



REASSESSMENT OF THE RESPONSE TO TSB RECOMMENDATION R17-01

Factors affecting severity of derailments involving dangerous goods

Background

On 14 February 2015, at about 2335 Eastern Standard Time, Canadian National Railway Company (CN) crude oil unit train U70451-10 was proceeding eastward at about 38 mph on CN's Ruel Subdivision when it experienced a train-initiated emergency brake application at Mile 111.7, at Gladwick, near Gogama, Ontario. A subsequent inspection determined that the 7th through 35th cars (29 cars in total) had derailed. Nineteen of the tank cars were breached, and about 1.7 million litres of petroleum crude oil were released to either the atmosphere or surface. The released product ignited, and the fires burned for 5 days. About 900 feet of mainline track was destroyed. There was no evacuation, and there were no injuries.

The Board concluded its investigation and released Railway Investigation Report R15H0013 on 16 February 2017.

TSB Recommendation R17-01 (February 2017)

The severity of the outcome in any derailment is directly related to train speed and other factors. One of the ways that the rail industry manages the risk of derailment is through the reduction of train speed. Train speed is restricted based on the class and the condition of the track. When additional track maintenance is required on the track, slow orders can be implemented to further restrict train speed. This is a regular practice in the industry.

While train speed contributes to the severity of outcome in any derailment, other factors also play a role, including train length, the cause of the derailment, the position of the first car(s) derailed, the position of the tank cars in the train and tank car safety design. Although managing train speed based on the condition of the track will help minimize the severity of outcome in the event of a derailment, the risk profile of each train should also be considered. For example:

- “Non-key” mixed merchandise trains that transport few or no dangerous goods (DGs) and unit trains transporting non-DG commodities (i.e., grain, potash, coal) have the lowest risk profile.
- “Key” mixed merchandise trains transporting the minimum number of DG tank cars that are dispersed throughout the train are exposed to less risk in a derailment since the derailment could occur in an area of the train that is either not transporting DG tank cars or only transporting a few.

- Similarly, “key” mixed merchandise trains that transport larger blocks of DG tank cars are exposed to more risk in the event of a derailment.
- “Key” unit trains of DG tank cars transporting Class 3 flammable liquids have the highest risk profile. When a derailment occurs that involves a unit train transporting Class 3 flammable liquids, the risk of release and adverse consequence is high no matter where the derailment occurs within the train, because all cars are carrying Class 3 flammable liquids.

To some extent, Transport Canada (TC) has recognized the role that train speed and train risk profile play in the severity of the outcome of a derailment, and has put some measures in place to limit the speed of “key trains” under certain conditions. The TC-approved *Rules Respecting Key Trains and Key Routes* restrict “key trains” to a maximum speed of 40 mph within the core and secondary core of census metropolitan areas. Although the restrictions contained in the rules were a step forward at the time issued, the current maximum speed of 40 mph was selected without being validated by any engineering analysis.

Furthermore, the fact that the new tank car standards (TC-117) will not be fully implemented before 2025 means that less robust tank cars, such as those involved in this occurrence, will continue to transport Class 3 flammable liquids. In its reassessment of TC’s response to Recommendation R14-01, the Board stated that, 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 called upon TC and industry to ensure that risk control measures during the transition are effectively managed. The Board is concerned that the associated train speed and residual risk may be too high for some “key trains.” Therefore, the Board recommends that

the Department of Transport conduct a study on the factors that increase the severity of the outcomes for derailments involving dangerous goods, identify appropriate mitigating strategies including train speeds for various train risk profiles and amend the *Rules Respecting Key Trains and Key Routes* accordingly.

TSB Recommendation R17-01

Transport Canada’s response to Recommendation R17-01 (May 2017)

Transport Canada acknowledges the recommendation and will conduct a literature review of existing studies, beyond those the department has already reviewed. This may provide additional analysis of speed and other factors which can directly influence the severity of the outcomes of the derailment of trains carrying dangerous goods.

