Revised: October 2017

RAIL SAFETY FIRST

COMMUNITIES FOR SAFE, TRANSPARENT + ACCOUNTABLE RAIL.

Transportation of Dangerous Goods by Rail

10 Critical Action Items

The derailments on August 21, 2016 and August 24, 2017 of CP Rail trains at Dupont Street and Howland Avenue in midtown Toronto underscore the risks in transporting dangerous goods[1] through densely populated urban areas and highlight the urgent need to take action to improve rail safety. Here are 10 things that Rail Safety First recommends the federal government should do immediately.

1. Relocate dangerous goods trains outside densely populated areas

As cities have grown, rail lines in remote areas (such as CP's Ottawa Valley line) have been abandoned. At the same time, the composition of freight rail cargo has changed and the risks associated with transporting dangerous goods through densely populated areas have grown exponentially. Even without access to the “corridor risk assessments” that railways are required to prepare, but which are kept secret, the risks are intuitively obvious. In the parlance of the U.S. Pipeline and Hazardous Materials Safety Administration (PHMSA), “high-hazard flammable trains” travelling through “high-threat urban areas” carry the potential for the occurrence of “high consequence events.” There is a low probability of derailments but the consequences are severe when they happen.

The efficacy of corridor risk assessments as a tool to improve rail safety has been questioned by the Transportation Safety Board of Canada in its reports on the February 14, 2015 (R15H0013) and March 7 2015 (R15H0021) fiery derailments of CN bitumen trains at Gogama, Ont.

The situation will only deteriorate as urban populations continue to grow, freight traffic increases and passenger and freight rail compete for limited track space.

Relocation of the midtown Toronto CP Rail line was suggested by the Grange Royal Commission Report on the November 1979 derailment and explosion of a CP freight train in Mississauga. This is the same rail line over which the train that derailed in Lac Mégantic passed only a few days before and is the same rail line on which the August 21, 2016 and August 24, 2017 derailments occurred. The Grange Report attributes the lack of fatalities in the Mississauga incident to good fortune as the site of the derailment – where Mavis Road crosses the CP mainline – was undeveloped.

As David Emerson notes in his February 2016 report on the review of the *Canada Transportation Act*, several cities including Red Deer, Lethbridge, Regina and Calgary have worked with railway companies and the federal government to relocate rail operations to sites on the periphery of urban centres. He recommends both the relocation of rail infrastructure outside dense urban centres and the separation of freight rail and passenger rail networks to enable connections between and within urban and suburban areas.

In the late 1950s, Canadian National Railway relocated its freight operations from the Union Station precinct in downtown Toronto to the MacMillan yards in Vaughan north of the city.

This freed up capacity for the inauguration of GO Transit service in 1967 and sparked the revitalization of downtown Toronto.

Nearly 50 years later, the province of Ontario and Metrolinx (the regional transportation agency for the Greater Toronto and Hamilton Area) announced an agreement-in-principle with CN to build a new freight rail corridor between Brampton and Milton to which CN could shift freight rail traffic. This would allow for regional express rail (RER) service from Union Station, through Brampton, to the Waterloo Region. The new corridor, which Metrolinx is aiming to have in operation by 2024, would have capacity for up to six mainline tracks. As the Chief Planner of the City of Toronto noted in her report to Council in June 2016, the new corridor could also support the relocation of the CP mainline from its current midtown Toronto corridor along Dupont Street to the existing rail corridor north of the city, thus freeing the midtown corridor for passenger rail use. This is an opportunity that the federal government, the province and the affected municipalities should seize.

2. Reduce the speed and length of trains carrying dangerous goods

The risk of tank cars puncturing, releasing their contents and exploding, increases exponentially with train speed and is correlated to the length (weight) of the train. The February 2016 *Rules Respecting Key Trains and Key Routes* issued by Transport Canada restrict the speed of trains carrying certain flammable liquids in DOT-111 and CPC-1232 tank cars to 50 miles per hour (80 kilometres per hour) and to 40 mph (60 km/h) in urban areas. These limits ignore empirical evidence of the explosion of such tank cars carrying crude oil in derailments in both Canada and the United States of trains travelling well below 40 mph.

As the TSB noted in its reports on the two 2015 Gogama derailments, no detailed engineering analysis had been performed to access the effect of the speed reduction on the severity of a derailment.

Permitting trains carrying dangerous goods to travel at these speeds, especially in urban areas, is like running with scissors.

