TSB Recommendation R14-01

Enhanced protection standards for Class 111 tank cars

The Transportation Safety Board of Canada recommends that the Department of Transport and the Pipeline and Hazardous Materials Safety Administration require that all Class 111 tank cars used to transport flammable liquids meet enhanced protection standards that significantly reduce the risk of product loss when these cars are involved in accidents.

Rail transportation safety investigation report	R13D0054
Date the recommendation was issued	19 August 2014
Date of the latest response	January 2023
Date of the latest assessment	March 2023
Rating of the latest response	Fully Satisfactory
File status	Closed

Summary of the occurrence

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, UN1267, 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.

Rationale for the recommendation

The examination of the 63 general-service Class 111 tank cars that derailed at Lac-Mégantic revealed that 59 of the cars (94%) had released product due to tank car damage. The damage to the pre-CPC-1232 tank cars in Lac-Mégantic clearly indicates that product release could have been reduced had the tank car shells and heads been more impact-resistant. Design

improvements to these types of cars are needed to mitigate the risks of a dangerous goods release and the consequences witnessed in the Lac-Mégantic accident. Commodities posing significant risks must be shipped in safe containers that include defences such as stronger tank shells, tank car jackets, full-height head shields, thermal protection and high-capacity pressure relief devices.

Given the magnitude of the risks and given that tank car standards must be set for the North American rail industry, the Board recommended that

> the Department of Transport and the Pipeline and Hazardous Materials Safety Administration require that all Class 111 tank cars used to transport flammable liquids meet enhanced protection standards that significantly reduce the risk of product loss when these cars are involved in accidents.
>
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Previous responses and assessments

April 2014: response from Transport Canada

On addressing DOT-111 tank car vulnerabilities, Transport Canada (TC) will immediately and unilaterally prohibit the use of the highest-risk group of older DOT-111 tanks cars. A Protective Direction under subsection 32(1) of the *Transportation of Dangerous Goods Act, 1992* was issued on 23 April 2014 and prohibits the use of tank cars that have no continuous reinforcement of their bottom shell to carry any Class 3 flammable liquids, including crude oil and ethanol. Industry had 30 days to fully comply.

TC will require that all pre-CPC 1232/TP 14877 tank cars used for the transportation of crude oil and ethanol be phased out of service or retrofitted within 3 years.

In the interim, the train routing restrictions outlined in the TC response to recommendation R14-02 are designed to reduce these risks. As North America's integrated market necessitates close cooperation, it is important that, in the longer term, Canada harmonizes with the United States to the greatest extent possible. However, in this area, Canada will move more aggressively to address the safety concerns of Canadians. The Departmental objective will be to meet or exceed any new United States standards; therefore, officials will continue to work closely to harmonize and accelerate the technical work required to develop future, more stringent tank car construction and retrofit standards to further enhance the safety of Canadians.

In addition, to ensure that the safety standard for these tank cars continues to be enhanced, to address the immediate safety issues, and as recommended by the Transportation of Dangerous Goods General Policy Advisory Council Working Group on Means of Containment, the Department will proceed expeditiously with *Canada Gazette*, Part II publication of 13 updated means of containment standards, including the 2011 standard for DOT-111 tank cars. Canada introduced this revised DOT-111 tank car standard for consultation on 11 January 2014,

proposing the requirement of end of-tank protection, thicker and more impact-resistant steel tanks, and protected top fittings, to improve accident performance.

June 2014: TSB assessment of the response

Transport Canada (Satisfactory in Part)

TC has accepted the recommendation and has immediately prohibited the use of some older Class 111 tanks cars. TC will also require that all pre-CPC 1232/TP 14877 tank cars used for the transportation of crude oil and ethanol be phased out of service or retrofitted within 3 years.

TC has committed to expeditiously publish updated regulations in the *Canada Gazette*, Part II. These regulations will incorporate by reference 13 updated means of containment standards, including the new standard TP 14877, which adopts the Association of American Railroads (AAR) 2011 CPC 1232 standard for Class 111 tank cars, making it mandatory to build new tank cars for the transport of crude oil and ethanol to the new standard as a minimum.

However, the revised Class 111 tank car standard introduced for consultation in January 2014 is not sufficiently robust to minimize the risk of dangerous goods releases when these cars are involved in a derailment. The railway industry is asking both Canadian and United States regulators to go much further than the AAR 2011 CPC 1232 standard, and it would seem that both governments are actively discussing improvements.

The Board is encouraged by the safety actions taken to date and the immediate steps to mitigate the risks. However, the process to implement safety enhancements to the fleet of tank cars will take time and the specific improvements to new tank car designs will not be known until the process is finalized. Therefore, until all pre-CPC 1232/TP 14877 tank cars are no longer used to transport flammable liquids and a more robust tank car standard with enhanced protection is set for North America, the risk will remain.

For these reasons, the Board considers TC's response to Recommendation R14-01 to be **Satisfactory in Part**.

June 2014: response from the Pipeline and Hazardous Materials Safety Administration

On 30 April 2014, the United States Department of Transportation (DOT), on behalf of the Pipeline and Hazardous Materials Safety Administration (PHMSA) and of the Federal Railroad Administration (FRA), submitted a notice of proposed rulemaking (NPRM) titled *Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains (HM-251)* to the Office of Management and Budget's (OMB) Office of Information and Regulatory Affairs (OIRA) for review. This followed the publication, on 06 September 2013, of an advanced notice of proposed rulemaking (ANPRM) titled *Hazardous Materials: Rail Petitions and Recommendations to Improve the Safety of Railroad Tank Car Transportation (RRR)*, in the *Federal Register* by the PHMSA.

This NPRM proposes a comprehensive approach to rail safety to improve tank car integrity, as well as to provide additional operational controls, to enhance emergency response, and to establish methods to improve the classification and characterization of hazardous materials. The PHMSA and the FRA are sharply focused on developing and finalizing this rulemaking.

In addition to ongoing regulatory efforts, on 07 May 2014, the PHMSA and the FRA issued Safety Advisory Notice No. 14-07, titled *Recommendations for Tank Cars Used for the Transportation of Petroleum Crude Oil by Rail*. In the Notice, the PHMSA and the FRA urge carriers transporting Bakken crude oil by rail to use the tank car specifications that are of the highest integrity within their existing fleet. The Notice also recommends that the railroad carriers avoid using DOT-111 or CTC-111 legacy tank cars for the shipment of such crude oil to the extent reasonably practicable.

Through collaboration in the United States–Canada Regulatory Cooperation Council, the PHMSA and the FRA have been working closely with Transport Canada on a variety of hazardous materials transportation issues, including the development of enhanced protection standards for tank cars.

July 2014: TSB assessment of the response

Pipeline and Hazardous Materials Safety Administration (Satisfactory in Part)

The PHMSA has accepted the recommendation and a NPRM on enhanced tank car standards has been submitted for review. The PHMSA and the FRA are continuing to work with the OIRA to expedite its review and ensure the NPRM is published as quickly as possible.

Also, as a result of the ANPRM published last September, the PHMSA has evaluated 130 comments from over 150 000 signatories on issues raised in 8 petitions for rulemaking and 7 safety recommendations from the National Transportation Safety Board (NTSB). The comments pertained to a variety of topics, including the redesign of DOT Specification 111 tank cars, as well as operational practices such as speed limits, train securement, and track integrity.

However, the enhanced tank car standards and operational controls are currently under review and the NPRM has not yet been published. The railway industry has asked both Canadian and United States regulators to go much further than the AAR 2011 CPC-1232 standard, and it seems that both governments are actively discussing improvements. In the interim, the recommendations contained in Notice No. 14-07, urging carriers to use the tank car specifications that are of the highest integrity and recommending that they avoid the use of the older (referred to as 'legacy') tank cars to the extent reasonably practicable, may in some small measure help reduce the risk of petroleum crude oil releases when tank cars are involved in a derailment.

The Board is encouraged by the safety actions taken to date, including measures taken to address issues raised in the safety recommendations issued by the NTSB on 23 January 2014. The Board also notes favourably the close cooperation between Canada and the United States in addressing this issue, as it is important that federal regulations in both countries be

harmonized to the greatest extent possible given that North America is an integrated market. However, the process to implement safety enhancements to the fleet of tank cars will take time and the specific improvements to new tank car designs will not be known until the process is finalized. Therefore, until all pre-CPC-1232/TP 14877 tank cars are no longer used to transport flammable liquids and a more robust tank car standard with enhanced protection is set for North America, the risk will remain.

For these reasons, the Board considers PHMSA's response to Recommendation R14-01 to be **Satisfactory in Part**.

February 2015: response from the Railway Association of Canada

The railways have continued to petition TC and PHMSA to bring the standard to a higher, harmonized level. The RAC has asked TC to increase the standard now required in the TP14877, with attention given to retrofitting and retirements of older tank cars. The railways are opposed to including ECP [electronically controlled pneumatic] braking in this standard at this time as it will lead to significant operational problems with very minimal safety benefit.

May 2015: response from Transport Canada

On 23 April 2014, the Minister announced a 3-year phase-out of older, less crash-resistant Class 111 tank cars. On 02 July 2014, the TP14877 standard was adopted by reference in the TDG regulations, establishing new minimum standards of safety for tank cars carrying certain flammable liquids. On 18 July 2014, Transport Canada published, for public consultation, proposed requirements for a new class of tank cars, the TC-140, designed for the transport of flammable liquids.