The results of this literature review will be used to determine whether additional scientific and engineering analysis would be meaningful to further the department’s understanding of factors affecting the severity of derailments to determine whether changes are warranted to the *Rules Respecting Key Trains and Key Routes*.

TSB assessment of Transport Canada’s response to Recommendation R17-01 (July 2017)

Transport Canada has acknowledged this recommendation.

TC will conduct a literature review of existing studies on the factors affecting the severity of derailments involving dangerous goods. TC will then assess the results of the literature review

to determine if additional scientific and engineering analysis would be meaningful to further understand the derailment severity factors. This assessment will allow TC to determine if changes should be made to the *Rules Respecting Key Trains and Key Routes*.

The Board notes that, although no timeline has been proposed, TC has committed to conducting a literature review of existing studies and to assessing the results of the review. However, beyond this commitment, there are no explicit plans for TC to conduct its own study on derailment severity factors.

Therefore, the Board considers the response to Recommendation R17-01 to be **Satisfactory in Part**.

Transport Canada's response to Recommendation R17-01 (February 2019)

Transport Canada committed to conducting a literature review of existing studies, beyond those the department has already reviewed which could provide additional analysis of speed and other factors which can directly influence the severity of the outcomes of the derailment of trains carrying dangerous goods.

In October 2018, Transport Canada's Rail Safety directorate and Innovation Center initiated a study to be undertaken by the National Research Council. The scope of the study involves conducting research on the factors contributing to train derailment outcomes. Factors include those that have already been identified in previous studies and other factors that may not be fully explained in existing research. The factors of interest include train length, train speed, track class, accident cause, and the position of cars in trains.

In addition, the study will determine how these factors affect the severity level of derailments considering that dangerous goods would be involved. The factors that are generally recorded and tracked in accident reports in Canada and the US will be used to categorize the severity of a derailment. As a minimum the severity levels will be classified based on the following criteria: number of derailed cars, number of derailed DG cars, number of damaged DG cars, and number of damaged DG cars that have spilled contents. Further, potential mitigation strategies (i.e. speed, placement of DG) will be identified.

The study is expected to be completed in Quarter 1, 2019. Based on the results, Rail Safety will determine if amendments to the *Rules Respecting Key Trains and Key Routes* are warranted. Rail Safety continues to monitor the compliance to the *Rules Respecting Key Trains and Key Routes* during its oversight program.

TSB reassessment of Transport Canada's response to Recommendation R17-01 (March 2019)

In October 2018, Transport Canada (TC) initiated a research study on the factors that contribute to train derailment outcomes. The study, which is being conducted by the National Research Council, will evaluate factors including train length, train speed, track class, accident cause, and the position of cars in trains. The study will also determine how these factors affect the severity level of derailments when dangerous goods are involved. The severity levels will be based on criteria such as: number of derailed cars, number of derailed DG cars, number of damaged DG cars, and number of damaged DG cars that have spilled contents. Based on this research, it is expected that mitigation strategies (e.g., speed of DG trains and the placement of DG tank cars) will be identified.

The study is expected to be completed by Summer 2019. Based on the results of the study, TC will determine if the *Rules Respecting Key Trains and Key Routes* should be amended.

The Board is encouraged with initiation of the research study on the factors affecting the severity of dangerous goods derailments and looks forward to the study results. The Board considers the response to Recommendation R17-01 to show **Satisfactory Intent**.

Transport Canada’s response to Recommendation R17-01 (December 2019)

In response to this recommendation, in October 2018, Transport Canada commissioned the National Research Council to undertake a study involving research on the factors contributing to train derailment outcomes. In Fall 2019, the National Research Council submitted a preliminary draft entitled, “Study on the Factors that Increase the Severity of the Outcomes for Derailments Involving Dangerous Goods and Identification of Mitigation Measures” with Transport Canada.

Transport Canada is currently reviewing the key findings and conclusion of this study. Once completed, Rail Safety will provide the Transportation of Safety Board with a copy of the study, as well as the department’s next steps.

