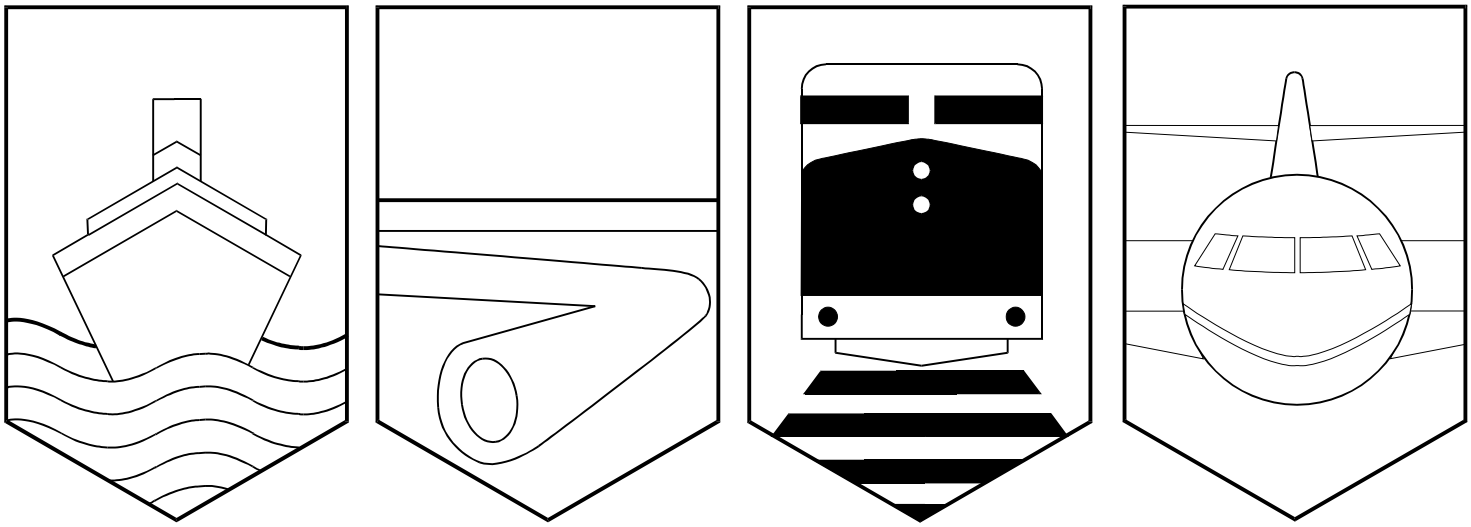
Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada



RAILWAY OCCURRENCE REPORT

CN NORTH AMERICA
DERAILMENT
TRAIN NO. 219-13
MILE 255.6, BALA SUBDIVISION
SUDBURY, ONTARIO
13 AUGUST 1993

REPORT NUMBER R93T0201

MANDATE OF THE TSB

The Canadian Transportation Accident Investigation and Safety Board Act provides the legal framework governing the TSB's activities. Basically, the TSB has a mandate to advance safety in the marine, pipeline, rail, and aviation modes of transportation by:

- conducting independent investigations and, if necessary, public inquiries into transportation occurrences in order to make findings as to their causes and contributing factors;
- reporting publicly on its investigations and public inquiries and on the related findings;
- identifying safety deficiencies as evidenced by transportation occurrences;
- making recommendations designed to eliminate or reduce any such safety deficiencies; and
- conducting special studies and special investigations on transportation safety matters.

It is not the function of the Board to assign fault or determine civil or criminal liability. However, the Board must not refrain from fully reporting on the causes and contributing factors merely because fault or liability might be inferred from the Board's findings.

INDEPENDENCE

To enable the public to have confidence in the transportation accident investigation process, it is essential that the investigating agency be, and be seen to be, independent and free from any conflicts of interest when it investigates accidents, identifies safety deficiencies, and makes safety recommendations. Independence is a key feature of the TSB. The Board reports to Parliament through the President of the Queen's Privy Council for Canada and is separate from other government agencies and departments. Its independence enables it to be fully objective in arriving at its conclusions and recommendations.

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The Transportation Safety Board of Canada (TSB) investigated 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.

