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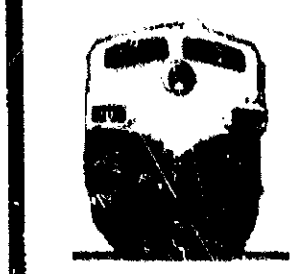

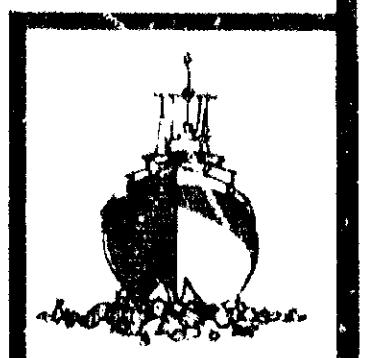

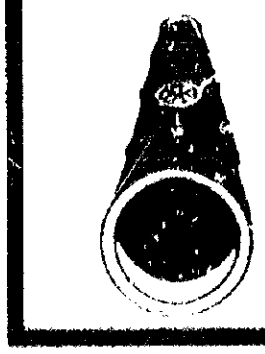

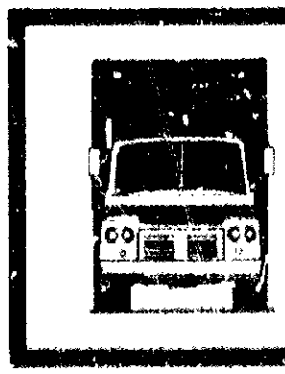

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

RAILROAD ACCIDENT REPORT

DERAILMENT OF
SEABOARD COAST LINE RAILROAD
TRAIN NO. 120,
AT COLONIAL HEIGHTS, VIRGINIA
MAY 31, 1982

NTSB/RAR-83/04

UNITED STATES GOVERNMENT

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. NTSB/RAR-83/04	2.Government Accession No. PB83-916304	3.Recipient's Catalog No.
4. Title and Subtitle Railroad Accident Report— Derailment of Seaboard Coast Line Railroad Train No. 120, at Colonial Heights, Virginia May 31, 1982.		5.Report Date May 3, 1983 6.Performing Organization Code
7. Author(s)		8.Performing Organization Report No.
9. Performing Organization Name and Address National Transportation Safety Board Bureau of Accident Investigation Washington, D.C. 20594		10.Work Unit No. 3576A 11.Contract or Grant No.
12.Sponsoring Agency Name and Address NATIONAL TRANSPORTATION SAFETY BOARD Washington, D. C. 20594		13.Type of Report and Period Covered Railroad Accident Report May 31, 1982 14.Sponsoring Agency Code
15.Supplementary Notes		

16.Abstract At 1:25 p.m., on May 31, 1982, northbound Seaboard Coast Line (SCL) freight train No. 120 derailed at the Swift Creek Bridge in Colonial Heights. Virginia, following a hard run in of slack which occurred when the train transited a change in grades. The train was classified as restricted by SCL timetable designation with a maximum authorized speed of 50 mph. The engineer stated the train speed was 45 mph at the time of derailment; however, tests conducted following the accident indicate that the train speed was 64 mph when the train derailed. Cars No. 89 through No. 118 derailed. A tank car was breached in the derailment, and its contents were released and immediately ignited. No crewmembers were injured as a result of the accident, but 12 firefighters and a state emergency official collapsed during firefighting operations. Erroneous and conflicting information concerning hazardous material on the train caused confusion and resulted in misdirected emergency response efforts.

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the engineer of train No. 120 to control the slack action of the train as it transited a change in grade. Contributing to the accident was the Seaboard Coast Line Railroad's allowing an engineer who was known to be deficient in train handling skills to operate the train. Contributing to the severity of the fire and to the ineffectiveness of the emergency response was inadequate training of railroad operating personnel and onscene railroad management.

17.Key Words Freight train, derailment, hazardous material release, tank car, breached, waybills, emergency response, training, command post, train dynamics analyzer class, hazard graph, firefighting operations		18.Distribution Statement This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161	
19.Security Classification (of this report) UNCLASSIFIED	20.Security Classification (of this page) UNCLASSIFIED	21.No. of Pages 46	22.Price

NTSB Form 1765.2 (Rev. 9/74)

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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

RAILROAD ACCIDENT REPORT

Adopted: May 3, 1983

DERAILMENT OF SEABOARD COAST LINE RAILROAD TRAIN NO. 120 at COLONIAL HEIGHTS, VIRGINIA MAY 31, 1982

SYNOPSIS

At 1:25 p.m., on May 31, 1982, northbound Seaboard Coast Line (SCL) freight train No. 120 derailed at the Swift Creek Bridge in Colonial Heights, Virginia, following a hard run in of slack which occurred when the train transited a change in grades. The train was classified as restricted by SCL timetable designation with a maximum authorized speed of 50 mph. The engineer stated the train speed was 45 mph at the time of derailment; however, tests conducted following the accident indicate that the train speed was 64 mph when the train derailed. Cars No. 89 through No. 118 derailed. A tank car was breached in the derailment, and its contents were released and immediately ignited. No crewmembers were injured as a result of the accident, but 12 firefighters and a state emergency official collapsed during firefighting operations. Erroneous and conflicting information concerning hazardous material on the train caused confusion and resulted in misdirected emergency response efforts.

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INVESTIGATION

The Accident

At 11:35 p.m., on May 30, 1982, northbound SCL freight train No. 120 (train No. 120), consisting of 2 locomotive units and 132 cars, departed Florence, South Carolina, for Richmond, Virginia. The train made an en route stop at Milar Yard, Fayetteville, North Carolina, where 25 cars were set out of the train. At 4:45 a.m., on May 31, the train arrived at Rocky Mount, North Carolina, where a third locomotive unit was added behind the original two units and cars were switched in and out, after which there were 186 cars in train No. 120. Mechanical department employees then inspected the train and tested the brakes. No exceptions were taken to the cars and locomotive units. A relief traincrew for train No. 120 came on duty at 7:30 a.m. At 8:30 a.m., the conductor reported that he took exception to a car in the train. After mechanical department employees inspected the car and found that the load in the car had shifted, the car was switched out of the train. By 9:00 a.m., the train had been reassembled, and the brakes were then retested with no exceptions being taken. The train departed Rocky Mount at 9:50 a.m., with 185 cars.

The engineer took no exception to the handling of the locomotive units or cars after leaving Rocky Mount; however, the lead locomotive unit from which he was operating had an inoperative speedometer. The inoperative speedometer had been reported on the locomotive work report by the engineer who brought the train from Florence to Rocky Mount.

When the train stopped at Collier Yard, Petersburg, Virginia, the brakeman on the head end of the train set out the first 58 cars behind the locomotive. The train then consisted of the 3 locomotive units and 127 cars. While the train was stopped, the flagman alighted from the caboose and started forward inspecting cars. When the train was reassembled, it departed slowly in order to pick up the flagman as he walked forward. The flagman inspected about 75 cars from the time the train stopped to the time he was picked up. After picking up the flagman, the engineer gradually increased the speed of the train. The engineer was operating the train from the control station on the lead locomotive, and the head brakeman was seated on the opposite side. The conductor and flagman were at the rear of the train riding in the cupola of the caboose. The train traversed a descending grade for approximately 2.5 miles before reaching the Appomattox River Bridge which is 3.8 miles north of Collier Yard. The engineer estimated the speed of the train to be 45 mph at that point. The engineer stated that at the Appomattox River Bridge he reduced the throttle to the No. 2 position and allowed the train to drift with the throttle remaining in the No. 2 position. He estimated the train speed to be 45 to 50 mph as it descended the grade to Swift Creek, 4.1 miles north of the Appomattox River. North of the Swift Creek Bridge, the gradient of the track begins to ascend. The engineer stated that approximately .9 miles north of Swift Creek Bridge (see figure 1), he increased the throttle to the No. 4 position and possibly to the No. 5 position. At this time, the flagman radioed to the engineer that the slack had run in. 1/ The conductor and the flagman later stated to investigators that it was a very hard run in of slack. When the engineer heard that the slack was in, he immediately reduced the throttle to the No. 2 position. Several seconds later, the train brakes went into an undesired emergency application. The conductor stated that following the emergency brake application, the first thing he saw was a large cloud of black smoke and fire at the Swift Creek Bridge and that he felt a bumping sensation which he thought was the cars hitting each other. Cars No. 89 through No. 118 had derailed. The caboose and 10 cars (No. 128 through No. 119) ahead of it remained on the track. Car No. 89 stopped 3,772 feet north of the point of derailment still attached to the lead portion of the train; only the trailing truck of the car derailed. Car No. 90 derailed and stopped on the track structure 2,956 feet north of the point of derailment. (See figure 2 for the location of the remaining derailed cars.) The accident was determined to have occurred about 1:25 p.m. near milepost 19.2.

Although the fact was not known immediately after the accident, three tank cars were involved in the derailment. Derailed car No. 96, tank car GATX 27250, came to rest on the east edge of the south end of the bridge with the dome pointing approximately 110° vertically downward. The tank was punctured in the head area on the B end of the car.

1/ Slack action is created when one portion of a train moves faster or slower relative to an adjacent portion of the train. When this difference in speed has taken up all slack (a run-in or run-out), these adjacent portions of the train suddenly attempt to attain a uniform speed, resulting in potentially damaging shock forces. Slack action is greatly affected by the time interval between brakes applying and releasing at the ends of a train; changes of brake shoe friction with change of speed; differences in braking ratio of empty versus loaded cars; length, weight and makeup of trains; and changes in grade and curvature.

STATION	MILE POST
RICHMOND	0
19.2	
SWIFT CREEK	19.2
2.8	
PETERSBURG	22.0
1.3	
APPOMATTOX RIVER	23.3
3.8	
COLLIER YARD	27.1
92.5	
ROCKY MOUNT	119.6
173.1	
FLORENCE	292.7

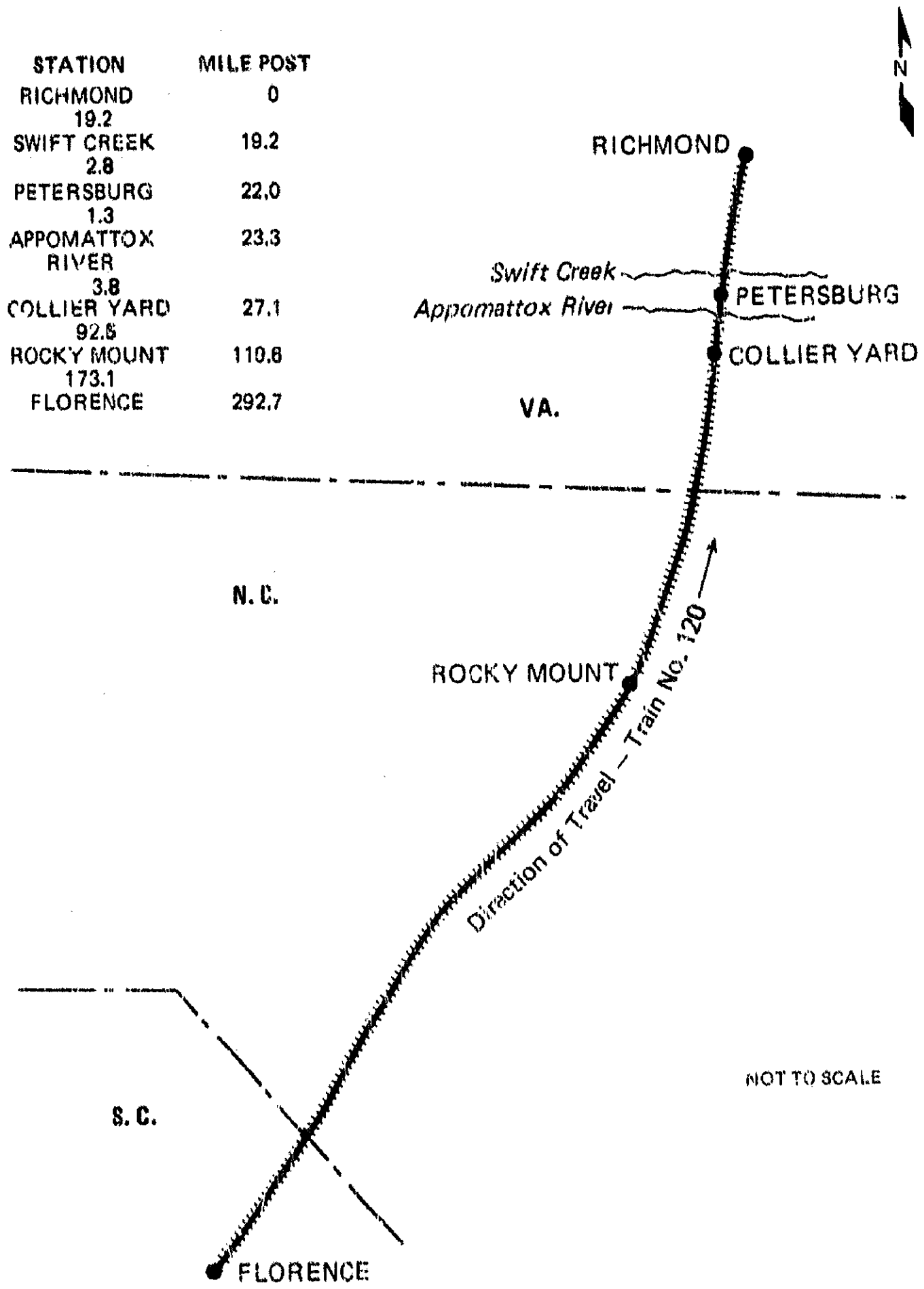


Figure 1.--Location plan.

Flammable liquid 2/ escaping through the puncture ignited immediately. Thereafter, the burning liquid flowed beneath the overturned tank car, and 30 feet to the ground underneath the bridge and east into a 100-square-foot area through which Swift Creek flowed and in which several derailed cars were located. (See figure 2.) The fire spread quickly to other cars and their contents including creosote treated crossties, the burning of which created a heavy black smoke.

The surrounding fire from GATX 27256 and the other cars, which among other things contained paper rolls, ignited the contents of car No. 97, tank car EBAX 3046, which came to rest 40 to 50 feet from the tracks with about one-third of the tank car in Swift Creek. EBAX 3046 contained a combustible liquid 3/ which was slowly released from the packing gland nut on the dome gauging device. The dome was rotated approximately 90° downward. The manway housing cover was dislodged during the derailment, and crushed stone was jammed into the manway ring.

