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Canada

Transportation Safety Board of Canada

Railway Investigation R15H0021

Derailment and fire of second Canadian National crude oil train near Gogama, Ontario

The occurrence

On 07 March 2015, Canadian National (CN) crude oil unit train U70451-02 was proceeding eastward on CN's Ruel Subdivision near Gogama, Ontario. The train crew was composed of a locomotive engineer, a trainee and a conductor. The train was equipped with 2 head-end locomotives hauling 94 Class 111 tank cars loaded with Petroleum Crude Oil (UN 1267). The train was 6,089 feet long and weighed 14,355 tons.

Around 02:42, while travelling at about 43 mph, a train-initiated emergency brake application occurred near Mile 88.70. Looking back, the crew observed a fireball about 700 feet behind the locomotives. They detached the locomotives and first 5 cars behind the locomotives from the derailed cars, and pulled clear. The temperature at the time was about -10°C.

The train was designated as a "Key Train"[1] operating on a "Key Route."[2] The accident occurred about 3 kilometres west of the town of Gogama, Ontario, in the vicinity of a CN rail bridge that traversed the Makami river. The CN Emergency Response Assistance Plan (ERAP) was implemented and a full incident command structure was established in the Gogama town hall. There were no injuries reported and no evacuation was required. All fires were extinguished by 10 March 2015.

What we know

Site examination revealed that the 6th to the 44th cars behind the locomotives (39 cars in total) had derailed. The 6th and 7th cars derailed to the south, but made it across the bridge to the east side of the river. The derailed trailing end of the 7th car struck the south side of the bridge structure as it crossed, the car rolled down the east embankment and its bottom outlet valve was compromised and released product. The last 2 cars (43rd and 44th) derailed but remained upright and came to rest near mile 88.75 on the west side of the river. The remaining cars derailed near the west end of the bridge. Two of the cars were submerged in the river, 3 cars were partially submerged in the river and the rest were in a pile on the west river bank (see Photo 1). A number of the cars were breached, released product and ignited a large pool fire which destroyed the steel rail bridge. Most of the remaining cars sustained fire damage ranging from minor to severe. About 700 feet of track was destroyed.

While firefighters dealt with the fire, investigators from the Transportation Safety Board of Canada (TSB) examined the area at the west end of the bridge and recovered a section of broken rail within a plug rail joint that had been installed 2 days prior to the accident (see Photo 2). The plug rail was put in place as a repair for an in-service thermite weld failure identified previously at that location. The recovered rail components were sent to the TSB Engineering Laboratory in Ottawa for further analysis.

Tank cars

The TSB conducted a preliminary damage assessment of the derailed tank cars. All of the Class 111 tank cars were constructed in the last 3 years, and were compliant with the industry's CPC-1232

standard. In comparison with the other general service "legacy" Class 111 tank cars, these tank cars have some enhancements which include half-head shields, improved top and bottom fitting protection, and normalized steel.

Preliminary assessment revealed that 1 tank car at the head-end of the derailment sustained minor damage and 2 tank cars at the tail-end of the derailment had no damage. The remaining derailed tank cars sustained more significant damage, releasing product that sustained a large pool fire. At least 5 of the tank cars exhibited thermal tears from exposure to the pool fire. Initial impressions are that these Class 111 tank cars performed similarly to those involved in the Lac-Mégantic accident. The amount of product released to atmosphere, the river or ground has not yet been estimated, but will be determined as site mitigation and clean-up continues.

Transportation of flammable liquids by rail

The transportation of flammable liquids by rail has been identified as one of the key risks to the transportation system and it is included on the TSB's 2014 Watchlist. The TSB has been pointing out the vulnerability of Class 111 tank cars for many years, and the Board has called for tougher standards for all Class 111 tank cars, not just new ones, to reduce the likelihood of product release during accidents. In Lac-Mégantic, investigators found that, even at lower speeds, the unprotected Class 111 tank cars ruptured, releasing crude oil which fuelled the fire.

The tank cars involved in the previous Gogama derailment (R15H0013) which occurred on 14 February 2015, and the tank cars involved in this derailment (R15H0021) were compliant with the CPC-1232 standard and were not equipped with a thermal protection system.[3] Preliminary assessments of the tank cars involved in both derailments identified that the derailed cars sustained significant damage and did not perform as well as expected. Until a more robust tank car standard with enhanced protection for all tank cars transporting flammable liquids is implemented for North America, the risk will remain.

In response to TSB Recommendation R14-01 issued in January 2014, Transport Canada (TC) adopted the TP 14877 standard in the *Transportation of Dangerous Goods Regulations* on 02 July 2014, requiring all new tank cars built for the transportation of flammable liquids in Canada to meet the CPC-1232 specifications. At that time, the TSB warned TC that this standard was not sufficient and that more needed to be done to provide an adequate level of protection.

TC-117

On 11 March 2015, TC announced proposed upgraded standards for a new series of tank car—the TC-117. The new standard 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 and improved bottom outlet valves. 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.

