Transportation Safety Board of Canada
Bureau de la sécurité des transports du Canada

REASSESSMENT OF THE RESPONSE TO TSB RECOMMENDATION R14-02

Route planning and analysis for trains transporting dangerous goods

Background

On 06 July 2013, shortly before 0100 Eastern Daylight Time, eastward Montreal, Maine & Atlantic Railway freight train MMA-002, which had been parked unattended for the night at Nantes, Quebec, started to roll. The train travelled about 7.2 miles, reaching a speed of 65 mph. At about 0115, while approaching the centre of the town of Lac-Mégantic, Quebec, 63 tank cars carrying petroleum crude oil, UN 1267, and 2 box cars derailed. As a result of the derailment, about 6 million litres of petroleum crude oil spilled. There were fires and explosions, which destroyed 40 buildings, 53 vehicles and the railway tracks at the west end of Megantic Yard, and 47 people were fatally injured. There was environmental contamination of the downtown, the adjacent river and lake.

The Board concluded its investigation and released report R13D0054 on 19 August 2014.

TSB Recommendation R14-02 (January 2014)

A primary safety concern related to the transportation of dangerous goods by rail is the prevention of a catastrophic release or explosion in a densely populated area or in an environmentally sensitive area. The Lac-Mégantic accident has heightened the public's awareness of the risks associated with the transportation of dangerous goods.

The Association of American Railroads (AAR) Circular OT-55-N or similar operating restrictions are necessary to alleviate many of the shortcomings identified during the Lac-Mégantic investigation and other investigations involving the release of dangerous goods.

However, these measures need to be complemented by a more comprehensive, proactive approach. An approach based on Circular OT-55-N, strengthened with a requirement to conduct route planning and analysis, would be a positive step to improve the safety of transporting dangerous goods by rail. Therefore, the Board recommended that

> the Department of Transport set stringent criteria for the operation of trains carrying dangerous goods, and require railway companies to conduct route planning and analysis as well as perform periodic risk assessments to ensure that risk control measures work.
>
> **TSB Recommendation R14-02**

Transport Canada's response to Recommendation R14-02 (April 2014)

On addressing route planning and analysis for trains carrying dangerous goods, Transport Canada (TC) issued an Emergency Directive under section 33 of the *Railway Safety Act* on

23 April 2014. It requires railways carrying dangerous goods to implement minimum key operating practices to address the Board's recommendation and manage the immediate safety issue, including speed restrictions for trains carrying dangerous goods, expansion of inspection requirements on restricted rail routes, and the completion of risk assessments for rail transportation routes. These requirements are built upon voluntary approaches in the United States, but also take into account differences in Canadian operations and areas where Canadian requirements are already more stringent.

The Emergency Directive is in force for 6 months and may need to be renewed to reflect further consultation with stakeholders, including the Federation of Canadian Municipalities, unions, and consideration of any additional United States requirements that may be established. Any further safety advisories or recommendations in this area from the TSB will also need to be taken into account.

At the same time, TC also issued a Ministerial Order under section 19 of the *Railway Safety Act* requiring railways carrying dangerous goods to formulate and submit for approval within 180 days new rules based on these operating practices to further improve the safe transportation of dangerous goods by rail in the long term.

TSB assessment of response to Recommendation R14-02 (June 2014)

Transport Canada (TC) has accepted the recommendation and has issued an Emergency Directive that requires railways to set improved criteria for the operation of trains carrying dangerous goods, to conduct route planning and analysis, and to perform initial and periodic risk assessments. Further consultations with stakeholders will be conducted and the Emergency Directive may be renewed and modified based on any new information.

The Emergency Directive will require risk assessments to be conducted on key routes over which key trains operate. It will require that such routes meet enhanced inspection and maintenance requirements. However, key routes are defined as a route over which 10 000 car loads of dangerous goods are transported annually. This threshold may limit the number of routes subject to these safety measures. A rigorous analysis should be conducted of the 10 000 car threshold to determine which routes with trains carrying dangerous goods will be excluded and whether the safety deficiency identified in R14-02 will be addressed.

TC also issued a Ministerial Order requiring railways carrying dangerous goods to formulate and submit for approval new rules to improve their operating practices for the safe and secure transportation of dangerous goods. If the new rules contain the same scope of activities or more, but are strengthened to include more railway routes, the risk posed by movements of dangerous goods could be significantly reduced. However, the proposed rules have not yet been developed and the outcome cannot be known until the process is finalized.

Therefore, the Board assesses the response to Recommendation R14-02 as having **Satisfactory Intent**.