3. Accelerate the phase-out of outdated, unsafe tank cars

In May 2015, Canada and the United States adopted a new, mostly harmonized, standard for the tank car carrying flammable liquids, the DOT/TC-117. The two countries also set out a schedule to phase out by 2025 tank cars built to the previous DOT-111 and CPC-1232 standards. The Canadian standard does not include the enhanced brake signal propagation technology called electronically controlled pneumatic (ECP) brakes.

In July, 2016, the Minister of Transport issued Protective Direction 38, which accelerated the phase-out of DOT-111 tank cars for crude oil service to October 31, 2016. While welcome, the 2025 deadline for the use of DOT-111 tank cars for ethanol service and CPC-1232 tank cars for crude oil service remains unchanged. This is an unacceptable risk as noted in the October 2017 National Academies of Sciences Transportation Research Board Special Report 35 *Safely Transporting Hazardous Liquids and Gases in a Changing U.S. Energy Landscape*.

Tank cars meeting the CPC-1232 standard have exploded in derailments in both Canada and the United States at speeds well below those permitted for their operation. The Transportation Safety Board of Canada has stated that tank cars meeting the CPC-1232 standard are not sufficiently crash-resistant to withstand the forces of an accident, which leads to a significant risk of tank car failure and release of dangerous goods.

The new DOT/TC-117 standard specifies that heads (or ends) of tank cars must be able to withstand the frontal impact of a loaded freight car at a speed of 18 mph and that the tank car shells must be able to withstand the side impact of a loaded freight car at the speed of 12 mph. Transport Canada has stated that, while transporting flammable liquids in DOT/TC-117 tank cars would not completely eliminate the probability of a release of a flammable liquid in a rail accident, the enhanced tank cars would significantly reduce the risk of release of a car’s contents.

Even these modest gains are not assured. Despite the inclusion of ECP brakes in the U.S. DOT-117 standard, bowing to industry pressure, the U.S. *Fixing America’s Service Transportation Act* (2015) referred the issue of their deployment for two years of study. The PHMSA issued a revised regulatory impact analysis on ECP brakes on Oct. 19, 2017, requesting comments by Nov. 1, 2017. While the RIA lowers the safety and business benefits of ECP brakes based on lower assumptions as to the number of carloads of crude oil and ethanol over a 20-year period and increased assumptions on the use of dynamic braking, ECP brakes continue to merit implementation. In addition, shippers are lobbying to water down the ceramic thermal protection that is mandated in the DOT/TC-117 standard to permit the use of glass fibre insulation. This insulation is intended to provide a minimum 100 minutes of protection from explosion in the event of a derailment, thus permitting first responders to assess the situation and act. It is acknowledged, however, that the glass fibre insulation would melt in a fire. The U.S. National Transportation Safety Board has reported that in a derailment in February 2015 at Mount Curbon, W.Va., unjacketed tank cars carrying crude oil exploded, with the first explosion occurring within 30 minutes.

4. Stabilize Bakken crude before loading

Bakken crude should be stabilized before loading to reduce its explosive characteristics below the standard currently approved and to condition it to reduce its hydrogen sulphide content.

The volatility of Bakken crude of the type involved in the Lac Mégantic derailment is high. Bakken crude contains more dissolved flammable gases, such as butane, pentane and propane, than conventional crude. This results in higher vapour pressure, thus making it more volatile and susceptible to an explosion in the event of a derailment and fire.

In Texas, comparable shale oil is stabilized to reduce its vapour pressure before it is shipped. In December 2014, the North Dakota Industrial Commission, whose mandate is to promote crude development and to regulate the same, pre-emptively established a vapour pressure standard of 13.7 pounds per square inch, considerably higher than the vapour pressure of the low - to mid-9 lbs/sq.in. observed by the TSB in the oil involved in the Lac Mégantic derailment. In its report (R13D0054), the TSB flagged volatility as an issue to be further examined as a risk factor. It also reported that the crude oil had been misclassified as being Class 3, packing group 3 (less volatile) rather than Class 3, packing group 1 (most volatile). Transport Canada arranged for 68 crude samples (only two from North Dakota) to be tested and found that the true vapour pressure of the samples was higher than the vapour pressure determined by the testing methodology used by North Dakota. The volatility issue was not addressed as part of the May 2015 new tank car standard, but was deferred for two years of further study.

