakeholder Interviews

[110] Retrieved from NDDES. February 25, 2015.

Table 8: North Dakota Grant-Funded Hazardous Materials Equipment

Equipment Type	Quantity
Cameras	10
Computers	18
Hazardous Materials Equipment (e.g. leak control kits, Liquid splash ensembles)	61
Miscellaneous (e.g. carts, battery chargers)	57
Monitors/Detectors (e.g., thermal imagers, dosimeters, gas meters, spotting scopes)	76
Other Rescue/Protective Equipment (e.g., hazmat suits and support equipment, hardhats, decontamination showers, stretchers)	88
Radios (mobile and portable)	83
Respirators	49
Self-Contained Breathing Apparatus	76
Tools (e.g., pumps, compressors, saws, cutters, spreaders	20
Vehicles (e.g., command, hazmat, tow, airboat, trailer)	29

4.6.4.6 North Dakota Department of Health

NDDoH manages 28 local public health units in eight regions across the state. NDDoH is responsible for community health programs, environmental health, and public health preparedness. NDDoH operates a Department Operations Center (DOC) as part of the SEOC structure. Strategies are identified at the SEOC and carried out at the DOC. Through this structure, NDDoH provides the following:

- Departmental command and control
- A NDDoH representative assigned to the SEOC
- A separate DOC as needed
- A coordinating entity for public health issues
- Core trained staff operating out of DOC with a capacity of two weeks of 24 hour operations
- A connection with state-used emergency management software with a separate significant events board for health and medical that feeds to the SEOC

NDDoH also operates and/or supports the following resources and networks:

- The Health Alert Network is the CDC's primary method of sharing cleared information about urgent public health incidents with public information officers; federal, state, territorial, and local public health practitioners; clinicians; and public health laboratories.
- Healthcare Standard system tracks vulnerable populations and hospital recipients. It scans individuals and tracks transportation and drop off locations. Local public health tracks the individuals through home healthcare organizations and other local operators.
- Vehicle and Staff Tracking is a homegrown application that tracks staff and emergency vehicles using a barcode tracking system.
- Public health hotline
- AM radio broadcast capabilities
- Electronic document library
- Emergency System for Advance Registration of Volunteer Health Professionals/ medical reserve: 17,000 registered reservists

4.6.4.6.1 North Dakota Department of Health – Environmental Health Division

The Environmental Health Division works with the contract air monitoring company on-scene at a crude oil transportation incident to verify data and ensure environmental compliance. The division utilizes USDOT's ERG for plume modeling, and it provides recommendations on evacuations or sheltering in place to local incident commanders. It also monitors cleanup operations to ensure mitigation and remediation measures meet state and federal standards. Once on scene, Environmental Health Division staff work through the incident commander and the RP (e.g. the railroad, pipeline operator, or motor carrier company involved) to provide technical recommendations for actions including types of monitoring or size of containment area.

The NDDoH has a six-person spill-response team available to support incident management. Generally, one person may respond to any given incident. Additionally, NDDoH staff assist with press release development and provide guidance on the information that goes to the public. Environmental Health Division staff receive hazardous materials response training through either the 24- or 40-hour Hazardous Waste Operations or Emergency Response Standard (HAZWOPER) class, plus an annual eight-hour refresher program.

4.6.4.7 North Dakota Department of Transportation

At the request of NDHP, NDDOT assists with traffic control measures (barricades, signage, detour and public information). NDDOT disseminates information about road closures, alternate routes through emergency management software, news media, state radio, 511 transportation information line and electronic information.

4.6.4.8 North Dakota Division of State Radio

North Dakota Division of State Radio (NDDSR) provides voice and data public safety communications to responding agencies, coordinates radio frequency use by responding agencies, provides situational awareness through multiple channels (phone, radio, fax, etc.), serves as the backup Public Safety Answering Point (PSAP) in the state, and dispatches ND Hazardous Materials RRTs at the direction of NDHLS.

4.6.4.9 North Dakota Fire Marshal

The North Dakota Fire Marshal (NDFM) provides technical assistance to local responders. The Fire Marshal may serve on scene as liaison, or as the on-scene commander in coordination with the SEOC, as requested. The NDFM supports environmental remediation and provides investigation support.

4.6.4.10 North Dakota Game and Fish Department

ND Game and Fish Department provides technical assistance, personnel, and equipment to remediate impacts to recreational properties, fish and wildlife populations and habitats, when requested.

4.6.4.11 North Dakota Highway Patrol

The NDHP's evaluates the need for and executes, if necessary, road closures, openings and alternate routes based on analysis from NDDOT for state and federal roadways. Additionally, NDHP coordinates with local law enforcement regarding state and federal road closures. NDHP assists with evacuations and search and rescue operations.

4.6.4.12 North Dakota Parks and Recreation Department

ND Parks and Recreation Department (NDRD) provides technical assistance with crude oil incidents that are within or may affect North Dakota state parks, designated nature areas, or other state park owned land.

4.6.5 Local

County and municipal emergency management entities bear primary responsibility for planning, and preparing for, and managing emergency response operations related to crude oil transportation incidents that occur within their jurisdictional boundaries. Any initial response will be made by local emergency responders, including emergency managers, fire departments, law enforcement, public works, and emergency medical services.

In North Dakota, local emergency managers and their operations are often funded through federal Emergency Management Performance Grants (EMPG) monies allocated by NDDES. The EMPG funding provided to each county varies, but local emergency managers stated that it usually provides less than 50% of the annual cost to employ a local emergency manager. With many local agencies increasingly challenged to maintain response capabilities for routine, everyday incidents, their ability to undertake new and additional planning and preparedness efforts necessary to adjust to the dramatic increase in crude oil transportation across the state is limited. Most emergency managers interviewed during this study reported that their time is often spent addressing the increase in hazardous materials incident reports, complaints, and compliance issues. Their ability to focus on updating and maintaining plans, mutual aid agreements, and preparedness measures exceeds current staffing capabilities.

Many local emergency managers also hold other job responsibilities, such as public information, city administration, 9-1-1 coordinator, or as responders. This requires emergency managers to divide their time among all their responsibilities and may not often allow them sufficient time to focus on emergency management – mitigation and protection, preparedness, response, and recovery activities.

Other local public safety and emergency response services, such as law enforcement, rely on federal grants to support staffing as well. Most county sheriff's departments have small staffs focused primarily on daily law enforcement duties. Crude oil transportation incidents requiring law enforcement support can overwhelm county resources. In most rural counties, mutual aid and state law enforcement support is necessary to provide rapid response to support an incident and maintain daily police operations.

Almost all, 96.9%, of fire services in the state rely on volunteers to staff and operate the services.[111] They have limited capabilities and resources to manage large oil transportation incidents. They rely on mutual aid and state support to provide operational staff, technical support, and specialized equipment to conduct operations outside of their normal structural and grass firefighting capabilities. Urban fire departments in larger cities have some hazardous

[111] US Fire Administration, *National Fire Department Census Quick Facts*, January 2015, https://apps.usfa.fema.gov/census/summary.cfm (accessed June 22, 2015).

materials response capabilities, usually provided by and through the RRTs that are based in their departments.

4.6.5.1 The Emergency Healthcare System in North Dakota

Local health care systems in North Dakota were under stress prior to the increase in oil production in the state. A survey of local emergency management and response personnel finds that the majority of local jurisdictions would consider any incident generating four or more casualties to be a large-scale emergency health-care response requiring mutual aid and state resource support. Considering the possible impact of a train derailment, pipeline rupture, or oil tanker accident on the highway, it is likely that the incident will have an impact on more than this number. In addition, none of the hospitals and medical centers in the state are Level 1 trauma centers, and there is no burn unit in the state. In-state hospitals therefore may not be equipped to provide the level of care needed by patients involved in an oil-related incident. Currently, hospitals routinely transport critical patients to other states, for example to the 17-bed burn unit at Hennepin County Medical Center in Minneapolis, Minnesota. Patient condition may dictate an air ambulance for expedited transport; otherwise, the trip can take several hours or longer by ground depending on the location of the incident. In addition, many local emergency medical services have limited staff certified to provide Advanced Life Support, and because of the rural geography of the state, these staff cover extensive services areas. Large service areas result in longer-than-ideal response times, often surpassing the recommended one-hour emergency-care standard.

4.6.5.2 Local Response Preparedness

The project team examined local preparedness via document review, interviews and an online survey tool, which were used to gather information from local emergency managers and responders. The survey explored local risk perception, capabilities, and response preparedness. Elected officials, emergency managers, fire officials, law enforcement officials, emergency medical service officials, and public health officials provided their insight through the interviews and surveys. Survey responses are summarized in the charts below.

While most respondents stated that they have incident- and hazard-specific plans, many acknowledged through the interview process that their plans have not been updated to reflect changes in risk, vulnerability, and response operations related to crude oil transportation. Less than half of the respondents are equipped with the specialized training, exercise, or actual incident response experience to manage a crude oil transportation incident.

Figure 8: Crude Oil Transportation Incident Response Capabilities

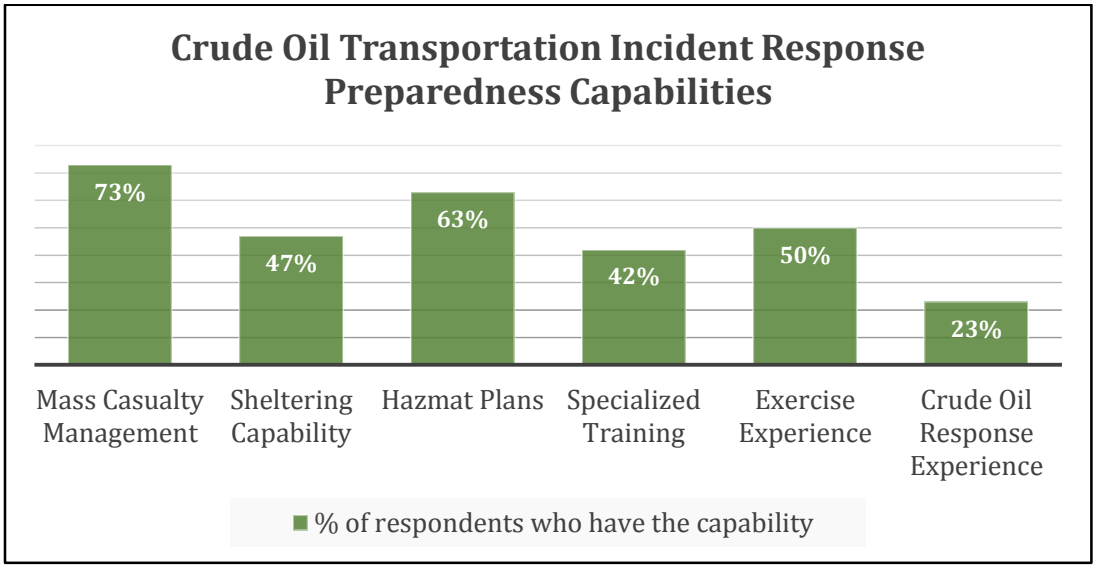
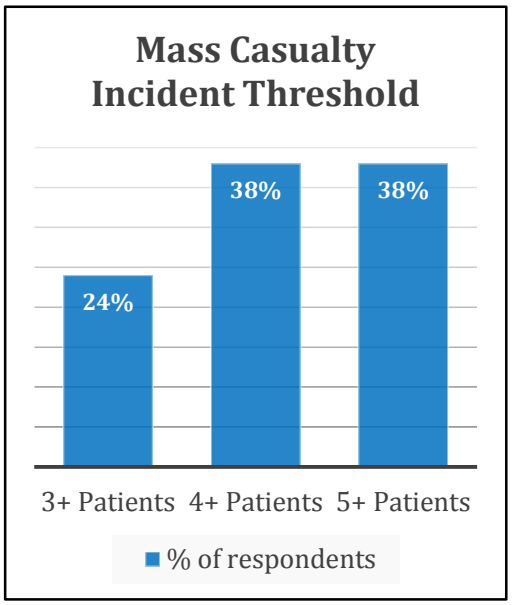


Figure 9: Mass Casualty Incident Threshold



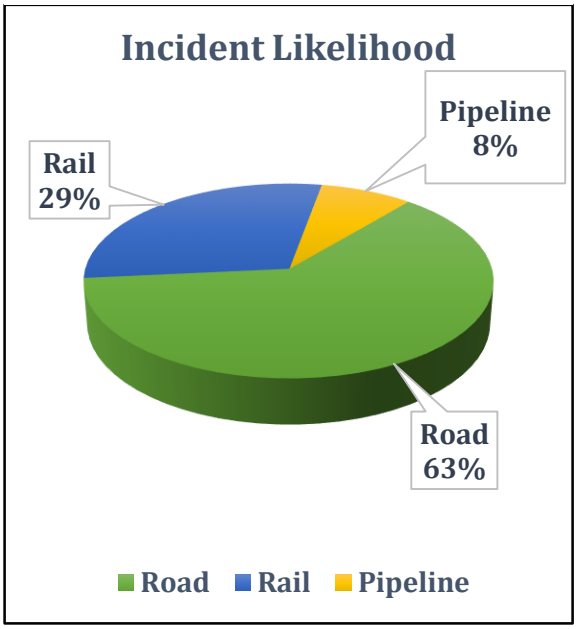
When asked about their capability to manage mass casualty incidents and thresholds for designating an incident, all stated they can manage up to three patients, but 38% of local communities said they are capable of handling up to five patients without requiring resource support.

Respondents were also asked to identify which mode of transportation would be the most likely to require an incident response in their community. Some respondents considered multiple modes equally, but the overall summary shows that 63% believe that a roadway incident is the most likely occurrence in their community.

Almost all responders who were interviewed stated that they have limited response capabilities or staffing for large-scale responses. In areas where volunteers serve as the primary response force, concerns were repeatedly expressed about the availability of first responders due to paid work obligations. The aging population of volunteer responders also concerns many officials at the state and local levels.

Local firefighting foam capabilities are reported to be inadequate for large-scale spills. To augment foam supplies, first responders rely on mutual aid, RRTs, nearby airports, and military installations. However, there are many types of foam, each serving a slightly different purpose, and each has a slightly different application procedure or tool. It is therefore unlikely that municipal fire departments will use the same types of foam as local airports and military installations, and it is even less likely that local departments will have the training, tools, and skill sets to apply them all. The different types of foam are summarized in the Equipment and Resources section below.

Figure 10: Incident Likelihood



4.6.5.3 Training and Exercise

Some local responders have had crude oil transportation incident training through the rail companies or through the Security and Emergency Response Training Center in Pueblo, Colorado. Others have received training through the North Dakota Firefighters Association, paid for by grants from the NDDES. Yet anecdotal responses during interviews revealed that many first responders remain inadequately trained to manage or mitigate a large incident, often due to training availability, refresher training limitations, and limited in-state opportunities for hands-on training with hazardous materials, including flammable liquids. Those limitations are created by limited fire training facilities within the state.

The Grand Forks Fire Department has been working to develop a hazardous materials response training facility that would allow responders from around the state to obtain hands-on training to crude oil spill response. The department is working to partner with the crude oil transportation industry to develop the training center. They are also seeking funding streams to develop and support the training center.

Some local jurisdictions in the state have participated in training opportunities specifically focused on crude oil transportation incidents. Transportation Community Awareness and Emergency Response (TRANSCAER) and Amtrak provide on-site first responder training as well as whistle-stop training programs along Class I rail lines in

North Dakota. Working with oil producers and rail operators such as Amtrak and BNSF, county emergency management representatives and response personnel have participated in a variety of training exercises. These training sessions, such as the Operation Binary BLEVE (Boiling Liquid Expanding Vapor Explosion) Training, provided insight into areas of improvement for future planning, preparedness, and response efforts. For example, the Operation Binary BLEVE Training (August 2014) revealed that procedures for establishing a Joint Information Center had not been clearly defined; that a large scale event involving public safety would quickly overwhelm local law enforcement agencies; and that routes of egress and ingress to a possibly affected area had not been predetermined, as well as many other findings. During stakeholder interviews, local emergency management personnel noted that trainings such as these supported their awareness, understanding, preparedness, and ability to respond to train derailments.

While the state firefighters association works to meet standards set forth in 29 CFR 1910.1209(q)(6), Emergency Response Program to Hazardous Substance Releases, local first responders indicated inconsistencies in hazardous materials responder training and skills for the awareness, operations, and technician level training. The National Fire Protection Administration (NFPA) 472: Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction (WMD) Incidents provides national standard guidelines for response to hazardous materials incidents, including competencies for the various levels of response operations, which guide minimum standards for training of first responders to hazardous materials incidents.

The table below provides a summary of core competencies related to awareness, operations, and technician level response to hazardous materials incidents, including crude oil spills, with or without fire. NFPA 472 also recognizes competencies for specialized hazardous materials response activities, including incident commanders, mission-specific responders, and specialists.[112]

[112] National Fire Protection 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents*, 2013, Print.

Table 9: NFPA 472 Core Competencies

Training Level	Core Competency
Awareness Level Personnel	For persons who, in the course of their normal duties, could encounter and emergency involving hazardous materials/WMD and who are expected to recognize the presence of the hazard, protect themselves, call for trained personnel, and secure the area.[113] *This level of training is appropriate for all firefighters, emergency medical technicians (EMTs), police officers, emergency managers, and public health officials.*
Operations Level Personnel	For persons who respond to hazardous materials/WMD incidents for the purpose of protecting nearby persons, the environment, or property from the effects of the release.[114] *This level of training is appropriate for firefighters, EMTs, private-sector spill response partners, and others as deemed appropriate by public safety officials.*
Technician Level Personnel	For persons who respond to hazardous materials/WMD incidents using a risk-based response process by which he or she analyzes a problem involving hazards, selects applicable decontamination procedures, and controls release using specialized protective clothing and control equipment. *This level of training is appropriate for firefighters, EMTs, private-sector spill response partners, and others as deemed appropriate by public safety officials.*

A list of available hazardous materials training programs and courses related to crude oil incident can be found in Appendix B of this report.

Any major spill or fire involving crude oil will require a significant commitment of specialized resources (specifically the foam products and application capability necessary for vapor suppression and fire control of ignitable liquids), and a large supply of spill containment materials. The type, amount, and capability of fire service assets available at the local, county and regional levels capable of the large volume foam operations varies across the state, but the majority of fire departments noted that they do not have enough foam to respond to a large scale incident in their respective jurisdictions. Inventories of foam concentrate and equipment, and the level of training and familiarity of response personnel with foam operations, is often

[113] National Fire Protection 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents*, Chapter 4, Core Competencies for Awareness Level Personnel, 2013, Print.

[114] National Fire Protection 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents*, Chapter 5, Core Competencies for Operations Level Personnel, 2013, Print.

dependent upon limited funding and resource levels. In some cases, local airports were noted to also have access to foam for spill response operations. However, airport foam capabilities may be different than those of the municipal fire departments, leaving most fire departments without a localized back up resource. As a result, equipment, foam concentrate, and training is often not standardized, and any practical skills training involving the actual production of foam in large volumes can be limited by USEPA restrictions and the cost of facilitating such a trainings.

As noted above, there are various types of foam available to municipal fire departments. Without standardized purchasing and operating procedures, local and mutual aid resources may not have the appropriate or sufficient product for the application. The most common types of firefighting foam available are:

- Class A foam, breaks down the surface tension of water, which in turn enables the water to better penetrate the surface of the fuel. When Class A fuels are pretreated with Class A foams, they tend to be more difficult to ignite because their level of hydration can be raised.
- Compressed Air Foam uses Class A foam solution with the addition of compressed air. Adding the compressed air to the foam solution dramatically enhances stream reach and surface protection time, making it ideal for structural exposure protection or wildland fuel pretreatment.
- Regular Protein foam (RP foam) produces stable foam blanket that has excellent heat resistance and drainage characteristics. It also has the ability to resist direct flame impingement such as would occur with a partially extinguished petroleum fire.
- Fluoroprotein foam (FP) provides fast fire knockdown, better resistance to fuel pick-up and greater compatibility when used in conjunction with dry-chemical extinguishing agents. FP foam should not be used on fires involving ethanol-gasoline blends containing more than 10% ethanol.
- Film Forming Fluoroprotein foam (FFFP) is designed to combine the fuel tolerance and burn-back resistance of a fluoroprotein foam with an increased knockdown power. FFFP foam also releases a film on the surface of a hydrocarbon fuel preventing volatile vapors from escaping the liquid.
- Aqueous Film Forming Foam (AFFF) is commonly used in crash fire rescue operations on fires involving simple hydrocarbon fuels like crude, diesel, jet fuel, home heating oil, and non-oxygenated gasoline. However, with the advent of federally mandated oxygenated gasolines, as well as gasoline-ethanol blends of varying concentrations, AFFF is no longer the optimal foam for those types of fuels.
- Alcohol Resistant Aqueous Film Forming Foam (AR-AFFF) is often the firefighting agent of choice for fires involving all types of hydrocarbon or solvent fuels. These solvents include ethanol and ethanol blended gasoline

(E-10, E-85 and E-95), acetone, methanol, ethers, esters, and some acids. AR-AFFF is required for fires and vapor suppression of spills involving E-10, E-85 and E-95 gasoline-ethanol blends now being carried in standard over-the-road gasoline tankers for delivery to retail gas stations.