Railway Occurrence Report

CN North America
Derailment
Train No. 219-13
Mile 255.6, Bala Subdivision
Sudbury, Ontario
13 August 1993

Report Number R93T0201

Synopsis

A CN North America (CN) northward train experienced a train-initiated emergency brake application at about Mile 255.6 of the Bala Subdivision. Two tank cars, the 35th and 36th cars in the train, both containing residues of a regulated product, had derailed but remained upright. One tank car, however, was found to be leaking hydrogen sulphide to which employees were exposed, but there were no reports of immediate adverse effects.

The Board determined that a lack of side bearing clearance and worn truck components on the 35th car provided a condition on a curve which initiated a wheel climb derailment. The hydrogen sulphide leak was from an incorrectly applied and deteriorated manway nozzle gasket which had been untouched for four years.

Ce rapport est également disponible en français.

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1.0 Factual Information

1.1 The Accident

CN North America (CN) freight train No. 219-13, designated Extra 5214 North, departed from CN's MacMillan Yard near Toronto, Ontario, at 1535 eastern daylight time (EDT) on 13 August 1993, bound for Winnipeg, Manitoba. At approximately 2315 EDT, with the lead locomotive in the vicinity of Mile 255.7 and while travelling at a recorded speed of 30 mph, the train experienced a train-initiated emergency brake application.

After conducting the required emergency procedures, the train crew determined that the 35th and 36th cars, both containing residues of dangerous goods, had derailed.

Railway employees were exposed to hydrogen sulphide, but there were no reports of immediate adverse effects. One derailed car was found to be leaking hydrogen sulphide.

1.2 Damage to Equipment

The two derailed cars were slightly damaged.

1.3 Other Damage

Approximately 100 feet of track was destroyed and about 5,000 feet of track and a switch were damaged.

1.4 Personnel Information

The crew consisted of a locomotive engineer and a conductor riding in the lead locomotive. They were qualified for their respective positions and met fitness and rest standards established to ensure the safe operation of trains.

1.5 Train Information

The train was powered by locomotives CN 5214 and CN 5165, and was hauling 62 cars, including 51 empties and 11 loads. It was approximately 3,950 feet in length and weighed about 3,100 tons. MacMillan Yard Equipment Department personnel had inspected the train and performed the required brake tests before departure. No irregularities were noted.

1.6 Occurrence Site Information

Wheel flange marks were evident on tie ends beginning at Mile 254.8, about 148 feet onto the Wanapitei River railway bridge and near the exit of a seven-degree track curve. After the bridge, there was heavy tie damage between the rails and damage to the easterly tie ends to a switch located at Mile 255.6. The switch was damaged, and tank cars Nos. CGTX55756 and PROX41064 were derailed and upright just past the switch.

1.7 Particulars of the Track

In the derailment area, the single main track consisted of 132-pound continuous welded

rail, laid in 1987 and secured by Fair rail anchors on Nordwood ties laid

3,110 to the mile. The track was in good condition.

Maximum permissible speed for freight trains from Mile 254.6 to Mile 256.8 was 35 mph.

1.8 Method of Train Control

Rail traffic in this area was governed by the Centralized Traffic Control System authorized by the Canadian Rail Operating Rules and supervised by a rail traffic controller located in Toronto.

1.9 Weather

The skies were clear. There were light north-northwest winds at 6 km/ h and the temperature was 19.6 degrees Celsius. The visibility was good.

1.10 Recorded Information

The event recorder transcript revealed that, while in the vicinity of Mile 254.8, the train was proceeding at a recorded speed of 38 mph, the throttle was in position No. 4, the brakes were released and the train was decelerating. As the train approached Mile 255.7, the recorded train speed was 30 mph, and the brakes were still released. The throttle had just been advanced to the No. 8 position when a train-initiated emergency brake application was recorded.

The hot box detector located at Mile 245.4 had not identified any problems with the train.

1.11 Tank Car Component Measurements

Tank car CGTX55756 was equipped with Barber S-2-A trucks and D-3 springs. Friction wedge rise at all four locations on the "A" end met or exceeded one inch. The "B" end displayed friction wedge rise exceeding one inch at three of the four locations. There was also no side bearing clearance at the AR and BL corners of the car.

A car with no side bearing clearance, except by design, does not meet the *Railway Freight Car Inspection and Safety Rules* and must be removed from service and repaired.

Tank car PROX41064 was found to have been maintained to industry standards.