On 11 March 2015, Transport Canada published an update on its development activities relating to new tank car standards. Transport Canada had renamed the proposed new class of tank cars as TC-117. The updated provisions would require all new tank cars built for the transport of flammable liquids to be constructed using thicker and more impact-resistant steel and to be equipped with jacketed thermal protection, full-height head shields, top fittings protection, improved bottom outlet valves and appropriate pressure relief devices. Transport Canada indicated that the phase-out of legacy Class 111 tank cars (including the CPC-1232 tank cars) in flammable liquid service would be gradually implemented using a risk-based approach, taking into consideration the features of the tank cars and the characteristics of the flammable liquid being transported.

In the interim, up to 7,500 CPC-1232 jacketed tank cars remained on order to be constructed for crude oil service in 2015. However, some tank car manufacturers had already started building new tank cars to the proposed TC-117 standard. In addition, some shippers and railway operators had announced orders for tank cars that meet the proposed TC-117 standard.

Transport Canada indicated its intention, following consultations, to consider including braking provisions, such as electronically controlled pneumatic (ECP) brakes, in train operating rules as opposed to the new TC-117 tank car standard.

On 01 May 2015, Transport Canada announced the *Regulations Amending the Transportation of Dangerous Goods Regulations* (TC-117 Tank Cars) which came into force when published in the Canada Gazette, Part II. These regulations require a new tank car standard (TC-117), retrofit requirements and implementation timelines to modernize the Canadian tank car fleet in flammable liquid service. The standards and timelines were generally harmonized with the US regulators (PHMSA and FRA).

The less robust legacy Class 111 cars used for petroleum crude oil service will be retrofitted first. Some Class 111 cars, including jacketed CPC-1232 cars, can remain in selected flammable liquid service until 2025. Transport Canada believes that the schedule is aggressive but achievable given industry capacity and the need for harmonization with the United States.

May 2015: response from the Pipeline and Hazardous Materials Safety Administration

On 01 August 2014, PHMSA, in coordination with the FRA, published in the Federal Register a NPRM entitled Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains (HM-251).

This NPRM proposed several changes to the Hazardous Materials Regulations (HMR) which would apply to certain trains transporting large volumes of Class 3 flammable liquids and include improvements in tank car standards as well as new operations requirements such as speed restrictions and enhanced braking.

Over 3300 public comments were received. Following the closing of the comment period on 30 September 2014, PHMSA, in coordination with the FRA, developed a final rule, which was submitted on 05 February 2015 to OIRA for review.

On 01 May 2015, the US Department of Transportation announced its new tank car standard (DOT-117), retrofit requirements and implementation timelines. These standards and timelines are generally harmonized with Transport Canada.

May 2015: TSB assessment of the response

Transport Canada (Satisfactory Intent)

Subsequent to the Lac-Mégantic accident, there has been considerable action by the railway industry to identify a superior tank car specification to replace the existing Class 111 tank cars. It was recognized that the TP14877 standard was not sufficiently robust to address the risks.

TC worked with the US regulators to develop and implement enhanced protection standards, including a harmonized tank car standard, retrofit requirements and implementation timelines. The new tank car standard (TC-117) requires all new tank cars built for the transport of flammable liquids to be constructed using thicker and more impact-resistant steel and to be equipped with jacketed thermal protection, full-height head shields, top fittings protection, improved bottom outlet valves and appropriate pressure relief devices. These provisions will

result in a more robust tank car with improved head and shell puncture resistance, improved top and bottom fittings protection and improved resistance to specified fire conditions.

A gradual phase-out of legacy Class 111 tank cars was established using a risk-based approach, based primarily on features of the tank cars, on the characteristics of the flammable liquid being transported and on the capacity of industry to retrofit existing tank cars, and to build new ones. The timeline will ensure that the less robust legacy Class 111 cars used for petroleum crude oil service will be retrofitted first. However, some Class 111 cars, including jacketed CPC-1232 cars, can remain in selected flammable liquid service until 2025. In setting the timeline, TC examined the industry's capacity to implement the required changes.

A preliminary assessment of the performance of CPC-1232 tank cars based on a number of recent crude oil unit train accidents identified vulnerability of this type of tank car to similar failures as the legacy Class 111 tank cars. Given the established timeline, and in light of recent derailments, the Board is concerned about the adequacy of the existing risk control measures during the transition. 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. These risks must be actively managed during the transition period.

TC has announced the final regulations detailing the new tank car requirements and timelines, allowing industry to begin modernizing the tank car fleet. Therefore, the Board considers TC's response to the recommendation to show **Satisfactory Intent**.

However, until flammable liquids are transported in tank cars built sufficiently robust to prevent catastrophic failure when involved in an accident, the risk will remain high. Therefore, the Board calls upon Transport Canada to ensure that risk control measures during the transition are effectively managed.

Pipeline and Hazardous Materials Safety Administration (Satisfactory Intent)

Following the NPRM on enhanced tank cars published in August 2014, PHMSA has evaluated over 3300 public comments. A proposed final rule that contains improvements to the tank car standard and new operations requirements was submitted in February 2015 to OIRA for review.

In April 2015, the NTSB issued urgent recommendations calling for specific tank car improvements and greater specificity for the phase-out schedule. In May 2015, the US Department of Transportation announced its new tank car standard (DOT-117), retrofit requirements and implementation timelines, which were generally harmonized with Transport Canada. However, until flammable liquids are transported in tank cars built sufficiently robust to prevent catastrophic failure when involved in an accident, the risk will remain high.

Therefore, the Board considers PHMSA's response to the recommendation to show **Satisfactory Intent**.

January 2016: response from the Railway Association of Canada

The RAC and industry support continued improvement to tank car standards.

February 2016: response from the Pipeline and Hazardous Materials Safety Administration

On 08 May 2015, PHMSA, in coordination with the FRA, published in the Federal Register the final rule entitled *Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains* (HM-251). This rule amends the *Hazardous Materials Regulations* (HMR).

The final rule is designed to reduce the consequences and, in some instances, reduce the probability of accidents involving trains transporting large quantities of Class 3 flammable liquids. Adopted provisions include operational and safety improvements to address the unique risks associated with the growing reliance on trains to transport large quantities of flammable liquids, such as:

- Regulating the operations (in terms of speed restrictions, braking systems and routing) of certain trains transporting large volumes of flammable liquids (defined as "high-hazard flammable trains")
- Implementing a sampling and classification program for unrefined petroleum-based products
- Adopting safety improvements in tank car standards, including the new DOT-117 specification, legacy tank car retrofit requirements and implementation timelines

Following the publication of the final rule, a number of appeals to the rule were submitted to PHMSA and FRA. Appeals included the following: tank car retrofit timeline, associated reporting requirements and tank car thermal protection provisions.

On 18 November 2015, PHMSA and FRA respectfully denied the appeals. PHMSA and FRA maintained that the new regulations and the regulatory analysis to support those decisions were conducted through careful consideration, and that industry was capable of complying with the final rule.

On 04 December 2015, President Obama signed into law the *Fixing America's Surface Transportation* (FAST) Act. The FAST Act contains numerous provisions aimed at further improving rail safety, including:

- Enhanced thermal protection requirements for new or retrofitted tank cars
- Top fittings protection requirements for retrofitted older tank cars
- Restrictions on the use of older DOT-111 tank cars in flammable liquid service
- A commodity-based tank car retrofit/phase-out schedule
- Monitoring of the progress of tank car fleet retrofits
- Applicability to all Class 3 flammable liquids, regardless of train configuration.

In February 2016, PHMSA indicated that it is in the process of developing a plan to implement the various provisions enacted by the FAST Act. This includes proposals for rulemaking for consequential revisions to the HMR.

March 2016: response from Transport Canada

In May 2015, Transport Canada published in the *Canada Gazette*, Part II the *Regulations Amending the Transportation of Dangerous Goods Regulations* (TC-117 Tank Cars). These regulations established the requirements for a new flammable liquid tank car standard (TC-117), retrofit requirements for older tank cars in flammable liquid service and implementation timelines to modernize the Canadian tank car fleet. The standards and timelines were generally harmonized with the US regulators (PHMSA and FRA). With the coming into force in the US of the recent FAST legislation, the US has further harmonized with the Canadian requirements.

The Canadian regulations require that all new tank cars built for the transport of flammable liquids be constructed using thicker and more impact-resistant steel and be equipped with jacketed thermal protection, full-height head shields, top fittings protection, improved bottom outlet valves and appropriate pressure relief devices.

Transport Canada continues to work with the Canadian industry to consider braking provisions, such as electronically controlled pneumatic (ECP) brakes, in train operating rules rather than considering such braking provisions within the requirements of the TC-117 tank car standard. Transport Canada is also following closely the new requirements brought forward by the US FAST legislation, which imposed new research requirements before ECP braking can be brought into effect in the US.

Transport Canada continues to monitor closely the construction of new TC-117 tank cars and the retrofitting of older flammable liquid tank cars. As of March 2016, for North America, over 7,000 new TC-117 tank cars have been built and put into service. Over 250 tank cars have been retrofitted to the new TC-117 standard. The retrofits have primarily been to CPC-1232 jacketed tank cars and unjacketed DOT-111 tank cars.

