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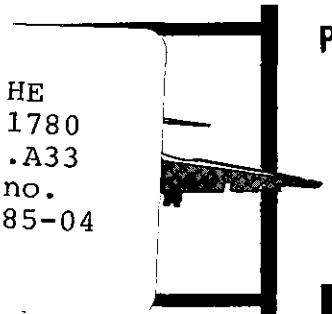

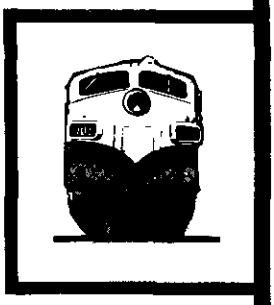

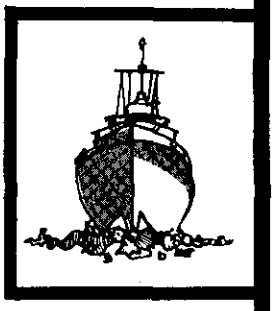

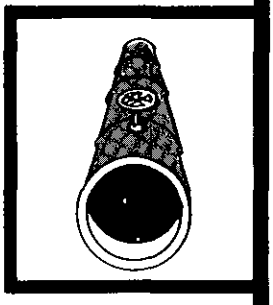

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

RAILROAD ACCIDENT REPORT

HEAD-ON COLLISION OF
BURLINGTON NORTHERN RAILROAD FREIGHT TRAINS
EXTRA 6714 WEST AND EXTRA 7820 EAST
WIGGINS, COLORADO
APRIL 13, 1984

AND

READ-END COLLISION OF
BURLINGTON NORTHERN RAILROAD FREIGHT TRAINS
EXTRA 7843 EAST AND EXTRA ATSF 8112 EAST
NEAR NEWCASTLE, WYOMING
APRIL 22, 1984

NTSB/RAR-85/04

UNITED STATES GOVERNMENT

TECHNICAL REPORT DOCUMENTATION PAGE

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16. Abstract

About 3:58 a.m., mountain standard time, on April 13, 1984, Burlington Northern Railroad Company freight trains Extra 6714 West and Extra 7820 East collided head-on on the single main track about 1,027 feet west of the west turnout of the passing track at Wiggins, Colorado. Seven locomotive units derailed and were destroyed in the collision and burning diesel fuel was released from ruptured fuel tanks; 40 cars derailed, 26 of which were destroyed. Five train crewmembers were killed and two were injured. Total damage was estimated to be $3,891,428.

About 4:56 a.m, mountain standard time, on April 22, 1984, eastbound Burlington Northern freight train Extra 7843 East struck the rear of Burlington Northern freight train Extra ATSF 8112 East on the main track at Pedro passing siding near Newcastle, Wyoming. During the collision and subsequent derailment sequence several cars of freight train Extra 5533 East, which were standing unattended in the Pedro passing track, were also struck and derailed. As a result, 5 locomotives units, a caboose, and 21 cars derailed. The locomotive units, caboose, and 13 cars were either destroyed or heavily damaged. Two train crewmembers were killed, and two were injured. Total damage was estimated to be $1,358,993.

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The National Transportation Safety Board determines that the probable cause of the Wiggins accident was the engineer and other head-end crewmembers of Extra 6714 West falling asleep and failing to comply with restrictive signal aspects. Contributing to the failure of the engineer and fireman was their consumption of alcohol and fatigue resulting from their voluntary lack of sleep during their off-duty time, aggravated by irregular work/rest cycles.

The National Transportation Safety Board determines that the probable cause of the Newcastle accident was the failure of the engineer and head brakeman of Extra 7843 East to operate their train in compliance with restrictive signal aspects because they were asleep or, in the case of the engineer, otherwise impaired. Contributing to their failure was the use of marijuana by the engineer, as well as the fatigue of the engineer and head brakeman due to their voluntary lack of sleep and unpredictable working hours.

Contributing to both accidents were (1) the conductors' failure in both instances to protect their trains in compliance with operating rules 34 and 804(B); and (2) Burlington Northern's failure to supervise properly its train operations.

CONTENTS

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

RAILROAD ACCIDENT REPORT

Adopted: April 1, 1985

HEAD-ON COLLISION OF BURLINGTON NORTHERN RAILROAD FREIGHT TRAINS EXTRA 6714 WEST AND EXTRA 7820 EAST WIGGINS, COLORADO APRIL 13, 1984

AND

REAR-END COLLISION OF BURLINGTON NORTHERN RAILROAD FREIGHT TRAINS EXTRA 7843 EAST AND EXTRA ATSF 8112 EAST NEAR NEWCASTLE, WYOMING APRIL 22, 1984

SYNOPSIS

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Contributing to both accidents were (1) the conductors' failure in both instances to protect their trains in compliance with operating rules 34 and 804(B); and (2) Burlington Northern's failure to supervise properly its train operations.

INVESTIGATIONS

The Wiggins Accident

Burlington Northern (BN) eastbound freight train Extra 7820 East (Train 100), consisting of 5 locomotive units, 77 cars, and a caboose, departed Denver, Colorado, for Akron about 2:23 a.m., April 13, 1984. The engineer, fireman, and the head brakeman were on the lead locomotive unit, the conductor and rear brakeman were on the caboose, and an off-duty BN train dispatcher was riding as an authorized passenger on the second locomotive unit. The fireman, who was a promoted and fully qualified engineer, was operating the train from the time it left Denver. About 1 hour after the train left Denver, crewmembers on the locomotive noticed sparking along the side of the train and stopped to investigate the source. The head-end of the train came to a stop between mileposts (MP) 483 and 484, about 4 1/2 miles west of the passing track at Wiggins, Colorado. The head brakeman went back to investigate the source of the sparking and found that the 13th head car had a loose tie-down chain and the 24th head car had loose metal banding which had been dragging and causing the sparks.

Once the head brakeman was back on the locomotive, the train resumed eastbound movement. The crew understood that they were to take the passing track at Wiggins to meet a westbound BN freight train. During the stop to correct the dragging material, the dispatcher had contacted the conductor of Extra 7820 East and confirmed this meet.

Westbound BN freight train Extra 6714 West (train No. 163), consisting of 5 locomotive units, 72 cars, and a caboose, departed from Akron for Denver about 2:55 a.m., on April 13. The engineer, fireman, and head brakeman were located on the locomotive; it was not possible to determine the exact location of each of these men or which of them was operating the train. The conductor and rear brakeman were located in the caboose.

Before Extra 6714 West reached Brush, Colorado, 23 miles west of Akron and 25 miles east of Wiggins, the engineer used his radio to talk with his conductor and the dispatcher. There was no further radio communication from the locomotive; the last radio message emanating from the train and recorded on the dispatcher's communications tape before the accident was, "We just got a highball both sides, Number 163," which was made by the conductor after his caboose passed the locomotive of an eastbound train standing in the passing track at Bijou, about 10 miles east of Wiggins. There was no response to this call. Also recorded on the tape were two subsequent transmissions, "Hello, head-end Number 163," both of which were apparently made after the accident occurred.

About 2 1/2 miles west of Bijou, and about 8 miles east of Wiggins, Extra 6714 West passed a wayside defective equipment indicator which alerts crews to defective equipment in their trains by means of intermittent radio signals. A special instruction in

the timetable required enginemen to notify crewmembers in the caboose when their train was approaching such a detector. (See appendix C.) Although the conductor and rear brakeman stated that the detector's radio signals were fully audible, the enginemen did not notify them as required. The conductor made no attempt to contact anyone on the locomotive following this failure.

The crewmembers on the locomotive of Extra 7820 East saw the eastward approach signal for Wiggins, at MP 481.44, displaying a yellow "approach" aspect. This was the signal they expected since they understood that they were to take the passing track at Wiggins to meet a westbound train. At a point 2 miles west of the west turnout to the passing track, Extra 7820 East entered a 3.7-mile-long stretch of straight track which extended to a point just beyond the east end of the passing track. The eastbound home signal at the west end of Wiggins displayed a red over lunar white "restricting" aspect, which permitted the train to proceed beyond the signal and into the passing track at restricted speed. 1/ As their train continued to proceed toward the turnout, the crewmembers saw the headlight of the oncoming westbound train move through a curve approaching the east end of the passing track. Although it is customary for enginemen to dim the locomotive's headlight when approaching an opposing train, the westbound train's headlight was never dimmed. When the home signal ahead changed from red over lunar to red over red, the "stop" aspect, the crewmembers on the locomotive of the eastbound realized that the westbound had passed the west turnout and that a head-on collision was imminent. The engineer and head brakeman evacuated the unit before the trains collided at a point 1,027 feet west of the turnout. When the trains collided, about 3:58 a.m., Extra 7820 East was moving at a speed of 15 mph; Extra 6714 West was traveling about 55 mph. According to the engineer of the eastbound train, the locomotive units of the westbound train were running under power when the collision occurred. (See figure 1.) At the time of the accident, it was dark and clear with no atmospheric restriction to visibility, and the temperature was about 38° F.

Injuries to Persons

The engineer, fireman, and head brakeman of Extra 6714 West, as well as the fireman and a dispatcher riding on Extra 7820 East, were killed in the collision. The engineer and head brakeman of Extra 7820 East were injured as they evacuated their locomotive before the collision.

	Extra 7820 East	Extra 6714 West	Total
Fatal	2	3	5
Nonfatal	2	0	2
None	2	2	4
Total	6	5	11

1/ Restricted speed was defined by BN as permitting a train to, "Proceed prepared to stop short of train, engine, obstruction, or switch not properly lined, looking out for broken rail or anything that may require the speed of a train or engine to be reduced, but not exceeding 20 mph." (See appendix C.)

Figure 1.--Aerial view facing west at Wiggins, Colorado. The BN main track is at the right and is occupied by the rear portion of Extra 6714 West. The collision site and primary derailment area are in the distance, beyond the edge of the town.

Train Information

Extra 7820 East consisted of 5 locomotive units, 59 loaded cars, 18 empty cars, and a caboose. The train had a trailing weight of 4,504 tons, a nominal length of 6,701 feet, and was authorized a maximum speed of 50 mph. Extra 6714 West consisted of 5 locomotive units, 59 loaded cars, 13 empty cars, and a caboose. The train's trailing weight was 5,251 tons, its nominal length was 5,945 feet, and its maximum authorized speed was 60 mph. The caboose was a standard BN type with a cupola, the sides of which were flush with the car sides.

The locomotive units on both trains were the 6-axle type, and the lead units were General Motors Model SD40-2 with a low-profile, short hood forward. Both lead units had Barco speed indicator/recorders, rotating amber beacon lights mounted on top of the cab roof, dual sealed-beam headlights, and overspeed controls set around 76 mph. Neither lead unit was equipped with foot-pedal type deadman controls, alerter device, or any other type of automatic backup safety control device.

The lead units and cabooses of both trains were equipped with permanently mounted radios set to BN channels 1 and 2. All were operable except the radio in the lead unit of Extra 7820 East would operate only on channel 2, and the radio in the cupola of the caboose of Extra 6714 West would not transmit effectively; a second radio set in the caboose, located at the conductor's desk, would transmit and receive effectively on both channels. The crew of Extra 7820 East and an on-duty trainmaster at Denver were aware that only channel 2 was available on its lead unit when the train left Denver. The eastbound crew also had a portable radio which transmitted and received on channel 1, but it was located in the caboose. Without a functional channel 1, the frequency used in road train communications, the train crewmembers on the lead unit of Extra 7820 East could not monitor radio transmissions between the dispatcher, other trains, and the rear of their own train. They could and did, however, communicate with the rear of their train on channel 2.

Damage

All five locomotive units of Extra 6714 West and the two leading locomotive units of Extra 7820 East derailed and were destroyed by the impact of the collision and subsequent fire which resulted from the diesel oil released from the ruptured fuel tanks. The lead units of both trains were totally demolished, with only their main frames remaining intact. (See figure 2.) Forty cars were derailed -- 37 in the westbound train and 3 in the eastbound. All were damaged to some extent, and 26 of Extra 6714 West's cars were beyond repair.

About 436 feet of track was destroyed, and there was minor damage to signal and communications wires. The power switch at the west end of the Wiggins passing track was damaged extensively as a result of having been run through by Extra 6714 West while it was aligned for the passing track.

Damage was estimated as follows:

Train Equipment and Lading	$3,850,928
Track and Expense of Clearing Wreckage	38,500
Signal and Communications	2,000
Total	$3,891,428

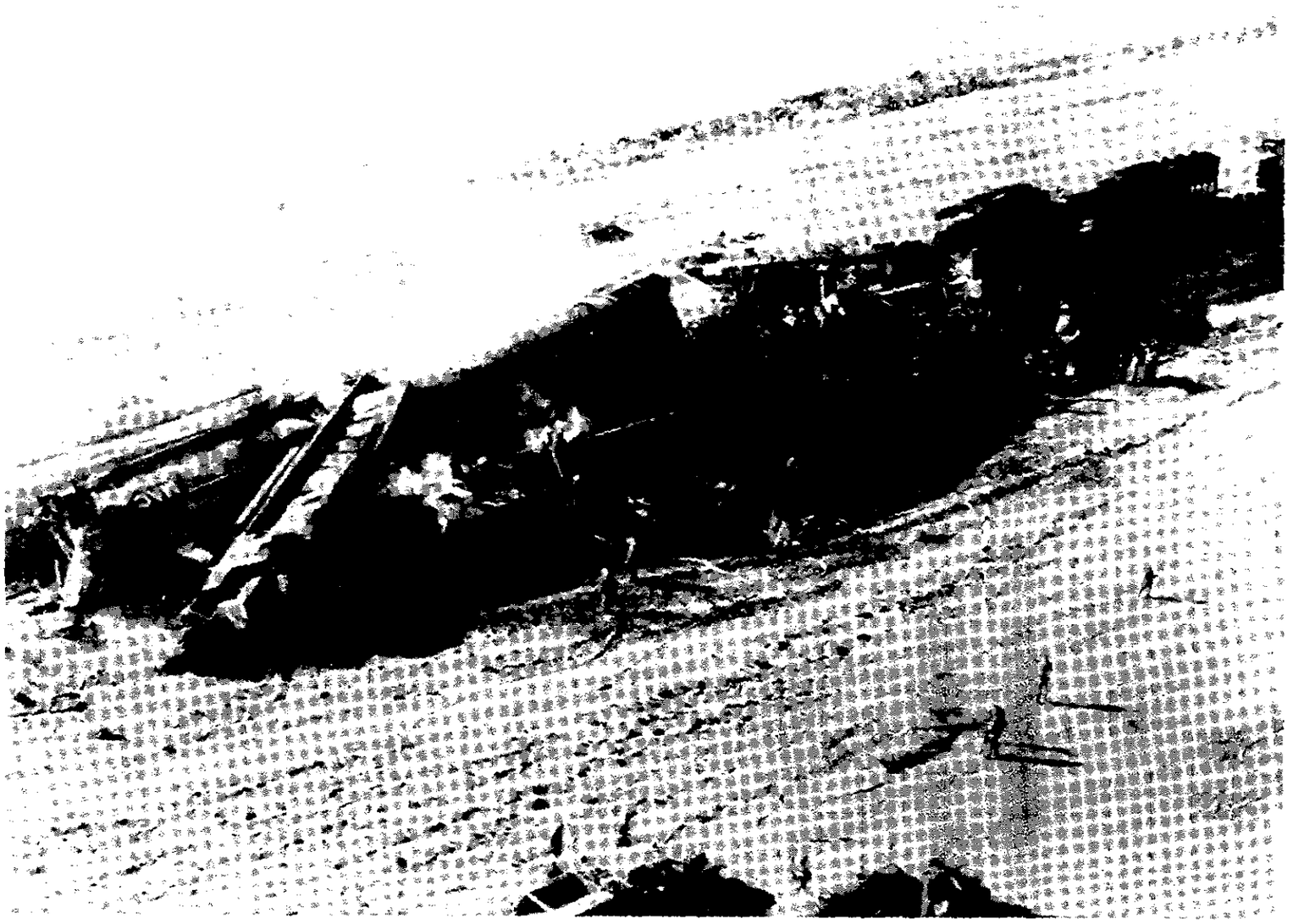


Figure 2.—View of the wreckage of Extra 6714 West and Extra 7820 East facing southwest. The rearmost units of Extra 7820 East that remained upright and in line with the main track are at the upper right corner of the photo.

Crewmember Information

Each of the crews consisted of an engineer, a qualified engineer working as a fireman, a conductor, a rear brakeman, and a head brakeman. All were qualified under BN rules without restrictions. Except for the head brakeman of Extra 7820 East, who was working off the Denver trainmen's extra board, all the train crewmembers were regularly assigned to the Denver-Akron freight pool. Denver was the home terminal for all the crewmembers. (See appendix B.)

A dispatcher headquartered at McCook, Nebraska, was riding the second locomotive unit of Extra 7820 East. He was making a routine familiarization trip over his assigned territory (McCook to Denver). Such familiarization trips were a requisite of the dispatcher's duties.