In August 2015 Transport Canada received a report from Alberta Innovates-Technology Futures on proper sampling and testing methods to determine the appropriate handling protocols and classifications of crude oil, condensates and related petroleum products.

In December 2016, the Attorney General of the State of New York submitted a petition requesting PHMSA to implement a vapour pressure limit less than 9 lbs per square inch for crude oil transported by rail.

In January 2017, PHMSA issued advance notice of proposed rulemaking, indicating that it is considering revising the current Hazardous Materials Regulations to establish vapour pressure limits for unrefined petroleum-based products and potentially all Class 3 flammable liquid hazardous materials during their transportation by any mode. PHMSA proposes to use comments in response to its notice to assess and respond to the petition and to evaluate any other regulatory actions related to sampling and testing crude oil and other Class 3 hazardous materials.

In June 2017 Canadian Crude Quality Technical Association published its Vapour Pressure Measurement and Best Practices report.

We would encourage Transport Canada to continue to play a leadership role in establishing standards that are responsive to public safety rather than allowing them to be set by default by the conflicted North Dakota Industrial Commission.

5. Overhaul the Safety Management System

The safety management system (SMS) introduced in 2001 by the federal government has failed to protect the public interest and is in need of a thorough re-think, not just tinkering.

Under SMS, railways develop their own rules to manage safety on a day-to-day basis. This allows railways to determine the balance between operating efficiency and public safety, although it is the responsibility of Transport Canada to provide oversight of the safety processes to protect the public interest. Both the Auditor General and the TSB have noted that Transport Canada does not audit the safety management system of railways in sufficient depth and frequency and confirm that proactive actions are effectively implemented. The fox is in charge of the hen house.

As the TSB noted in its reports on the March 7, 2015 fiery derailment of a CN bitumen train at Gogama Ont. (the second such derailment within three weeks on that stretch of track, the prior occurring on February 14, 2015 – a third derailment on that stretch of track on March 5, 2015 at Minnipuka Ont. was not investigated by TSB) train "velocity" – the movement of trains as quickly and safety as possible – can create inter – functional pressures within a railway – conflict between track maintenance decisions and train operations. The TSB reports illustrate the failure of SMS as train operations were given priority over track maintenance, and hence public safety and Transport Canada did not proactively provide oversight.

There are myriad reasons for this but the bottom line is that the public interest in safety is not being served under a system in which railways write their own rules without adequate oversight. The matter is exacerbated by a confrontational relationship between labour and management at the railway companies. [2]

There is mounting industry pressure in the US to further erode regulatory oversight. The nominee to lead the Federal Railway Administration is on record as pushing for "performance – based regulation". Such an approach can have significant downsides, particularly in the face of budget cuts and staff cuts at regulators.[3]

We would urge Transport Canada not to succumb to such expansion of self-regulation and to re-think SMS with a view to taking back the responsibility to balance rail operations and public safety.

6. Improve railway technology and operations

Railways should be required to implement available technologies and operating procedures to reduce the inherent risk of the transportation of dangerous goods.

This includes implementing enhanced track maintenance (broken welds and rails are a leading cause of derailments), examination of track geometry, detection (hot box for bearings, dragging equipment, faulty wheels, etc.) and mandatory action on reporting. As noted in TSB report R13T0060, the derailment of a CP train carrying crude at White River, Ont. on April 3, 2013 was caused by a broken wheel that had been detected by way-side wheel impact load detector (WILD) technology four days earlier. The tank car was condemnable under the American Association of Railroads rules but CP uses a less stringent protocol for setting out a car with a faulty wheel and it permitted the car to remain in service. The derailment of the train, which was on its way to Toronto, spilled more than 100,000 litres of crude oil. The issue of elevated wheel impacts was noted again in TSB report R15H0005 on the January 13, 2015 derailment of a CP train carrying dangerous goods in Dublin, Ont., as well as in TSB report R16W0004 on the January 9, 2016 derailment of a CN train in Webster, Ont. In each of the reports, TSB noted that despite the deployment of WILD technology, each of CN and CP establishes its own criteria for condemning rail cars. Transport Canada does not mandate a criteria. The criteria established by the railways are not based on empirical analysis. Again a classic example of the operation of SMS and performance-based regulation in practice, highlighting why the public lacks confidence in the rail safety system.