1.12 Dangerous Goods

1.12.1 Hydrogen Sulphide

Tank car CGTX55756 contained about a 6,000-pound residue of hydrogen sulphide (H_2S).

H_2S is a highly toxic, colourless, flammable gas with a strong odour of rotten eggs. As H_2S can quickly destroy the sense of smell, odour cannot be relied upon to warn of its presence.

Concentrations of 20 to 150 parts per million (PPM) cause irritation to the eyes. Slightly higher concentrations may cause irritation of the upper respiratory tract and, if exposure is prolonged, pulmonary oedema may result. A concentration of 300 PPM is considered to be "immediately dangerous to life and health" by the National Institute for Occupational Safety and Health. The United Nations recommends that H_2S be classified as a toxic (poison) gas.

At the time of the occurrence, the *Transportation of Dangerous Goods Regulations* classified H_2S as 2.1 (flammable gas), 6.1 (toxic substance) and 9.2 (environmentally hazardous).

At present, Schedule II of the *Transportation of Dangerous Goods Regulations* classifies hydrogen sulphide differently than Schedule XII of the same regulations.

1.12.2 Vinyl Acetate

Tank car PROX41064 contained a residue of vinyl acetate which was classified as 3.2 (flammable liquid) and 9.2 (environmentally hazardous).

Vinyl acetate is a volatile flammable liquid which may react with numerous other substances including air and water. It is included in the extremely hazardous substances list issued by the United States Environmental Protection Agency.

1.12.3 Dangerous Goods Identification (Hydrogen Sulphide)

Tank car CGTX55756 was placarded as a "residue" of flammable gas. The placard was red with a white flame in one corner with the words "residue" appearing in red on a white rectangular diagonal. The United Nations identification number (UN 1053) was indicated on the placards. The placards were located on each side and on each end as required. The words "Inhalation Hazard" were stencilled on either side of the car in letters four inches high.

The train consist identified the car as "Dan" (meaning dangerous goods) being shipped "empty".

The bill of lading accompanying the car identified it as an empty tank car which last contained hydrogen sulphide, 2.1 - flammable gas (6.1 - toxic substance) (9.2 - environmentally hazardous), UN 1053, and C.T.C. Special Permit 676.

1.12.4 Dangerous Goods Leak

A CN Assistant Superintendent arrived at the derailment site within 30 minutes of the derailment. He detected a strong odour of rotten eggs in the vicinity of the derailed cars and, at one point, experienced coughing apparently from inhaling the releasing product. He conducted a cursory examination of car CGTX55756, but could not determine the source of the leak.

A CN re-railing crew arrived 15 minutes later and, after donning self-contained breathing apparatus (SCBA), used an explosive meter and "Draeger" chemical detection device in an unsuccessful attempt to determine the

source of the leak and the rate of release. No measurable amount of product was detected, but during the re-railing process, the employees working at the site detected the smell of rotten eggs from time to time.

Once re-railed, both tank cars were forwarded 20.8 miles to the CN repair track in Capreol, Ontario. CN employees indicated that the smell of rotten eggs was also present around tank car CGTX55756 at Capreol.

Tank car CGTX55756 was left on a repair track for the weekend of 14 and 15 August 1993.

The nature and hazards posed by H_2S were not established nor was the appropriate emergency response action taken in case of a leak. Such information can be obtained from the railway traffic controller or the Transport Canada publication *Dangerous Goods Initial Emergency Response Guide*. CN employees indicated that they felt the odour was from spilled product left on the car after off-loading.

In the morning of 16 August 1993, CN employees investigated the odour source again and determined that the H_2S was leaking at the tank car manway. A "Draeger" detection device was used to measure the concentration of the product at the manway. The reading initially was incorrectly interpreted to be 60 PPM but later determined to be 600 PPM. At this time, CN established contact with Thio-Pet Chemicals Limited (Thio-Pet) in Fort Saskatchewan, Alberta, the lessee of the tank car. Thio-Pet, in turn, contacted Liquid Carbonic, in Corunna, Ontario, the consignee of the car when loaded.

Liquid Carbonic dispatched a two-person team to attempt to stop the leak. By the evening of the same day, the Liquid Carbonic team, after evaluating the possibility of stopping the leak by tightening the nuts on the manway nozzle securement studs, had determined that the studs and nuts were rusted and that torquing them might disturb the gasket and make the leak worse. They also found that the car was pressurized to 230 pounds per square inch (psi), the pressure of vaporization of H_2S at approximately 67° F. At that time, Transport Canada would not allow the car to be returned to Liquid Carbonic to be dealt with.

