CANADA

REPORT OF THE MISSISSAUGA RAILWAY ACCIDENT INQUIRY

THE HONOURABLE MR. JUSTICE SAMUEL G.M. GRANGE
SUPREME COURT OF ONTARIO
COMMISSIONER

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The Honourable Mr. Justice Samuel G.M. Grange,
Supreme Court of Ontario,
Commissioner

December 1980

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THE SUPREME COURT OF ONTARIO

THE HONOURABLE MR. JUSTICE GRANGE

OSGOODE HALL
TORONTO, ONTARIO M5H 2N5

The Honourable Jean-Luc Pepin,
Minister,
Transport Canada,
Ottawa, Ontario.

Dear Mr. Minister:

I now submit the Report of the Mississauga Railway Accident Inquiry.

Yours very truly,

S.G.M. Grange
Commissioner.

/ma
Encl.

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INTRODUCTION

On the 4th of December, 1979, the Privy Council by Order-in-Council set in motion this Inquiry. The Order-in-Council is attached as Appendix 1.

The Report is now done. While it is the first Report, I consider it also to be the final Report. At the same time I appreciate that I have not fulfilled my mandate if the terms of reference are given their broadest interpretation. I have certainly dealt as fully as I am capable with terms 1 and 2 being the causes of the Mississauga derailment and the steps to be taken to reduce the risk of recurrence. I have also tried to answer the problems raised in terms 3, 4 and 5 relating to the law and practice in the handling and carriage of dangerous goods but there is this limitation that my consideration and the Report are substantially restricted to the lessons of Mississauga.

I hope I was justified in so restricting it. The railway industry and its accidents are by statute under the continuous supervision of the Canadian Transport Commission and indeed that Commission has through its officers and agents continued its investigation of other accidents while this Inquiry was pending. Mississauga was a very special accident requiring very special treatment. That treatment I hope this Inquiry has given it.

There is, however, another and perhaps more important reason why the Inquiry was limited substantially to the events of Mississauga. In dealing with that event and its ramifications the Inquiry occupied in evidence and argument a total of 127 days. There were 687 exhibits, many of which were multiple, and 23,594 pages of transcript. To me it is of vital concern that if this Report is to have any value in preventing or helping to prevent a recurrence of the accident, it be completed quickly. The original terms of the Order-in-Council required the submission of the Report within six months which was June 4th, 1980, a date which passed while we were still receiving evidence and before any of the public submissions had been received. The date was later extended to December 4th, 1980 and that deadline will be met although because of the exigencies of translation and printing (if the Report is deemed worthy of either) it may not be in the hands of the public by that time.

I must also concede there is consideration of Item 6 - investigative and corrective action in response to an accident - only as it affects the federal power. The term does not require or permit me to consider the evacuation procedures carried out by the provincial and municipal authorities which were so important an element in the Mississauga experience and as I have stated in the body of the Report, I did not consider the validity of the decisions of the Command Team to be relevant except in so far as those decisions reflected the danger facing the populace.

Finally there is virtually no consideration of that part of Item 7 dealing with roadbeds and track and their maintenance. The state of the track was not a problem at Mississauga; it had recently been repaired and renewed and was in excellent shape; our problem was one of equipment or rolling stock, its operation and its inspection.

With these acknowledged deficiencies, my Report on the Mississauga Railway Accident of November 10th, 1979 now follows.

I. THE DERAILMENT

1. THE EVENT

A few minutes before midnight on Saturday, November 10, 1979, Train 54 of CP Rail from London, destined for the Toronto yards at Agincourt, suffered a derailment at Mavis Road in the City of Mississauga. The first derailed car was the thirty-third in the one-hundred-and-six car train and was a tank car loaded with Toluene. It took with it twenty-three other cars into the derailment, twenty-one of which were tank cars and nineteen of which, including the Toluene car, the first in the derailment, were carrying what is classed in the Canadian Transport Commission's Red Book (we will hear much more of both—the Canadian Transport Commission will be referred to hereafter as the CTC) as Dangerous Commodities. Fire spread through most if not all of the derailed cars, and the eight, twelfth and thirteenth cars which were loaded with propane exploded and caused considerable damage to neighbouring property. The seventh car in the derailment which was loaded with Chlorine, a deadly gas, suffered a hole in its shell 2 1/2 feet in diameter and, because of fear of the consequences of the escape of Chlorine, almost a quarter of a million people, mainly from the City of Mississauga, were evacuated from their homes and businesses for periods of up to five days. It is that derailment, its causes, its consequences and the means of avoiding its repetition that is the subject of this Inquiry.

2. THE CAUSE

There is really no problem about the cause of the derailment. The Toluene car suffered a "hot box" in its right-rear journal box. Almost all railway cars have eight wheels upon four axles which are numbered one to four from the "B" end of the car. The cars can go in either direction, but for reference purposes one end is labelled "A" and the other "B"; the "B" end is the end where the hand brake is to be found. The axles and wheels are lettered "L" for left and "R" for right looking from B to A. The hot box therefore was in the R1 position. The axles at their extremities are called journals. These journals bear the weight of the car and are housed in journal boxes. The two forward and two rear axles are connected by side frames of which the journal boxes are a part and the whole assembly in front is called the leading truck and the whole assembly behind is called the trailing truck. Inside the journal boxes are bearings resting upon the constantly revolving journals. Some of these bearings—the modern ones—are roller bearings, but the majority and the ones in the Toluene

car (Car 1) were of the friction or plain bearing type. In the plain bearing arrangement a wedge rests upon a brass (the actual bearing) which rests upon the journal with a lubricator pad (soaked in oil) beneath the journal supplying the lubrication which is so sorely needed between the brass and the journal. If for any reason the lubricator pad ceases to perform its task, the bearing and journal will be in direct contact and the journal will start to overheat. Eventually and inevitably if unattended, the journal will burn off and the tank car will collapse. With Car 1 the rear axle, together of course with its two wheels, separated from its truck and the car over a mile short of the derailment site. The car proceeded on its six wheels to and past Erindale Station Road where apparently the front wheels of the trailing truck, i.e. R2 and L2 derailed. The wheels however did not then detach and the car proceeded on its 6 wheels, 4 on the rails and 2 off, almost to Mavis Road where the remaining wheels hit a switch and the whole car derailed. The other 23 cars then followed it off the track.

3. THE CONSEQUENCES

The eventual resting place of the 24 cars is shown on the attached Appendix 2 reduced from Exhibit 14 at the Inquiry. I will deal later with the properties of the commodities involved and the remedial action taken. It is sufficient now to repeat again that 3 of the cars exploded within one-half hour of the derailment and as a result of these explosions 3 great fire balls were sent into the sky and the larger parts of the bodies of Cars 8, 12 and 13 were sent flying 145 feet east, 440 feet southeast, and 2222 feet (sometimes stated to be 2214 feet) northeast respectively with other parts sent in varying distances in all directions. These explosions are known (not always accurately) as BLEVE's—an acronym for Boiling Liquid Expanding Vapour Explosion—to indicate that the pressure within the tank induced by the boiling liquid has expanded as it vapourized to the point where the tank could no longer resist the pressure. The main property damage was inflicted by the explosion of Car 12 in a south-easterly direction but not as much damage was done as might have been expected and miraculously no casualties were suffered. The reason is simple and most fortunate; notwithstanding that the train had entered one of the most concentrated population centres in the country, at the precise point of the derailment, there was to the immediate south only industrial property, and to the north and northeast, except on the strip of Mavis Road itself, there existed one of the few large areas of undeveloped land remaining in the greater Toronto region.

