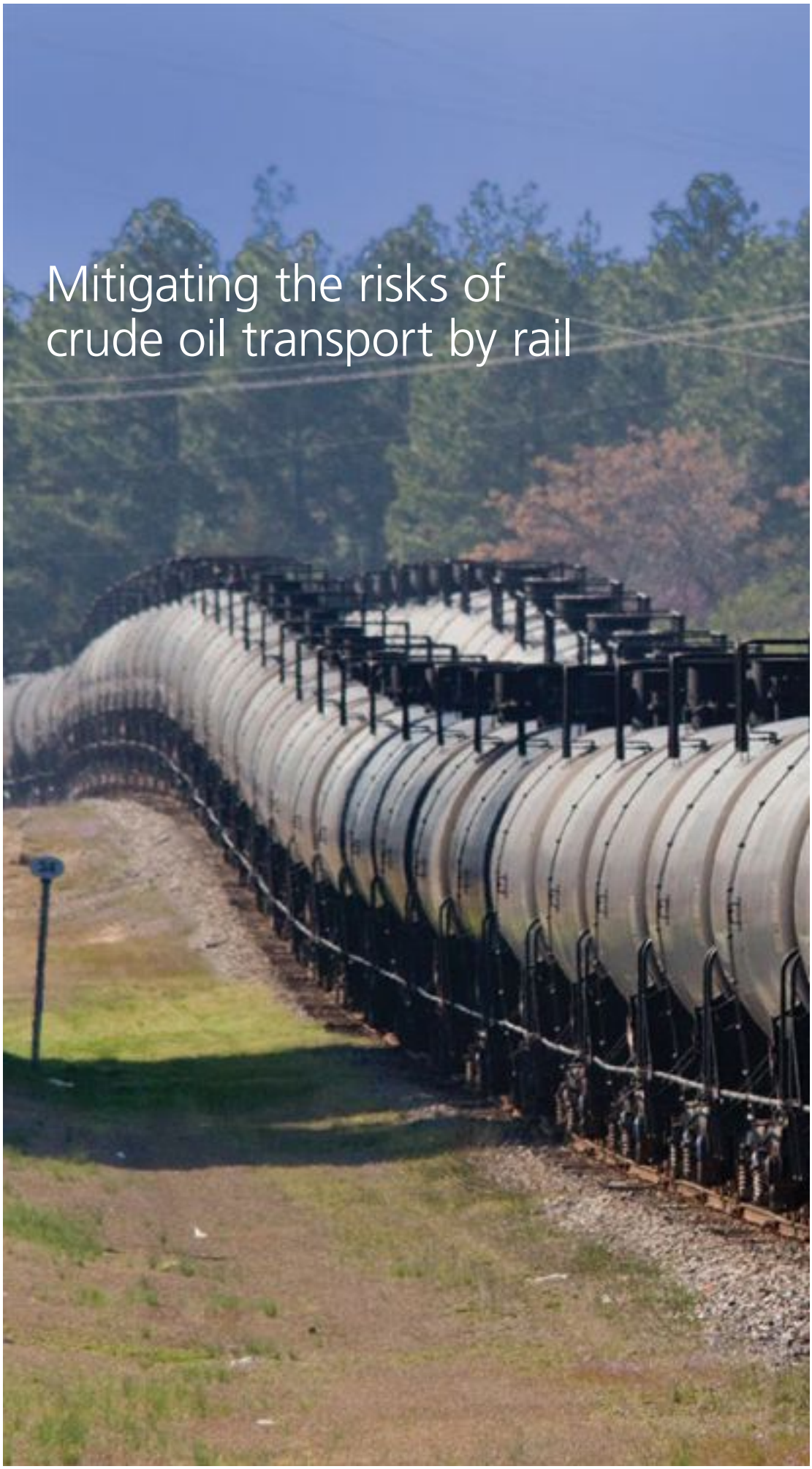
Mitigating the risks of crude oil transport by rail



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Oil exploration and production are on the rise in North America, and energy companies are relying more heavily on railways to safely transport crude oil from remote areas and across long distances to refineries. On a frequency basis, accidents are down, but the severity of accidents has, in some instances, been catastrophic.