- Alcohol Resistant Film Forming Fluoroprotein Foam (AR-FFFP) forms an aqueous film on the surface of the hydrocarbon fuel to reduce vapor release of the product. When used on polar solvents (or water miscible fuels), the polysaccharide polymer forms a tough membrane, which separates the foam from the fuel and prevents the destruction of the foam blanket. Both AR-AFFF and AR-FFFP foams are available as 3% to 6% concentrates.
- Mid- and High-Expansion Foam (MHEF) is commonly used in engineered fire suppression systems in aircraft hangars, tire warehouses rack storage and chemical manufacturing. MHEF also has been found to be effective in suppressing liquid natural gas events.

5 CRUDE OIL TRANSPORTATION: RISK AND VULNERABILITY ASSESSMENT METHODOLOGY

This section presents a top-level summary of the risks and vulnerabilities associated with transporting crude oil through North Dakota. The analysis considers crude oil transportation routes, previous events, likelihood of future incidents, and potential impacts from those incidents to derive an aggregate value for risk. County-specific information may be available to those who are authorized to review it upon official request to NDDES.

This risk assessment is intended for planning purposes only, including: to prioritize and develop prevention, protection, mitigation, response, and/or recovery strategies and resources. The following sections describe the terms used within the risk and vulnerability assessments and the associated methodologies.

5.1 Hazard Area

The "hazard area" is the geographic area within 0.5 miles of the centerline of the crude oil transportation infrastructure.

This hazard area is expressed as a "buffer" (a constant offset from a non-point geographical feature). This buffer distance was selected because 0.5 miles corresponds to the USDOT Emergency Response Guidebook evacuation zone for a crude oil transportation incident involving fire and explosion which represents the worst case scenario.

5.2 Exposure

"Exposure" refers to the population, structures, and environment within the identified hazard area.

The following exposure categories were researched and analyzed:

- Population – The estimated number of people living within the buffer
- Structures – The estimated number of structures within the buffer
- Dependent Population Facilities – The estimated number of dependent population facilities (DPFs) within the buffer zone. For the purposes of this report, this category includes schools (K-12 schools and licensed day cares), healthcare facilities (hospitals, skilled nursing facilities, and assisted living facilities), and corrections facilities.
- Environmental – The estimated number of square miles of environmentally sensitive lands. For the purposes of this report the environmental impact researched and studied includes the following (as defined by US Geological Survey):

- Cultivated Crops – Areas characterized by herbaceous vegetation that has been planted or is intensively managed for the production of food, feed, or fiber.
- Wetlands – Areas where vegetation (emergent herbaceous or woody) accounts for 75-100% of the cover, and the soil or substrate is periodically saturated or covered with water
- Open Water – all areas of open water, generally with less than 25% cover of vegetation/land cover.

5.3 Vulnerability

"Vulnerability" is defined as the population, structures, and environment that are susceptible to impacts by the hazard. Vulnerability is a subset of exposure. As it regards crude accidents, any particular incident is likely to affect only a small portion of the buffer. Therefore, 10% of the total exposure within each category was determined to be vulnerable.

Total Exposure × 10% = Vulnerability

5.4 Impact

The "impact" is the potential effect an incident might have on populations, structures, and the environment, including: casualties, damage to buildings, and/or harm to the environment.

5.4.1 Impact Level

In order to analyze impact, an Impact Rating Scale was developed. The Impact Rating Scale, shown in Table 10: Impact Rating Scale, assigns a qualitative level (low, medium, or high) to the effects an incident would likely have on vulnerable assets – that is, 10% of all assets within the buffer. (This report assumes all exposed areas to have the potential to suffer at least a low impact level.)

Table 10: Impact Rating Scale

Impact Level	Population Impact Expected	Dependent Population Facilities Impact Expected	Environmental Impact Expected
low	No fatalities expected and/or no injuries	None	<1 sq. mi. of environmentally sensitive land affected
medium	Fewer than 8 injuries and/or fatalities	Damage to 1 to six 6 Dependent Population facilities, but no total losses	1-6 sq. mi. of environmentally sensitive land affected
high	8 or more injuries and/or fatalities	Damage to greater than 6 Dependent Population facilities or at least one Dependent Population facility total loss	>6 sq. mi. of environmentally sensitive land affected

The impact levels were assigned as described below.

5.4.2 Population Impact Level

The Population Impact Level was assigned quantitatively, based on the table above, where the population vulnerability was analyzed by county to be:

- Zero (0) injuries and/or fatalities, a low value was assigned;
- One(1) or more, but fewer than eight (8) injuries and/or fatalities, a medium value was assigned; or
- Eight (8) or more injuries and/or fatalities, a high value was assigned.

5.4.3 Dependent Population Facilities Impact Level

The Dependent Population Facilities Impact Level was assigned quantitatively, based on the table above, where the dependent population facilities vulnerability was analyzed by county to be:

- Zero (0) facilities, a low value was assigned;
- From one (1) to six (6) facilities, a medium value was assigned; or
- Greater than six (6) facilities, a high value was assigned.

5.4.4 Environmental Impact Level

The Environmental Impact Level was assigned quantitatively, based on the table above, where the environmental vulnerability was analyzed by county to be:

- Less than one (1) square mile, a low value was assigned;
- One (1) to six (6) square miles, a medium value was assigned; or
- Greater than six (6) square miles, a high value was assigned.

5.4.5 Average Impact Value

An average impact value for each county was calculated by assigning a quantitative value to each impact level within each exposure category (population, Dependent Population facility, and environmental). The values were weighted and multiplied to produce a non-linear distribution of results, so as to better identify highly impacted outliers. (Refer to Table 11: Impact Value)

Table 11: Impact Value

Impact Level	Impact Value
Low	1
Medium	3
High	5

To calculate the Average Impact Value,

(Population Impact Value + Dependent Population Facility Impact Value + Environmental Impact Value)÷3 = Average Impact Value

5.5 Likelihood

Likelihood is an estimate of how often an incident might occur within the buffer. Incidents may occur within the buffer with or without impact. In this Report, likelihood is described by a Likelihood Rating Scale – an assessment of the chances that a hazard event might occur in the buffer zone during a 20-year timespan, based on a review of historic events and available data.

The Likelihood Rating Scale is applied consistently across the transportation modes (refer to Table 12: Likelihood Rating Scale). However, the methodology for determining likelihood within each mode is different. The specific methodology for determining the Likelihood Rating for each individual mode can be found in the respective mode's risk and vulnerability sections.

Table 12: Likelihood Rating Scale

Likelihood Value	Likelihood Rating	% Probability per 20 years
1	negligible	<1.0%
2	low	1.0 – 10.0%
3	moderate	10.1 – 30.0%
4	high	30.1-50.0%
5	extreme	>50.1%

5.6 Risk

"Risk" is a metric that aggregates all the analyses described above. It combines the potential impacts with the likelihood of occurrence. In this report, risk is expressed using two metrics: risk level (H, M, L) and risk value (an absolute numeric value).

5.6.1 Risk Level

Each county was assigned a risk level using the Average Impact Value and the Likelihood Value, correlating with the matrix shown in Table 13: Assigning Risk Level.

Table 13: Assigning Risk Level

		Average Impact Value				
		1	2	3	4	5
Likelihood Value	1	L	L	L	L	M
	2	L	L	M	M	M
	3	L	M	M	M	H
	4	L	M	M	H	H
	5	M	M	H	H	H

5.6.2 Risk Value

A numeric value representing each county's risk was calculated by multiplying the average impact value by the assigned likelihood value.

Average Impact Value × Likelihood Value= Risk Value

5.7 Data Collection and Metadata

5.7.1 Transportation Network Datasets

The following datasets were used to derive the vulnerable Dependent Population facilities:

Table 14: Transportation Network Datasets

Data Name	Data Provided By	Data Description	Data Type
Pipeline Network	PennWell Corp. (MAPSearch)	ND Pipeline Gathering/Transmission Lines	ESRI Polyline Shapefile
Railroad Network	ND GIS Hub	ND Railroads (Edited to include RR Class I, Line Type (e.g. Mainline, Siding, Yard), and County	ESRI Polyline Shapefile
Roadway Network (includes US Highways and Interstates, major state corridors for crude oil, and state feeder routes.)	FHA North Dakota Div. Energy Corridors/Freight Network Maps	Major Roadway Energy Corridors	ESRI Polyline Shapefile

5.7.2 Population Vulnerability

The following datasets were used to derive the vulnerable population based on geographic location (not demographic factors):

Table 15: Population Datasets

Data Name	Data Provided By	Data Description	Data Type
Structures	ND GIS Hub	Structures	ESRI Point Shapefile
2010 Census	US Census Bureau	Demographic Data	Spreadsheet /Attribute

Population estimates were interpolated from the average number of people per structure (as reported by the US Census Bureau), and the vulnerable structures data totals for each county.

Average # of People per Structure × # Vulnerable Structures = Est. Vulnerable Population

5.7.3 Dependent Population Facilities Vulnerability

The following datasets were used to derive the vulnerable Dependent Population facilities:

Table 16: Dependent Population Facilities Vulnerability

Data Name	Data Provided By	Data Description	Data Type
Hospitals	ND GIS Hub	Hospitals	ESRI Point Shapefile
Schools	ND GIS Hub	Schools	ESRI Point Shapefile
Assisted Living	ND GIS Hub	Assisted Living	ESRI Point Shapefile
Skilled Nursing	ND GIS Hub	Skilled Nursing	ESRI Point Shapefile
Daycares	USDHS: 2013 Homeland Security Infrastructure Program geodatabase	Daycares	ESRI Point Shapefile

5.7.4 Environmental Vulnerability

The following datasets were used to derive the environmental vulnerability:

Table 17: Environmental Vulnerability

Data Name	Data Provided By	Data Description	Data Type
Land Use/Land Cover	US Geological Survey	Land Use/Land Cover	ESRI Grid (converted to ESRI Polygon Shapefile

5.8 Metadata

Each exposure dataset was overlaid and "clipped" by the 0.5-mile buffer using geographic information systems (GIS) to produce six *exposure* datasets for each county:

- Structures exposed to road hazards
- Structures exposed to rail hazards
- Structures exposed to pipeline hazards
- Environmental areas exposed to road hazards
- Environmental areas exposed to rail hazards
- Environmental areas exposed to pipeline hazards

The derivation of these exposure datasets is described in greater detail within the respective transportation mode's risk and vulnerability section.

6 PIPELINE: CRUDE OIL TRANSPORTATION RISK AND VULNERABILITY

The pipeline network in North Dakota is growing to meet transportation demand for light sweet crude oil. Three new, significant pipelines are scheduled to be in service by 2018, providing an additional 895,000 barrels per day of expanded capacity.[115] The current pipeline infrastructure will continue to age, while new pipelines will add to the overall distance oil travels via pipeline throughout the state.

6.1 Pipeline: Vulnerable Population Impact

Table 18: Pipeline Vulnerable Population Impact provides, by county, the length of crude oil pipeline, estimated population and structures within the buffer, and the vulnerable population impact level (Refer to Table 10: Impact Rating Scale).

Table 18: Pipeline Vulnerable Population Impact

County	Estimated Linear Mile of Pipeline	Estimated Population	Estimated # of Structures	Population Vulnerability
Barnes	43.01	86	40	9
Benson	30.91	1,474	505	147
Billings	333.05	495	208	50
Bottineau	97.75	164	80	16
Bowman	173.01	93	41	9
Burke	127.41	293	142	29
Cavalier	7.05	21	10	2
Divide	22.31	10	5	1
Dunn	605.83	1,280	502	128
Golden Valley	86.21	54	25	5
Grand Forks	40.85	6,855	3,007	686
Hettinger	14.66	24	11	2
McHenry	37.32	438	205	44
McKenzie	951.19	10,571	3,901	1,057

[115] United Press International, *Dalyrmple: North Dakota needs more pipelines,* May 7, 2015, http://www.upi.com/Business_News/Energy-Resources/2015/05/07/Dalrymple-North-Dakota-needs-more-pipelines/1531431003162/ (accessed June 22, 2015).

County	Estimated Linear Mile of Pipeline	Estimated Population	Estimated # of Structures	Population Vulnerability
McLean	3.64	2	1	0
Mercer	23.45	52	23	5
Morton	17.97	1,577	660	158
Mountrail	571.56	2,403	914	240
Nelson	88.31	2,182	1,075	218
Oliver	30.85	46	19	5
Pembina	194.99	72	34	7
Pierce	18.88	2,720	1,308	272
Ramsey	80	503	221	50
Ransom	24.97	29	10.11	3
Renville	64.14	387	164	39
Sargent	25.31	24	11	2
Slope	1.48	0	0	0
Stark	446.44	5,460	2,304	546
Steele	30.82	46	21	5
Walsh	24.73	101	47	10
Ward	113.9	5,629	2,307	563
Williams	670.3	8,957	3,828	896

6.2 Pipeline: Vulnerable Dependent Population Facilities Impact

The potential impact of a pipeline incident on facilities housing dependent populations was estimated through an analysis of the number of dependent population facilities (schools/childcare centers, including K-12 schools and licensed childcare centers; healthcare facilities, including assisted living facilities, skilled nursing facilities, and hospitals; and corrections facilities) within the buffer (refer to Table 19: Pipeline Vulnerable Dependent Population Facilities Impact).

Table 19: Pipeline Vulnerable Dependent Population Facilities Impact

County	# Schools/ Childcare	# Healthcare	# Corrections	Total # of Facilities	Facility Vulnerability
Barnes	0	0	0	0	0
Benson	2	0	0	2	0.2
Billings	0	0	0	0	0
Bottineau	2	0	0	2	0.2
Bowman	0	0	0	0	0
Burke	0	0	0	0	0
Cavalier	0	0	0	0	0
Divide	0	0	0	0	0
Dunn	0	0	0	0	0
Golden Valley	0	0	0	0	0
Grand Forks	2	2	0	4	0.4
Hettinger	0	0	0	0	0
McHenry	2	0	0	2	0.2
McKenzie	6	0	0	6	0.6
McLean	0	0	0	0	0
Mercer	0	0	0	0	0
Morton	1	1	0	2	0.2
Mountrail	5	0	0	5	0.5
Nelson	3	2	0	5	0.5
Oliver	0	0	0	0	0
Pembina	0	0	0	0	0
Pierce	2	3	2	7	0.7
Ramsey	0	0	0	0	0
Ransom	0	0	0	0	0
Renville	0	0	0	0	0
Sargent	0	0	0	0	0
Slope	0	0	0	0	0
Stark	1	0	0	1	0.1
Steele	0	0	0	0	0
Walsh	0	0	0	0	0
Ward	4	0	0	4	0.4
Williams	6	0	0	6	0.6

6.3 Pipeline Vulnerable Environmental Impact

Table 20: Pipeline Vulnerable Environmental Impact provides, by county, the total area in square miles of crops, wetlands, and open water within the buffer and the determined impact level. The entire area, each of these summed, is used to calculate the environmental vulnerability for each county from which the impact level was assigned as described in 5.4.1: Impact Level.

Table 20: Pipeline Vulnerable Environmental Impact

All Counties	Cultivated Crops Area	Wetlands Area	Open Water Area	Total Sensitive Area	Environmental Vulnerability
Barnes	31.29	3.31	1.22	35.82	3.58
Benson	17.27	2.00	1.79	21.05	2.11
Billings	34.83	2.61	0.92	38.36	3.84
Bottineau	44.85	3.25	0.68	48.77	4.88
Bowman	20.68	0.40	0.18	21.26	2.13
Burke	54.37	5.04	1.41	60.83	6.08
Cavalier	3.91	0.59	0.07	4.57	0.46
Divide	8.76	0.79	2.23	11.78	1.18
Dunn	102.76	6.66	3.99	113.41	11.34
Golden Valley	18.45	0.72	0.22	19.39	1.94
Grand Forks	30.51	1.50	0.34	32.35	3.24
Hettinger	7.50	0.11	0.00	7.61	0.76
McHenry	8.43	3.20	0.17	11.80	1.18
McKenzie	208.58	9.85	4.14	222.57	22.26
McLean	1.14	0.04	0.41	1.59	0.16
Mercer	3.46	0.46	0.09	4.02	0.40
Morton	5.89	0.54	0.11	6.54	0.65
Mountrail	209.61	6.85	5.91	222.37	22.24
Nelson	30.62	11.18	1.98	43.78	4.38
Oliver	12.98	0.46	0.02	13.46	1.35
Pembina	39.63	1.76	0.55	41.94	4.19
Pierce	9.72	0.99	0.71	11.42	1.14
Ramsey	22.51	5.05	3.05	30.61	3.06
Ransom	10.11	1.39	0.26	11.76	1.18
Renville	30.80	1.43	0.08	32.31	3.23
Sargent	15.57	2.40	0.49	18.46	1.85

All Counties	Cultivated Crops Area	Wetlands Area	Open Water Area	Total Sensitive Area	Environmental Vulnerability
Slope	0.54	0.00	0.01	0.55	0.05
Stark	157.15	1.50	0.64	159.30	15.93
Steele	23.08	2.98	1.03	27.09	2.71
Walsh	13.24	0.93	0.06	14.22	1.42
Ward	65.33	2.23	1.28	68.84	6.88
Williams	272.97	13.47	7.11	293.55	29.35

6.4 Pipeline Incident Likelihood

While future spills cannot be predicted, a historical review can be used to conservatively estimate the chances of significant pipeline accidents. Based on PHMSA data, North Dakota experienced 57 significant pipeline incidents from 1995 through 2014.[116] (PHMSA considers a pipeline incident to be "significant" if it causes a death or serious injury, costs more than $50,000, releases more than 50 barrels of oil, or results in a fire or explosion.) In the most active year during the period of 1995 - 2014, there were 12 significant spills. The range of incidents provides a best-case year/worst-case year overview.

Table 21: Pipeline Incident Summary, 1995-2014 (20 years)

	20 Year Average	20 Year Range
Incident Count	3	0 – 12
Fatalities	0	0 – 1
Injuries	0	0 – 4
Property Damage	$2,094,516	$0 - $20,862,915

Causative factors included third-party excavation damage, corrosion, materials/ construction, incorrect operation, and damage from environmental conditions (refer to Table 22: Significant Pipeline Incidents by Cause).

[116] US Department of Transportation, Pipeline Hazardous Materials Safety Administration, *Incident Reports Database Search*, https://hazmatonline.phmsa.dot.gov/IncidentReportsSearch/ (accessed June 22, 2015).

Table 22: Significant Pipeline Incidents by Cause

Reported Cause of Incident	% of All Incidents
Corrosion	10.5%
Excavation Damage	24.6%
Incorrect Operation	7.0%
Material/Weld/Equipment Failure	38.6%
Natural Force Damage	5.3%
Other Outside Force Damage	5.3%
All Other Causes	8.8%

Based on historical data presented in Table 21: Pipeline Incident Summary, there are an average of 3 (rounded) pipeline incidents per year, or 60 incidents would be expected over a 20 year period. Furthermore, assuming that past incidents are indicative of future incidents, future significant pipeline incidents in North Dakota are not likely to result in few injuries or deaths. Future events are projected to release hundreds of barrels of crude oil and cause tens of thousands of dollars of damage—with occasional incidents resulting in over 1,000 barrels released and over $1 million in damages (five incidents meeting those criteria were reported from 1986 to 2012).

6.4.1 Pipeline: Likelihood Value

The pipeline likelihood value was derived in a multi-step process. First, each county's share of pipeline was determined by dividing its pipeline miles by total mileage of pipeline in the state.

County Pipeline Miles ÷ State Pipeline Miles = % Total Pipeline

The county's percent of the total pipeline was then multiplied by the total number of incidents projected to occur in North Dakota within a 20-year period. This resulted in the Pipeline Likelihood Value.

% Total Pipeline × 60 = Pipeline Likelihood Value (20 year)

The result is a projection of the number of incidents in each county over the next 20 years, from which probability is derived.

6.4.2 Pipeline: Annual Probability

The 20-year probability was then annualized by dividing the pipeline likelihood value by 20.

Pipeline Likelihood Value (20 year) ÷ 20 = Annual Probability

6.4.3 Pipeline: Likelihood Rating

The likelihood rating was then assigned by examining the percent probability and assigning the appropriate value as outlined in Table 23: Pipeline Likelihood Rating Table.