Response from the Railway Association of Canada (RAC) to Recommendation R14-02 (February 2015)

The Emergency Directive (ED) issued on 23 April 2014 placed restrictions on key trains and key routes. It also required that risk assessments be conducted for all key routes. RAC filed a rule to incorporate these requirements with the Minister on 20 October 2014. This rule has not yet been

approved, as TC asked for an extension. There is currently a second ED in effect, identical to the first. On 17 November 2014, under section 36 of the *Railway Safety Act*, TC required companies to file their Key Route Risk Assessments by December 1st. Industry complied, including CP, CN, BNSF, and SOR.

Transport Canada's response to Recommendation R14-02 (May 2015)

The Railway Association of Canada (RAC) on behalf of its member railways filed the Rules respecting Key Trains and Key Routes, on 20 October 2014. The period for TC's consideration of the rules was extended to allow for further examination of the RAC proposal. On 17 April 2015, TC rejected the RAC proposal, after determining that the proposed rules were not sufficiently conducive to safe railway operations. TC will be issuing a new Ministerial Order before summer to the industry. The deadline to submit proposed rules will be provided at that time. On 23 April 2015, given that no rules were approved, and in the interest of ensuring continued safety, TC issued a new Emergency Directive regarding the Rail Transportation of Dangerous Goods which will remain in effect until 17 August 2015.

The 5 railways that have identified Key Routes have filed their risk assessments with TC which are currently being reviewed. The reviews will be completed by summer 2015. As required, the railways will be informed of what is needed in order to meet the Emergency Directive.

TC is confident that under the current definition of Key Routes, all mainlines and secondary lines have been identified. With respect to the 10,000 car load threshold, it was adopted based on the criteria outlined in the AAR's Circular OT-55-N, which were also adopted by US railways. TC recognizes that more analysis must be performed in order to determine a carload threshold that would optimize the safe transportation of dangerous goods, which may lead to more stringent criteria for Key Routes. TC will contract a third party expert to conduct the necessary analysis to determine the appropriate threshold criteria.

TC is also considering whether to expand the current criteria that define key trains by introducing requirements for technology that could enhance braking capability. Moreover, through the Risk Based Planning process, TC will review all federally regulated railways to identify those that transport crude oil, but did not meet the 10,000 tank car threshold on their routes. Through this risk-based approach, TC will assign appropriate resources to further monitor these railway operators.

The *Railway Safety Management System Regulations*, 2015 published in the Canada Gazette, Part II, on 25 February 2015 and in force on 01 April 2015, contain requirements for a risk assessment process. Section 15 of the regulations requires that a railway company must conduct a risk assessment when it proposes to begin transporting dangerous goods, or to begin transporting dangerous goods different from those it already transports, or when there is a proposed change to its railway operations. Changes in railway operations include a change that may affect the safety of the public or personnel or the protection of property or the environment, such as an increase in the volume of dangerous goods it transports and a change to the route on which dangerous goods are transported.

Furthermore, in May 2015, TC announced the final regulations detailing the new tank car requirements (TC-117) and the retrofit schedule, allowing industry to begin modernizing the tank car fleet for transporting flammable liquids.

TSB reassessment of the response to Recommendation R14-02 (May 2015)

Transport Canada (TC) issued a new Emergency Directive regarding the Rail Transportation of Dangerous Goods which will remain in effect until 17 August 2015. Key Route risk assessments have been prepared by the railways and are currently under review by TC. For railways that do not meet the 10,000 tank car threshold, TC will assign appropriate resources to monitor the railway's route planning and analysis and risk assessments for the operation of trains carrying dangerous goods. The *Railway Safety Management System Regulations*, 2015 also contain requirements for the railway to conduct risk assessments under several additional scenarios involving the transportation of dangerous goods. These proposed safety actions, combined with the implementation of new tank car standards (TC-117), are expected to substantially reduce the risk associated with this safety deficiency.

A preliminary assessment of the performance of CPC-1232 tank cars based on a number of recent crude oil unit train accidents has identified vulnerability of this type of tank car to similar failures as the legacy Class 111 tank cars. Given the schedule for the implementation of new tank car standards, and in light of recent derailments, the Board is concerned about the adequacy of the existing risk control measures during the transition. Strategies for Route Planning and Analysis must consider the risks when using Class 111 tank cars during the phase-out period. The risk assessments of transporting flammable liquids by rail using the current tank cars must include a thorough review of the operational and infrastructure risks and these risks must be effectively managed.