The main problem, however, was not with the propane explosions however spectacular and potentially dangerous they may have been. What most concerned the authorities was that it was apparent almost from the beginning that some Chlorine was escaping into the air and it became known at least by the early morning of Monday, November 12, that Car 7 in the derailment, the Chlorine car, had a hole between 2 and 3 feet in diameter. No one could make an exact measurement of the amount of Chlorine remaining in the car and no one could give a guarantee that what remained would not be released in either the process of sealing the hole or in the process of removing the Chlorine from the sealed tank. As a result, as I have said, a large portion of Mississauga together with a small part of Oakville to the west and isolated pockets of Etobicoke, a Borough of Metropolitan Toronto to the east, was evacuated on Sunday, November 11, and the area of Mississauga from Burnhamthorpe Road south to Lake Ontario, and from Highway 10 on the east to Erin Mills Parkway and Southdown Road on the west—an area of about 45 square kilometers (17.4 square miles) involving close to 75 thousand people remained evacuated until Friday, November 16. Even then, however, the Chlorine car was not completely empty. The draining of Chlorine and the clean-up of the site continued for some days, once again fortunately without casualty. Nevertheless the property damage and to a much larger extent the evacuation of the population was a major disruptive force in the history of Mississauga and surrounding areas and demands a full investigation. The results of that investigation follow.

II. THE WITNESSES

For purposes of fixing the location along the railway line, we will use the mileages of the Galt Subdivision of the London Division of CP Rail. Metrication has not yet come to the railways; distances are measured in percentages of a mile and speed in miles per hour. The Galt Subdivision is measured from Union Station at Toronto (mileage 0.0) to London (mileage 114.6). The mileage at Mavis Road, where the derailment occurred, is 16.56. Other relevant mileages are as follows:

Guelph Junction	39.02
County Road 9 Campbellville	38.58
Trafalgar Road	27.57
Winston Churchill Blvd.	24.65
Derry Road	23.43
Ontario Street, Streetsville	21.20
Eglinton Avenue	19.25
Burnhamthorpe Road	17.98
Erindale Station Road	17.35
Wolfedale Road	16.82

All of these locations can be found in the attached Appendix 3 which is a portion of Exhibit 5 on the Inquiry.

At or near all of these points except Winston Churchill Blvd. there were witnesses to the passage of the train. Some of those witnesses saw smoke or flames or sparks emanating from the train; some did not. Winston Churchill Blvd. is included only because it marks in this area the start of what we will see is the curve most advantageous for the viewing either from front or rear of the train of a hot box or any other exceptional feature to the right or south side of a train proceeding eastward. The witnesses at Guelph Junction were CP Rail employees and their evidence will be detailed when we consider the progress of the train itself.

1. CAMPBELLVILLE

The first non-rail witnesses were Mr. and Mrs. Alfred James Houston of Mississauga, who on November 10 were visiting friends west of Campbellville. At about 11:15 p.m. they were stopped on the south side of County Road 9, mileage 38.58. They noticed smoke coming from the train. Mr. Houston said to his wife that it looked like smoke from a journal box. His wife suggested it might be smoke from braking, but Mr. Houston thought not. It was the only smoke they saw emanating from the train; to Mr. Houston it did not appear to be coming from the part of the wheels where brake smoke would be expected but rather from the journal box; Mrs. Houston could say only that the smoke was coming from the right rear of a car and could not be more precise. While they lived in Mississauga they had previously lived for many years in the Campbellville area; Mrs. Houston had before seen sparks from a train at that point but never smoke. Mr. Houston had before seen neither smoke nor flame nor sparks from a train at that point.

Mr. Houston said the smoking car passed him at about 20 miles per hour but the train had speeded up to about 40 miles per hour by the time the caboose passed.

They proceeded eastward along Highway 401 arriving in Mississauga just as the train blew up. There can be no doubt that the train they saw was the one involved in the derailment.

2. TRAFALGAR ROAD

Mr. Frank Anthony is a farmer who lives in Limehouse, Ontario and undertakes the farming of others' lands on a contract or rental basis. In the late evening of November 10, he was farming rented acreage immediately to the northwest of the Trafalgar Road crossing of the CP line (mileage 27.57). As the train went by he had harvested corn in an adjacent field and was seated on a combine proceeding east at a point about 500 feet north of the track and about 1200 feet west of Trafalgar Road. The seat of the combine is about 10 feet from the ground and the CP tracks are 5 to 7 feet above ground level.

When he first noticed the train the locomotive was slightly ahead of him. As a child he had regularly visited an uncle who was a CNR station agent, one of whose jobs was the inspection of trains, and he had helped his uncle in that task from time to time. In any event he was tired and bored on the night in question and looked at the train throughout its length. He saw nothing out of the ordinary; no sparks, no flames and no reflection of either. It is to be remembered he was looking from the north side and the hot box that eventually caused the derailment was on the south.

He estimated the speed of the train as about average, in his view between 45 and 50 miles per hour.

3. DERRY ROAD

The next witnesses were Mr. and Mrs. David McGregor, who were eastbound on Derry Road when they stopped for the crossing. (At this point the rail line has turned south and most of the roads it crosses go east and west until south of Burnhamthorpe where the track again turns east, but in railway language the line is deemed always to be running east and west between London and Toronto. That would place the McGregors on the "south" side of the train). They saw a light on the train about 200 feet from the crossing and as the car passed they could see that the light was indeed fire and coming from the wheels. Mr. McGregor said the flame was a maximum of 4 feet in diameter and extended out from the undercarriage about a foot and trailed as well. He was afraid it might cause a brush fire as it went down the track and he could see it clearly as the train proceeded on its way. Mrs. McGregor also said the fire extended out about a foot, but estimated its diameter at 2 feet.

Mr. McGregor thought the train was going about 50 miles per hour. Mrs. McGregor estimated it at 50 to 60 miles per hour and said it was "going very rapidly past".

4. STREETSVILLE

Between Derry Road and Eglinton Avenue there were two witnesses who saw the train from outside their houses which were on the west (or south in railway terms) side of the tracks.

The first was Miss Nancy Bota, who resides at 100 Rutledge Road, which is just south of Ontario Street at mileage 21.20. On November 10 she was outside her house feeding her dogs when she saw the train go by from about 35 to 40 feet away. She saw neither the front nor the end of the train and she was not particularly watchful of it. She saw no smoke or flame; the only thing she did see was some sparks coming from one wheel at the rail and that was not an unusual sight to her. She said the train was going faster than usual and "pretty quickly". When pressed she estimated the speed at between 45 and 50 miles per hour.

The second witness in this area was Miss Cynthia Carter, who resides at 1651 Barbertown Road, which is about 700 feet (215.7 meters) north of Eglinton and about 140 feet (41.5 meters) west (in railway language south) of the tracks. At the relevant time she was standing on a walkway 12 feet east and 5 feet south of her house. She saw the train go by and out of habit counted the cars reaching a total of 116. She said she counted them by observing the light between the cars, that she could see each car from top to bottom and that she observed neither flame nor sparks nor smoke emanating from any car. The great difficulty with her evidence is that she stated that she looked straight and not at an angle at the tracks, but Det. Sgt. Bertram, a police officer retained by the Commission, testified that from the position in which she stated she was standing and looking in the direction in which she stated she was looking, one could see only the top half of the cars; if that be so she could see no part of the running gear at all.

5. EGLINTON AVENUE

Mr. Henry Siu was driving home from work east on Eglinton Avenue and saw the barriers come down as he approached the crossing. While stopped he caught a flickering to his left and turned his head to see fire coming from one of the wheels of an approaching train. It extended over about one-half the wheel and trailed 2 or 3 feet. The flame was reflected on the bushes as the train went by. He estimated the speed of the train at about 55 miles per hour.

6. BURNHAMTHORPE ROAD

Mr. and Mrs. Timothy Truckle were in the second car facing the crossing coming from the east; in railway terms they were on the north side of the tracks. They both saw sparks and flames coming from the bottom area of a car. Mrs. Truckle said it seemed to be coming from a wheel but Mr. Truckle identified the source as the rear axle. He also said the flame, including the sparks, was about 5 feet in diameter. He had no sensation of excessive speed.