Recent accidents and the increased volume of crude oil being transported by rail are prompting railroads, government regulators and industry associations to work together on how best to mitigate the significant exposures of transporting crude oil by rail.

The effects of a spill

While rail losses have decreased 42 percent in North America since 2000, a startling 1.15 million gallons of oil were spilled in 2013. There were 800,000 spilled in the previous 35 years combined[1 2]. The following accidents were key contributors to that volume.

- **July 2013, Lac-Mégantic, Quebec**: A train carrying crude oil derailed in a small Quebec town resulting in multiple explosions and fires. Forty-seven people were killed, and multiple businesses destroyed. The cleanup and recovery costs are expected to exceed $400 million.[3] The train's operator, Montreal, Maine & Atlantic (MMA) Railway Ltd., had $25 million in liability insurance and has since declared bankruptcy.[4]
- **November 2013, Aliceville, AL**: Twenty-five out of 90 DOT-111 tankers derailed spilling 750,000 gallons of crude into a wetlands area. There is still speculation as to the success of the cleanup efforts.[5]
- **December 2013, Casselton, ND**: A train carrying crude oil collided with a train carrying grain resulting in a spill of over 400,000 gallons of crude oil. The spill was followed by an explosion that burned for over 24 hours and caused 2,400 people to be evacuated. While no injuries were reported, there were financial and environmental losses.[6]
- **January 2014, Plaster Rock, New Brunswick**: A freight train with 122 cars travelling from Toronto, ON, to Moncton, NB, derailed due to mechanical failure. The railcars were carrying propane and crude oil; they burned for over 18 hours and caused 150 people to be evacuated from their homes.[7]
- **April 2014, Lynchburg, VA**: A train carrying just 15 cars of crude oil derailed. Three cars caught fire, and an estimated 50,000 gallons of oil were spilled, some of which ended up in the James River. The accident also resulted in evacuation of 300 people.[8]

With catastrophic losses such as these, the cost of cleanup and property and casualty damage is so great that it will likely be borne by all involved, regardless of indemnifications and insurance arrangements. Defense costs alone can be significant and are not always covered by insurance. In addition, as with Montreal, Maine & Atlantic (MMA), most oil-by-rail transportation risks are underinsured due to lack of capacity and the cost of commercial insurance for such risks.[9]

Issues surrounding ownership

The decentralized nature of the rail industry makes it difficult, if not impossible, to eliminate all of the exposures and potential for losses. The ownership structure of the rail industry complicates accountability and promotes inconsistency of procedures. Railroad tracks and locomotives are privately owned by a variety of railroad companies. The actual tank cars may be owned by independent tank car leasing companies, the transporter, or sometimes, the customer. This results in variations in maintenance protocols, upgrades and designs.

The actual crude being shipped may be owned by a broker, an energy company or another independent company/entity. These organizations/companies will have different approaches to and levels of risk management and transfer. It can be the responsibility of the shipper to inspect and safely load the tank cars, as well as ensure the cars are properly labeled based on test results.[10]

Who sets the standards for the railroad industry?

The following legislation and organizations are helping to tackle the issues emerging from the increasing use of railways to transport crude oil.

The Staggers Act of 1980: This legislation drastically changed the railroad industry by significantly deregulating it. In recent years, North America has seen increasing deregulation of the rail industry along with a concurrent move to harmonized standards.

Association of American Railroads (AAR): An independent organization, AAR sets standards for North American railroads to ensure safe and productive transportation. Its industry standards are often more stringent than the required government regulations. In addition, AAR is generally the organization that petitions government authorities to increase requirements and enforce better practices.

Federal Railroad Administration (FRA): A branch of the United States Department of Transportation (US DOT), the FRA sets federal regulations to ensure safe and reliable rail transportation, as well as emergency response support.