Extra 6714 West's crew had reported for duty at Akron about 2:55 a.m., April 13, and had been on duty continuously for about 1 hour at the time of the accident. Prior to reporting for duty, the crewmembers had been off duty for 10 hours 25 minutes following their being transported ("deadheaded") by highway vehicle from Denver. 2/ Typically, the trip takes 2 to 3 hours.

The conductor and rear brakeman had last worked in actual train service on April 11, and had been off duty 16 hours 35 minutes before being deadheaded on April 12. The engineer, fireman, and head brakeman were last used in train service on April 10; they had been off duty continuously for 25 hours 10 minutes, 58 hours 39 minutes, and 50 hours 20 minutes, respectively, before being transported on April 12. 3/

Hours worked by Extra 6714 West crewmembers
during 75-hour period before
reporting for duty on April 13, 1984. 1/

	Time in actual train service		"Deadhead" travel time		Total	
	(hrs)	(mins)	(hrs)	(mins)	(hrs)	(mins)
Engineer	7	10	4	20	11	30
Fireman	3	20	2	10	5	30
Head Brakeman	6	40	2	10	8	50
Conductor	16	25	6	40	23	50
Rear Brakeman	16	25	6	40	23	5

1/ (See appendix D for details).

2/ "Deadheading" is the term for the practice of moving train crewmembers from one location to another without having them perform their normal duties in the process. This is done by train or highway vehicle. While en route they are considered to be on duty and in pay status. (See appendix G.)

3/ The engineer had been deadheaded from Akron to Denver on April 11, which accounts for the shorter period of time he was continuously off duty.

After arriving at Akron at 4:25 p.m., on April 12, the crew of Extra 6714 West was transported to a motel where each man was assigned a room. The motel rooms were made available to BN crews through contract to the BN and housed only BN employees, including train crewmembers out of Denver, Colorado, and McCook, Nebraska, between runs. The motel provided van transportation between the motel and the BN station where the crews went on and came off duty. BN crews relaxed and socialized in the motel's game room.

After checking into the motel, the conductor and engineer played poker in the game room until about 7:15 p.m. The conductor was then picked up by a friend who took him to Fort Morgan, Colorado, about 35 miles west of Akron. He returned to the motel about 11:30 p.m., watched television and napped in his room until the motel proprietor notified him at 1:45 a.m. that he was to report for duty at 2:55 a.m.

The engineer played a game of pool in the game room after the poker game broke up, and then went to supper with the fireman about 7:30 p.m. About an hour later, the two men went to a bar in Akron where they played pool and drank beer for about 2 hours. According to the proprietor of the bar, they each drank two 12-ounce bottles of beer while in his establishment. Between 10:30 p.m. and 1:45 a.m., the engineer and fireman went to another bar in Akron, where they socialized with some local residents, played pool, and drank beer. The woman tending the bar told Safety Board investigators that she served four or five beers to each man.

About 1:40 a.m., the motel proprietor called the bar, had the engineer called to the telephone, and informed him he was to report for duty at 2:55 a.m. During this conversation, the engineer told the motel proprietor that the fireman was with him. The motel proprietor testified that he called the bar because he had called the rooms of the two men and when neither call was answered, he called the bar, because the engineer had telephoned him about 10:30 p.m from a place with "loud music in the background." He had assumed that the engineer was at the bar. Employees of a restaurant next to the motel stated that the engineer and fireman came in about 2 a.m. and had breakfast; they said that the two men appeared to have been drinking. According to the motel proprietor, motel maids who tended the rooms the morning of April 13 found that the beds in the rooms of the engineer and the fireman had not been slept in or otherwise showed any evidence of use.

The activities of the head brakeman on the night of April 12-13 could not be determined. However, he was in his room and answered the telephone when the motel proprietor called about 1:40 a.m. to inform him that he was to go on duty at 2:55 a.m. According to the proprietor, the head brakeman did not look well, and he stated that he did not feel well when he came into the motel lobby after being called to go to work. Moreover, the head brakeman complained that he had not slept well because of the noise coming from his conductor's room.

The rear brakeman had watched the poker game for 30 to 45 minutes before going to his room, where he laid down, without sleeping, until about 7 p.m. He then returned to the game room in time to see the poker game break up. Thereafter, he visited a friend, returned to his room about 10 p.m., and slept until about 1:40 a.m, when called by the motel proprietor.

The motel proprietor stated that the engineer and fireman returned to the motel between 2 a.m. and 2:30 a.m. At that time, he said he detected the odor of alcohol on the engineer and noticed that he was "visibly affected." The engineer's ". . . speech seemed a little slower than usual, like his tongue was a little bit heavy," according to the proprietor. Also according to the proprietor, after going to his room, the engineer returned to the motel lobby smelling as though he had used mouthwash. Later, the proprietor asked the fireman if he was going to run the train, since the engineer "seemed a little bit high." The fireman, who appeared to the proprietor to be "normal," replied in the negative and said that the engineer would run the train. About 2:45 a.m, the proprietor drove the five crewmembers to the BN station. By this time, he said, the engineer's speech seemed "very normal." According to the proprietor, the crewmembers of Extra 6714 West were "very pleasant people to work with," and had never caused any problems at his motel.

The surviving crewmembers of Extra 6714 West were discharged by the BN following the Wiggins accident. The rear brakeman had no prior record of being formally disciplined for violations. However, 2 days before the accident, he had been verbally censured by the trainmaster for failing to inspect a switch properly. The conductor had been suspended for a 15-day period in 1983, in connection with a yard derailment, and he had been reprimanded twice for failing to be available for work assignments. He was described by his superiors as intelligent, talkative, and likeable, but they also considered him to be reluctant to assume responsibility. About 2 weeks before the accident, he had been verbally reprimanded in this regard by the trainmaster and the road foreman of engines.

All three crewmembers on the head end of Extra 6714 West had been fired by BN at one time or another before the accident, but had been reinstated on the basis of leniency. 4/ In 1982, the engineer was dismissed for nullifying the deadman control of his locomotive and for reading material unrelated to his work while on duty. He was reinstated 3 months later. Later in 1982, the engineer had been suspended for 45 days after having violated train order rules; in 1983, he was also suspended for 5 days for failure to report for his assignment.

According to members of his family, the engineer was in good health and was not under treatment for any physical disorder. A close friend of the engineer related that he had complained of stress on the job, the irregularity of his working hours, and the lack of recreational facilities at Akron, which he said forced the BN's employees to drink. Some of the engineer's coworkers described him as a "partier" and "drinker," and stated they had seen him intoxicated while on duty in the past. Several questioned his proficiency as a road engineer and his knowledge of the railroad. The trainmaster described the engineer as a congenial complainer.

The fireman had been fired in 1980, after being assigned to a crew whose train had passed a stop signal. He had not been operating the train at the time, and he was reinstated on a leniency basis in less than 3 months. Other than this incident, his record

4/ BN used dismissal for rules violations as a "management educational tool" and about 85 to 90 percent of fired employees were reinstated on a leniency basis as a matter of BN policy. Rule G violators could be reinstated after 6 months providied they had successfully completed a prescribed rehabilitation program.

was clear of reprimands and disciplinary actions. The fireman's supervisors and coworkers considered him to be amiable, relaxed, professional, and responsible. The road foreman of engines had ridden with him twice during the 2 months preceding the accident, and thought him to be a proficient engineer.

The head brakeman had been fired twice -- once in 1979, for being a member of a crew whose train had passed a stop signal without stopping, and once in 1982, after he was found asleep on duty. He was reinstated through the BN's policy of leniency both times, in the most recent instance after 5 months. In 1982, the head brakeman was suspended for 5 days after his train was handled improperly. In both 1982 and 1984, he had to take BN's biennial rules examinations twice in order to pass them. Witnesses stated the head brakeman thought the discipline he had received was unfair since he was not responsible for running the trains involved. Several coworkers described him as a "sleeper;" one stated that he often slept on duty and was difficult to arouse from sleep. The head brakeman's supervisors considered him to be amiable, but slow to accept responsibility.

Method of Operation

The accident occurred on the BN's Colorado Division main line between McCook, Nebraska, and the 31st Street Yard at Denver, Colorado, a distance of 253 miles. Akron, Colorado, a crew change and layover point, is about 143 miles west of McCook and 110 miles east of 31st Street Yard. Trains are operated over the single main track by wayside automatic block signals. Between Akron and Denver, there are 14 passing tracks, or sidings, spaced 5 to 10 miles apart. These range in length from 4,000 to 8,000 feet. The passing track at Wiggins was 7,291 feet long; the next eastward passing track, Bijou, was about 10 miles to the east and was 7,925 feet long. (See figure 3.)

Operations are conducted through the use of a Centralized Traffic Control (CTC) system which is controlled by a dispatcher at McCook. Both Wiggins and Bijou were controlled passing tracks under the CTC system and were equipped with remotely controlled switches at their turnouts. The home signals for the control points were the single-aspect searchlight-type with rotating color discs. The intermediate block signals between control points were the approach-lighted, three-aspect-color-light type. Both intermediate and home signals were mounted on a high mast; the main track home signals at both ends of Wiggins passing track being located on the right hand side of the track in the direction of the movement they governed. The approach signal west of Wiggins, intermediate signal No. 4816, was also located on the right hand side for an eastbound train. However, intermediate signal No. 4749, the westbound approach signal for the east end of Wiggins, was located on the left hand, or south side, of the main track. (See figure 4.)

The dispatcher at McCook monitored the movement of trains as they reached and passed control points. These control points were represented by lights on the panel board of his CTC console. Through the use of the power switches at the control points, the dispatcher remotely established the routes to be used by trains at the control points. Once the route was established, the governing signals were automatically locked in.

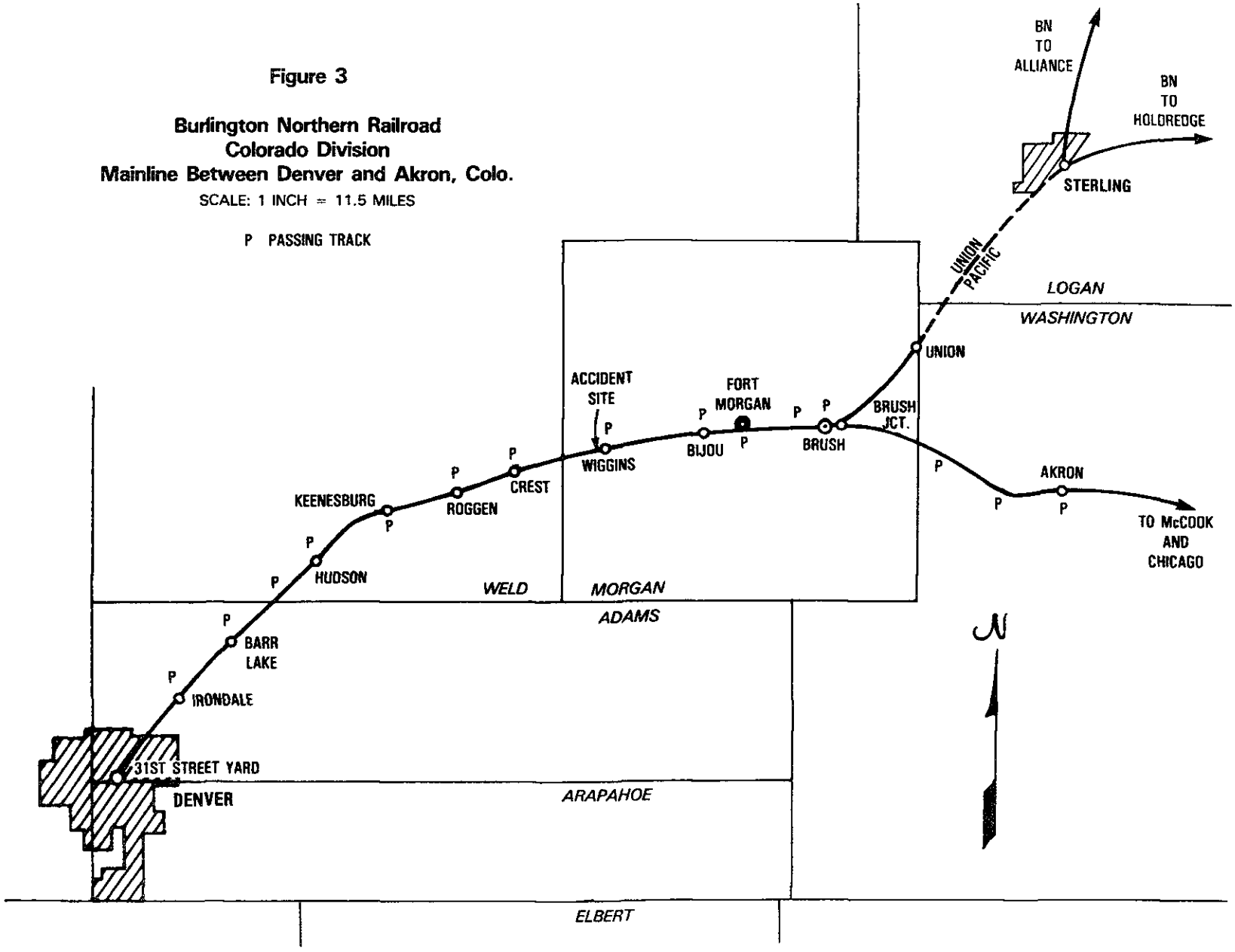
With the route at the west end of Wiggins established for Extra 7820 East to take the diverging route into the passing track, the signals governing the train would have displayed the following aspects:

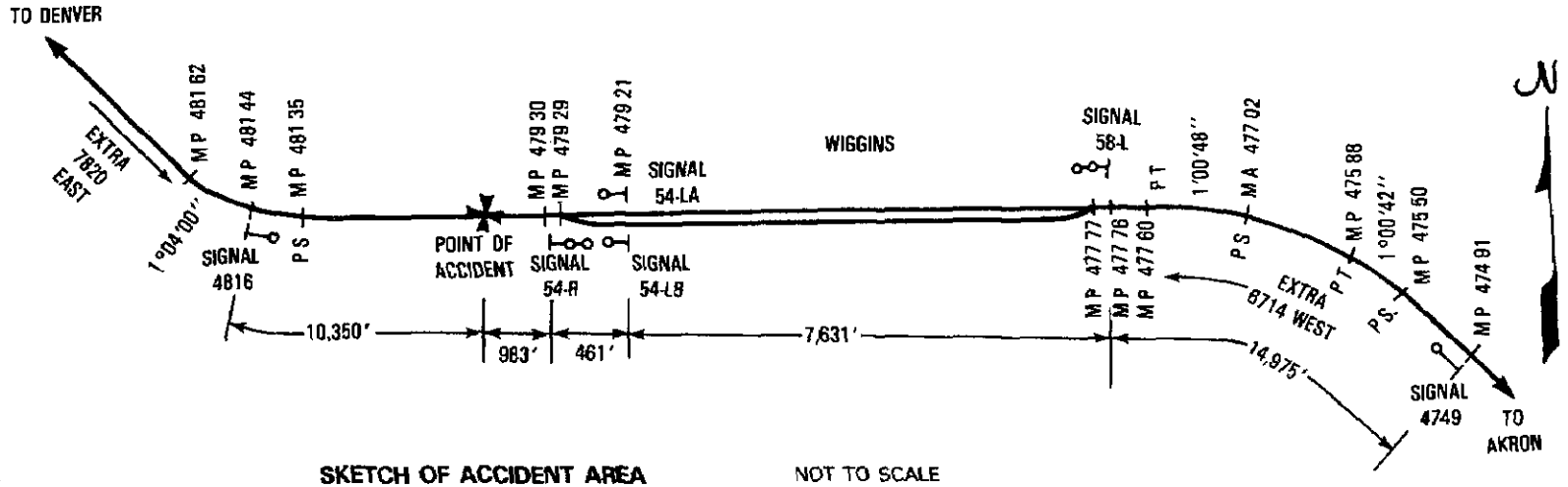
Figure 3

Burlington Northern Railroad
Colorado Division
Mainline Between Denver and Akron, Colo.