Car No. 95, empty tank car DUPX 14672, which last carried nitrating acid, was turned over on its right side adjacent to the tracks. This car was heated by fire from adjacent cars, and produced a small vapor cloud.

Emergency Response

At 1:28 p.m., a nearby resident reported a derailment and fire to the Colonial Heights Police Department dispatcher, who notified the Colonial Heights Fire Department.

Immediately after the derailment, the brakeman and the flagman walked to the north and to the south of the train, respectively, to flag and stop trains that might be approaching. The engineer radioed the SCL's Rocky Mount Division train dispatcher at 1:35 p.m. and advised him that train No. 120 had derailed at Dunlop, Virginia, milepost 19.7 on the Collier SCL Division. The engineer reported that there was a fire and that the fire department should be notified. (Later during this initial notification, the dispatcher was advised that fire and police units had already arrived on the scene and that notification of local authorities would not be necessary.) The train dispatcher advised that he could protect both ends of the train by stopping traffic from approaching the derailment area. The dispatcher was then advised that the conductor would be providing the car numbers of the northernmost and southernmost derailed cars as soon as possible. The dispatcher relayed this information to the SCL Operations Center at Jacksonville, Florida, and notified appropriate Division response personnel.

Having heard on his radio that the dispatcher would protect train No. 120 from oncoming trains, the brakeman returned to the train, obtained his copy of the hazard graph 4/ from the engineer, and proceeded to make a walking inspection of the train. When he reached the first derailed car, he noted its number and radioed this information to the conductor. He then continued walking south along the tracks where he met a Chesterfield County Fire Department fire officer in a car at a grade crossing who drove the brakeman to the Swift Creek Bridge area. During the ride with the fire officer to the Swift Creek Bridge area, the brakeman gave the fire officer his copy of the hazard graph. The brakeman stated that when they reached a location several hundred feet north of the bridge, he saw a tank car on its side with a liquid pouring out and burning. He also saw another tank car on the bridge.

2/ Phenolic antioxidants, "ethyl" antioxidant 733 toluene 80% mixture.
3/ Organic manganese compound "ethyl" MMT/LP46.
4/ The hazard graph contains the car number, the position of the car in the consist, the hazardous material in the car, and emergency response guidelines.

DERAILMENT SEABOARD COAST LINE TRAIN NO. 120 COLONIAL HEIGHTS, VA, MAY 31, 1983

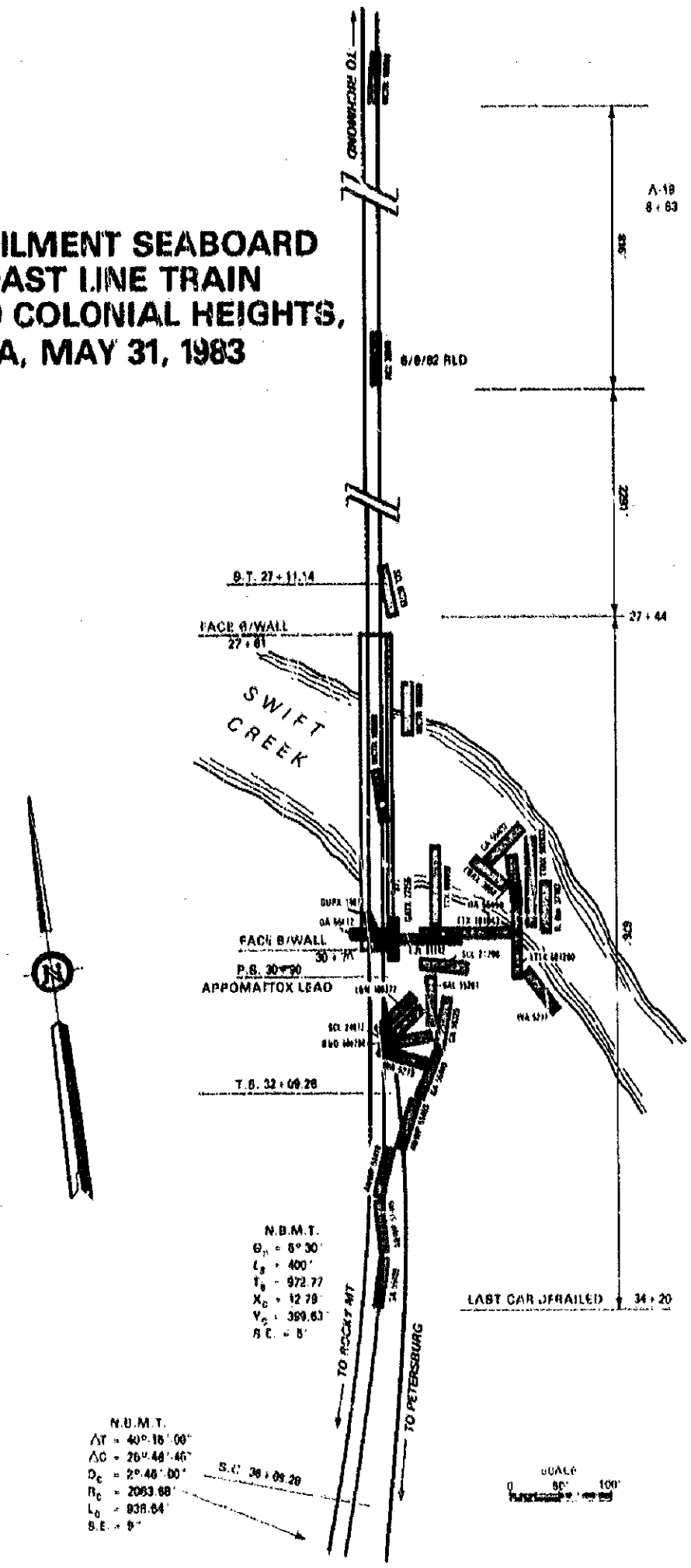


Figure 2.—Site plan.

While waiting for the brakeman to provide the identification number of the first derailed car, the conductor began reviewing the train consist, the tonnage graph, the hazard graph, and the waybills in an attempt to determine what dangerous commodities might have been involved in the derailment. Because he could see the intense fire and believed that there was a possibility of an explosion, he remained a "safe" distance from the derailed cars.

The first Colonial Heights Fire Department emergency response unit, under the command of the Assistant Fire Chief, arrived at the south end of the derailment area within minutes after being notified, and began laying hose lines from hydrants in front of the North Elementary School, located 600 feet southwest of Swift Creek Bridge. About 1:35 p.m., while setting up hose streams, the firefighters observed one tank car lying across the railroad tracks at the bridge over Swift Creek and a burning box car beside it (see figure 3). They also observed multiple fires and heard explosions. At this time, the heavy black smoke prevented the identification of other cars by persons south of the bridge (see figure 4). The conductor stated that he was surprised to see firefighters and other response units arriving on scene at this time because of the short time since the derailment. The conductor also remarked that there was much commotion created by different persons announcing their presence to him. He stated that he inquired as to "who was in charge" and was advised that "the chief of police was the man that was going to get the information."

Shortly thereafter, the Colonial Heights Emergency Services Coordinator (ESC) arrived and established a command post at the north side of the elementary school. The initial command post consisted of three emergency service cars within a roped-off area about one-quarter mile from the train caboose. Public safety officials decided that the school area should be evacuated and a security perimeter be established to keep the public out of the area. At this time, units from the Chesterfield Fire Department and the Virginia State Police began arriving at the derailment site. The school was promptly evacuated, and access to the site was controlled by local and state police, and SCL security personnel.

Meanwhile, the flagman had returned to the caboose, and he and the conductor reviewed the consist to determine which cars had derailed and what materials were involved. The conductor stated that he identified from the consist and the waybills two tank cars marked "dangerous" 5/ (GATX 27256 and DUPX 14672). Shortly before 2:00 p.m., he then walked to the command post and conveyed this information to the chief of police and gave him a copy of the two waybills; one waybill was for the empty tank car, DUPX 14672.

Shortly after 2:00 p.m., the conductor contacted the train dispatcher and provided the numbers of the northernmost and southernmost derailed cars. Following this notification, the train dispatcher obtained a copy of the train consist at the Division Office in Rocky Mount, and the SCL Operations Center at Jacksonville, Florida, attempted to reproduce a copy of the train consist from its computer system. The conductor did not advise either the train dispatcher or the SCL Operations Center that he had passed information to the local emergency response personnel at about 2:00 p.m.

5/ The word "dangerous" is required by 49 CFR §174.25 to be noted next to the car number on waybills, switching orders, and other billing for most classes of hazardous materials. This is not required for combustible liquids.

Figure 3.--Tank car on bridge.

Earlier while still reviewing the waybills, the conductor had given a police officer the hazard graph (see appendix E), which contained numbers indicating the position of the cars in the train when it arrived at Collier Yard. The police officer subsequently gave this document to the ESC about 1:45 to 1:50 p.m. The copy of the hazard graph which the head brakeman had previously given to a Chesterfield Fire Department officer was not provided to the ESC, but was taped to the side of the Fire Department's Technical Service Unit, which was near the command post.

The SCL Freight Agent from Hopewell, Virginia, arrived at the derailment site between 1:45 p.m. and 2:00 p.m. and was given copies of the train consist and two waybills for tank cars by the conductor. At 1:57 p.m., the Freight Agent gave the ESC the waybills for tank cars GATX 27256 (Flammable Liquid NOS 6/) and DUPX 14672 (Empty, last contained nitrating acid), both of which were involved in the derailment. The Freight Agent further advised that one of the two derailed tank cars was on the bridge and the other was in the water.

6/ "NOS" means not otherwise specified.

Figure 4.—Fire and smoke preventing view of derailed cars.

At 2:04 p.m., the ESC requested that the Virginia Office of Emergency Services (VOES) at Richmond be notified that a hazardous materials team was needed to aid in handling the emergency. At 2:13 p.m., the VOES verified the request by calling the Fire Department, and at 2:18 p.m., the VOES requested information about the types of materials involved. It was advised that there was an empty tank car which last contained nitrating acid and a tank car containing fuel oil additive.

Based on available information from the hazard graph, the ESC knew that anhydrous ammonia was on train No. 120, but because the numbers on the hazard graph did not accurately reflect the position of the cars, he did not know the precise location of the anhydrous ammonia. Therefore, the ESC's immediate concern was that anhydrous ammonia might be involved in the derailment and recommended that the area be evacuated. The SCL Freight Agent, having learned of the planned evacuation and of the ESC's belief that anhydrous ammonia might be in the derailment, at 2:00 p.m., was able to convince the ESC that the tank cars containing anhydrous ammonia were with the front portion of the train and were not among the derailed cars. This information did not change the ESC's decision to evacuate and, at 2:20 p.m., residents within 2,000 feet of the derailment were ordered to be evacuated.

The ESC had a copy of the Department of Transportation's (DOT) Emergency Response Guidebook. 7/ Guide 26 is applicable when "Combustible Liquid, NOS" and "Flammable Liquid, NOS" are involved, and Guide 45 is applicable when "Nitrating Acid" is involved. Both Guides recommend the wearing of self-contained breathing apparatus and full protective clothing during emergency actions.

The trainmaster, who had been notified of the derailment at 1:45 p.m., arrived on scene about 2:40 p.m. After assessing car damage at the south end of the derailment, he walked north to the engines and talked with the train crewmen and learned that two waybills had been turned over to the local fire department. The trainmaster stated that since the fire personnel were using these documents, he did not request to inspect them, but obtained other similar information. Before permitting the traincrew to depart (The traincrew left the derailment area around 4:40 p.m. with the front portion of the train, which consisted of 88 cars and 3 locomotive units.), the trainmaster asked the conductor to list the cars on the train and put the waybills in sequence, beginning with the locomotive, in order to account for the waybills in the possession of railroad personnel. The trainmaster was able to determine from the information provided to him in response to the request that the "consist list" for the train included one car which had been "set out" at Rocky Mount and that two hazardous materials waybills were at the Command Post.

Meanwhile, the train dispatcher, having obtained a copy of the train consist, identified the hazardous materials that were involved in the derailment. He relayed this information to the SCL Operations Center, which in turn passed the information on to the SCL Hazardous Materials Control Division at 2:30 p.m. However, the Operations Center log shows "that the details of the incident were very sketchy at this time. No consist was available as yet." At 2:40 p.m., SCL field hazardous materials specialists in Louisville, Kentucky, and Raleigh, North Carolina, were alerted to prepare to go to the accident scene. At 2:43 p.m., the ESC was told that a hazardous materials specialist would be at the scene in about 15 minutes.

At 2:50 p.m., SCL Hazardous Materials Control Division contacted the police dispatcher to obtain an update on activities at the scene; the police dispatcher was unable to provide any new information.

At 2:51 p.m., a SCL hazardous materials specialist in Jacksonville, Florida, called the Colonial Heights Fire Department dispatcher requesting information about the hazardous materials involved in the derailment. The dispatcher was unable to provide the desired information.

At 2:57 p.m., a VOES specialist in a vehicle specifically equipped for disaster response arrived from Richmond, Virginia. He met with the Public Safety Officials to assure that available equipment was adequate for handling the emergency. At the time of this specialist's arrival, still only one tank car had been sighted because heavy black smoke kept personnel from seeing within the perimeter of the derailment area. The specialist recommended that the firefighters attempt to extinguish the crosstie fires in order to eliminate the black smoke and consequently improve the view of the derailment on the bridge. The firefighters were successful in their efforts, and as a result were able to see the tank car on the bridge that was discharging fuel which was afire.

7/ Department of Transportation DOT-P-5800.2.

The firefighters continued to apply water to the boxcar fires. During this time, an aerial survey of the wreckage was unsuccessful in obtaining additional information as to the identity of the tank cars. Also, during this time, most arriving railroad officials entered the site from the south, along the tracks which were controlled by railroad security personnel, and did not check in at the command post.

At 3:38 p.m., a representative of the SCL in Jacksonville, Florida phoned the Colonial Heights Fire Department dispatcher and advised that he had information about the commodities involved in the derailment to pass on to persons at the accident site. He relayed that there were 29 derailed cars, including 3 tank cars. He then provided the tank car numbers and the contents of two of the tank cars, and stated that the contents of the empty tank car was unknown at that time. This information was not transmitted to the command post.

Relying on the traincrew's advice that there were only two tank cars in the wreckage, the VOES specialist and a fire officer with hose streams protecting them, climbed onto GATX 27256 and obtained its identification number. With the tank car number, they could now identify the product fueling the fire. Shortly thereafter, while accompaning several railroad personnel surveying the wreckage at the creek, the fire officer overheard the railroad personnel discussing the possibility that there might be a third tank car involved in the derailment.