When key route risk assessments and mitigation strategies are completed and when the new tank car standards and retrofits are substantially implemented, the risks associated with the transportation of flammable liquids by rail should be significantly reduced.

Therefore, the Board reassesses the response to the recommendation as having **Satisfactory Intent**.

Transport Canada's response to Recommendation R14-02 (January 2016)

Transport Canada (TC) issued an updated Emergency Directive regarding the Rail Transportation of Dangerous Goods on 17 August 2015, in effect until 18 February 2016, along with a new Ministerial Order for re-formulated rules respecting Key Trains and Key Routes. The rules were submitted on 15 December 2015.

The 5 railways that have identified Key Routes have filed their risk assessments with Transport Canada. The risk assessments were reviewed during March and April 2015 by Transport Canada and discussions were held with each company on the content of their submission. Transport Canada had further discussions with those companies whose risk assessments were not deemed to have met the intent of the Emergency Directive requirements. As a result, those companies provided additional analysis and information.

TC is confident that under the current definition of Key Routes, all mainlines and secondary lines have been identified. With respect to the 10 000-carload threshold, it was adopted based on the criteria outlined in the AAR's Circular OT-55-N, which was also adopted by United States railways. TC recognizes that more analysis must be performed to determine a carload threshold that would optimize the safe transportation of dangerous goods, which may lead to more stringent criteria for Key Routes. TC has contracted a third-party expert to conduct the necessary analysis to determine the appropriate threshold criteria.

The project, which is being led by TC's Transport Development Centre, will determine the appropriate threshold criteria for Key Routes. The decision has been made to develop a TC-specific tool/methodology for this project. Evaluation of existing applications revealed these were not designed for the purpose of the project work and lacked Canadian data. Research into background of the AAR OT-55-L definition of key routes is ongoing. As this definition dates back more than 20 years, there is little historical information available. The literature gathered to date is being reviewed. In addition, Canadian rail traffic (carload/volume) and accident data analysis is ongoing. The final report for this project is expected by October 2016.

TC is also considering whether to expand the current criteria that define key trains by introducing requirements for technology that could enhance braking capability. Moreover, through the Risk-Based Planning process, TC will review all federally regulated railways to identify those that transport crude oil, but did not meet the 10 000 tank car threshold on their routes. Through this risk-based approach, TC has assigned appropriate resources to further monitor these railway operators.

As part of its risk-based business planning process, oversight of the emergency directives (EDs) on Rail Transportation of Dangerous Goods (Key Trains/Key Routes) was identified as a key risk control action. TC has incorporated into its National Oversight Plan a dedicated inspection program for railways operating key trains (including those who did not meet the 10 000 tank car threshold of having a key route).

The *Railway Safety Management System Regulations*, 2015, published in the *Canada Gazette*, Part II, on 25 February 2015 and in force on 01 April 2015, contain requirements for a risk assessment process. Section 15 of the regulations requires that a railway company must conduct a risk assessment when it proposes to begin transporting dangerous goods, or to begin transporting dangerous goods different from those it already transports, or when there is a proposed change to its railway operations. Changes in railway operations include a change that may affect the safety of the public or personnel, or the protection of property or the environment, such as an increase in the volume of dangerous goods it transports and a change to the route on which dangerous goods are transported.

Finally, in May 2015, TC published in the *Canada Gazette*, Part II, new regulations detailing the requirements for new-build flammable liquid tank car (TC-117), its associated retrofit requirements / schedule for older DOT-111 and CPC-1232 tank cars, modernizing the tank car fleet for transporting flammable liquids in North America.

Railway Association of Canada's response to Recommendation R14-02 (January 2016)

On 15 December 2015, the Railway Association of Canada filed a rule with the Minister to incorporate these requirements. Industry has completed risk assessments on all key routes in the network.

TSB reassessment of the response to Recommendation R14-02 (March 2016)

This recommendation is related to the TSB Watchlist issue of "Transportation of flammable liquids by rail". The transportation of flammable liquids, such as crude oil, by rail across North America has created emerging risks that need to be effectively mitigated.

On 17 August 2015, Transport Canada (TC) issued an updated Emergency Directive regarding the Rail Transportation of Dangerous Goods, which was in effect until 18 February 2016. TC

also issued a Ministerial Order for new rules regarding key trains and key routes. TC approved the *Rules Respecting Key Trains and Key Routes* that were filed under section 19 of the *Railway Safety Act* on 15 December 2015. These rules came into effect on 19 February 2016.

Following the risk assessments from 5 railways reviewed in spring 2015, assessments which were deemed not to have met the Emergency Directive were returned for additional analysis and information.