SCALE: 1 INCH = 11.5 MILES

P PASSING TRACK





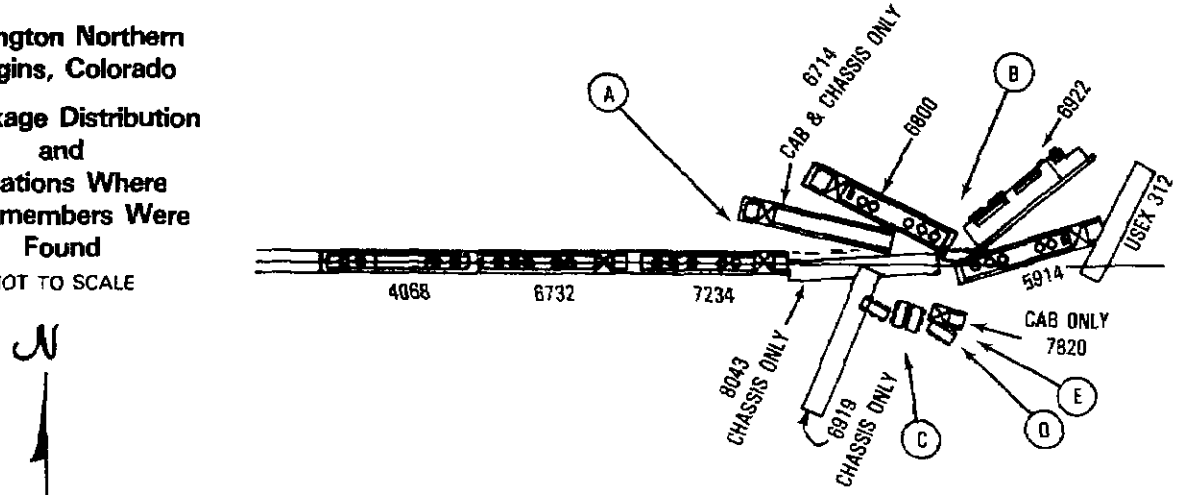
SKETCH OF ACCIDENT AREA NOT TO SCALE

Figure 4

Burlington Northern
Wiggins, Colorado

Wreckage Distribution and Locations Where Crewmembers Were Found

NOT TO SCALE



		EXTRA 6714 WEST		EXTRA 7820 EAST
A	FIREMAN, EXTRA 6714 WEST	6714	LEAD UNIT	7820 LEAD UNIT
B	ENGINEER, EXTRA 6714 WEST	6319	2ND UNIT	8043 2ND UNIT
C	DISPATCHERR, EXTRA 7820 EAST	6800	3RD UNIT	7234 3RD UNIT
D	FIREMAN, EXTRA 7820 EAST	5914	4TH UNIT	6732 4TH UNIT
E	HEAD BREAKMAN, EXTRA 6714 WEST	6922	5TH UNIT	4068 5TH UNIT

Intermediate Signal 4816		(Milepost 481.44)
Aspect	Name	Indication
Yellow	Approach	Proceed prepared to stop before any part of train or engine passes the next signal. Trains exceeding 35 mph must immediately reduce to that speed.

Eastbound Home Signal 54R		(Milepost 479.30)
Aspect	Name	Indication
Red over Lunar White	Restricting	Proceed at restricted speed

With the route for Extra 7820 East thus established, the signals governing the movement of westbound train Extra 6714 West as it approached the west end of Wiggins would have displayed the following aspects:

Intermediate Signal 4749		(Milepost 474.91)
Aspect	Name	Indication
Yellow	Approach	Proceed prepared to stop before any part of train or engine passes the next signal. Trains exceeding 35 mph must immediately reduce to that speed.

Westbound Home Signal 58L		(Milepost 477.76)
Aspect	Name	Indication
Yellow over Red	Approach	Proceed prepared to stop before any part of train or engine passes the next signal. Trains exceeding 35 mph must immediately reduce to that speed.

Westbound Home Signal 54L		(Milepost 479.21)
Aspect	Name	Indication
Red	Stop	Stop before any part of train or engine passes the signal.

BN operating rule G prohibits the use of alcoholic beverages, intoxicants, narcotics, marijuana, or other controlled substances by employees who are "subject to duty," or their use or possession while on duty. (See appendix C.) BN operating rules 34 and 804(B) require train crewmembers to communicate with the operator of their train should he fail to stop or reduce the speed of the train as indicated by signal aspects. If the communication does not bring about the required action, crewmembers are obliged to use the emergency brake valve to stop the train. According to BN's Colorado Division superintendent and the trainmaster in charge of train operations between Akron and Denver, the rules apply to crewmembers in the caboose as well as those on the head end of the train. According to the trainmaster, this interpretation was stressed during the rules examinations conducted on the division in July 1983. Although the road foreman of engines also interpreted the rules as applying to crewmembers in the caboose, he did not recall hearing this interpretation given in rules examinations. The conductor of Extra 7820 East stated that he probably would not take any action even if he was aware that his engineer had failed to comply with an "approach" signal aspect. One of his brakeman stated that he had never heard an interpretation of Rule 34 given during a rules examination. The other brakeman gave a similar response and stated that he was not ". . . going to run the head end from the rear end."

According to the conductor of Extra 7820 East, he required the head end to communicate all restrictive signal aspects to the rear end. The conductor of Extra 6714 West stated that this was the customary practice on the division. However, he also stated that he did not receive such communication as his train approached Wiggins. The conductor and rear brakeman of Extra 6714 West stated that they were unable to see the signal aspects approaching the accident location before the head end of their train passed them.

Medical and Pathological Information

Following the accident, the conductor and rear brakeman of Extra 6714 West submitted to blood tests which were found to be negative for alcohol and drugs. Postmortem examination of blood and tissue samples from the engineer, fireman, and head brakeman were made at the Forensic Toxicology Research Unit of the Federal Aviation Administration (FAA). A specimen of clotted blood obtained from the engineer's body revealed the presence of alcohol, but the sample was not sufficient to yield a quantitative analysis. No evidence of acidic, neutral, or basic drugs, or of carbon monoxide was detected.

Analyses of blood and urine samples obtained from the fireman yielded alcohol levels of .056 percent in the blood and .091 percent in the urine. There was no evidence of neutral, acidic, or basic drugs, and no evidence of carbon monoxide in the blood. A culture of the fireman's blood produced a moderate growth of E. Coli and .061 percent ethyl alcohol after 24 hours incubation.

Toxicological analysis of blood samples from the head brakeman revealed no evidence of blood alcohol. Less than 1 percent saturation of carbon monoxide was found with a hemoglobin concentration of 14 grams. (See appendix E.)

Toxicological analysis of blood samples taken from the crewmembers of Extra 7820 East were negative for blood alcohol, and revealed no evidence of neutral, acidic, or basic drugs, as well as carbon monoxide.

Survival Aspects

The engineer and head brakeman of Extra 7820 East received minor injuries as a result of jumping from the lead locomotive unit to avoid the collision. The other surviving train crewmembers of the two trains were uninjured.

The force of the collision caused the lead locomotive units to be overridden; the carbodies of both were separated from the main frames and demolished. The bodies of the four train crewmembers and the dispatcher riding on Extra 7820 East were apparently ejected from the locomotive units during the collision sequence. The bodies of the engineer and fireman of Extra 6714 West were found about 20 feet apart to the north of the main track at or near the point of collision. The bodies of the other men were found south of the main track near the point of collision. These were located 20 to 30 feet apart with the head brakeman of Extra 6714 West farthest to the east, the fireman of Extra 7820 East in the middle, and the dispatcher farthest to the west. (See figure 4.)

Tests and Research

Extra 6714 West had originated at Chicago, Illinois, where it received an initial terminal air brake test in compliance with BN air brake rules and Federal Railroad Administration (FRA) regulations. En route, the train also had received the required 1,000-mile air brake test at Galesburg, Illinois, and an intermediate air brake test following a change of its locomotive units at Lincoln, Nebraska. As far as could be determined during the investigation, these tests did not reveal any defects in the train's air brake system.

Following the accident, the brake equipment of both trains was tested and found to function properly. One of the undamaged cars in Extra 6714 West's train was found to have brake cylinder piston travel of 10 3/4 inches--1/4 inch greater than the maximum allowed under FRA regulations for initial terminal air brake testing. The main track east of the point of collision was inspected and found free of sand or other evidence that would indicate that Extra 6714 West was in emergency braking just before the collision. Damage to the switch at the west end of Wiggins passing track indicated that a westbound train had run through it while it was aligned to the passing track.

Barco speed recorder tapes were recovered from locomotive units of both trains. The tape from Extra 6714 West indicated that speed was maintained at 55 mph to the point of collision. The speed recorder that yielded the tape was calibrated after the accident and found to record actual speed between 40 and 60 mph. A tape from an Extra 7820 East unit indicated that the speed of that train was maintained at 15 mph to the collision point. Calibration of the recorder revealed that recorder speed was 1 mph greater than actual speed between 10 and 30 mph.

All of the signals and associated systems were inspected and tested on April 14, 1984. The inspections and tests were made by BN signal supervisors and maintainers in the presence of qualified FRA inspectors. The relays and circuitry were found to be free of defects, and all signals displayed the proper aspects during the tests. The investigation also determined that the interlocking at the west end of Wiggins passing track received the required annual test on April 11, 1984, during which no defects were discovered in the system.

On May 16, 1984, a Safety Board investigator and an FRA operating practices supervisor conducted a test from the caboose of a westbound BN freight train to determine whether the aspects of signals 4749, 58L, and 54L could be seen from that location before the head end of the train passed them. For the purposes of the test, the dispatcher aligned the switch at the west end of Wiggins passing track to the passing track so that the three westbound signals would display the same aspects as had been displayed for Extra 6714 West. The test train was 6,217 feet long, or about 72 feet longer than Extra 6714 West. The test was performed at night; visibility was restricted by rain occasionally mixed with snow. Although the test train's caboose had a modified cupola extending beyond the car sides, the sight test was made using only the forward cupola window on the right, or north side, which was the same as that of the caboose of Extra 6714 West. Speed of the test train approaching Wiggins was 35 mph, in conformity with signal aspects displayed. At this speed, the yellow "approach" aspect of Signal 4749 could be seen for about 1 1/2 minutes; the yellow over red "approach" aspect of Signal 58L was clearly visible, although track curvature and the lights of an interstate highway interchange behind the signal obscured visibility for a time; and the red "stop" aspect displayed by Signal 54L was clearly visible after the rear of the train entered straight track at the east end of Wiggins passing track. Throughout the test, the view through the forward window was distorted by raindrops on the glass face.

Other Information

Akron, Colorado, has long been a division point on the BN's Chicago-Denver mainline. As such, it was the away-from-home layover terminal for the traincrew working out of Denver and McCook, Nebraska. Until March 1, 1983, BN maintained a dormitory for its crews at Akron. Dubbed the "doghouse" by employees, the dormitory had some recreational facilities and was staffed by BN employees. Frequently, there were as many as 35 train crewmembers laying over at Akron, and since this was in excess of the dormitory's capacity, the overflow was accommodated at a hotel, next door to the BN's station and dormitory.

Akron had a small business district, a library, a golf course, a shooting range, and a small airport. The only theater in town was closed. There were four public lounges or restaurants, including the one next to the station motel, that served liquor, wine, and beer by the drink. These stayed open as late as 2 a.m., and had recreational devices such as billiard tables and video games. There was also a private club that served drinks, and there were two carry-out package stores that sold intoxicants by the bottle. The carryout stores were open all day and closed at 10 p.m.

Akron's old high school gymnasium was regularly open to the public for the playing of basketball and volleyball. In summer, there was an active softball league. Other seasonal outdoor activities included tennis and gardening. Because of the irregularity of their work, the railroad men found it impractical to participate in scheduled team sports in the town. However, a few of them played basketball in the gym, and some had gardens they tended in summer. The engineer of Extra 7820 East testified that he occasionally rented an airplane at the airport, and one of the motel proprietors stated that the head brakeman of Extra 6714 West had attended church services in Akron.

The three larger-sized towns nearest to Akron were Brush (22 miles), Fort Morgan (32 miles), and Sterling (34 miles). (See figure 3.) With a population of more than 10,000, Sterling was the largest of these and it offered the most extensive recreational opportunities. This city was also a BN division point; here BN continued to operate a

dormitory with recreational facilities for its crews. As many as 15 BN train crewmembers (including the fireman of Extra 6714 West) kept automobiles or pickup trucks at Akron in order to get around Akron and to travel to Sterling and the other nearby cities.

When BN closed its Akron dormitory, it began housing its traincrews at the motel which had been built by private businessmen for that express purpose. The motel was operated for the exclusive use of BN employees, and BN guaranteed the daily occupancy of 35 room units. The motel agreed to transport the BN traincrews to and from the station and to call the crews to report for duty. This enabled the BN to abolish the crew caller job at the station, as well as the employees' jobs at the dormitory.

The proprietors of the motel posted a list of house rules, among which was the prohibition of the use of alcoholic beverages on the premises, and a rule stating that unbecoming conduct could result in permanent ejection from the motel. The employees protested the house rules to their union representatives. According to the senior proprietor, they wanted to be allowed to drink beer in their rooms. Responding to pressure from a union representative, the trainmaster in charge of the Denver-Akron traincrews wanted the motel to drop all the rules. Ultimately, the "unbecoming conduct" rule was dropped at the insistence of the trainmaster, but the "no alcoholic beverages" rule remained in force.

The Newcastle Accident

This accident involved three eastbound Burlington Northern (BN) unit coal trains which originated at or near Gillette, Wyoming, and were en route to Edgemont, South Dakota. The first of these trains, Extra 5533 East, consisted of 5 locomotive units, 93 cars, and a caboose, and had departed from the Rawhide Coal Mine, north of Gillette, about 1 a.m. on April 22, 1984. The train had proceeded 71.1 miles to Pedro, 7.3 miles west of Newcastle, Wyoming, where it was routed into the passing track. There the train was left unattended when its four crewmembers boarded the locomotive units of following train Extra ATSF 8112 East.

Extra ATSF 8112 East, consisting of 5 locomotive units, 111 cars, and a caboose, had departed Gillette at 1:15 a.m. The train had proceeded 69.2 miles to Pedro Siding where it had stopped to pick up the crew of Extra 5533 East. As soon as the crew boarded, the train resumed eastward movement. The engineer was operating the train from the lead locomotive unit, which was also occupied by the head brakeman. The conductor and rear brakeman were in the caboose. The crewmembers of Extra 5533 East were riding in the second and third locomotive units.

Extra 7843 East, consisting of 5 locomotive units, 115 cars, and a caboose, had departed from the Eagle Butte Coal Mine, north of Gillette, about 1:50 a.m. and followed Extras 5533 and ATSF 8112 East. The train had traveled 73.9 miles to Pedro and was moving east on the single main track. (See figure 5.) The engineer was operating the train from the lead locomotive unit. The head brakeman was also on the lead unit, and the conductor and rear brakeman were in the caboose.

Between 4:00 a.m. and 4:58 a.m., on April 22, 1984, there were nine freight trains in the 29-mile section between Thornton, Wyoming, and the Pedro passing track near Newcastle. Extras 5533, ATSF 8112, and 7843 East, preceded by yet another eastbound

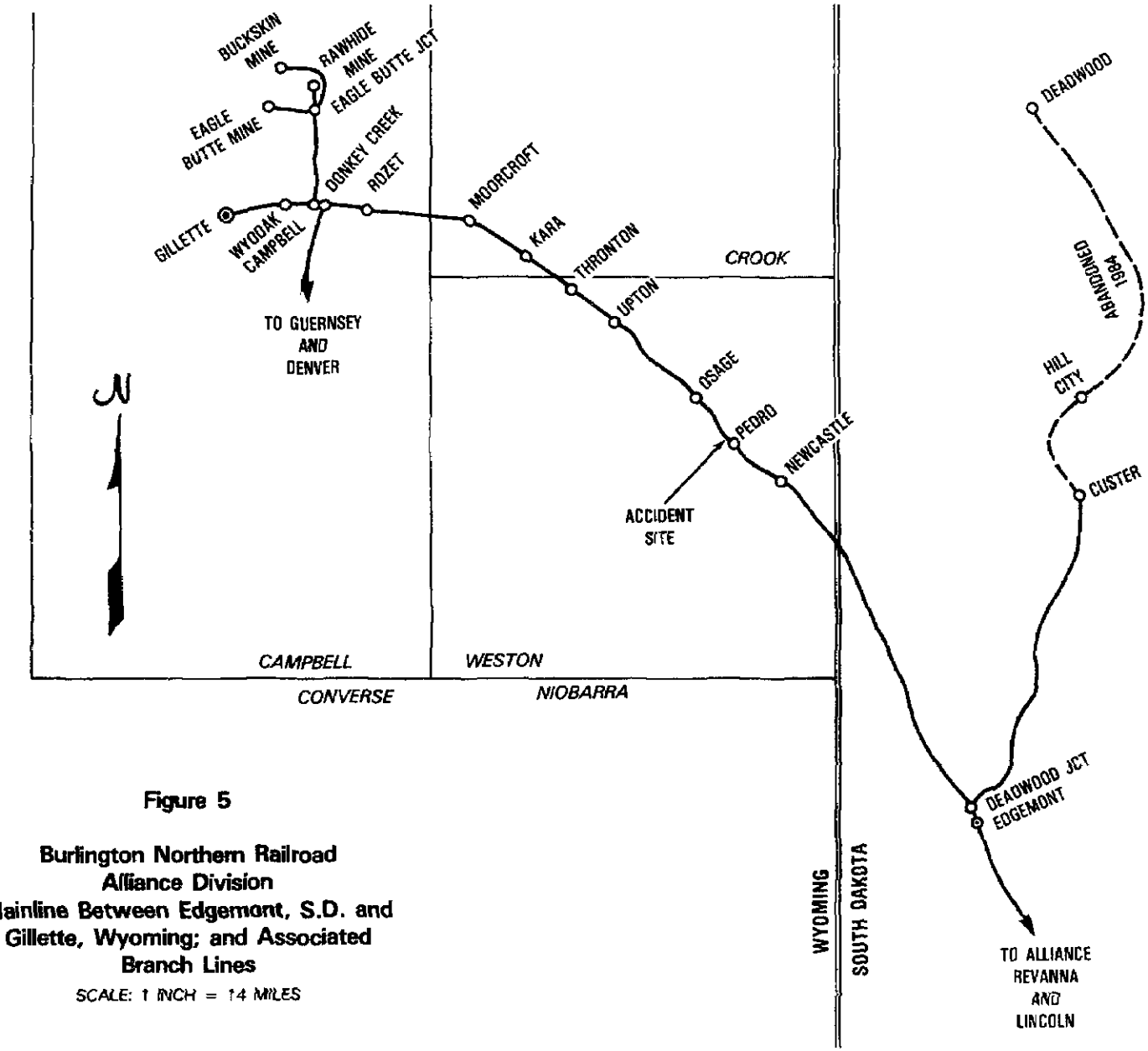


Figure 5

Burlington Northern Railroad
Alliance Division
Mainline Between Edgemont, S.D. and Gillette, Wyoming; and Associated Branch Lines

SCALE: 1 INCH = 14 MILES

coal train, were being moved past five westbound freight trains in this section. (See figures 6 and 7.) Four of the westbounds waited in the passing tracks at Thornton and Upton for the eastbounds to pass; the fifth was advanced to Osage where it was routed into the passing track. This delayed Extra 5533 East which had to stop and wait for about 10 minutes for the westbound to arrive and clear into the passing track at Osage. In the process, the distances between the three eastbound trains were shortened considerably. Extra ATSF 8112 East reached the west end of Osage about 5 1/2 minutes after the preceding eastbound had cleared the east end of the passing track and was now running about 9 minutes ahead of Extra 7843 East.