Pipeline and Hazardous Materials Safety Administration (PHMSA): Another branch of the US DOT, PHMSA defines regulations for proper hazardous material identification and handling.

Transport Canada: This government department is responsible for developing regulations and policies to ensure safe and efficient transportation operations, as well as providing information and support for effective emergency response.

Transportation of Dangerous Goods (TDG) Act: The TDG Act is a Canadian legislation, which regulates and promotes the safety of transferring dangerous goods. For example, Part 5 of the TDG Act deals with container specifications required for the movement of dangerous goods.

Railway Safety Act (RSA): This legislation regulates Canadian railways that cross provincial borders. Provinces have authority over railways within their respective jurisdictions. In March 2001, an amendment to the RSA required railway companies to establish a safety management system (SMS). The intention was to better integrate safety into the daily operations of railway companies by providing more autonomy in structuring their SMS. A 2007 report by a federal advisory panel suggests that the enforcement and practice of SMS has been inconsistent, and most employees had a limited understanding of its function.

Railway Association of Canada (RAC): This organization conducts research and works with the government and organizations to promote railway safety.[13]

These various organizations and laws all have common goals, but while the AAR may set the standards, it is up to the government organizations to require and enforce better practices by the railroad companies, shippers, producers and car owners. For example, while the AAR may establish best practices, they cannot force railcar owners to upgrade their railcars or replace the existing cars with improved designs without the backing of the US DOT making these upgrades a requirement.

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Addressing the risks

As a result of recent accidents, the rail industry as a whole is taking action to prevent such events from occurring in the future. Employing standard risk management practices, railroads and associated organizations are first looking to eliminate the exposures that could lead to derailments and other accidents. To identify those exposures, they are evaluating the root causes of prior incidents and accidents. When possible, they are changing or improving practices, policies and procedures. If it is determined an exposure cannot be eliminated, it is essential that an effective procedure be established to control it.

Governments also are stepping in to address risks in response to recent disasters. For example, in Canada in August 2014, The Honourable Lisa Raitt, Minister of Transport, directed Transport Canada to take the following measures in the aftermath of the Lac-Mégantic accident.[14]

- Removing the least crash-resistant DOT-111 tank cars from dangerous goods service;
- Introducing new safety standards for DOT-111 tank cars, and requiring those that do not meet the new standards to be phased out by May 1, 2017;
- Requiring railway companies to slow trains transporting dangerous goods and introduce other key operating procedures;
- Requiring emergency response plans for even a single tank car carrying crude oil, gasoline, diesel, aviation fuel, and ethanol; and,
- Creating a task force that meets regularly and brings municipalities, first responders, railways and shippers together to strengthen emergency response capacity across the country.

Earlier, in November 2013, the American Association of Railroads (AAR) and American Short Line and Regional Railroad Association (ASLRRA) issued a position paper stating that they "support even more stringent standards for new tank cars used to transport these materials. Furthermore, AAR and ASLRRA propose additional requirements for tank cars transporting flammable liquids, including packing group III flammable liquids, retrofits of existing cars in flammable liquid service, and an aggressive phase-out of cars that cannot meet retrofit requirements."[15]

Managing exposures

Removing and retrofitting the least crash resistant DOT-111 tank cars can reduce an exposure, however, due to resource constraints and manufacturing backlogs, it is expected to take years before all existing tank cars are upgraded or replaced. There are also many other exposures that the rail industry is working to eliminate or control in order to minimize the potential for losses. These include:

Track infrastructure – Rail's widespread infrastructure and the industry's ability to expand more efficiently and economically when compared to alternate options, such as pipelines, have resulted in a significant increase in the use of rail for transporting crude. The goal of the railroad companies is to maintain the tracks in place and expand their network so that it is more robust. To achieve these goals, many railroad companies are investing in their infrastructure by building additional tracks and improving inspection practices. Progressive Railroading reported that in 2014 on average, capital spending for Class I railroads increased by 9 percent overall.[16] One railroad was forecasted to increase their capital expenditure by 12 percent. (Please note that rail company infrastructure investments target track inspections, repairs and expansion. Again, the railroads do not own or control the upgrades to tank cars, so these investments do not address the retrofit requirements or purchase of new tankers.)