Positive train control[4] (which would likely have prevented the August 21, 2016 CP derailment in Toronto) and ECP brakes[5] should be mandated in Canada, the latter despite efforts by industry challenging this implementation. Proper train securement protocols should be implemented over and above those currently in place. The rail right-of-way should be secured and not used to store tank cars (full or empty) in urban areas. The reporting – and public disclosure – of such issues as speed, movement exceeding limits of authority, uncontrolled movement, defect, should be required.

In its June 2016 report, the House of Commons Standing Committee on Transport, Infrastructure and Communities recommended the development of regulatory structures to mandate the use of locomotive voice and video recording (LVVR) by railways for use by government authorities during TSB accident investigations. The Transport Committee report also recommended that action be taken to improve the management of crew fatigue through a working group that is to table its report by January 2018. Both are initiatives that implicate collective bargaining agreements but they also affect public safety.

The need for LVVR has been on the TSB Watchlist since 2012. In September 2016, TSB recommended that data from LVVR, used in the context of a pro-active, non-punitive safety management system, would be invaluable to help railways to identify and mitigate risks before accidents occur. TSB indicated in its report that it will initiate discussion with Transport Canada regarding next steps for implementing LVVRs and the expanded use of on-board recordings in all modes.

Following discussions between Transport Canada and stakeholders, in June 2017 the *Transportation Modernization Act* proposed amendments to the *Railway Safety Act* to mandate the installation of LVVR in locomotive cabs for certain purposes. We support this initiative.

7. Increase transparency of transportation of dangerous goods

The level of disclosure regarding the transportation of dangerous goods to first responders is still not adequate. The communication of information to the public during and after a derailment is inadequate.

Protective Direction 36 and the AskRail mobile app both demand pull models that require first responders to make inquiries regarding the cargo contained on a train. This entails a loss of reaction time when minutes matter. First responders should have real-time information on train cargo.

In addition, the public should be provided with real-time information from official sources about what to do in the event of a derailment together with a report setting out how the current response system functioned in each derailment.

8. Railways should bear the cost of preparedness

Those making the profit should bear the external costs that their business imposes.

The cost of training and equipping local first responders should not be borne by taxpayers. This is the principle in airport safety, whose costs are borne by the airport authority and passed on to airlines and ultimately the passengers. No municipality, however large, is equipped to deal with a major incident. Plaster Rock (TSB report R14M0002) Lac Mégantic, the two Gogama derailments and Mississauga in 1979 make this clear. Nearly 85 percent of fire departments in Canada are composed of volunteers.

Evacuation plans should be current and tested frequently.

9. Shift liability and compensation costs away from the public

The enhanced liability and compensation regime under the *Safe and Accountable Rail Act* is inadequate. The public should not bear the risk associated with the transportation of dangerous goods under the common carrier model. That risk should be allocated to shippers, railways and consignees as they are best able to manage the risk.

There should be strict liability for damages with no obligation to prove negligence for damages exceeding insurance minimums mandated by statute.

The shipper levy of $1.65 per tonne of crude ($0.23/barrel) will take years to fully fund the $250 million compensation fund mandated under the act. That fund, together with the minimum insurance coverage, is below what would be required to compensate for a major derailment.

The Auditor-General has noted that, given the volume of traffic and the nature of cargo being transported, additional major events are possible with a cost of up to $10 billion. Transport Canada has estimated the cost of an incident such as Lac Mégantic at $1.5 billion.

TSB reports on the derailment in Lac Mégantic and the March 7, 2015 derailment in Gogama illustrate that in addition to wrongful death, moral damages and property and economic claims, such occurrences entail substantial environmental impacts. In the case of Lac Mégantic, the Province of Quebec received 52.4% of the funds available for compensation. In the case of Gogama, the Mattagami First Nations commenced legal proceedings in August 2017 to recover $30 million in environmental damages. In October 2017 CN lost an appeal of an award against it to pay compensation to the Province of Ontario as a result of the Gogama derailment.

The federal government has regulatory oversight for the transportation of dangerous goods by rail and is in a position to manage that risk.

For claims in excess of available insurance, any compensation fund and the resources of the shippers' railways and customers, the federal government should provide, as it does in the nuclear industry, a backstop as it does in the nuclear industry and collect premiums from shippers, railways and consignees.

10. Revisit guidelines for new development near rail operations

In May 2013, two months before the Lac Mégantic derailment, the Federation of Canadian Municipalities and the Railway Association of Canada published guidelines for new development near railway lines, which called for a setback of 30 metres and construction of an earthen berm. The guidelines do not address the risk associated with explosion or release of toxins.