Since it was doubtful that the crew of Extra 5533 East would be able to reach its destination of Edgemont before the expiration of maximum allowable duty time under the Hours of Service Act, 5/ the dispatcher routed the train into the passing track at Pedro and instructed Extra ATSF 8112 East by radio to stop there and pick up the crewmembers. Extra 5533 East cleared the main track at the west end of Pedro about 4:39, and approximately 8 minutes later, the locomotive of the following train stopped on the main track opposite its caboose. After the conductor and rear brakeman had boarded its locomotive, Extra ATSF 8112 East pulled east to the locomotive of the train in the passing track and picked up its engineer and head brakeman. In the process, the caboose of Extra ATSF 8112 East cleared the turnout at the west end of Pedro passing track about 4:53.

The engineer of Extra 7843 East stated that he was aware that there were eastbound trains moving ahead of his train and that after leaving Upton, he encountered only restrictive signals -- yellow "approach" and flashing yellow "approach medium" aspects, both requiring reduction of speed to 35 mph. Before reaching Osage, the engineer heard radio transmissions between the crewmembers of the eastbound trains ahead concerning the picking up of the Extra 5533 East crew at Pedro. In the 10 miles preceding the interlocking at East Osage, Extra 7843 East was operated at speeds ranging between 15 and 32 mph. The engineer recalled seeing the signal at West Osage displaying a flashing yellow aspect, the westbound train standing in the Osage passing track, and a member of that train's crew in position on the ground to inspect his train. After that, he said, he must have "nodded off." He was unable to recall seeing the signal at East Osage or the two intermediate signals between East Osage and the Pedro passing track. The head brakeman recalled passing the westbound train at Osage, but he could not recall seeing the signals at West Osage or East Osage, or the intermediate signals east of East Osage.

The conductor of Extra 7843 East stated that under normal conditions he expected slack run-in at the caboose of an eastbound coal train when the caboose was about one-half mile west of a 3-mile, 0.80-percent grade known as Y.T. Hill. This, he said, resulted from the engineer's initiating dynamic braking to control speed after the train started down the grade. 6/ Shortly after the slack run-in, the conductor said, he would expect the train brakes to apply.

5/ 49 CFR, Part 228, Appendix A.

6/ Dynamic braking is initiated by reversing the field of the locomotive's traction motors, thereby changing them into generators and thus causing the retardation of the locomotive wheels. This form of braking is independent of the train and locomotive air brake systems. Retarding the locomotive units when the train is free-rolling with the slack stretched will usually result in slack run-in throughout the train. Hence, initiation of dynamic braking is often readily apparent to those in the caboose who often know where to anticipate it and to brace themselves against slack run-in.

FIGURE 6

TRAIN MOVEMENTS BETWEEN MOORCROFT AND NEWCASTLE, WYOMING

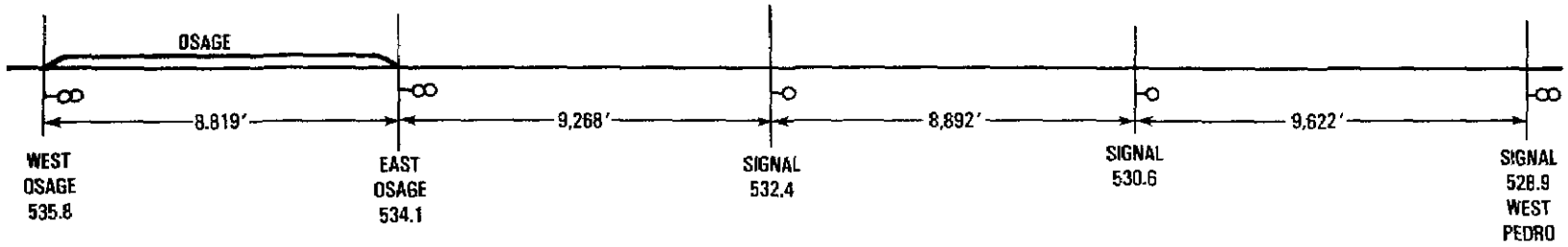
3:46 TO 4:56 A.M., APRIL 22, 1984

(Times Shown Indicate When Front and Rear Ends of Trains Passed Signals*)

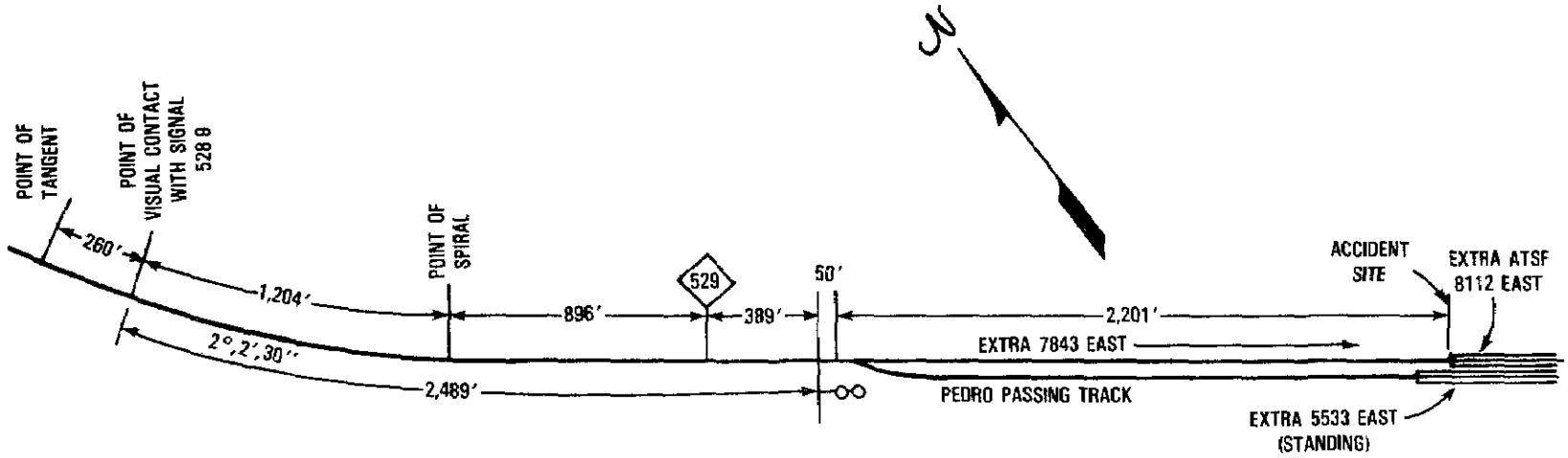
LOCATION	Extra 6371 East	Extra 5533 East	Extra 8112 East	Extra 7843 East	Extra 7226 West	Extra 5002 West	Extra 7811 West	Extra 7825 West	Extra 5128 West
Moorcroft (MP 569.0						4:34:32 4:31:46	4:48:39 4:44:59	5:06:11 5:03:00	
Kara (MP 562.0)					4:14:24 4:11:43	4:24:23 4:21:37	4:41:40 4:33:33	4:48:06 4:44:38	
Thornton (MP 556.3)				3:54:06 3:57:39	4:04:47 4:02:14	4:12:20 4:09:08	4:23:34 4:20:50	4:34:30 4:31:44	
Milepost 552.1				4:04:27 4:08:09			4:14:43 4:10:25	4:25:55 4:22:37	
Milepost 551.6			3:47:19 3:51:13	4:05:54 4:09:08			4:13:08	4:24:59 4:21:36	
West Upton (MP 550.2)			3:51:33 3:54:22	4:09:26 4:12:01					
Upton (MP 548.1)			3:55:39 3:58:51	4:12:56 4:15:38					
East Upton (MP 547.2)		3:47:59 3:51:35	3:57:38 4:00:49	4:14:42 4:18:02					
West Osage (MP 535.8)		4:08:07 4:12:00	4:34:49 4:35:51	4:44:57 4:48:56					5:01:24 4:58:17
East Osage (MP 534.1)	3:46:54 3:50:15	4:24:39 4:29:13	4:36:28 4:39:16	4:49:14 4:51:52					4:20:50 4:17:21
West Pedro (MP 528.9)	3:57:56 4:03:50	4:35:49 4:38:57	4:46:31 4:53:08	4:55:51					4:11:20 4:09:07
East Pedro (MP 527.3)	4:06:50 4:10:05								4:03:30 4:00:10
West Newcastle (MP 519.3)	4:16:39 4:19:16								3:54:22 3:52:29

* From Signal Computer Printout

Figure 7



Signals Between Osage and Pedro
SCALE: 1 INCH = 1.5 MILES



Burlington Northern Railroad
Alliance Division
Approach to Pedro Passing Track and Accident Site
SCALE: 1 INCH = 500 FEET

Extra 7843 East began accelerating from a speed of about 21 mph in the vicinity of MP 536, approaching West Osage interlocking. The engineer had the locomotive running in full throttle. The train passed through the East Osage interlocking (MP 534.1) at an average speed of 26.4 mph. About 1.3 miles east of East Osage interlocking, the train began to descend Y.T. Hill, and by the time the locomotive had reached the vicinity of MP 530.4, slightly more than 3 1/2 miles east of East Osage, the train was moving at a speed of about 65 mph. (See figure 7.)

The train's rapid acceleration going down Y.T. Hill alerted the conductor, and he began calling the engineer on the radio. This awoke the engineer who saw the speed indicator registering a speed of "60 to 62" mph. The engineer stated that he responded at MP 530.3 or 530.4 by successively making a full service application of the train brakes, reducing the throttle to idle and simultaneously changing to dynamic braking, and putting the train brakes in emergency. According to the engineer, he changed from power to dynamic braking out of habit, and he described the time between the full service and the emergency application as "just a pause." He acknowledged that he had apparently fallen asleep and had already passed the approach signal for the west end of the Pedro passing track when he awoke and began taking action.

The sound of the initial air brake application aroused the head brakeman who recalled seeing the engineer standing up in what he described as a state of panic. The engineer asked the brakeman if he had seen the last signal, and after receiving a negative response he stated that they were going about 60 miles per hour, "too fast to get stopped for the next signal." It was then that he placed the brakes in emergency, according to the head brakeman. About 30 seconds later, the "stop" aspect displayed by signal 528.9, the home signal at the west end of Pedro, came into view. The engineer then twice shouted over the radio, "Get off your waycar." 7/ He stated that he also sounded the whistle repeatedly, although the head brakeman could not remember his doing this. When the locomotive had reached a point about 500 feet west of Signal 528.9, the engineer and head brakeman jumped to the ground. According to the engineer, the train was moving about 40 mph at the time.

As Extra 7843 East approached the west end of the Pedro passing track, Extra ATSF 8112 East began to resume eastward movement on the main track. The crewmembers on the locomotive of the train recalled hearing a single garbled radio transmission of which they recalled understanding only the word "waycar," and they were unaware of the overtaking train. Their conductor and rear brakeman apparently did not hear the warning and remained on the caboose. Extra 7843 East was moving at about 35 mph when it struck the caboose at about 4:56 a.m. The location was MP 528.5, about 2,251 feet east of Signal 528.9.

At the time of the accident it was dawn and clear with no atmospheric restriction to visibility. The temperature was about 35° F.

Injuries to Persons

Injuries	Extra 5533 East	Extra ATSF 8112 East	Extra 7843 East	Totals
Fatal	0	2	0	2
Nonfatal	0	0	2	2
None	4	2	2	8
Totals	4	4	4	12

7/ Another term for caboose.

Train Information

At the time of the accident, Extra 7843 East consisted of three General Motors Model SD40-2 six-axle locomotive unit and two General Electric Model C-30-7 six-axle locomotive units, 115 loaded coal hopper cars, and a Union Pacific bay-window-type caboose. The train had a trailing weight of 14, 656 tons, a nominal length of 6,137 feet, and was restricted to a maximum authorized speed of 45 mph. Extra ATSF 8112 East consisted of 5 locomotive units, 110 loaded coal hopper cars, 1 empty car, and a BN cupola-type caboose. The train's trailing weight was 14,138 tons. Extra 5533 East consisted of 5 locomotive units, 93 loaded coal cars, and a caboose.

The lead locomotive unit of Extra 7843 East had the low-profile short hood forward and was equipped with a functioning Chicago Pneumatic tape-type speed indicator/recorder, a rotating amber beacon light mounted on top of the cab roof, a dual sealed-beam headlight, and overspeed control set at about 69.5 mph. The unit was not equipped with a foot-pedal type deadman control, an alerter device, nor any other type of automatic backup safety control device.

The lead locomotive units and cabooses of Extra 7843 East and Extra ATSF 8112 East were equipped with permanently mounted radios operable on BN channels 1 and 2. The cabooses of both Extra ATSF 8112 East and Extra 5533 East were standard BN cupola-type cabooses equipped with electrically powered red marker lights mounted on the rear platforms. These lights and the radios drew their power from batteries which were charged when the cars were moving by belt-driven alternators. The battery on the caboose of Extra ATSF 8112 East would not hold a charge and the radio functioned only when the caboose was in motion. 8/ The engineer of Extra 7843 East stated that his headlight illuminated both cabooses and that he saw the red marker light on the caboose in the passing track. He said he saw no light on the caboose on the main track before he jumped from his train.

Damage

All five locomotive units and six of the cars of Extra 7843 East derailed in the collision; the locomotive units and 5 of the 6 cars were damaged heavily. The caboose of Extra ATSF 8112 East was destroyed as were 7 of the 12 coal cars in the train that were derailed as a result of the collision impact. During the collision/derailment sequence, the three rear cars of Extra 5533 East's train standing on the passing track were struck and derailed. These cars received moderate to heavy damage as a result. About 720 feet of track was destroyed.

Damage was estimated as follows:

Train Equipment	$1,216,250
Train Lading	70,743
Track and Signals	18,000
Expense of Clearing Wreckage	54,000
Total	$1,358,993

8/ According to the engineer of Extra ATSF 8112 East, he was told at Gillette that the caboose radio only worked intermittently. When he attempted to make the required end-to-end radio check while the train was standing at Gillette, he received no response from the caboose.

Crewmember Information

Each of the crews of the trains involved consisted of an engineer, a conductor, a head brakeman, and a rear brakeman; all were qualified under BN rules without restrictions. Edgemont, South Dakota, was the home terminal for all the crewmembers. (See appendix B.)

The crews of Extras 5533 and ATSF 8112 East had reported for duty at Gillette, Wyoming, at 5:25 p.m., and 10:30 p.m., respectively, on April 21. Their respective prior off-duty periods at Gillette were 16 hours, and 16 hours 45 minutes. At the time of the accident, the crew of Extra 5533 East had been on duty continuously for 11 hours 33 minutes; the crew of Extra ATSF 8112 East, 6 hours 26 minutes.