> “Many railroads currently have track safety technology along their routes, and additional devices are being installed along tracks carrying 20 or more crude oil cars.”

Track inspections – A 2012 research study using FRA data on Class I railroads between 2001 and 2010 identified broken rails or welds as the main cause of derailments.[17] Consequently, track inspections are an integral part of rail safety. FRA regulations require comprehensive track inspections. The regulations define inspection methods and frequencies, including internal rail inspections on main line rail routes. AAR standards recommend that rail companies perform at least one additional internal inspection above the FRA requirements and two automated high-tech track geometry inspections each year for all main line routes where trains carrying 20 or more cars of crude oil will travel. This is an illustration of how the industry is moving toward best practice vs. regulatory driven actions.[18 19]

Route selections – Both U.S. and Canadian Railroads utilize a Rail Corridor Risk Management System (RCRMS), a statistical route modelling tool used to determine the safest and most secure route to transport materials. As of July 2014, all trains carrying more than 20 cars of crude oil are required to use RCRMS to define their route.[20]

Train speed controls – As of August 2013 in the U.S. and April 2014 in Canada, a national rail speed limit of 50 mph was implemented for trains carrying 20 or more railcars of crude oil. In July 2014, the U.S. further enacted laws restricting trains to a maximum speed of 40 mph in areas designated as high-threat urban zones when one or more of the 20 cars were the older DOT-111 design. There are 46 such zones throughout the country as defined by the Department of Homeland Security (DHS).[21 22]

Predictive technology – Many railroads currently have track safety technology along their routes, and additional devices are being installed along tracks carrying 20 or more crude oil cars. One such technology is track-side heat detection. This detection is designed to measure wheel bearing heat generation and predict a potential failure. Another technology being utilized is a specialized inspection car that is able to identify track and ground defects.[23]

Engine braking systems – New braking system requirements were enacted on April 1, 2014, for trains carrying 20 car loads of crude or more.[24] They require locomotives in the middle of the train to distribute power or two-way, braking end-of-train devices. This allows crews to brake the train from either end, resulting in stopping the train faster.

> “It has always been the responsibility of the ‘producer,’ in this case, the oil companies, to test and properly classify the hazard levels of the material being shipped via rail.”

Train crew size – Currently, U.S. railways require a minimum crew size of one, while Canadian rules require a minimum of two operators. There are proposals in place to set the minimum crew size to two employees in the U.S. as well, which will provide more oversight and assistance during transport.[25]

Product classification – It has always been the responsibility of the “producer,” in this case, the oil companies, to test and properly classify the hazard levels of the material being shipped via rail. As of February 2014, U.S. Federal regulations require that crude oil, specifically from the Bakken region, be tested prior to transport, and railcars are classified and labelled accordingly.[26 27]

On October 17, 2014, Transport Canada issued an emergency order requiring companies to conduct new classification tests on all oil they transport and report their findings to the Dangerous Goods Directorate.[28] Until these tests are done, all crude oil must be classified as Class 3 PG 1, the highest volatility liquid. Proper identification is important so that first responders are able to respond to an event appropriately.

Railcar design – According to the AAR, railcar design is the primary element driving exposure and losses.[29] Just as passenger cars have evolved in design to minimize the potential of injury to occupants, from seatbelts to airbags, intricate sensors and crumple zones, railcar designs are being reviewed and improved to minimize the severity of losses following a crash or derailment. The severity of recent railcar accidents and increased use of railcars for transporting crude oil has escalated the need for advancements in their design. PHMSA (U.S.) and Transport Canada are responsible for setting federal regulations for tank car designs in their respective countries.