On the morning of 18 August 1993, Thio-Pet decided to send a team to Capreol and depressurize the car by flaring off the pressurized H_2S gas. Transport Canada issued a permit to move the car to an isolated gravel pit, approximately four miles from Capreol, where the flare-off was to take place.

The flare-off procedure was initiated on the morning of 19 August 1993 and conducted in a professional manner. It was completed at 0830 EDT on 20 August 1993. The empty car was then shipped to Thio-Pet for purging and from there to the CGTX Inc. (CGTX) shop in Red Deer, Alberta, for repair.

1.12.5 Hydrogen Sulphide Tank Car Requirements

1.12.5.1 Association of American Railroads

The Association of American Railroads (AAR) *Manual of Standards and Recommended Practices* specifies that H_2S can only be shipped by railway on an exemption basis. A permit from the regulator is required, and the construction material, fittings, and manner of fabrication of the tank cars used have to be above normal standards.

In addition, the AAR requires that H_2S tank cars be internally inspected six months after entering service and, thereafter, be so-inspected every 12 months.

1.12.5.2 Canadian General Standards Board

The responsibility for specifications for railway tank car tanks used for the transport of regulated products, formerly contained in the *Regulations for the Transportation of Dangerous Commodities by Rail*, was transferred to the Canadian General Standards Board (CGSB). CGSB Standard 43-GP-147, published in December 1992, stipulates that H_2S must be shipped in 106A800X tank car tanks.

1.12.5.3 106A800X Tank Car Tanks

The 106A class of tank car tanks are carried on flatcars and designed to be removed from the car for filling and emptying. Such tanks (one tonners) must meet stringent material and fabrication standards and be pressure-tested to
800 psi.

1.12.5.4 Special Permit No. 676 (Revision 35)

The safety requirements for the transportation of dangerous goods by rail are governed by the provisions of the *Regulations for the Transportation of Dangerous Commodities by Rail* and the *Transportation of Dangerous Goods Regulations*.

Special Permit No. 676 was issued to the membership of the Railway Association of Canada to meet the need to transport large quantities of H_2S for use in the Canadian atomic energy program. The permit exempted Canadian railways from the AAR requirement which prohibits the bulk shipment of H_2S as well as the provisions in the *Regulations for the Transportation of Dangerous Commodities by Rail* requiring the use of only 106A800X tank car tanks.

Special Permit No. 676 (Revision 35), effective 21 January 1991 and expiring 06 November 1995, was issued pursuant to section 71.6 of the *Regulations for the Transportation of Dangerous Commodities by Rail*. Section 71.6 allows for exemptions to the requirements of the regulations provided that the level of safety associated with the granting of the exemption does not "appreciably lower the standards of safety." This permit shows H_2S as a Class 2.1 (6.1) product.

The *Transportation of Dangerous Goods Act* does not provide for an exemption similar to Section 71.6 described above, although subsection 31(1) stipulates that a permit authorizing any activity not complying with the Act can be issued, if a level of safety, at least equivalent to that provided by the Act, can be met.

1.12.5.5 Permit No. SR4574

On 12 October 1994, Transport Canada issued Permit No. SR4574, a "Permit for Equivalent Level of Safety", to Thio-Pet, authorizing the bulk shipment of H_2S. The permit indicates that such shipments can be made although the provisions of the *Transportation of Dangerous Goods Regulations* are not met.

1.13 Other Information

1.13.1 Tank Car CGTX55756

Tank car CGTX55756 was owned by CGTX of Montreal, Quebec, and was leased to Thio-Pet of Fort Saskatchewan on 05 November 1986. At the time of the derailment, it was being transported from Liquid Carbonic, Corunna, for loading at Thio-Pet at Fort Saskatchewan.

Tank car CGTX55756 was manufactured in November 1965 to specification CTC-105A600W. The tank had last been tested in 1988 and the safety relief valve had last been tested in 1992.

CGTX advised that, when tank cars in H_2S service are tank-tested, the manway nozzles are removed and the inside of the tanks are visually inspected. Neither CGTX nor Thio-Pet were aware of the AAR requirement that the tanks be internally inspected every year.