While the proposed standards look promising, the TSB has concerns about the implementation timeline, given initial observations of the performance of CPC-1232 cars in recent derailments. If older tank cars, including the CPC-1232 cars, are not phased out sooner, then the regulator and industry need to take more steps to reduce the risk of derailments or consequences following a derailment carrying flammable liquids.

Track infrastructure

The CN Ruel Subdivision consists of single main track which extends westward from Capreol, Ontario (Mile 0.00) to Hornepayne, Ontario (Mile 296.20). It is primarily composed of continuous welded rail (CWR) and is rated as Class 4 track under the TC-approved Track Safety Rules. Class 4 track permits track speeds of up to 60 mph for freight trains and 80 mph for passenger trains. However, there were permanent slow orders on much of the subdivision to protect against various infrastructure and track maintenance issues.

Preliminary indications are that track infrastructure failures may have played a role in each of the Gogama accidents and a 3rd accident that involved a mixed manifest train on the Ruel Subdivision near

Minnipuka, Ontario on 5 March 2015. Petroleum crude oil unit trains transporting heavily-loaded tank cars will tend to impart higher than usual forces to the track infrastructure during their operation. These higher forces expose any weaknesses that may be present in the track structure, making the track more susceptible to failure. Given the potential damage of a train derailment, particularly when petroleum crude oil unit trains are involved, the TSB has issued a Safety Advisory Letter hyperlink to letter calling on TC to review the risk assessments conducted for the Ruel Subdivision, assess the track infrastructure condition and determine whether additional risk control measures are required when operating a ”Key Train” on this “Key Route.”

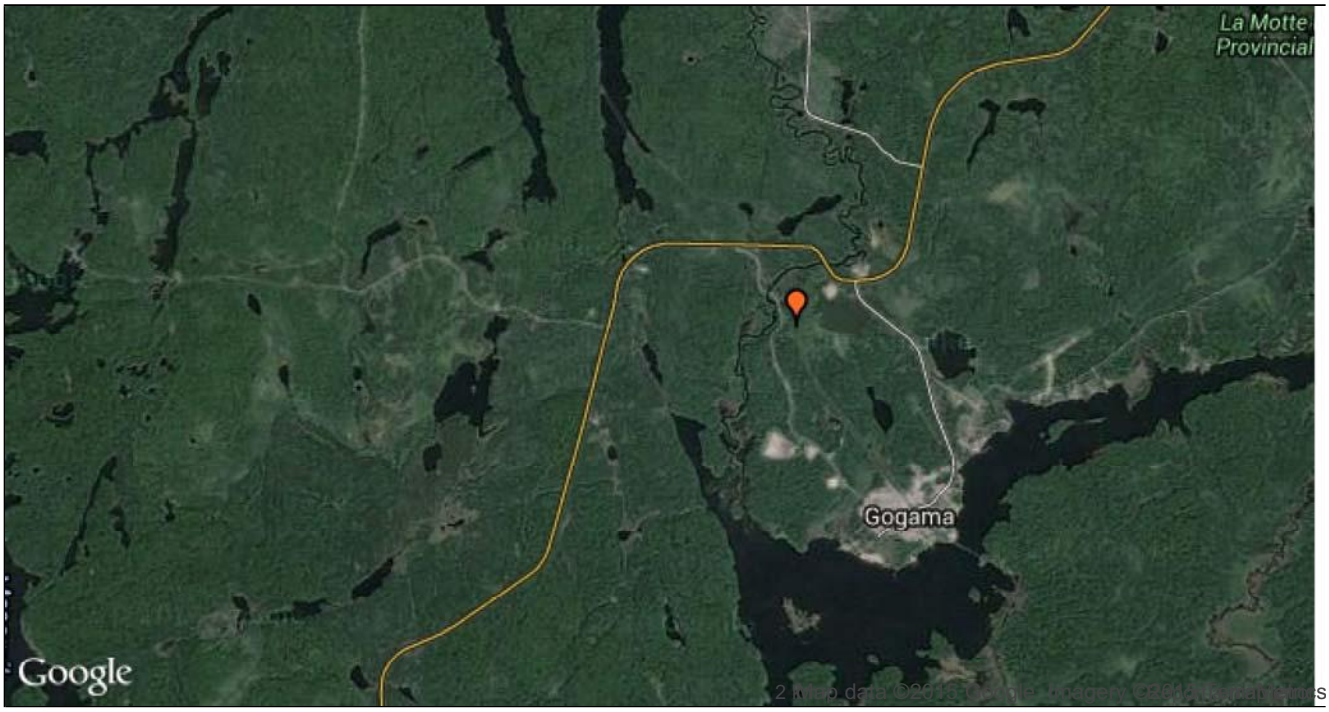
Next steps

The investigation is ongoing and the next steps include:

- Examination of rail components from the derailment site.
- Sampling and testing of product from select tank cars.
- Review of Wheel Impact Load Detector records for the train and previous trains.
- Review of track infrastructure maintenance records for the area.
- Review of CN Engineering Track Standards.
- Review of TC-approved *Track Safety Rules.*
- Review and evaluation of ERAP and emergency response.
- Conducting of additional interviews as required.