With the ongoing low world demand for crude oil, and its associated low world price, the transportation of crude oil by rail has slowed, and consequently so has tank car demand. Shippers and builders have used this low demand cycle to better assess fleet usage, tank car demand and retrofit requirements. With the coming into force of the U.S. FAST Act, which brings U.S. requirements further in line with Canadian requirements, industry has begun to ramp up retrofitting of DOT-111 tank cars in flammable liquid service. Over the coming months, Transport Canada expects to see the number of retrofitted/new build tank cars to continue to increase to meet demand and the phase-out schedule.

At present, Transport Canada's analysis is that there is sufficient tank car retrofit and new build capacity to meet present and projected tank car demand. Industry is aware of the phase-out/retrofit timelines and continues to reiterate to the department that it will meet the

timelines prescribed in the Canadian regulations. If necessary, Transport Canada will fully enforce the phase-out retrofit timelines as prescribed in the regulations.

March 2016: TSB assessment of the response

Pipeline and Hazardous Materials Safety Administration (Satisfactory Intent)

The final rule published in May 2015 amended the HMR and included various safety and operational improvements such as enhanced tank car standards, speed restrictions, braking systems and routing. With the signing of the FAST Act into law in December 2015, additional safety improvements to tank cars were enacted, including the requirement for enhanced thermal protection, top fittings protection and provisions to monitor the progress of the retrofits of tank car fleets.

The final rule, combined with the provisions of the FAST Act, puts in place the regulatory framework for the enhancement of protection standards for tank cars used to transport flammable liquids.

The Board looks forward to the timely implementation of these new provisions, in particular the monitoring of the progress of tank car fleet retrofits.

Until all flammable liquids are transported in tank cars built sufficiently robust to prevent catastrophic failure when involved in an accident, the risk will remain high. Therefore, the Board considers PHMSA's response to the recommendation to show **Satisfactory Intent**.

Transport Canada (Satisfactory Intent)

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. R14-01 is specific to new and existing Class 111 tank cars for the transport of flammable liquids.

In May 2015, TC published a new set of regulations that established the requirement for a new tank car standard (TC-117), retrofit requirements, and timelines to retrofit the tank car fleet. The new regulations require that all new tank cars built for the transport of flammable liquids be constructed using thicker and more impact-resistant steel and be equipped with jacketed thermal protection, full-height head shields, top fittings protection, improved bottom outlet valves and appropriate pressure relief devices. TC is monitoring the construction of new TC-117 tank cars and is reviewing and considering braking provisions such as electronically controlled pneumatic brakes (ECP) from a train operations perspective, but no specific initiatives have yet been identified in this regard. The RAC and industry continue to support improvement in tank car standards.

TC is also in the process of updating TP14877, Containers for Transport of Dangerous Goods by Rail, December 2013. This standard covers large means of containment used in the handling, offering for transport and transporting of dangerous goods by rail. The update will focus on incorporating recent regulatory changes and proposals to be considered by the TP14877

Consultative Committee. This committee is comprised of key stakeholders with extensive knowledge and expertise relating to the transportation of dangerous goods by rail. On 08 March 2016, a public notice was issued seeking input and comments for updating this standard.

The Board acknowledges TC's commitment and progress made on the publication of the new tank car standards and the updating of TP14877. The Board notes the progress made on the construction of new TC-117 tank cars and the retrofitting of older flammable liquid tank cars. Given TC's progress made on this issue, its ongoing monitoring and its intention to fully enforce the phase out retrofit timelines, the Board considers the response to the recommendation to show **Satisfactory Intent**.

However, until all flammable liquids are transported in tank cars built sufficiently robust to prevent catastrophic failure when involved in an accident, the risk will remain high. Therefore, the Board calls upon Transport Canada to ensure that risk control measures during the transition are effectively managed.

February 2017: response from Transport Canada

This recommendation is linked to TSB Recommendation R07-04.

The new TC-117 regulation established the requirements for a new flammable liquid tank car standard (TC-117), retrofit requirements for older tank cars in flammable liquid service and implementation timelines to modernize the North American tank car fleet. The standards and timelines were generally harmonized with the US regulators (PHMSA and FRA).

On 13 July 2016, the Minister of Transport issued Protective Direction (PD) 38, in accordance with the *Transportation of Dangerous Goods Act*, 1992. This PD further accelerates the phase-out of both jacketed and unjacketed legacy DOT-111 tank cars from being used for crude oil service in Canada as of 01 November 2016.

In October 2016, a planning session was held with respect to the feasibility of further accelerating the prescribed tank car phase-out schedule. TDG has been examining options to broaden the department's scope of action in terms of the phase-out of DOT-111 and CPC-1232 tank cars. This will include: analyzing the state of the tank car industry; assessing whether sufficient tank cars exist in light of current demand for transporting flammable liquids by rail; recommending potential acceleration of the phase-out schedule where feasible, and developing an impact assessment. This will lead to recommendations on whether to further accelerate the tank car phase-out schedule introduced in May 2015 and ending in 2025. This feasibility study is expected to be completed by late 2017.

Transport Canada continues to monitor closely the construction of new TC-117 tank cars and the retrofitting of older flammable liquid tank cars. Transport Canada continues to study the possibility of further acceleration of the prescribed phase-out schedule. Transport Canada will collaborate with US DOT and industry in monitoring the flammable liquid tank car fleet.

March 2017: response from the Railway Association of Canada

RAC members support the Class 117 tank car standards that resulted from the combined effect of the final rule and the FAST Act. Importantly, these standards were harmonized with the TC 117 standards for tank car design, construction and retrofit.

However, the timelines for implementation were not harmonized and this presents a number of challenges which could be further complicated if implementation timelines are changed. TC consulted appropriately before changing the phase-out date for the legacy DOT 111 cars through PD 38 and any further consideration of changes to implementation timelines must also be very carefully considered to avoid creating a non-harmonized patchwork combination of dates, product and car types that becomes unworkable for shippers, car owners and railways.

March 2017: response from the Pipeline and Hazardous Materials Safety Administration

On 15 August 2016, the Pipeline and Hazardous Materials Safety Administration (PHMSA) published in the Federal Register the final rule entitled Hazardous Materials: FAST Act Requirements for Flammable Liquids and Rail Tank Cars (HM-251C). This rule amends the *Hazardous Materials Regulations* (HMR), and implements various provisions enacted by the *Fixing America's Surface Transportation* (FAST) Act of 2015. Provisions include:

- A revised commodity-specific phase-out schedule for all DOT-111 tank cars used to transport Class 3 flammable liquids;
- Requirements that each tank car built to DOT-117 and each non-jacketed tank car retrofitted to DOT-117R be equipped with a thermal protection blanket that is at least ½ inch thick and meets existing federal thermal protection standards; and
- Minimum requirements for top fittings protection for tank cars retrofitted to DOT-117R.

The U.S. Department of Transportation (DOT) is working with industry to develop a set of reporting mechanisms aimed at monitoring industry's progress towards retrofitting the existing fleet of tank cars in Class 3 flammable liquid service by the applicable legislated deadlines. In accordance with section 7308(f) of the FAST Act, the DOT will also be providing Congress with an annual report outlining industry's progress towards the retrofit of the tank car fleet.

March 2017: TSB assessment of the response

Transport Canada (Satisfactory Intent)

This recommendation is related to the TSB Watchlist issue of "Transportation of flammable liquids by rail," which was updated in 2016. The transportation of flammable liquids, such as crude oil, by rail across North America has created an elevated risk that needs to be mitigated effectively. Recommendation R14-01 is specific to new and existing Class 111 tank cars for the transportation of flammable liquids.

Transport Canada's new regulations modernizing the North American tank car fleet established a new tank car standard (TC-117) and prescribed retrofit requirements for older tank cars in

flammable liquid service as well as implementation timelines. These were generally harmonized with the U.S. regulators (PHMSA and FRA).

In July 2016, TC issued Protective Direction 38, which accelerated the phase-out of legacy DOT 111 tank cars from crude oil service in Canada as of 01 November 2016. In October 2016, a planning session was held with respect to the feasibility of further accelerating the prescribed tank car phase-out schedule, involving both DOT-111 and CPC-1232 tank cars. This feasibility study is expected to be completed by late 2017.

The Board acknowledges TC's continued efforts to monitor the construction of new TC-117 tank cars and the retrofit of older tank cars in flammable liquid service. While there are no prescribed regulatory provisions requiring industry to provide detailed fleet retrofit progress data, TC is collaborating with the U.S. DOT and industry to monitor the state of the tank car fleet in flammable liquid service.

The Board is encouraged with the progress made to date on the phase-out of legacy tank cars in flammable liquid service and looks forward to a fleet status update following TC's collaboration with the U.S. DOT and industry. However, until all flammable liquids are transported in tank cars built sufficiently robust to prevent catastrophic failure when involved in an accident, the risks will remain. Therefore, the Board continues to call upon TC to ensure that risk control measures during the transition and phase-out are effectively managed.

The Board considers TC's response to Recommendation R14-01 to show **Satisfactory Intent**.