The engineer, conductor, and head brakeman of Extra 7843 East were regularly assigned to the Edgemont-Gillette freight pool. The rear brakeman was assigned to the brakemen's extra board at Edgemont. The crew had reported for duty at Gillette at 11:00 p.m, April 21, and had been on continuous duty for 5 hours 56 minutes when the accident occurred. Prior to reporting at Gillette, the crewmembers had been off duty for 9 hours 35 minutes. They had previously taken a train from Edgemont to Gillette, and in the process, had been on duty from 2:20 a.m. to 1:25 p.m. on April 21. The following is their work/rest history during the 72 hours preceding the accident, as traced backward from 4:56 a.m., April 22 (see appendix D for details):

	Engineer		Conductor		Rear Brakeman		Head Brakeman	
	Hrs.	Mins.	Hrs.	Mins.	Hrs.	Mins.	Hrs.	Mins.
	5	56 ON	5	56 ON	5	56 ON	5	56 ON
	9	35 OFF	9	35 OFF	9	35 OFF	9	35 OFF
	11	15 ON	11	15 ON	11	15 ON	11	15 ON
	16	50 OFF	16	50 OFF	11	0 OFF	10	10 OFF
	3	05 ON	9	30 ON	9	55 ON	8	15 ON
	25	19 OFF	18	54 OFF	9	30 OFF	11	15 OFF
					11	59 ON	9	0 ON
					2	40 OFF	6	34 OFF
Totals	20	16 ON	26	41 ON	39	5 ON	34	26 ON
	51	44 OFF	45	19 OFF	32	55 OFF	37	34 OFF

After going off duty at 1:25 p.m., on April 21, the crewmembers who were to later man Extra 7843 East were assigned rooms in the sleeping/rest facilities BN maintained for its traincrews at Gillette. According to the engineer, he visited a friend and played golf during the afternoon. He said that about 7:00 p.m. he went to bed in his room and slept until he was awakened at about 11:05 p.m. and was told by his conductor that they had been called to duty. He had not eaten. He said he waited until 7:00 p.m. to retire because he expected he and his crew would not stand for duty until they had been at Gillette for 15 to 16 hours. The engineer based this estimate on the approximately 16 crews which were available for duty ahead of his, and his calculation that about one crew would be used per hour. He also stated there was no other means at Gillette for the traincrews to obtain accurate information as to when they could expect to be called to duty.

Other than the 4 hours bed rest at Gillette, the engineer's only bed rest during the 48 hours preceding the accident was about 2 1/2 hours at his home during the night of April 20-21. He described himself as being, "a little tired" when he reported for duty shortly after 11:00 p.m. on April 21.

The engineer said he smoked a pack of cigarettes daily and drank an occasional beer. He also described himself as having been a marijuana user for 4 or 5 years, and that he smoked marijuana about once a week. He further stated that he had smoked one marijuana cigarette at Gillette about 2:00 p.m., April 21. He refused to state whether or not he had smoked marijuana between that time and the time of the accident, or after the accident, as well as whether he had marijuana in his possession while he was on duty on Extra 7843 East. 9/

The head brakeman stated that he, too, believed he would be in Gillette for about 16 hours and for this reason stayed up throughout the afternoon and early evening. He related that he watched television at the BN dormitory where he was lodged until about 9:30 p.m., occasionally dozing off in his chair. After being told by a trainman of another crew that his crew had been called, he went to bed. He said he was awakened by his conductor at 11:05. Like the engineer, he had nothing to eat before being taken to his train. While at home during the night of April 20-21, the head brakeman slept in bed about 3 to 3 1/2 hours. This, and what he got at Gillette, was the only bed rest he had during the 51 hours preceding the accident. He described himself as "extremely tired. . . extremely exhausted," after going on duty as a crewmember of Extra 7843 East.

The conductor stated that he went to bed in his room at Gillette about 2:00 p.m., and slept until he was called at 9:30 p.m. Before leaving Gillette, he drank two cups of coffee, but apparently had nothing to eat. The rear brakeman stayed up at Gillette until about 5:30 p.m. and slept in his room from that time to 9:30 p.m., when he was called to duty at 11:00 p.m. Before going to his room, the rear brakeman ate dinner at a restaurant and then went to a tavern where he drank two beers. He also said that after being called, he drank two cups of coffee. Both the conductor and rear brakeman indicated they were heavy coffee drinkers. The rear brakeman stated he had tried smoking marijuana, "about 3 years ago," but was not a user of the drug at the time of the accident.

The engineer of Extra 7843 East had been dismissed on January 25, 1983, for his "failure to take necessary action," to stop a train he was assigned to as fireman before it passed a "stop" signal. He was reinstated on a leniency basis as an engineer on July 25, 1983. The conductor had been suspended for 10 days in 1976 for his responsibility in a switching accident, and for 5 days in 1982 for improperly claiming overtime. The rear brakeman had been held out of service on April 10, 1984, after failing to pass BN's biennual rules examination. He was restored to service on April 17, 1984, upon passing reexamination. The head brakeman's service record indicated that he had been suspended for 5 days in 1982, for missing a call to report to duty. (See appendix B.)

Method of Operation

The accident occurred on BN's Alliance Division main line extending from Ravenna, Nebraska, to Gillette, Wyoming, a distance of 469 miles. The portion between Edgemont, South Dakota, and Gillette, is 121.1 miles long. This line reportedly carries the highest annual line-haul tonnage carried over any single-track railroad line in the United States,

9/ Throughout his testimony at the Safety Board's public hearing, the engineer selectively invoked the Fifth Amendment when questioned concerning his use and possession of marijuana. He had counsel present during his testimony.

and probably the world. 10/ Its tonnage, consisting mostly of unit coal trains from Wyoming, was expected to exceed 120 million gross tons in 1984. Twenty years ago, the line was a secondary main line over which the annual haulage was about 7 to 8 million gross tons.

Operations are conducted through the use of a Centralized Traffic Control (CTC) System controlled by a dispatcher at Alliance, Nebraska. Traincrews are also directed in their duties by radio-transmitted instructions from the dispatcher. Pedro is a 8,146-foot controlled passing track with remotely controlled power switches at the turnouts. The home signals at each end of the siding are the color-light type with two sets of three light units. Osage, the first controlled passing track west of Pedro, was similarly signalled. Between Osage and Pedro, there are two intermediate automatic block signals of the approach-lighted, 3-light unit color-light type which govern the movement of eastbound trains. These are signal 530.6, located 9,622 feet west of the eastbound home signal at the west end of Pedro passing track, and signal 532.4, located 8,892 feet west of signal 530.6 and 9,268 feet east of signal 534.1, the eastbound home signal at the east end of Osage passing track.

With Extra 5533 East occupying the Pedro passing track, and Extra ATSF 8112 East occupying the block between intermediate signal 530.6 and eastbound home signal 528.9 at the west end of Pedro, the signals governing the movement of Extra 7843 East were designed to display the following aspects:

Home Signal 534.1 (East end of Osage)

Aspect	Name	Indication
Flashing Yellow	Approach Medium	Proceed prepared to pass next signal not exceeding 35 mph.

Intermediate Signal 532.4

Aspect	Name	Indication
Yellow	Approach	Proceed prepared to stop at next signal. Trains exceeding 35 mph must immediately reduce to that speed.

Intermediate Signal 530.6

Aspect	Name	Indication
Red	Restricted Proceed	Proceed at restricted speed through entire block.

10/ American Railway Engineering Association Bulletin 697, Volume 85, October 1984.

With Extra 5533 East occupying the Pedro passing siding and Extra ATSF 8112 East occupying the block between the eastbound home signals at the west and east ends of Pedro, the signals governing the movement of Extra 7843 East were designed to display the following aspects:

Intermediate Signal 532.4

Aspect	Name	Indication
Flashing Yellow	Approach Medium	Proceed prepared to pass next signal not exceeding 35 mph.

Intermediate Signal 530.6

Aspect	Name	Indication
Yellow	Approach	Proceed prepared to stop at next signal. Trains exceeding 35 mph must immediately reduce to that speed.

Home Signal 528.9 (West end of Pedro)

Aspect	Name	Indication
Red over Red	Stop	Stop before any part of train or engine passes the signal.

Track Information

The accident occurred on straight track on a 0.50-percent ascending grade eastbound. An eastbound train moving between Osage and the accident site would encounter the following approximate gradients:

MP Locations	Gradient
534.8 to 532.9	Level
532.9 to 529.9 ("Y.T. Hill")	0.80% descending
529.9 to 529.7	Level
529.7 to 529.4	0.70% ascending
529.4 to 528.6	Level
528.6 to 528.5	0.50% ascending

Over the above distance, the track was straight except for five curves ranging in length from about 600 to about 1,900 feet, and in degree of curvature from 1 degree, 1 minute, 15 seconds, to 2 minutes, 30 seconds. The aggregate length of these curves was

about 1.2 miles. The curve closest to the accident site was a 1,464-foot, 2-degree, 2-minute, 30-second lefthand curve eastbound. The distance from the exit spiral of this curve to the accident site was about 3,536 feet. (See figure 7.)

Survival Aspects

The engineer and head brakeman of Extra 7843 East jumped from their locomotive before the collision and both escaped serious injury. The caboose of Extra ATSF 8112 East was completely crumpled and torn apart in the collision sequence. The largest remnant of the caboose was found crushed against the loaded coal hopper cars that had been ahead of it (see figure 8). A smaller remnant was impaled to the front end of one of Extra 7843 East's locomotive units, which veered north after striking the caboose. According to the rear brakeman of Extra 5533 East, he found the body of the conductor in what remained of the cupola in the larger remnant of the caboose. He stated, "The way it looked to me. . .he never got out of his chair." The body of the rear brakeman was found under the larger remnant of the caboose wreckage almost completely buried under dirt and ballast stone displaced during the collision/derailment sequence.

Medical and Pathological Information

Autopsies were performed by an Iowa State Medical examiner on the conductor and rear brakeman of Extra ATSF 8112 East. According to the autopsy reports, the conductor died from multiple acute blunt trauma received in the collision sequence and the rear brakeman died from suffocation.

Blood and tissue samples were taken from the dead crewmembers and were sent to the FAA's Civil Aeromedical Institute (CAMI) in Oklahoma City, and to W.O. Brown, M.D. and Associates, P.C., at Scotts Bluff, Nebraska, for toxicological testing. Remaining blood samples were sent to the University of Utah's Center for Human Toxicology for quantitative analysis for the presence of cannabinoids (marijuana). Tests performed by CAMI for the presence of blood alcohol, carbon monoxide, and illicit drugs other than cannabinoids were negative. Results of the cannabinoid testing are shown in Table 1.

Blood and urine samples were taken from the 10 surviving train crewmembers for toxicological screening at the direction of the BN. All the samples were obtained at the Weston County Memorial Hospital in Newcastle from 3 hours 45 minutes to 4 hours 54 minutes after the accident. The samples were sent to W.O. Brown, M.D., and Associates for toxicological screening. At the request of the Safety Board, portions of the samples were sent from W.O. Brown to the Armed Forces Institute of Pathology (AFIP) in Washington, D. C., for verification of the screening, and to the Center for Human Toxicology for quantitative analysis of the presence of cannabinoids. Tests for the presence of blood alcohol and illicit drugs other than cannabinoids were negative for all the individuals. The results of the cannabinoid testing are also shown in table 1.

Tests performed by AFIP for the presence of other toxic substances produced the following results:

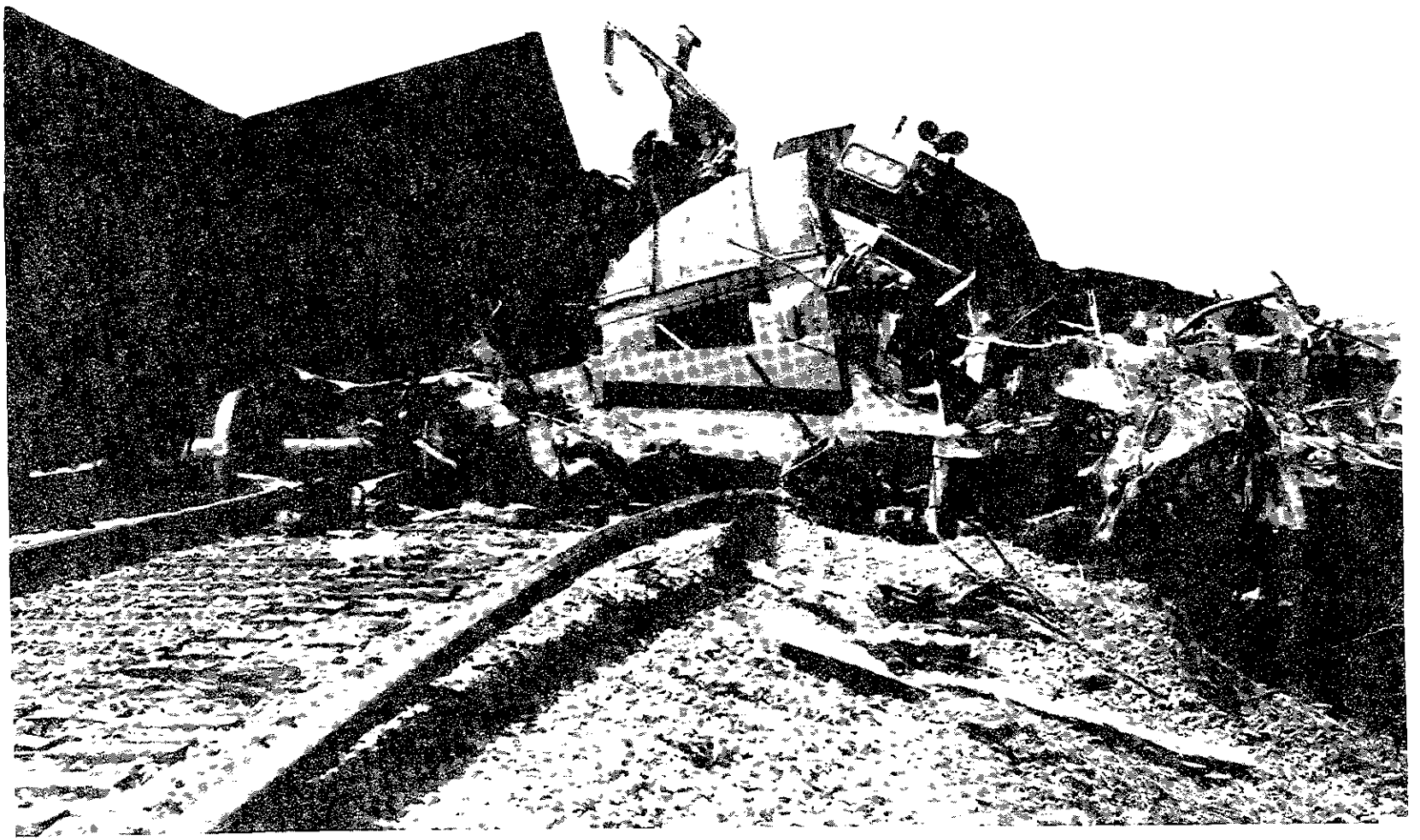


Figure 8.—Wreckage of the caboose of Extra ATSF 8112 East viewed facing west along the main track at Pedro. The third head locomotive unit of Extra 7843 East is behind the caboose. The cars at the extreme left are on the passing track and are at the extreme rear end of Extra 5533 East.

TABLE I
CANNABINOID TEST RESULTS

Train	URINE SCREENING			BLOOD TESTING			Time Blood Drawn Or.
Extra 7843 East	W.O.BROWN,M.D. & ASSOC.		AFIP	CENTER FOR HUMAN TOXICOLOGY **			April 22, 1954
	EMIT 1/	THIN LAYER CHROMA	GC/MS 2/	Delta 9 THC	OH 3/	COOH 4/	
ENGINEER	+	+	+	1.0 ng/ml *	–	79ng/ml	0849
HEAD BRAKEMAN	–	–	–	–	–	–	0950
CONDUCTOR	+	–	–	–	–	–	0841
REAR BRAKEMAN	–	–	–	–	–	3 ng/ml	0936
Extra 8112 East							
ENGINEER	–	–	–	–	–	–	0925
HEAD BRAKEMAN	+	+	+	3.8 ng/ml	1.6 ng/ml	78 ng/ml	0931
CONDUCTOR	NA	NA	NA	–	–	–	NA
REAR BRAKEMAN	NA	NA	NA	–	–	5ng/ml	NA
Extra 5533 East							
ENGINEER	+	+	+	–	–	9 ng/ml	0906
HEAD BRAKEMAN	–	–	–	–	–	–	0857
CONDUCTOR	–	–	–	–	–	–	0945
REAR BRAKEMAN	+	+	+	1.1 ng/ml	–	35 ng/ml	0914

\+ Positive
\- Negative
1/ Enzyme Immunoassay Technique
2/ Gas-Liquid Chromatography/Mass Spectrometry
3/ Hydroxy Metabolite
4/ Carboxylic Acid Metabolite
NA Not Applicable

* nanograms/milliliter

** The values shown are those produced by samples submitted by NTSB. Samples submitted to the Center for Human Toxicology by W. O. Brown & Associates produced slightly different values in some instances. According to the assistant director of the Center, the variation in values was within accepted tolerances for the test equipment.

	Carbon Monoxide*	Acetone**
Engineer, Extra 7843 East	8.4	
Head Brakeman, Extra 7843 East	5.7	-
Conductor, Extra 7843 East	7.3	-
Rear Brakeman, Extra 7843 East	4.9	
Engineer, Extra ATSF 8112 East	9.1	-
Head Brakeman, Extra ATSF 8112 East	1.3	-
Engineer, Extra 5533 East	9.2	-
Head Brakeman, Extra 5533 East	1.2	0.01 g/L
Conductor, Extra 5533 East	1.0	-
Rear Brakeman, Extra 5533 East	1.6	0.03 g/L

* Percent saturation in the blood.
** May be the result of diet or metabolic disorder.