In addition, TC has contracted a third-party to conduct the analysis to determine the appropriate threshold criteria on key routes. TC will be developing a specific tool/methodology for this project. TC will conduct ongoing research and will continue to review the rail traffic and accident data and literature. The final report is expected by October 2016.

TC will continue its risk-based approach and assign appropriate resources to monitor the railways. TC has incorporated a dedicated inspection program for railways operating key trains into its plan.

Given TC's progress on this issue, including more stringent risk assessment criteria for railways handling dangerous goods, the ongoing analysis to determine the appropriate threshold criteria on key routes, and the recent promulgation of *Rules Respecting Key Trains and Key Routes*, the Board considers the risks associated with a catastrophic dangerous goods release or explosion to have been reduced. However, while some progress has been made on the 5 railways that have identified key routes, analysis of the appropriate threshold criteria for key routes must still be performed.

Therefore, the Board reassesses TC's response to Recommendation R14-02 as having **Satisfactory Intent**.

Transport Canada's response to Recommendation R14-02 (March 2017)

Transport Canada has put in place a significant number of measures to improve railway safety including improved regulations regarding company's safety management systems, regulations prescribing fines for contraventions to the *Railway Safety Act*, and a new liability and compensation regime for federally regulated railways.

Transport Canada issued an Emergency Directive under the *Railway Safety Act* in April 2014 which required railways carrying dangerous goods to implement minimum key operating practices, including speed restrictions for trains carrying dangerous goods, and the completion of risk assessments for rail transportation routes.

In February 2016, Transport Canada approved the *Rules Respecting Key Trains and Key Routes*, which is a permanent rule for the safe transportation of dangerous goods by rail. This rule requires railway companies that operate key trains[1] to not exceed 50 mph, and it places a further reduction on speed to a maximum of 40 mph for key trains operating in highly urbanized areas.

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1 **"Key Train"** means an engine with cars:

a) that includes one or more loaded tank cars of dangerous goods that are included in Class 2.3, Toxic Gases and of dangerous goods that are toxic by inhalation subject to Special Provision 23 of the *Transportation of Dangerous Goods Regulations*; or

For companies operating Key Routes[2], the rule expands requirements for inspection of track and requires defective equipment detectors. The rule also requires more robust Key Route risk assessments to be conducted at a minimum of every three years, based on minimum of 28 factors such as, volume and type of dangerous goods transported, population density along the route, and emergency response capability along the route.

Self-reporting by railways has indicated that, for Class 1 railways (Canadian National and Canadian Pacific), 95% or greater of their core networks are Key Route miles. As part of their Key Route risk assessment, railway companies are required to identify, evaluate and compare alternative routes over which the company has the authority to operate. In addition, the rule requires companies to incorporate input from municipalities and other local governments into their risk assessments.

Transport Canada's oversight activities include monitoring the safety of railway companies' operations, as well as compliance with rules, regulations and standards through audits and inspections, and taking appropriate enforcement action as required. Oversight of the new rules has been integrated into the oversight plan and continues to be an area of priority.

The requirements for risk assessment in the rule are complementary to the *Railway Safety Management System Regulations, 2015* (SMS Regulations) which came into force on 01 April 2015. The SMS Regulations require a railway company to conduct a risk assessment when it has a change in operations which may affect the safety of the public or personnel or the protection of property or the environment. The following are considered circumstances requiring a risk assessment under the SMS regulation: beginning to transport dangerous goods, transporting dangerous goods different from those already carried, increasing the volume of dangerous goods carried, or changing the route on which dangerous goods are transported. The risk assessment process must describe the risks, identify remedial actions, and evaluate the effectiveness of remedial actions.

Transport Canada inspectors can use a variety of tools to address non-compliance. On 01 April 2015, new *Administrative Monetary Penalty Regulations* came into force under the *Railway Safety Act*. Since then, Railway Administrative Monetary Penalties (fines) have been issued by Transport Canada for non-compliance.

In its June 2014 assessment of TC's response to recommendation R14-02, the TSB stated:

> The Emergency Directive will require risk assessments to be conducted on key routes over which key trains operate. However, key routes are defined as a route over which 10,000 car loads of dangerous goods are transported annually. This threshold may limit the number of routes subject to these enhanced safety

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b) that includes 20 or more loaded tank cars or loaded intermodal portable tanks containing dangerous goods, as defined in the *Transportation of Dangerous Goods Act*, 1992 or any combination thereof that includes 20 or more loaded tank cars and loaded intermodal portable tanks.