Pipeline and Hazardous Materials Safety Administration (Satisfactory Intent)

The final rule published in August 2016 amended the HMR and implemented provisions enacted by the FAST Act of 2015, including a revised commodity-specific phase-out schedule for DOT-111 tank cars, requirements for thermal protection blankets for new DOT-117 and non jacketed DOT-117R tank cars, as well as minimum requirements for top fittings protection for DOT-117R tank cars.

The requirements for thermal protection blankets in the final rule are only applicable to new DOT-117 and non-jacketed DOT-117R tank cars, which has the effect of permitting the retrofit of suitable existing jacketed and insulated tank cars to a DOT-117R specification. The performance of such jacketed and insulated tank cars will continue to be monitored by the TSB through its investigations of railway occurrences.

While the final rule does not fully implement a detailed fleet retrofit reporting mechanism, the DOT is working with industry to develop a set of reporting mechanisms in accordance with the provisions of the FAST Act.

The Board looks forward to the full implementation of the fleet retrofit monitoring program, including the periodic reporting of collected fleet retrofit progress data.

Until all flammable liquids are transported in tank cars built sufficiently robust to prevent catastrophic failure when involved in an accident, the risk will remain.

The Board considers PHMSA's response to Recommendation R14-01 to show **Satisfactory Intent**.

January 2018: response from the Railway Association of Canada

The railways have continued to encourage TC, FRA and PHMSA to bring tank car standards to a harmonized level. Implementation timelines must be very carefully considered to avoid creating a disparate combination of dates, product and car types that would make it unworkable for shippers, car owners and railways.

The RAC continues to work closely with TC and the U.S. Department of Transportation to offer assistance on the retrofit of older tank cars in flammable liquid service and the construction of new TC-117's.

February 2018: response from Transport Canada

TP14877

Consultations have been held and the updated standard will be incorporated into the TDG Regulations in 2018/19.

TC-117

On July 25, 2016, Transport Canada issued Protective Direction 38 (PD 38), accelerating the phase-out of TC/DOT-111 tank cars transporting crude oil to November 1, 2016. The accelerated timeline phased out unjacketed legacy TC/DOT-111 tank cars six months earlier, and legacy jacketed TC/DOT-111 cars 16 months earlier than what was published in the TDG Regulations in May 2015. The more robust TC/DOT-117 tank car, which has been engineered to higher safety standards based on the lessons learned from the Lac-Mégantic disaster, will be the only acceptable tank car for all flammable liquids in Canada after April 30, 2025. The Department is closely monitoring the progress of the phase-out, and is identifying areas where the phase-out could be accelerated as tank car usage and patterns evolve. There have been no recorded non-compliance of dangerous goods being transported in tank cars that are no longer authorized based on the phase-out schedule and requirements of PD 38.

In addition, TDG is examining options to broaden the department's scope of action in terms of the phase-out of DOT-111 and CPC-1232 tank cars. This includes: analyzing the state of the tank car industry; assessing whether sufficient tank cars exist in light of current demand for transporting flammable liquids by rail; recommending potential acceleration of the phase-out schedule where feasible, and developing an impact assessment. This will lead to recommendations on whether to further accelerate the tank car phase-out schedule introduced in May 2015 and ending in 2025. This feasibility study is expected to be completed in Spring 2018.

TDG completed an analysis of the tank car industry in July 2017, in relation to the phase-out of TC/DOT-111 tank cars. The study reviewed key characteristics of the oil and gas industry, with a view to determining the potential future demand of tanker cars, and by extension providing considerations on the feasibility (and desirability) of accelerating the phase-out of TC/DOT-111 tank cars in crude oil service. Results indicate that industry has responded to incidents like the one that occurred in Lac-Mégantic with a precipitous decline in carloads using the DOT-111. This market analysis will help to inform recommendations on further accelerating the phase-out schedule.

TDG is taking risk control measures pending full implementation of the DOT-111 phase-out schedule. Since the Lac-Mégantic tragedy in 2013, TDG has hired 64 new inspectors (as of December 31, 2017). It should be noted that in addition to the 64 new inspectors, TDG's oversight personnel went up by 91, as some of the engineers also perform inspections. Of the current 133 inspectors, all of them perform inspections of transportation of dangerous goods on rail across the country.

February 2018: response from the Pipeline and Hazardous Materials Safety Administration

Following the publication of the final rule entitled *Hazardous Materials: FAST Act Requirements for Flammable Liquids and Rail Tank Cars* (HM-251C) in the *Federal Register* on 15 August 2016, the Pipeline and Hazardous Materials Safety Administration (PHMSA) indicated that the U.S. Department of Transportation (DOT), in collaboration with its stakeholders, entered into an agreement with the Bureau of Transportation Statistics (BTS) to collect and report retrofit data for tank cars in Class 3 flammable liquid service. On 22 September 2017, a report detailing the fleet composition of rail tank cars that transport flammable liquids was submitted to Congress.

PHMSA, in collaboration with the BTS, is monitoring tank car modifications and compliance with the phase-out deadlines. Going forward, the BTS and PHMSA will work with the Association of American Railroads (AAR) and the Railway Supply Institute (RSI) to identify tank car modification facilities, and will survey these facilities on an annual basis to determine the number of tank cars that have been retrofitted to the DOT-117R standard and the number of new DOT-117 tank cars built to transport Class 3 flammable liquids.

Based on the results of that survey, the BTS and PHMSA will produce an annual report in order to track industry's progress towards the phase-out of legacy cars and compliance with the new flammable liquid tank car standards. The next annual report is scheduled for September 2018, and such reports will be produced through 2029, at which time all tank cars in flammable liquid service are to meet the DOT-117/117R standard.

March 2018: TSB assessment of the response

Transport Canada (Satisfactory Intent)

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. R14-01 is specific to new and existing Class 111 tank cars for the transport of flammable liquids.

In July 2017, TC completed an analysis of the tank car industry, including a review of the key characteristics of the oil and gas industry such as fleet status and the demand for tank cars in the transport of flammable liquids. TC has started reconciling this information with the actions taken by the industry to determine the feasibility of further accelerating the tank car phase-out schedule. This feasibility study is expected to be completed in spring 2018.

Pending full implementation of the DOT-111 phase-out schedule, TC has taken additional measures, including the hiring of additional inspectors. Between mid-2013 and December 2017, TC hired 64 new TDG inspectors, which increased the number of these inspectors to 133. There is now an increased capacity for TC to perform rail-specific inspections relating to the transportation of flammable liquids.

The Board acknowledges TC's efforts with regards to collecting tank car retrofit information and with identifying options to further accelerate the phase-out of Class 111 tank cars. The Board is encouraged with the continued commitment to accelerate the phase-out of legacy tank cars in flammable liquid service, and looks forward to the results of the feasibility study.

However, until all flammable liquids are transported in tank cars built sufficiently robust to prevent catastrophic failure when involved in an accident, the risks will remain. The Board continues to call upon TC to ensure that appropriate risk control measures during the transition and phase-out are effectively implemented and managed. The Board considers TC's response to the recommendation to show **Satisfactory Intent**.

Pipeline and Hazardous Materials Safety Administration (Satisfactory Intent)

PHMSA, in collaboration with the Bureau of Transportation Statistics, has been collecting retrofit data for tank cars in Class 3 flammable liquid service. In September 2017, PHMSA submitted a report to Congress detailing the fleet composition of rail tank cars in Class 3 flammable liquid service. Using the collected data, PHMSA has been monitoring the industry's progress towards tank car modifications, and its compliance with the phase-out deadlines. PHMSA will continue to work with the AAR and the Railway Supply Institute to collect data annually on tank car retrofits and on newly manufactured tank cars in order to track progress and compliance with the new flammable liquid tank car standards.

The Board acknowledges PHMSA's efforts with respect to collecting tank car retrofit information and with the annual reporting of this information. The Board considers PHMSA's response to the recommendation to show **Satisfactory Intent**.

February 2019: response from the Railway Association of Canada

The railways have continued to encourage TC, FRA and PHMSA to bring tank car standards to a harmonized level. Implementation timelines must be very carefully considered to avoid

creating a disparate combination of dates, product and car types that would make it unworkable for shippers, car owners and railways.

The RAC continues to work closely with TC and the U.S. Department of Transportation to offer assistance on the retrofit of older tank cars in flammable liquid service and the construction of new TC-117s. This process is well underway and is complete for some flammable liquid products. In September 2018, Transport Canada imposed new DOT-111 tank car replacement dates to accelerate the removal of older cars without jackets and thermal protection from DGs.

February 2019: response from Transport Canada

Transport Canada agrees with the intent of the recommendation.

Transport Canada has responded to this recommendation by publishing in Canada Gazette Part II in May 2015 the TC-117 standard as well as the recent updating of the TP14877 tank car standard. The following are updates on the Department's actions regarding standards TP14877 and TC-117:

TP14877

The TP14877 standard establishes the requirements for several pressurized and non-pressurized tank cars including the TC-117 tank car. Following consultations, the new TP14877 standard was published by Transport Canada in January 2018. The regulatory publication to bring the updated TP14877 standard into law is expected in *Canada Gazette*, Part II, in April or May 2019.

Once published in *Canada Gazette*, Part II, the regulation enacting the new TP14877 standard will remove the TC-117 from the regulation and place it in the standards with the other tank car requirements as well as bring all tank car Protective Directions issued before January 2018 into the standard.