Removal of the manway nozzle proved difficult as the 20 securement studs were badly rusted with 14 of the nuts seized onto the studs. When the manway nozzle was removed, it was determined that a 3 1/ 2-inch-long section of the manway nozzle gasket had not been properly seated in the seal ring. The gasket had been pinched when the manway nozzle had been secured and showed evidence of deterioration and unevenness in the pinched section.

The thermometer well and the sample line pipes had been intentionally plugged. The small valve at the base of the safety valve, used to check the integrity of the frangible disc, had been painted over and showed no evidence of having been turned since painting. The four safety relief valve securement bolts were badly corroded and one had been torch cut to length. Foam insulation, sprayed on the tank in 1989, had reached the manway nozzle and showed no sign of having been disturbed since application.

1.13.2 History of Worn Truck Suspension Concerns

Research by Canadian railways and the AAR has identified the adverse effects that truck component wear can have on suspension damping and truck rigidity. Torsionally rigid tank cars have been shown to be particularly vulnerable to derailment from worn truck components. The TSB has issued recommendations regarding truck component wear, addressing condemning limits and cost-recovery issues (R92-06 and R92-07 issued in March 1992).

In response, the railway industry has adopted a standard outlining a 3/ 4-inch maximum friction wedge rise condemning limit for Barber S-2-A trucks with D-3

springs; however, this standard applies only to cars released after rebuilding or a heavy repair. Cars subject to the 10-year inspection requirement or tank cars inspected in compliance with the stub sill inspection program must also meet this standard at inspection. All tank cars with D-3 springs must be inspected to this standard but only by 31 December 1997. The new requirements also stipulate that, when new stabilizing springs are required, they are to be replaced with double coil side springs to reduce the negative effects of component wear on suspension damping.

1.13.3 CGTX Hydrogen Sulphide Fleet Inspections

The tanks of the other five CGTX tank cars in H_2S service have last been tested on the dates indicated:

CGTX55755 - 1989
CGTX55757 - 1993
CGTX55758 - 1991
CGTX55759 - 1985
CGTX55760 - 1984

1.13.4 Hydrogen Sulphide Off-loading

Off-loading of H_2S at Liquid Carbonic in Corunna involves the creation of pressure differentials between the respective containers. The off-loading process leaves the car pressurized with a small amount of liquid product remaining.

At Liquid Carbonic, during off-loading, H_2S cars are isolated and electronically monitored with gas sensors. Gas sensors are strategically placed to detect even small amounts of H_2S.

CGTX55756 had not been leaking before, during, or after off-loading by Liquid Carbonic.

2.0 Analysis

2.1 Introduction

The analysis will focus on the cause of the derailment and the handling of the leaking tank car. The safeguarding of railway employees and the public from the risks of exposure to H_2S will also be explored.

2.2 Consideration of the Facts

2.2.1 The Derailment

No rail defects or track geometry irregularities were evident in the derailment area. The operation of the train, with the exception of a 3-mph overspeed above the 35-mph maximum, conformed to company procedures and government safety standards. The minor overspeed, however, did not play a role in the derailment. Neither train operation nor track conditions, therefore, caused or contributed to the derailment.

As tank car CGTX55756 travelled through the seven-degree curve at Mile 254.8, the absence of side bearing clearance restricted truck rotation and increased lateral forces on the wheels. Worn truck components increased the propensity of truck parallelogramming, increasing the wheel flange to rail angle of attack and resulting in a wheel climb and derailment of the trailing truck. The train continued in a derailed state until the derailed wheels struck the switch at Mile 255.6, causing brake pipe hose separation, an emergency brake application and the derailment of the following car.

The friction wedge rise on CGTX55756 met AAR standards for a car in service but would have been condemnable had the car been subject to the new AAR standards outlined earlier in sub-subsection 1.13.2. Tank car derailments resulting from truck component wear will continue to occur until cars with friction wedge rise in excess of the prescribed limits are removed from service when detected.

2.2.2 Car Mechanical Inspection

The lack of side bearing clearance had not been detected at the last or previous inspection points. A defect of this nature takes many months to develop and the out-of-standard car would have undoubtedly been inspected many times before this occurrence. Side bearing clearance is clearly visible on a tank car of this configuration, and therefore should be evident during inspections.