About this time, the trainmaster obtained the two waybills from the Command Post, one of which was the waybill for tank car EBAX 3064. He stated that he then advised the VOES specialist that there were actually three tank cars among the derailed cars, but that he could not determine the identity of the tank cars.

Shortly thereafter, the fire officer sighted a burning tank car in Swift Creek, and so informed the VOES specialist. The specialist and a fire officer in full protective equipment entered the wreckage area to inspect and identify the third tank car. They observed that the third tank car was a "pressure car" with fire blowing from the main valve or fitting. They reported that bolts on the manway ring and the uphill end of the tank were glowing white-hot, and that the tank was heaving. The two men quickly left the wreckage fearing that the tank car might explode. At 5:27 p.m., the command post was moved and all emergency response personnel were evacuated. During this time, several firefighters and the VOES specialist collapsed from unknown causes and exhibited symptoms of respiratory problems. They were given first aid at the scene and were transported to Petersburg General Hospital. The Fire Chief, refusing to continue to expose his personnel to unknown dangers, ordered all firefighters to the command post and ceased emergency response activities.

About the same time as the command post was being moved and emergency response personnel were being evacuated, the VOES Operations Center transmitted information on the derailed cars to its emergency vehicle at the scene. This information was received from a SCL representative in Jacksonville, Florida, and was the same information which was earlier provided to the Fire Department dispatcher but which was not relayed to personnel at the derailment. Almost 4 hours had elapsed from the time of the derailment to the time personnel at the site received the information.

Meanwhile, the SCL Division Superintendent, who had arrived on scene around 4:30 p.m., had been informed by the trainmaster that "only two of the cars possibly carried materials that were considered hazardous while the third tank car involved did not contain a hazardous material."

Because the firefighting personnel had been evacuated, SCL personnel requested and were allowed to use the firefighting equipment "to control the fire and keep it from burning the under-bridge structure and possibly causing more damage to some of the cars."

At 5:40 p.m., a SCL hazardous materials control specialist from Raleigh, North Carolina, arrived at the derailment site. En route, this specialist had obtained a listing of all cars in the derailment, which he provided to the Command Post. The SCL specialist observed that the emergency response personnel, having just learned that there were three tank cars in the derailment, were concerned that contents of this third car might have been the cause of the injuries to the firefighters. The SCL specialist and the ESC discussed the information available at that time, and the Coordinator asked if it was safe to resume emergency response actions, since many of the firefighters had collapsed earlier for unknown reasons. The specialist, using full protective equipment, surveyed the derailed cars, including EBAX 3064; he reported that, except for a small flame burning from the dome, the tank car was not on fire. He then advised the Coordinator that it would be safe to fight the fire if the firefighters wore self-contained breathing apparatus.

Hospital personnel were attempting to identify precisely what chemicals might have caused injury to the firefighters and the fire officials insisted on knowing specifically the chemical composition of the products before again committing their personnel to combat the fires. With the assistance of CHEMTREC, 8/ SCL contacted the shipper of the derailed tank cars at Orangeburg, South Carolina, at 8:12 p.m., and obtained the chemical ingredients of the materials. This information was given by the SCL to the VOES Operations Center, which in turn transmitted it to the Command Post at 8:32 p.m. About 8:30 p.m., the specialist recommended to the fire department that the residents who had been evacuated earlier be allowed to return to their homes. SCL advised the VOES Operations Center at 9:15 p.m. that the shipper suggested that firefighters "fight the fire with foam and treat the fire as any other oil base fire." Specifically, the shipper advised that the escaping vapors should be allowed to burn as much as possible in order to render them harmless and to cool the tank in order to eliminate the possibility of the tank's exploding.

After 9:15 p.m., the fire at the tank car vent was allowed to burn and firefighters focused their efforts on extinguishing the fires on other rail cars. Having brought the fires under control, and having decided to allow the cars to burn themselves out, most of the firefighters left the scene about 2:00 a.m., on June 1, leaving about five firefighters and some equipment to maintain control. The fire on the tank car in the creek burned until June 7, when the tank car was pulled from the creek. Firefighters then extinguished the dome fire and stopped the leak by tightening the manway housing ring.

The ESC stated that he received pertinent information about the train derailment only from the SCL Freight Agent and the SCL's hazardous materials control specialist. The VOES specialist stated that while he had talked briefly with several SCL personnel, they had provided no substantive information about the tank cars or the hazardous materials contained in these cars. Additionally, the Fire Chief stated that SCL personnel used a SCL telephone located near the derailment all during the emergency, but that at no time did these personnel provide any information to emergency response personnel about the derailment.

8/ CHEMTREC is the acronym for Chemical Transportation Emergency Center, operated by the Chemical Manufacturers Association, which provides technical advice to emergency response personnel in cases of transportation accidents involving hazardous materials.

The conductor and the brakeman stated that prior to this accident they had not experienced a derailment involving hazardous materials. Both stated that they had expected the emergency response units to know what to do with the documents they had provided. The SCL provides no training concerning the emergency actions expected of employees in response to the timetable and train bulletin requirements.

Injuries

There were no injuries to crewmembers or other persons as a result of the derailment; however, 12 firefighters and a state emergency official collapsed while fighting the fire. At the time the firefighters and state official collapsed, hospital personnel were concerned that they had been affected by the hazardous materials involved in the accident; it was unknown at the time what chemical compounds may have been involved. The hospital personnel later determined that the firefighters and the official had collapsed from heat exhaustion.

Damage

Of the 30 cars that derailed, 13 were burned and completely destroyed, 8 were heavily damaged, 5 were moderately damaged, and 4 received minor damage. Damage was estimated as follows:

Cars	$ 636,366
Track, Cleanup and Repair	204,433
Lading	387,645
Total	$ 1,228,444

Seven highway trailers were also destroyed as a result of the accident. Foliage to the east and to the west of the track was browned from the heat of the fire.

Fire consumed most of the hazardous materials in the tank cars, and based on available information, only minor air pollution resulted from the released hazardous materials. The fire reduced the emissions to primarily CO_2 and water, with a small amount of manganese oxide released from EBAX 3064. The shipper estimated that EBAX 3064 lost approximately 2,300 pounds of product and that the small amount of manganese oxide within the released material "would not have been a health hazard to humans, animals, or plants."

On June 1, two containment booms were placed in Swift Creek 100 yards downstream of the derailment as a precaution against water contamination. On June 7, the Virginia Water Control Board (VWCB) tested the water downstream of the derailment site for contamination and evidence of fish kills. The VWCB reported that they found no evidence of damage to the environment.

Traincrew Information

The traincrew was qualified without restrictions under SCL Operating Rules. The conductor, head brakeman, and flagman were regularly assigned to work together. The engineer worked on a different rotating pool, and therefore worked with various crews. (See appendix B.)

The crewmembers had gone on duty at Rocky Mount, North Carolina, at 7:30 a.m., and had been on duty about 6 hours when the accident occurred. They had been off duty the previous day and stated that they had had sufficient rest before going on duty for train No. 120.

The conductor stated that he saw the crewmembers as they reported for duty at Rocky Mount, and he took no exception to their fitness for duty.

The engineer involved in this accident had been working as an engineer for 38 years. He qualified for the position of engineer through on-the-job training. 9/

The engineer had been disciplined in 1969, 1976, and 1977 because of coupler failures due to poor train handling. The SCL superintendent advised the Safety Board that in reviewing train separation reports of coupler failures on the Rocky Mount Division, the engineer had been disciplined four times in a 60-day period during the later part of 1981. On December 21, 1981, while handling Extra 7018 North, the engineer experienced multiple coupler knuckle failures. After it was determined that improper train handling was involved, the engineer was removed from road service. In April 1982, the engineer requested that he be allowed to return to road service. A condition for his return was that he had to attend the train dynamics analyzer (TDA) program to determine train handling problems and to improve his ability to handle road trains properly.

The TDA is built into a mobile highway van and is moved from location to location on the SCL, where classes are set up on a weekly or biweekly basis. The TDA is a mini-computer with a cathode ray tube (CRT) display. Track profile data stored on magnetic tapes are fed into the computer simultaneously with train consist data, which include locomotive power, car weight, car length, and car location. The train consist can be changed as required to simulate different types of trains and operating conditions.

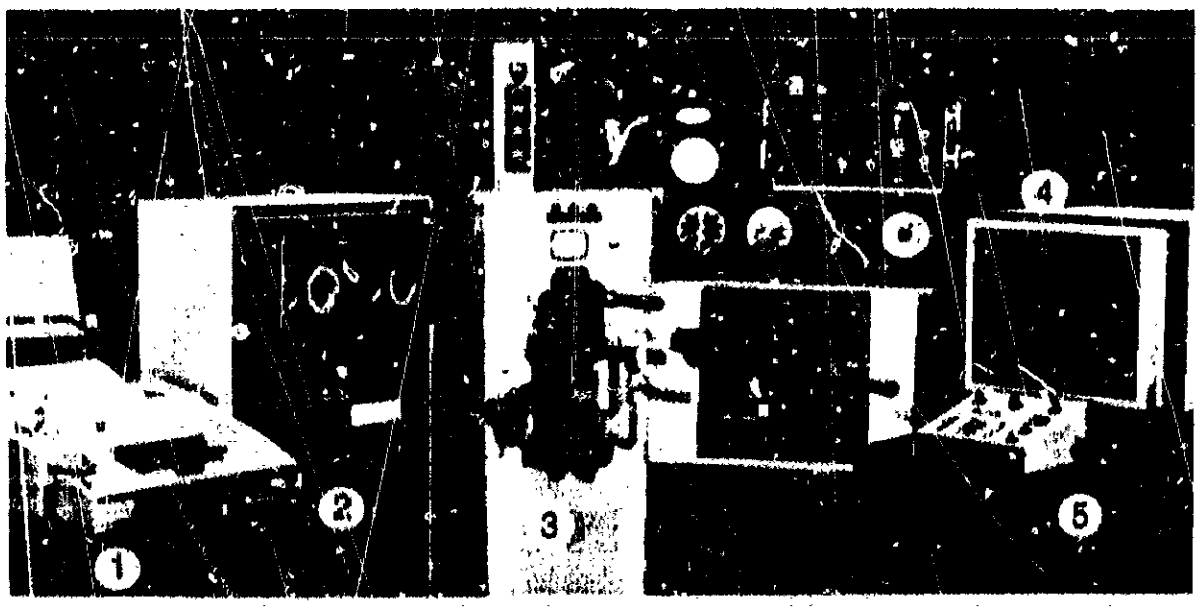
In the test, the engineer uses a standard Association of American Railroads (AAR) locomotive control stand to input variable data, such as throttle, dynamic braking, and automatic and locomotive independent brakes. (See figure 5.) The results of the engineer's inputs are displayed immediately on the CRT. (See figure 6.)

The operator sees the following on the CRT display:

- A representation of approximately 4 miles of railroad profile with curves, mileposts, and line of grade.

- The simulated movement of the train getting underway. (The train remains in a fixed location on the tube while the track profile moves under the train from right to left.)

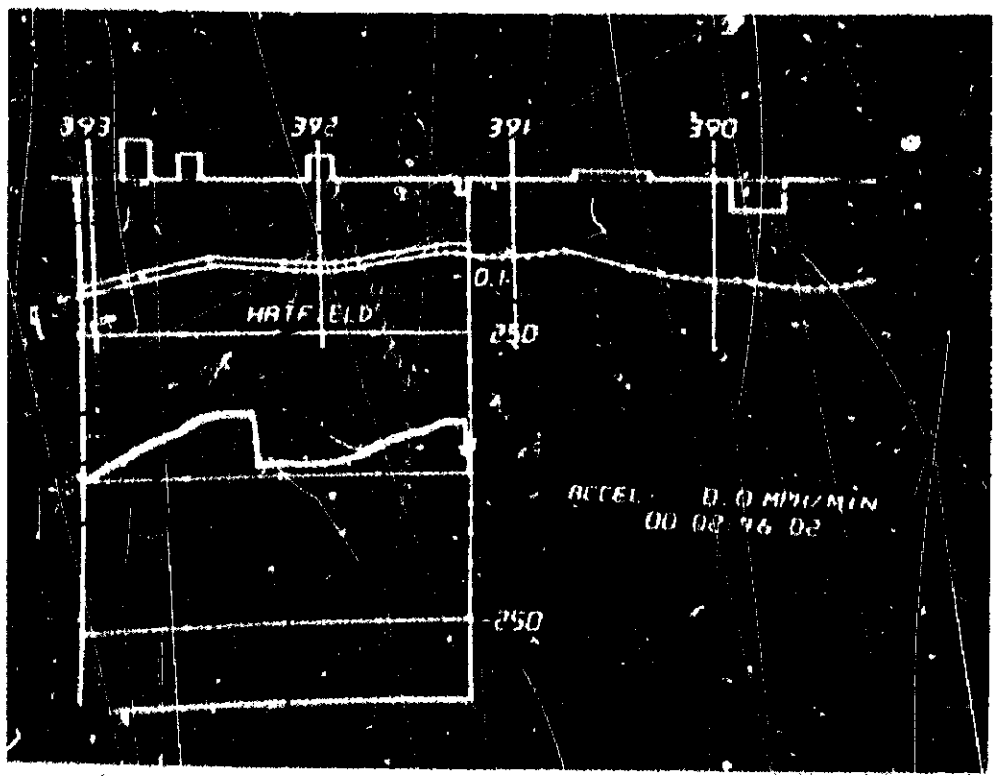
9/ The SCL instituted a formal training program for engineers about 10 years ago. Candidates are selected from the ranks of trainmen and must attend a 15-week engineer training school course which covers the subjects of diesel engines and systems, lubricating system, fuel oil systems, operation of engines, freight train handling, and passenger train handling. After successfully completing the course, the student engineer must then qualify on the division over which he will operate. After qualifying on the division, the student engineer is promoted to engineer. For engineers that have been working longer then 10 years, SCL offers a retraining class. All retraining is offered to engineers on a voluntary basis.



TDA Components and Operating Controls...

(1) Teletype prepares and reads paper tape consists, (2) Tape Deck stores digitized profile data, (3) Locomotive Controls unitized with Mini-computer, (4) Cathode Ray Tube Display, and (5) Input Unit for Variable Data.

Figure 5.—TDA with an Association of American Railroads Standard Locomotive Control Stand.



Zero force line: forces above line are tension (draft) - forces below line are compression (buff). Both are in increments of 50 K pounds with numerical display of + 250K and -- 250K.