TC-117

The TC-117 standard established the requirements for new tank car designed for the transport of flammable liquids. Under TC-117, TC requires a significantly more robust jacketed tank car for transporting flammable liquids in Canada. It also prescribed the retrofit requirements for older DOT-111 and CPC-1232 tank cars as well as established phase-out schedule of these older tank cars.

Following a market study on the availability of tank cars, manufacturing capacity and the volume of flammable liquids being transported, Transport Canada identified further opportunities to accelerate the tank car phase-out schedule.

Consequently, in August 2018 the Minister issued Protective Direction 39 (PD 39) that further accelerated the phase-out timelines for unjacketed CPC-1232 tank cars from April 2020 to November 1, 2018. PD 39 also accelerated the phase-out of condensates used to dilute crude oil

to January 1, 2019 from the previous April 30, 2025 timeline prescribed in the original regulation. With the issuance of PD 39, as of November 1, 2018, crude oil can only be transported in a jacketed CPC-1232 tank car or a tank car that meets the TC-117 standard. As of January 1, 2019, condensates must also be transported in a jacketed CPC-1232 tank car or TC-117 tank car.

An industry-led working group is looking at providing recommendations to the Department in early Q2 of 2019 on whether there are enough tank cars available in the marketplace, following the significant increase in the transport of crude oil, to accelerate further the removal of the jacketed CPC-1232 tank car in crude and condensate service prior to the April 2025 timeline.

All other flammable liquids will be required to be transported in the more robust TC/DOT-117 tank car, at the latest, as of May 1, 2025.

TDG is taking risk control measures pending full implementation of the DOT-111 phase-out schedule. Following the implementation of Budget 2016, TDG has hired more than 60 new additional inspectors increasing TDG's oversight by a total of 91 positions, as some of the engineers also perform inspections. The Department continues to closely monitor the progress of the phase-out and verifying compliance with requirements through its risk based inspection program. There have been no recorded non-compliance of dangerous goods being transported in tank cars that are no longer authorized (based on the phase-out schedule) including the new requirements established in PD 39.

February 2019: response from the Pipeline and Hazardous Materials Safety Administration

The Pipeline and Hazardous Materials Safety Administration (PHMSA) continues to actively monitor tank car modifications and compliance with the phase-out deadlines for all DOT-111 tank cars used to transport Class 3 flammable liquids as specified in the final rule entitled Hazardous Materials: *FAST Act Requirements for Flammable Liquids and Rail Tank Cars* (HM-251C) published in the *Federal Register* on 15 August 2016.

Since 2017, the Bureau of Transportation Statistics (BTS) and PHMSA have produced an annual report that tracks industry's progress towards the phase-out of legacy cars and compliance with the new standards. The latest annual report was submitted to Congress in September 2018 and describes the progress of tank car safety upgrades from 2013 through 2017, by tank car type and type of flammable liquid. According to the report, as of the end of 2017, 20 percent of the fleet met the new safety requirements for DOT-117 and DOT-117R, a significant increase from the 2 percent in 2015.

Of the tank cars meeting the new safety requirements, 61 percent were new and 39 percent had been retrofitted. The report further indicates that 11,727 DOT-117 and DOT-117R tank cars are projected to be built or retrofitted in 2018. The next annual report is scheduled for the fall of 2019, and such reports will be produced through 2029, at which time all tank cars in flammable liquid service are to meet the DOT-117/117R standard.

March 2019: TSB assessment of the response

Transport Canada (Satisfactory Intent)

This recommendation is specific to new and existing Class 111 tank cars for the transport of flammable liquids.

In May 2015, the TC-117 standard established the requirements for the new tank car specifically designed for the transport of flammable liquids. In addition, retrofit requirements for older DOT-111 and CPC-1232 tank cars were prescribed, as well as the establishment of a phase-out schedule for these older tank cars.

In July 2016, Transport Canada (TC) issued Protective Direction 38 (PD 38) which accelerated the phase-out of unjacketed legacy TC/DOT-111 tank cars (i.e., six months earlier) and the phase-out of jacketed legacy TC/DOT-111 cars (i.e., 16 months earlier).

In August 2018, TC issued Protective Direction 39 (PD 39) that accelerated the phase-out of unjacketed CPC-1232 tank cars for the transportation of crude oil from April 2020 to November 1, 2018. PD 39 also accelerated the phase-out of legacy DOT-111 tank cars and unjacketed CPC-1232 tank cars for the transportation of condensates from April 30, 2025 to January 1, 2019.

TC is continuing to assess the feasibility of further accelerating the tank car phase-out schedule. To assist with this review, an industry-led working group is evaluating whether there are enough tank cars available in the marketplace to accelerate the phase-out of jacketed CPC-1232 tank cars in crude and condensate service. The working group recommendations are expected by Q2 of 2019.

Pending full implementation of the DOT-111 phase-out schedule, TC has taken additional risk control measures, including hiring more than 60 additional TDG inspectors since 2016. With some TDG engineers also performing inspections, TDG's oversight capacity has increased by 91 positions. Through its risk based inspection program, TDG inspectors closely monitor the progress of the phase-out and verify compliance with the standard. There have been no recorded non-compliance of dangerous goods being transported in tank cars that are no longer authorized based on the phase-out schedule, including the new requirements established in PD 39.

The RAC continue to work closely with TC and the U.S. Department of Transportation to offer assistance on the retrofit of older tank cars in flammable liquid service and the construction of new TC-117s.

With a number of recent derailments involving retrofitted CPC-1232 tank cars (i.e., TC-117 standards), there is an opportunity to assess the performance characteristics of these more robust tank cars. This assessment will help verify whether flammable liquids are being transported in tank cars built sufficiently robust to significantly reduce the risk of product loss when these cars are involved in accidents. The Board continues to call upon TC and the railway

industry to ensure that appropriate risk control measures during the transition and phase-out are effectively implemented and managed.

The Board considers Transport Canada's response to Recommendation R14-01 to show **Satisfactory Intent**.

Pipeline and Hazardous Materials Safety Administration (Satisfactory Intent)

Since 2017, PHMSA and the Bureau of Transportation Statistics have produced an annual report that tracks industry's progress towards the phase-out of legacy cars and compliance with the new standards. The latest annual report was submitted to Congress in September 2018 and the next annual report is scheduled for fall 2019.

The report indicates that, as of the end of 2017, 20 percent of the fleet met the new safety requirements for DOT-117 and DOT-117R, as compared to 2 percent of the fleet at the end of 2015. Of the tank cars that met the new safety requirements, 61 percent had been newly constructed and the remaining 39 percent had been retrofitted. The report further indicates that about 11 700 DOT-117 and DOT-117R tank cars were expected to be built or retrofitted in 2018.

Using the collected data, PHMSA continues to monitor the industry's progress towards tank car modifications, and its compliance with the phase-out deadlines. The Board appreciates PHMSA's efforts with respect to collecting tank car retrofit information and with the annual reporting of this information. However, the Board notes that PHMSA has not indicated whether it will be considering changes to the phase-out timelines for the legacy Class 111 tank cars, in light of the accelerated timelines being implemented by Transport Canada.

The Board considers PHMSA's response to Recommendation R14-01 to show **Satisfactory Intent**.

November 2019: response from the Pipeline and Hazardous Materials Safety Administration

The Pipeline and Hazardous Materials Safety Administration (PHMSA) continues to actively monitor tank car modifications and compliance with the phase-out deadlines for all DOT-111 tank cars used to transport Class 3 flammable liquids as specified in the final rule entitled Hazardous Materials: FAST Act Requirements for Flammable Liquids and Rail Tank Cars (HM-251C) published in the Federal Register on 15 August 2016.

Since 2017, the Bureau of Transportation Statistics (BTS) and PHMSA have produced an annual report that tracks industry's progress towards the phase-out of legacy cars and compliance with the new standards.

The latest annual report was submitted to Congress in October 2019 and describes the progress of tank car safety upgrades from 2013 through 2018, by tank car type and type of flammable liquid.

According to the report, in 2018, the overall size of the fleet used to transport Class 3 flammable liquids has increased for the first time since 2015, growing by 4 percent to 80,298 rail tank cars.

Meeting the established deadlines, crude oil is no longer being carried in non-jacketed DOT-111 tank cars (as of 1 January 2018) and jacketed DOT-111 tank cars (as of 1 March 2018).

The number of DOT-117 rail tank cars, both new and retrofitted, grew to 34 percent of the entire fleet used to carry Class 3 flammable liquids, a significant increase from just 2 percent in 2015. Of the tank cars meeting the DOT-117 requirements, 52 percent (14,184 tank cars) are new and 48 percent (13,357 tank cars) are retrofitted. The report further indicates that 6,700 new DOT-117 tank cars are projected to be built and 8,410 tank cars are projected to be retrofitted to the DOT-117R specification in 2019.

The next annual report is scheduled for the fall of 2020, and such reports will be produced through 2029, at which time all tank cars in flammable liquid service are to meet the DOT-117/117R standard.