[2] "**Key Route**" means any track on which, over a period of one year, is carried 10,000 or more loaded tank cars or loaded intermodal portable tanks containing dangerous goods, as defined in the *Transportation of Dangerous Goods Act*, 1992 or any combination thereof that includes 10,000 or more loaded tank cars and loaded intermodal portable tanks.

> measures. A rigorous analysis should be conducted of the 10,000-car threshold to determine which routes will be excluded and whether the safety deficiency identified in R14-02 will be addressed.

In response to this assessment, TC committed that it would review the 10,000 car loads threshold to define Key Routes.

TC and the National Research Council Canada recently completed a study which included scientific and engineering analysis to connect the volume of dangerous goods transported (in terms of car loads) in the context of risk factors within the Canadian rail network (such as railway infrastructure conditions, operation and maintenance practices) correlated with traffic volumes, and potential consequences to safety of population exposed along the route, the environmental consequences to waterways and parklands, as well as the economic consequences to rail transportation in Canada.

The study illustrated that risk is influenced by more than the number of car loads of dangerous goods which are carried. Other factors such as operating and maintenance practices of railways, infrastructure conditions, as well as population density and environmental conditions along the route also strongly influence risk.

At the current volume of dangerous goods being transported, the study found the impact of reducing the Key Route threshold was low. In the case of Class 1 railways (CN and CP), the majority of their mainline subdivisions are already Key Routes. Shortline railways generally transport an annual average of dangerous goods car loads much lower than 10,000.

In addition, Class 1 railway subdivisions analyzed in the study have relatively flat safety risk gradients, meaning that based on current operating conditions, their risk level does not appear to increase or decrease by much with changes in volumes of dangerous goods transported.

The study reinforced TC's current risk-based approach to oversight by concluding that a targeted oversight approach, on an on-going basis, to identify subdivisions with the highest risk gradient and risk level, would be the most effective approach.

Taking into account the outcomes of the study, the Department has decided the threshold for defining a key route will remain at 10,000 car loads in the Rule. Going forward, TC will incorporate outcomes from the study, with respect to identifying subdivisions with the highest risk gradient and risk level, to inform and enhance its oversight of railways operating Key Trains and Key Routes.

Transport Canada has implemented a series of integrated measures that improve safety and reduce risk for the transportation of dangerous goods by rail. These measures respond to all aspects of Recommendation R14-02.

Railway Association of Canada's response to Recommendation R14-02 (March 2017)

On 15 December 2015, the Railway Association of Canada filed a rule (*Rules Respecting Key Trains and Key Routes*) with the Minister to incorporate these requirements. Transport Canada approved the rules (effective 19 February 2016) and the new rules have been implemented by the railways.

The industry is prepared to work with TC regarding the analysis of the appropriate threshold criteria for key routes that they are performing.

TSB reassessment of the response to Recommendation R14-02 (March 2017)

This recommendation is related to the TSB Watchlist issue of "Transportation of flammable liquids by rail." The transportation of flammable liquids, such as crude oil, by rail across North America has created emerging risks that need to be effectively mitigated.

In February 2016, Transport Canada approved the *Rules Respecting Key Trains and Key Routes*, which is a permanent rule for the safe transportation of dangerous goods by rail. This rule requires railway companies that operate key trains to not exceed 50 mph, with a further speed reduction to a maximum of 40 mph for key trains operating in highly urbanized areas. This rule requires increased frequencies for rail flaw inspections and geometry inspections for some classes of track on key routes. In addition, there are enhanced joint bar inspection requirements for key routes. The rule also requires railways to install wayside defective bearing detectors on key routes, and to ensure that trains do not proceed more than 40 miles without a roller bearing inspection.

About 95% of the core network for Class 1 railways is key routes. Key route risk assessments have been conducted and will be conducted every 3 years (at a minimum). These risk assessments considered 28 specific factors to assess the safety and risk for each key route. However, in conjunction with these assessments, railway companies should also proactively anticipate the impact of certain risk factors, such as the increase in traffic tonnage, the increased use of heavier rail cars and the potential for more rapidly degrading track structure. This approach will help ensure that track on key routes is maintained to the required standards and that the risk of track infrastructure failure is appropriately mitigated. As part of the key route reviews, the railways must also incorporate input from municipalities and other local governments into their risk assessments. Railway companies must then identify, evaluate, and compare alternative routes over which the company has the authority to operate.