Table 23: Pipeline Likelihood Rating Table

County	Estimated Linear Miles of Pipeline	% Total Pipeline	Likelihood Value	Annual Probably
Barnes	43.01	0.86%	0.52	2.58%
Benson	30.91	0.62%	0.37	1.85%
Billings	333.05	6.66%	4.00	19.98%
Bottineau	97.75	1.95%	1.17	5.86%
Bowman	173.01	3.46%	2.08	10.38%
Burke	127.41	2.55%	1.53	7.64%
Cavalier	7.05	0.14%	0.08	0.42%
Divide	22.31	0.45%	0.27	1.34%
Dunn	605.83	12.11%	7.27	36.34%
Golden Valley	86.21	1.72%	1.03	5.17%
Grand Forks	40.85	0.82%	0.49	2.45%
Hettinger	14.66	0.29%	0.18	0.88%
McHenry	37.32	0.75%	0.45	2.24%
McKenzie	951.19	19.02%	11.41	57.05%
McLean	3.64	0.07%	0.04	0.22%
Mercer	23.45	0.47%	0.28	1.41%
Morton	17.97	0.36%	0.22	1.08%
Mountrail	571.56	11.43%	6.86	34.28%
Nelson	88.31	1.77%	1.06	5.30%
Oliver	30.85	0.62%	0.37	1.85%
Pembina	194.99	3.90%	2.34	11.69%
Pierce	18.88	0.38%	0.23	1.13%
Ramsey	80.00	1.60%	0.96	4.80%

County	Estimated Linear Miles of Pipeline	% Total Pipeline	Likelihood Value	Annual Probably
Ransom	24.97	0.50%	0.30	1.50%
Renville	64.14	1.28%	0.77	3.85%
Sargent	25.31	0.51%	0.30	1.52%
Slope	1.48	0.03%	0.02	0.09%
Stark	446.44	8.93%	5.36	26.78%
Steele	30.82	0.62%	0.37	1.85%
Walsh	24.73	0.49%	0.30	1.48%
Ward	113.90	2.28%	1.37	6.83%
Williams	670.30	13.40%	8.04	40.20%

6.5 Pipeline: Risk

Table 24: Pipeline Risk Table summarizes the likelihood, impact, and associated risk in each county, for pipeline crude oil transportation. (Refer to the methodology presented in Section 5.6: Risk.)

Table 24: Pipeline Risk Table

All Counties	Likelihood Level	Likelihood Value	Population Impact Level Value	Dependent Population Facilities	Environmental Impact Level Value	Average Impact Value	Risk Value
Barnes	low	2	3	1	3	3.00	6.00
Benson	low	1	5	1	3	3.00	3.00
Billings	moderate	5	5	1	3	3.00	15.00
Bottineau	low	3	5	1	3	3.00	9.00
Bowman	moderate	4	3	1	3	2.33	9.33
Burke	low	3	5	1	5	3.67	11.00
Cavalier	negligible	1	1	1	1	1.00	1.00
Divide	low	1	1	1	3	1.67	1.67
Dunn	high	5	5	1	5	3.67	18.33
Golden Valley	low	3	1	1	3	1.67	5.00

All Counties	Likelihood Level	Likelihood Value	Population Impact Level Value	Dependent Population Facilities	Environmental Impact Level Value	Average Impact Value	Risk Value
Grand Forks	low	2	5	1	3	3.00	6.00
Hettinger	negligible	1	1	1	1	1.00	1.00
McHenry	low	1	5	1	3	3.00	3.00
McKenzie	extreme	5	5	3	5	4.33	21.67
McLean	negligible	1	1	1	1	1.00	1.00
Mercer	low	1	1	1	1	1.00	1.00
Morton	low	1	5	1	1	2.33	2.33
Mountrail	high	5	5	3	5	4.33	21.67
Nelson	low	3	5	3	3	3.67	11.00
Oliver	low	1	1	1	3	1.67	1.67
Pembina	moderate	4	1	1	3	1.67	6.67
Pierce	low	1	5	3	3	3.67	3.67
Ramsey	low	2	5	1	3	3.00	6.00
Ransom	low	1	1	1	1	1.00	1.00
Renville	low	2	5	1	3	3.00	6.00
Sargent	low	1	1	1	3	1.67	1.67
Slope	negligible	1	1	1	1	1.00	1.00
Stark	moderate	5	5	1	5	3.67	18.33
Steele	low	1	1	1	3	1.67	1.67
Walsh	low	1	3	1	3	2.33	2.33
Ward	low	3	5	1	5	3.67	11.00
Williams	high	5	5	3	5	4.33	21.67

7 RAILROAD: CRUDE OIL TRANSPORTATION RISK AND VULNERABILITY

According to the USEIA, North Dakota produced 90,641,000 barrels of crude oil in 2010. That number increased more than four times over the next five years, to 396,745,000 barrels of crude oil in 2014.[117] To accommodate such a rapid increase in production and the related need for transportation of the crude oil, a greater reliance on rail was required. From 2010 to 2014, estimates of the system capacity to transport crude oil by rail from North Dakota jumped from 95,000 to 1,260,000 barrels per day. By the end of 2015, the estimated potential rail loading capacity in North Dakota will approach 1,490,000 barrels per day, compared to a pipeline/refining capacity of 827,000 barrels per day.[118] Currently, and for the foreseeable future, the majority of crude oil produced in North Dakota will be transported via rail.

7.1 Railroad Vulnerable Population Impact

It is important to note that the amount of railroad infrastructure in a county is not directly proportionate to the risk to population. For example, Ward County has the most linear miles of railroad track (208.42 miles) with 27,019 people and 11,305 structures within the 0.5-mile buffer zone. Cass County has the largest population (38,850) and number of structures (14,716) within the 0.5-mile buffer zone and 180.9 linear miles of track, or 215 people per mile of railroad compared to 129 people per mile of railroad in Ward County.

Table 25: Railroad Vulnerable Population Impact provides, by county, the length of crude oil rail line, estimated population and structures within the buffer, and the vulnerable population impact level (Refer to Table 10: Impact Rating Scale).

Table 25: Railroad Vulnerable Population Impact

County	Estimated Linear Mile of Railroad	Estimated Population	Estimated # of Structures	Population Vulnerability
Barnes	112.97	2,962	1,417	296.20
Benson	34.06	800	516	80.00
Billings	22.18	289	217	28.90
Burke	28.25	580	537	58.00

[117] US Energy Information Administration, *Table 26. Production of Crude Oil by PADD District and State, December 2010,* http://www.eia.gov/petroleum/supply/monthly/archive/2011/2011_02/pdf/table26.pdf (accessed June 22, 2015).
[118] North Dakota Pipeline Authority. US Williston Basin Crude Oil Export Options, April 13, 2015, https://ndpipelines.files.wordpress.com/2012/04/wb-oil-export-options-4-13-2015.jpg (accessed June 22, 2015).

County	Estimated Linear Mile of Railroad	Estimated Population	Estimated # of Structures	Population Vulnerability
Burleigh	45.21	15,987	8,115	1,598.70
Cass	180.09	38,850	14,716	3,885.00
Eddy	30.25	1,318	948	131.80
Foster	51.40	1,503	911	150.30
Golden Valley	24.03	1,111	761	111.10
Grand Forks	92.31	18,951	6,468	1,895.10
Griggs	31.69	255	169	25.50
Kidder	33.93	852	650	85.20
McHenry	152.10	3,426	1,914	342.60
McKenzie	15.16	398	468	39.80
McLean	41.44	576	433	57.60
Mercer	39.06	3,647	2,464	364.70
Morton	110.71	12,668	5,811	1,266.80
Mountrail	90.35	4,515	2,894	451.50
Nelson	26.84	1,137	1,015	113.70
Oliver	35.48	111	74	11.10
Pierce	43.34	2,212	1,264	221.20
Ramsey	44.48	4,884	3,539	488.40
Ransom	28.49	1,114	533	111.40
Renville	5.10	16	10	1.60
Richland	75.11	6,405	4,270	640.50
Sheridan	8.87	92	67	9.20
Stark	90.08	9,632	4,816	963.20
Steele	4.31	36	28	3.60
Stutsman	91.89	7,653	3,229	765.30
Traill	40.87	2,188	1,376	218.80
Ward	208.42	27,019	11,305	2701.90
Wells	77.39	2,301	1,403	230.10
Williams	102.51	8,590	5,053	859.00

7.2 Railroad Vulnerable Dependent Population Facilities Impact

The potential impact of a railroad incident on facilities housing dependent populations was estimated through an analysis of the number of dependent population facilities (schools/childcare centers, includes K-12 schools and licensed childcare centers; healthcare facilities, includes assisted living facilities, skilled nursing facilities, and hospitals; and corrections facilities) within the buffer (refer to Table 26: Railroad Vulnerable Dependent Population Facilities Impact).

Table 26: Railroad Vulnerable Dependent Population Facilities Impact

County	# Schools/ Childcare	# Healthcare	# Corrections Facility	Total # of Facilities	Facility Vulnerability
Barnes	2	3	0	5	0.5
Benson	2	0	0	2	0.2
Billings	0	0	0	0	0
Burke	2	0	0	2	0.2
Burleigh	20	4	2	26	2.6
Cass	60	4	2	66	6.6
Eddy	4	2	0	6	0.6
Foster	3	2	0	5	0.5
Golden Valley	2	1	0	3	0.3
Grand Forks	18	4	1	23	2.3
Griggs	1	0	0	1	0.1
Kidder	4	0	0	4	0.4
McHenry	8	2	0	10	1
McKenzie	0	0	0	0	0
McLean	2	0	0	2	0.2
Mercer	5	1	0	6	0.6
Morton	20	3	2	25	2.5
Mountrail	4	1	1	6	0.6
Nelson	3	2	0	5	0.5
Oliver	1	0	0	1	0.1
Pierce	4	2	2	8	0.8
Ramsey	7	1	1	9	0.9
Ransom	2	1	0	3	0.3
Renville	0	0	0	0	0
Richland	19	1	1	21	2.1
Sheridan	0	0	0	0	0
Stark	27	2	0	29	2.9
Steele	0	0	0	0	0

County	# Schools/ Childcare	# Healthcare	# Corrections Facility	Total # of Facilities	Facility Vulnerability
Stutsman	22	3	2	27	2.7
Traill	3	3	1	7	0.7
Ward	34	8	1	43	4.3
Wells	5	2	1	8	0.8
Williams	9	0	0	9	0.9

7.3 Railroad Vulnerable Environmental Impact

Table 27: Railroad Vulnerable Environmental Impact provides, by county, the total area, in square miles, of crops, wetlands, and open water within the buffer, and the determined impact level. The entire area, each of these summed, is used to calculate the vulnerability for each county from which the impact level was assigned as described in 5.4.1: Impact Level.

Table 27: Railroad Vulnerable Environmental Impact

County	Cultivated Crops (sq. mi)	Wetlands	Open Water (sq. mile)	Total Square Miles	Environmental Vulnerability
Barnes	61.19	7.30	3.65	72.14	7.21
Benson	17.56	2.19	1.13	20.88	2.08
Billings	2.73	0.19	0.17	3.09	.31
Burke	18.94	1.54	0.29	20.77	2.08
Burleigh	7.49	3.99	2.17	13.65	19.8
Cass	94.43	1.85	1.07	97.35	9.74
Eddy	9.78	2.32	0.12	12.22	1.22
Foster	0.00	4.61	1.26	5.87	.59
Golden Valley	7.52	0.18	0.08	7.78	.78
Grand Forks	44.72	1.06	0.34	46.12	4.61
Griggs	17.05	1.79	0.49	19.33	19.3
Kidder	0.00	1.58	1.23	2.81	.28
McHenry	45.55	14.39	3.52	63.46	6.35
McKenzie	4.56	0.99	0.32	5.87	.59
McLean	16.64	3.87	2.77	23.28	2.33

County	Cultivated Crops (sq. mi)	Wetlands	Open Water (sq. mile)	Total Square Miles	Environmental Vulnerability
Mercer	6.36	5.03	0.65	12.04	1.20
Morton	16.86	7.26	1.79	25.91	2.59
Mountrail	26.14	2.49	3.21	31.84	3.18
Nelson	11.66	5.39	1.18	18.23	1.82
Oliver	7.99	6.13	1.77	15.89	1.59
Pierce	18.58	3.06	1.83	23.47	2.35
Ramsey	20.17	5.05	2.17	27.39	2.74
Ransom	7.91	1.08	0.52	9.51	.95
Renville	1.23	0.00	0.00	1.23	.12
Richland	44.44	2.06	0.74	47.24	4.72
Sheridan	4.37	1.17	0.19	5.73	.57
Stark	17.19	1.22	1.46	19.87	1.99
Steele	2.16	0.05	0.02	2.23	.23
Stutsman	0.00	6.16	4.24	10.40	1.04
Traill	0.00	0.14	0.52	0.66	.07
Ward	48.65	4.27	4.98	57.90	5.79
Wells	0.00	5.09	1.05	6.14	.61
Williams	30.11	5.68	1.78	37.57	3.76

7.3.1 Railroad Likelihood

While future rail incidents cannot be predicted, a historical review can be used to conservatively estimate the chances of a railroad accidents per year. Based on PHMSA data, North Dakota experienced 20 serious railroad incidents from 2008 through 2014.[120] PHMSA considers a railroad incident to be "serious" if it involves:

- A fatality or major injury caused by the release of a hazardous material
- The evacuation of 25 or more employees, or responders or any number of the general public, as a result of release of a hazardous material or exposure to fire
- A release or exposure to fire which results in the closure of a major transportation artery
- The alteration of an aircraft flight plan or operation

[120] US Department of Transportation, Pipeline Hazardous Materials Safety Administration, *Incident Reports Database Search*, https://hazmatonline.phmsa.dot.gov/IncidentReportsSearch/ (accessed June 22, 2015).

- The release of radioactive materials from Type B packaging
- The suspected release of a Risk Group 3 or 4 infectious substance
- The release of over 11.9 gallons or 88.2 pounds of a severe marine pollutant
- The release of a bulk quantity (over 119 gallons or 882 pounds) of a hazardous material[121]

Table 28: Railroad 7 Year Incident History

	2008 - 2014	
	7 Year Average	7 Year Range
Incident Count	3	0 - 6
Fatalities	0	0
Injuries	0	0
Property Damage	$382,363	$0 - $ 2,305,018.00

Causative factors range from human error, to equipment malfunction, to infrastructure failure. Table 29: Serious Railroad Incidents by Cause is calculated by tank car, rather than per incident.

Table 29: Serious Railroad Incidents by Cause

Failure Cause Description	% of All Accidents
Broken Component or Device	5%
Defective Component or Device	5%
Derailment	36%
Derailment; Fire Temperature or Heat	2%
Deterioration or Aging	2%
Fire Temperature or Heat	5%
Human Error	2%
Human Error; Improper Preparation for Transportation; Overfilled	2%
Loose Closure Component or Device	27%
Missing Component or Device	7%
Missing Component or Device; Valve Open	2%
Valve Open; Loose Closure Component or Device	5%

Based on historical data presented in Table 28: Railroad 7 Year Incident History, North Dakota is estimated to experience 3 significant railroad incidents per year, or approximately 60

[121] US Department of Transportation, Pipeline Hazardous Materials Safety Administration, *Serious Incident Definition*, http://www.phmsa.dot.gov/portal/site/Pipeline Hazardous Materials Safety Administration/menuitem.6f23687cf7b00b0f22e4c6962d9c8789/?vgnextoid=706851d415b7c110VgnVCM1000009ed07898RCRD&vgnextchannel=8010dd246007c110VgnVCM1000009ed07898RCRD (accessed June 22, 2015).

incidents over the next 20 years. Of those 60 incidents, based on statistical data, approximately 20 of those would be estimated to be caused by derailment.

7.4 Railroad Incident Likelihood

The railroad likelihood value was derived in a multi-step process. Each county's total train miles was determined by multiplying the total linear mile of track by the average number of trains that traverse the tracks. The average number of trains per week was calculated using averaged ranges of trains per week based on the most recent available data provided by BNSF and CP Railroads. It is important to note that the actual number of trains per week can vary depending on oil production and transportation routing. This assessment should be considered as a snapshot of a regularly changing and adjusting transportation industry.

(Linear Mile of Track × Average # Trains) = Train Miles

Each county's train miles were evaluated to determine the percent of total train miles within the state.

County Train Miles ÷ State Train Miles = % Total Train Miles

The county's percent of the total train miles was then multiplied by the total number of incidents projected to occur in North Dakota within a 20-year period. This resulted in the Railroad Likelihood Value.

% Total Railroad × 60 = Railroad Likelihood Value(20-year)

The result is a projection of the number of incidents in each county over the next 20 years, from which probability is derived.

7.4.1 Railroad: Annual Probability

The 20-year probability was then annualized by dividing the railroad likelihood value by 20.

Railroad Likelihood Value ÷ 20 = Annual Probability

7.4.2 Railroad: Likelihood Rating

The likelihood rating was then assigned by examining the percent probability and assigning the appropriate value as outlined in Table 30: Railroad Likelihood Rating Table.

Table 30: Railroad Likelihood Rating Table

County	Estimated Linear Miles of Rail	# Trains per week	Total Train Miles	% Total Train Miles (Statewide)	Likelihood Value	Annual Probability
Barnes	112.97	49	5,535.53	10.22%	6.13	30.66%
Benson	34.06	3	102.18	0.19%	0.11	0.57%
Billings	22.18	7	155.26	0.29%	0.17	0.86%
Burke	28.25	4.5	127.13	0.23%	0.14	0.70%
Burleigh	45.21	14	632.94	1.17%	0.70	3.51%
Cass	180.09	50.5	9,094.55	16.79%	10.07	50.37%
Eddy	30.25	25	756.25	1.40%	0.84	4.19%
Foster	51.40	34	1,747.60	3.23%	1.94	9.68%
Golden Valley	24.03	1.5	36.05	0.07%	0.04	0.20%
Grand Forks	92.31	3	276.93	0.51%	0.31	1.53%
Griggs	31.69	25	792.25	1.46%	0.88	4.39%
Kidder	33.93	15	508.95	0.94%	0.56	2.82%
McHenry	152.10	37	5,627.70	10.39%	6.23	31.17%
McKenzie	15.16	2.5	37.90	0.07%	0.04	0.21%
McLean	41.44	4.5	186.48	0.34%	0.21	1.03%
Mercer	39.06	2	78.12	0.14%	0.09	0.43%
Morton	110.71	15	1,660.65	3.07%	1.84	9.20%
Mountrail	90.35	37.5	3,388.13	6.25%	3.75	18.76%
Nelson	26.84	3	80.52	0.15%	0.09	0.45%
Oliver	35.48	2	70.96	0.13%	0.08	0.39%
Pierce	43.34	42.5	1,841.95	3.40%	2.04	10.20%
Ramsey	44.48	3	133.44	0.25%	0.15	0.74%
Ransom	28.49	9	256.41	0.47%	0.28	1.42%
Renville	5.10	4.5	22.95	0.04%	0.03	0.13%
Richland	75.11	16.5	1,239.32	2.29%	1.37	6.86%
Sheridan	8.87	9	79.83	0.15%	0.09	0.44%
Stark	90.08	15	1,351.20	2.49%	1.50	7.48%
Steele	4.31	25	107.75	0.20%	0.12	0.60%
Stutsman	91.89	24	2,205.36	4.07%	2.44	12.21%
Traill	40.87	3	122.61	0.23%	0.14	0.68%
Ward	208.42	47	9,795.74	18.08%	10.85	54.25%
Wells	77.39	34	2,631.26	4.86%	2.91	14.57%
Williams	102.51	34	3,485.34	6.43%	3.86	19.30%

7.5 Railroad Risk

Table 31: Railroad Risk Table summarizes the likelihood, impact and associated risk in each county for railroad crude oil transportation based utilizing the methodology presented in Section 5.6: Risk.