December 2019: response from the Railway Association of Canada

The railways have continued to work closely with TC and the U.S Department of Transportation on tank car standards. In September 2018, Transport Canada imposed new DOT-111 tank car replacement dates to accelerate the removal of older cars without jackets and thermal protection from DGs. This is accomplished with PD39 and the adoption of the amended TP14877 Standard and adoption into Canadian TDG Regulations as published in Regulatory amendment SOR19/101.

December 2019: response from Transport Canada

Transport Canada agrees with the intent of the recommendation.

Transport Canada responded to this recommendation by introducing a new Class 117 specification and prescribing a phase-out for existing Class 111 tank cars in flammable liquid service.

In June 2015, the Class 117 tank car specification was added to the TDG Regulations following publication in the Canada Gazette, Part II. The Class 117 is more robust than Class 111, and is intended for the transportation of flammable liquids: it features a thicker tank shell, jacketed thermal protection, full head shields, top fittings protection, and an enhanced bottom outlet design. The amendment also contains provisions for retrofitting existing Class 111 tank cars to the Class 117 specification.

The amendment made the Class 117 tank car mandatory for new flammable liquid tank car construction as of October 2015. For existing 111 tank cars in the flammable liquid fleet, the amendment prescribed a phase-out schedule based on the design of the tank car, i.e. legacy vs. enhanced (CPC-1232), unjacketed vs. jacketed, and the flammable liquid transported (i.e. crude oil, ethanol or other).

In July 2016, Transport Canada issued Protective Direction 38, which accelerated the phase-out of all legacy 111 tank cars in crude oil service to November 2016.

In January 2018, Transport Canada published a new edition of tank car standard TP14877, which consolidated the requirements for the Class 117 tank car and the phase-outs for existing 111 tank cars in flammable liquid transport. This new edition of the standard was published in the Canada Gazette, Part II and took effect in the TDG Regulations in July 2019.

In August 2018, Transport Canada issued Protective Direction 39, which accelerated the phase-out of unjacketed CPC-1232 tank car in crude oil service to before November 2018 and accelerated the phase-out of all legacy 111 tank cars and unjacketed CPC-1232 tank cars from condensate service to January 2019.

Transport Canada believes that we have met the full intent of this recommendation and therefore expect that it will be closed.

March 2020: TSB assessment of the response

Pipeline and Hazardous Materials Safety Administration (Satisfactory Intent)

Since 2017, PHMSA and the Bureau of Transportation Statistics have produced an annual report that tracks progress on the phase-out of the legacy cars and on industry's compliance with the new standards. The latest annual report, which was submitted to Congress in October 2019, summarizes the progress from 2013 through 2018 by tank car type and by type of flammable liquid. The next annual report is scheduled for fall 2020.

Based on the established deadlines, crude oil is no longer being carried in non-jacketed DOT-111 tank cars (i.e., as of 01 January 2018), nor in jacketed DOT-111 tank cars (i.e., as of 01 March 2018). As of the end of 2018, the overall size of the tank car fleet used to transport Class 3 flammable liquids has increased to 80 298 rail tank cars, of which 52 percent had been newly constructed and the remaining 48 percent had been retrofitted. The report further indicates that about 15,110 DOT-117 and DOT-117R tank cars were to be built or retrofitted in 2019. Using the collected data, PHMSA continues to monitor the industry's progress on tank car modifications, and its compliance with the phase-out deadlines.

The Board acknowledges PHMSA's efforts with respect to collecting tank car retrofit information and with the reporting of this information on an annual basis.

The Board considers PHMSA's response to the recommendation to show **Satisfactory Intent**.

Transport Canada (Satisfactory Intent)

This recommendation is specific to new and existing Class 111 tank cars for the transport of flammable liquids.

Transport Canada (TC) had previously introduced a new Class 117 specification and had prescribed a phase-out for existing Class 111 tank cars in flammable liquid service. The Class

117 is intended for the transportation of flammable liquids, and is a more robust design than Class 111 as it features a thicker tank shell, jacketed thermal protection, full head shields, top fittings protection, and an enhanced bottom outlet design.

For existing Class 111 tank cars in the flammable liquid fleet, the phase-out schedule is based on the design of the tank car (i.e., legacy vs. CPC-1232), whether the tank car is jacketed or unjacketed, and the type of flammable liquid being transported (i.e., crude oil, ethanol or other).

In January 2018, TC had published a new edition of tank car standard TP14877, which consolidated the requirements for the Class 117 tank car and the phase-outs for existing 111 tank cars in flammable liquid transport. This new edition of the standard was published in the Canada Gazette, Part II and took effect in the TDG Regulations in July 2019.

Pending full implementation of the Class 111 phase-out schedule, TC has been taking additional risk control measures, including hiring more than 60 additional TDG inspectors since 2016. Through its risk based inspection program, TDG inspectors continue to closely monitor the progress of the phase-out and to verify compliance with the standard.

The RAC and the railways have continued to work closely with TC and the U.S Department of Transportation on tank car standards.

With a number of recent derailments involving both new and retrofitted TC-117 tank cars, the performance characteristics of these more robust tank cars are being assessed. This assessment will help verify whether flammable liquids are being transported in tank cars built sufficiently robust to significantly reduce the risk of product loss when these cars are involved in accidents. The Board continues to call upon TC and the railway industry to ensure that appropriate risk control measures during the remaining phase-out period are effectively implemented and managed.

The Board considers Transport Canada's response to the recommendation to show **Satisfactory Intent**.

January 2021: response from the Railway Association of Canada

Progress on this matter continues as per update provided in December 2019.

January 2021: response from the Pipeline and Hazardous Materials Safety Administration

The Pipeline and Hazardous Materials Safety Administration (PHMSA) continues to actively monitor tank car modifications and compliance with the phase-out deadlines for all DOT-111 tank cars used to transport Class 3 flammable liquids as specified in the final rule entitled Hazardous Materials: FAST Act Requirements for Flammable Liquids and Rail Tank Cars (HM 251C) published in the Federal Register on 15 August 2016.

Since 2017, the Bureau of Transportation Statistics (BTS) and PHMSA have produced an annual report that tracks industry's progress towards the phase-out of legacy cars and compliance with the new standards.

The latest annual report was submitted to Congress in September 2020 and describes the progress of tank car safety upgrades from 2013 through 2019, by tank car and flammable liquid type.

According to the report, in 2019, new and retrofitted DOT-117 tank cars comprised nearly half of the fleet carrying Class 3 flammable liquids (at 48%). Among the fleet of tank cars that met the DOT-117 specification in 2019, 47% (25,300 tank cars) are new and 53% (28,261 tank cars) are retrofitted. Half of the new DOT-117 rail tank cars carried crude oil and 65% of retrofitted DOT-117 tank cars carried either crude oil or ethanol in 2019. The report further indicates that 7,938 tank cars are projected to be built or modified in 2020 to meet the new safety requirements. Regardless of the fleet size, the DOT-117 tank cars will continue to become a significant part of the fleet to meet the safety goal by 2029.

The next annual report is scheduled for the fall of 2021, and such reports will be produced through 2029, at which time all tank cars in flammable liquid service are to meet the DOT-117/117R standard.

February 2021: response from Transport Canada

In May 2015, Transport Canada established the requirements for:

- A new, more robust, flammable liquid tank car standard (TC-117);
- Retrofit requirements for older tank cars in flammable liquid service; and
- Implementation timelines to modernize the Canadian tank car fleet.

Performance of Class 117 tank cars

Following recent main-track derailments of flammable liquid tank cars, Transport Canada has been appraising the crash worthiness of Class 117 tank cars. These appraisals include field examinations conducted by Transport Canada officials at derailments involving both retrofitted (specification 117R) and newly constructed (specification 117J) tank cars. These examinations have shown that the Class 117 tank cars are more robust in comparison to Class 111 tank cars involved in previous derailments. Improvements to service equipment design and protection in Class 117 tank cars have significantly reduced the potential for dangerous goods release from top fittings and have essentially eliminated release from bottom outlets. Where product release leads to fire, the Class 117 thermal protection system has increased the survivability of the tank cars and reduced the hazard to emergency response personnel managing the fires.

Additionally, Transport Canada has collaborated with the United States Federal Railroad Administration (FRA) on modelling full train derailments, which shows that performance of specification 117J tank cars is significantly improved compared to Class 111 tank cars. These models were derived from data obtained from full scale tank car impact tests conducted by the

FRA. Research will continue with modelling to evaluate the performance of specification 117R tank cars.

Monitoring of the flammable liquid tank car fleet

Transport Canada is monitoring the composition of the flammable liquid tank car fleet and the progress that industry is making in constructing new specification TC 117J tank cars and phasing-out existing legacy Class 111 and CPC 1232 tank cars or retrofitting them to TC 117R specification. Industry has complied with phase-out deadlines that have already passed and is producing new 117J tank car and retrofitted 117R tank cars at a rate sufficient to meet the rest of the phase-out schedule up to the final April 30, 2025 deadline.

Risk mitigation measures

Transport Canada also continues to improve risk control measures for trains carrying large volumes of flammable liquids. The Department has issued series of Ministerial Orders that require railway companies to reduce train speeds and to implement additional track safety measures. In November 2020, Transport Canada issued Ministerial Order MO 20-10 to further reduce the risk of derailments during cold temperatures. The Order requires railway companies to restrict train speed based on temperature, under condition that a Winter Operation Risk Mitigation Plan specific to each subdivision where higher risk key trains operate be developed and submitted to Transport Canada.

