



The Transportation Safety Board of Canada (TSB) is investigating this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability. Because the investigation is ongoing, the information provided is subject to change as additional facts become available.

The purpose of this communication is to update interested organizations and persons on the factual information gathered to date, to provide information regarding safety-related activities, and to provide information about further investigation activities. The analysis of the available factual information is still under way; consequently, it would be inappropriate to speculate as to the findings of the Board on this occurrence.



## Railway Investigation Update

Main-Track Derailment

Canadian National

Train U-781-21-18

Mile 3.87, Lévis Subdivision

Saint-Henri-de-Lévis, Quebec

17 August 2004

Investigation Number R04Q0040

*Ce point sur l'enquête est également disponible en français.*

## *Synopsis*

At approximately 1440 eastern daylight time on 17 August 2004, 18 tank cars of Canadian National (CN) train U-781-21-18, a petroleum product unit train travelling from the Ultramar Canada Inc. refinery in Lévis, district of Saint-Romuald, Quebec, and bound for Montréal, Quebec, derailed at Mile 3.87 of the Lévis Subdivision, in the marshy area of the Grande plée Bleue, near Saint-Henri-de-Lévis. Approximately 200 000 litres of gasoline and diesel fuel spilled into the marshy area, but the spilled product was recovered. There were no injuries.

## *Investigation Organization*

The investigation team examined the circumstances surrounding the accident and all aspects of the railway operation: condition of rolling stock, train operation, inspections, and integrity of track structure. The investigation team also performed geotechnical studies, analysed traffic data and weather conditions, and examined an axle with a shifted wheel and three pieces of broken rail.

## *Factual Information*

### *The Accident*

Shortly after leaving the refinery, the train had covered a distance of 11.2 miles when a train-initiated emergency brake application occurred. The event recorder on the lead locomotive indicates that, when the emergency brakes were applied, the train was travelling at a speed of 38 mph and the throttle was in the maximum position. The train crew followed emergency procedures and determined that 17 cars (23rd to 39th cars) had derailed.

The train was powered by two locomotives, measured approximately 4040 feet in length and weighed some 8170 tons. It was made up of 68 loaded tank cars divided into four blocks. The first two blocks were loaded with diesel fuel (UN 1202), and the last two were loaded with gasoline (UN 1203). The train crew consisted of a locomotive engineer and a conductor. Both were qualified for their respective positions and met fitness and rest standards.

### *Accident Site*

The Lévis Subdivision extends approximately 15 miles between Saint-Charles (Mile 0.0) and the Ultramar refinery in Saint-Romuald (Mile 14.97). The main track is a single track running in a north-south direction. From 1987 to 1995, annual railway traffic totalled approximately 800 000 tons and included both passenger and freight trains. Following the introduction of unit trains carrying hydrocarbons from the Saint-Romuald refinery in 1996, traffic has progressively increased to reach approximately 6 million tons annually. At the time of the accident, the maximum permissible speed on the track was 40 mph for freight trains.

The derailment took place in a section where the track crosses a marshy area known as the Grande plée Bleue. The track was built on a sand and gravel roadbed, which rests on peat. In April 1999, there was a 10-car derailment at the same location (TSB report No. R99Q0019) caused by a broken splice bar resulting from cross-level defects at the rail joints. Following the derailment in 1999, significant rehabilitation work was done to reinforce the roadbed: the ties, ballast and rail anchors were replaced, rail joints were eliminated, and 132-pound continuous welded rail was installed between Mile 3 and Mile 5.9. A berm and new ditch were constructed on the east side of the track.

### *Examination of Accident Site*

The derailed cars sustained damage to their underframe, trucks, body bolsters, and brake rigging. The tank shells of three cars were breached; eight other cars showed minor shell denting. The flexible loading couplings between some of the cars pulled apart. The elbow connection on one car was damaged, resulting in a leak of product.

The 39th car on the train remained upright 100 metres north of the primary derailment area, its leading truck having derailed on the east side of the main track. The following eight cars jackknifed and plowed into the peat surface. The other cars rolled over parallel to the east side of the track. A total of 250 metres of track was destroyed.