Railways are correct when they argue that urban growth has eroded the buffers to their operations. This is because the guidelines are more honoured in the breach than in the observance. Municipalities, land use control bodies (such as the Ontario Municipal Board and the Province) foster intensification/densification, routinely compromising the safety benefit that the Guidelines seek to provide.

With urban growth expected to continue, the guidelines should be revisited with a view to their effectiveness and in order to protect rail corridors.

[1] Railways are common carriers under the *Canada Transportation Act*. They are obliged to transport products offered to them by shippers provided that the product is properly classified and packaged in appropriate means of containment.

There are nine classes of dangerous goods. Some classifications have sub categories called packaging groups. The class of dangerous goods that has attracted the most attention is Class 3 flammable liquids, which is broken down into packing groups 1-3, with packing group 1 being the most flammable. They pose the risk of fire and explosion such as at Lac Mégantic, Que., and Gogama, Ont. Class 3 includes include crude oil, aviation fuel, gasoline and ethanol.

Other dangerous goods pose different risks, such as Class 2 compressed gasses or liquids such as anhydrous ammonia, chlorine and propane, Class 6 goods that are toxic by inhalation or contact, such as hydrogen cyanide and Class 8 goods that are corrosive, such as sulphur acid and hydrochloric acid. Each class of dangerous good is identifiable by a distinctive colour-coded placard that must be attached by the shipper to the container in which the product is shipped. Each dangerous good has assigned to it a number designated by the United Nations that is globally recognized. For example, chlorine is 1017, propane 1978, anhydrous ammonia 1005, gasoline 1203, ethanol 1987, sulphuric acid 1831.

[2] For a good discussion of SMS see the Lac Mégantic Disaster and Transport Canada's Safety Management System (SMS) Model: Implications for Reflexive Regulatory Regimes, Mark Winfield, 28.3 *Journal of Environmental Law and Practice* 299.

[3] See limits of Performance-Based Regulation, Casey Coglianese (2017) Volume 5, Issue 3, and University of Michigan Journal of Law Reform.

[4] Positive train control (PTC) is a system for monitoring and controlling train movement. Think of it as analogous to the work currently under way with respect to autonomous vehicles on roads. The system is designed to prevent train-to-train collisions, over speed derailments, incursions into work zone limits and movement of a train through a switch left on the wrong position.

The American Association of Railroads has seized on the rollout of PTC as a basis to argue for the reduction of locomotive crews from two to one. The operation of a train by a single person was cited as a contributing factor to the Lac Mégantic derailment. In the 1979 Mississauga derailment, brakeman Larry Krupa ran back to the undamaged 32nd car in the train to allow the engineer in the locomotive to release the airbrakes between the head of the train and the derailed cars and move the undamaged cars to safety. Similarly, the conductor in the January, 2015 derailment at Dublin, Ont., who attended at the derailed tank cars, was overcome by propane fumes. PTC was mandated in the United States soon after an October 2008 collision between a Metrolink commuter train and a Union Pacific freight train in the Chatsworth district of Los Angeles that resulted in fatalities. The original implementation date of December 2015 has been extended to December 2018.

In Canada there are currently no PTC systems in use by freight or passenger railways, and there are no planned PTC installations for federally regulated railways. However, to meet the PTC requirements for their United States operations, both CN and CP have PTC implementation plans for their United States routes. As part of CP's implementation plan, 1004 locomotives will be equipped with the required on-board systems as will approximately 2850 miles of track in the United States. As part of CN's PTC implementation plan, 1000 locomotives will be equipped with the required on-board systems, as will approximately 3720 route miles of tracks in the United States.

TSB Report R16T0162 on the August 21, 2016 derailment along Dupont Street in Toronto and TSB Report R12T0038 on the February 26, 2012 derailment of a VIA train in Burlington Ontario that involved operating crew fatalities both reference the benefit of PTC technology.

[5] Trains use air brakes, whose use dates from 1869. The brakes are activated mechanically in sequence from the locomotive then to the rear of the train. In long trains – more than 8,000 feet -- the brake signal takes up to two minutes to reach all cars, with the result that the train does not decelerate as quickly as it could and often cars will jackknife or pile up in a derailment. The ECP systems activate the brakes on each car almost simultaneously using an electric signal, resulting in faster application of brakes. Other systems that can accelerate the transmission of the brake signal from the head of the train are distributed power (which uses a locomotive in the middle of the train) or end-of-train devices.