2.2.3 Hydrogen Sulphide Detection

The rotten egg odour of hydrogen sulphide was smelled near tank car CGTX55756. Employees entered the derailment area without apparently realizing the risk posed by exposure to this toxic and flammable gas. Although the product name and a warning indicating "Inhalation Hazard" were stencilled on the car and listed on the bill of lading, no one contacted the RTC to obtain emergency response information, consulted the Transport Canada publication *Dangerous Goods Initial Emergency Response Guide*, or sought to obtain information about the product.

At the derailment site, CN employees used an explosive meter and a "Draeger" chemical detection device to attempt to locate the leaking product and to determine the rate of leak. Both instruments were poorly suited for the task under the conditions that existed. Both devices precisely measure the presence of a gaseous chemical but can only be used as a leak location device in very limited circumstances. The explosive meter used would only have registered the presence of H_2S once it reached a concentration level well beyond the lethal limit.

2.2.4 Hydrogen Sulphide

Exposure to H_2S can quickly destroy the sense of smell and, in a very short time, can be lethal if present in concentrations above 300 PPM. The railway employees working around the car both at the derailment site and at Capreol on the morning of 16 August 1993 were not afforded proper warning of the dangerous nature of H_2S by the single placarding scheme identifying the car as a residue of flammable gas. Tank cars containing flammable gas are very common and railway employees do not normally consider such substances dangerous to inhale except in heavy concentrations. Their immediate and foremost concern, when faced with the release of a product so-classified, is the danger of explosion and fire. Placards displaying the skull and cross-bones symbol, meeting international conventions and most appropriate for H_2S, would have undoubtedly prompted those who had initial contact with the product to avoid further exposure.

Neither the bill of lading nor the train consist contained information on the product other than indicating that it was a dangerous commodity. Reference to Special Permit No. 676 and hydrogen sulphide on the bill of lading and on the tank car side did not provide additional warning of the product's extremely hazardous nature. Employees would normally not be knowledgeable of the meaning of Special Permit No. 676 or the specific hazards of hydrogen sulphide.

2.2.5 Tank Car CGTX55756

2.2.5.1 Tank Maintenance

CGTX55756 was leaking product around a compromised manway nozzle gasket which had been pinched on installation and had deteriorated over a period of time. The forces on the car as it travelled in a derailed condition for approximately 5,000 feet and the severe jolting at the switch at Mile 255.6 may have further compromised the already weakened gasket.

AAR standards stipulate that H_2S cars be internally inspected each year. CGTX advised that this is done at the time of the annual pressure test. Although CGTX records show that the safety relief valve on CGTX55756 was tested in 1992, the extensive corrosion of the manway nozzle securement bolts and the unbroken nature of the thermal protective layer applied in 1989 indicate that the manway nozzle had not been removed for at least four years.

Annual removal of the manway nozzle for the internal inspection would have led to the discovery and replacement

of the pinched manway nozzle gasket before it deteriorated to the point where product could escape.

Records provided by CGTX indicating the dates of pressure testing of the H_2S tank car fleet show that the tank cars are only receiving tank pressure and safety relief valve testing at the intervals required of all 105 series tank cars (i.e. 10 years and 5 years respectively). The annual inspections required by the AAR are therefore not being conducted.

2.2.6 The Regulations

2.2.6.1 The Placarding

The placarding requirements outlined in the *Transportation of Dangerous Goods Regulations* are not appropriate as this product is primarily a poison gas requiring the skull and cross-bones designation, and need to be altered to reflect the poison gas classification.

2.2.6.2 The Special Permit

The special permit expires on 06 November 1995. The *Transportation of Dangerous Goods Act* only allows for such permits to be issued if the level of safety dictated by the Act can be maintained at an equivalent level. Since the Act stipulates that H_2S must be shipped in 106A series tank car tanks (one-tonne containers), bulk shipment in 105 cars should not continue as the level of safety ensured by the one-tonne containers cannot be maintained when there is bulk shipment in large tank cars. Shipment of H_2S in 105 series cars should end on 06 November 1995.

2.2.6.3 The Flare-Off

Once the hazards posed by the releasing product were recognized, subsequent emergency procedures were carried out in a safe and expeditious fashion. The flare-off procedure was conducted without incident and with minimal risk.