Mrs. Catherine Hutchinson was in the car behind. She said she saw the light first more than half way up to McConnell Road (mileage 18.65). It appeared like a bush fire and then as friction or sparks, not flames, about 3 feet around and shooting out from the train. She followed it as it crossed Burnhamthorpe and saw the train buckle and something fly out of it. She described the object as 1 1/2 feet big and it landed, she thought, just beside the train.

I pause now to relate the adventures of Mr. and Mrs. John Riddel who lived at 1437 Freeport Drive, which backs on to the railway track just south of (or as the railways would have it, just east of) Burnhamthorpe Road. Mr. Riddel was asleep at 11:45 and Mrs. Riddel was in bed but awake and heard the train go by. She heard first a crack and then an explosion. She went to the window and saw the fire at Mavis Road. She also saw in her garden a red glow and by the light of the explosion could see that it was a set of red-hot wheels. She immediately woke her husband who went outside to find a neighbour already hosing down the wheels. He (the husband) went to the track and to the Burnhamthorpe crossing and 25 yards beyond. He found marks on the south side of both rails for eastbound traffic. He also saw the gouge in the ballast where the wheels had left the rails. He found a cotton pad and two pieces of foam rubber or plastic saturated in oil on the north rail of the south track about 20 or 30 feet east of the crossing. He also found a chunk of metal about 3 inches by 4 inches and one-quarter inch thick on the south side of the south rail. Mrs. Riddel said that the train when she heard it was definitely not going too fast. She could tell its speed by the noise.

Mr. Alberto Galvan, who lives just two doors from the Riddels at 3681 Codrington Court, was in his living room when he heard the engine go by. He went to the bedroom of one of his young sons briefly and then to that of the other son from whose window one can see the train passing by. In that room he pulled the curtains and watched perhaps 30 cars. He saw no flame or sparks or unusual light. He also did not see the wheels in the Riddels' backyard although the yard was visible from the boy's window; nor did he hear any unusual noises from the train or from the Riddels' yard. He estimated the speed of the train at between 40 and 45 miles per hour.

7. ERINDALE STATION ROAD

Dr. John Carey was proceeding west on Burnhamthorpe intending to go south on Erindale Station Road. Just as he was making his turn he saw a light in the train as it was making the crossing at Burnhamthorpe. When he proceeded down Erindale Station Road and the train crossed his path, he saw a white light on the back of a tank car which lit up about two-thirds of the car together with white sparks in a fan shape, 2 or 3 feet off the ground. He also saw what he took to be the brakeline uncoupled at the rear of the car.

Mr. Winston Chandler was walking his dog on the other side of the Erindale Station Road crossing.

He saw a shower of sparks about 4 or 5 feet high spraying out coming from under one of the tank cars near its junction with another car. He said the train was moving as fast as any train he had seen at that crossing.

We also heard evidence from Mr. Gavin Correa, who resides at 3592 Ellengale Road, close to Erindale Station Road. His living room faces the track about 25 to 30 yards away. A passing train can be seen through a large patio door and he was facing the patio. Between the door and the track is a slatted wooden fence, the solid part of which obscured the lower portion of a passing train. On the night in question he watched about one-third of the train, glancing, as he said, out of the patio door every now and then (he was accompanied in the room and engaged in conversation with three other persons) and he saw nothing unusual, no smoke, no flames, no sparks.

8. WOLFEDALE ROAD

At the Wolfedale crossing, Mr. Paul John Richard Harwood and his passengers, who included his wife, Mr. Clarence Hyde and Miss Cheryl Ross, were travelling south and stopped behind other cars for the crossing. Mr. Harwood saw a tanker going by sparking with the sparks rising to about half-way up the car. He noted that the tanker seemed to be listing over about 15 degrees. Miss Ross at first thought the sparks rose about one-third of the way up the car; then she said, they rose over the top. Mr. Hyde saw two sets of sparks, the first spraying out from one car and sending a shower to the top of the car, and then after a gap, some more bright white sparks. He said he had not seen trains go as quickly before. Miss Ross said the train was going quickly but not faster than she had seen other trains go.

On the other side of the Wolfedale crossing Mr. James Allan Duke was driving the only car stopped for the train. He too saw two sets of sparks, the first being very unimpressive but the later sparks about 3 or 4 cars away from the first were much heavier fanning out in all directions and illuminating the lower section of the tanker. The train seemed to be going faster than other trains.

Police Constable Elliot (Chuck) McConnell lives on Eagle Mount Crescent and his property backs on to the track near Wolfedale. He didn't see the train before the derailment but he heard it. The engines sounded all right but as the train went by it was screeching and banging. He had no particular impression that it was going fast. After the derailment he went out to the track where he found a reddish-white piece of hot metal which turned out to be a journal stub. Indeed it is believed to be the stub of the Car 1 R1 journal and much more will be said of it later on.

9. MAVIS ROAD

At Mavis Road itself, driving south and stopped at the crossing, were Mr. and Mrs. Ronald Walter Dabor. They are our only witnesses to the derailment. As the train passed their first concern was its speed. Mr. Dabor estimated that speed at 70 miles per hour and noted that the cars seemed to be leaning towards him. Mrs. Dabor, an inveterate counter of cars, found she could not follow her avocation because the train was going too fast. She also found the train to be swaying. As she looked to the right she saw what she first thought to be flares, but then realized were sparks. She then saw that there was a wheel off the track creating bright yellow and red sparks.

One car and then another seemed to lurch at them and Mr. Dabor started to back his car up as fast as he could. As he did so, his wife saw the train cars start to uncouple in the air. Although there was no one behind them Mr. Dabor, not unnaturally, lost control of his car and it became immobilized in a ditch. By this time the fire and the explosions had started. They evacuated their car and escaped to the north being at one time thrown to the pavement by an explosion.

All of the others at the scene who gave evidence were witnesses only to the explosions and to the conflagration subsequent to the derailment. The recitation of the evidence of the witnesses listed above will be very relevant when we come as we do now to the consideration of the train itself, its inspection, its manner of operation and whether the hot box should have been seen before the derailment.

III. THE TRAIN TO GUELPH JUNCTION

1. THE RULES

Before we consider the operation and inspection of the train, we must know the rules.

The fundamental rules are found in the Uniform Code of Operating Rules promulgated by the Board of Transport Commissioners (now the Canadian Transport Commission) and the Code is supplemented by rules published by the railways themselves.

The relevant inspection sections of the Uniform Code are as follows:

> 90A. Unless otherwise directed by special instructions, on freight, mixed and work trains in motion between stations, conductors and enginemen will see that trainmen are at the front and rear of trains in position to observe the safe operation of trains and, when practicable, exchange signals when approaching and passing stations. Approaching junctions, railway crossings at grade, drawbridges, points where trains may be required to stop, where trains are to be met or passed, and at a safe distance before descending heavy grades or at any point where failure of the brakes may be attended with hazard, a trainman must be within convenient access of the emergency valve.

> 111. When other duties will permit, employees in the vicinity of passing trains must observe the condition of equipment in such trains; trainman at rear of moving trains will be in position, on rear platform where provided, and trainmen of standing trains in best possible position on the ground from which a view of

both sides of passing trains can be obtained. If a dangerous condition is apparent every effort must be made to stop the train.

Train and engine crews of moving trains must, when practicable, be on the lookout for signals given by employees calling attention to conditions on their train.

Trainmen at rear of moving trains must frequently look back at the track to see if there is evidence of dragging equipment.

Conductors and trainmen must know that cars in their trains are in good order before starting and inspect them whenever they have an opportunity to do so. All cars taken in their trains en route must be examined with extra care.

When practicable, employees of a moving train must make frequent inspection of their train to ensure it is in order, and when a freight train stops a trainman will be in position to inspect the train as it pulls by.

When starting freight trains speed must be regulated to permit trainmen to entrain.