Once all remaining product has been removed from the tank cars and they have been cleaned and purged, the TSB will complete a detailed damage assessment of the cars. The object of the assessment is to compare the performance of these tank cars against the known performance of the legacy Class 111 tank cars that were involved in the Lac-Mégantic accident and the CPC-1232 compliant Class 111 cars involved in the previous CN unit crude oil train accident. This will include further failure analysis, testing and metallurgical examination at the TSB Engineering Laboratory.

Map of the area



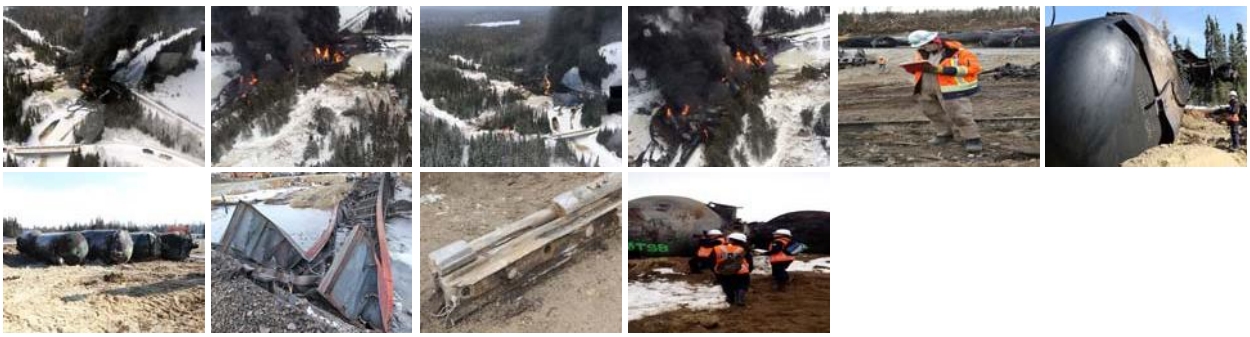
Investigator-in-charge

George Fowler has been with the Transportation Safety Board of Canada since 2002. Prior to joining the TSB, he held various senior engineering positions during a 30 year career with CN in Edmonton, Kamloops, Montreal and Toronto.

Mr. Fowler has extensive knowledge and experience in railroad engineering and has been involved in the investigations of a number of serious railroad occurrences across Canada since joining the TSB.

Mr. Fowler graduated from the University of Alberta with a degree in Civil Engineering and is a registered professional engineer.

Photos



See more high resolution pictures on the TSB Flickr page.

Transportation Safety Board investigation process

There are 3 phases to a TSB investigation:

1. **Field phase**: a team of investigators examines the occurrence site and wreckage, interviews witnesses and collects pertinent information.
2. **Examination and analysis phase**: the TSB reviews pertinent records, tests components of the wreckage in the lab, determines the sequence of events and identifies safety deficiencies. When safety deficiencies are suspected or confirmed, the TSB advises the appropriate authority without waiting until publication of the final report.
3. **Report phase**: a confidential draft report is approved by the Board and sent to persons and corporations who are directly concerned by the report. They then have the opportunity to dispute or correct information they believe to be incorrect. The Board considers all representations before approving the final report, which is subsequently released to the public.

For more information, see our Investigation process page.

The TSB is an independent agency that investigates marine, pipeline, railway and aviation transportation occurrences. Its sole aim is the advancement of transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

Media

News releases

2015-03-17

Derailment and fire of second Canadian National crude oil train near Gogama, ON
Read the news release

Deployment notices

2015-03-07

TSB deploys team to crude oil train derailment and fire 3 km west of Gogama, Ontario
Read the deployment notice

Safety Advisory Letter

2015-03-17

Condition of track infrastructure on CN Ruel subdivision
Read the safety advisory letter

Other correspondence

2014-10-09

Letter to Transport Canada regarding: Replacement and Retrofit of Class 111 Tank Cars
Read the letter

2014-10-09

Letter to the Pipeline and Hazardous Materials Safety Administration regarding: Replacement and Retrofit of Class 111 Tank Cars
Read the letter

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1 A “Key Train” is defined as any train containing 1 or more cars of Poison Inhalation Hazard (PIH) or Toxic Inhalation Hazard (TIH) material, such as anhydrous ammonia, ammonia solutions, spent nuclear fuel or high-level radioactive waste, or containing 20 car loads, or intermodal portable tank loads, of any combination of other hazardous materials (e.g., crude oil).

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

3 The CPC-1232 standard does not require tank cars to be fitted with a thermal protection system.

Date modified: 2015-03-17