Conclusion

The Canadian Class 117 tank car fleet will continue to grow towards the April 30, 2025 deadline, at which point, all tank cars in Canada in flammable liquid service will meet this minimum standard. Given the increasing use of the Class 117 tank car fleet and its performance to date, Transport Canada believes that we have met the full intent of this recommendation.

March 2021: TSB assessment of the response

Pipeline and Hazardous Materials Safety Administration (Satisfactory Intent)

Since 2017, the Pipeline and Hazardous Materials Safety Administration (PHMSA) and the Bureau of Transportation Statistics have produced an annual report that tracks progress on the phase-out of the legacy cars and on industry's compliance with the new standards. The latest annual report, which was submitted to Congress in September 2020, summarizes the progress from 2013 through 2019 by tank car type and by type of flammable liquid. The next annual report is scheduled for fall 2021.

By the end of 2019, new and retrofitted DOT-117 tank cars comprised nearly half of the fleet carrying Class 3 flammable liquids. In 2019, half of the new DOT-117 cars carried crude oil and 65% of retrofitted DOT-117 tank cars carried either crude oil or ethanol. PHMSA indicated that DOT-117 tank cars will continue to become a significant part of the fleet to meet the safety goal by 2029.

The Board acknowledges PHMSA's efforts with respect to collecting tank car retrofit information and with the reporting of this information on an annual basis. The Board notes that a well-defined phase-out schedule of older tank cars is in place and industry's progress in that regard is being monitored by PHMSA. This will help ensure that, by 01 May 2029,[1] all flammable liquids in the United States are transported in more robust Class 117 tank cars.

Therefore, the Board considers PHMSA's response to Recommendation R14-01 to show **Satisfactory Intent**.

Transport Canada (Satisfactory Intent)

In May 2015, Transport Canada (TC) introduced a new Class 117 specification tank car and prescribed retrofit requirements for older tank cars in flammable liquid service and implementation timelines to modernize the Canadian tank car fleet. Class 117 tank cars feature a thicker tank shell, jacketed thermal protection, full head shields, top fittings protection and an enhanced bottom outlet design.

TC has been assessing the crashworthiness of both new (117J) and retrofitted (117R) Class 117 tank cars involved in recent main-track derailments. According to TC, the improved service equipment design features of Class 117 tank cars significantly reduce the potential for the release of dangerous goods from top fittings and bottom outlets, and the thermal protection system increases the survivability of the tank cars when involved in fires.

The RAC and the railways have continued to work closely with TC and the U.S. Department of Transportation on tank car standards.

TC has also been participating in modelling full train derailments in collaboration with the Federal Railroad Administration (FRA). According to TC, the results of these models show that the performance of the specification 117J tank cars is significantly improved compared to Class 111 tank cars. TC indicated that research will continue with modelling to evaluate the performance of the specification 117R tank cars.

TC continues to monitor industry's progress towards tank car modifications and compliance with the phase-out deadlines. TC indicated that industry has complied with the phase-out deadlines that have passed and that it is producing new 117J tank cars and retrofitted 117R tank cars at a rate sufficient to meet the phase-out schedule by the 2025 deadline in Canada.

Pending the full implementation of the new flammable liquid tank standard, TC continues to improve risk control measures for trains carrying large volumes of flammable liquids. Such measures include speed reductions, additional track safety measures and specific operating restrictions for higher-risk key trains.

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1 As specified in the final rule entitled Hazardous Materials: FAST Act Requirements for Flammable Liquids and Rail Tank Cars (HM 251C) published in the Federal Register on 15 August 2016.

The Board acknowledges TC's implementation of improved risk control measures for trains carrying large volumes of flammable liquids. The Board notes that a well-defined phase-out schedule of older tank cars is in place and industry's progress in that regard is being monitored by TC. This will help ensure that, by 01 May 2025, all flammable liquids in Canada are transported in Class 117 tank cars.

The Board also acknowledges TC's continuing efforts to characterize and evaluate the crashworthiness of Class 117 tank cars involved in accidents. The Board notes that ongoing TSB investigations (R19W0050 and R19W0320) will assess the performance of class 117 tank cars in train accidents and the subsequent risk of product loss. Until the results of these assessments are known, the Board considers TC's response to Recommendation R14-01 to show **Satisfactory Intent**.

November 2021: response from the Railway Association of Canada

Progress on this matter continues as per update provided in December 2019.

November 2021: response from Transport Canada

Transport Canada continues to monitor industry's progress towards tank car modifications and compliance with the phase-out deadlines. Industry has complied with the phase-out deadlines that have passed and is producing new 117J tank cars and retrofitted 117R tank cars at a rate sufficient to meet the phase-out schedule. As of October 2021, the flammable liquid tank car fleet still requires approximately 17 500 more class 117 tank cars to be constructed or retrofitted. Given that on average just under 600 cars are being constructed or retrofitted each month (with even higher numbers pre-COVID), there should be sufficient industry capacity to produce enough class 117 tank cars in the next 42 months before the May 1, 2025 phase-out deadline.

December 2021: response from the Pipeline and Hazardous Materials Safety Administration

The Pipeline and Hazardous Materials Safety Administration (PHMSA) continues to actively monitor the upgrade of the rail tank car fleet to the new DOT-117 standard, which was finalized in 2015. The design characteristics of DOT-117 tank cars include a thicker, insulated/thermally protected tank, a full head shield, and top and bottom valve fitting protection.

Since 2017, in compliance with the applicable provisions of the *Fixing America's Surface Transportation (FAST) Act*, the Bureau of Transportation Statistics (BTS) and PHMSA have produced an annual report that tracks industry's progress in upgrading the rail tank car fleet to the DOT-117 standard.

The latest annual report was submitted to Congress in September 2021 and describes the progress of tank car safety upgrades from 2013 through 2020, by tank car and flammable liquid type.

In 2020, 111,177 tank cars transported class 3, flammable liquids, a 1.3% reduction from 2019. A variety of economic challenges and shifts have occurred that year, notably in the reduction of shipments of crude oil. Shipments of flammable liquids were down 15% overall, and crude shipments alone were down 38% compared to 2019. For the first time, in 2020, DOT-117s comprised over half of the fleet at 54%. Among the fleet of rail tank cars that met the DOT-117 specification in 2020, 52% (30,883 tank cars) were new, and 48% (28,803 tank cars) were retrofitted. In 2020, 65% of DOT-117 rail tank cars carried crude or ethanol, and 55% of retrofitted DOT-117 tank cars carried either crude oil or ethanol. According to the report, 7,413 DOT-117 and DOT-117R tank cars were projected to be built or retrofitted in 2021.

Regardless of the fleet size and economic fluctuations, DOT-117 tank cars have continued to become an increasingly significant proportion of the fleet transporting class 3 flammable liquids, allowing for the expected compliance to all parts of the FAST Act by 2029.

March 2022: TSB assessment of the response

Transport Canada (Satisfactory Intent)

In May 2015, Transport Canada (TC) introduced a new class 117 specification tank car and prescribed retrofit requirements for older tank cars in flammable liquid service and implementation timelines to modernize the Canadian tank car fleet. Class 117 tank cars feature a thicker tank shell, jacketed thermal protection, full head shields, top fittings protection, and an enhanced bottom outlet design.

TC continues to monitor industry's progress towards tank car modifications and compliance with the phase-out deadlines. According to TC, industry has complied with the phase-out deadlines that have passed, and there should be sufficient industry capacity to produce enough class 117 tank cars before the 01 May 2025 phase-out deadline.

The Board notes that, in TSB investigation R19W0050, it was determined that the overall performance of the class 117R tank cars was somewhat improved as compared to legacy class 111 and unjacketed CPC-1232 tank cars that have been examined in previous TSB derailment investigations involving crude oil unit trains.

The Board further notes in TC's response that a well-defined phase-out schedule of the older tank cars is in place to replace them with the newer and more robust class 117 tank cars to ensure that, by 01 May 2025, all flammable liquids in Canada are transported in class 117 tank cars. However, the Board previously indicated that it will assess the performance of class 117 tank cars through ongoing TSB investigation (R19W0320) and the subsequent risk of product loss. Therefore, until the results of this investigation are known, the Board considers TC's response to Recommendation R14-01 to be **Satisfactory Intent**.

Pipeline and Hazardous Materials Safety Administration (Satisfactory Intent)

In 2015, the Pipeline and Hazardous Materials Safety Administration (PHMSA) introduced a new Class 117 specification tank car and prescribed retrofit requirements for older tank cars in

flammable liquid service and implementation timelines to modernize the tank car fleet. class 117 tank cars feature a thicker tank shell, jacketed thermal protection, full head shields, top fittings protection and an enhanced bottom outlet design.

Since 2017, PHMSA and the Bureau of Transportation Statistics have produced an annual report that tracks progress on the phase-out of the legacy cars and on industry's compliance with the new standards.