The extension of these rules by CP Rail is found in s. 2, Rules 4.1 and 9.1 of the General Operating Instructions as follows:

4.1 When practicable, crews equipped with radio at the front and rear of trains will communicate with each other at the following times and places:

a) Before passing stations, stating the name of the station in the communication.

b) Between one and three miles from - yard limits and station limits on trains affected by Rules 93 and 93A.
   - points where protection of impassable or slow track has been provided by train order.
   - points at which the train is required to wait, meet, pass another train, clear a superior train, move through a siding or when required to stop clear of or move through a crossover.

c) Transmission of results of all running inspections of the train and track to the rear.

9.1 In addition to the strict compliance with Rules 90A and 111, a member of the crew must inspect their train when in motion from both sides of the diesel unit and at the rear of the train from both sides of the caboose, for any evidence of a hot box or defective equipment or shifted load.

(Sub-clause c) of Rule 4.1 of CP Rail's General Operating Instructions does not fit grammatically but I presume it is intended that after the inspections have been made as required in sub-clauses a) and b) there will be transmission of the results by radio between the head and the tail end of the train.)

There is no binding statutory rule for mechanical inspection of a train (except a limited one promulgated by the CTC relating to inspections at places of origin of a dangerous commodity car which I will refer to later) but by the rules of the Association of American Railroads of which CP Rail (as well as Canadian National) is a member, the railways are responsible for the cars of others after they have accepted them. It is the practice of CP Rail to have a mechanical inspection of every train as soon as it is marshalled and to inspect mechanically all cars received at interchanges and all added cars along the route where practical. The practicality is governed by the fact that mechanical inspections are performed by carmen and cannot and are not normally performed by the crew. For our purposes, a mechanical inspection involves, where friction bearings are in place, the lifting of the lid of the journal box and the checking of the level of oil as well as inspecting for any defects in the parts that might be apparent from such a view.

The running inspections as required under the rules, supra, are to some extent left to the crew's discretion. The general practice seems to be that at every station the engineman is expected to call the mileboard—which is located one mile short of the station or of the switch leading to the station siding—and then the conductor and the rear end trainman (if there is one) make an inspection of the train forward on both sides, and backwards for signs of anything dragging. The conductor then radios from the caboose radio his findings. This is often in the form "highball" which indicates that all is well and is acknowledged by the head end.

The other regular occasions for inspection are on curves where one side of the train can be seen from either the head or tail end. As part of their training, crews are taught which curves are valuable for this purpose. The conductor again reports to the head end his findings on the curve, again often in the form of "highball" and the engineman acknowledges. Both the head and tail end are expected to look up or down the appropriate side. For a right-hand curve and view that responsibility might fall to the engineman who sits on the right, but if he is otherwise occupied, the head end trainman will cross over and look out and back along the right-hand side.

The crew of a train in Canada consisted until recently of four men, an engineman and a head end trainman or brakeman in the engine and a conductor (in charge of the train) and a tail end trainman or brakeman in the caboose or van as the caboose is sometimes called. Effective July of 1979 and pursuant to an arbitration award of the Honourable Emmett Hall, crews could be reduced to three, eliminating the tail end brakeman. This alternative, however, is confined to trains of 120 cars or less and there are built-in grandfather clauses so the change will come about only slowly and through attrition.

2. THE DOCUMENTS

The running of a modern railway requires a great deal of documentation but for our purposes the important documents are first the "consist" which lists the cars in order from the caboose, their destination and their contents. If those contents are classified by the CTC as "dangerous commodities" the consist so specifies. These consists are now computerized and there is or should be a new one prepared or the old one amended each time cars are set off or lifted. Secondly, there is required for each dangerous commodity car by CTC order an Emergency Response Form which is prepared by the shipper specifying the nature of the commodity and the danger and the appropriate response in case of accident or fire. It also contains an emergency telephone number to call. The document is a Canadian invention and unlike most other rules has no United States counterpart or application. In any event, the consist is provided to and kept by both conductor and engineman and the Emergency Response Forms, where required, are provided for and kept by the conductor.

Two other documents with which we may be concerned are the train orders and the placards. The former are last-minute orders transmitted to the conductor and engineman en route. They are taken by the operator at the station and handed to the conductor and engineman if it is a scheduled stop, or hooped onto the train to them if no stop is scheduled. They include such matters as changes in meeting times with other trains, special slow orders, etc.

The placards (of which there will be more anon) are cards required again by CTC order to be placed on all dangerous commodity cars. The forms are set forth in the Red Book regulations. The reverse side of these cards still indicates danger but states that the tank car is empty; when that condition exists the card is turned over and reinserted.

Perhaps the most important document by which a freight train is run, however, is the timetable. It contains the times at which the particular train is scheduled to reach a particular station but that in itself is not important because freight trains rarely run to schedule. What is important is that the timetable includes many special orders respecting particular trains and particular areas. It is also almost the only indication to the crew of the maximum speed at any location for any train. As we will see, generally speaking, the railways govern the speed of their own trains.

3. THE LONDON DIVISION

The Galt Subdivision to which I have made reference is part of the London Division. That portion of the division between London and Windsor is known as the Windsor Subdivision. Train 54 which was derailed, originated in London as I have said, but its progenitor was Train 84 out of Windsor. At London it merely changes its crew and its number and proceeds on its way. One of the reasons for the change of crew is simply that most of the trainmen, although resident in London, regularly work either the Windsor or Galt Subdivisions, but not both.

To say that Train 84 becomes Train 54 at London is not to say that the train that leaves London is the same as the train that left Windsor. That train regularly stops at Chatham and picks up cars of the Chesapeake and Ohio Railway coming from Sarnia. And so it did on November 10, 1979. Indeed, all the cars that derailed were originally from Sarnia and were part of Local 4 of the Chesapeake and Ohio which were transferred to CP Rail at Chatham. To find then the origin of Train 54, we must follow CP Train 84 from Windsor to Chatham, Local 4 of the Chesapeake and Ohio from Sarnia to Chatham and the combined train CP 84 from Chatham to London.

4. TRAIN 84, WINDSOR TO CHATHAM

The first part of that story was, indeed, uneventful. The crew of Train 84 out of Windsor consisted of Conductor Gordon Bach, engineman (or engineer—the former term seems to be preferred by the railway, the latter by the men) Tim Ready and trainmen Charles Cook and William Mahoney. They all live in London and all arrived at Windsor the night before in preparation for taking on the train scheduled to leave Windsor (actually Walkerville) at 1245 on the 24-hour clock. Before they took over, the train had been marshalled by the yardmen and inspected by a carman. We need not be concerned about the marshalling or the inspection because no dangerous commodity cars were included, the only placarded car being empty. The train proceeded on its way, arriving in Chatham at approximately 1500 hours, proceeding to the CP yard which includes interchange tracks where it awaited, pursuant to instructions, the arrival of the Chesapeake and

Ohio Local 4 from Sarnia. As we will see, the latter train pulled into the yard at about 1600 hours but as the cars were being transferred from one rail line to another there was an additional wait for a mechanical inspection.

5. THE INSPECTION OF LOCAL 4 AT SARNIA

The Chesapeake & Ohio Railway, a part of the Chessie System in the United States, has track in Ontario from Sarnia through Chatham to Blenheim and from Windsor through Blenheim, St. Thomas, London and Welland to Niagara Falls and Buffalo. The Sarnia, Windsor and Buffalo terminals are linked to trackage in the United States. The head office for Canada is at St. Thomas.

Sarnia is, of course, a major chemical-producing centre and many cars carrying dangerous commodities originate there, some for transportation by CN and some for transportation by C&O. Those destined for CP Rail are carried by the C&O to Chatham and transferred there.

There is no fixed rule, but most of these latter dangerous commodity cars leave Sarnia on Local 4 of the C&O scheduled to depart at 0200 hours, 6 days per week, but as with CP Rail the departure time is very elastic and on November 10th it actually left at 0710, composed of 69 (or 70 - the evidence is conflicting) cars of which 63 cars were bound for the CPR at Chatham, 4 for the CIL plant at Courtwright and 2 for the CNR at Chatham.