Table 31: Railroad Risk Table

All Counties	Likelihood Level	Likelihood Value	Population	Dependent Population Facilities Impact Level	Environmental Impact Level Value	Average Impact Value	Risk Score
Barnes	high	4	5	5	5	5.00	20.00
Benson	negligible	1	5	3	3	3.67	3.67
Billings	negligible	1	5	1	1	2.33	2.33
Burke	negligible	1	5	3	3	3.67	3.67
Burleigh	low	2	5	3	3	3.67	7.33
Cass	extreme	5	5	5	5	5.00	25.00
Eddy	low	2	5	3	3	3.67	7.33
Foster	low	2	5	3	3	3.67	7.33
Golden Valley	negligible	1	5	3	3	3.67	3.67
Grand Forks	low	2	5	3	3	3.67	7.33
Griggs	low	2	5	3	3	3.67	7.33
Kidder	low	2	5	1	1	2.33	4.67
McHenry	high	4	5	5	5	5.00	20.00
McKenzie	negligible	1	5	3	3	3.67	3.67
McLean	low	2	5	3	3	3.67	7.33
Mercer	negligible	1	5	3	3	3.67	3.67
Morton	low	2	5	3	3	3.67	7.33
Mountrail	moderate	3	5	3	3	3.67	11.00
Nelson	negligible	1	5	3	3	3.67	3.67
Oliver	negligible	1	5	3	3	3.67	3.67
Pierce	moderate	3	5	3	3	3.67	11.00
Ramsey	negligible	1	5	3	3	3.67	3.67
Ransom	low	2	5	3	3	3.67	7.33
Renville	negligible	1	3	1	1	1.67	1.67
Richland	low	2	5	3	3	3.67	7.33
Sheridan	negligible	1	5	3	3	3.67	3.67

All Counties	Likelihood Level	Likelihood Value	Population	Dependent Population Facilities Impact Level	Environmental Impact Level Value	Average Impact Value	Risk Score
Stark	low	2	5	3	3	3.67	7.33
Steele	negligible	1	3	1	1	1.67	1.67
Stutsman	moderate	3	5	3	3	3.67	11.00
Traill	negligible	1	5	1	1	2.33	2.33
Ward	extreme	5	5	3	3	3.67	18.33
Wells	moderate	3	5	3	3	3.67	11.00
Williams	moderate	3	5	3	3	3.67	11.00

8 ROADWAY: CRUDE OIL TRANSPORTATION RISK AND VULNERABILITY

8.1 Roadway Vulnerable Population Impact

Table 32: Roadway Population provides, by county, the length of roadway, estimated population and structures within the buffer, and the vulnerable population impact level (Refer to Table 10: Impact Rating Scale).

The roadway network analyzed included US Highways and Interstates, major state corridors for crude oil, as well as state feeder routes.

Table 32: Roadway Population Impact

County	Estimated Linear Mile of Major Roadway	Estimated Population	Estimated # of Structures	Population Vulnerability
Adams	33.40	1,421	794	142
Barnes	43.54	4,792	2,293	479
Benson	73.26	1,212	782	121
Billings	71.98	352	265	35
Bottineau	151.07	2,228	1,650	223
Bowman	69.88	2,387	1,501	239
Burke	134.05	1,101	1,019	110
Burleigh	217.03	349	177	35
Cass	113.57	74,284	28,138	7,428
Dickey	25.24	1,383	790	138
Divide	110.14	883	626	88
Dunn	145.78	1,931	1,332	193
Eddy	18.66	1,104	794	110
Emmons	61.89	1,752	1,130	175
Foster	27.99	2,020	1,224	202
Golden Valley	94.92	55	38	6
Grand Forks	101.06	33,302	11,366	3,330
Kidder	30.19	365	279	37
LaMoure	24.49	440	277	44
McHenry	185.68	2,794	1,561	279
McKenzie	277.82	3,233	3,804	323

County	Estimated Linear Mile of Major Roadway	Estimated Population	Estimated # of Structures	Population Vulnerability
McLean	333.56	1,463	1,100	146
Mercer	127.81	290	196	29
Morton	278.23	0	0	0
Mountrail	214.39	6,182	3,963	618
Nelson	26.29	811	724	81
Pembina	62.04	1,550	951	155
Pierce	30.85	751	429	75
Ramsey	43.15	3,704	2,684	370
Renville	72.92	1,118	690	112
Richland	49.80	198	132	20
Rolette	50.55	5,737	2,732	574
Sheridan	29.49	88	64	9
Slope	40.93	267	192	27
Stark	210.60	7,236	3,618	724
Stutsman	105.26	10,888	4,594	1,089
Towner	46.11	950	798	95
Traill	30.88	833	524	83
Walsh	51.91	3,800	2,135	380
Ward	329.31	20,850	8,724	2,085
Wells	57.73	2,040	1,244	204
Williams	291.76	16,592	9,760	1,659

8.2 Roadway Vulnerable Dependent Population Facilities Impact

The potential impact of a roadway incident on facilities housing dependent populations was estimated through an analysis of the number of dependent population facilities (schools/childcare centers, includes K-12 schools and licensed childcare centers, healthcare facilities, includes assisted living facilities, skilled nursing facilities, and hospitals, and corrections facilities) within the buffer (refer to Table 33: Roadway Dependent Population Facilities Impact).

Table 33: Roadway Dependent Population Facilities Impact

County	# Schools/ Childcare	# Healthcare	# Corrections	Total # of Facilities	Facility Vulnerability
Adams	2	3	1	6	0.6
Barnes	9	2	1	12	1.2
Benson	5	0	0	5	0.5
Billings	0	0	0	0	0
Bottineau	5	1	0	6	0.6
Bowman	6	3	0	9	0.9
Burke	4	0	0	4	0.4
Burleigh	1	0	0	1	0.1
Cass	99	14	2	115	11.5
Dickey	4	2	0	6	0.6
Divide	2	3	0	5	0.5
Dunn	2	1	0	3	0.3
Eddy	2	-	0	2	0.2
Emmons	7	3	0	10	1
Foster	3	2	0	5	0.5
Golden Valley	0	0	0	0	0
Grand Forks	23	3	2	28	2.8
Kidder	2	0	0	2	0.2
LaMoure	1	1	0	2	0.2
McHenry	8	1	0	9	0.9
McKenzie	2	0	0	2	0.2
McLean	2	2	-	4	0.4
Mercer	0	0	0	0	0
Morton	0	0	0	0	0
Mountrail	6	3	1	10	1
Nelson	2	2	0	3	0.3
Pembina	7	-	0	7	0.7
Pierce	4	1	0	5	0.5
Ramsey	2	0	1	3	0.3
Ransom*	0	1	0	3	0.3
Renville	3	0	0	0	0
Richland	0	0	0	15	1.5
Rolette	11	3	1	0	0

County	# Schools/ Childcare	# Healthcare	# Corrections	Total # of Facilities	Facility Vulnerability
Sheridan	0	0	0	2	0.2
Slope	2	0	0	20	2
Stark	17	2	1	23	2.3
Stutsman	19	2	2	4	0.4
Towner	2	2	0	1	0.1
Traill	0	0	1	9	0.9
Walsh	7	1	1	21	2.1
Ward	16	5	0	4	0.4
Wells	2	2	0	21	2.1
Williams	17	3	1	6	0.6

Note: While the analysis did not identify qualifying road miles within Ransom County, the analysis did a show dependent population facility, a skilled nursing home, within the buffer zone of a road in a neighboring county.

8.3 Roadway Vulnerable Environmental Impact

Table 34: Roadway Environmental Impact provides, by county, the total area, in square miles, of crops, wetlands, and open water within the buffer, and the determined impact level. The entire area, each of these summed, is used to calculate the vulnerability for each county from which the impact level was assigned as described in 5.4.1: Impact Level.

Table 34: Roadway Environmental Impact

County	Cultivated Crops (sq. mi)	Wetlands (sq. mi.)	Open Water (sq. mi)	Total Environmental Area	Vulnerability
Adams	14.52	0.44	0.16	15.12	1.51
Barnes	21.59	1.72	1.80	25.11	2.51
Benson	34.16	3.82	9.19	47.17	4.72
Billings	7.68	0.56	0.24	8.48	0.85
Bottineau	79.35	7.50	3.14	89.99	9.00
Bowman	25.42	0.36	0.52	26.3	2.63

County	Cultivated Crops (sq. mi)	Wetlands (sq. mi.)	Open Water (sq. mi)	Total Environmental Area	Vulnerability
Burke	59.92	4.45	2.93	67.3	6.73
Burleigh	11.88	2.20	0.73	14.81	1.48
Cass	60.45	1.22	0.47	62.14	6.21
Dickey	8.09	0.71	0.21	9.01	0.90
Divide	55.31	2.95	2.78	61.04	6.10
Dunn	26.22	0.96	0.32	27.5	2.75
Eddy	6.97	0.61	0.18	7.76	0.78
Emmons	16.46	0.52	1.66	18.64	1.86
Foster	13.35	2.04	0.16	15.55	1.56
Golden Valley	13.07	0.37	0.33	13.77	1.38
Grand Forks	64.84	1.90	0.56	67.3	6.73
Kidder	60.45	1.47	0.63	62.55	6.26
LaMoure	0.00	0.94	0.10	1.04	0.10
McHenry	8.09	8.91	2.12	19.12	1.91
McKenzie	55.31	4.37	2.72	62.4	6.24
McLean	26.22	3.78	4.51	34.51	3.45
Mercer	6.97	0.30	0.01	7.28	0.73
Morton	16.46	0.03	0.00	16.49	1.65
Mountrail	13.35	3.38	3.89	20.62	2.06
Nelson	13.07	5.46	1.13	19.66	1.97
Pembina	0.00	0.29	0.41	0.7	0.07
Pierce	11.09	1.23	0.22	12.54	1.25
Ramsey	23.55	4.59	3.48	31.62	3.16
Ransom	0.00	0.00	0.00	0	0
Renville	51.44	2.07	0.90	54.41	5.44
Richland	38.64	0.85	0.20	39.69	3.97
Rolette	14.14	2.01	2.18	18.33	1.83
Sheridan	3.34	0.35	0.04	3.73	0.37
Slope	10.28	0.35	0.35	10.98	1.10
Stark	35.68	0.36	0.08	36.12	3.61
Stutsman	47.29	6.98	3.80	58.07	5.81
Towner	27.30	3.84	2.14	33.28	3.33

County	Cultivated Crops (sq. mi)	Wetlands (sq. mi.)	Open Water (sq. mi)	Total Environmental Area	Vulnerability
Traill	24.70	0.24	0.31	25.25	2.53
Walsh	41.27	0.21	0.41	41.89	4.19
Ward	90.80	7.40	4.26	102.46	10.25
Wells	29.56	2.85	0.82	33.23	3.32
Williams	113.42	7.36	3.98	124.76	12.48

8.4 Roadway Incident Likelihood

The US Census Bureau reports that on average 280 million ton-miles of crude oil product are transported by both for-hire truck and private truck in North Dakota with an average shipment traveling just 50 miles.[122]

Table 35: Roadway 20 Year Incident

	1995 - 2014	
	20 Year Average	20 Year Range
Incident Count	6	0 - 27
Fatalities	0	0
Injuries	0	0
Property Damage	$117,808	$0 - $ 775,758

Causative factors range from human error, to equipment malfunction.

Table 36: Serious Roadway Incidents by Cause: Breakdown

Failure Cause Description	% of All Accidents
Auxiliary Valve	2
Basic Material	4
Body	4
Check Valve	2
Closure (e.g. Cap Top or Plug)	2

[122] US Census Bureau. *Commodity Flow Study*, 2012, http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=CFS_2012_00A07&prodType=table (accessed June 22, 2015).

Failure Cause Description	% of All Accidents
Cover	1
Discharge Valve or Coupling	4
Excess Flow Valve	2
Fill Hole	1
Gasket	1
Gauging Device	3
Hose	9
Hose Adaptor or Coupling	4
Loading or Unloading Lines	1
Manway or Dome Cover	4
Piping or Fittings	2
Pressure Relief Valve or Device - Reclosing	2
Remote Control Device	1
Sump	1
Tank Shell	5
Valve Body	3
Vapor Valve	1
Vent	17
Washout	1
Weld or Seam	0
Not reported	48

Based on the historical data, Table 35: Roadway 20 Year Incident, North Dakota experienced 124 highway accidents from 1995 through 2014.[123] There were as many as 27 accidents in any given year during in the period 1995 – 2014. The range of incident provides a best case year/worst case year overview.

8.4.1 Roadway Likelihood Value

The roadway likelihood value was calculated in a multi-step process. First, each county's share of roadway was determined by dividing its roadway miles by total roadway miles within the state.

County Roadway Miles ÷ State Roadway Miles = % Total Roadway

[123] US Department of Transportation, Pipeline Hazardous Materials Safety Administration, *Incident Reports Database Search*, https://hazmatonline.phmsa.dot.gov/IncidentReportsSearch/ (accessed June 22, 2015).

The calculated percent total roadway is then multiplied by the number of incidents projected to occur within a 20 year period to determine the Roadway Likelihood Value.

% Total Roadway × 124 = Roadway Likelihood Value (20-year)

The result is a projection of the number of incidents in each county over the next 20 years, from which probability is derived.

8.4.2 Roadway: Percent Probability

The 20-year probability was then annualized by dividing the roadway likelihood value by 20.

8.4.3 Roadway: Likelihood Rating

The likelihood rating was then assigned by examining the percent probability and assigning the appropriate value as outlined in Table 37: Roadway Likelihood Rating Table.

Table 37: Roadway Likelihood Rating Table

County	Total Road Miles	% Total Road Miles (Statewide)	Likelihood	Annualized Probability
Adams	33.40	0.74%	0.89	4.46%
Barnes	43.54	0.97%	1.16	5.81%
Benson	73.26	1.63%	1.96	9.78%
Billings	71.98	1.60%	1.92	9.61%
Bottineau	151.07	3.36%	4.03	20.16%
Bowman	69.88	1.55%	1.87	9.33%
Burke	134.05	2.98%	3.58	17.89%
Burleigh	217.03	4.83%	5.79	28.97%
Cass	113.57	2.53%	3.03	15.16%
Dickey	25.24	0.56%	0.67	3.37%
Divide	110.14	2.45%	2.94	14.70%
Dunn	145.78	3.24%	3.89	19.46%
Eddy	18.66	0.42%	0.50	2.49%
Emmons	61.89	1.38%	1.65	8.26%
Foster	27.99	0.62%	0.75	3.74%
Golden Valley	94.92	2.11%	2.53	12.67%
Grand Forks	101.06	2.25%	2.70	13.49%

County	Total Road Miles	% Total Road Miles (Statewide)	Likelihood	Annualized Probability
Kidder	30.19	0.67%	0.81	4.03%
LaMoure	24.49	0.54%	0.65	3.27%
McHenry	185.68	4.13%	4.96	24.78%
McKenzie	277.82	6.18%	7.42	37.08%
McLean	333.56	7.42%	8.90	44.52%
Mercer	127.81	2.84%	3.41	17.06%
Morton	278.23	6.19%	7.43	37.14%
Mountrail	214.39	4.77%	5.72	28.62%
Nelson	26.29	0.58%	0.70	3.51%
Pembina	62.04	1.38%	1.66	8.28%
Pierce	30.85	0.69%	0.82	4.12%
Ramsey	43.15	0.96%	1.15	5.76%
Renville	72.92	1.62%	1.95	9.73%
Richland	49.80	1.11%	1.33	6.65%
Rolette	50.55	1.12%	1.35	6.75%
Sheridan	29.49	0.66%	0.79	3.94%
Slope	40.93	0.91%	1.09	5.46%
Stark	210.60	4.68%	5.62	28.11%
Stutsman	105.26	2.34%	2.81	14.05%
Towner	46.11	1.03%	1.23	6.15%
Traill	30.88	0.69%	0.82	4.12%
Walsh	51.91	1.15%	1.39	6.93%
Ward	329.31	7.33%	8.79	43.95%
Wells	57.73	1.28%	1.54	7.71%
Williams	291.76	6.49%	7.79	38.94%

8.5 Roadway Risk

Table 38: Roadway Risk Table summarizes the likelihood, impact and associated risk in each county for roadway crude oil transportation based incident, utilizing the methodology presented in Section 5.6: Risk.

Table 38: Roadway Risk Table

All Counties	Likelihood Level	Likelihood Value	Population Impact Level Value	Dependent Population Facilities Impact Level Value	Environmental Impact Level Value	Average Impact Value	Risk Score
Adams	low	2	5	3	3	4	7.33
Barnes	low	2	5	3	3	4	7.33
Benson	low	2	5	3	3	4	7.33
Billings	low	2	5	1	1	2	4.67
Bottineau	moderate	3	5	3	5	4	13.00
Bowman	low	2	5	3	3	4	7.33
Burke	moderate	3	5	1	5	4	11.00
Burleigh	moderate	3	5	1	3	3	9.00
Cass	moderate	3	5	5	5	5	15.00
Dickey	low	2	5	3	1	3	6.00
Divide	moderate	3	5	1	5	4	11.00
Dunn	moderate	3	5	1	3	3	9.00
Eddy	low	2	5	1	1	2	4.67
Emmons	low	2	5	3	3	4	7.33
Foster	low	2	5	3	3	4	7.33
Golden Valley	moderate	3	3	1	3	2	7.00
Grand Forks	moderate	3	5	3	5	4	13.00
Kidder	low	2	5	1	3	3	6.00
LaMoure	low	2	5	1	3	3	6.00
McHenry	moderate	3	5	3	3	4	11.00
McKenzie	high	4	5	1	5	4	14.67
McLean	high	4	5	1	5	4	14.67
Mercer	moderate	3	5	1	1	2	7.00
Morton	high	4	1	1	1	1	4.00
Mountrail	high	4	5	3	5	4	17.33

All Counties	Likelihood Level	Likelihood Value	Population Impact Level Value	Dependent Population Facilities Impact Level Value	Environmental Impact Level Value	Average Impact Value	Risk Score
Nelson	low	2	5	1	3	3	6.00
Pembina	low	2	5	3	3	4	7.33
Pierce	low	2	5	3	3	4	7.33
Ramsey	low	2	5	1	3	3	6.00
Renville	low	2	5	1	3	3	6.00
Richland	low	2	5	1	3	3	6.00
Rolette	low	2	5	3	3	4	7.33
Sheridan	low	2	5	1	1	2	4.67
Slope	low	2	5	1	3	3	6.00
Stark	moderate	3	5	3	3	4	11.00
Stutsman	moderate	3	5	3	3	4	11.00
Towner	low	2	5	1	3	3	6.00
Traill	low	2	5	1	3	3	6.00
Walsh	low	2	5	3	3	4	7.33
Ward	high	4	5	3	5	4	17.33
Wells	low	2	5	1	3	3	6.00
Williams	high	4	5	3	5	4	17.33

9 RISK AND VULNERABILITY SUMMARY

Table 39: Risk and Vulnerability Summary Table provides an overview of the total crude oil transportation risk in North Dakota. The total risk value is the sum of the risk value for each transportation mode.

Table 39: Risk and Vulnerability Summary Table

All Counties	Pipeline Risk Value	Railroad Risk Value	Roadway Risk Value	Total Risk Value
Mountrail	21.67	11.00	17.33	50.00
Williams	21.67	11.00	17.33	50.00
Ward	11.00	18.33	17.33	46.66
McKenzie	21.67	3.67	14.67	40.01
Cass	N/A	25.00	15.00	40.00
Stark	18.33	7.33	11.00	36.66
McHenry	3.00	20.00	11.00	34.00
Barnes	6.00	20.00	7.33	33.33
Dunn	18.33	N/A	9.00	27.33
Grand Forks	6.00	7.33	13.00	26.33
Burke	11.00	3.67	11.00	25.67
McLean	1.00	7.33	14.67	23.00
Billings	15.00	2.33	4.67	22.00
Bottineau	9.00	N/A	13.00	22.00
Pierce	3.67	11.00	7.33	22.00
Stutsman	N/A	11.00	11.00	22.00
Nelson	11.00	3.67	6.00	20.67
Wells	N/A	11.00	6.00	17.00
Bowman	9.33	N/A	7.33	16.66
Burleigh	N/A	7.33	9.00	16.33
Golden Valley	5.00	3.67	7.00	15.67
Ramsey	6.00	3.67	6.00	15.67
Foster	N/A	7.33	7.33	14.66
Benson	3.00	3.67	7.33	14.00
Pembina	6.67	N/A	7.33	14.00
Renville	6.00	1.67	6.00	13.67
Morton	2.33	7.33	4.00	13.66
Richland	N/A	7.33	6.00	13.33
Divide	1.67	N/A	11.00	12.67

All Counties	Pipeline Risk Value	Railroad Risk Value	Roadway Risk Value	Total Risk Value
Eddy	N/A	7.33	4.67	12.00
Mercer	1.00	3.67	7.00	11.67
Kidder	N/A	4.67	6.00	10.67
Walsh	2.33	N/A	7.33	9.66
Sheridan	N/A	3.67	4.67	8.34
Ransom	1.00	7.33	N/A	8.33
Traill	N/A	2.33	6.00	8.33
Adams	N/A	N/A	7.33	7.33
Emmons	N/A	N/A	7.33	7.33
Rolette	N/A	N/A	7.33	7.33
Slope	1.00	N/A	6.00	7.00
Dickey	N/A	N/A	6.00	6.00
LaMoure	N/A	N/A	6.00	6.00
Towner	N/A	N/A	6.00	6.00
Oliver	1.67	3.67	N/A	5.34
Steele	1.67	1.67	N/A	3.34
Sargent	1.67	N/A	N/A	1.67
Cavalier	1.00	N/A	N/A	1.00
Hettinger	1.00	N/A	N/A	1.00

10 FINDINGS AND RECOMMENDATIONS

North Dakota's overall record of safe hazardous materials transportation demonstrates that federal, state, local, and industry partnerships have been generally effective at preventing serious incidents from occurring. The safe, effective responses to significant incidents such as the Casselton and Heimdal derailments are evidence of effective partnerships on the response side. However, recent incidents from across North America illustrate that a crude oil transportation incident in a populated area could pose risk to public health and safety, the environment, and infrastructure, and test the readiness, capabilities, and coordination of state and local government.