The latest annual report, which was submitted to Congress in September 2021, summarizes the progress from 2013 through 2020 by tank car type and by type of flammable liquid. PHMSA indicated that a variety of economic challenges and shifts have occurred in 2020, notably in the reduction of shipments of crude oil. By the end of that year, for the first time, DOT-117 tank cars comprised over half of the fleet at 54%. Among the fleet of rail tank cars that met the DOT-117 specification in 2020, 52% were new and 48% were retrofitted. In 2020, 65% of DOT-117 rail tank cars carried crude or ethanol, and 55% of retrofitted DOT-117 tank cars carried either crude oil or ethanol.

According to PHMSA, regardless of the fleet size and economic fluctuations, DOT-117 tank cars have continued to become an increasingly significant proportion of the fleet transporting class 3 flammable liquids, allowing for the expected compliance to all parts of the FAST Act by 2029.

The Board acknowledges PHMSA's efforts with respect to collecting tank car retrofit information and with the reporting of this information on an annual basis.

The Board notes that, in TSB investigation R19W0050, it was determined that the overall performance of the class 117R tank cars was somewhat improved as compared to legacy class 111 and unjacketed CPC-1232 tank cars that have been examined in previous TSB derailment investigations involving crude oil unit trains.

The Board further notes in PHMSA's response that a well-defined phase-out schedule of the older tank cars is in place and industry's progress in that regard is being monitored by PHMSA. This will help ensure that, by 01 May 2029, all flammable liquids are transported in the U.S. in more robust class 117 tank cars. However, the Board previously indicated that it will assess the performance of class 117 tank cars through ongoing TSB investigation (R19W0320) and the subsequent risk of product loss. Therefore, until the results of this investigation are known, the Board considers PHMSA's response to Recommendation R14-01 to show **Satisfactory Intent**.

Latest response and assessment

November 2022: response from the Pipeline and Hazardous Materials Safety Administration

The Pipeline and Hazardous Materials Safety Administration (PHMSA) continues to actively monitor the upgrade of the rail tank car fleet to the new enhanced DOT-117 standard, which was finalized in 2015. The design characteristics of DOT-117 tank cars include a thicker,

insulated/thermally protected tank, a full head shield, top fitting protection, and disengaging bottom outlet valve handles.[2]

Since 2017, in compliance with the applicable provisions of the *Fixing America's Surface Transportation* (FAST) Act, the Bureau of Transportation Statistics (BTS) and PHMSA have produced an annual report that tracks industry's progress in upgrading the rail tank car fleet to the DOT-117 standard.

The latest annual report was submitted to Congress in September 2022 and describes the progress of tank car safety upgrades from 2013 through 2021, by tank car and flammable liquid type.

In 2021, 103,312 tank cars transported Class 3 flammable liquids, a 7.1% reduction from 2020. Shipments of flammable liquids were down 10% overall, and crude oil shipments alone were down 32% compared to 2020. In 2021, DOT-117s comprised over half of the fleet at 57%. Among the fleet of rail tank cars that met the DOT-117 standard in 2021, 53% (31,313 tank cars) were new, and 47% (27,411 tank cars) were retrofitted. In 2021, 72% of the DOT-117 tank cars and 58% of the retrofitted DOT-117 tank cars carried crude oil or ethanol. According to the report, 8,322 DOT-117 and DOT-117R tank cars were projected to be built or retrofitted in 2022.

In 2021, there was a decrease in rail cars likely due to the reduction of shipments of crude oil. While the total fleet size has decreased, the proportion of tank cars meeting the DOT-117 standard, which features enhanced protection characteristics, continues to increase. DOT-117 tank cars have continued to become an increasingly significant proportion of the fleet transporting Class 3 flammable liquids, allowing for the expected compliance to all parts of the FAST Act by 2029. The next significant phaseout date for DOT-111 tank cars is May 1, 2023, after which ethanol may not be transported in a DOT-111 tank car, unless it was manufactured to the upgraded CPC-1232 standard. Unjacketed CPC-1232 tank cars may not be used to transport ethanol after July 1, 2023.

December 2022: response from Transport Canada

Transport Canada (TC) continues to monitor the industry's progress towards tank car modifications and compliance with the phase-out deadlines. Industry has complied with the phase-out deadlines and continue to produce 117J/117R tank cars to meet the phase-out schedule.

Since 2015, TC requires that flammable liquids be transported in Class 117 tank cars or the enhanced Class 111 tank cars; Class 117 tank cars feature a thicker tank shell, jacketed thermal protection, full head shields, top fittings protection, and an enhanced bottom outlet design. The

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[2] All responses are those of the stakeholders to the TSB in written communications and are reproduced in full. The TSB corrects typographical errors in the material it reproduces without indication but uses brackets [ ] to show other changes or to show that part of the response was omitted because it was not pertinent.

new Class 117 tank cars and associated features have shown to significantly reduce the risk of product loss when involved in accidents, and this has been demonstrated in computer modelling, testing, and derailments.

As for the enhanced Class 111 tank cars, it conforms with enhanced protection standards that significantly reduce the risk of product loss if these cars are involved in accidents.

The Class 111 tank cars are being progressively phased out until the deadline of April 30, 2025, while the industry production capacity of 117J/117R remains sufficient to meet the deadlines for phase-outs of Class 111 tank cars.

January 2023: response from the Railway Association of Canada

The phaseout schedule has not changed since the last report; however, the Canadian Tank Car Standard (TP-14877) has been reviewed by a Committee facilitated by the Canadian General Standards Board (CGSB) and has been updated (final Committee vote still TBA). This standard is referred to as CGSB 43.147 and is to be incorporated into the Canadian Dangerous Goods regulations in Spring 2023 via publication in the *Canada Gazette*, Part ll.

March 2023: TSB assessment of the responses

Pipeline and Hazardous Materials Safety Administration (Fully Satisfactory)

The Pipeline and Hazardous Materials Safety Administration (PHMSA) continues to actively monitor the upgrade of the rail tank car fleet to the United States Department of Transport's enhanced DOT-117 standard, and to produce, in conjunction with the Bureau of Transportation Statistics, an annual report on the industry's progress on this upgrade. The latest annual report was submitted to Congress in September 2022 and describes the progress of tank car safety upgrades from 2013 through 2021. According to the report, in 2021, DOT-117 cars comprised 57% of the fleet. Of these, 53% (31 313 tank cars) were new and 47% (27 411 tank cars) were retrofitted. Another 8 322 DOT-117 and DOT-117R tank cars were projected to be built or retrofitted in 2022. DOT-117 cars are forming an increasingly significant proportion of the fleet transporting Class 3 flammable liquids, allowing for the expected compliance with all parts of the *Fixing America's Surface Transportation Act* by 2029.

The Board notes that the DOT-117 tank car specification has been in place since 2015, along with a prescribed phase-out schedule/retrofit program for older tank cars. The DOT-117 tank cars feature enhanced protection characteristics such as a thicker tank shell, jackets, insulation/thermal protection, full head shields, top fittings protection, and an enhanced bottom outlet valve design. The Board also notes that, over the past 8 years, flammable liquids have increasingly been transported in the more robust DOT-117 tank cars, in accordance with the established phase-out schedule.

In TSB investigation R19W0050 of a crude oil unit train derailment involving Class 117 tank cars, it was determined that the overall performance of these cars was somewhat improved as compared to legacy Class 111 tank cars. In TSB investigation R19W0320 of a crude oil unit train

derailment involving Class 117 tank cars, although no bottom outlet valves were breached or released product, it was not possible to evaluate the performance of the tank cars due to damage sustained during the derailment, fire, and remediation activities.

Given the significant improvements to the tank car standards and the performance seen to date, the Board is satisfied that the risk of product loss when DOT-117 tank cars transporting flammable liquids are involved in accidents has been reduced. The Board therefore considers the response from PHMSA to Recommendation R14-01 to be **Fully Satisfactory**.

Transport Canada (Fully Satisfactory)

In May 2015, Transport Canada (TC) introduced a new Class 117 specification tank car and prescribed retrofit requirements for older tank cars in flammable liquid service, as well as implementation timelines to modernize the Canadian tank car fleet. Class 117 tank cars feature a thicker tank shell, jackets, insulation/thermal protection, full head shields, top fittings protection and an enhanced bottom outlet design.

TC continues to monitor industry's progress towards tank car modifications and compliance with the phase-out deadlines. According to TC, industry has complied with these deadlines and continues to produce Class 117 tank cars to meet the phase-out schedule.

The Board notes that the Class 117 tank car specification has been in place since 2015, along with a prescribed phase-out schedule/retrofit program for older tank cars. The Board also notes that, over the past 8 years, flammable liquids have increasingly been transported in the more robust Class 117 tank cars, in accordance with the established phase-out schedule.

In TSB investigation R19W0050 of a crude oil unit train derailment involving Class 117 tank cars, it was determined that the overall performance of these cars was somewhat improved as compared to legacy Class 111 tank cars. In TSB investigation R19W0320 of a crude oil unit train derailment involving Class 117 tank cars, although no bottom outlet valves were breached or released product, the extensive tank car damage due to the derailment, as well as fire and remediation damage, made it impossible to evaluate the performance of the tank cars.

Given the significant improvements to the tank car standards and the performance seen to date, the Board is satisfied that the risk of product loss when Class 117 tank cars transporting flammable liquids cars are involved in accidents has been reduced. The Board therefore considers TC's response to Recommendation R14-01 to be **Fully Satisfactory**.

File status

This deficiency file is **Closed**.