Figure 6.—TDA Cathode display tube.

- o A graphic representation of computer calculated coupler force distribution throughout the train. Tension or draft forces are shown above a zero base line in 50,000-pound increments; buff or compression forces below the base line are also shown in 50,000-pound increments.

- o A graphic representation of computer calculated brake cylinder pressures which shows their propagation throughout the train as an air release is made.

- o A digital display of acceleration or deceleration in miles per hour/per minute.

An SCL supervisor with 39 years of railroad service, the last 12 years of which has involved the training of engineers, made the following observation about the TDA program: "I think -- now, this is just a personal opinion -- but I think the TDA is one of the best machines that we have got today to try to figure out the problems of an engineer. It's the only thing I know of today that's available to use to find such a problem. I think it's one of the best tools I know of that we can use, that we can afford at the present time. It's the first time that I know of that an engineer was able to look at a train from front to rear. I think it's a valuable training tool."

On April 15 and 16, 1982, the engineer visited the TDA van in Rocky Mount. When the engineer reported to the TDA van on April 15, he told the instructor that he needed some help in braking. According to the instructor, he had not been advised by anyone that the engineer would be reporting to the van, nor had the instructor been advised that the engineer had been removed from road service and was being required to attend the classes. The instructor worked with the engineer in the proper method of braking a train. (Because engineers can voluntarily come in and operate the TDA without having been disciplined or required to attend the TDA, the fact that the engineer came in would not have alerted the instructors to any such problems.)

Another TDA instructor also worked with the engineer during the period he attended the TDA van in Rocky Mount. Asked if he identified any problems with the engineer's train handling during that session, he replied, "No I can't identify. All I can state is the remarks he made to me after he operated the TDA machine. He realized that he had some problem with train handling. He noticed it in his operation of the TDA machine; that is, he acknowledged some of his problems himself." This instructor was also not aware that the engineer had been removed from road service and that it was a requirement that he attend the TDA sessions in order to return to road service. This instructor had been a road foreman of engines (supervisor of engineers) on the Rocky Mount Division from July 1975 through February 1980. The instructor stated that during this period, he had ridden on trains operated by the engineer and had observed the engineer having problems handling trains. He explained that the problem was, "Normal train separations. Nothing serious. Normal problems, like I say, that most engineers experienced at one time or another." The engineer had also attended a TDA session on October 1, 1981, immediately before the 60-day period when he experienced the four broken coupler knuckles and 81 days before he was removed from road service. The road foreman of engines who had taken the engineer out of road service stated that the reason for taking the engineer off the road was, "He had a lot of problems in the twelve months prior to that with his train, broken knuckles, draw bars." When asked if the engineer had problems with a specific type of train, he replied, "His problems were--each time he had

had a problem, it had been with a heavy train." The superintendent of the Rocky Mount Division who had been in that position for 14 months, stated that in those 14 months he had not known of a road foreman removing any other engineer from road service.

Train Information

When the train left Florence, South Carolina, it consisted of 2 3,600-horsepower General Motors SD-45-2 diesel electric locomotive units, 131 freight cars, and a caboose, for a total of 8,303 trailing tons. The lead locomotive unit was being operated with the short hood forward and was equipped with a functioning dual-sealed beam headlight, a speed indicator that was not operating, and an overspeed control. SCL locomotives are not equipped with speed recording devices. A radio installed in the locomotive cab enabled the engineer to communicate with the caboose, other trains, and the train dispatcher. The locomotive was equipped with 26-L brake equipment. An emergency brake valve was installed on the left side of the cab near the head brakeman's position.

When the train arrived at Rocky Mount, North Carolina, the consist of the inbound train was switched, and 57 cars that were on the original train were coupled to 129 cars in the yard. Also, another SD-45-2 locomotive unit was added to the rear of the two units.

When train No. 120 left Collier Yard, it consisted of 3 locomotive units and 128 cars. The train was 7,911 feet long and had 10,698 trailing tons.

Method of Operation

Trains are operated over the two main tracks between Collier Yard and Richmond, Virginia, by automatic wayside signals of a centralized traffic control system. Train movements are controlled by the train dispatcher in Rocky Mount, North Carolina. Trainorews are directed in their duties by the dispatcher using the radio.

Each engineer is given a tonnage graph of his train when he takes over the operation of the train (see appendix C). The tonnage graph shows the engineer the distribution of the loaded cars and the empty cars in the train.

Each engineer is also provided a SCL manual of train handling instructions and information pertaining to air brake equipment on engines and cars. The manual states, in part, "the same fundamental characteristics of the long heavy train 10/ increase the difficulty in controlling slack while running, and at the same time, combine to sharply increase the magnitude of longitudinal and lateral forces that will result if proper control is not maintained. Greater possibility of derailment and/or damage to the track, equipment or lading is the result, which possibility is in turn increased if adequate recognition is not given to the greater delay in acceleration and deceleration time, brake application and release time and brake system charge and recharge time inherent in such trains."

Crewmembers are also provided, and required to comply with, timetable instructions. The timetable indicates the maximum authorized speed of passenger trains as 79 mph, piggyback trains as 70 mph, unrestricted trains as 60 mph, and restricted trains as 50 mph. The operating rules of the SCL defines a restricted freight train as "a train handling blocks of thirty or more cars of coal, phosphate, aggregates, (including limerock, sand, etc.) which must be handled next behind the engines, whenever practicable; or one

10/ A train weighing 10,000 tons or greater and exceeding 100 cars in length.

or more restricted cars or loads and must be operated at designated speed." The timetable defines restricted cars and trains. (See appendix D.) Train No. 120 was a restricted train as indicated by the timetable.

SCL's Timetable No. 6, effective October 25, 1981, was applicable to the operations at the time of this accident. According to this timetable, traincrews are required, among other duties, to ascertain that appropriate placards are in place on both sides and ends of cars. In addition, the timetable provides that in an emergency involving hazardous materials and "IF IT IS SAFE TO DO SO," personnel at the scene are to take as soon as possible, among others, the following actions:

1. Survey the scene and adjacent area, determine conditions, and notify, by the quickest means available, the appropriate authority.

2 Protect life and property. This phase may require evacuation of people from the area, fire fighting, and the removal of cars or containers and contents. The course of action to be taken depends on conditions and the hazardous materials involved as identified from the waybills or other documents which the conductor must keep in his possession for ready reference. Steps to be taken are as follows:

- o Identify cars/trailers containing hazardous materials (all placarded cars) involved in the accident, or in the immediate area, and determine their condition.

- o Identify contents and "hazard class" of all cars or containers involved from the shipping papers or waybills.

- o Notify dispatcher or appropriate authority as soon as possible of contents of cars or containers involved in the incident and their condition--fuming, leaking, burning, etc.

- o ...review the characteristics of the hazard class of the material and advise emergeny personnel of the hazards and recommended emergency actions to be followed. If emergency personnel are not available, follow recommended action to save lives and to protect the environment.

- o If a car, trailer, or container is involved in a fire and is placarded and if any hazardous materials are burning or their contents or car is involved in a fire, all persons should be kept out of the area and contact with fumes or smoke avoided.

Additionally, on February 24, 1982, the Superintendent issued Train Bulletin No. RM-13, which assigned conductors the responsibility for assuring that "proper action has been taken to insure public safety, protect property, and look after the Company's best interests" in the event of a derailment. This Bulletin identified information to be obtained and transmitted to the Chief Dispatcher by the quickest means available, including, among the items, the following:

- The number and position of locomotives and/or cars derailed.
- Cars in train and location in train of derailed cars.
- Contents of derailed cars, including STCC 11/ and UN 12/ identification numbers of any hazardous materials, and whether or not there is any evidence of leaking or loss of materials.

If the derailment involves spillage, loss of hazardous materials, or fire, the Bulletin also made the conductor responsible for notifying or requesting that the chief train dispatcher notify the nearest available emergency response agency. Upon arrival of the response group, the conductor was required by the Bulletin to identify himself and furnish information from waybills and the train consist about the hazardous materials contained in the derailed cars.

Track Information

The track structure in the vicinity of the derailment site consists of two main tracks on a fill section, including a five span ballast deck bridge traversing Swift Creek. The two tracks are laid at 15-foot 0-inch centers, on a compacted fill subsoil, upon which is a compacted crushed #4 granite ballast section. The ballast section extends 12 inches below the bottom of the crossties, and the tie cribs are full and compacted. The ballast shoulder is full and extends 12 inches and more outward from the crosstie ends. The crossties are treated hardwood, measuring 7 inches by 9 inches, by 8 feet 6 inches and are laid at 19 1/2-inch intervals. The tie plates measure 7 3/4 inches by 14 inches and are double shouldered. In the vicinity of the derailment, the spiking pattern, per tie plate, consists of two rail holding spikes on the gage side of the rail, one rail holding spike on the field side of the rail, one plate holding spike on the gage side of the rail, and one plate holding spike on the field side of the rail. The spikes are five-eighths of an inch by 6 inches. Base grip-type rail anchors are applied to the rail at each side of each crosstie, exclusive of the turnouts. The rail is 132-lb RE section continuous welded rail (CWR), exclusive of bolted components within the turnouts, such as the frog, closure rails, and switchpoints.

The track is maintained as Class 4 within the Federal Railroad Administration (FRA) Track Safety Standards. A permanent 60-mph speed restriction is in effect at the Swift Creek location.

The two tracks are on a descending grade for about 6 miles approaching the derailment site from the south. The grade descends at about 1/2 percent to a point about 670 feet north of the bridge. Approaching from the north, the tracks proceed through a 2° 45' left hand curve, about 939 feet long. A 400-foot-long exit spiral is at the north end of the curve. Superelevation measures 5 inches in the curve, uniformly decreasing through the spiral to the tangent as per design. The point of tangency is about 139 feet south of the south backwall of the bridge. A No. 10 switch is located south of the bridge, the point of switch being 20 feet south of the backwall. The point of frog is about 78 feet 9 inches south of the point of switch. The frog is a rail bound manganese type, 18 feet 9 inches long. The left-hand turnout is of 132-lb bolted construction, and is the lead to the north leg of a wye track. The tangent track is about 498 feet long, proceeding

11/ Standard Transportation Commodity Code (STCC) numbers are seven digit numbers defining a specific hazardous material as indexed in the Association of American Railroads Standard Transportation Commodity Code of Hazardous Materials.
12/ A four digit identification number, an international coding system for hazardous materials.

into an entry spiral to the left at a point about 50 feet north of the north backwall of the bridge. The entry spiral is about 120 feet long, proceeding into a left-hand 1°00' curve, about 333 feet long. The superelevation in the curve is 1 1/2 inches. The tracks proceed through an exit spiral about 120 feet long and then through about 234 feet of tangent track. At that point, another 120-foot-long entry spiral begins, leading into a 1° right-hand curve, about 230 feet long, with 1 1/2 inches of elevation, with an exit spiral of 120 feet. The tracks continue tangent beyond where train No. 120 came to rest after the accident.

The bridge, track structure, and alignment in the derailment area are part of a new construction project completed in June 1981.

Investigation of the track structure within the derailment site indicated that the first set of markings (southernmost) occurred about 315 feet south of the point of switch leading to the north leg of the wye track, approximately at the midpoint of the exit spiral of the 2°45' curve. Rail superelevation at this point was about 2 1/2 inches, and head wear was negligible. The markings proceeded downward from the gage corner of the east rail of the main track to the bottom corner of the rail head for about 6 inches. Crossties at this location did not exhibit any defects as determined by the FRA Track Safety Standards, but did exhibit wheel flange marks near and inside of the tieplates for the west rail. Track spikes on crossties at this location were found to be elevated on the gage side of the east rail and bent over outwardly on the field side. Wheel marks were found in the gage side rail web from this location up to the frog of the turnout. The rails exhibited several fractures, none of which displayed evidence of preexisting defects. All but approximately 7 feet of the east rail was discovered. The fracture face abutting the missing rail also did not display any evidence of preexisting defects or batterment. The frog was found displaced approximately 25 feet north of its installed location and lying just west of the west main track. The closure rails and switchpoints were attached and extended over onto the west main track. The legs of the frog were spread and were severely battered. The turnout side (eastside) guardrail was bent to a 45° angle. The normal side (westside) guardrail displayed wheel flange markings at its base. At this location, the west rail of the east main track was displaced to the west and displayed wheel flange marks in the gage side web of the rail for approximately one-half mile proceeding north. The east rail was displaced to the east, and was off the bridge deck towards the north.

Rails recovered from the wye track at the derailment site displayed impact marks on the west side of the west rail and were bowed and displaced eastwardly.

Following the derailment, the SCL Engineering Department measured the distance that the locomotive traveled when the train brakes went into emergency as 3,503 feet, a distance of 1,529 feet north of milepost 18.

Meteorological Information

At 12:54 p.m., the National Weather Service Office at Richmond, Virginia, which was approximately 19 miles north of the accident site, reported that it was partly cloudy, the winds were from the northwest at 4.3 mph, the temperature was 88° F, and visibility was 8 miles. Rain began at 8:26 p.m. and ended at 10:35 p.m., resulting in 1.34 inches of accumulation.

Tests and Research

Tests using the train operations simulator (TOS) were conducted based on the data of train No. 120 and the track profile of the accident area. The (TOS) is a computer model developed under the Track-Train Dynamics Research Program at the Association of American Railroads (AAR) Technical Center in Chicago, Illinois. It simulates the performance of a train composed of diesel-electric locomotives and freight cars. The purpose of the program as stated by the AAR is to allow users to determine longitudinal coupler forces and L/V 13/ ratios, to investigate accidents with respect to train handling and forces, and to check out potential consists and track layouts to insure that excessive forces will not occur. A validation of the TOS computer program was conducted by the AAR, and in its report R-335 dated November 1978, the AAR made the following conclusion: "The TOS shows reasonable agreement with test data when speed-time and longitudinal coupler forces are compared. Speed agreement is normally within 2 mph except under heavy braking to a stop in which case the discrepancy may grow somewhat at speeds of less than 10 mph."

TOS test No. 1 began with the locomotive at milepost 25.2 and the train traveling at 10 mph. The throttle was advanced one notch at a time at intervals of two-tenths of a mile until reaching throttle power position. The throttle remained in that position for the duration of the test. The maximum speed obtained as the train descended was 65 mph. As the head end of the train began to ascend, the train speed was 64 mph at milepost 18.3. Based on calculations of the length of the train, the locomotive should have been at milepost 18.3 when the derailment occurred at milepost 19.3.