Tests and Research

According to BN, the consist of Extra 7843 East received an initial terminal air brake test and inspection on April 21, 1984, which revealed no defects in the train. This was performed at Alliance, Nebraska, while the train was en route to the Eagle Butte Mine for reloading intact. The reloading was performed after the crew of Extra 7843 East had boarded the train at the mine, and as far as could be determined, there had been no change in the makeup of the train.

According to the engineer, the train ran freely and no stops were made between Eagle Butte Mine and the accident site. He said he controlled the speed of the train when necessary by throttle manipulation and through the use of dynamic braking, which he described to be exceptionally effective. The engineer indicated that he had not used the automatic air brake until he perceived that an emergency situation existed approaching Pedro.

Postaccident inspection of the lead locomotive unit of Extra 7843 East revealed the throttle to be in the No. 8, or full, position and in dynamic braking. The automatic brake valve was found in the emergency position, the independent brake valve was in release position, the reverser was in the forward position, the heater switch on the engineer's side was set on "medium," and the headlight switch was in the "bright" position. According to members of the other traincrews, they observed the headlight of the unit burning brightly after the accident. The unit did not have a "deadman" pedal nor a crew alerter device.

About 7 hours after the accident, the air brake equipment of the rear 105 cars and caboose of Extra 7843 East was inspected and tested. Brake pipe leakage was found to be 1 pound per minute. The brakes on all but one car applied properly, and no other defects were found in the air brake equipment.

On May 16, 1984, the type 26-L automatic brake valve and the independent brake valve removed from the lead unit of Extra 7843 East were bench tested at BN's laboratory at Lincoln, Nebraska. The automatic brake valve functioned properly during every phase of testing. The independent brake valve had a minimal leak below the measurable scale in the release position, but it functioned properly in all phases of application.

The speed recorder on the lead unit of Extra 7843 East yielded a legible tape that indicated speed had accelerated from about 21 mph in the vicinity of Osage to about 63 mph at a point a little more than 1 mile west of the accident site. Thereafter, the tape indicated that speed reduced to about 35 mph at the point of collision.

The speed indicator/recorder removed from the lead unit of Extra 7843 East was calibrated by BN in the presence of a Federal Railroad Administration (FRA) locomotive inspector on April 30, 1984. Calibration revealed that both indicated and recorded speeds were within 1 mph of calibrated, or actual, speed in the 10 to 40 mph range and 2 mph slower than actual speed at 50 mph. Indicated speed was 2 1/2 mph slower, and recorded speed was 3 mph slower than actual speed at 60 mph. The discrepancy increased to minus 3 1/2 and 4 mph for indicated and recorded speeds, respectively, at 70 mph.

The radio was recovered from the caboose of Extra ATSF 8112 East and bench tested. Under normal inputs of 13 volts, the radio transmitted and received properly over a range of 1 mile. At 7 volts, the audio output across the speaker terminals was significantly reduced. However, the test did not develop any data relating to how this affected reception range. Inasmuch as the caboose batteries were destroyed in the accident, it was not possible to establish the level of their power output. The radio recovered from the lead unit of Extra 7843 East was also tested; it functioned properly under normal voltage supply.

All signals involved in this accident were inspected and tested on April 22, 1984, by qualified BN signal supervisors and FRA signal inspectors in the presence of Safety Board investigators. The relays and circuitry were found to be free of defects and the signals displayed the proper aspects during the tests. Safety Board investigators also performed sight distance tests that indicated signal 528.9 could first be observed from the head end of an eastbound train at a point about 2,489 feet west of the signal, and about 4,740 feet west of the accident site. According to the BN, signals 530.6, 532.4, and 534.1 could be first seen from an eastbound train at distances of 3,380, 4,700, and 3,120 feet, respectively.

General Information

First-Line Supervision.--A trainmaster and a road foreman of engines, both headquartered at Denver, supervised BN's train operations between Denver and Akron. There was round-the-clock supervision of BN's Denver terminal operations, and the Safety Board's investigation established that there was almost always a terminal trainmaster on duty at the 31st Street Yard office where road conductors and brakemen reported and went off duty. There was no supervisor on duty at the locomotive facility where the engineers and firemen reported for duty at the time of the Wiggins accident. Following the accident, the enginemen were required to report at the yard office with the remainder of their crew. BN had no supervisor headquartered at Akron.

Both the trainmaster and road foreman of engines worked daylight tours of duty, typically 7 a.m. to 4 or 5 p.m., Monday through Friday, and they worked on alternating weekends. However, they could expect to be called out at any time in the event of an emergency, and they were expected to make periodic surprise efficiency checks at night. Typically, they made these checks together. In addition, each was required to ride six

trains per month. 11/ Their territorial responsibility was confined to the Denver-Akron mainline (110 miles), and a branch from the mainline at Brush to Sterling (35 miles). About two-thirds of the Sterling line was over tracks of the Union Pacific Railroad, and this section was, therefore, not included under the supervisors' responsibilities.

According to the trainmaster, BN operated about 1,000 trains per month over his territory at the time of the accident. He estimated that the number of trains operated had tripled during the past 10 years and stated that there had been no increase in the supervisory force during that period. Much of the increased traffic came from new coal mines in Wyoming.

Both the trainmaster and road foreman of engines stated that much of their on-duty time was taken up by adjusting the train crewmember's extra board, holding and attending disciplinary hearings, handling personal injuries, filing reports, dealing with labor representatives and municipal and county officials, the reduction of overtime, and other administrative duties. The road foreman said he thought it was "unrealistic" that he be expected to spend 8 to 12 hours a day in administrative functions and then go out on the line and make efficiency checks, or attend safety meetings. He stated that when he first assumed his duties at Denver, he was instructed to, "Get on trains; get out there and meet your people." According to the road foreman, he was required to ride a minimum of four through freight trains, one local freight train, and one Amtrak passenger train per month. He estimated that during the 3 1/2 months he had been on the job before the accident, he had ridden about 20 trains, including 6 into Akron, and he stated that none of these rides were between the hours of midnight and 6 a.m. The trainmaster stated that he usually rode trains over the westerly one-third of the Denver-Akron mainline. He described his efficiency checks as being mostly radar speed and whistle checks, and he indicated that he favored certain locations for making these checks.

According to the trainmaster, it was his practice to make surprise checks at Akron once or twice a month. However, the motel proprietors recalled seeing him once every 2 months on the average, whereas the junior proprietor of the motel remembered seeing the road foreman four or five times during the 3 1/2 months preceding the accident. The trainmaster stated that he never checked out the drinking establishments when he was in Akron. The proprietor of one of the lounges in Akron stated that to his knowledge he had never met any BN supervisor in his establishment. However, he said that he was familiar enough with the engineer and fireman of Extra 6714 West to state positively that he had served them on the night of the accident.

The road foreman remembered being told by his predecessor at Denver that the engineer of Extra 6714 West was a "problem employee," but he stated that he had not met him and was not familiar with his service record. Neither the road foreman nor the trainmaster acknowledged knowing that the engineer may have had a drinking problem, nor did they know that the engineer and fireman of Extra 6714 West had worked on Amtrak passenger trains during the month preceding the accident.

11/ According to the trainmaster, they had formerly been required to ride 10 trains per month. However, the requirement was relaxed about 1981, in lieu of increased administrative responsibilities, including intensified liaison with local county and city officials.

The trainmaster and road foreman knew the head brakeman and were aware of his reputed propensity for sleeping on duty. The trainmaster had found him sleeping in a caboose in 1982, following which the head brakeman had been dismissed from BN service.

The immediate supervisor of the traincrews involved in the Newcastle accident was a trainmaster headquartered at Edgemont, South Dakota. He was directly responsible for the mainline from Edgemont 105 miles west to Rozet, Wyoming, (15 miles east of Gillette); 11 miles of the main line east of Edgemont; and for a 44-mile branch line from Edgemont to Custer, South Dakota, (see figure 5). At the time of the accident, he had about 250 train service employees under his direct supervision -- one yard crew at Edgemont, an assigned local crew, 49 pool crews, and a 41-man extra board. He was also responsible for overseeing the duties of 12 clerks and operators. There was also a road foreman of engines stationed at Edgemont. However, he was on sick leave from February 15, 1984, to May 1, 1984. During the road foreman's absence, no supervisor was sent to Edgemont to temporarily handle his duties.

The trainmaster stated that he had been assigned to Edgemont for 5 years and that during that period traffic had doubled. When he first went to Edgemont, only he and the road foreman of engines were assigned there. As traffic increased with the development of the Wyoming coal fields, an additional trainmaster and a second road foreman were assigned to Edgemont. However, about 2 years before the accident, the two additional supervisory positions were abolished. According to the trainmaster, there was a "little less" traffic when there were four supervisors at Edgemont than there was at the time of the accident. He said that currently about 40 trains were operated over his territory in a typical day, but as many as 55 trains had been operated in a single day.

According to the trainmaster, his normal workday began between 6:00 and 7:00 a.m. and ended between 6:00 and 6:30 p.m. When the road foreman was working, the trainmaster had every other weekend off. On his weekend to work, he usually came in to the office for about 5 hours each day. During the period the road foreman was on sick leave, the trainmaster had no days off, and he stated it was necessary for him to let some things "slide" in order to handle the entire supervisory load by himself. According to the trainmaster, he was required to ride trains twice a month, which he normally did; one of the trains was the daylight local freight and the other, a through freight to Rozet, generally during the day, but occasionally at night. He was also required to make about 30 efficiency checks each month. Typically, he said, he would be out on his territory after 6:00 p.m., 3 or 4 times a month, usually in connection with an accident, Rule G violation, or other emergency situation.

According to the trainmaster, much of his time was consumed by administrative functions such as reviewing traincrew time claims, holding formal investigations, submitting reports, and handling correspondence. In addition, he had to transport traincrews on the average of once a day, which typically took 2 hours of his work day. According to the trainmaster, the road foreman had fewer administrative responsibilities and was able to spend more time riding trains than he. The trainmaster stated he was not happy with the lack of personal contact he had with the employees he supervised. To do his job well, he said, he should have had more contact with them. The trainmaster admitted that his traincrews would consider it unlikely that they would encounter him out on the railroad at night. He said he had "indications" that employees were using marijuana and he acknowledged that such use would probably more likely occur during the time the employees would not expect to see him.

The trainmaster had 14 years service with BN, having joined the company as a management trainee. He had been appointed assistant trainmaster in 1971 and trainmaster in 1979. The trainmaster stated that he conducted the biennial rules examinations given the train service employees, assisted by men from the BN Safety and Rules Department. These examinations, he said, did not include question and answer sessions or general discussions of the rules. He could remember no instance of the "subject to duty" provision of BN Rule G having been explained or discussed during a rules examination. The trainmaster's interpretation of the "subject to duty" provision was that it applied to an employee whenever he was marked up, properly rested as provided for under the Hours of Service Act, and available for work. He also stated that he considered BN Rule 34 (see appendix C) to apply only to the head end crewmembers of a train.

Division Management.--The Colorado Division superintendent, who was in charge of the line involved in the Wiggins accident, testified that, in his opinion, effective field supervision was based on (1) efficiency testing, (2) train riding, and (3) unannounced observations. He stated that he thought that supervisory activity had been inadequate and that there had been infrequent supervisory activity between the hours of 10 p.m. and 6 a.m, although train operations were normally heavy and the making of supervisory checks was critical during that part of the day.

The Alliance Division superintendent stated that he had 20 first line supervisors, of which 6 worked at night at Guernsey, Gillette, and Alliance. He estimated that traffic had increased 10 to 12 percent since he had been made superintendent. Since that time, he had reduced the supervisory force by four positions, and he said he had made no provision to fill the road foreman position at Edgemont on a temporary basis while the incumbent was off sick. He also stated that during his tenure as superintendent he had centralized the work of calling crews for the entire division at Alliance.

The trainmaster at Edgemont, responsible for the territory in the Newcastle accident, reported to an assistant superintendent at Gillette, who in turn reported to the division superintendent at Alliance, Nebraska. According to the assistant superintendent, he was responsible for about 500 to 550 miles of lines, comprising about half of the Alliance Division and 800 to 900 employees. He stated that 75 to 90 trains were operated daily over his territory, about half of them between Edgemont and Gillette. In addition to the trainmaster at Edgemont, he had two trainmasters and a road foreman at Gillette, and two trainmasters at Guernsey, Wyoming. He said that in the recent past, road foreman jobs at Gillette and Guernsey (one at each location) had been abolished. The assistant superintendent estimated that BN had operated 350 more coal trains out of the Gillette area during the first 5 months of 1984 than had been operated during the corresponding period of 1983. He also stated that during the early part of 1984, about 200 to 300 persons had been hired on the Alliance Division to handle the increased traffic. He estimated that about half of these were put to work on his part of the division.

BN's Safety and Rules Program.—BN had a regional office of safety and rules at Denver that was staffed by a director, assistant director, and manager of safety and rules. These men helped the line supervisors conduct the mandatory examination on the BN's operating rules -- annually for the supervisors and biannually for train service employees. They had also supervised the holding of round-the-clock "marathon" safety meetings at points where traincrews reported for work. One such series of safety meetings was conducted during July 1983, featuring a Union Pacific film called, "Too Dangerous to Work With." The topic of this 15-minute film was the use of alcohol and drugs.

Each "marathon" meeting and film showing was attended by the train service employees as they reported for work, and each lasted about 30 minutes. 12/ A record was kept of those who attended the meetings, but no effort was made to assure that all employees had seen the film. The director of safety and rules estimated that 80 percent of the Denver Region train service employees had attended the "marathon" meetings. However, the records of attendance indicated that only the engineer of Extra 6714 West and one other of the 10 train crewmembers involved in the Wiggins accident had attended any of the meetings which featured the film, "Too Dangerous to Work With."

BN's biennial program for reinstructing and examining train service employees consisted of a slide presentation covering recent changes in the rules and instructions followed by a written examination on the rules. This consisted of 185 multiple-choice questions. The passing grade was 75 percent for brakemen and switchmen; 85 percent for conductors and engineers. However, according to the Denver Region Director of Safety and Rules, if an employee appeared to "lack knowledge in what we would consider an important area, he could still be failed and required to retake the examination." When an employee failed the examination, he was required to retake and pass the examination within 30 days. Failing to do so, the employee was held out of service. Testimony taken by the Safety Board indicated that the rules classes did not include discussions on the meaning and application of the rules before or after the written examination.

The Denver safety and rules office set the standards for supervisory efficiency checks and audited the monthly reports of checks that were made. The safety and rules supervisors did not make a practice of riding with traincrews, and according to the director of safety and rules, they had only begun to participate in supervisory efficiency checks about a year before the Wiggins accident. However, the division superintendent stated that he had no knowledge of safety and rules supervisors having assisted his supervisors on efficiency checks.

According to BN's assistant vice president of safety and rules, his department was responsible for attaining system-wide uniformity in the interpretation of operating and safety rules. He gave the opinion that Rule G required total freedom from the presence of cannabinoids in the systems of employees; therefore, to comply with the rule, employees had to abstain completely from the use of marijuana. Beyond this, he said, that since the use of marijuana was illegal, any employee charged with its possession or use could be dismissed under the provisions of BN's Rule 700, even if he had not been convicted of the offense. (See appendix C.)

Two of the five Denver Region safety and rules department field supervisors were headquartered at Alliance, Nebraska. Both had backgrounds in train operations. Their responsibilities included participation in the biennial rules examinations and the "marathon" safety meetings, and working with the division supervisors and with the Alliance Division Safety Committee.

The assistant vice president of safety and rules gave 31 as the median age for all Denver Region employees and he thought that the relatively large number of young and inexperienced employees was an underlying cause of the region's poor showing in BN's system-wide safety competition. He cited the Alliance Division as ranking 16th among

12/ The term "marathon" referred to the fact that the meetings were conducted on a continuous basis around the clock in an effort to reach as many employees on the job as was possible.

BN's 18 operating divisions during the first 4 months of 1984 based on BN's method of using employee injury severity as the criterion for judging safety performance. Although the safety and rules department performed safety audits and analyses across the system, no definitive trends or problems had been identified as underlying the Alliance Division's relatively poor safety performance.

BN Management.--BN's senior-vice president of regional operations concurred with the assistant vice president's interpretation of the constraints imposed by Rule G on employees' use of marijuana and other drugs. He said that he had been concerned about the drug abuse problem "within the past year." He also stated that he was responsible to see that the regions operated safely, had to be on the lookout for problem indicators, and had to formulate and implement policy to deal with problems.

The senior vice president of regional operations testified that the BN system embraced a little less than 29,000 miles of rail lines in 25 States and 2 Canadian Provinces, employed about 32,000 persons in train service, had an annual operating budget of $1.7 billion, and had an annual capital outlay budget of $634 million. He stated that there were "roughly 200" line operating officers, of which 68 to 70 were confined to terminal operations. He said that, about a year before the Newcastle accident, BN had surveyed its supervisory force and had made quite a few transfers and additions of supervisors to reduce supervisors' work weeks from the level of 70 to 80 hours to 48 to 50 hours a week. The senior vice president also acknowledged that BN was "looking at" the possibility that there was an imbalance between daylight and nighttime supervision. He also acknowledged that supervising a major railroad's operations was far more difficult than overseeing a typical industrial operation, particularly in light of the fact that it functioned over a far-flung territory 24 hours a day, 7 days a week.