TSB reassessment of Transport Canada’s response to Recommendation R17-01 (March 2020)

In Fall 2019, Transport Canada (TC) received the preliminary draft report prepared by the National Research Council entitled, “Study on the Factors that Increase the Severity of the Outcomes for Derailments Involving Dangerous Goods and Identification of Mitigation Measures.”

TC has been reviewing the report, including the findings and conclusions. Once the review is complete, TC will identify the next steps.

The Board is encouraged that the research has been completed and a draft report has been prepared. However, an increase in the transportation of flammable liquids, and recent train derailments involving crude oil, demonstrate that identifying mitigating strategies requires urgent attention. The Board looks forward to the study results and the next steps.

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

Transport Canada’s response to Recommendation R17-01 (February 2021)

In September 2020, the National Research Council report “Study on the Factors that Increase the Severity of the Outcomes for Derailments Involving Dangerous Goods and Identification of Mitigation Measures” was finalized, published on Transport Canada’s website, and shared with the TSB.

This study informed a number of measures the department took in 2020 to reduce the likelihood and severity of derailments and enhance rail safety in Canada. For example, under Section 32.01 of the *Railway Safety Act*, the Minister of Transport issued Ministerial Orders 20-03, 20-05 and 20-06 to restrict the speed of trains carrying dangerous goods, incorporated the definition for a “Higher Risk Key Train” (trains carrying large quantities of crude oil or liquid petroleum gas), and required companies to implement a winter operation risk mitigation plan to implement

speed restrictions based on temperature rather than time of year. The Orders also included new requirements for railways regarding track inspection and maintenance (e.g. requirements for the management of joints in continuous welded rail and for the use of replacement rails).

In addition, as requested by the Minister under section 19 of the *Railway Safety Act*, the Railway Association of Canada (RAC) submitted its revised *Rules Respecting Key Trains and Key Routes* to TC in December 2020, which incorporate the aforementioned changes and bring the railway companies in line with modern standards and industry practice.

On 22 February 2021, TC issued a letter to the RAC approving the revised *Rules Respecting Key Trains and Key Routes*, with an effective date of 22 August 2021.

TSB reassessment of Transport Canada’s response to Recommendation R17-01 (March 2021)

The National Research Council of Canada (NRC) completed its report “*Study on the Factors that Increase the Severity of the Outcomes for Derailments Involving Dangerous Goods and Identification of Mitigation Measures*” and Transport Canada (TC) made it available to the public as of September 2020. Based on this study, several Ministerial Orders (MO) were issued by TC aiming to reduce the likelihood and severity of derailments involving dangerous goods (DG) and enhance rail safety in Canada.

Specifically, MO 20-06 required railway companies to update the *Rules Respecting Key Trains and Key Routes* that govern the movement of DG by rail in Canada. Following the issuance of the MOs, the Railway Association of Canada (RAC), on behalf of the industry, submitted revised *Rules Respecting Key Trains and Key Routes* to TC on 24 December 2020.

The updated rules are intended to permanently implement the following measures:

- New definition for higher-risk key train;
- Requirement for railways to have a winter operation risk mitigation plan;
- Modified cold weather speed restrictions for higher-risk trains;
- New requirements for track inspection and maintenance (e.g. management of joints installed using joint bars in continuous welded rail and the use of replacement plug rails).

On 22 February 2021, TC approved the revised *Rules Respecting Key Trains and Key Routes* with an effective date of 22 August 2021.

In response to Board Recommendation R17-01, TC commissioned the NRC *Study on the Factors that Increase the Severity of the Outcomes for Derailments Involving Dangerous Goods and Identification of Mitigation Measures*. The NRC study was completed and available to the public as of September 2020. TC has also approved the revised *Rules Respecting Key Trains and Key Routes* on 22 February 2021, with an effective date of 22 August 2021. Since both of these measures have been completed, Board Recommendation R17-01 has been fulfilled.

The Board considers the response to Recommendation R17-01 to be **Fully Satisfactory**.

Next TSB action

This deficiency file is **Closed**.