TOS test No. 2 was conducted based on information furnished by the engineer. The test began with the locomotive at milepost 25.2 and the train traveling at 10 mph. The throttle began in position No. 2 and was advanced at intervals of two-tenths of a mile until reaching position No. 8, at which time the locomotive was at milepost 24.2. At milepost 22.7, the throttle was reduced at intervals of one-tenth of a mile until reaching power position No. 2 at milepost 22.2. At milepost 18.3, the throttle was advanced to position No. 5, and at milepost 18.1, the throttle was reduced to position No. 2. The speed of the train at milepost 18.3 was 54 mph. During this test, no excessive force occurred on the train.

TOS test No. 3 began with the locomotive at milepost 23.2 and the train traveling at 59 mph with the throttle in position No. 8. At milepost 18.9, the throttle was reduced to the No. 2 position, and at milepost 18.7, the throttle was advanced to the No. 5 position. The speed of the train at milepost 18.3 was 64 mph. At milepost 18.4, the train speed was 64 mph, and a shock wave of 239,000 lbs of buff forces occurred at the No. 83 car in the train and traveled back through the train.

In tests No. 4 and No. 5, the TOS was used to simulate the stopping distance of the head portion of the train following the derailment. In test No. 4, the locomotive with the 89 head cars was placed at milepost 18.3 traveling at a speed of 54 mph, the speed developed from test No. 2. An undesired emergency brake application from car No. 89 was simulated. The train stopped 544 feet north of milepost 18. In test No. 5, the locomotive was placed at milepost 18.3 with the train traveling at 64 mph. An undesired emergency brake application from the rear car was simulated. The locomotive stopped 1,559 feet north of milepost 18.

13/ L/V ratio is the ratio of the lateral force to the vertical force of a car or locomotive wheel on a rail. It is an important indicator of wheel climb, rail turn over and/or derailments.

History of the Hazardous Materials Shipments

The derailed cut of 29 cars on train No. 120 contained three hazardous materials tank cars (Nos. 96, 97, and 98), which were prepared for shipment by Ethyl Corporation, Orangeburg, South Carolina, on or about May 28, 1982. Two of the tank cars (GATX 27256 and EBAX 3064, No. 96 and No. 97, respectively) contained petroleum base additives. The "empty car" (DUPX 14672, No. 98) contained approximately 50 gallons of a nitrating acid. On May 29, 1982, SCL prepared waybills. a train consist, and emergency handling instructions to accompany the shipment.

GATX 27256 (Car No. 96).--Ethyl Corporation loaded tank car GATX 27256 (a Department of Transportation (DOT) 103A100 with Type E couplers) with 77,200 lbs (approximately 10,000 gallons) of a phenolic antioxidant, "Ethyl" Antioxidant 733 Toluene 80% mixture. Ethyl Corporation furnished SCL a certified bill of lading, No. 5559-10, which described the commodity as a "RQ Flammable Liquid, NOS, (Toluene) (Phenol) UN 1993, Placarded Flammable (Gasoline or Fuel Oil Additives containing less than 50% by weight of petroleum)."

SCL prepared waybill No. 803258 to accompany GATX 27256 and provided carrier routing of the tank car to its destination at Edison, New Jersey. In preparing the waybill, SCL incorrectly listed the shipper's description of the commodity by omitting the "RQ" designator for hazardous substances, and omitting "(Toluene) (Phenol)." SCL added the required "Dangerous" placard endorsement, 14/ which indicated that special handling was required, and assigned STCC 4910535 to the shipment. The crewmen on train No. 120 were provided, in addition to the waybills, a train consist and an emergency guide reflecting the above STCC and "Dangerous" endorsement.

EBAX 3064 (Car No. 97).-- Ethyl Corporation loaded tank car EBAX 3064 (a DOT 105A300W) with 24,600 lbs (approximately 3,000 gallons) of an organic manganese compound, "Ethyl" MMT/LP46. Ethyl Corporation furnished SCL a certified bill of lading, No. 19615/51, which described the commodity as a "Combustible Liquid, NOS, NA 1993, Placarded Combustible (Petroleum Oil, NOI)."

SCL prepared waybill No. 803259 to accompany EBAX 3064. This waybill provided carrier routing of EBAX 3064 to its destination at Pointe Aux Trembles, PQ Canada, and identified the commodity as "Petroleum Oil, NOS, Combustible Liquid, 1270, Interstate Shipment Placarded Combustible in Bulk." The waybill also assigned the commodity STCC 4915245. Since this material was a combustible liquid, the waybill did not require a "Dangerous" placard endorsement or special handling.

SCL changed the shipper's primary description from "Combustible Liquid, NOS" to "Petroleum Oil, NOS," provided a different North American identification number, and assigned a STCC which reflected the altered shipping description. The AAR/SCL emergency guides for "Combustible Liquids, NOS, 1993" and "Petroleum Oil, NOS NA 1270" provide much of the same information to firefighters about hazards and emergency actions; however, these guides differ markedly with respect to the use of solid water streams, the types of foam extinguishment to use on fires, the need to avoid bodily contact with the material, and the necessity for the use of full protective clothing and self-contained breathing apparatus. The guide for "Combustible Liquid, NOS" indicated a greater need for caution and recommended the use of more protective equipment for firefighters, than did the guide for "Petroleum Oil, NOS, NA 1270."

14/ As stipulated under 49 CFR Sections 174.83 through 174.93.

DUPX 14672 (Car No. 98).-- Ethyl Corporation used the "return empty bill of lading" provided by the original shipper of this car, E.I duPont de Nemours DUPX 14672 (a DOT 111A100W2 tank car converted from a ICC 112A400W with shelf couplers). This bill of lading described the shipment as "Empty, last contained RQ Nitrating Acid, Oxidizer, NA 1796, Mixed Acid (Car not washed, Returning to Shipper)." Ethyl determined that the remaining contents in DUPX 14672 weighed 600 lbs (about 50 gallons).

SCL prepared waybill No. 621144 to accompany DUPX 14672 to its destination at Gibbstown, New Jersey. The waybill identified the commodity as, "Empty Tank Car, Last Contained RQ Nitrating Acid, Oxidizer NA 1796 Mixed Acid." The waybill identified the commodity as "Dangerous," but was not endorsed in the upper left corner as requiring special handling. Since DUPX 14672 was designated "empty," no STCC was assigned. The SCL's guide information is computer-generated, based upon the assigned STCC identification number. Consequently, the hazard graph contained no emergency response guidance fpr DUPX 14672.

State Emergency Plan

The Commonwealth of Virginia Emergency Services and Disaster Law of 1973, codified at Va. Code §44-146.13 et seq., created a State Office of Emergency Services, which authorized the creation of local organizations for emergency services in the State's political subdivisions to provide for the rendering of mutual aid. The law conferred upon the Governor and upon the governing bodies of the State's political subdivisions specific emergency powers to effectively prepare for and use resources and facilities for handling disasters.

The Office of Emergency Services is charged with performing a variety of functions to assist the State's political subdivisions in their preparations for handling disasters and emergencies involving release of hazardous materials.

The individual political subdivisions of the State have the responsibility for local disaster preparedness and for the coordination of the local response actions. To carry out this mandate, each political subdivision is required to have a director of emergency services, who has the authority to appoint an Emergency Services Coordinator.

During the emergency response activities for this accident, the Office of Emergency Services provided communication support and dispatched a hazardous materials specialist to the accident site. Also, a police officer was designated as the ESC; however, the Colonial Heights emergency plan does not establish a procedure to assure that the ESC receives from participating agencies all information relevant to the emergency sufficient to assess the adequacy of ongoing activities. For example, in this accident, the ESC was not informed when railroad or specialist personnel arrived, and he did not receive information regarding the discovery of the third tank car or the second hazard graph.

SCL Emergency Procedures

In April 1982, the Family Lines Rail System 15/ established an organizational structure, procedures, and training to create Initial Survey Teams (IST) to "...provide a survey and assessment of conditions and problems resulting from transportation incidents involving hazardous materials for the purpose of developing accurate information for

15/ Family Lines Rail System, Hazardous Materials Initial Survey Team Procedures Manual, p. 1, April 1982.

establishment of mitigation procedures." 16/ Under the plan, two or three persons, with alternates, located throughout the rail system, who, on a collateral duty basis, are on 24-hour standby for dispatch to the scene of a hazardous materials incident occuring on company trackage. Qualifications for assignment on a team are: supervisory status within the company's transportation, mechanical, or engineering departments; at least 5 years of experience which must include derailment activities; and completion of an 8-hour training course in the familiarization and use of the assigned protective equipment. Once on-scene, the team function is to, ". . .safely survey the problem and report the survey results to the superintendent." The survey consists of noting the rail car numbers, the position and condition of the cars, the amount of chemical(s) spillage, if any, the direction of flow, evidence of vapor leaks, and any other unsafe conditions. Surveys are not to be performed if smoke, fire, or toxic gas clouds are present at the scene of the accident.

It is implicit throughout the IST Manual that the information gained from this effort is to be used only by railroad personnel who are in decisionmaking positions. The only mention in the manual of IST coordination with local emergency response officials is that the latter may provide, ". . .extremely valuable information about the problem." There is an underlying assumption that local response groups will be on-scene prior to the arrival of team members and be actively involved in some phase of their own size-up of the incident.

ANALYSIS

The Accident

The crewmembers of train No. 120 were properly qualified for their respective positions in accordance with SCL requirements, although the engineer had a history of having had difficulty with some aspects of train handling. Postaccident inspection of the rail disclosed no evidence of preexisting defects which would have contributed to the accident. Postaccident inspection of the locomotives and cars disclosed no mechanical defects which would have contributed to the accident.

The actual stopping distance of the locomotive and 89 head cars following the derailment and separation was 3,503 feet. A test at a speed of 54 mph (TOS test No. 2), involving a simulation conducted to match the statement of the engineer, indicated the train would have stopped 544 feet north of milepost 18, a total stopping distance of 2,518 feet, or 985 feet short of the actual stopping point. A test with the train traveling at 64 mph (TOS test No. 3) indicated the train would have stopped in 3,533 feet, or 30 feet from the actual stopping point.

Although the engineer regularly handled trains and was aware that train No. 120 was a restricted speed train, and despite the fact he had handled trains sufficiently to have been able to estimate train speed with good accuracy, he might have allowed the train to attain speeds greater than the authorized speed of 50 mph because the speedometer on the locomotive was inoperative.

The engineer stated that he reduced the throttle from the No. 8 position to the No. 2 position, probably immediately after the rear-end crew reported that the slack had run in. If he had then increased the throttle from the No. 2 to the No. 5 positon as the train began to ascend, a shock wave would have traveled through the rear of the train.

16/ SCL is one of six railroads that comprises the Family Lines Rail System, which is a unit of the CSX Corporation.

Such a shock wave occurred in TOS test No. 3 when the train was traveling at 64 mph; however, one did not occur when the train was traveling at 54 mph during TOS test No. 2. Based on the results of the TOS tests and on the actual stopping distance of the locomotive, the Safety Board concludes that train No. 120 was traveling about 64 mph at the time of the derailment.

Because the derailment initially occurred in the exit spiral of a curve, the reaction to the resultant combined force of the train's overspeed and the longitudinal compressive force of the slack run-in shock wave would have been at the wheel flange-to-rail interface on the outside rail of the curve. When there is excessive lateral force, a wheel has a tendency to climb the rail. The vertical force resisting the lifting component of the turning moment of the lateral force is determined by the vertical load, or weight, of the car. Car No. 95 was a tank car which was 38 feet long and weighed only 73,1000 lbs. A shock wave of 239,000 lbs (TOS test No. 3) would have created the necessary lateral force on the rail to cause wheel lift and to raise this light tank car. Because this tank car left the track structure near the switch, before reaching the bridge, it would appear that this was the first car to derail. The tank car tore out the switch and guard rail, turning the rail ahead of it and pulling the cars ahead of it off the track. When the derailed car struck the frog in the turnout south of the bridge, the other rail was rolled and displaced.

The southernmost derailment marks, about midpoint in the exit spiral south of the switch, the displacement of the fastener (spike) at that location, and the tangential deviation of the derailed equipment from that location, indicate lateral displacement of the high rail in the exit spiral. Since track structure had been newly reconstructed 1 year before the accident, it is not likely that the rail was displaced by loads within normal design parameters. Rather, it is likely that the rail was subjected to excessive lateral thrust for a short period. Had this been a sustained excessive lateral thrust, it would likely have manifested itself in the body of the full curve, rather than in the exit spiral. Excessive lateral thrust of short duration is critical when it occurs at or near a lightweight car, thus creating a potential for wheel lift. Wheel lift is accompanied by an unloading of vertical force, resulting in irregular lateral loads on the track structure.

Approximately a 7-foot section of rail which had laid about 210 feet north of the first derailment marks from the accident site was never recovered. The fracture faces of the rail ends abutting both ends of the missing rail did not display any evidence of preexisting defects, and were typical of overstress type fractures. Neither of the abutting fracture faces showed any evidence of batterment, also indicating that the fractures occurred after wheel-to-rail interface. Based on this evidence and on the fact that the track structure had been newly reconstructed 1 year before, the Safety Board concludes that there were no preexisting defects on this section of rail that would have contributed to the accident.

Engineer Training

The engineer had a history of poor train handling, and supervisory personnel were aware of the engineer's problem. The engineer's immediate supervisor, the road foreman of engines, had suggested that the engineer attend a TDA class in October 1981. During a 60-day period following the TDA session, the engineer had four train separations due to his poor train handling. The SCL superintendent took the engineer out of road service in December 1981. As a condition for his return to road service, the engineer was required to attend a 2-day session on the TDA on April 15 and 16, 1982. SCL supervision did not inform the instructors in the TDA program of the engineer's problems, and therefore the TDA instructors were not aware that the engineer had been removed from road service.

The engineer apparently was not completely aware of his problem, since he told the instructor that he needed help with braking. The Safety Board believes that SCL supervision should have taken a more active role in assisting the engineer in identifying and correcting his train handling problems. SCL should have informed the instructors in the TDA program about the engineer's problems and should have monitored the engineer's performance after his training.

SCL established a comprehensive formal training program in 1973 to qualify engineers. However, engineers promoted prior to the establishment of the training school are only given retraining on a voluntary basis. According to the SCL engineer training officer, the TDA is the best equipment available today to evaluate the problems of an engineer in train handling. The Safety Board believes that the SCL is not using the TDA equipment to its fullest potential, and that engineers who have train handling problems should be required to attend the TDA classes.