Railcar design standards are defined by the AAR Tank Car Committee and are often more stringent than federal regulations. In 2011, new standards were implemented for railcars transporting hazardous materials such as crude oil. The 2011 standards require the use of a thicker tank car shell or jacket and protective head shields of at least half height at both ends of the car to provide more puncture resistance. The regulations also require additional protection for fittings on the top of the car. More standards were recommended by the AAR in 2013, including full height shields, further improved top fitting protections, jackets and thermal protections, and bottom outlet handles. The older model DOT-111 railcars, many of which are still in use, do not have these protective features and are, therefore, considered inadequate for transporting crude oil and flammable liquids. Proposals have been made by the AAR to require railcar owners to either retrofit DOT-111 railcars with improved safety features, or faze them out of hazardous service. It’s critical to ensure contracts address this discrepancy in railcar design and require only railcars meeting the highest standards be used.[30]

An increase in tank wall thickness is expected to make the cars more resistant to failure in the event of a crash.[31] Unfortunately, this change will increase the net car weight and therefore decrease capacity, which will require more cars to ship the same volume of material.

With more cars required to ship the same volume of material, overall train lengths may increase. Longer trains might require the use of newer technology and braking systems to address other safety concerns. Longer trains might also increase the wear and tear on infrastructure such as tracks and bridges. They may also cause traffic issues at crossings.

> “It is essential that rail companies, as well as the owners of the fuel being shipped, have comprehensive crisis response and communication plans and, even more so, that they practice the execution of those plans regularly with their teams.”

Emergency response management

The high-severity losses in the rail, as well as the oil & gas, industry have placed an increased need for and focus on crisis management and preparedness. It is essential that rail companies, as well as the owners of the fuel being shipped, have comprehensive crisis response and communication plans and, even more so, that they practice the execution of those plans regularly with their teams. Any organization linked to the shipment of fuel by rail needs to have an intimate knowledge of the plans and should verify the plans are known and challenged not just at the C-suite level but throughout the organization and affected areas. As with blowout prevention (BOP) drills on a rig, practice is the only way to ensure everyone will know how to respond when a crisis happens, and practicing once a year is not sufficient. It is essential that all parties involved share the same commitment to safety. Crisis communication and response plans should be shared and audited. Joint drills should be considered.

As of May 2014, the DOT is requiring railroads transporting large volumes of Bakken crude to notify the state emergency response commissions of these shipments.[32] Previously, communications to the local communities regarding hazardous material transport and safety plans were provided by railroads only upon request. Railroads are making efforts to communicate with areas impacted by their operation to address concerns and also providing assistance in preparing for potential emergencies.

Railroads have full-time employees dedicated to hazardous materials safety and emergency response, as well as personnel trained to assist with environmental issues, industrial hygiene and medical response during an event. A network of contractors remains on call throughout high risk/high exposure areas to assist with environmental, safety or health issues. High-risk areas include residential as well as environmentally sensitive locations. Emergency response equipment, such as containment booms, pumps and monitoring devices, is available in these areas. The DOT has recently started to require railroads to develop an inventory list of emergency response resources, their locations and emergency contact information along routes used by crude oil trains. This report must be provided to the DOT along with deployment plans. It must also be available to emergency responders upon request.[33] [34]

Beyond training their own employees, some railroad companies are also providing various levels of training to thousands of local and state emergency responders and other third-party personnel throughout their areas of service. Basic training includes web-based training, classroom sessions, and table-top and hands-on drills. The Security and Emergency Response Training Center (SERTC) is utilized by the railroad companies to provide advanced training to emergency responders, railroad employees, and chemical and petroleum employees all over the country. Furthermore, railroad companies are investing $5 million to develop a specific crude-by-rail training program and providing tuition assistance for emergency responders during the first year.[35] [36]