According to the senior vice president, one of BN's objectives was to rely more heavily on its engineers and conductors for the management of its train operations rather than increase its supervisory force. He stated, "We pay our engineers and conductors. . .a differential over the other crafts to take charge and take responsibility for the train. I think it's a waste of stockholder's money to have to over-manage if we've got the resources and the ability for our employees to do their job of managing their operations."

Employee Rehabilitation.--Since 1950, BN has had an employee assistance program (EAP) to help its employees deal with emotional, marital, legal, financial, occupational, drug addiction, family relationship, and other personal problems. At the time of the Wiggins accident, the EAP program was administered on a regional basis by nine counselors and was open to all employees and members of their families. The program's clients either sought the help of the counselors directly, or were referred to them by their supervisors, families, other employees or the courts. After identifying their clients' most significant problems, the counselors referred them to clinical rehabilitation programs. The use of alcohol was typically identified as the client's most significant problem in 50 percent or more of the EAP case load. It was mandatory for employees who had been discharged under the provision of BN's Rule G to go through the EAP and complete whatever rehabilitative treatment was deemed necessary before they could be reinstated to service.

According to the 1983 annual evaluation report of BN's EAP, 1,500 clients were assisted during the year ending June 30, 1983. Of these, 1,208 were employees (2.9 percent of BN's 41,198 employees); the rest were members of employee families. Alcohol use was a problem with 57 percent of the clients; the EAP counselors assessed it

as the most significant problem in 55 percent of the cases. Usage of other drugs was cited as a problem for 26 percent of the clients, but was considered the most significant problem in only 5 percent of the cases.

The counselor for the Denver Region served a territory embracing BN operations in South Dakota, Wyoming, Colorado, Nebraska, and Texas, with a total employee population of 4,882. The counselor supplemented the articles on EAP that appeared regularly in BN's monthly magazine, with a direct mailing to each employee on the Denver Region and by distributing posters and bulletins advertising the program to locations where employees reported to work. He also made oral and videotape presentations to division and terminal safety committees, union meetings, and during the "marathon" safety meetings. The latter included the 1983 effort which was built around the film, "Too Dangerous to Work With." In addition, he periodically took his program into the field, setting up shop at division point offices for as long as a week at each location.

According to the Denver EAP counselor, his office handled 272 clients during the 10 months following July 1, 1983. Extrapolated to a 12-month basis, his program had reached 6.7 percent of his employee population, or more than twice the utilization rate for the BN's EAP system wide. Alcohol and other drug usage were identified as the most significant problem categories with 102 and 47 employee clients, respectively. On a 12-month basis, these two problem categories represented 2.5 percent and 1.16 percent of the employee populations, respectively -- significantly higher than the 1.6 percent for alcohol use and 0.15 percent for other drug use given for the entire BN system for the previous year. The counselor attributed the apparent greater outreach of the Denver Region EAP, compared to that of the BN program as a whole, to his taking the program into the field rather than waiting for the employees to come to him.

According to the Denver counselor, referrals of the 272 EAP clients came from the following sources: self, 109; supervisor, 86; family, 30; courts, 17; and doctors and other sources, 30. None of the clients had been referred to him by a fellow employee. The system-wide report for the previous year gave the total number of referrals by other employees as 64, but no data were given to indicate whether all of these clients were employees, nor was there any indication of how many clients had significant alcohol or other drug usage problems.

None of the employees in the Wiggins accident had ever been EAP clients; survivors of the accidents said they were unaware of the program. However, the Denver counselor recalled that the BN trainmaster at Trinidad, Colorado, had informed him about a year before the Wiggins accident that the fireman of Extra 6714 West indulged in drinking when he was at away-from-home terminals. The counselor stated that he had no subsequent contact with the fireman, and that he had not received any adverse reports on the fireman since he had been working out of Denver.

The Denver EAP counselor estimated that as much as 50 percent of the BN's Denver Region employee population might be users of alcohol and/or drugs on the basis of the perceptional view of such usage within the male adult population as a whole. He stated that he had no accurate data to support this estimate, and he added that it reflected the fact that a high percentage of the Denver Region's employees were in the highly prone to drug usage 26 to 36 age group. National statistics on alcohol use in this age group indicate that approximately 85 percent of males (age 21-35) are alcohol users, and 25 percent are heavy alcohol users (National Institute of Alcohol Abuse and Alcoholism).

The Safety Board does not single out alcoholics in these figures, since the fatiguing effects of a few drinks on the performance of transportation operators is the same for alcoholics as it is for nonalcoholics.

The EAP counselor at Denver stated that he had become increasingly aware that a "multitude of problems" were developing on the Alliance Division. His concerns motivated him to make a special trip to Alliance in January 1984, to meet with the assistant division superintendents, acquaint them with what he termed the serious drug and alcohol problems on the division, and organize and put into motion a program to deal with them. The meeting resulted in what the counselor described as a team approach involving management, unions, the safety and rules department, the claim department, and the Alliance Division safety committee. Subsequently, it was decided to make the safety committee responsible for creating division-wide consciousness of the depth of the abuse problem and for publicizing the EAP. Thereafter, the counselor spent a week each month at Alliance so that potential clients could avail themselves of his help and BN's program. "Marathon" safety meetings were held across the division; these featured the Union Pacific drug abuse film and involved the participation of the safety committee and supervisors. According to the counselor, none of the train crewmembers involved in the Newcastle accident had been EAP clients or had otherwise sought his assistance.

After the Newcastle accident, the EAP counselor was reassigned to a new prevention and referral program for the entire BN system. This program is to utilize peer committees to identify employees with alcohol or other drug-related problems and to encourage them to become EAP clients without jeopardizing their job status. According to the counselor, the program is to be conducted in conjunction with the United Transportation Union, the Brotherhood of Locomotive Engineers, and the Federal Railroad Administration. This so-called "Rule G Bypass" program is similar to one in operation on the Union Pacific Railroad and has been proposed by the labor organizations as an alternative to proposed Federal regulation requiring mandatory abstinence and postaccident toxicological testing.

Alerter Devices.--According to BN officials, their locomotive units were formerly equipped with "deadman" pedals. Some also had alerter devices. These were removed, they said, because it was easy for the crews to nullify their purpose, they were costly to maintain, and they frequently malfunctioned. Those BN officials who were questioned on the point stated that they were unaware that the Pulse Electronics "Train Sentry" alerter device was in use on the locomotives of the Denver & Rio Grande Western and other railroads. They also stated that they were not familiar with the automatic train control with cab signals in use on the locomotives of the Union Pacific Railroad, which operates a double-and-triple-track mainline across Wyoming and Nebraska.

According to the manufacturer of the Train Sentry alerter, this device functions on a variable interval basis, typically on a 60-second cycle up to a given speed, although the timing can be varied at the option of the railroad. The operating cycle becomes shorter as train speed increases. Any of several actions on the part of the engineer-- blowing the whistle, changing throttle position, and initiating braking action-- will recycle the alerter. Otherwise, the engineer must depress a push button before the end of the cycle. If he fails to do so, a light and a horn inside the cab begin intermittent operation. After 5 seconds, the light and horn operate continuously for another 5 seconds. If the engineer fails to respond to these warnings, full service application of the automatic air brake system is initiated. The push button must reset after the engineer depresses it; the device will not recycle if the push button remains depressed.

According to Pulse Electronics, Southern Railway and Norfolk and Western Railway, both subsidiary companies of Norfolk Southern Corporation and pioneer users of advanced crew alerter devices, use the Train Sentry on their locomotives. Aside from Denver & Rio Grande Western, other current users include the Canadian National System railroads in Canada and the U.S., and the Santa Fe, the Chessie System railroads, and the Seaboard System Railroad in the U.S. Pulse also advised that since the accident BN has ordered Train Sentry alerters for 56 new locomotive units and is reportedly considering installing the devices on 800 units in its existing locomotive fleet.

ANALYSIS

Common Factors in the Accidents

Aside from the fact that both accidents occurred within 10 days of each other on the same region of the BN system, there were numerous factors common to both the Wiggins and Newcastle accidents. Both accidents occurred between midnight and 6 a.m., the time of day when human performance under normal conditions is typically at its lowest ebb. Both occurred on busy single-track main lines where trains were operated by the indications of automatic signals of a CTC system. In both accidents, one of the trains involved was not being operated in compliance with restrictive signal aspects because the engineer and a second crewmember on the controlling locomotive unit either fell asleep or was otherwise impaired, or both. None of these men had even minimal bed rest over long periods before the accidents. Moreover, the investigation revealed that the engineers of these trains were under the influence of either alcohol or drugs. The engineer and firemen of Extra 6714 West in the Wiggins accident had been drinking beer for 6 to 7 hours before reporting for duty; the engineer of Extra 7843 East in the Newcastle accident was a marijuana user and admitted that he had smoked a marijuana cigarette before going to work. He refused to say whether or not he had smoked marijuana after going to work, but the evidence establishes that he had.

Although the conductors of the trains being operated by these engineers were in the cabooses at the ends of the trains, both were afforded unmistakable indications that all was not well on the locomotive. Action on their parts could have prevented the accidents. Additionally, the conductor of Extra 6714 West should have observed the restrictive signals at Wiggins before the train reached them -- the weather was clear and the terrain and sight distances involved were such that observation was possible.

The Safety Board's investigations established that there was a lack of uniform understanding of BN Rules 34 and 804(B) which relate to crewmember responsibility for taking action when their engineers fail to comply with restrictive signal aspects. High-ranking divisional, regional, and system officers, including those who headed the safety and rules department, stated that these rules apply to crewmembers on cabooses, as well as to those on locomotives. However, only one of the train crewmembers involved in these accidents interpreted the rules that way. The trainmaster, who directly supervised the train crewmembers in the Newcastle accident, stated the rule did not apply to crewmembers in the caboose. A similar dichotomy appears to have existed in the interpretation of the "subject to duty" provision of BN's Rule G.

Although train operations were conducted 24 hours a day, 7 days a week in both instances, the supervisors who were directly in charge of the traincrews involved in the Wiggins and Newcastle accidents worked daylight hours. They were heavily burdened with administrative duties, rarely rode trains, and had infrequent contact with their respective

traincrews. Except in emergency situations, they did not work between midnight and 6 a.m., and their traincrews had no reason to expect that they would encounter them during those hours.

There might have been fewer crewmember fatalities had adequate radio capability been available on the controlling unit of Extra 7820 East at Wiggins and had adequate battery power been available on the caboose of Extra ATSF 8112 East at Newcastle. Finally, neither accident would have occurred had the controlling units of the errant trains, Extra 6714 West at Wiggins and Extra 7843 East at Newcastle, been equipped with automatic train control, or some other form of sophisticated crew alerter device, the function of which could not be deliberately overridden en route.

Operation of the Trains in the Wiggins Accident

After leaving Denver, the alert head-end crew of Extra 7820 East noticed sparking caused by banding dragging from the 24th car from the head end of their train. They stopped the train and corrected the problems as required and reported the incident to the dispatcher by radio. The dispatcher had previously set the CTC machine so that Extra 7820 East would be routed into the Wiggins passing track to permit the passage of Extra 6714 West. Since there was no passing track between Wiggins and where Extra 7820 East had stopped and since it was evident that the two opposing trains would reach Wiggins about the same time, the dispatcher did not change the routes he had originally set up for the meet. It was now imperative, however, that the crew of Extra 6714 West comply with the signals approaching the meeting point. Failing to do so made the collision of the two trains inevitable.

Extra 7820 East approached the meeting point on straight track. When the two trains were still about 3 miles apart, the head end crew of the eastbound observed Extra 6714 West approaching with its headlight on bright. Since it was customary that trains dim their headlights when approaching each other and the westbound failed to do so, the eastbound crew should have suspected that something was amiss. Since the track was straight between the trains, the westbound's headlight blinded the eastbound crew and it was impossible for them to judge the speed of the train or whether it was going to stop short of the turnout at the west end of the Wiggins passing track. Had the radio on the eastbound's controlling unit functioned properly on the road channel, or had the crew thought to give their portable radio which did function properly to one of the head-end crewmembers, the crew may have radioed the westbound train. Even had they not been able to arouse the head-end crew of Extra 6714 West, the lack of response might have alerted them to the danger in time for everyone to evacuate the locomotive before the collision. As it was, the engineer and head brakeman barely escaped; there was not enough time for the fireman, who was operating the locomotive, to do so.

By the time Extra 6714 West reached Brush, 23 miles out of Akron and where the crew had boarded the train, the crewmembers on the locomotive had ceased using or responding to the radio. The conductor informed the head end on the radio that the crew of an opposing train in the passing track at Bijou had apparently inspected both sides of the train and had signalled a "highball" (an indication to proceed and that the train was alright). However, the response he expected to receive from the head end was not forthcoming. When the train reached a wayside defective equipment detector about 8 miles east of Wiggins, the crewmembers on the locomotive failed to notify the conductor of the fact, although required to do so. Although the conductor testified that it was also the practice for head-end crewmembers to notify the conductor when restrictive signals were being approached, this was not done either.

The engineer's failure to communicate with the conductor at times when he was required to do so indicated that he was asleep or impaired at the time. Moreover, the engineer's failures should have alerted the conductor that a serious problem might exist on the locomotive of the train. He should have made repeated attempts to contact his engineer, and in any event, he should have kept a sharp lookout ahead in an effort to observe the signal aspects being displayed before his train reached them. Although he had no known vision restriction, he stated that he was not able to see the signals before his train reached them. However, postaccident testing determined that the succession of signals approaching the accident location could be plainly seen from the caboose cupola even in falling snow and rain, and with raindrops on the forward cupola windows. Had the conductor observed the restrictive signals without the speed reduction they required, he could have initiated emergency braking from the caboose, stopping the train before it overran the turnout and collided with Extra 7820 East. Such action is clearly within the responsibility of the conductor.

Operation of Trains in the Newcastle Accident

Unexpected, but informative events also occurred in the preaccident scenario at Newcastle. Three eastbound coal trains were being fleeted past opposing trains which had been routed into passing tracks. Adequate spacing was maintained between the eastbound trains for some time after they had left the Gillette area. These trains were all restricted to a maximum speed of 45 mph, and they were relatively similar in terms of tonnage and locomotive power. It was a routine situation on a railroad line that normally had an extraordinary flow of trains in both directions. However, when the first eastbound train, Extra 5533 East, was stopped at Osage to await the arrival of the last of the westbound fleet, the space between it and the two following trains was lessened. Extras ATSF 8112 and 7843 East began encountering restrictive approach and approach medium signal aspects that required reduction of their speed to 35 mph. These signals also told their enginemen that they had closed up on a train ahead and that ultimately they might have to stop behind that train. The situation demanded their compliance with the signal rules and their attention to duty.

Since the crewmembers of Extra 5533 East were running out of their allowable continuous duty time, the dispatcher decided to have them put their train onto Pedro passing track and to have them picked up by Extra ATSF 8112 East. In the process, that train had to stop twice, further reducing the distance between it and the following Extra 7843 East. The engineer of Extra 7843 East overheard radio transmissions between crewmembers of the trains ahead, and he understood what was being done at Pedro. Nevertheless, both he and his head brakeman failed to respond to the signals west of Pedro, all of which displayed restrictive aspects requiring reduction of the train's allowable speed. The last two signals they passed displayed "approach" aspects which further required that the engineer be prepared to stop short of the next signal. In each case, Extra ATSF 8112 East was occupying a part of the block governed by that signal. However, the engineer either did not see these signals because he had dozed off, or having seen them, failed to respond to them because he was impaired. The head brakeman had fallen asleep, did not see the signals, and could not alert the engineer to them or otherwise take action to stop the train.

Between East Osage and West Pedro, the heavily laden coal train would have to descend the 3-mile, 0.80-percent grade called Y.T. Hill. The downgrade force of gravity on the hill would require the judicious use of both dynamic braking and the automatic air brake to prevent acceleration, even if only "clear" signal aspects were encountered

and the train could proceed at its authorized speed of 45 mph. Controlling speed in compliance with restrictive signal aspects required even greater care in the handling of the train and its braking systems.

The conductor knew that he was following other trains, and he probably had heard the same radio conversations his engineer heard concerning the pickup of the Extra 5533 East crew at Pedro. He probably could not see the signal aspects displayed for his train from East Osage eastward because he had a bay-window caboose and the sight distances approaching the signals were considerably shorter than his train. Nevertheless, he could reasonably expect that at least some of these signal aspects might be restrictive. He could have called the head end to find out for certain, but he failed to do so.

Past experience had taught the conductor to expect slack run-in from the normal initiation of dynamic braking when his caboose was about 1/2 mile west of the top of Y.T. Hill, even if his train was running on "clear" signals. This event would be soon followed by the application of the train brakes to further prevent acceleration as more and more of the train was on the downgrade. When neither the slack run-in nor the train brake application occurred, the conductor should have immediately begun trying to contact the engineer. At the time the slack run-in should have occurred, the head end of the train was approaching MP 532 and was still about 1 3/4 miles west of the point where the engineer was awakened by the conductor's radio call and began taking action.