This section identifies 39 key findings and 59 related recommendations to address gaps in current practices, regulations, or standards. The findings and recommendations were identified by subject matter experts in consultation with state and local stakeholders, as well as industry representatives. This section is organized by the various functions of federal, state, local, and private industry stakeholders as related to their capabilities in crude oil transportation: incident prevention, preparedness, and response.

Prevention

1 Finding: Most counties and cities in North Dakota do not sufficiently or specifically address the risks and vulnerabilities related to crude oil transportation nor the mitigation measures than can reduce risks.

Many county mitigation plans recognize hazardous materials (transportation and fixed facilities) as a community hazard, but they typically identify generalized mitigation strategies to reduce risk. Under 44 CFR 201.6, local hazard mitigation plans are not required to include human-caused or technological hazards. However, recognizing the risk and vulnerability associated with crude transportation and outlining strategies for reducing risk can help improve a community's resilience. Assessing and prioritizing a community's risks from possible hazards is an activity accomplished primarily at the local (county or in some cases municipal) level of government. For example, the City of Bismarck has recognized train derailments as a historic and potential hazard and has included a full hazard profile, including mitigation measures, in its most recent mitigation plan update.

In another example, Morton County recognizes hazardous materials releases in its mitigation plan. It specifically addresses crude oil (and other hazardous materials) transportation incidents, and it has developed detailed mitigation strategies to address the hazard, as shown in the excerpt below:

2014 Morton County Hazard Mitigation Plan - Hazardous Materials Mitigation Strategies

- Mitigate possibility of a train derailment and the potential for a hazardous materials release and/or explosion through decreasing train speed through Hebron.
- Hold a Hazardous Materials Forum in conjunction with Tesoro to educate the public and area businesses about how to prevent a hazardous materials spill.
- Establish and enforce use of hazardous materials transportation routes within Morton County. Identify hazardous materials routes, employ GIS mapping to depict routes, and erect signage along routes.
- Establish and enforce use of hazardous materials transportation routes and identify storage within Mandan. Identify hazardous materials routes, employ GIS mapping to depict routes, and erect signage along routes.
- Identify sites where significant quantities of hazardous materials are located, the types and quantities, use predominant wind direction and build modeling to identify areas that should evacuate, shelter-in-place or a combination thereof. Also build canned messages for Code RED. Probably use the irregular shape function on our mapping to distinguish which protective action residents in various areas should take.

ND House Bill 1068, signed into law on April 20, 2015, allows access by the Three Affiliated Tribes to the geographic information system database of pipelines located within the boundaries of the Fort Berthold Reservation. Access to this data will allow the tribes to assess risk and vulnerability for mitigation actions as well as response preparedness.

1.A Recommendation: In counties and tribal areas where crude oil is transported by pipeline, rail, or truck, local and tribal governments could foster improved resilience for crude transport hazards by addressing them in hazard mitigation plans, including a full profile of the hazard, local capability assessments, risk and vulnerability assessments, and defined protection and mitigation strategies. Mitigation plans are essential to long-term community planning and resiliency from recognized hazards. By recognizing and assessing the hazard at the local level, communities can identify and implement strategies that improve pubic and environmental safety. Counties and cities may also refer to their mitigation plans as a basis for FEMA, DHS, and DOT federal grant applications related to the identified hazards by listing the identified strategies as known risks and vulnerabilities with “shovel ready” strategies.

1.B Recommendation: Counties and municipalities, with support from the state, should consider identifying, mapping, and assessing the vulnerability of critical infrastructure located within 0.5 miles of crude oil transportation routes (pipeline, rail, and road). Local jurisdictions may also want to include mapping of demographic factors to determine social vulnerability for planning and risk communication purposes.

2 Finding: Local emergency managers expressed concerns about portions of their jurisdictions being cut off by stationary trains that block railroad crossings.

During the interview process for this report, many local emergency managers, primarily in small communities or rural areas, expressed concerns about access at grade crossings that bisect their cities and communities. They noted that trains often stop on the tracks, blocking the only crossing in town and limiting the response capabilities of emergency services.

2.A Recommendation: NDDOT should conduct a survey of local communities to determine the most impacted grade crossings, then make assessments on how to best remedy the problem.

2.B Recommendation: Local officials should consider working with state and federal officials to enforce the ND 10 minute rule provided in the ND Century Code 49-11-19.

2.C Recommendation: Local responders should pre-plan alternate emergency response routes that utilize other grade crossings. If none are available or practical, local officials may consider developing emergency grade crossings outside of train staging areas. Additional grade crossings may require property easements, road development, and coordination with railroad operators.

3 Finding: Unmarked and illegal makeshift rail crossings are safety concerns for both government officials and railroad operators.

Local emergency managers and railroad officials recognize the risks associated with unmarked and makeshift rail crossings. Motorists using unmarked crossings may not maintain situational awareness, jeopardizing their own lives and increasing the likelihood of train accidents and derailments. Additionally, instances have been cited in which makeshift grade crossings were installed so that construction vehicles can cross over tracks without using thoroughfares and established crossings. In at least one example in Trenton, a bulldozer built a temporary crossing over the rails, but no one was informed, resulting in a derailment.[124]

Property owners who wish to install a private crossing must work with railroad owners to obtain approval and meet crossing standards so that track integrity is not jeopardized.

[124] Fluke, Elizabeth (Northwest Regional Emergency Manager), Amtrak, Interview, March 19, 2015.

Senate Bill 2008, signed onto law on April 29, 2015, provides funding for one additional full time rail inspector and one temporary employee salary for the years 2017-2019. The additional staff will work for the PSC and support current railroad inspections in the state.

3.A Recommendation: Local community officials should consider working with county road departments, NDDOT, railroad operators, and private road owners to install railroad crossing signs, lights, arms, bells, rumble strips, and/or other safety devices on unmarked private crossings to remind motorists to practice caution.

3.B Recommendation: Local government road departments, local and state law enforcement, and state and federal railroad inspectors should consider monitoring roads that parallel rail lines for illegal makeshift crossings, notifying railroad operators, and denying vehicle access to those crossings.

3.C Recommendation: Local leaders and railroad operators should work together through community outreach programs and whistle-stop programs to educate the public on rail-crossing safety as well as the process for approval of rail crossings.

4 Finding: The 8-1-1 system has program gaps that leave risk of digging-related pipeline accidents.

Anecdotal evidence reveals that delays in the 8-1-1 system may leave gaps that contribute to risk of pipeline accidents caused by digging. In some instances, the 8-1-1 system cannot keep up with the volume of requests, so requesters grow impatient, and some ultimately dig before underground utilities are marked. In other cases, developers and landowners do not make the requests through 8-1-1 prior to digging. In either scenario, the consequences could be deadly and catastrophic.

4.A Recommendation: State and local authorities should consider developing strategies to enhance the 8-1-1 education and outreach program to improve property owner knowledge of and compliance with procedures before digging, and to increase awareness of potential risks related to digging near pipelines.

4.B Recommendation: The state should consider review and regular monitoring of the 8-1-1 system database to determine if pipeline data is up to date and whether there are options to the request ticketing procedure that will expedite marking utilities.

5 Finding: Many city and county officials believe that train speeds through their communities are too high.

Although first responders and emergency managers in larger cities are generally satisfied with the federally mandated 40 mph railroad speed restrictions in their jurisdictions, many small city and county officials think that train speeds through their communities are too high. Only a few local emergency managers reported that they clock train speeds to determine if trains are traveling at or under the established speed limits.

5.A Recommendation: State agencies and railroad operators should consider working together to develop educational materials that summarize current speed limits for High-Hazard Flammable Trains, as well as other cargo and passenger trains through open areas, communities, and urban areas. Rail operators should be asked to provide up-to-date summaries of corporate policy where lower speed limits are imposed through their own operations so local officials have accurate information for evaluation of train speed.

5.B Recommendation: Local officials should consider surveying operating speeds in their jurisdiction to determine if trains are operating at or under required speeds. They could also conduct transportation studies to assess whether safe operating speeds should be adjusted to reduce risk in developed areas of their jurisdictions.

6 Finding: There is little coordination between state and local law enforcement, and tribal law enforcement regarding road safety related to trucking.

State, local, and tribal law enforcement agencies could improve coordination of commercial traffic enforcement around tribal borders. Interviews with officials indicate that the lack of coordination allows for potentially unsafe trucking between jurisdictions. Although some agreements are in place to request and secure jurisdictional assistance by fellow law enforcement agencies, practices and agreements can be improved.

6.A Recommendation: State, tribal, and local law enforcement should work together to develop multi-jurisdictional roadside commercial vehicle checkpoints at state/tribal borders to ensure the appropriate law enforcement agents are enforcing safety laws for drivers and vehicles hauling crude oil.

7 Finding: Illegal dumping of crude oil production byproducts including saltwater and radioactive filter socks continues to be a problem in drilling fields.

Local emergency managers receive reports of illegal saltwater dumping along roadways. Local and NDDoH officials have also repeatedly responded to vacant properties and land where radioactive filter socks are being dumped. The illegal dumping and disposal of these waste products can negatively impact public health and the environment. NDDMR is currently considering options for tracking production saltwater disposal.

7.A Recommendation: NDDMR, NDDOT, NDDoH, NDHP, and local law enforcement departments should consider monitoring the frequency of illegal dumping in the trucking areas and prevent activity through regulation and enforcement.

7.B Recommendation: A possible solution for illegal saltwater dumping currently considered by NDDMR is to require a sign-off process for loading and unloading of saltwater at the well site and the disposal site so that all wastewater is accounted for on both ends of the hauling operation.

7.C Recommendation: NDDMR may consider proposing criminal penalties to the ND Legislature for illegal dumping of crude oil drilling byproducts, including saltwater and radioactive filter socks.

8 Finding: The state lacks a central database to track intrastate and interstate pipeline installations.

There are several state departments that maintain pipeline data including the Public Service Commission, the NDPA, and the North Dakota Industrial Commission. None of these departments maintain a central repository of pipeline data for risk analysis or response management, but each maintains pieces of a whole network based on its authority and responsibility.

8.A Recommendation: The state should consider assigning to one state department the responsibility for maintaining a central database of all operational, under-construction, planned, and proposed pipelines (including gathering, transmission, and distribution lines) in the state. With this centralized data, emergency responders can better evaluate risks and vulnerabilities, and plan for potential pipeline incidents in their jurisdictions.

8.B Recommendation: The state should consider legislation that requires sharing of private sector crude oil transportation data with state and local emergency managers, and public safety leaders for the purposes of community protection and response preparedness, providing for the protection of sensitive information.

9 Finding: The FRA One Time Movement Approval does not require railroads to report the movement of damaged rail cars to state or local authorities.

State and local emergency responders have no way to know whether damaged cars are being hauled along the tracks. They also have no way to determine if damaged cars are near or part of an accident, creating potentially higher risk if the car is unstable or patched.

In 2013, FRA issued 564 one-time movement approvals for crude oil-laden cars. Seeing an added risk, regulators have pushed for clearer markers on cars moving under one-time approvals, and the FRA believes that better identification of rail cars moving under One-Time Movement Approvals (OTMAs) listed on the train consist would provide further benefit to emergency responders as these cars generally have some type of defect.[125]

9.A Recommendation: The state should consider or support policy requiring that damaged cars in transit be clearly labeled alongside the USDOT placard so first responders can be alerted to additional risks during an incident. North Dakota could also consider developing policy, legislation, or regulation requiring crude oil carriers to notify state authorities of OTMA shipments in the state prior to any movement of a damaged rail car. Such notifications to state authorities could be disseminated to local authorities along the identified transportation route. Considerations include covering all OTMA rail cars carrying hazardous materials in bulk and residual quantities, whether full or empty.

Preparedness

10 Finding: Not all local response organizations have planning/response support documents that cross-reference railroad mile markers and grade crossing identifiers; in those that do, many responders are not familiar with them.

[125] Quarterman, Cynthia (Former Pipeline Hazardous Materials Safety Administration Administrator) *Letter to experts at the National Transportation Safety Board*. July 16, 2013, Print.

Local emergency managers and first responders may not be aware of USDOT crossing identifiers and railroad mileposts. Also known as an FRA number, each crossing is marked with a metal plate that displays the six-digit-plus-a-letter identifier. Maintaining a cross-reference guide of the two indicators (rail mile marker and FRA grade crossing identifier) can expedite response to a given location or access point, whether by responders, state and federal resources, railroad industry responders, or contract response organizations.

10.A Recommendation: Local emergency managers should consider working with the FRA, NDDOT, and railroad owners to develop and maintain a local database, along with printed reference sheets for field use, of street crossings, railroad mileposts, and USDOT crossing identifiers. These documents would not generally be available or designed for public use but should be maintained and readily available to police, fire, EMS, and emergency managers to communicate exact incident locations for responding resources. An example cross-reference table is provided below:

Table 40: Mountrail County Road/BNSF RR Crossing Milepost Table

Road Crossing/Reference Point	BNSF Milepost	USDOT Crossing Identifier
Mountrail/Ward County Line	61.394	---
Main Street	82.113	035760D

Note: The mileposts and crossing identifiers are for reference only and not actual mileposts or identifiers.

The FRA Office of Safety maintains a public highway-rail crossing inventory that can be utilized to collect USDOT crossing identifiers. Local inventories can be queried through the FRA website: http://safetydata.fra.dot.gov/officeofsafety/default.aspx , under Section 8 – Highway-Rail Crossing Inventory.

11 Finding: Crude oil storage and transportation companies do not regularly attend Local Emergency Planning Committee (LEPC) meetings.

Most North Dakota counties with crude oil transport hold regular LEPCs meetings. Although refineries and many natural gas carriers participate in these meetings, counties reported rare to no attendance from crude oil transportation carriers. Most of the major crude oil pipeline and railroad companies do not have full time staff in North Dakota to regularly attend meetings, but Class 1 railroads and pipeline companies have indicated they will attend, if invited, based on staff availability. Motor carriers are not well identified in the state, making it difficult for local emergency managers to invite them.

11.A Recommendation: LEPCs should invite and seek attendance by crude oil transportation companies, and transportation companies should send representatives to LEPC meetings as often as possible. The LEPC is the forum for local responders and industry officials to meet and discuss risk, vulnerability, capability, and concerns for coordinated safety, preparedness, response, and mitigation of crude oil transportation incidents.

12 Finding: Some LEPCs have limited active membership and participation in the community's emergency response planning, particularly related to crude oil transportation response preparedness.

Some of the local emergency managers interviewed during the discovery process of this report stated that their LEPCs were not active in response preparedness planning. In certain cases, LEPCs reportedly only had one or two members.

12.A Recommendation: Local emergency managers should consider reviewing the ND LEPC handbook and seeking support of the SERC to develop better participation of local public safety, community leaders, and companies that produce, store, or transport hazardous materials, and to develop or enhance current hazardous materials transportation incident plans through active LEPC involvement.

12.B Recommendation: The SERC may consider polling local emergency managers to determine which counties need assistance enhancing LEPC membership, participation, and activity.

12.C Recommendation: The SERC may consider developing a crude oil transportation incident response planning committee to develop guidance and work with LEPCs to develop local incident specific response plans and capabilities.

13 Finding: Facilities meeting the requirements for storage and handling of hazardous materials, as outlined in the USEPA Risk Management Plan Rule, must maintain a risk management plan and update it every five years.

Facilities meeting the USEPA criteria under the Risk Management Plan Rule are required to develop and submit a risk management plan to the USEPA for review every five years. Additionally, the SERC, LEPC, and local emergency responders may review risk management plans for situational awareness and response planning. Community population growth, business and residential development, cyclical changes in environmental conditions (e.g. drought, flood, extreme seasonal temperatures), and long-term climate change can impact emergency response planning and

operations when considering evacuations, sheltering, firefighting operations, and environmental protection related to hazardous materials releases.

13.A Recommendation: LEPCs and local emergency responder departments should consider reviewing local facility risk management plans at least annually to determine if community development or environmental changes/conditions have newly assumed risks and vulnerabilities related to potential facility incidents, then update local emergency response plans accordingly.

14 Finding: Many local volunteer first responders need better communications training related to general radio use and the use of Bank 5.

Volunteer departments whose staff rarely utilize mobile and portable radios may not be comfortable with using them and do not understand radio communication protocols or procedures. They may have difficulty effectively communicating via the statewide interoperable communications radio channels located in the state's Bank 5 mobile radio system.

14.A Recommendation: NDDES should consider development of web-based and hands-on training and exercise programs that familiarize local responders with emergency and non-emergency radio operations, including the use of Bank 5. Web-based training would allow volunteers to schedule training so as to work around other commitments, while follow-up hands-on training – possibly through a train-the-trainer program – would cover operational use and familiarity with equipment and standard procedures. Additionally, the web-based training could provide opportunities for annual refresher training and/or training on procedure modifications.

15 Finding: Many local emergency managers must split their time and focus on other job assignments.

Many local emergency managers hold other job functions in their jurisdictions, such as 9-1-1 Coordinator, Tax Director, Floodplain Manager, and Community Planner. This limits time available to plan and prepare for emergencies. Some emergency managers are allotted as few as 10 hours per week for emergency management duties.

Budget limitations often prevent full-time staffing, but comprehensive and effective emergency management requires time and discipline to maintain required plans, communicate with the public

about risks and preparedness, facilitate training and exercises, manage incidents, and address mitigation and recovery strategies to ensure a community's resilience against disasters.

15.A Recommendation: Emergency managers need to be able to focus on and develop effective programs, maintain professional development and credentials for their positions, and assist organizations with response roles to obtain the necessary skills through training and exercise. County and community leaders should consider identification or development of revenue to support a full-time emergency manager in each county or consider resource sharing among neighboring counties to create a full-time emergency manager position that serves the larger community or region.

15.B Recommendation: Local and state emergency management leaders should consider researching and seeking grants that support emergency management positions in all North Dakota counties and tribal nations.

16 Finding: Many local first responders are not adequately trained to manage or operate at a large crude oil incident.

Some local responders have had crude oil transportation incident training through the rail companies or the Security and Emergency Regional Training Center in Pueblo, Colorado, but the majority lack the specialized training. Local volunteer firefighters and emergency medical technicians (EMTs) are limited by funding and availability of specialized training opportunities.

16.A Recommendation: The state, North Dakota Firefighters Association (NDFA), and the crude oil transportation industry should work together to identify, fund, and offer specialized hazardous materials response training to local, state, and tribal responders. These partners should consider providing training that meets the appropriate response level criteria of NFPA 471: Recommended Practice for Responding to Hazardous Materials Incidents. The state, NDFA, and the crude oil transportation industry should consider training and certification that meet the nationally accepted standards of the Pro Board Fire Service Professional Qualifications System or the International Fire Service Accreditation Congress, the latter of which are developed and maintained in concert with NFPA 471. The state should consider requiring that law enforcement officers participate in at least awareness level hazardous material response training.

North Dakota Senate Bill 2008, passed into law on April 29, 2015, requires that railroads make training available to all fire departments having jurisdiction along routes where unit oil trains travel. Under the new law, initial training must be made available by June 30, 2016, with refresher training made available at least every three years. The training must address the general hazards

posed by oil, response strategies, incident command operational considerations for fire suppression and evacuation, and hazard impact assessments for the public and the environment, including suggested practices for accomplishing these tasks.

17 Finding: Not all local jurisdictions have written evacuation /sheltering plans.

Based on information provided through interviews and surveys, many local emergency managers do not have evacuation and sheltering plans. Some stated that they are familiar with identified or potential shelter locations, while others have no identified plan or strategy.

17.A Recommendation: NDDES, NDDoH, and ND Department of Human Services could enhance local public safety operations by providing assistance with development of local evacuation and sheltering plans. Assistance can include planning templates or outlines to support local planning and response management efforts, particularly in areas where staffing resources are limited. This support would also ensure that plan structure/format is consistent across counties. A consistent plan structure reduces confusion for responding state and mutual aid resources.

18 Finding: Local emergency managers and first responders currently have insufficient coordination and relationships with pipeline, rail, and motor carrier companies.