Initial SCL Emergency Response Actions

Throughout a hazardous materials emergency, and especially during the early minutes, it is essential that to the fullest extent possible, accurate and complete information be provided to emergency response personnel about the hazardous materials which present a threat to the safety of the public and the responding personnel. How quickly this information is provided to the appropriate personnel often determines the magnitude and duration of these incidents. The prompt transfer of accurate information is one task which the Safety Board has observed repeatedly as being the main impediment to an efficient and coordinated response to a transportation accident involving hazardous materials. The inaccurate information provided to the emergency response personnel during the early stages of this accident caused the firefighters to misdirect their actions, and as a result, they were exposed to potential harm from the third tank car of which they were unaware.

Immediately following an accident, the conductor is responsible for obtaining and providing emergency response personnel information about the train and its contents. The conductor in this accident correctly identified the number of cars involved in the derailment, but failed to identify correctly the derailed tank cars that were transporting hazardous materials. According to Train Bulletin RM-13, the conductor should have searched the train documents for cars with STCC and UN identification numbers. Instead, the conductor searched for cars with a "dangerous" endorsement, identifying one loaded and one "empty" tank car; a second loaded tank car was not identified because it did not require the "dangerous" endorsement to highlight the need for special handling during switching and transportation. The conductor and the flagman, who assisted the conductor, did not follow the company prescribed procedures for identifying cars transporting hazardous materials.

The conductor provided the emergency response personnel a copy of the hazard graph and, through the SCL Freight Agent, provided the waybills for two tank cars. The conductor did not provide further assistance because he believed that the emergency response personnel knew what to do with the documents. This action was contrary to the direction provided in Train Bulletin No. RM-13, which requires that the information from waybills and train consists be provided, rather than the documents themselves. The Safety Board believes that traincrews should be trained for and be required to interpret the operating documents and advise emergency response personnel about the numbers and types of cars transporting hazardous materials, the specific hazardous materials transported and contained within the damaged cars, and to provide guidance from the documents which accompany the shipments of hazardous materials. Emergency response

personnel throughout the Nation cannot be expected to be familiar with the variety of nonstandard specialized operating documents that railroads have developed for internal use.

In this accident, other SCL personnel should have reviewed the information the conductor provided to the emergency response personnel. If they had done so, they would have discovered that it was inaccurate. The freight agent, who should know what actions to take during an emergency and know how to identify from the consist and the hazard graph those cars transporting hazardous materials, did not question the conductor about the adequacy or accuracy of the information provided to the emergency response personnel, nor did he independently review the available documents to assure that the information provided was correct. The trainmaster, who arrived on scene about 2:40 p.m., also did not review the information provided by the conductor. He was aware that train documents had been provided to the Command Post, but until 5:30 p.m., he took no action to review the consist or waybills for the purpose of verifying the accuracy of the information provided by the conductor. When he did review the documents at 5:30, he discovered that there were three tank cars involved in the derailment. The superintendent, who arrived about 4:30 p.m., was advised by the trainmaster that "only two cars possibly carried materials that were considered hazardous." He also did not review the consist waybills or hazard graph to ascertain the accuracy of the information provided, nor did he inquire to determine if others had verified the information. The SCL Operations Center was advised by the Chief Dispatcher at Rocky Mount of the cars that had derailed and that a copy of the consist was available at Rocky Mount. Even though this information was available to the SCL Operations Center about 2:30 p.m., a delay was experienced in the Center's obtaining a computer-generated consist of the train. Despite this delay, the Operations Center did not again contact the Chief Dispatcher to obtain information from the consist available at Rocky Mount. The Chief Dispatcher could have identified the derailed cars which were transporting hazardous materials.

Even though traincrews may be instructed properly and trained about actions to take during emergencies, a carrier should recognize that employees often do not adequately perform all actions expected of them during emergency situations. The Safety Board believes that the SCL, through its supervisory and management employees, should provide support for traincrew actions immediately after an accident by requiring its dispatchers to verify that traincrews have taken the required emergency actions and by requiring that first-arriving supervisory personnel review the actions taken by traincrews in order to determine that accurate and sufficient information has been provided to emergency response personnel about any hazardous materials being transported in cars that have been damaged or are derailed.

Initial Survey Teams (IST)

In implementing the IST procedures, SCL management should recognize that local response groups almost always perceive the arrival of equipped, rapid deployment company officials as a source of "expert advice" whose expertise and training will be immediately available to mitigate the harmful effects of an accident. It is clear from the IST Manual that initial survey team members are neither experts in the handling of hazardous materials nor available to local response groups for advice. In view of this wide discrepancy between what local emergency groups expect and the current actual functions of the initial survey team's deployment, Company management should emphasize in its IST training the need for team members to identify the purpose of their onscene activities to local response agencies and to inform them that advice based on the information gained from the survey will be forthcoming from other company officials.

The National Transportation Safety Board has investigated several accidents during the past 10 years in which serious shortcomings were noted in the procedures used by railroad operating personnel during the emergency response. Little or no action has been taken by the railroads to overcome these problems, and the situation remains much as it did when the Safety Board undertook a Special Study (Special Study--Railroad Emergency Procedures, NTSB-RSS-80-1) to document the reasons for these procedural shortcomings.

The Safety Board made the following recommendations to the Federal Railroad Administration on January 18, 1980:

> Develop and validate through simulated disaster exercises a model emergency response plan for the guidance of the railroad industry in formulating individual plans to be utilized by their train crewmembers in the event of emergency. (R-80-6)
>
> Require operating railroads to develop emergency response plans, put them into effect and file those plans with the Federal Railroad Administration in a similar manner as is required by 49 CFR 217 with respect to operating rules. (R-80-7)

After the original letter of recommendation to the FRA and several followup letters, the Safety Board in its letter of May 26, 1981, noted, "The letter of November 14, 1980, is the most recent written position of the FRA on Safety Recommendations R-80-6 and R-80-7. It does not indicate an intent to implement these recommendations, and, therefore, until receipt of the information requested, they will be held in an 'Open--Unacceptable Action' status." These recommendations are still in an "Open--Unacceptable Action" status pending receipt of information that the FRA is developing such guidance. The Safety Board is concerned that response to rail accidents involving hazardous materials continues to be characterized by uncertainty among carrier and public officials over: (1) what information is available at the scene regarding hazardous materials involved and guidance for emergency response, (2) who has the responsibility to provide and interpret this information, (3) when does the local community's responsibility for providing assistance end, and (4) where is this responsibility outlined.

Hazardous Materials Information

The use of other than the shipper-provided descriptions of hazardous materials for tank cars EBAX 3064 and GATY 27256 by the SCL in documentation resulted in inappropriate emergency information being incorporated into its hazard graph. The Safety Board previously has identified problems during emergency response actions created by carriers using other than shipper-provided descriptions of hazardous materials. 17/ The Safety Board recognizes that shipper-provided descriptions can be in error; however, the Safety Board believes that a shipper's description of a hazardous material should be used by carriers unless a change is made in consultation with the person(s) who first classified the materials. This course of action should result in the least risk of improperly listing the classification and material descriptions in the carriers documents and also should provide reasonable assurance to emergency response personnel that information about hazardous materials provided by carrier personnel addresses the materials which actually may be involved at the scenes of accidents.

17/ National Transportation Safety Board's Railroad Accident Report, "Derailment of Southern Pacific Transportation Company Train No. 01-BSMFF-05, Carrying Radioactive Material, at Thermal, California, January 7, 1982 (NTSB-RAR-83-1).

Because the SCL provides guidance only for cars identified with STCC numbers and because tank cars like DUPX 14672 which are considered to be "empty" do not receive STCC numbers, emergency guidance for the hazardous material remaining in the DUPX 14672 tank car was not provided. The Safety Board has previously identifed problems experienced by emergency response personnel when tank cars with residual quantities of hazardous materials are placarded as "empty." 18/ As a result of its investigation of the May 22, 1981, derailment which involved tank cars that had not been completely unloaded and had been placarded as "empty," the Safety Board made the following recommendations to the Materials Transportation Bureau (MTB):

> Amend 49 CFR 171.8 to define in specific quantities the maximum quantity of a hazardous material that may be moved in a tank car placarded under 49 CFR 172.525 and offered for transportation by a shippe as an "Empty" tank car under DOT regulations. (R-81-097)
>
> Amend 49 CFR 174.25(c) to require that shippers show on shipping papers the approximate weight of a hazardous material contained in a tank car offered by the shipper to a carrier as an "Empty" tank car for movement under Rule 35 of the Uniform Freight Classification Tariff. (R-81-098)

On July 23, 1981, the MTB published its Advance Notice of Proposed Rulemaking; "Placarding of Empty Cars," Docket No. HM-180, in response to a petition by the International Association of Fire Chiefs for the removal of the requirements for the display of placards on tank cars. On October 20, 1981, the Safety Board filed a comment on this rulemaking proposal stating that "The Safety Board believes that the use of EMPTY tank car placards is appropriate for some shipments that have not been completely unloaded. However, this action by itself does not provide adequate information about the quantity of material remaining in a tank car to permit first arriving emergency response officials to estimate the potential hazards a tank car and its contents may pose. EMPTY placards should have a specific, consistent meaning for all persons, especially firefighters and other persons who respond to emergencies involving tank cars. To accomplish this objective, we believe that the use of the EMPTY placard should be limited to only tank cars containing residual quantities and forms of hazardous materials, which pose no unreasonable risks during transportation emergencies such as accidents." More than fifty responses have been received by MTB in response to this proposal; however, MTB has not isued a final rule addressing this safety problem. The Safety Board believes that MTB should expedite the issuance of a final rule.

Emergency Guidelines

NOS commodities were being transported, and the descriptions on the waybills provided sufficient information for the firefighters to identify the correct DOT Guides for handling the emergency. These Guides provided adequate precautions to protect firefighters early in the response period. An equal level of protection would have been provided by the AAR/SCL guidance included on the hazard graph had the appropriate guides been identifled by the SCL, and had the SCL provided guidance for the material in the "empty" tank car.

18/ National Transportation Safety Board's Railroad Accident Reports, "Freight Train Derailment Passenger Train Collision with Hazardous Material Car, Sound View, Connecticut, October 8, 1970 (NTSB-RAR-72-1)," and "Derailment of Southern Pacific Transportation Company Freight Train Extra 9164, West Surf, California, May 22, 1981 (NTSB-RAR-81-8)."

When the firefighters exhibited symptoms similar to those of persons exposed to toxic chemicals and the fire officers perceived that the risks were greater than those noted in the Guide, the NOS descriptions were not sufficient for evaluating the continuing risks posed by the cars or for determining the type of treatment to be administered to those persons affected. Once a need for additional information was expressed, information was obtained from the shipper, through SCL, about the specific chemical ingredients, toxicity, and emergency handling information. While the delay in obtaining information for the handling of this emergency was excessive, the Safety Board believes that had the SCL provided the appropriate guidance information on its hazard graph for all products, including the materials being transported in the "empty" tank car, and had the information provided early by the traincrew about the number of tank cars in the derailment been correct, the need for the specific product information would not have arisen. However, when specific information about hazardous materials is requested by emergency response personnel, an expeditious means for obtaining such information should be available.

Site Security

This accident demonstrates the need for several improvements in the emergency response plan of Colonial Heights, improvements which would be applicable to other jurisdictions which might face the risks associated with a hazardous materials incident. The plan should state that the accident site should be secured so that all persons entering or leaving are known to the onscene accident ESC. Because in this instance some entrances to the site were controlled by public officials and others by railroad officials, arriving railroad personnel were allowed to enter the "secured" area without the ESC's knowledge. He was thus unaware of the various resources available on scene during the emergency response and also was confused by the submission of conflicting information by a variety of sources.

The emergency response officers also did not recognize the necessity for maintaining continuous communication with railroad personnel as a resource for interpreting the information and documents which were received during the emergency. Had the freight agent or another railroad employee been required to remain at the Command Post, the ESC might have learned that he had only a small portion of the available documents about the train and its cargo, and he could have asked for immediate access to the additional information through railroad personnel.

Management of Emergency Response Units

The system for handling hazardous materials and other emergencies established by the Commonwealth of Virginia Emergency Services and Disaster Law of 1973 provides the framework for the effective management of available resources during emergencies. Also, the assignment of overall responsibility to one State agency for providing assistance and training to the various political jurisdictions charged with implementing emergency response preparedness programs should be an effective means for assuring that each jurisdiction's program is adequate to respond to foreseeable emergencies. However, in this accident, several events indicate that additional assistance from the Office of Emergency Services is needed to help the jurisdictions refine their local programs.

Postaccident assessment indicates that information pertinent to the coordination of response actions was in the hands of the Police Department, the Fire Departments, the Virginia Emergency Services specialist, and railroad employees which was not known to the ESC. For example, the ESC was not aware that the Chesterfield Fire Department had

communicated with the head-end crew and received a copy of the hazard graph, which the Fire Department posted on the side of a vehicle close to the command post. In order to effectively coordinate the support of fire, police, and other emergency response units, the ESC must know about the changing conditions and have all current information relating to the emergency. The Safety Board believes that an ESC's role in emergency response actions should be to analyze available information, identify the need for additional data, assess the effectiveness of present actions to control the emergency, and counsel emergency response units and assist them in obtaining additional assistance or information.

In its Special Investigation Report "Onscene Coordination Among Agencies At Hazardous Materials Accidents," 19/ the Safety Board discussed several elements of emergency response actions it believed necessary to successfully respond to hazardous materials emergencies: (1) single command of the accident response, (2) coordination of effort, (3) communications, (4) command post, and (5) control of accident site access. The response to this accident indicates the need for improvement in two of these elements -- coordination of effort and control of accident site access.

The Commonwealth of Virginia Emergency Services and Disaster Law of 1973 provides for the designation of Emergency Service Coordinators; however, neither this law nor the State Office of Emergency Services which administers it defines the duties of the ESC. The Safety Board believes that future emergencies in the State of Virginia could be better controlled and managed if the ESC were to be designated as the focal point for all information relating to the emergency.

CONCLUSIONS

Findings

1. The engineer of train No. 120 had a history of poor train handling.

2. The Seaboard Coast Line was aware that the engineer had had train handling problems but did not take adequate measures to evaluate and correct his train handling problems.

3. Even though the engineer attended train dynamics analyzer sessions, he continued to experience train handling problems.

4. Postaccident inspection of locomotive and car equipment disclosed no evidence of any mechanical defects that contributed to this accident.

5. The track was maintained properly and did not contribute to this accident.

6. Immediately following a heavy slack run in as the train descended the grade, high buff forces developed due to throttle reductions which led to the derailment.