The train, as it was being made up in Sarnia, was inspected by the only carman on duty, Robert Nethercott, who testified to the nature of his inspection. It includes a brake test of all cars (the No. 1 brake test) an inspection of safety devices of the tanks to ensure they are not leaking, of the air hoses to see that they are coupled and of the placards to see that they are in place. It seems that there were only 7 plain bearing cars on the train and for the inspection of these he would lift the lid, check the oil, the brass and the lugs on the brass. He would also make sure that the wedge, brass and lubricator pad were all in position and that the oil was at the required one-half inch level and was not watered. He stated he could not tell whether the right size of lubricator pad was installed. I mention this only because it is alleged that the C&O in an earlier refit of the journal boxes of Car 1 installed oversized lubricator pads and I will deal with that problem when I come to consider the car itself.

For roller bearings he needed only a visual inspection to ensure that no grease was leaking and that the adapter (if any) was in place.

No cars were rejected in the course of that inspection although many minor repairs such as the addition of oil to plain bearings may have been performed. On his "daily inspection report" (which seems to be a weekly report for many train inspections) he made no entry under "Remarks" to indicate any special concern. That report incidentally has a column entitled "Time Air Test Completed with Yard Testing Device" under which each inspector has inserted only his name and the date and has another column entitled "Time Test" and subtitles for the time the test started and the time it was completed. For each of 19 inspections recorded in the one report filed with us, the elapsed time was put at twenty minutes regardless of the length or nature of the train or the time of day or night. There is no evidence that Mr. Nethercott did not do his work properly, but the record is of little comfort to us and I suspect little or no use to the railway.

6. LOCAL 4 FROM SARNIA TO CHATHAM

The train proceeded on its way to Chatham conducted by James Reynolds with Mr. Roberts, his engineer, and Messrs. Mooser and Babcock as rear and head brakeman respectively (the words "brakeman" and "trainman" are synonymous, the former being preferred by C&O, the latter sometimes by CP Rail). The train arrived at the CIL plant at Courtwright at 0810, set off the 4 cars and lifted 6 and continued on its way to Chatham, arriving at the C&O yard after passing by the CPR yard at 1340 hours.

At the Chatham C&O yard 2 of the lifted cars from CIL were set off and the train, now consisting of the 2 CN cars and the 67 CP cars, was taken to the CP yard a few hundred yards to the north and the 67 cars placed partly in interchange track 2 and partly in interchange track 3 at about 1555 hours. The C&O engine with the 2 CN cars then left the CP yard for return to the C&O yard at 1600 hours.

7. THE INSPECTION AT CHATHAM

The Chatham carmen are Robert Males and Austin Jones and usually they do the inspection as a team, but Jones has Monday off and Males Saturday, each without a replacement. Consequently on this Saturday, November 10th, only Jones was available. As it happens he saw the train go by as it was proceeding south to the C&O yard and saw it again (slightly reconstituted) on the opposite side as it pulled into the CPR yard. In each case he gave it a "pull-by" inspection which involves a visual inspection of the undercarriage of the train on the move, much like those inspections contemplated in Uniform Rule 111.

As soon as the C&O cars were in place on tracks 2 and 3 he commenced the inspection. Mr. Jones testified that his inspection involved lifting the lids of the journal boxes of plain bearing cars, seeing that wedges, brasses and lubricator pads are in place, and that there is enough oil. He will add oil if there is only one-half inch preferring to see a level of three-quarters of an inch as opposed to Mr. Nethercott who is quite content with a level of one-half inch. In this inspection he remembers using some oil, possibly 1 gallon. He also remembers finding water in 2 boxes. The rest of the inspection involves seeing that the adapters of roller bearings are in place and there is no excess grease showing, checking the couplers, safety equipment, walkways, handrails, ladders, checking the undercarriage for cracks, checking the handbrakes to see that the chain is in place, checking the brake shoes, the doors of the box cars to ensure they are closed, the placards for placement and the stencils on the cars to ensure that the time for repacking has not passed. It is a formidable task and it appears to have been completed for all 67 cars in 1 hour to 1 hour and a half because the crew of Train 84 had some more switching to do and departed at about 1800 hours. I am not, however, prepared to say that Mr. Jones skimped on the inspection. While it would be quite impossible for me and most others to accomplish the task in a little more than a minute for both sides of each of the 67 cars, it must be remembered that Mr. Jones has been a carman or carman's helper since 1953 and inevitably has acquired much skill and speed in the performance of his duties. It is also to be remembered that the examination of plain bearing journals is the task requiring the most time and of plain bearing cars inspected by him there were only 7.

Mr. Jones also seemed to have difficulty keeping accurate records for he filled in his time for the day on his time card before the inspection had started. I do not suggest any dishonesty, but such conduct gives us no help in determining how long he was engaged and deprives his employers of one opportunity to supervise his work.

After Jones had completed his inspection he announced the fact by radio to the crew. Upon that advice the crew of Train 84 proceeded to couple the C&O cars to the train. They dropped some cars of their original train behind but after coupling had 102 cars including 5 cars to be set off at Woodstock. The cars were numbered from the caboose, the 64th being the Chlorine car and the 70th the Toluene car.

After the coupling the crew were required to perform a brake test. There are 2 types of brake test being called (by CP) the No. 1 and the No. 2. The former is a test of all the brakes in a train and involves the engineman setting the brake, i.e. charging all cars with air. Thereupon the trainmen walk the train, one from each end inspecting the brakes and the release of the brakes. After this is done, the van or caboose is checked by the conductor and then the test is complete. This test (No. 1) is performed at the terminal after a train is made up. When cars are lifted, however, only the No. 2 test is required. This involves the same procedure but only for the lifted cars and for the van after the lift. At Chatham there was a No. 2 test only but, of course, it involved a considerable lift and a considerable test.

8. TRAIN 84 CHATHAM TO LONDON

After the coupling and the brake test Train 84 proceeded out of Chatham at about 1800 hours bound for London. Again there was nothing remarkable on the trip. On arrival at London the train is normally subject to a pull-by inspection by 2 carmen on either side as it pulls into the station. The 2 carmen on duty in London that night were Mario Piccolo and Kenneth Hopper. Hopper was on the south side as the train pulled in and performed his share of the task. As it happened Piccolo was absent on duty and returned only after the train had stopped, necessitating a walking inspection. Neither found any defects or exceptions. Neither the pull-by nor the walking inspection involves lifting the lids of plain bearing journals.

When Train 84 came to a stop at London, the Windsor Subdivision crew came off duty and were replaced by the Galt Subdivision crew, a reduced crew of 3, a rarity made necessary by the unavailability of regular crews.

This crew consisted of William Edward Nichol, conductor, Keith Pruss, engineer, and Larry Krupa, head end trainman. The latter is also the son-in-law of engineer Pruss. It was their task to pick up 4 cars all of which were placed at the tail end bringing the total to 106, but the No. 2 brake test necessitated thereby was performed by Hopper with, of course, the assistance of Pruss in setting the brakes.