The requirements for the key route risk assessments are complementary to the *Railway Safety Management System Regulations, 2015* (SMS Regulations) which came into force on 01 April 2015. Circumstances requiring a risk assessment under the SMS Regulations include transporting dangerous goods different from those already carried, increasing the volume of dangerous goods carried, or changing the route on which dangerous goods are transported.

TC recently completed its study to determine the appropriate threshold criteria on key routes. The study indicated that risk is influenced by more than the number of car loads of dangerous goods carried. Other factors that were found to influence risk included operating and maintenance practices of railways, infrastructure conditions, population density, and environmental conditions along the route. As a result, TC decided that the threshold for defining a key route will remain at 10 000 carloads. TC believes that the study outcome reinforces its risk-based approach to oversight and that identifying subdivisions with the highest risk gradient and risk level is the most effective approach. TC will use the outcomes from the study to help identify the subdivisions with the highest risk levels in order to enhance its oversight of railways operating key trains and key routes.

Moreover, TC had previously indicated that, through its risk-based planning process, it would review all federally regulated railways to identify those that transport crude oil but do not meet the 10 000-carload threshold on their routes. Through this risk-based approach, TC would

assign appropriate resources to further monitor these railway operators. TC's national oversight plan includes a dedicated inspection program for railways operating key trains, including those that do not meet the 10 000-carload threshold.

TC's risk-based planning process should ensure that all federally regulated shortline railways are assessed for risk and are appropriately monitored with respect to route planning and analysis. However, this process must also ensure that any future increases in the volumes of crude oil being transported by shortline railways are considered and that any necessary adjustments are made to the risk-based approach.

The Board acknowledges TC's progress on a number of integrated measures relating to route planning and analysis for trains transporting dangerous goods. However, some TSB investigations[3] have shown that railway companies have not always effectively managed the emerging risks to railway infrastructure associated with transporting increased volumes of dangerous goods.

The Board reassesses TC's response to Recommendation R14-02 as having **Satisfactory Intent**.

Transport Canada's response to Recommendation R14-02 (January 2018)

Since the tragic accident in Lac-Mégantic, Transport Canada has put in place a significant number of measures to improve railway safety including more stringent requirements for the securement of unattended railway equipment, improved regulations regarding a company's safety management systems, regulations prescribing fines for contraventions to the *Railway Safety Act*, improved tank car standards, emergency response plans, and a new liability and compensation regime for federally regulated railways. A detailed list of measures can be found at http://www.tc.gc.ca/eng/mediaroom/infosheets-menu-7564.html.

The Transportation Safety Board's recommendation R14-02 recommended "Transport Canada set stringent criteria for the operation of trains carrying dangerous goods, and require railway companies to conduct route planning and analysis as well as perform periodic risk assessments to ensure that risk control measures work".

To address the immediate safety issues after the Lac-Mégantic derailment, Transport Canada issued an Emergency Directive under the *Railway Safety Act* in April 2014 which required railways carrying dangerous goods to implement minimum key operating practices, including speed restrictions for trains carrying dangerous goods, and the completion of risk assessments for rail transportation routes.

In February 2016, Transport Canada approved the *Rules Respecting Key Trains and Key Routes*, which is a permanent rule for the safe transportation of dangerous goods by rail (www.tc.gc.ca/eng/railsafety/rules-996.html). This rule requires railway companies that operate Key Trains[4] to not exceed 50 miles per hour, and it places a further reduction on speed to a maximum of 40 miles per hour for key trains operating in highly urbanized areas.

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3 R05E0059, R13E0142, R14E0081, R14W0256, R15H0013, R15H0021.

4 **"Key Train"** means an engine with cars:

a) that includes one or more loaded tank cars of dangerous goods that are included in Class 2.3, Toxic Gases and of dangerous goods that are toxic by inhalation subject to Special Provision 23 of the *Transportation of Dangerous Goods Regulations*; or

For companies operating Key Routes[5], the rule expands requirements for inspection of track and requires defective equipment detectors. The rule also requires more robust Key Route risk assessments to be conducted at a minimum of every three years, based on minimum of 28 factors such as, volume and type of dangerous goods transported, population density along the route, and emergency response capability along the route.

As part of their Key Route risk assessment, railway companies are required to identify, evaluate and compare alternative routes over which the company has the authority to operate. In addition, the rule requires companies to incorporate input from municipalities and other local governments into their risk assessments. Transport Canada's oversight activities include monitoring the safety of railway companies' operations, as well as compliance with rules, regulations and engineering standards through audits and inspections, and taking appropriate enforcement action as required. Oversight of the new rule has been integrated into the oversight plan and continues to be an area of priority.