Only a few local emergency managers and first responders report having developed relationships with pipeline, rail, and motor carrier companies that operate in their jurisdictions. Some local authorities do not know the names of the railroad or pipeline companies that have infrastructure in their counties. Few local emergency managers and first responders know the names of the primary motor carriers transporting crude in or near their jurisdictions.

18.A Recommendations: The state and local jurisdictions should consider working together to identify and engage crude oil transportation industry representatives so that communication and coordination processes are established in advance of an incident.

18.B Recommendation: Private and public sector partners with a role in crude oil transportation and related preparedness and response activities should consider developing and maintaining communication forums through local, regional, or state meetings and conferences, LEPC meetings, or joint training opportunities provided by the state and industry.

19 Finding: Local firefighting foam capabilities are not sufficient to fight large-scale crude oil spills.

Fire departments have to rely on mutual aid resources, RRTs, and other nearby partners like airports and military installations to augment foam supplies in an incident. There are many types of foam, each serving a slightly different purpose, and each has a different application procedure or tool. Fire departments will stock foam based on their most likely need, from a Class A foam (used on Class A combustibles like wood) to AFFF (used on flammable liquids) or other types of foam. Additionally, foam can vary from 1% - 6% concentration, so it is not likely that all municipal fire departments will use the same types of foam, and even less likely that they will stock the same foam as local airports and military installations.

19.A Recommendation: NDDES and NDFA could work together to establish a statewide standard for firefighting foam for municipal fire department operations at a crude oil spill. Once the standard is defined for the state, NDDES and North Dakota Firefighters Association then can work with local fire departments and partner resources to bring local response organizations to the standard and ensure that sufficient foam caches are available to support firefighting operations.

19.B Recommendation: The NDFA should consider conducting a study to determine how much firefighting foam is required to maintain operations on a crude oil spill with and without fire. The study would be based on the average amount of crude oil involved in pipeline, rail, and roadway incidents, and the anticipated amount of foam required to maintain a foam blanket over the duration of response operations.

19.C Recommendation: Based on results of the recommended study in 20.B (how much firefighting foam is required to maintain operations), NDDES should consider purchasing and strategically placing adequate supplies of firefighting foam and application tools for rapid deployment.

20 Finding: Local emergency operations plans, annexes, incident response plans, and standard operating procedures/guidelines do not adequately address crude oil transportation incidents.

Some, but not all, local emergency operations plans address hazardous materials incident responses. Of those that do address hazardous materials incidents, most typically do not provide

specific response guidance for crude-oil transportation incidents including pipeline, rail, and roadway incidents.

20.A Recommendation: State departments including NDDES and NDDoH could work with local emergency managers to develop crude oil release incident response annexes. Suggested topics to cover include:

- Preparedness, monitoring, and situational awareness for crude oil transport incident risk
- Public awareness and risk communication responsibilities, and activities specific to crude oil transport incidents
- Support resources (public, private, and industry) that are available to support incident response and management
- Contact information for relevant railroads, pipelines, and motor-carriers; the NRC; and other resources
- Evacuation zones and shelters
- Operational guidance, including a "toolkit" covering reference equipment and tools needed to assess the incident (e.g., Emergency Response Guidebook)
- A list of geographic and environmental factors that may influence the management/ outcome of an incident
- Coordination procedures with regional, state, and federal resources.

21 Finding: Local emergency managers have little access to information regarding trucking industry operations or safety compliance.

Motor carriers play a significant role in transportation of crude oil within the drilling field, from well pads to transload facilities. Unlike in the rail and pipeline sectors, many of these carriers are small, independent operators. When incidents occur on roadways, local responders typically have to rely on truck drivers to determine the responsible party for the incident.

21.A Recommendation: The state should consider developing a database of approved motor carrier operators in North Dakota and provide access to local responders so officials know who is transporting crude oil through their jurisdictions and facilitate determination that those carriers meet state and federal compliance regulations.

22 Finding: Gaps in regional planning and coordination related to crude oil transportation response preparedness could diminish effectiveness and efficiency when an incident requires response from multiple local jurisdictions.

Many state and local officials report that there are verbal and/or written mutual aid agreements in place to provide support to local emergency response. However, regional (multi-county) planning for such incidents is not currently coordinated.

22.A Recommendation: NDDES has established emergency management regions and provides regional coordinators to assist local governments with planning and response efforts. These coordinators could work with local emergency managers and response organizations to develop and maintain regional crude oil transportation incident response capabilities, written mutual aid agreements, and multi-jurisdiction coordination strategies.

23 Finding: No single state department currently maintains a centralized, comprehensive database of crude-oil incident response equipment and resources.

NDDES maintains a list of equipment purchased through state and federal grant funds, but does not currently maintain a database of equipment status, location, or a replacement schedule. Responses to crude oil spills or fires in the state may involve local, county, state, and federal agencies as well as response assets from the carrier and its contractors. Coordination of these efforts to provide for an integrated and effective response can be challenging, particularly during critical initial phases, which can have significant impacts on outcomes and impacts of an incident. One challenge to an effective response is a clear understanding of available firefighting, safety, spill containment, medical, and other response resources. For example, the first responders to an incident involving a train derailment, spill, and fire might be unaware of other department, federal agency, or industry assets staged nearby, such as the US Department of Defense's firefighting equipment and resources. Having knowledge of what those capabilities are, where they are located, their availability, and procedures for accessing them could greatly benefit an effective, timely response.

23.A Recommendation: NDDES should consider development of a comprehensive database of applicable federal, state, and local equipment and resources, including location, availability, and procedure for activation, deployment, and mobilization. The database could include a listing of state-approved private spill management contractors including their available equipment (pending the private contractors' willingness to share such information). The database could also identify the jurisdiction, assets, and capabilities of response agencies and organizations, both public and private. This would improve the ability to identify any gaps in

planning, preparedness, and response capabilities. Through the routine interaction necessary to maintain this data, database management would also improve communication and coordination among government agencies at all levels, as well as with the transportation companies and their supporting response organizations.

24 Finding: The state does not maintain a database of qualified oil spill response contractors.

There are several established spill response contractors operating in the state. Other small firms are also starting business throughout the Bakken field. The state does not currently maintain a means to identify and track spill response companies' capabilities, equipment, and operational procedures.

24.A Recommendation: The state should consider support or passage of policy, law, or regulation, that requires private spill response contractors operating in North Dakota to provide a list of qualifications, equipment, and means of safe collection, transport, and disposal of crude oil products involved in a spill. A database of this information can be used to enlist available resources who can provide specialty services and/or equipment to address specific response needs. The database would also help to confirm that private spill response contractors operating in the state meet state and federal requirements for hazardous materials collection, transportation, and disposal.

25 Findings: Federal, state, and industry training and readiness information is often difficult to locate and access.

Many federal, state, and industry informational resources related to preparedness and response are available to local emergency managers and responders. However, much of this information is scattered across multiple sources and is not adequately advertised. This often prevents local emergency managers and first responders from availing themselves of grants, training, and support that may be readily accessible, sometimes at no cost. Given the fiscal constraints that many local governments face, every opportunity should be made to maximize existing opportunities.

25.A Recommendation: In conjunction with state associations such as NDFA and North Dakota Emergency Management Association and in concert with the state's 2015-2017 Multi-Year Training and Exercise Plan, NDDES should consider development of a comprehensive, one-stop web portal to provide access to training opportunities, grants, and other preparedness and response resources, including National Incident Management System/ Incident Command

System courses, Security and Emergency Response Training Center, the American Petroleum Institute, the US Centers for Disease Control and Prevention, and the Rural Domestic Preparedness Consortium.

TRANSCAER, a national outreach effort of volunteer representatives from the chemical manufacturing, transportation, distributor, and emergency response industries as well as government agencies, offers first responder and community training along railroads. Local and state emergency managers should consider working with TRANSCAER to develop program offering schedules and publicize TRANSCAER and whistle-stop rail training programs to local response organizations and emergency managers.

26 Finding: North Dakota has no legal mechanism for collecting information on the transportation of crude oil through the state.

Maintaining an adequate data collection system and knowledge base regarding crude oil transportation in the state is essential to public safety. Currently, no governmental agency at either the state or federal level collects this information for current tracking of petrochemical products. This information gap limits the ability to adequately prepare for and respond to crude oil transportation emergencies

26.A Recommendation: North Dakota should consider development of policy or legislation that would require crude oil producers and carriers to provide timely, up-to-date information on the volume and characteristics of crude oil moving in the state. Crude producers and shippers would regularly report average daily quantities being transported via each mode and route, and projections for near-term future shipment quantities. Reporting could be to a federal agency, to simplify the burden of reporting requirements, via a tool that would provide appropriate immediate access to state and local governments.

27 Finding: Required oil train traffic notifications from the railroads to the state have too great a range of traffic volume for effective planning purposes.

Federal rules require that any train hauling over 1 million gallons of crude (approximately 35 tank cars) notify the State Emergency Response Committee (SERC) regarding the movement of such trains through each county. The SERC noted that they are rarely notified in advance of train movement and are only notified when a 25% or more change in total volume occurs.

The 25% change in volume requirement, given a range of 25-45 trains per week (in some cases), means that railroads will notify the state when that range drops below 20 or exceeds 51 trains per week.

27.A Recommendation: The state should consider asking the FRA to require railroads to notify the SERC in advance of scheduled shipments with a smaller range of traffic volume (e.g. no more than a 10 train per week range variance) or when a 10% or greater change in traffic volume is scheduled to occur. Doing so will provide better response planning data in determining areas of risk based on rail traffic volume.

Response

28 Finding: Local first responder staffing limitations constrain operational capabilities.

Almost all first responder departments report limited response capabilities and staffing; these would likely be exceeded in large-scale response incidents. In areas where volunteers serve as the primary response force, there are consistent concerns about staffing numbers, aging volunteers, and availability of first responders in an emergency.

Staffing limitations are a legitimate concern when considering response to disaster incidents. Even the largest cities in North Dakota would require additional resources to maintain multiple operational periods in a large and complex incident. The concern is even greater in smaller communities, which may not have the revenue, or have otherwise not made the investment, to develop career responder organizations and are thus forced to rely on a limited volunteer base to staff firefighter and EMT positions. Full-time job requirements, often outside an individual's home community, may undermine the availability of volunteers, particularly among younger working-age populations. Meanwhile, as current volunteers age, they retire, resulting in attrition among responder ranks.

While written and verbal mutual aid agreements exist between local jurisdictions, the availability and capability of mutual aid resources may not be enough to augment local response needs during disaster incidents.

Purchasing additional equipment and tools are of limited utility without requisite staffing. And even small, otherwise-manageable incidents become more serious for understaffed departments.

28.A Recommendation: Local jurisdictions and NDDES should consider funding opportunities to support staffing and training of first responders as a preparedness and operational priority.

28.B Recommendation: The state could explore supporting additional regional resources that provide a broader complement of emergency services. For example, RRTs focus on hazardous-materials response staffing, certification, and equipment. Their resource is therefore limited to specific tasks and capabilities. NDDES supported firefighting, emergency medical services, and law enforcement capabilities, similar to the structure of the hazardous materials RRTs, could augment local response services by providing authorized, qualified, capable, and equipped first responders in a relatively short deployment time.

29 Finding: Local first responders need real-time access to cargo manifest data for rail and road shipments.

In an oil incident, first responders often have to rely on drivers and train engineers to advise them of cargo on board. During an incident, communication and information sharing may be hindered if the vehicle operator is injured, killed, or otherwise unavailable. Having real-time access to cargo data would expedite public safety and response operations.

29.A Recommendation: The railroad and motor carrier industries have developed mobile applications – QCMobile and AskRail – that provide the real-time cargo manifest data first responders need. State and local authorities should consider working with industry to provide first responders the required training and security clearances to utilize the mobile applications and to enable each responding jurisdiction to have access to and training on those applications.

30 Finding: First responders need to be more familiar with using the Emergency Response Guidebook (ERG) and Safety Data Sheets (SDS).

Most first responders and especially firefighters receive basic hazardous materials incident-response training, which includes basic coverage of the ERG and SDS, but such training does not always establish working familiarity with these resources. The ERG and SDS provide the basic information needed to support personal and public health protection from harmful materials, including certain warnings related to reactivity to air and water, flame impingement, and other environmental factors.

30.A Recommendation: NDDES should consider a mandate that all first responders (fire, police, and EMS) attend an annual training/refresher course in hazardous materials response. This

training/refresher could include an ERG and SDS practicum that supports application and understanding.

30.B Recommendation: NDDES should consider working with state and local first responders to provide for availability of the most recently published ERG and to require the ERG be stored and readily available in all response vehicles (including fire apparatus, police cars, ambulances, emergency management vehicles, mobile command vehicles, etc.)

31 Finding: Few local jurisdictions maintain Standard Operating Guidelines for crude oil transportation incidents.

Most local jurisdictions' operations plans and tactics are written into Emergency Operations Plans (EOPs) and Standard Operating Procedures/Standard Operating Guidelines (SOPs/SOGs). Although EOPs and SOPs/SOGs provide the foundation for response management at an administrative level, they are not intended as tactical response guides, and they are not generally readily accessible to first responders (police, fire, EMS, and emergency managers) when responding to an incident or establishing operations. Also, EOPs and SOPs/SOGs rarely provide tactical procedures or task lists. Those response groups who do not maintain SOGs may not have written guidance for the roles, responsibilities, and tasks for ICS positions to manage incident specific responses to a crude oil spill. Crude oil incident response SOGs should be developed and available for on-scene reference by responders to guide operations and tasks while improving safety and incident outcomes.

31.A Recommendation: Local response groups should consider development of a Crude Oil Transportation SOG that provides specific tactics and responsibilities designed to support responder safety while expediting operations. The new SOG would outline use of ICS, appropriate and adequate personal protective equipment, procedures for notifying and activating resources (including contact information), immediate evacuation operations based on ERG-127 (guide for initial response to flammable liquids incidents), and radio communication procedures using Bank 5.

32 Finding: Regional Response Team roles, responsibilities, and capabilities are not clearly understood by local first responders and emergency managers.

Local first responders and emergency managers have differing expectations and varying degrees of understanding of what the RRTs can and will do during incident response. Many think that the RRTs will serve as the primary response team to mitigate the incident, while others understand

that the RRTs will support local operations through limited equipment, staffing, and functional capabilities.

32.A Recommendation: NDDES and the RRTs should consider steps to improve educational outreach to local first responders detailing the regional roles and responsibilities of the RRTs, including how they will interface with the incident management team, operational teams, and other responding resources. Additionally, RRTs can also train with response departments in their regions so that local responders fully understand what services the RRTs provide and how all parties will coordinate during an incident. When realistic expectations are established, local responders can adjust response plans as needed, including requesting additional specialized resources as appropriate.

33 Finding: Local expectations regarding the North Dakota Department of Health's response time to assist with evacuations are not realistic.

During interviews, NDDoH representatives advised that their agency typically requires 48 hours to deploy and establish evacuation support of vulnerable populations. Historic accounts of power outage events and floods shows that local responders and healthcare living facilities were not prepared for, nor aware of, the time required to mobilize NDDoH support for evacuations.

33.A Recommendation: Through the use of regional health district staff, webinars, and outreach efforts, NDDoH could better educate and inform local responders about the activation and deployment process for NDDoH assets, including registered volunteer health professionals activation and mobilization, and equipment staging/movement. It may also be beneficial to deliver educational programs to nursing homes and healthcare facilities so that all stakeholders can be prepared to initiate evacuation procedures early.

34 Finding: Hospitals and emergency medical services in North Dakota have not kept pace with the increase in potential need for trauma care.

The oil boom in North Dakota has generated an influx of population and high injury-risk jobs around the state, particularly in the Bakken field. Emergency managers reported that most of their local hospitals and emergency medical services are not equipped to provide urgent trauma care to accident-related injuries including respiratory exposure, crushing injuries, and burns. Emergency medical services in North Dakota are able to provide only limited advanced life support operations, and due to limited care and response times to trauma centers, air ambulances may be required to

transport unstable and critical patients to out-of-state facilities. Transportation resource can also be limited by weather conditions or access to accident sites, leaving critical patients at greater risk.

34.A Recommendation: Hospitals should consider identifying and seeking trauma care funding through federal programs, such as the Patient Protection and Affordable Care Act (PPACA). The state could also explore avenues to increase funding to institute better trauma care capabilities for emergency medical services and emergency rooms at public regional and local hospitals.

35 Finding: Public notification systems may not adequately reach all impacted populations.

Most local governments are equipped with public emergency notification systems such as mobile alert programs, but their effectiveness is limited by low program subscription rates and incomplete communications-network coverage. Many programs rely on "opt-in" programs, but transient populations and new residents may not opt-in to receive emergency messages, or they may not be aware of the opportunity. Also, in parts of rural North Dakota, particularly on reservations, cell phone coverage is inadequate, and many residents do not have landline phones, so telephone communications cannot provide adequate notification coverage.

35.A Recommendation: State and local governments should consider developing community education programs that highlight the importance of opting-in to emergency local emergency notification systems. Outreach programs to transient workers could be developed and delivered on a monthly basis at temporary housing facilities around the state.

35.B Recommendation: The state should consider further development and expansion of the Integrated Public Alert and Warning System (IPAWS) through local Public Safety Answering Points (PSAPs) and State Radio so that notification of local emergencies can be automatically provided by local jurisdictions to cell phone users via Wireless Emergency Alerts. The state can continue to work with local PSAPs to ensure they are programmed to process the following (non-weather) emergency and warning Emergency Alert System (EAS) codes:

Table 41: Non-Weather-Related EAS Event Codes

EAS Test Codes	Emergency Codes
RWT – Required Weekly Test	LAE – Local Area Emergency
RMT – Required Monthly Test	CEM – Civil Emergency Message
	TOE – Telephone Outage (9-1-1) Emergency
	CAE – Child Abduction Emergency

Evacuation Codes	Warning Codes
EVI – Evacuation Immediate	CDW – Civil Danger Warning
SPW – Shelter-In-Place Warning	FRW – Fire Warning
	HMW – Hazardous Materials Warning
	LEW – Law Enforcement Warning
	RHW – Radiological Hazard Warning

35.C Recommendation: The state should consider working with rural areas and tribal reservations where IPAWS does not reach community members (wireless "dead zones") to identify funding support to install outdoor warning sirens that will alert communities of an emergency and then direct them to radio, television, or emergency alert radios for more information. State, local, and tribal leaders also can develop programs to distribute emergency alert radios to the community for EAS warnings.

36 Finding: Certain critical firefighting assets are not easily attainable via existing US Department of Homeland Security grant programs.

The Department of Homeland Security (USDHS) publishes an authorized equipment list that is eligible for grant funding, but the list does not include foam concentrate, appliances, and equipment that is critical for responding to incidents involving crude oil.

36.A Recommendation: The state, North Dakota Firefighters Association, and LEPCs should consider asking the USDHS to update the authorized equipment list to include crude oil firefighting equipment and supplies.

37 Finding: North Dakota toxic-plume modeling capabilities are limited by equipment and staffing resources.

A large-scale emergency often exhausts resources at the municipal and county levels and requires support from the state. Using lessons from the Lac-Mégantic incident, a similar crude oil release would have site contamination concerns and fire or explosions that create a toxic cloud of smoke significant enough to trigger an environmental health emergency. These types of impacts must be assessed before an incident to address planning, capability, training, and other preparedness actions.

NDDES, the RRTs, and NDDoH possess some capability to support or conduct plume modeling for hazard prediction and assessment of environmental impacts. These capabilities are employed as part of the department's day-to-day function and activities, but equipment maintenance, and staff training and availability are limiting factors in their use.

37.A Recommendation: North Dakota should consider development of effective airborne contaminant plume modeling capability to assist first responders. Data considered should include prevailing wind-mapping models and immediate access to weather forecasts for an impacted area. NDDES and NDDoH should consider identification of the most appropriate modeling tools available and development of appropriate training to assist state department and local first responders in use and application.

Utilizing plume modeling as part of incident pre-planning and onsite incident operations to account for prevailing and/or current weather conditions can aid evacuation and sheltering operations and reduce public health emergencies.

The National Center for Biomedical Research and Training, Academy of Counter-Terrorist Training at Louisiana State University offers an Introduction to Computer-Aided Management of Emergency Operations (CAMEO) course. The USDHS-certified, free course provides training on the use of the CAMEO suite including Area Locations of Hazardous Atmospheres (ALOHA) and Mapping Application for Response, Planning, and Local Operational Tasks (MARPLOT).[126]

38 Finding: State emergency notifications may not reach all tribal residents.

Because Native American tribes are sovereign governments operating independently from the state, they may experience gaps in receiving notifications through the state notification system, meaning that some of their residents may not receive prompt alerts regarding incidents that could affect them.