9. TRAIN 54 FROM LONDON TO GUELPH JUNCTION

The train, besides getting a new crew, now obtained a new number, namely 54, and headed east for Woodstock where it had been ordered to set off the 5 cars destined for that city and placed at the head of the train at Chatham in anticipation and lift 5 more cars for delivery to the Agincourt yards at Toronto. On the way to Toronto it had the first of 3 "meets", that is passing of another train travelling west on the same track, that it would encounter before derailment. This one was at Nissouri at mileage 104 on the Galt Subdivision and involved a train called Extra 5530 West out of Agincourt. (Apparently all trains not mentioned in the timetable—and there are many—are labelled "extra"). This train, manned by Clarence Parsons as conductor, Robert Billingsley as engineer, John Haggith as head end trainman, and Gary Dagelman as rear end trainman, arrived at Nissouri after Train 54 had arrived, pulled into the siding and passed the stopped train. In doing so, Parsons and Dagelman and Haggith inspected the north side of Train 54 and found nothing unusual. They all saw Krupa on the ground at the switch which he had to work to let Extra 5530 into the siding and to permit Train 54 to proceed after the extra had cleared the switch. For their part the crew of Train 54 inspected both sides of the Extra. Pruss said he put on his headlights and "ditchlights which as I said are very strong" for the purpose. As it happened the model of locomotive he was driving was not equipped with ditchlights. I have no doubt that his statement was honestly made based upon his general custom, but it does not lend credibility to any of his statements of precise facts on the night in question.

At Woodstock - Jellicoe, mileage 88, the train stopped for the lift/set off. As it happens a CPR employee, Robert Deadman, observed the train as it pulled in from the north side and saw no exceptions. Train orders were delivered to the engineer and conductor by the operator who in so doing inspected the south side of the train and found no exceptions. I should mention here that there were train orders at Galt also,another station on the south side at mileage 57.2. Again the operator who delivered the orders inspected the south side of the train and noted no exceptions.

It probably has nothing to do with the subsequent derailment, but the No. 2 brake test made necessary by the lift at Woodstock was not performed. Nichol was caught outside the train when it started to move. There are special rules relating to 3 men crews which rules are set forth in the timetable of the Region at p.69 and include a prohibition against putting the train in motion without a clear direction to the engineer from the conductor. Obviously this rule was breached as well.

Nichol managed to get back on the van and the train proceeded on its way to Guelph Junction. As this was the train in its final form, I should give some relevant statistics. They are -

Length - 6,627 feet

Weight - 9,050 tons

Distance head end to car 33 (Car 1 in derailment) - 2,163 feet

Distance tail end to car 33 - 4,464 feet

The night was cool and dark and clear.

On the way to Guelph Junction the train had two more meets, one at Puslinch, mileage 45, and one at Guelph Junction itself, mileage 39.2. The meet at Puslinch was with Extra 5748 West out of Agincourt which was in the siding when Train 54 went by. The crew of that extra inspected Train 54 with the head end trainman dismounting and crossing to the south side with a lamp for better viewing. None found any exceptions to the train.

At Guelph Junction the meet was with Extra 5015 West. Guelph Junction is, for trains travelling westerly, the end of the double track, the single track to the west being a continuation of the northern or westbound track. At the juncture, mileage 39.95, is a spring switch enabling trains travelling east to move across to the south track and Extra 5015 stopped with the head end just short of that switch to await 54's arrival. As Train 54 pulled by, it was inspected on the north side by the rear end trainman and the engineman of 5015, and on the south side by the head end trainman, Nicholas Dionne. No one noticed anything unusual although Dionne saw smoke from the brake shoes throughout the whole train. This was not unusual as the train is required to slow to 15 miles per hour for the spring switch and smoke often lingers on after the brakes are released.

There were train orders at Guelph Junction for both passing trains. The operator hooped the orders to Train 54 from the north side and in so doing inspected that side and noted no exceptions.

Train 54 pulled through Guelph Junction at about 15 miles per hour and headed eastward to disaster.

IV. THE TRAIN FROM GUELPH JUNCTION TO MAVIS ROAD

The train proceeded from Guelph Junction to Mavis Road, a distance of 22 1/2 miles before the 24 cars derailed. I have already set forth what was seen (or not seen) by the witnesses outside the train over that distance. It is very easy to state what was seen by the crew; they saw nothing, neither Nichol from 73 cars back nor Pruss and Krupa from 32 cars and 3 engines forward. If this were a civil action dealing with the recovery of damages consequent upon the derailment, I doubtless would have to determine whether they should have seen something in the course of that run and taken the appropriate measures to prevent the derailment. I am most anxious not to make any unnecessary findings of fact but I am required by Term 1 of the Order-in-Council to determine not only the causes but the contributing factors and by Term 3 to determine the "level and adequacy...of the practices and procedures governing railway safety with respect to this accident...". The failure to detect the hot box was a failure of the running inspection system. I see no way of avoiding the determination of whether the failure was attributable all or partly to the defects of the system itself or to the default of the persons who employed it. To this end I must consider not only the rules for inspection and the evidence of inspections made but also the opportunities for inspections and the other duties that might have inhibited taking advantage of those inspections. I think I must also consider the probable state of the hot box at the time the opportunity to see it presented itself, i.e. whether it would be in a state of development of fire that would render it readily visible to the viewer.

1. THE METHOD OF RUNNING INSPECTIONS

As I have pointed out earlier, the crew is required by Rule 111 of the Uniform Code of Operating Rules and Rule 9.1 of CP Rail's General Operating Instructions to make inspection of the train in motion. The latter rule requires inspection "from both sides of the diesel unit and at the rear of the train from both sides of the caboose for any evidence of a hot box...".

As I need hardly point out the best opportunity for observation of the running gear of the train is on a curve and all the railway witnesses described how in their training they came to know the best curves and inspected the train on them. Under CP Rule 4.1(c) the crew are required to transmit, presumably to each other, the results of all running inspections and under Rule 4.1(a) to communicate with each other before passing each station,all "when practicable". The London Division appears to have added to this rule by requiring an inspection,presumably also when practicable,at the mileboard before each station.

2. COMMUNICATION OF INSPECTIONS

There is no fixed method of communication but it appears customary for the engineer to call the mileboard, for the conductor to acknowledge and then after he has made his inspection to report the results to the engineer who acknowledges. A satisfactory, i.e. no defect, result is often signified by the word "highball". On curves it is usually the conductor who initiates the highball and the engineer who acknowledges.

3. DUTIES AT THE HEAD END

While primarily the engineer is responsible for observing back the right-hand side, when he is engaged in other duties he may direct the head end trainman to come over to that side and look back. The inspection on the left-hand side is, of course, performed by the head end trainman. These inspections are made by looking back out the right or left window. On the night in question the lead locomotive was a GO unit, equipped with rear-view mirrors. The GO units were sometimes rented on weekends but none of the crew had much experience with them. Pruss and Krupa specifically stated that they at no time made use of the rear-view mirrors or really appreciated their existence. In this they were supported by their superiors, particularly Mr. George Bathgate, the road foreman, who maintained that rear-view mirrors were no part of CP Rail's training or operation and he would forbid their use if he thought any engineer or trainman was tempted.

4. DUTIES AT THE TAIL END

The van or caboose is equipped with a cupola or observation dome on the top having seats on either side and a platform at the rear. At the mileboard inspection the conductor (and/or the rear end trainman, if any) generally go back to the rear platform and down the steps to lean out and regard the train from either side and to the rear. On curve inspections there seems to be no set formula and the inspections can be made either from the platform or the appropriate side of the cupola.

5. THE CURVES

It is clear from the evidence and from the examination of the route of the track that there is no good curve for visibility after Guelph Junction until one gets to Winston Churchill Blvd. which is the start of a long, fairly pronounced curve to the right, leading into Streetsville. At the south end of Streetsville there is a short curve to the left (sometimes known as the Reid's Mill Curve) and the track proceeds across the Credit River; it then turns to the right again and proceeds south to cross Eglinton, McConnell (Hydro) Road and Burnhamthorpe. After Burnhamthorpe it turns gently to the left and is going almost straight and more or less easterly when it crosses Mavis Road.