The requirements for risk assessments in the rule is complementary to the *Railway Safety Management System Regulations, 2015* (SMS Regulations) which came into force on April 1, 2015. The SMS Regulations require a railway company to conduct a risk assessment when it has a change in operations which may affect the safety of the public or personnel or the protection of property or the environment. The following are considered circumstances requiring a risk assessment under the SMS Regulations: beginning to transport dangerous goods, transporting dangerous goods different from those already carried, increasing the volume of dangerous goods carried, or changing the route on which dangerous goods are transported. The risk assessment process must describe the risks, identify remedial actions, and evaluate the effectiveness of remedial actions.

Transport Canada Railway Safety Inspectors can use a variety of tools to address non-compliance to rules and regulations. On April 1, 2015, new *Administrative Monetary Penalty Regulations* came into force under the *Railway Safety Act*. A list of railway administrative monetary penalties (fines) issued by Transport Canada can be found at https://www.tc.gc.ca/eng/railsafety/railsafety-975.html.

In one of its reassessments of Transport Canada's response to recommendation R14-02, the TSB stated:

> The Emergency Directive will require risk assessments to be conducted on key routes over which key trains operate. However, key routes are defined as a route over which 10,000 car loads of dangerous goods are transported annually. This threshold may limit the number of routes subject to these enhanced safety measures. A rigorous analysis should be conducted of the 10,000-car threshold to

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b) that includes 20 or more loaded tank cars or loaded intermodal portable tanks containing dangerous goods, as defined in the *Transportation of Dangerous Goods Act*, 1992 or any combination thereof that includes 20 or more loaded tank cars and loaded intermodal portable tanks.

[5] "**Key Route**" means any track on which, over a period of one year, is carried 10,000 or more loaded tank cars or loaded intermodal portable tanks containing dangerous goods, as defined in the *Transportation of Dangerous Goods Act*, 1992 or any combination thereof that includes 10,000 or more loaded tank cars and loaded intermodal portable tanks.

> determine which routes will be excluded and whether the safety deficiency identified in R14-02 will be addressed.

In response to this assessment, Transport Canada made a commitment that it would review the 10,000 car loads threshold to define Key Routes.

To this end, Transport Canada and the National Research Council Canada have recently completed a study which included scientific and engineering analysis to connect the volume of dangerous goods transported (in terms of car loads) in the context of risk factors within the Canadian rail network (such as railway infrastructure conditions, operation and maintenance practices) correlated with traffic volumes, and potential consequences to safety of population exposed along the route, the environmental consequences to waterways and parklands, as well as the economic consequences to rail transportation in Canada.

The study illustrated that risk is influenced by more than the number of car loads of dangerous goods which are carried. Other factors such as operating and maintenance practices of railways, infrastructure conditions, as well as population density and environmental conditions along the route also strongly influence risk.

At the current volume of dangerous goods being transported, the study found the impact of reducing the Key Route threshold was low. In the case of Class 1 railways (CN and CP), the majority of their mainline subdivisions are already Key Routes. Shortline railways generally transport an annual average of dangerous goods car loads much lower than 10,000.

In addition, Class 1 railway subdivisions analyzed in the study have relatively flat safety risk gradients, meaning that based on current operating conditions, their risk level does not appear to increase or decrease by much with changes in volumes of dangerous goods transported.

The study reinforced Transport Canada's current risk-based approach to oversight by concluding that a targeted oversight approach, on an on-going basis, to identify subdivisions with the highest risk gradient and risk level, would be the most effective approach.

Taking into account the outcomes of the study, the Department has decided the threshold for defining a Key Route will remain at 10,000 car loads in the Rule. Going forward, Transport Canada will incorporate outcomes from the study, with respect to identifying subdivisions with the highest risk gradient and risk level, to inform and enhance its oversight of railways operating Key Trains and Key Routes.

In conclusion, Transport Canada has implemented a series of integrated measures that improve safety and reduce risk for the transportation of dangerous goods by rail. These measures respond to all aspects of Recommendation R14-02 of the Transportation Safety Board.

While no new initiatives were undertaken in 2017 related to this recommendation, as mentioned previously, the focus remains on oversight for compliance to the current rules and regulations and further refining the risk-based oversight methodology with the assistance of a statistician consultant which will result in an increase in the number of risk-based inspections. More specifically, updates have been made to the risk-based planning process for 2018-19:

1. The risk matrix used has been updated to a 5x5 matrix that is used in other modes. Clear definitions for each impact and likelihood level are provided.