Examination of the derailed cars did not reveal any pre-existing defects that might have contributed to the derailment. An axle with a shifted wheel and three pieces of broken rail were recovered on site and sent to the TSB Engineering Laboratory for examination.

Cross-level variation was measured to the north of the last derailed car, between Mile 3.905 and Mile 3.955, and found to be between 12 mm and 20 mm; the maximum allowable cross-level variation is 44 mm.

### *Inspections Before the Accident*

An inspection of the train and a brake test were conducted before departure from Saint-Romuald. No defective rolling stock was identified.

Prior to the emergency brake application, the crew did not observe any irregularity in the operation of the train or condition of the track.

The track had been regularly inspected in accordance with regulatory inspection intervals. During an inspection by a track geometry vehicle on 07 May 2004, cross-level variation was determined to be approximately 20 mm in the vicinity of the derailment point. CN indicated that the track had been resurfaced on 30 July 2004, two weeks before the accident, to rectify the cross-level variation.

## *Technical Evaluations*

### *Analysis of Traffic Data and Weather Conditions*

On the day of the accident, the temperature was 23°C, with a slight wind blowing from the west at 15 km/h. The sky was clear. In the 30 days preceding the derailment, the region had received 96 mm of rain, which is close to seasonal averages.

An analysis of traffic distribution, conducted for the two-month period preceding the accident, did not reveal any significant change in traffic patterns in terms of train frequency or tonnage.

### *Shifted Wheel and Broken Rail*

The TSB Engineering Laboratory examination of the shifted wheel and three pieces of broken rail revealed that the wheel displacement and rail fractures resulted from excessive, instantaneous stresses during the derailment.

### *Equipment and Operational Issues*

No safety issues have been identified in the investigation in the areas of train equipment and train operations. The focus of the investigation is on track infrastructure.

### *Integrity of Track Structure*

#### *Independent Geotechnical Evaluation*

The TSB contracted with local engineers, working in conjunction with Université Laval's geotechnical laboratory, to conduct an independent technical study. The study's terms of reference included determining soil characteristics, its grade line, bearing capacity, behaviour under dynamic load, potential for sudden collapse, and environmental factors affecting soil stability.

Bore holes were drilled at several locations between Mile 4.2 and Mile 3.75. Shear and penetration tests were conducted on the soil, under the track and on each side of the embankment. Laboratory tests were conducted on several samples to determine the soil type and particle size composition, and its water content and specific mass.

### *CN's Geotechnical Evaluation*

A soil analysis in the derailment area was conducted by an engineering firm hired by CN. The study involved drilling into the soil, conducting shear tests using a vane apparatus, taking interstitial pressure, vibration and displacement measurements, as well as analysing subgrade stability. Interstitial pressure and vibrations in the peat, measured while trains were travelling at a speed of 10 mph, were relatively weak.

### *Spill and Site Clean-up*

Public security officials from the city of Lévis were notified immediately after the accident and implemented the emergency plan. Because of the presence of hydrocarbon fumes, the area within a one-kilometre radius of the derailment site was sealed off for a period of four days. The hydrocarbons that spilled into the ditches and marshy areas were contained by booms and dikes. Two clean-up companies subsequently recovered the hydrocarbons and decontaminated the water and soil.

### *Action Taken*

On 19 August 2004, Transport Canada imposed a speed restriction of 25 mph between Mile 1.0 and Mile 6.0. In the immediate vicinity of the derailment, the speed was reduced to 10 mph.

### *Investigation Plan*

Although significant geotechnical work has been carried out, further study on differential settlement is required in order to better understand whether it had any effect on track geometry. This work cannot be carried out until the spring thaw in 2006. Once the investigation team will receive the results of the study a draft report will be completed. The draft report will be submitted to the Board for its approval, following which it will be released as a confidential draft report to designated reviewers. The Board will consider the representations of the designated reviewers, and amend the report, if required. At the end of this process, the Board will issue the final investigation report to the public.

If at any time during the investigation, the TSB identifies a safety deficiency, it will issue a safety communication to the Department of Transport or CN.