6. THE EVIDENCE OF THE CREW

The engineer, Keith Pruss, testified that pursuant to orders in the timetable he reduced the speed at Guelph Junction to 15 miles per hour and picked up speed as the van cleared the spring switch. He said there were poor inspection curves allowing only glances at part of the train from there through Milton. He said he called the mileboard at Milton and got a highball back from the conductor. (At another point in his evidence he indicated that his call recorded on the transcript of radio communications (which is attached as Appendix 4) at the time 23.36.35 was for the curve outside and east of Milton.) At Winston Churchill Blvd. he can see the whole train for a period but his view is cut off by trees and bushes in places and he is pre-occupied by signals, switches and crossings from some time before Derry Road right through Streetsville. He would take a glance at Britannia Road (mileage 21.41) and again after he had crossed the Credit River and again after passing McConnell Road (mileage 18.65). The major inspection to the right or south was, however, at Winston Churchill Blvd. and the major burden of that was left to Krupa who crossed over to the right-hand side to inspect. He said he always "highballed" the Winston Churchill curve.

Conductor Nichol said that with a full crew one inspects from the rear every station but with a reduced crew it is difficult to do more than every second one. He inspected at Milton as best he could but did not give a highball until he was past the curve east of Milton. Thereafter there was no inspection until close to Winston Churchill Blvd. He then went out on the platform to inspect the train on both sides, and returned into the van at Winston Churchill Blvd. just as the engineer was calling the mileboard at Streetsville. He acknowledged the call and thereafter remained in the cupola except for one descent to check the order board at the Streetsville station. He said he gave the highball for the Winston Churchill curve after the van had passed Derry Road. He did some changes from side to side in the cupola and in fact was in the act of changing from the north side to the south side at Erindale Station Road when the train went into emergency, causing him some slight injury. He says he checked the rear from time to time including at Burnhamthorpe and saw no markings indicating dragging equipment along or beside the track.

The head end trainman Larry Krupa said he could see at least 50 cars with running gear on the Winston Churchill Blvd. curve, that as a practice he goes over and looks back at that curve from the engineer's side but is back on his own side well before Derry Road, that thereafter he glances at available opportunities on his own or left-hand side including Reid's Mill (mileage 20) and the Hydro Road (McConnell Road, mileage 18.65). He has never crossed over or been instructed to do so at Derry Road or any place east of Winston Churchill Blvd. to Mavis Road. Mr. Parsons, the conductor of the "meet" at Nissouri, said he would inspect the south side just before Eglinton and Mr. Lemon, the engineer of the "meet" at Puslinch, would expect the head end trainman to cross over to look back after the Eglinton crossing is passed.

7. THE TRANSCRIPT

The head and tail end are, of course, equipped with radios for communication between them. The engineer's is of 25 wattage but the conductor's is only of 5 wattage apparently on the principle that only one radio need be powerful enough for communication with the dispatcher. These communications are on a frequency receivable also in dispatching offices and accordingly can be recorded and transcribed. The difficulties however appear to be that some of the engineer's calls are missed because they are simply not within range and many of the conductor's calls are lost for that reason or because of the low wattage. Also some communications are overridden by more powerful or closer calls of other trains on the same frequency.

The main purpose of having the train on a frequency heard in a dispatcher's office is not apparently for monitoring purposes but for communication between office and train. While the equipment is capable of recording those communications heard, it is not intended to be a transcription of every communication. Whether it should be, of course, is another problem to be dealt with later.

With these limitations in mind we should examine the transcript of radio communications recorded for the help it can afford us.

Appendix 4 (Exhibit 115 at the Inquiry) records the conversations received at the Toronto dispatcher's office relative to Train 54 from Guelph Junction to Mavis Road.

It appears to show the following:

1. A highball from engineman to conductor on leaving Guelph Junction.
2. A highball from engineman to conductor at Milton.
3. A calling of the Streetsville mileboard by the engineman.
4. An acknowledgment of the previous call by the conductor.
5. A "highball Streetsville" from the conductor.
6. An acknowledgment of the previous call by the engineman.

It is certainly possible to infer from these excerpts the following:

1. There was no call at the Milton mileboard as required by the rules.
2. There was no highball given or received with respect to the curve at Winston Churchill Blvd.

but it is not possible to conclude as much. First of all there are the limitations of the equipment described. Secondly, the crew maintain stoutly that they did highball the Winston Churchill curve. They did not know it by that name but as the curve "at the top of Streetsville" and the communications numbered 5 and 6 above could be the highball of the conductor given after Derry Road but referable to the whole curve and the acknowledgment of that highball. I can only regret that the inadequacy of the equipment and the total lack of uniform language requirements in the communications, makes it impossible for us to determine the precise facts.

8. THE TEST TRAIN RESULTS

On December 8, 1979, CP Rail under the direction of the London Division Superintendent G.A. Nutkins, operated a test train over the track with a light fixed on or close to the appropriate place on a tank car 2,167 feet 2 inches from the engine (the actual distance on November 10th was 2,163 feet 7 inches) which for this purpose was the same GO unit as that of Train 54. The train was run at night at 50 miles per hour in conditions similar to those that prevailed on November 10th. Three tests were made, the first from Guelph Junction to Mavis Road with observations made from the south doorway of the GO unit, the second over the same territory but with observations from the open window at the engineman's position on the south side, and the third from Streetsville to a point east of Mavis Road with observations from the north side window and in this last test the light was relocated on the north side of the tank car. The results of these tests were as follows:

For test 1, between Winston Churchill Blvd. and Derry Road the light was visible for almost 49 seconds and not seen for an equivalent period. From Derry Road to Eglinton Avenue the light was visible for a total of 17.7 seconds in a total travelling time of about 5 minutes. In test 2, the light was slightly less visible to Derry Road and slightly more visible thereafter. The three places of visibility after Derry Road are as the tank car negotiated the curve west of Derry Road, the curve west of the Streetsville station and the curve between the Credit River and Eglinton. On test 3, the light was not visible at all until the train approached Burnhamthorpe Road.

Although every effort was made to simulate conditions of observation of the crew of Train 54, actual identity could not be achieved for many reasons. First of all the conditions for observation are always better when one is looking for something known to exist and one is not distracted by other duties. On the other hand the light given forth was only 12 volts and the light from the hot box may have been considerably brighter and may have extended out laterally making visibility easier.

9. THE CULLEN VISIBILITY TEST

Another test was made to determine the visibility of a hot box at night. This one was undertaken by Dr. A.P. Cullen, a professor of optometry with formidable qualifications who is now on the staff at the University of Waterloo. An attempt was made to simulate a burning hot box distant 2,167 feet to the rear. The flame was placed directly to the rear of the engine in the place where it would be on straight or tangent track, i.e. the box itself was out of sight of the cab. It was found that the fire that was induced was clearly visible from the cab of the GO unit either by direct observation or through the rear-view mirror. This would seem to indicate that on the straightaway without benefit of any curve whatever, a burning hot box would be visible. Yet this test too must be viewed with caution. No attempt was made to simulate the working conditions, particularly the actual movement of a train at 50 miles per hour. Moreover the test was conducted with the lid of the journal open apparently on the basis that it had to be if the McGregors' evidence of the flames shooting out was to be accepted. There is, however, no direct evidence that the lid was in fact open.

10. THE EVIDENCE ON THE GROUND

The first untoward marks on the rails were found just east of mileage 18.3 between McConnell (or Hydro Road) and Burnhamthorpe. The first marks were to the spikes and outside base of the south rail. At Burnhamthorpe there were heavy marks on and adjacent to both rails. These marks continued and were especially heavy at the crossings and frogs and switches, (a frog in railway language is a connection between the main track and the track leading into it) until at Mavis Road the derailment occurred. It seems to be common ground that the truckside on the south side dropped at the first mark, that the R1 wheel rose up and over the south track at Burnhamthorpe bringing the north wheel over to the south side of the north track. The two wheels and axle continued to move to the south side and somehow escaped entirely from the truck into the Riddels' backyard. This brought the left rear truck side down as well so that both rear truck sides rode along the ties with the car still being carried along with the forward truck still in place and the leading wheels of the rear truck still on the track. At Erindale Station Road the car managed to pass the crossing and the north truck side managed to survive a frog although the frog was damaged. Shortly thereafter the south truck side hit what is known as the Erindale team track switch and damaged it. One theory is that the car derailed there, but the theory is hard to support in light of the evidence of witnesses at Wolfedale and Mavis, particularly that of Mrs. Dabor. It is probable, however, that the front wheels of the trailing truck derailed at this point to the south of both the south and north rails. The car continued in this fashion through Wolfedale Road to a point where there is a switch to the

Alkaril Chemical Limited building just west of Mavis Road. There the whole rear truck was pulled out causing the derailment.