3.0 Conclusions

3.1 Findings

1. Neither train operation nor track conditions played a role in this derailment.

2. The lead wheels of the trailing truck of tank car CGTX55756 derailed, then struck a switch, subsequently resulting in the derailment of the following car and brake pipe separation.

3. The combination of worn truck components on tank car CGTX55756, reducing the ability of its trucks to resist parallelogramming, and the absence of side bearing clearance on the AR and BL corners of the car, restricting the rotation of its trucks when travelling over a seven-degree curve, led to an increased angle of attack between the wheel flanges and the high rail of the curve sufficient to result in a wheel climb.

4. The side bearing clearance on tank car CGTX55756 did not meet *Railway Freight Car Inspection and Safety Rules*.

5. Car inspections prior to the occurrence did not detect the long-standing lack of side bearing clearance on CGTX55756.

6. Truck component wear had not reached AAR condemnable limits (applicable at the time of the occurrence) for cars in service.

7. CGTX55756 leaked hydrogen sulphide at an incorrectly applied and deteriorated manway nozzle gasket which had not been removed or replaced for at least four years.

8. The placard on CGTX55756 did not provide employees with the warning required considering the toxic nature of hydrogen sulphide.

9. Hydrogen sulphide is being shipped in bulk in tank cars that are not equivalent in design and strength to the one-tonne cylinders specified by the *Transportation of Dangerous Goods Regulations*.

10. CN employees entered the occurrence site area believing that the site was free from leaking hydrogen sulphide vapours.

11. CN employees coming in contact with the hydrogen sulphide did not apparently realize the associated hazards or attempt to obtain information on the product to protect themselves. Appropriate emergency response measures were not taken.

12. The gas measuring devices used at the derailment site were poorly suited to determine the location of a leak or the rate of leakage.

13. The internal inspection of tank car CGTX55756 was not performed at the AAR-required intervals.

14. Neither the car owner nor the lessee were aware that an annual internal tank inspection was required.

15. Hydrogen sulphide flare-off procedures were conducted in a professional manner with minimal risk.

3.2 Cause

A lack of side bearing clearance and worn truck components on the 35th car provided a condition on a curve which initiated a wheel climb derailment. The hydrogen sulphide leak was from an incorrectly applied and deteriorated manway nozzle gasket which had been untouched for four years.

4.0 Safety Action

4.1 Action Taken

4.1.1 Emergency Response Procedures

In September 1993, the TSB forwarded a Rail Safety Information Letter to Labour Canada and Transport Canada concerning possible anomalies in the emergency response procedures relative to a hydrogen sulphide release and the post-accident handling of tank car CGTX55756. Transport Canada responded that proper action was taken by CN emergency response personnel in the performance of their duties.

4.1.2 Maintenance of Tank Cars

Subsequent to this occurrence, Transport Canada Surface Group Safety Officers inspected CGTX55756 and instructed Thio-Pet Chemicals Limited employees regarding proper maintenance practices and responsibilities for the securement of loads, such as the importance of checking the integrity of the rupture discs.

4.1.3 Placarding of Dangerous Goods

At the time of this occurrence, the applicable documentation and emergency response information accurately reflected the multiple hazards associated with hydrogen sulphide. However, the placards on the tank car alone did not depict the highly toxic properties of the product. Transport Canada Amendment Schedule 18 to the *Transportation of Dangerous Goods Regulations* has now changed the primary classification of hydrogen sulphide to 2.3 (poison gas) and made the use of Class 2.3 placards mandatory.

4.1.4 Safety Inspections

In December 1994, a TSB Rail Safety Advisory was sent to Transport Canada concerning the inspection of tank cars. The advisory referenced five examples, including CGTX55756, where cars with safety defects had passed CN inspections. The advisory highlighted the need for a review of the adequacy of CN's inspection procedures and practices for tank cars.

In response, Transport Canada advised that the Railway Safety Directorate conducted a survey and random interviews of CN (and CP) certified car inspectors to evaluate their knowledge of the safety rules. As a result, CN has effected a refresher program for their inspectors on the AAR interchange requirements and railway freight car inspection rules.