7. The Seaboard Coast Line waybills for tank cars GATX 27256 and EBAX 3064 provided shipping descriptions different than those assigned by the shipper.

19/ (NTSB-HZM-79-3).

8. The Seaboard Coast Line waybills for tank cars GATX 27256 and EBAX 3064 did not accurately describe the materials transported as required by 49 CFR Section 172.101.

9. The traincrew did not comply with Train Bulletin RM-13 and failed to recognize that two loaded tank cars and one "empty" tank car had derailed.

10. Access to the accident site was not fully controlled by emergency response agencies.

11. Arriving emergency response personnel were advised by the conductor that only two tank cars were included within the derailment.

12. Upon arriving on scene, Seaboard Coast Line supervisory personnel did not determine what information had been provided by the traincrew to emergency response personnel nor did Seaboard Coast Line supervisory personnel independently review the train documents to verify the accuracy of the information provided.

13. Because the Seaboard Coast Line did not use the shipper's description of the hazardous materials in the loaded tank cars in its documentation and because Seaboard Coast Line's procedure is not to provide emergency guidance information for hazardous materials residues in "empty" tank cars, Seaboard Coast Line's hazard graph provided inaccurate and insufficient emergency guidance information regarding hazardous materials contained in the derailed tank cars.

14 The Department of Transportation Guides used by fire officers provided sufficient instruction for a safe response to the hazards presented by the hazardous materials transported.

15. Seaboard Coast Line traincrews and supervisory personnel are not trained adequately about the actions to take during emergencies, nor are they periodically tested about the actions required of them during emergencies.

16. The shipping descriptions in the waybills for the hazardous materials classified as NOS (not otherwise specified) provided insufficient information to physicians who had to assess whether the hazardous materials might have been responsible for the symptoms exhibited by injured firefighters.

17. Fire consumed most of the hazardous materials released during the emergency; thus only minor damage to the environment resulted from the released materials.

18. Hazardous material placards on the tank cars were ineffective in warning emergency response personnel about the types of materials transported.

19. The emergency response plan for Colonial Heights needs improvements regarding site security and control and analysis of information.

Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the engineer of train No. 120 to control the slack action of the train as it transited a change in grade. Contributing to the accident was the Seaboard Coast Line Railroad's allowing an engineer who was known to be deficient in train handling skills to operate the train. Contributing to the severity of the fire and to the ineffectiveness of the emergency response was inadequate training of railroad operating personnel and onscene railroad management.

RECOMMENDATIONS

As a result of its investigation of this accident, the National Transportation Safety Board made the following recommendations:

—to the Seaboard System Railroad:

Revise practices for developing waybills to require use of the hazardous material shipping description provided by shippers unless a change is approved by the persons(s) originally selecting the shipping description. (Class II, Priority Action) (R-83-46)

Revise practices to include emergency response guidance information on the hazard graph for tank cars containing residual quantities of hazardous materials classified as "empty". (Class II, Priority Action) (R-83-47)

Periodically instruct and test traincrews and supervisory personnel on the procedures for using train documents to identify all cars transporting hazardous materials and the information to be provideed to assist emergency response personnel. (Class II, Priority Action) (R-83-48)

Require supervisory personnel arriving at the scene of an emergency to determine what information has been provided by traincrews to emergency response personnel, to verify the accuracy of the information provided, and to advise the onscene coordinator of any errors or omissions in the initial information given by the traincrew. (Class II, Priority Action) (R-83-49)

Revise the engineers' retraining program to require annual attendance at the train dynamics analyzer classes with special emphasis on correcting deficiencies observed by supervisors while evaluating the engineers' performance in service. (Class II, Priority Action) (R-83-50)

Require engineers who fail to demonstrate proficiency in train handling during mandatory train dynamics analyzer classes to attend the engineers' training school and thereafter require that they demonstrate an ability to properly operate a train before being allowed to return to train service. (Class II, Priority Action) (R-83-51)

--to the Virginia Office of Emergency Services:

> Assist the Town of Colonial Heights and other jurisdictions, as necessary, in improving their emergency response programs for accidents involving hazardous materials, in better defining the responsibilities of the Emergency Services Coordinator for receiving and analyzing response related information and in developing more effective site security procedures. (Class II, Priority Action) (R-83-52)

The Safety Board also reiterated the following recommendations made to the Federal Railroad Administration on March 5, 1980:

> Develop and validate through simulated disaster exercises a model emergency response plan for the guidance of the railroad industry in formulating individual plans to be utilized by their train crewmembers in the event of emergency. (P-80-6)
>
> Require operating railroads to develop emergency response plans, put them into effect and file those plans with the Federal Railroad Administration in a similar manner as is required by 49 CFR Part 217 with respect to operating rules. (R-80-7)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JIM BURNETT
Chairman

/s/ PATRICIA A. GOLDMAN
Vice Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ G.H. PATRICK BURSLEY
Member

/s/ DONALD D. ENGEN
Member

May 3, 1983

APPENDIXES

APPENDIX A

INVESTIGATION

Investigation

The National Transportation Safety Board was notified of the accident about 6:00 p.m., on May 3, 1982. A New York Field Office investigator was immediately dispatched to the accident site. The Safety Board also dispatched three investigators from its Washington, D.C. headquarters to the accident site.

Groups formed to investigate the hazardous material, mechanical, operating, and track aspects of the accident were comprised of personnel from the Safety Board, Seaboard Coast Line Railroad, Federal Railroad Administration, Association of American Railroads, Chesterfield County Fire Department, Colonial Heights Police and Fire Departments, Virginia Office of Emergency Services, and the Ethyl Corporation.

Depositions were taken in Richmond, Virginia, on July 28, 1982. Sworn testimony of the facts of the accident was taken from seven witnesses.

APPENDIX B

PERSONNEL INFORMATION

Conductor

Conductor S.S. Medlin, Jr., 38, was employed as a trainman on July 1, 1963, by the SCL. He was promoted to conductor in September, 1965. He was qualified in the SCL operating rules in 1981. He had been disciplined for two incidents: (1) on January 2, 1964, he received 20 demerits for responsibility in connection with a derailment; and (2) on October 29, 1964, he received demerits for responsibility in connection with the train he was on leaving ahead of another train without authority.

Engineer

Engineer J.R. Tingle, 65, was employed as a fireman on January 26, 1942, by the SCL. He was promoted to engineer on April 21, 1945. He was last certified in the SCL operating rules on March 17, 1981. Engineer Tingle had been disciplined in connection with train operations as follows: (1) he received 30 demerits on October 19, 1956, in connection with a derailment and failure to comply with rules; (2) he was dismissed from service on November 23, 1962, for a personal injury sustained in violation of a rule when getting off a locomotive -- he was reinstated on February 10, 1963, (3) he received 20 demerits on August 16, 1968, for his responsibility in connection with a derailment; (4) he received 15 demerits on November 4, 1969, for his responsibility in connection with a coupler failure and violation of instructions relative to starting freight trains; (5) he was dismissed from service on July 27, 1970, for a collision — on April 24, 1973, he was reinstated; (6) on July 16, 1975, he was given 15 demerits in connection with a derailment; (7) on November 19, 1976, he was given another 15 demerits in connection with a coupler knuckle failure on a train he was operating; and (8) on October 17, 1977, he was given 20 demerits in connection with a coupler failure on a train he was handling.

Rear Brakeman

Brakeman C.A. Jasper, 49, was employed as a switchman on the SCL on December 28, 1956. He was promoted to conductor in May, 1964. He was reexamined in the SCL operating rules on March 18, 1981. He had been disciplined in connection with train operations as follows: (1) on December 23, 1964, he was given 20 demerits for responsibility in connection with a switch having been left open resulting in a derailment; (2) he was given 10 demerits on June 23, 1965, for failure to have a member of the crew on the lead end of cars being shoved into track resulting in a derailment; (3) he was given 30 demerits on October 19, 1966, for responsibility in connection with a switching operation that resulted in a personal injury to a nonrailroad employee and damage to several freight cars; (4) on February 28, 1980, he was given a 30-day suspension for responsibility in connection with a collision between locomotive units; and (5) on July 14, 1981, for failing to inspect his train when it stopped, he was given a 15-[illegible] suspension.

Head Brakeman

Brakeman C.W. Prince, 42, was employed as a switchman on the SCL on January 27, 1962. He was promoted to conductor on July 22, 1968, and on August 23, 1969, he was promoted to yardmaster. However, on September 15, 1978, he relinquished his position as yardmaster to return to train service. He was reexamined in the book of rules in 1981. He had been disciplined as follows: (1) he was given 30 demerits on June 14, 1974, for responsibility in connection with a derailment; (2) he was given a 30-day suspension on July 1, 1975, for responsibility in connection with a fire damaging a freight car; and (3) on January 26, 1979, he was given a 5-day suspension for responsibility in connection with a hard coupling with a locomotive to a caboose.

APPENDIX C

TONNAGE GRAPH FOR SCL TRAIN NO. 120

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-HTL- *23B05APAB52APG                                                    15218200/4
 TONNAGE GRAPH  * = 2 TONS  H = HAZARD STCC   C = CONTAMINATED   E = FLATL C-I

                                                                    100 TON
      SCLA  2000**                                                      |
      SCLA  2030**                                                      |
      SCLA  2009**                                                      |
 4    WF   65248EEEEEEEEEEEEEEEEEEEE                                    |
 5    WF   64924**********************                                |
 6    SCL  60565**************************************************|****
 7    WF   66537EEEEEEEEEEEEEEEEEEEEEE                                  |
 8    SCL  60342EEEEEEEEEEEEEEEE                                        |
 9    SCL  60430EEEEEEEEEEEEEEEE                                        |
10    GATX  1256**************************************************|**********
11    SSW  24132EEEEEEEEEEEEEEEEEEEE                                    |
12    SCL 195225EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|EEEEEEEE
13    ACL  84255EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|EEEEE
14    SCL 684941EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|EEEEE
15    LN   32095EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|EEEEEE
16    SCL 190823EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|EEEEE
17    SCL 190156EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|EEEEE
18    SCL 190035EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|EEEEE
19    SCL 190860EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|EEEEE
20    ACL  84224EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|EEEEE
21    SCL 637344**************************************************|****
22    VSO   6131EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE                  |
23 L  TTKX902395*********************                                  |
24    NIRX 60625EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE                  |
25    BO  603188**************************************************      |
26    SOU 565291EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|EEEEE
27    CIRR 91092EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE  |
28    CIRR 90206EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|EEEE
29    SCL 772952**********************                                |
30    SCL 772948**********************                                |
31    SCL 772840**********************                                |
32    NATX 73275**************************************************|**********
33    SCL  20376**************************************************      |
34    SCL  22961EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE  |
35    SCL  95337EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|EEEEEEEEEEEE
36    SOU 565308EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|EEEEEEEE
37    SOU 565368EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|EEEEEEEEE
38    ATTX470719**********************                                |
39    SOU 565232EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|EEEEEEEEEE
40 L  TTX 471343**************************************************      |
41    TTPX 80603**************************************************|*********
42    SM    6048**************************************************|**********
43    RFP   6093EEEEEEEEEEEEEEEEEEE                                     |
44    RFP   6055EEEEEEEEEEEEEEEEEEE                                     |
45    CR  229472EEEEEEEEEEEEEEEEEEE                                     |
46    GATX 43671EEEEEEEEEEEEEEEEEEEEEEEEE                               |
47    RTCX  5286**********************                                |
48    TTPX 80847**************************************************      |
49    SCL 678566**************************************************      |
50    SCL  29224EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE  |
51    SCL  29299EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE  |
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52    GATX 98545
53    GATX 24714
54    GATX 49710
55    SCL 243746
56    SCL 241467
57    SCL 243321
58    TTPX 82104
59    SCL   2193
60    RBOX 11359
61    RBOX 40531
62    SCL  40421
63    SCL  29240
64    RBOX 15131
65    SCL  25501
66    SCL  24052
67    SCL  29256
68    SCL  29877
69    GATX 45988
70    GATX 39195
71  L TTAX98447
72    SAL  48253
73  L DUPX 29716
74  S UTLX 94632
75  S UTLX 88103
76  S UTLX 84596
77  S UTLX 94197
78    UTLX 87938
79    LN   112134
80    SCL  21345
81    SCL  40435
82    SCL  637921
83    SCL  636075
84    SCL  23389
85    FBNE   312
86    SCL  28280
87    DH    8206
88    CR   166499
89    ACL  37813
90    SCL  20014
91    WCTR100980
92    ACL  38040
X 93  SCL  60619
94    WCTR100509
95    WCTR100988
96    GATX 27256
97  S EBAX  3064
98    DUPX 14672
99    GA   55412
100   GA   55402
101   GA   55458
102   RBOX 37183
103 L TTAX98193
104 L LTTX50129
105 L TTX 60085
106 L TTX 10184
107   WA    3217
108   EJE  91142
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109   SCL  21796EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|EEEE
110   SAL  15261**************************************************|****
111   LN  480377EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|EE
112   SCL  24672EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|EEE
113   BO  486284EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|E
114   WA    5219EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|
115   GA   55325EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|
116   GA   55448EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|E
117   AWP  51453EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|E
118   AWP  51418EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|E
119   AWP  51445EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|E
120   GA   55469EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|E
121   SCL  25543EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE|EE
122   GA   55201**************************************************|****
123   CR  170705***************                                   |
124   BLE  30025****************                                  |
125   BAR   5688EEEEEEEEEEEEEEE                                   |
126   LN  171999**************************************************|***
127   LN  480348EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE      |
128   SCL 816710*******************                               |
129   SCL  29006******************                                |
130   SCL  25562EEEEEEEEEEEEEEEEEEEEEE                            |
      SCL    635**                                                |

      GRAND TOTALS          TOTAL   PIGBACK   AUTRACK   PERISH   GRTONS   LENGTH
                            L  E    L  E      L  E      L  E

-EOT-143 LINES-APA#852-DATE 06/02/82-TIME 0747
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APPENDIX D