38.A Recommendation: NDDES and the tribes should consider working together to improve shared communications through current emergency notification systems so that tribal officials can alert their responders and populations of incidents that may affect their

[126] National Center for Biomedical Research and Training, *Introduction to Computer-Aided Management of Emergency Operations (CAMEO) Suite (PER-229)*, http://www.ncbrt.lsu.edu/catalog/performance/icameo.aspx (accessed June 22, 2015).

communities. Tribal emergency managers should consider a protocol to make notification to NDDES State Radio of incidents that may affect areas off tribal lands.

39 Finding: The emergency management software used by the state is not utilized to provide real-time needs for public health and medical services operations coordinated through NDDoH.

NDDoH manages the state's Public Health and Medical Services EOC and response function for the state in a virtual environment separate from the physical State EOC operating out of NDDES. Although this EOC's operational capabilities, resources, and tools are an exemplary practice at the state level, its response operations require a real-time situational awareness tool or operating picture to improve capabilities and expedite activations, deployments, and mobilization of equipment caches.

The state uses an emergency management software program that includes operational boards for display of incident information, but information is not provided rapidly enough to impact NDDoH's real-time operations. The software is used primarily as an Incident Action Plan development tool, and it serves that purpose well, but the current operational configuration does not provide the real-time information needed to make immediate operational/incident command-based decisions.

39.A Recommendation: The state should consider research to identify operational tools that can be integrated with the state's emergency management software and provide a real-time common operating picture to enhance situational awareness in support of tactical and operational decision making. Given the large volunteer base, equipment cache, and medical reserves managed by NDDoH, expedited information exchange would enhance response times for all provided services to impacted areas.

APPENDIX A: OTHER BILLS IN THE 114TH CONGRESS OF RELEVANCE

Number	Name	Sponsor	Date Introduced	Date Referred to Committee	Summary
H.R. 2834	To enact certain laws relating to the environment as title 55, United States Code, "Environment"[127]	Rep. Tom Marino [R-PA]	6/18/2015	6/18/2015	The purpose of this Act is to codify certain existing laws relating to the environment as a positive law title of the United States Code.
S. 1462	Eliminating Dangerous Oil Cars and Ensuring Community Safety Act[128]	Sen. Charles Shumer [D-NY]	5/22/2015	5/22/2015	Bill to improve the safety of oil shipments by rail and for other purposes.
H.R. 2379	To prohibit the transportation of certain volatile crude oil by rail.[129]	Rep. Nita Lowey [D-NY]	5/15/2015	5/18/2015	To prohibit the transportation of certain volatile crude oil by rail

[127] US Congress, *H.R.2834 - To enact certain laws relating to the environment as title 55, United States Code, "Environment."* https://www.congress.gov/bill/114th-congress/house-bill/2834/text (accessed June 29, 2015).
[128] US Congress, *S.1006 - Eliminating Dangerous Oil Cars and Ensuring Community Safety Act* https://www.congress.gov/bill/114th-congress/senate-https://www.congress.gov/bill/114th-congress/senate-bill/1462/text?q=%7B%22search%22%3A%5B%22%5C%22s1462%5C%22%22%5D%7D (accessed June 29, 2015).
[129] US Congress, *H.R.2379 - To prohibit the transportation of certain volatile crude oil by rail.* https://www.congress.gov/bill/114th-congress/house-bill/2379/text?q=%7B%22search%22%3A%5B%22%5C%22hr2379%5C%22%22%5D%7D (accessed June 29, 2015).

Number	Name	Sponsor	Date Introduced	Date Referred to Committee	Summary
S. 1175	Hazardous Materials Rail Transportation Safety Improvement Act of 2015[130]	Ron Wyden [D-OR]	4/30/2015	4/30/2015	To improve the safety of hazardous materials rail transportation, and for other purposes
H.R. 2074	The Toxics by Rail Accountability and Community Knowledge (TRACK) Act[131]	Rep. Donald Norcross [D-NJ]	4/28/2015	4/29/2015	Bill to "improve hazmat-by-rail safety by implementing a series of recommendations made by the National Transportation Safety Board (NTSB) following the 2012 train derailment in Paulsboro, NJ.
S. 1041 H.R. 1930	End Polluter Welfare Act of 2015[132]	Sen. Bernard Sanders [I-VT]/ Rep. Keith Ellison [D-MN]	4/22/2015	4/22/2015	Amends a variety of environmental acts, including, the Oil Pollution Act to eliminate the limitation on liability for offshore facilities and pipeline operators for oil spills

[130] US Congress, *S.1175 - Hazardous Materials Rail Transportation Safety Improvement Act of 2015*, https://www.congress.gov/bill/114th-congress/senate-bill/1175/text?q=%7B%22search%22%3A%5B%22%5C%22s1175%5C%22%22%5D%7D (accessed June 29, 2015).

[131] US Congress, *All Bill Information for S. 546 – RESPONSE Act of 2015*, https://www.congress.gov/bill/114th-congress/senate-bill/546/all-info#summary (accessed June 29, 2015).

[132] US Congress, *S.1041 - End Polluter Welfare Act of 2015,* https://www.congress.gov/bill/114th-congress/senate-bill/1041?q=%7B%22search%22%3A%5B%22%5C%22s1041%5C%22%22%5D%7D (accessed June 29, 2015).

Number	Name	Sponsor	Date Introduced	Date Referred to Committee	Summary
S. 1006	Positive Train Control Safety Act[133]	Sen. Dianne Feinstein [D-CA]	4/16/2015	4/16/2015	Bill to modify specific sections of Section 20157 (a) (1) of title 49, U.S. Code. Among the changes is incentivizing early adoption of positive train control.
S. 1006	Positive Train Control Safety Act[134]	Sen. Dianne Feinstein [D-CA]	4/16/2015	4/16/2015	Bill to modify specific sections of Section 20157 (a) (1) of title 49, U.S. Code. Among the changes is incentivizing early adoption of positive train control.
H.R. 1804	Crude-By-Rail Safety Act[135]	Rep. Jim McDermott [D-WA]	4/15/2015	4/16/2015	Bill to protect the public, communities across America, and the environment by increasing the safety of crude oil transportation by railroad, and for other purposes.

[133] US Congress, *S.1006 - A bill to incentivize early adoption of positive train control, and for other purposes* https://www.congress.gov/bill/114th-congress/senate-bill/1006?q=%7B%22search%22%3A%5B%22%5C%22s1006%5C%22%22%5D%7D (accessed June 29, 2015).

[134] US Congress, *S.1006 - A bill to incentivize early adoption of positive train control, and for other purposes* https://www.congress.gov/bill/114th-congress/senate-bill/1006?q=%7B%22search%22%3A%5B%22%5C%22s1006%5C%22%22%5D%7D (accessed June 29, 2015).

[135] US Congress, *H.R.1804 - Crude-By-Rail Safety Act*, https://www.congress.gov/bill/114th-congress/house-bill/1804?q=%7B%22search%22%3A%5B%22%5C%22hr1804%5C%22%22%5D%7D (accessed June 29, 2015).

Number	Name	Sponsor	Date Introduced	Date Referred to Committee	Summary
H.R. 1789	Tank Car Safety and Security Act of 2015[136]	Donald Payne [D-NJ]	4/14/2015	4/27/2015	Directs the Secretary of Transportation (DOT) to revise federal regulations regarding DOT-111 tank cars used to move flammable liquids. Directs the Administrator of the Transportation Security Administration to issue regulations to require that all rail safety coordinators ensure that no tank car containing crude oil is left unattended during any period that it is being transferred between railroad carriers or between a railroad carrier and a shipper. Directs the Secretary to submit to Congress a plan to phase out older-model DOT-111 tank cars that are not retrofitted to meet the new federal requirements.

[136] US Congress, *H.R.1789 - Tank Car Safety and Security Act of 2015*, https://www.congress.gov/bill/114th-congress/house-bill/1789?q=%7B%22search%22%3A%5B%22%5C%22hr1789%5C%22%22%5D%7D (accessed June 29, 2015).

Number	Name	Sponsor	Date Introduced	Date Referred to Committee	Summary
H.R. 1679	Bakken Crude Stabilization Act of 2015[137]	Rep. John Garamendi [D-CA]	3/26/2015	3/27/2015	This bill authorizes Bakken crude oil to be transported by rail only if it has a Reid vapor pressure of not more than 9.5 pounds per square inch (the maximum volatility set by the New York Mercantile Exchange for crude oil futures contracts).
H.R. 1290	To provide for a study by the Transportation Research Board of the National Academies on the impact of diverting certain freight rail traffic to avoid urban areas, and for other purposes.[138]	Rep. Keith Ellison [D-MN]	3/4/2015	3/5/2015	To provide for a study by the Transportation Research Board of the National Academies on the impact of diverting certain freight rail traffic to avoid urban areas, and for other purposes.

[137] US Congress, *H.R.1679 - Bakken Crude Stabilization Act of 2015*, https://www.congress.gov/bill/114th-congress/house-bill/1679?q=%7B%22search%22%3A%5B%22Bakken+Crude+Stabilization+Act+2015%22%5D%7D (accessed June 29, 2015).

[138] US Congress, *H.R.1290 - To provide for a study by the Transportation Research Board of the National Academies on the impact of diverting certain freight rail traffic to avoid urban areas, and for other purposes*. https://www.congress.gov/bill/114th-congress/house-bill/1290/titles?q=%7B%22search%22%3A%5B%22provide+for+study+the+Transportation+Research+Board+National+Academies+impact+diverting+certain+freight+rail+traffic+avoid+urban+areas%22%5D%7D (accessed June 29, 2015).

Number	Name	Sponsor	Date Introduced	Date Referred to Committee	Summary
H.R. 1679	Bakken Crude Stabilization Act of 2015[139]	John Garmendi (CA-03)	3/26/2015	3/27/2015	Bill to authorize Bakken crude oil to be transported by rail only if it has a Reid vapor pressure of not more than 9.5 pounds per square inch (psi) (the maximum volatility set by the New York Mercantile Exchange for crude oil futures contracts).
H.R. 1804	Crude-By-Rail Safety Act	Rep. Jim McDermott [D-WA]	4/15/2015	4/16/2015	Bill to protect the public, communities across America, and the environment by increasing the safety of crude oil transportation by railroad, and for other purposes.
H.R. 2074	The Toxics by Rail Accountability and Community Knowledge (TRACK) Act[140]	Donald Norcross (NJ-01)	4/28/2015	4/29/2015	Bill to "improve hazmat-by-rail safety by implementing a series of recommendations made by the National Transportation Safety Board (NTSB) following the 2012 train derailment in Paulsboro, NJ.

[139] *Congressman Norcross Introduces First Bill, Improves Rail Safety following Paulsboro Derailment*, April 29, 2015, http://norcross.house.gov/media-center/press-releases/congressman-norcross-introduces-first-bill-improves-rail-safety (accessed June 22, 2015).

[140] US Congress, *All Bill Information for S. 546 – RESPONSE Act of 2015*, https://www.congress.gov/bill/114th-congress/senate-bill/546/all-info#summary (accessed June 22, 2015).

Number	Name	Sponsor	Date Introduced	Date Referred to Committee	Summary
H.R. 2379	To prohibit the transportation of certain volatile crude oil by rail.[141]	Nita Lowey [D-NY]	5/15/2015	5/18/2015	To prohibit the transportation of certain volatile crude oil by rail
H.R. 2834	To enact certain laws relating to the environment as title 55, United States Code, "Environment"[142]	Tom Marino [R-PA]	6/18/2015	6/18/2015	The purpose of this Act is to codify certain existing laws relating to the environment as a positive law title of the United States Code.
S. 859	Crude-by-Rail Safety Act	Sen. Maria Cantwell [D-WA]	3/25/2015	3/25/2015	Bill calls for enhanced breaking mechanisms, raising the standards for tank car safety, increasing crude-by-rail inspections, increasing penalties for non-compliance, considerable changes for all rail oil spill response plans, and further research on tank car design and oil-volatility levels. The bill also includes many changes to emergency response resource inventories and would mandate reporting on "close-call" incidents.

[141] US Congress, *H.R.2379 - To prohibit the transportation of certain volatile crude oil by rail.* https://www.congress.gov/bill/114th-congress/house-bill/2379/text?q=%7B%22search%22%3A%5B%22%5C%22hr2379%5C%22%22%5D%7D (accessed June 29, 2015).
[142] US Congress, *H.R.2834 - To enact certain laws relating to the environment as title 55, United States Code, "Environment."* https://www.congress.gov/bill/114th-congress/house-bill/2834/text (accessed June 29, 2015).

Number	Name	Sponsor	Date Introduced	Date Referred to Committee	Summary
S. 859	Crude-by-Rail Safety Act[143]	Sen. Maria Cantwell [D-WA]	3/25/2015	3/25/2015	Bill calls for enhanced breaking mechanisms, raising the standards for tank car safety, increasing crude-by-rail inspections, increasing penalties for non-compliance, considerable changes for all rail oil spill response plans, and further research on tank car design and oil-volatility levels. The bill also includes many changes to emergency response resource inventories and would mandate reporting on "close-call" incidents.

[143] US Congress, *S.859 - Crude-By-Rail Safety Act,* https://www.congress.gov/bill/114th-congress/senate-bill/859?q=%7B%22search%22%3A%5B%22%5C%22s859%5C%22%22%5D%7D (accessed June 29, 2015).

APPENDIX B: FIRST RESPONDER TRAINING COURSES

FEMA	
IS-700: National Incident Management System (NIMS), an Introduction	This independent study course introduces the NIMS concept. NIMS provides a consistent nationwide template to enable all government, private-sector, and nongovernmental organizations to work together during domestic incidents.
IS-800: National Response Framework (NRF), an Introduction	The course introduces participants to the concepts and principles of the NRF.
ICS-100: Introduction to ICS	This independent study course introduces ICS and provides the foundation for higher level ICS training. It describes the history, features and principles, and organizational structure of the system. This course also explains the relationship between ICS and NIMS.
ICS-200: ICS for Single Resources and Initial Action Incidents	This independent study course is designed to enable personnel to operate efficiently during an incident or event within the ICS. ICS-200 provides training and resources for personnel who are likely to assume a supervisory position within the ICS.
ICS-300: Intermediate ICS for Expanding Incidents	ICS-300 provides training and resources for personnel who require advanced knowledge and application of the ICS. This course expands upon information covered in the ICS-100 and ICS-200 courses.
ICS-400: Advanced ICS	This course provides training and resources for personnel who require advanced application of ICS. This course expands upon information covered in ICS-100 through ICS-300.

ICS Position-Specific Training	These courses are designed to provide state and local-level emergency responders with a robust understanding of the duties, responsibilities, and capabilities of Command and General Staff members. Exercises, simulations, discussions, and a final exam enable participants to process and apply their new knowledge.
IS-5A: An Introduction to Hazardous Materials	This independent study course is intended to provide a general introduction to hazmats that can serve as a foundation for more specific studies in the future. The course does not meet hazmat response requirements identified in HAZWOPER standard. No prior knowledge of the subject is required or assumed. The course has five Units which are outlined below: • Health and Environmental Regulations • Hazmat Identification Systems • Identifying hazmats • Hazmats and Human Health • Preparing for hazmat Incidents
IS-340: Hazardous Materials Prevention	This course will provide the assistance and confidence needed to effectively plan for and respond to hazmat incidents through sound emergency planning and with the highest level of safety for response personnel. This course addresses the basis for hazmat planning, beginning the planning process, identifying hazards, analyzing vulnerabilities, establishing response priorities, assessing resources, and developing the appendix. The target audience for this course is members of the local emergency planning committee (LEPC), local emergency managers, hazmat coordinators, inspectors, as well as members of local law enforcement and firefighters.

IS 810: Emergency Support Functions (ESF) #10 – Oil and Hazardous Materials Response Annex	This course introduces ESF #10 – Oil and Hazardous Materials Response Annex focusing on the ability to: • Describe the purpose and scope of ESF #10. • Identify the supplemental assistance ESF #10 provides to state, tribal, and local governments. • Identify typical actions accomplished by ESF #10 resources and teams. • Describe the types of partnerships formed between ESF #10 and other response agencies and organizations. This course is intended for government executives, private-sector and nongovernmental organization (NGO) leaders, and emergency management practitioners. This includes senior elected and appointed leaders, such as federal department or agency heads, governors, mayors, tribal leaders, and city or county officials – those who have a responsibility to provide for effective response.

Security and Emergency Response Training Center	
Crude by Rail (CBR) Emergency Response: FEMA Funded	This program will provide the first responder basic knowledge, skills, and abilities to respond to incidents involving CBR. The program is delivered over three days (24 hours) with over 60% field exercise. The program covers: the history of crude oil, chemical and physical properties of the different crude oil transported, basic site and damage assessment, tank car design and construction. Additional subjects include: tactical product control methods including the application of firefighting foam agents, water and spill control procedures, planning for crude oil incidents, and the environmental impacts. The practical evolutions will include a demonstration of crude oil fires, boil overs, and foam applications as applied to crude oil incidents by rail and advanced firefighting techniques. The practical evolutions will culminate in a full-scale derailment exercise.
Highway Emergency Response Specialist (HERS): FEMA funded	This course focuses on specific fundamentals and skills associated with an emergency response to a highway incident involving hazmats/WMD highway emergencies. Participants are provided with detailed technical information on cargo tanks (all types), intermodal (IM) portable tanks, freight vans, design and construction, non-bulk packaging, and compressed gas cylinders. Participants are trained to be proficient in hazard mitigation techniques for highway transportation incidents, transfer procedures, grounding and bonding, and safety considerations, including extensive hands-on practice of actions and responses to simulated hazmats/WMD incidents.

Highway Emergency Response Specialist: Advanced (HERS-A)	This 40-hour course was developed to challenge the seasoned HERS through a number of hands-on simulated, complex highway related incidents/accidents involving cargo tanks, intermodal tanks, van trailers, non-bulk packaging, and compressed gas cylinders. Participants respond throughout the week to function within a designated emergency response team to mitigate the dangers they confront throughout the exercises.
Hazmat/WMD Technician for Surface Transportation (HWMDTST)	This FEMA-certified 80-hour course will provide state of the art Hazardous Materials Technician training that complies with OSHA 29 CFR 1910.120 (q) and NFPA Standard 472 requirements. Course modules include laws and regulations, chemical properties, NIMS, emergency response planning, hazmat/WMD monitoring equipment, personal protective equipment, respiratory systems, decontamination, and modules relating to rail, freight, intermodal, and highway transportation systems.
Leadership and Management of Surface Transportation Incidents (LMSTI): FEMA funded	This 40-hour course utilizes NIMS/ICS guidelines and is designed to prepare participants in leadership and management of hazmats/WMD incidents involving surface transportation. The course requires participants to lead and manage incidents involving actual hazmat technicians responding to scenario-based emergencies while following NIMS/ICS guidelines and structures.

Rural Domestic Preparedness Consortium	
Rail Car Incident Response	This eight-hour awareness-level course is designed to increase the knowledge of first responders in recognizing and characterizing the different types of rail cars, potential leaks, and courses of action to be taken based on initial site assessment. The course will increase participants' knowledge of safety and hazardous conditions that may exist at the scene, and will allow them to become familiar with safe practices adopted by the railroad industry. This course has been developed by The University of Findlay and is delivered in an instructor-led format.
American Petroleum Institute	
Introduction to Oil and Gas Courses	The Introduction to Oil and Gas library includes 12 self-paced eLearning courses intended to provide the student with a solid introduction to various aspects of the oil and gas industry. Courses include: History, Completions, Drilling, Evaluation, Offshore, Productions, Rigs and Installation, Hydrocarbon Formation, and Advanced Techniques and Intervention.
Centers for Disease Control and Prevention	
Environmental Health Training in Emergency Response (EHTER) Awareness Level	The purpose of the course is to increase the level of emergency preparedness of environmental health practitioners and other emergency response personnel by providing them with the necessary knowledge, skills, and resources to address the environmental health impacts of emergencies and disasters.[144]

[144] http://www.cdc.gov/nceh/ehs/elearn/ehter.htm

North Dakota Firefighters Association	
Hazmat Awareness	This course is designed to teach the first responder how to safely and effectively manage a hazmat release using first due resources until the arrival of additional specialized units. This course is four hours in length and has prerequisites.
Hazardous Materials Operations	After completing this course, students will be able to describe and practice basic strategies to safeguard their health and safety when their work involves potential exposure to hazmats. Students will gain the knowledge and skills needed to: • Recognize and identify the clues that determine the presence of hazmats/WMD • Research and evaluate exposure information • Make decisions and execute first responder actions This course supersedes Hazardous Materials Awareness level and can be used for Firefighter I State Certification and has no prerequisites.
Responding to Oil Field Emergencies	This class helps emergency responders develop the knowledge and skills necessary to safely and effectively manage a typical oil field emergency. The hands-on portion of this class provides students the opportunity to experience live fire training using fixed, live fire props at the Dickinson Fire Department training site. Hazardous Materials Awareness is a recommended prerequisite. Only students attending the hands-on portion of the course are required to supply their own full personal protective equipment including SCBA.