I should add that various parts of journal box steel, brake shoes, journal wedges, bearings and lubricator pads and truck springs were found along and adjacent to the track particularly in the neighbourhood of crossings. As noted earlier, the rear axle and wheels were found by Mr. and Mrs. Riddel near Burnhamthorpe, and the burnt-off journal stub by P.C. McConnell near Wolfedale Road. Both truck assemblies and the three remaining wheel sets were found at or near the final resting place of Car 1, but separated from the car.

11. THE SPEED OF THE TRAIN

As will be noted later, the speed limits for trains are, generally speaking, set by the railways. For a train the size of Train 54 the CP timetable as previously noted requires a speed of 15 miles per hour going through the spring switch at Guelph Junction. There is a limit of 45 miles per hour on curves from Guelph Junction to Milton, but otherwise the limit to Mavis Road is 50 miles per hour. Engineman Pruss testified that he did not at any time exceed the limit. CP Rail filed as an exhibit a chart showing the calculated speeds of the train through various portions of the trip from London to Mavis Road based upon the dispatcher's records, the chart recorder times (taken by machine along the route) and from the radio transcripts. The speeds calculated from Guelph Junction and points eastward to Mavis Road varied from 40 miles per hour to just over 50 miles per hour.

12. THE TRAIN OPERATIONS SIMULATOR TEST

This test was conducted by Mr. Gordon English, a Professional Engineer with the Canadian Institute of Guided Ground Transport, a research institute mainly involved in railway issues. From the known lengths and tonnage of the locomotives and the first 32 (or non-derailed) cars and the known track profile and certain resistance and braking factors calculated for each car, he was able to calculate the stopping distance at assumed speeds upon the application of the emergency brakes. Upon a derailment the brake hose will separate and immediately the train will go into emergency. Depending therefore upon the point of derailment and the stopping place of the train, one can calculate the speed of the train at the point of derailment. His calculation included the possibility (based largely on the evidence of Dr. Carey, supra, that he had seen a dangling brake hose at Erindale Station Road) that there had been a break in the brake hose operating the emergency on the front end of the train but for some reason (perhaps the pinching of the mate to the dangling hose) the rear end did not go into emergency.

Engineman Pruss gave evidence that the lead locomotive came to a stop at a point just short of a certain signal point which was calculated to be at mileage 15.43. Under Mr. English's calculation then, assuming an uncoupling of the hoses at the Alkaril switch just west of Mavis Road, the speed of the train at the time would be 54 miles per hour. Assuming an earlier uncoupling the speed would be greater; indeed with some assumptions the train at much greater speed would have stopped much earlier and some of those assumptions can be discarded. In light of all of the visual evidence (except possibly that of Dr. Carey) it is reasonable to suppose an uncoupling and a full application of brakes at or near Mavis Road, and consequently we should consider the test result figure of 54 miles per hour.

That figure cannot be accepted as certain and Mr. English does not make that claim. The test is not universally accepted, the figures for all cars while close are not precise and there can be a variation of up to 15 per cent in some of the calculations. In the circumstances it would, in my view, be unsafe on the basis of this test alone, or indeed upon all the evidence, to assume that the speed of the train was any greater than the 50 miles per hour maximum attested to by Engineman Pruss and laid down in the CP Rail timetable for a train of this size at this location. I should state that I am not applying a criminal burden of proof. What I am saying is that I cannot be satisfied that the speed at the time of the derailment was greater than 50 miles per hour. On the other hand, I would have difficulty in being satisfied that it was any less. I shall have something to say about the propriety of that speed later.

13. LOOKING FORWARD v. LOOKING BACK

This problem arises out of a possible conflict in the rules relating to the duties of the engineer and the trainmen, particularly the latter when the train is travelling through urban areas. Those areas carry with them many crossings, signals and switches. Indeed between Derry Road and Mavis Road inclusive there are 11 crossings, 5 signals, 8 switches, a station where train orders may be waiting, and a bridge over the Credit River where children and others might be trespassing, all requiring the attention of the head end.

The Operating Rules (supra, Rules 90A and 111) create the conflict. The former seems to require the constant attention of trainmen to the front at points of difficulty and the latter requires these same trainmen "when practicable" to make "frequent inspections of their train". Neither the CPR's General Instructions or the Chessie System's operating rules seem to resolve the conflict. Mr. Nutkins, the superior of the crew of Train 54, was clearly of the view that the duty to look ahead takes precedence and a trainman who failed to keep a vigilant lookout ahead in order to look back would be in breach of the rules. Mr. J.P. Kelsall, the CP Superintendent in Sudbury, on the other hand, agreed that the "principal function of the head end trainman is really during the operation of the train to be inspecting both sides of the train" and "when the engineman's duties are occupying him with the operation of his train, the head end trainman will be crossing back and forth carrying out running inspections". One can be forgiven for inferring a different interpretation of the rules or at least a different emphasis in Sudbury from that in London. The trainman's dilemma is surely not to be resolved by geography.

14. TYPICAL v. QUICK BURN-OFF

There is just one more problem to state before we leave the train's fateful journey. That involves the consideration of the development of the hot box and particularly whether it was a "typical" or a "quick" burn-off. We will discover that the hot box is one of the most (if not the most) common causes of derailments and yet it is remarkable how little evidence we were able to muster on the progress of hot boxes. One witness who did attest to the subject was Mr. Edward H. Wright, now a railroad consultant, but with over 40 years' railroad experience, much of it with the New York Central now part of the Penn Central System, and much of it concerned with the investigation of derailments. He said that in his opinion Train 54's was a typical burn-off, one normally extending 18-20 miles from first ignition to burn-off and detectable by a slight taper of the burnt-off stub or nubbin, by the fact that the edge of the break is rounded and the core of the break-off is larger in diameter and the fractured surface is smaller. A quick burn-off which has little or no taper, he said, is now rare being the product of the reconditioned journal now outlawed. On the other hand, Mr. R.W. Barratt, Chief Equipment and Facilities Assessment, Ontario Region of the Railway Transport Committee of the CTC, on examining the nubbin and finding its diameter 5 13/16th inches at 7 1/2 inches from the collar, and 5 15/16th inches at 1 inch from the collar concluded that it was a quick burn-off. I should say in passing that the Ontario Research Foundation's precise measurements of the stub shows a diameter of 5.81 inches at 7 1/2 inches from the collar and 5.98 inches at 1 inch from the collar. That is a taper certainly, but whether it is pronounced enough to indicate a typical burn-off, I cannot say—none of the literature before the Inquiry indicated how much of a taper is necessary to signify a typical burn-off nor how little will signify a quick burn-off. We also did not have the benefit of Mr. Barratt's evidence to explain how he reached his conclusion. No one is to blame for that omission; there occurred to no one that there was a discrepancy in his report and the evidence of Mr. Wright until after argument had commenced.

The significance of the discrepancy is this: if it is a typical burn-off then in Mr. Wright's view the whole process will be in operation from Guelph Junction and the fire which at first will be intermittent will be constant by Winston Churchill Blvd. If it is a quick burn-off then the fire seen by the McGregors at Derry Road (and not seen by the Misses Bota and Carter at Streetsville) may have been only intermittent at Derry Road and not even that at Winston Churchill Blvd. I prefer not to resolve this question on the opinion of experts, only one of whom was subject to cross-examination. I prefer to make deductions from the evidence of the eye-witnesses and I shall do so later in this report.