EXCERPTS FROM SCL TIMETABLE

ROCKY MOUNT DIVISION

36

LINE SPEED CHART

	Line Capacity (Lbs.) 4-Axle Cars	Unless Restricted By Engine, Equipment in Train, Special Instructions Or Train Order, Authorized Maximum Speed Of Trains in M.P.H. is:				Restricted speed (M.P.H.) as shown below for certain equipment								
						Cars weighing				Engines in series			Wrecker Nos.	
		Psgr trains handled by psgr type engines except Amtrak Series 640-699 and 800-849	Piggy-back Trains	Unrestricted Trains 107, 217, 109, 225, 175, 227, 176, 275, 210, 276, 211, 290, 215	Restricted Trains Are All Others	220,001 to 240,000 Lbs.	240,001 to 251,000 Lbs	251,001 to 263,000 Lbs.	263,001 to 270,000 Lbs.	250-261, 300-392, 556-559, 700, 800, 900, 1000, 4600, 4700	500-555, 1300, 1400, 1500, 1600, 1700, 1800, 3200, 3400, 4000, 4200, 5100, 5500, 6000	1900, 2000, 2100, 7000, 8000, 8100	765250 765251 765252 771200 771201 771202 771203 771253 771254 771255 771256 771257 L & N 40022	765157 765160 L&N 40029 40030 Ga. 1901 A&WP 7 See Note D
COLLIER SUBDIVISION														
Richmond Terminal-West Route:														
Richmond to Centralia	270,000	79	70	60	50								35	35
Meadow to Clopton	270,000				10									
Clopton to South Richmond	270,000				10									
Clopton to FA	270,000				10									
Richmond Terminal-East Route:														
Richmond to Centralia	270,000	60	60	60	50								35	35
Bridge MP 0.4N to 0.6		15	15	15	15									
Richmond Terminal:														
Centralia to South Collier	270,000	79	70	60	50								35	35
Old Main Line (Appomattox Lead) To End of Line	270,000				20									
HOPEWELL SUBDIVISION														
Richmond Terminal:														
Bellwood to Hopewell	270,000				25									
NORTH END SUBDIVISION														
South Collier to South Rocky Mount	270,000	79	70	60	50								35	35
Bridge MP 81.9 to 83.5		40	40	40	40									
SOUTH END SUBDIVISION														
Rocky Mount to Florence	270,000	79	70	60	50								35	35
Bridge MP 280.3 to 282.8		40	40	40	40									
Erwin Spur	270,000				15				7		NOTE B	BARRED		
Winona to Stone	270,000				10									
W&W SUBDIVISION														
Contentnea to MP 242.2	270,000				40								30	30
Bridge MP 234.6 to 234.8					20									
MP 242.2 to Davis Yard	270,000				20									
Bridge MP 242.3 to 242.4					20									
Bridge MP 245.8 to 245.9					20									
Bridge MP 248.2 to 248.3					20									
PEE DEE SUBDIVISION														
Whiteville to MP 297.5	270,000				25									
MP 297.5 to MP 316.6	270,000				40								25	25
MP 316.6 to Pee Dee	270,000				25									
Bridges MP 316.6 to 317.4					10									
NASHVILLE SUBDIVISION														
Rocky Mount to Spring Hope (Note C)	270,000				25				20		BARRED	BARRED	10	10
Bridge MP 121.9 to 122.0					10						BARRED	BARRED	10	10
FAIRMONT SUBDIVISION														
Elrod to Fairmont	270,000				10			7	7		BARRED	7		7
KINSTON SUBDIVISION														
Parmele to MP 170.1	270,000				40								25	25
MP 170.1 to Kinston	270,000				10									

RESTRICTED AND UNRESTRICTED TRAINS

4—Thirty (30) or more empty cars will be positioned on rear of trains immediately ahead of caboose whenever practicable to do so.

RESTRICTED CARS include:

WORK EQUIPMENT CARS—All work equipment cars will be considered **RESTRICTED CARS**;

PULPWOOD FLAT CARS—Loaded with pulpwood;

FLAT CARS— Loaded with logs or poles;

FLAT CARS— Loaded with machines of pivot or swinging type such as cranes, etc., where practicable, when boom is attached, must be handled near head of train with boom trailing;

LAT CARS— Loaded with oversize shipment(s) or twin or triple loaded cars when in the judgment of local forces such loads should be restricted;

NDOLAS— Loaded with stump wood. When loaded with oversize or overhanging shipments when in the opinion of local forces such loads should be restricted;

TANK CARS—Loaded with clay slurry or flammable compressed gas.

In addition trains handling any of the following equipment or cars will be further restricted as follows:

CABOOSE CARS, except series 5700-5760 and 1150-1195, are restricted to 60 M.P.H.

WELDED RAIL CARS, loaded or empty, 40 M.P.H. When loaded, 10 M.P.H. through t[illegible]outs and crossovers, and must be handled on head end of t[illegible]. When empty, must be handled on rear of trains sepa[illegible] from caboose by three empty cars.

DUMP CARS 45 M.P.H. and when loaded must be handled in local freight or work trains when practicable.

JORDAN DITCHERS 40 M.P.H. Must be handled near head of train.

PILE DRIVER 20 M.P.H. Must be handled near head of train.

SCALE TEST CARS 771815, 771816, 771817, and 771818 at maximum speed allowed freight trains and next behind locomotive.

LOADED "TANK TYPE" COVERED HOPPER CARS in series SCL 747050-747099, 747145-747179 and SAL 7050-7099 must not exceed 45 M.P.H.

LOADED AND EMPTY SCL CENTER BEAM BULKHEAD FLAT CARS, in series SCL 109000-109029, must not be moved except under authority of written special instructions and ONLY by ROUTE AUTHORIZED.

EMPTY gondolas of Penn Central Railroad Series PC 698500-698999 have a pronounced truck hunting tendency at high speeds. Therefore, the above series of "PC" gondolas when EMPTY must not exceed 50 M.P.H., and must only be handled in RESTRICTED TRAINS.

APPENDIX E

HAZARD GRAPH

-HTL- #23786APA723APG
0 LIST HAZARD GRAPH

15218041035

HAZARDOUS COMMODITY 4904210

UTLX 94632 CAR 74 IN CONSIST
UTLX 88103 CAR 75 IN CONSIST
UTLX 94197 CAR 77 IN CONSIST
UTLX 87938 CAR 78 IN CONSIST

ANHYDROUS AMMONIA
NONFLAMMABLE GAS, CORROSIVE UN1005
ENVIRONMENTALLY HAZARDOUS SUBSTANCE (RQ-100/45.4)

ANHYDROUS AMMONIA IS A CLEAR COLORLESS GAS WITH A CHARACTERISTIC ODOR. IT IS USED AS A FERTILIZER, AS A REFRIGERANT, AND IN THE MANUFACTURE OF OTHER CHEMICALS. ALTHOUGH IT IS CLASSED AS A NONFLAMMABLE GAS, IT WILL BURN WITHIN CERTAIN VAPOR CONCENTRATION LIMITS, AND THE FIRE HAZARD WILL INCREASE IN THE PRESENCE OF OIL OR OTHER COMBUSTIBLE MATERIALS. ITS 'COMBUSTIBILITY' IS DEFINITELY NOT A COMMON PROBLEM IN THE EVENT OF LEAKAGE. IT IS SHIPPED AS A LIQUID UNDER PRESSURE. CONTACT WITH THE LIQUID CAN CAUSE FROSTBITE. IT IS SOLUBLE IN WATER FORMING A CORROSIVE LIQUID. ALTHOUGH AMMONIA IS LIGHTER THAN AIR, THE VAPORS FROM A LEAK INITIALLY HUG THE GROUND.
IT WEIGHS 5.7 POUNDS PER GALLON.

IF MATERIAL INVOLVED IN FIRE
EXTINGUISH FIRE USING AGENT SUITABLE FOR TYPE OF SURROUNDING FIRE
(MATERIAL ITSELF DOES NOT BURN OR BURNS WITH DIFFICULTY.)
COOL ALL AFFECTED CONTAINERS WITH FLOODING QUANTITIES OF WATER
APPLY WATER FROM AS FAR A DISTANCE AS POSSIBLE
USE WATER SPRAY TO ABSORB VAPORS

IF MATERIAL NOT INVOLVED IN FIRE
KEEP MATERIAL OUT OF WATER SOURCES AND SEWERS
ATTEMPT TO STOP LEAK IF WITHOUT HAZARD
USE WATER SPRAY TO KNOCK-DOWN VAPORS

PERSONNEL PROTECTION
AVOID BREATHING VAPORS
KEEP UPWIND
WEAR SELF-CONTAINED BREATHING APPARATUS
AVOID BODILY CONTACT WITH THE MATERIAL
WEAR BOOTS, PROTECTIVE GLOVES, AND SAFETY GLASSES
DO NOT HANDLE BROKEN PACKAGES WITHOUT PROTECTIVE EQUIPMENT
WASH AWAY ANY MATERIAL WHICH MAY HAVE CONTACTED THE BODY WITH COPIOUS AMOUNTS OF WATER OR SOAP AND WATER
IF CONTACT WITH THE MATERIAL ANTICIPATED, WEAR FULL PROTECTIVE CLOTHING

EVACUATION
IF MATERIAL LEAKING (NOT ON FIRE), DOWNWIND EVACUATION MUST BE CONSIDERED

ENVIRONMENTAL CONSIDERATIONS - LAND SPILL
DIG A PIT, POND, LAGOON, HOLDING AREA TO CONTAIN LIQUID OR SOLID MATERIAL

DIKE SURFACE FLOW USING SOIL, SAND BAGS,
FOAMED POLYURETHANE, OR FOAMED CONCRETE
ABSORB BULK LIQUID WITH FLY ASH OR CEMENT POWDER
NEUTRALIZE WITH VINEGAR OR OTHER DILUTE ACID

ENVIRONMENTAL CONSIDERATIONS - WATER SPILL
NEUTRALIZE WITH DILUTE ACID OR REMOVABLE STRONG ACID
IF DISSOLVED, APPLY ACTIVATED CARBON AT TEN TIMES THE SPILLED AMOUNT
IN REGION OF 10PPM OR GREATER CONCENTRATION
USE MECHANICAL DREDGES OR LIFTS
TO REMOVE IMMOBILIZED MASSES OF POLLUTANTS AND PRECIPITATES

ENVIRONMENTAL CONSIDERATIONS - AIR SPILL
APPLY WATER SPRAY OR MIST TO KNOCK DOWN VAPORS
VAPOR KNOCKDOWN WATER IS CORROSIVE OR TOXIC AND SHOULD BE DIKED FOR
CONTAINMENT

HAZARDOUS COMMODITY 4910535

GATX 27256 CAR 96 IN CONSIST

ADDITIVES, FUEL OIL, GASOLINE OR LUBRICATING OIL, CONTAINING
LESS THAN 50% BY WEIGHT PETROLEUM OIL (FLAMMABLE LIQUID, N.O.S.)
FLAMMABLE LIQUID UN1993

ADDITIVES, FUEL OIL, GASOLINE OR LUBRICATING OIL ARE VARIOUS COLORED LIQUIDS HAVING A PETROLEUM-LIKE ODOR. THEIR FLASH POINT IS BELOW 100 DEG. F. THEY ARE LIGHTER THAN WATER AND INSOLUBLE IN WATER. THEIR VAPORS ARE HEAVIER THAN AIR.

IF MATERIAL ON FIRE OR INVOLVED IN FIRE
DO NOT EXTINGUISH FIRE UNLESS FLOW CAN BE STOPPED
USE WATER IN FLOODING QUANTITIES AS FOG
SOLID STREAMS OF WATER MAY SPREAD FIRE
COOL ALL AFFECTED CONTAINERS WITH FLOODING QUANTITIES OF WATER
APPLY WATER FROM AS FAR A DISTANCE AS POSSIBLE
USE FOAM, CARBON DIOXIDE OR DRY CHEMICAL

IF MATERIAL NOT ON FIRE AND NOT INVOLVED IN FIRE
KEEP SPARKS, FLAMES, AND OTHER SOURCES OF IGNITION AWAY
KEEP MATERIAL OUT OF WATER SOURCES AND SEWERS
BUILD DIKES TO CONTAIN FLOW AS NECESSARY
ATTEMPT TO STOP LEAK IF WITHOUT HAZARD
USE WATER SPRAY TO KNOCK-DOWN VAPORS

PERSONNEL PROTECTION
AVOID BREATHING VAPORS
KEEP UPWIND
WEAR BOOTS, PROTECTIVE GLOVES, AND SAFETY GLASSES
DO NOT HANDLE BROKEN PACKAGES WITHOUT PROTECTIVE EQUIPMENT
WASH AWAY ANY MATERIAL WHICH MAY HAVE CONTACTED THE BODY WITH COPIOUS
AMOUNTS OF WATER OR SOAP AND WATER

APPENDIX E

HAZARDOUS COMMODITY 4915245

EBAX 3064 CAR 97 IN CONSIST

OIL, N.O.S., PETROLEUM OIL OR PETROLEUM OIL, N.O.S.
COMBUSTIBLE LIQUID NA1270

OIL IS A CLEAR COLORLESS LIQUID TO A DARK BROWN-BLACK TAR. IT HAS A FLASH POINT BETWEEN 100 AND 199 DEG. F. IT IS LIGHTER THAN WATER AND INSOLUBLE IN WATER. ITS VAPORS ARE HEAVIER THAN AIR. PYROXYLIN SOLVENT, N.O.S. IS THE

IF MATERIAL ON FIRE OR INVOLVED IN FIRE
DO NOT EXTINGUISH FIRE UNLESS FLOW CAN BE STOPPED
USE WATER IN FLOODING QUANTITIES AS FOG
SOLID STREAMS OF WATER MAY SPREAD FIRE
COOL ALL AFFECTED CONTAINERS WITH FLOODING QUANTITIES OF WATER
APPLY WATER FROM AS FAR A DISTANCE AS POSSIBLE
USE FOAM, CARBON DIOXIDE OR DRY CHEMICAL

IF MATERIAL NOT ON FIRE AND NOT INVOLVED IN FIRE
KEEP SPARKS, FLAMES, AND OTHER SOURCES OF IGNITION AWAY
KEEP MATERIAL OUT OF WATER SOURCES AND SEWERS
BUILD DIKES TO CONTAIN FLOW AS NECESSARY
USE WATER SPRAY TO KNOCK-DOWN VAPORS

PERSONNEL PROTECTION
AVOID BREATHING VAPORS
KEEP UPWIND
WEAR BOOTS, PROTECTIVE GLOVES, AND SAFETY GLASSES
DO NOT HANDLE BROKEN PACKAGES WITHOUT PROTECTIVE EQUIPMENT
WASH AWAY ANY MATERIAL WHICH MAY HAVE CONTACTED THE BODY WITH COPIOUS AMOUNTS OF WATER OR SOAP AND WATER

-EOT-153 LINES-APA0723-DATE 06/01/82-TIME 1837

*U.S. GOVERNMENT PRINTING OFFICE : 1982 O-361-828/3