2. Additionally, data analysis is playing a major role in risk identification, and risk monitoring, which has led to a more evidence-based risk planning process.

3. More focus has been placed on addressing risk areas, through inspections, audits, or other activities such as reviews of data/documents, analysis, and following up on occurrences.

4. The random sample selected used to calculate defect rates has been reduced based on the recommendation of a statistician. This has freed up resources to focus on risk areas.

Using the revised methodology, each functional discipline (e.g., operations, equipment, track, crossings or signals) will address the highest risk locations as top priority. In contrast to past years and after working with the statistician consultant, Rail Safety has reduced the number of sampling inspections significantly, in order to be able to place more resources towards addressing areas of risk. In taking this approach, the sampling program will still allow for trends to be developed, which should be the main focus of a sampling program; the minimum amount of inspections that will give you enough information to get the pulse of the industry.

Railway Association of Canada's response to Recommendation R14-02 (January 2018)

Railway companies have implemented a number of safety enhancements that have a direct influence on the safe transport of trains carrying dangerous goods. This includes enhanced safety management systems and application of the *Rules Respecting Key Trains and Key Routes*. One item of the rule requires railway companies to conduct risk assessments and periodic updates based on significant change to determine the level of risk associated with each Key Route over which Key Trains are operated by the company. These risk assessments consider 28 specific factors to assess the safety and risk for each key route. Included in the 28 factors are requirements to take in account track class, maintenance schedules, and track design, to name a few. The RAC is confident the SMS and the key train rule ensures appropriate risk mitigation measures for the safe travel of dangerous goods, including infrastructure consideration.

Science and technology is also used extensively throughout the railway industry to improve operating conditions and advance the safety of Canadian railways. The Canadian railway industry has been adopting various types of technologies that have been developed to specifically address equipment and track-related derailment causes.

TSB (Transportation Safety Board) main-track derailments have decreased substantially from 2007 to 2016. The data shows that track-caused derailments have decreased by 71% over the last 10 years. This significant improvement, in the midst of increasing rail traffic volumes, can also be attributed to the substantive investments made by railways in technologies and data processes to effectively address main-track derailment factors.

The combination of safety improvements such as SMS, Key Train rules, advancements in science and implementation of technology are measures that respond to all aspects of Recommendation R14-02.

TSB reassessment of the response to Recommendation R14-02 (March 2018)

This recommendation is related to the TSB Watchlist issue of "Transportation of flammable liquids by rail". The transportation of flammable liquids, such as crude oil, by rail across North America has created emerging risks that need to be effectively mitigated.

Following this recommendation, Transport Canada implemented a series of integrated measures to improve safety and reduce risk for the transportation of dangerous goods by rail, including:

- more stringent requirements for the securement of unattended railway equipment;
- improved regulations regarding a company's safety management systems;
- regulations prescribing fines for contraventions of the *Railway Safety Act*;
- improved tank car standards;
- emergency response plans; and
- a new liability and compensation regime for federally regulated railways.

While no new initiatives related to this recommendation were undertaken in 2017, TC remained focused on railway company oversight. The oversight activities involved audits and inspections, which monitored the safety of railway operations, as well as the companies' compliance with rules, regulations and engineering standards. TC took appropriate enforcement action as required.

For 2018-19, specific updates were made to TC's risk-based planning process, which is expected to lead to an increase in the number of risk-based inspections. Using the revised methodology, each functional discipline (e.g., operations, equipment, track, crossings or signals) will address the highest risk locations as top priority.

The Railway Association of Canada indicated that railway companies have implemented a number of safety enhancements such as enhanced safety management systems and the application of the *Rules Respecting Key Trains and Key Routes*.

The Board acknowledges TC's progress on various integrated measures to improve safety and to reduce risk for the transportation of dangerous goods by rail. For example, in 2016, TC conducted a study on the threshold criteria for key routes. Although the threshold remained at 10,000 carloads, TC reviewed all federally regulated railways to identify those that transport crude oil, but did not meet the threshold on their routes. TC's national oversight plan was then modified to include a dedicated inspection program for railways operating key trains, including those that did not meet the 10,000 carload threshold.

With the expected increase in the number of inspections on key routes due to the revised risk-based planning process, the Board looks forward to continued safety improvement on these routes, including a reduction in the number of occurrences due to railway infrastructure issues.

The Board considers the response to the recommendation to be **Fully Satisfactory**.

Next TSB action

The TSB will continue to monitor progress on how railways address operational risks in the transportation of flammable liquids through TC's and industry's responses to recommendations R17-01 and R17-02.

This deficiency file is **Closed**.