Flammable Liquids/ Boil Over Emergencies	After completing this course, students will be able to describe and practice basic strategies to safeguard their health and safety when responding to incidents involving flammable liquid storage tanks. This course takes a specific look at crude oil storage but tactics and information can be related to other types of flammable liquids. Students will gain the knowledge and skills needed to: • Recognize and identify the factors leading towards a boil over • Evaluate situation and develop tactics based on relevant information. • Make decisions and execute First Responder actions Hazardous Materials Awareness is a recommended prerequisite. Students are required to supply their own full personal protective equipment including SCBA.

APPENDIX C: ACRONYMS

AAR	American Association of Railroads
AFFF	Aqueous Film Forming Foam
AM	Amplitude Modulation
AR-AFFF	Alcohol Resistant Aqueous Film Forming Foam
AR-FFFP	Alcohol Resistant Film Forming Fluoroprotein Foam
API	American Petroleum Institute
BLEVE	Boiling Liquid Evacuation Vapor Explosion
BNSF	Burlington Northern and Santa Fe Railway
CBR	Crude by Rail
CBRNE	Chemical, Biological, Radiological, Nuclear, and Explosives
CDC	Centers for Disease Control and Prevention
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHEMTREC	Chemical Transportation Emergency Center
CMV	Commercial motor vehicle
CN	Canadian National Railway
CP	Canadian Pacific Railway
CPC	Casualty Prevention Circular
CSX	Central Southern Railroad
DAS	Distributed Acoustic Sensing
DMR	Department of Mineral Resources
DMVW	Dakota, Missouri Valley & Western
DOC	Department Operations Center
DOT	Department of Transportation
EAS	Emergency Alert System
EMPG	Emergency Management Performance Grant
EMS	Emergency Medical Service
EMT	Emergency Medical Technician
EOC	Emergency Operations Centers
EPCRA	Emergency Planning and Community Right-to-Know Act
ERG	Emergency Response Guidebook
ERT	Emergency Response Team
ESF	Emergency Support Function
FAQ	Frequently Asked Questions
FEMA	Federal Emergency Management Agency
FFFP	Film Forming Fluoroprotein Foam
FMCSA	Federal Motor Carrier Safety Administration
FOG	Field Operations Guide
FOSC	Federal On-Scene Coordinator

FP	Fluoroprotein Foam
FRA	Federal Railroad Administration
HazMat (hazmat)	Hazardous Material
HAZWOPER	Hazardous Waste Operations or Emergency Response Standard
HERS	Highway Emergency Response Specialist
HHFT	High Hazard Flammable Train
HM/DG	Hazardous Materials/Dangerous Goods
HMG-127	Hazardous Materials Guidance 127
IPAWS	Integrated Public Alert and Warning System
IS	Independent Study
ITIC	Internet Ticket Processing
ICS	Incident Command System
LEPC	Local Emergency Planning Committee
MAP-21	Moving Ahead for Progress in the 21st Century Act
MCSAP	Motor Carrier Safety Assistance Program
MHEF	Mid- and high-expansion foam
NDDA	Department of Agriculture
NDDES	North Dakota Department of Emergency Services
NDFA	North Dakota Firefighters Association
NDHP	North Dakota Highway Patrol
NDDMR	North Dakota Department of Mineral Resources
NDDoH	North Dakota Department of Health
NDDOT	North Dakota Department of Transportation
NDPA	North Dakota Pipeline Authority
NFPA	National Fire Protection Association
NIMS	National Incident Management System
NPR	Northern Plains Railroad
NRC	National Response Center
NRDA	Natural Resource Damage Assessment
NRF	National Response Framework
NTSB	National Transportation Safety Board
OPA-90	Oil Pollution Act of 1990
OST	Office of the Secretary of Transportation
OTMA	One Time Movement Approval
PADD	Petroleum Administration for Defense Districts
PHMSA	Pipeline and Hazardous Materials Safety Administration
PSA	Protective Security Advisor
PSC	Public Service Commission
psi	pounds per square inch

RESPONSE	Railroad Emergency Services Preparedness, Operational Needs, and Safety Education
RP foam	Regular protein foam
RP	Responsible Party
RRT	Regional Response Team
SAI	Security Action Items
SDS	Safety Data Sheet
SEOC	State Emergency Operations Center
SEOP	State Emergency Operations Plan
SERC	State Emergency Response Commission
SPCC	Spill Prevention, Countermeasures, and Control
SPE	Skill Performance Evaluation
TRACK	Toxics by Rail Accountability and Community Knowledge
TRANSCAER	Transportation Community Awareness and Emergency Response
TSA	Transportation Security Administration
USC	United States Code
USCG	United States Coast Guard
USDHS	US Department of Homeland Security
USDOI	US Department of Interior
USDOT	US Department of Transportation
USEIA	US Energy Information Administration
USEPA	US Environmental Protection Agency
USGS	US Geological Survey
WMD	Weapons of Mass Destruction

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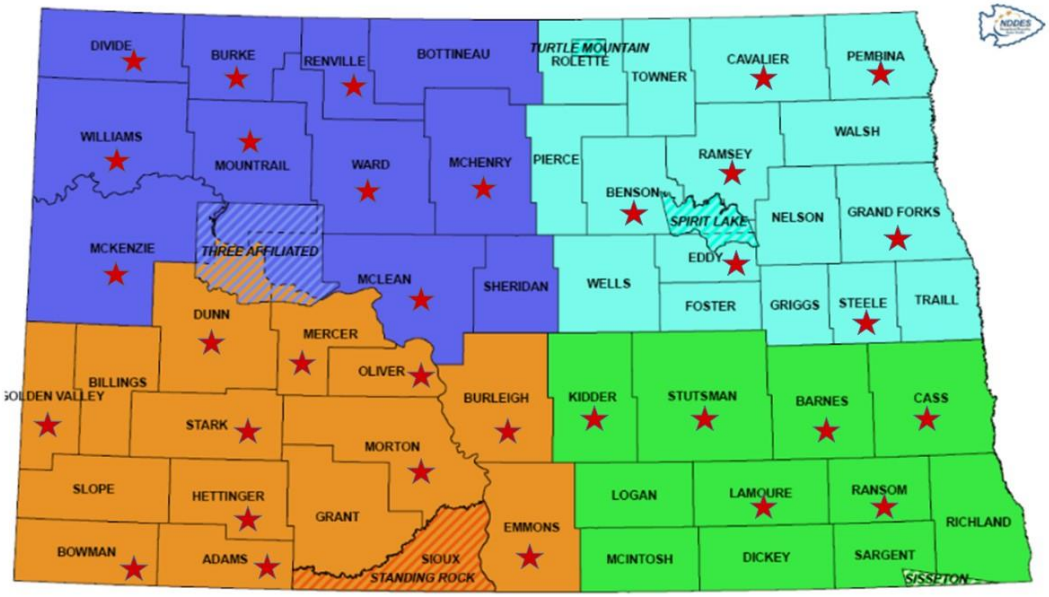
APPENDIX D: MEETINGS AND INTERVIEWS

D.1 Interview Location Map



★ *Indicates Counties where interviews have been conducted.*

D.2 Interview Table

NDDES Northwest Region	NDDES Southwest Region
Burke County Emergency Management	Adams County Emergency Management
Divide County Emergency Management	Bismarck Deputy Fire Department
McHenry County Emergency Management	Bismarck Emergency Management
McKenzie County Emergency Management	Bowman County Emergency Management
McLean County Emergency Management and Sheriff's Department	Burleigh & Emmons County Emergency Management
Minot Fire Department	Dunn County Emergency Management and Sheriff's Department
Mountrail County Emergency Management	Golden Valley Emergency Management
Renville County Emergency Management	Hettinger County Emergency Management
Three-Affiliated Tribes (Fort Berthold) Emergency Management	Mercer and Oliver County Emergency Management
Ward County Emergency Management	Morton County Emergency Management
Williston Fire Department	Stark County Emergency Management

NDDES Northeast Region
Barnes/Steele County Emergency Management
Benson County Emergency Management
Cavalier County Emergency Management
Devils Lake Fire Department
Eddy County Emergency Management
Larimore Fire Department and Mayor
Pembina County Emergency Management
Ramsey County Emergency Management
Grand Forks Fire Department

NDDES Southeast Region
Cass County Emergency Management
Fargo Emergency Management
Fargo Fire Department
Kidder County Emergency Management
LaMoure County Emergency Management
Ransom County Emergency Management
Stutsman County Emergency Management

Local Interest Groups
North Dakota League of Counties
North Dakota League of Cities

State Departments and Affiliates
Department of Emergency Services
Department of Mineral Resources
Indian Affairs Commission
North Dakota Department of Health
North Dakota Department of Transportation
North Dakota Game and Fish
North Dakota Pipeline Authority
Public Service Commission

Federal Departments and Affiliates
US Coast Guard Bridge Administration Division
Army Corps of Engineers

Private Sector Stakeholders
Sakakawea Area Spill Response, LLC
Burlington Northern Santa Fe Railroad
Canadian Pacific Railroad

APPENDIX E: PHMSA CHRONOLOGY

PHMSA and FRA Safe Transportation of Energy Products Chronology September 2012 – April 2015	
April 17, 2015	PHMSA issued a Safety Advisory to remind hazardous materials shippers and carriers of their responsibility to ensure that current, accurate and timely emergency response information is immediately available to first responders. PHMSA and FRA issued a Safety Advisory to remind railroads operating a high-hazard flammable train that certain information may be required by PHMSA and/or FRA personnel during the course of an investigation immediately following an accident. FRA issued an Emergency Order to require that trains transporting large amounts of Class 3 flammable liquid through certain highly populated areas adhere to a maximum authorized operating speed of 40 mph. FRA issued a Safety Advisory recommending that railroads use highly qualified individuals to conduct the brake and mechanical inspections and recommends a reduction to the impact threshold levels the industry currently uses for wayside detectors that measure wheel impacts to ensure the wheel integrity of tank cars in those trains. FRA issued a notice and comment request seeking to gather additional data concerning rail cars carrying petroleum crude oil in any train involved in an FRA reportable accident. FRA Acting Administrator sent a letter to the Honorable Edward Hamberger, president of the Association of American Railroads, asking continued commitment of its member railroads to address the safety issues presented.
February 5, 2015	USDOT submitted a draft Final Rule on the safe transportation of flammable liquids (including crude oil) by rail to the Office of Management and Budget for formal review.
December 11, 2014	PHMSA hosted a follow-up meeting with emergency response officials to address gaps in preparedness and training since February 10, 2014 engagement.
July 23, 2014	USDOT releases comprehensive rulemaking proposal to improve the safe transportation of large quantities of flammable materials by rail, including a Notice of Proposed Rulemaking for enhanced tank car standards, an Advanced Notice of Proposed Rulemaking seeking to expand oil spill response planning requirements for shipments of flammable materials, and a report summarizing the analysis of Bakken crude oil data gathered by PHMSA and FRA.

PHMSA and FRA Safe Transportation of Energy Products Chronology September 2012 – April 2015	
May 13, 2014	Secretary Foxx dispatched a letter to 48 state governors and select city mayor's alerting them about the issuance of Emergency Order OST-2014-0067 and urging them to facilitate coordination between the rail industry, State Emergency Response Commissions and local first responders.
May 7, 2014	USDOT issues Emergency Order requiring railroad carriers to inform first responders about crude oil being transported through their towns and communities.
May 7, 2014	PHMSA and FRA issued a Safety Advisory requesting companies to take all possible steps to avoid the use of DOT 111 tank cars when transporting Bakken crude oil.
May 1, 2014	DOT sent a comprehensive PHMSA rulemaking package to the White House Office of Information and Regulatory Affairs (OIRA). The proposal includes options for enhancing tank car standards and retrofitting. We look forward to working collaboratively with OIRA on the Administration's proposal and initiating the formal comment process as soon as possible.

PHMSA and FRA Safe Transportation of Energy Products Chronology September 2012 – April 2015	
April 1, 2014	As an outgrowth of the Working Groups established at the August 2013 Emergency Meeting of FRA's RSAC, two of the working groups produced recommendations that were adopted by the full RSAC for consideration in future rulemakings. Based upon the efforts of the Securement Working Group and the approval of the full RSAC, the FRA plans to issue a Notice of Proposed Rulemaking (NPRM) later this year. The RSAC recommendations on train securement would prohibit certain unattended freight trains or standing freight cars on main track or sidings and require railroads to adopt and implement procedures to verify securement of trains and unattended equipment for emergency responders. It would also require locomotive cabs to be locked and reversers to be removed and secured. Railroads would also be required to obtain advance approval from FRA for locations or circumstances where unattended cars or equipment may be left. Additionally, the full RSAC approved four recommendations of the Hazardous Materials Issues Working Group relating to identification, classification, operational control and handling of certain shipments. The four recommendations, directed to the Pipeline and Hazardous Materials Safety Administration (PHMSA), include amending or revising the definitions of "residue" and "key train," and clarifying its regulatory jurisdiction over the loading, unloading and storage of hazmat before and during transportation. (See May 1, 2014 entry below.). The third Working Group, established to consider Appropriate Train Crew Size requirements was unable to reach a consensus. However, the valuable input received during their deliberations will allow FRA to move forward with developing a proposed rule on train crew size that will protect the public while recognizing the nuance of railroad operations. A Notice of Proposed Rulemaking requiring two-person train crews on crude oil trains and establishing minimum crew size standards for most main line freight and passenger rail operations is expected later this year.

PHMSA and FRA Safe Transportation of Energy Products Chronology September 2012 – April 2015	
March 6, 2014	To provide further clarity for shippers and to prevent attempts to circumvent the requirements in our recent Emergency Order concerning the safe transport of crude oil by rail, the Department issued an amended version that specifies which tests are required, while also prohibiting shippers from switching to an alternate classification that involves less stringent packaging.
February 25, 2014	USDOT issues Emergency Order requiring stricter standards to transport crude oil by rail.
February 20, 2014	Transportation Secretary Foxx sent a letter to the Association of American Railroads (AAR) with a list of actions to be voluntarily taken immediately by industry to dramatically improve the safety of railroads transporting crude oil and the communities they move through. AAR President and CEO Edward Hamberger signed the agreement that same day, subsequently followed by individual member railroads. Other railroad signatories include: Genesee & Wyoming, Inc., the Iowa Interstate Railroad, Iowa Pacific Holdings, Wheeling and Lake Erie Railway Company.
February 12, 2014	In response to the Secretary's Call to Action, the American Short Line and Regional Railroad Association (ASLRRA) identified five actions that it believes small railroads can voluntarily take to contribute to a safer national rail network: 1. Train Speed: Unit trains of crude oil will operate at a top speed of no more than 25 mph on all routes. 2. Emergency Response: Railroads will develop a program of best practices to ensure a seamless system of timely and effective emergency response to crude oil spills. 3. Recovery and Environmental Remediation: Railroads will sign master service agreements with qualified environmental cleanup providers to ensure prompt and effective remediation in all areas subjected to unintentional discharge of crude oil. 4. Tank Car Standards: ASLRRA will support and encourage the development of new tank car standards. 5. Risk Reduction Program: Contingent upon securing a 6-12-month pilot project grant from FRA, ASLRRA plans to create the Short Line Safety Institute.
February 10, 2014	PHMSA met with emergency response stakeholders and industry groups to discuss training and awareness related to the transport of Bakken crude.

PHMSA and FRA Safe Transportation of Energy Products Chronology September 2012 – April 2015	
February 4, 2014	PHMSA issues $93,000 in proposed civil penalties after investigation into the transportation of Bakken crude oil finds companies improperly classified shipments.
January 22, 2014	Secretary Foxx issues follow-up letter to Call to Action participants summarizing industry commitments.
January 16, 2014	Secretary Foxx meets with rail company CEOs and rail and energy association leadership as part of the Department's Call to Action to discuss how to maintain our safety record even as domestic crude oil production and movement has increased.
January 2, 2014	PHMSA issued a safety alert to notify the general public, emergency responders and shippers and carriers that the type of crude oil being transported from the Bakken region may be more flammable than traditional heavy crude.
November 20, 2013	PHMSA and FRA issued a safety advisory reinforcing the importance of proper characterization, classification, and selection of a packing group for Class 3 materials.
October 1, 2013	FRA Administrator Szabo sends a letter to railroad industry organization asking they detail actions they've taken in response to the Safety Advisory issued August 2.
September 6, 2013	PHMSA published an Advance Notice of Proposed Rulemaking seeking public comment on a proposed rule requiring comprehensive improvements to rail safety of flammable liquids.
August 29, 2013	Administrator Quarterman and Administrator Szabo address the Railroad Safety Advisory Committee during an emergency session.
August 29, 2013	FRA and PHMSA launched Operation Classification in North Dakota's Bakken oil region to verify that crude oil is being properly classified.
August 27-28, 2013	FRA and PHMSA host a joint public meeting to receive public input on improving the safe transport of hazardous materials by rail.
August 2, 2013	FRA issued Emergency Order No. 28, requiring railroads to properly secure rolling equipment. FRA also published a Safety Advisory recommending additional actions.
July 29, 2013	In a letter to the American Petroleum Institute, FRA informed industry that it will use PHMSA's test sampling program to ensure that crude oil is being properly tested and classified.

PHMSA and FRA Safe Transportation of Energy Products Chronology September 2012 – April 2015	
July 18, 2013	FRA and PHMSA announced a two-day public meeting on August 27 and 28 in Washington, DC, to receive public input on improving the safe transport of hazardous materials by rail, including a discussion on enhanced design specifications for the DOT-111 tank cars commonly used to transport petroleum crude oil and ethanol and operational issues related to the rail transportation of hazardous materials.
December 2012	FRA initiated several steps to address the risks related to increases in rail traffic in the Bakken Oil Region, the point of origin for most crude oil by rail shipments in the US Under our Bakken Rail Accident Mitigation Project (RAMP), FRA conducted additional hazardous materials safety inspections in the area as well as facilitating hazardous materials safety training seminars with shippers, consignees, contractors, and sub-contractors. In addition, as a result of increased commercial motor vehicle traffic in the region associated with crude oil production, FRA worked with stakeholders, participating agencies, local officials and rail carriers on highway-rail grade crossing safety and trespass prevention, to increase law enforcement patrols at grade crossings and expanded educational outreach to professional drivers (including public service announcements and advertisements at major truck stops in the area).
October 2012	PHMSA Bakken Field Working Group established to increase inspection focus on hazmat shipments by truck and rail from the Bakken region and increase awareness within the emergency response community.
September 2012	PHMSA Administrator Quarterman visits North Dakota Bakken Region to observe operations at rail loading facilities and the application of US DOT regulations.

APPENDIX F: PLANNING RESOURCES

F.1 Federal Standards and Guidance

FEMA. Comprehensive Preparedness Guide 101: Developing and Maintaining Emergency Operations Plans. Version 2. (2010). http://www.fema.gov/media-library-data/20130726-1828-25045-0014/cpg_101_comprehensive_preparedness_guide_developing_and_maintaining_emergency_operations_plans_2010.pdf

FEMA. National Preparedness Goal. (2011). http://www.fema.gov/media-library/assets/documents/25959.

FEMA. National Prevention Framework. (2013). http://www.fema.gov/media-library-data/20130726-1913-25045-6071/final_national_prevention_framework_20130501.pdf.

FEMA. National Protection Framework. (2014). http://www.fema.gov/media-library-data/1406717583765-996837bf788e20e977eb5079f4174240/FINAL_National_Protection_Framework_20140729.pdf

FEMA. National Mitigation Framework. (2013). http://www.fema.gov/media-library-data/20130726-1914-25045-9956/final_national_mitigation_framework_20130501.pdf

FEMA. National Response Framework. Second Edition. (2013). http://www.fema.gov/media-library-data/20130726-1914-25045-8516/final_national_response_framework_20130501.pdf

FEMA. National Disaster Recovery Framework. (2008). http://www.fema.gov/media-library-data/20130726-1820-25045-5325/508_ndrf.pdf

F.2 State Standards and Guidance

North Dakota Department of Emergency Services. Local Emergency Planning Committee Handbook. (2014). http://www.nd.gov/des/uploads/resources/570/09-12-2014-local-emergency-planning-committee-handbook-9-2014.pdf.

North Dakota Department of Emergency Services. North Dakota State Emergency Operations Plan (SEOP). (2010).

F.3 Industry Standards and Guidance

NFPA. NFPA 1600: Standard on Disaster/Emergency Management and Business Continuity Programs. (2013). http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=1600

ISO 22301: 2012. Societal security -- Business continuity management systems --- Requirements. http://www.iso.org/iso/catalogue_detail?csnumber=50038.

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