Risk transfer considerations

It is important to understand the limits and exclusions on the policies carried by the rail companies. In the Lac-Mégantic event, Montreal, Maine & Atlantic Railway (MMA) was covered for $25 million in liability. Quebec has already issued a claim for $400 million, and the cleanup and recovery efforts are not complete.[37] [38]

While common carrier laws in the U.S. may prohibit the railroads from forcing liability back on the shipper, if the event is catastrophic, everyone associated with the shipment will likely be a named defendant in the resulting civil litigation. Test results used to classify the oil will be scrutinized as will car design and maintenance records. An understanding of the contracts associated with the railcars is needed. Is it a full service or net service contract? The roles and responsibilities of all parties need to be clearly defined in contracts to avoid potential coverage as well as litigation issues.

“Regardless of what regulations are developed, the onus will be on energy and rail companies to ensure they are doing their part to protect not just the public but also the environment from potential losses and impacts.”

Conclusion

Technology and regulations are evolving quickly, and industries and governments are convening to discuss how to move fuels and chemicals safely and efficiently. Regardless of what regulations are developed, the onus will be on energy and rail companies to ensure they are doing their part to protect not just the public but also the environment from potential losses and impacts. Energy companies will be expected to do their due diligence in assessing the rail companies they choose to move their chemicals and crude. Beyond understanding contracts and what mechanisms rail companies have in place for transfer of liabilities, energy companies must understand which technologies are being employed from braking to speed controls and, more importantly, what types of emergency plans have been developed and how frequently those plans are challenged. Rail companies, rail car leasing and energy companies will be expected to not just do the minimum required by law, they need to have a best-in-class approach to safety.

What to consider when choosing rail transport

Rail losses have declined significantly in the last 13 years, but the severity of the last two has negated any benefit from this trend. Energy companies must not just understand but also work with the rail companies to ensure chemicals and crude can be moved safely because, in the event of a catastrophic loss, all involved will be assigned some degree of liability. Developing a very good understanding of everyone you are dealing with and openly sharing plans and commitments to safety are crucial.

Here are key points to consider from a risk management perspective:

- Know your business partners and their risk transfer vs. risk management practices.
- Partner with communities on disaster planning and response.
- Conduct emergency response drills. Planning for a response is not enough.
- Engage third parties to help with disaster planning and drills.
- Leverage risk management specialists to assist with audits, training and planning.

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Her goal is to maximize customer profitability and efficiency through reducing property losses at customer locations. Andrea works with other Zurich departments and resources to identify risk and develop appropriate improvement strategies for clients.

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26 The transportation of Bakken crude is not a new phenomenon. Bakken has been transported by various methods for many decades, but rail shipments have increased dramatically in the past few years due to the increased production. In the past, shipping any grade of crude oil by rail was very limited, and of that crude, light crude made up a very small proportion. With the major increase in shipping light crude oil by rail, the associated risks are coming to light, which is evident in the uptick in losses associated with light crude transportation.

27 Bakken crude is considered a light crude oil with an average API of 41, but has a range of 36 to 45. For reference, West Texas Intermediate (WTI) has an approximate API of 40 and Brent Crude has an API of 38. Bakken also contains approximately 3% condensate or NGLs, which are light hydrocarbons (ethane, propane, butane and pentane). In comparison, WTI contains 1% condensate. It is possible to stabilize Bakken crude, which would remove NGLs before entering rail cars, as is done with other crudes, but there are a few hold ups in implementing this. Unlike in other areas, such as Texas, there are no regulations to limit crude oil vapor pressure, which would otherwise force them to strip out NGLs. Additionally, there are high costs associated with building a stabilization unit, and there is no infrastructure to process or transport the reclaimed NGLs. As a result, the flammability of Bakken crude remains relatively high when shipped on railcars. On the other hand, flammable liquids such as butane and propane, which are far more flammable than Bakken crude, are frequently shipped via rail and have been for years.

Notes *Continued*

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For more information on the risk management services available from Zurich, contact your broker or visit zurichna.com/zna/energy/customer-services/riskengineering.htm.

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