4.2 Action Required

4.2.1 Movement of Hydrogen Sulphide

The *Transportation of Dangerous Goods Regulations* specify that shipping of hydrogen sulphide in Canada must be in TC 106A800X multi-unit tank car tanks (one-tonne cylinders). However, Section 31(1) of the *Transportation of Dangerous Goods Act* states in part that a permit can be issued, authorizing an activity that does not comply with the *Transportation of Dangerous Goods Act* if the Minister, or designated person, is satisfied that the authorized activity will be conducted at a level of

safety at least equivalent to that provided by the Act.

As seen in this occurrence, bulk shipments of hydrogen sulphide were being conducted in 105J600W tank cars (a fleet currently consisting of 14 cars) under authority of Transport Canada permit SP 676 (now replaced by SR4574). The shipments typically originate in Western Canada and are delivered to various locations across Canada.

Appendix A contains information and specifications, such as vessel construction and relief device pressures, of both 105J600W tank cars and 106A800X cylinders. This information illustrates that 105J600W cars are not equivalent to 106A800X cylinders in several aspects which could have an impact on the level of safety in regards to the containment and movement of hydrogen sulphide.

A large quantity leak or release of a high pressure, toxic and flammable commodity such as hydrogen sulphide could be serious. To minimize the potential for such emissions, appropriate safeguards need to be in place. Since 105J600W tank cars do not seem to provide an equivalent level of safety to that afforded by the required 106A800X multi-unit tank car tanks, the Board recommends that:

> The Department of Transport reassess permit No. SR4574 for 105J600W tank cars to confirm the safe containment and movement of hydrogen sulphide.
>
> R95-01

4.3 Safety Concern

4.3.1 Compliance with Regulations

The investigation of this occurrence uncovered several indications that the inspection and loading procedures used by the shipper did not fully comply with the *Transportation of Dangerous Goods Regulations* or AAR Regulations. In addition, neither the car owner nor the shipper were aware of all the AAR annual maintenance requirements, and the carrier had not detected inadequate side bearing clearance on the car during regular car inspections. Systemic deficiencies for any one area could not be substantiated from this occurrence alone; however, considering the extensive scope and potential seriousness of some of the discrepancies, the Board is concerned that aspects of the existing inspection and regulatory overview procedures may be inadequate. Hence, through an ongoing analysis of similar occurrences, the Board will assess the issue of shipper, carrier, and regulatory inspections with a view to identifying underlying unsafe conditions and recommending corrective action.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson, John W. Stants, and members Zita Brunet and Hugh MacNeil, authorized the release of this report on 17 May 1995.

Appendix A - 105 Tank Car and 106 Cylinder Specifications

The following table provides some information on 105 tank car and 106 cylinder specifications.

Comparison Between 105 Tanks and 106 Cylinders

Specification	105J600W	106A800X
Test pressure	600 psi	800 psi
Max. psi at which safety relief device must open	450 psi +/ - 3% (437-463 psi)	600 psi +/ - 3% (582-618 psi)
Min. psi at which relief device must be vapour tight	360 psi	480 psi
Size of tank, max. water capacity (lb.)	Tank car 287,903 lb.	Cylinder 2,600 lb.

Some noteworthy differences between the two types of vessels follow.

- The 106 cylinder is tested to a pressure 33 per cent higher than that of a 105 tank.

- The AAR's "Emergency Action Guides" state that the pressure of hydrogen sulphide in transit could reach 350 to 400 psi. The safety valve on a 105J600W car can open as low as 437 psi, which is only slightly higher than pressures that may develop in normal transit, and which could be surpassed if the car was involved in an accident or fire. Should the safety valve open for any reason to reduce internal pressures, it may not return "vapour tight" as its internal pressure may remain higher than 360 psi.

- A 105J600W tank car has more than 100 times the volume of a 106A800X cylinder; hence, a larger volume of product could be released in the event of an accident or an overpressure release.

- A tank car tank has more parts requiring maintenance and inspection (e.g., a tank car has a manway complete with gasket material and securement bolts; its pressure relief device has a frangible disc used in combination with a safety valve; the tank is permanently attached to a rail car, thereby subjected to all the forces associated with train movements, switching, etc.).

- Valves on a 106A800X cylinder are recessed on the concave head of the cylinder, protected by a metal cover. Their location and design provide protection to the valves in a roll-over type accident. On a 105J600W tank car, the valves are on the top of the tank located within a manway enclosure. As the location of the manway enclosure protrudes beyond the tank's profile, the valves are more vulnerable to damage.

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