The conductor's failure to react immediately to what was happening resulted in a delay of at least 1 1/2 minutes before braking was initiated. With the entire train now on the downgrade, every second lost resulted in an increase in Extra 7843 East's momentum and lessened the distance between that train and Extra ATSF 8112 East. Moreover, after the latter got underway, it would reduce the closing rate once Extra 7843 East was fully in the braking mode. It is probable that a collision would not have occurred had the conductor taken timely action in what was obviously a developing emergency. Even if Extra 7843 East had caught up with the train ahead of it, the speed differential at impact might not have been catastrophic. In any event, the engineer of Extra 7843 East would have had more time to sound the whistle, and the crewmembers in the caboose would have had more time to comprehend what was happening and to evacuate.

Safety Backup Devices

In both the Wiggins and Newcastle accidents, as with numerous other train accidents investigated by the Safety Board, the conductors or other train crewmembers on the rear of the trains failed to take the timely and requisite action that would have prevented the accidents or mitigated their consequences. This has been invariably true even though conductors on all railroads are in charge of their trains, are held responsible for their safety, and almost universally have the advantage of end-to-end radio communication. The attitude of most of the conductors and brakemen who survived the Wiggins and Newcastle accidents seemed to be that they ought not interfere with the engineers' management of their trains. One seasoned trainman went so far as to emphatically say that he was not going to run the train from the rear end. The veteran conductor of Extra 7820 East at Wiggins stated that even if he recognized that his engineer was failing to comply with a restrictive signal aspect, he probably would not call him on his radio, much less set the air brakes from the caboose.

Given this attitude, which Safety Board investigators have repeatedly encountered during the investigation of catastrophic railroad accidents, there should be no question of the value, from a train safety standpoint, of equipping locomotives with modern and

relatively foolproof safety backup devices. Over a span of many years, the Safety Board has recommended to individual railroads and the Association of American Railroads (AAR) the use of such devices. The Safety Board has also repeatedly called upon the Federal Railroad Administration (FRA) to promulgate regulations requiring the installation, use, and maintenance of safety backup devices on locomotives. The specific areas of concern that have been addressed by the Safety Board have been (1) the universal need for a fail-safe alerting device that will stop a train if the engineer becomes incapacitated, falls asleep, or is otherwise impaired while operating the locomotive, and (2) the need for a backup device such as automatic train control, with cab signals, that will stop a train if its engineer fails to control it in compliance with signal aspects.

Following the investigation of the head-on collision of two Penn Central freight trains after the engineer and head brakeman of one train apparently fell asleep at Herndon, Pennsylvania, in 1972, 13/ the Safety Board recommended on May 3, 1973, that the FRA:

> In cooperation with the Association of American Railroads, develop a fail-safe device to stop a train in the event that the engineer becomes incapacitated by sickness or death, or falls asleep. Regulations should be promulgated to require installation, use, and maintenance of such device. (R-73-8)

This recommendation was reiterated by the Safety Board following the investigations of accidents at Indio, California, in 1973; Pettisville, Ohio, in 1976; Lewisville, Arkansas, in 1978; Muncy, Pennsylvania, in 1979; Thousand Palms, California, in 1979; Orleans Road, West Virginia, in 1980; and Pacific Junction, Iowa, in 1983. 14/

FRA first responded to this recommendation in 1973, reporting that the Transportation Safety Center (TSC) was conducting a study of existing crew alerters and potential new devices or techniques for maintaining alertness. In 1977, FRA reported the studies were under review, and in 1980, advised that it hoped to have a research locomotive and train-handling evaluator operational in 1982, "to conduct research pertinent to this area of concern." On April 30, 1984, FRA requested that the Safety Board close the recommendation on the basis that the number of accidents which alerters would prevent "are so very small," and that improved training and efficiency testing programs, as well as FRA system assessments of railroads with poor safety records, would "attack the root cause of the problem (human error)." The Safety Board closed out the recommendation and superseded it on June 18, 1984, with a new recommendation issued as

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13/ Railroad Accident Report--"Head-on Collision of Two Penn Central Freight Trains at Herndon, Pennsylvania, March 12, 1972" (NTSB-RAR-73-3).

14/ Railroad Accident Reports--"Rear-end Collision of Two Southern Pacific Transportation Company Freight Trains, Indio, California, June 25, 1973" (NTSB-RAR-74-1); "Head-on Collision of Two Penn Central Transportation Company Freight Trains Near Pettisville, Ohio, February 4, 1976" (NTSB-RAR-76-10); "St. Louis Southwestern Railway Company Freight Train Derailment and Rupture of Vinyl Chloride Tank Car, Lewisville, Arkansas, March 29, 1978" (NTSB-RAR-78-8); "Rear-end Collision of Two Consolidated Rail Corporation Freight Trains, Muncy, Pennsylvania, January 31, 1979" (NTSB-RAR-79-6); "Rear-end Collision of Southern Pacific Transportation Company Freight Trains 02-HOLAT-21 and 01-BSMFK20, Thousand Palms, California, July 24, 1979 (NTSB-RAR-80-1); "Head-on Collision of Baltimore & Ohio Freight Trains Extra 6474 East and Extra 4367 West, Orleans Road, West Virginia, February 12, 1980" (NTSB-RAR-80-9); and "Rear-end Collision of Two Burlington Northern Railroad Company Freight Trains, Pacific Junction, Iowa, April 13, 1983" (NTSB/RAR-83/09).

a result of its investigation of the rear-end collision of two Seaboard System Railroad trains at Sullivan, Indiana, on September 14, 1983, 15/ which the Safety Board concluded resulted from the failure of one train's head-end crewmembers "to remain alert due to the use of alcohol on duty."

> Develop and promulgate a requirement that locomotives operated in main track service be equipped with an alerting device which will stop a train if the engineer fails to respond to an alarm indicating that he or she has fallen asleep or has become incapacitated. (Class II, Priority Action) (R-84-31)

On October 11, 1984, FRA responded to this latest recommendation by reporting that it was making a safety inquiry to explore thoroughly "the safety related aspects of operating or riding in a locomotive," and the issue of alerting devices. The Safety Board believes there is enough evidence for FRA to understand the crew alertness problem without needing to make additional inquiries and studies. Commercially made crew alerters that are fully functional, highly reliable, and virtually tamper-proof have been available for the past 10 years, during which time a number of the larger U.S. and Canadian railroads have installed them on their locomotives. FRA should take immediate action to implement Recommendation R-84-31.

The history of the Safety Board's concern for the need for a backup safety device on locomotives operating over signalled lines to ensure engineers' compliance with signal aspects is nearly as old as that regarding the alerter control. Following the rear-end collision of two Texas and Pacific Railway freight trains at Meeker, Louisiana, in 1975, 16/ the Safety Board concluded that it was the result of an engineer's failure to comply with a restrictive signal aspect and on January 25, 1976, recommended that FRA:

> Promulgate regulations to require an adequate backup system for mainline freight trains that will insure that a train is controlled as required by the signal in the event that the engineer fails to do so. (R-76-3)

This recommendation was reiterated by the Safety Board following the investigations of accidents at Pettisville, Ohio, in 1976; Muncy, Pennsylvania, in 1979; Royersford, Pennsylvania, in 1979; Orleans Road, West Virginia, in 1980; Welch, West Virginia, in 1980; and Hermosa, Wyoming, in 1980. 17/

15/ Railroad Accident Report--"Rear-end Collision of Seaboard System Railroad Freight Trains Extra 8051 North and Extra 1751 North, Sullivan, Indiana, September 14, 1983" (NTSB/RAR-84/02).

16/ Railroad Accident Report--"Rear-end Collision of Two Texas and Pacific Railway Company Freight Trains, Meeker, Louisiana, May 30, 1975" (NTSB-RAR-75-9).

17/ Railroad Accident Reports--"Head-on Collision of Two Penn Central Transportation Company Freight Trains Near Pettisville, Ohio, February 4, 1976" (NTSB-RAR-76-10); "Rear-end Collision of Two Consolidated Rail Corporation Freight Trains, Muncy, Pennsylvania, January 3, 1979" (NTSB-RAR-79-6); "Rear-end Collision of Consolidated Rail Corporation Freight Trains ALPG-2 and APJ-2, Near Royersford, Pennsylvania, October 1, 1979" (NTSB-RAR-80-2); "Head-on Collision of Baltimore & Ohio Freight Trains Extra 6474 East and Extra 4367 West, Orleans Road, West Virginia, February 12, 1980" (NTSB-RAR-80-9); "Side Collision of Norfolk and Western Railroad Company's Train No. 86 with Extra 1589 West, Near Welch West Virginia, September 6, 1980" (NTSB-RAR-81-2); and "Rear-end Collision of Union Pacific Railroad Company Freight Trains, Near Hermosa, Wyoming, October 16, 1980" (NTSB-RAR-81-3).

FRA responded to this recommendation on July 26, 1976, stating that it believed the immediate answers to the problem were improved training and effective testing rather than installation of costly mechanical or electrical backup devices. In 1977, FRA repeated this assessment and responded that it intended to complete an analysis of training and testing procedures in the railroad industry. FRA estimated that constructive action "will be about 2 years in the future." On December 24, 1980, FRA responded that contract research programs to catalog railroad training programs had been completed and it was distributing the reports of findings to the railroads. FRA's most recent response, on April 30, 1984, was embodied in that cited previously for Recommendation R-73-8, and for the same reasons it asked that the Safety Board close out Safety Recommendation R-76-3. There has been no further response from FRA, and the Safety Board continues to carry this recommendation in an "Open--Unacceptable Action" status.

These latest accidents reinforce the Safety Board's conviction that improved training, periodic retraining, and supervisory testing, invaluable and essential though they undeniably may be, are insufficient in themselves to eliminate the dreary litany of periodic recurrences of catastrophic railroad accidents resulting from the failures of engineers to comply with signal aspects. Again, the Safety Board believes the FRA understands the dimensions of the problem and needs to take timely regulatory action.

There is undeniable merit in the argument that the "deadman" pedals and some early designs of alerting devices were costly to maintain and were largely ineffective because their purpose could be, and often was, easily defeated by the engineers. BN advanced these reasons for its removing the pedals and alerters formerly installed on its locomotive units. However, before the Wiggins and Newcastle accidents, there was apparently no serious study given to the use of automatic train control or to the newer and improved alerter devices being used extensively by other major railroad systems. The Wiggins and Newcastle accidents may have brought about a significant change in BN policy in this area, for BN has ordered Train Sentry alerters for its new locomotive units and is considering retrofitting a large number of its existing locomotive units with similar devices. The Safety Board commends BN management for this action and urges BN to pursue positive and timely action in this direction insofar as concerns the existing fleet and future locomotive purchases. Moreover, the Safety Board urges all U.S. line-haul railroads to install state-of-the-art safety backup devices on those of their locomotives not already equipped with them.

Crewmember Rest and Performance

Federal regulations limit to 12 hours the maximum consecutive period of time employees in railroad train service may be actually on duty. 18/ The minimum time they must be allowed off duty between work assignments is 8 hours. Off-duty time begins when the employee goes off duty, not when he actually reaches his home or away-from-home lodging, and it ends when he reports for his next assignment. Typically, the employee is notified 90 minutes before his reporting time. Thus, he can be allowed as little as 6 1/2 hours of time in which to rest and from this value must be deducted whatever period of time he needs to travel from his duty location to his home or lodging. It is essential that employees working under such conditions be provided with reasonably reliable advance information as to when they may be recalled to duty. While the Safety Board recognizes that many factors impact on the predictability of train movements and

18/ 49 CFR, Part 228, Appendix A, Pg. 119.

crew utilization, the investigation of the Newcastle accident indicated that traincrews laying over at Gillette sometimes had to resort to guesswork in the absence of accurate information as to when they could expect to be called to duty.

The median age of the crewmembers of Extra 6714 West in the Wiggins accident was 32; that for those assigned to Extra 7843 East in the Newcastle accident was 30. The engineers of the two trains were 34 and 27, respectively. As far as could be determined, all of the crewmembers of the two trains were in good health. Typical of railroad train service employees who work in road freight pool service or who are assigned to the extra board, their work schedules were habitually irregular and unpredictable, and they probably were accustomed to going for long periods without bed rest. It would not be unusual for them to avoid sleeping altogether when away from home, particularly if they worked in a relatively short-haul time freight pool, such as that between Denver and Akron. Since they could normally expect to make the trip home to Denver in 3 to 4 hours, some might spend their off-duty hours at Akron awake and wait until they get home to sleep. This tendency, which is not unusual in railroading, is probably aggravated by the fact that often the sleeping rooms available to them do not afford the proper environment required for restful sleep. 19/

There is much scientific evidence that human performance varies with the time of the day, and that it is correlated with the approximately 24-hour circadian 20/ rhythm of human body temperature. Major decrements of performance have been demonstrated when body temperature is at its lowest level, typically between midnight and 7 a.m. 21/ Research has shown that this is the most difficult time period for persons to stay awake, even when they are accustomed to working at that time of day. Gradual shifting of the biological clock can be accomplished by delaying or advancing the initiation of the sleeping period by not more than 1 or 2 hours per day, but adverse effects on the performance of many persons, including fatigue inducement, can be caused by irregular and constantly changing work/sleep cycles. The extent of these effects is only now being discovered. 22/

Persons with constantly changing work periods are often trying to sleep when their bodies are trying to wake them up, and trying to be awake when their bodies are trying to sleep. Length and quality of sleep depend on when a person sleeps rather than on the length of prior wakefulness. Because persons with irregular and changing work periods never habituate to a single sleep cycle, they never sleep sufficiently. They are frequently tired while working, often to the point of chronic fatigue, and they commonly experience some form of insomnia when attempting to sleep. Some researchers have found that such

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19/ According to the crewmembers involved in the Newcastle accident, this was the case with the older of BN's dormitories at Gillette, where, they said, there was little to insulate the rooms from exterior sound and there was usually much noisy activity in the adjoining rooms and hallways.

20/ From "circa" (about) and "dian" (day).

21/ Moore, Ede, Sulzman and Fuller, The Clocks That Time Us: Harvard University Press, 1982. Akerstedt, Torswell, and Gillberg: "Sleepiness and Shift Work; Field Studies." Sleep, 5:S95-S106: New York, Raven Press, 1982.

22/ Johnson, L. C. and Naitoh, P., "The Operational Consequences of Sleep Deprivation and Sleep Deficit," AGARDOGRAPH No. 193, June 1974. "Biological Clocks and Shift Work Scheduling," Hearings before the Subcommittee on Investigations and Oversight of the Committee on Science and Technology, House of Representatives, Ninety-Eighth Congress, March 23, 1983.

chronic fatigue and insomnia may result in a self-medication process leading to alcoholism. Fatigued workers may ingest massive doses of caffeine by drinking coffee or tea to stay awake, and then consume high amounts of alcoholic beverages to calm their systems in order to sleep. Alcoholism is known to be more prevalent among changing-shift workers than in the regular working population. Caffeine and alcohol only intensify the problem of fatigue, because they further disturb the normal sleep process.

A study reported in the Annual Review of Medicine, 1983, stated that smoking low to moderate doses of marijuana produced a ". . .sense of well-being, with relaxation, drowsiness, altered sense of time and distance . . .particularly during complex perceptual motor tasks." The complex task cited in the study was driving an automobile, which in terms of complexity is generally categorized with flying airplanes and operating locomotives.

The crewmembers of Extra 6714 West had been off duty for periods varying from 16 1/2 to more than 58 hours before they were transported from Denver to Akron on April 12. It is reasonable to assume that, while at home, they had slept during the night of April 11-12 and had arisen to begin their day's activities by 8 a.m., or about 20 hours before the accident occurred at Wiggins. The engineer and fireman had no bed rest during that period. All that is known of the head brakeman's rest at Akron is that he complained to the motel proprietor that he had not slept well because of the noise coming from the conductor's room. The conductor did not return to his room until 11:30 p.m., after which he watched television -- the likely source of the noise that bothered the head brakeman. At most, the conductor got less than 2 hours rest and it is doubtful that either he or the head brakeman actually slept at Akron. The rear brakeman said he had about 3 1/2 hours sleep before getting up to go to work. It is not possible to state that any member of the crew could be considered to be properly rested when they reported for duty at Akron.

The engineer of Extra 7843 East had a total of 6 1/2 hours sleep, including about 4 hours at Gillette on the evening of April 21, during the 48 hours preceding the Newcastle accident. The head brakeman, who said he was extremely exhausted, had at the most, an hour of sleep at Gillette and probably no more than a total of 4 hours sleep during the 51 hours preceding the accident. Both of these men were unquestionably suffering from fatigue and were unfit for duty when they went to work. The conductor, who at 38 was 9 to 10 years older than any other man on the crew, was also the best rested, having slept 7 1/2 hours while laying over at Gillette. The rear brakeman had only slept about 3 1/2 hours.

The engineer and head brakeman said that they delayed going to bed at Gillette because they thought they would be there about 16 hours and wanted to be rested when they went to work. They said they based this calculation on the supposition that the 16 crews ahead of them in the calling rotation would be used at the rate of one an hour. As it turned out, they were actually called 9 1/2 hours after going off duty, because the crews had been used faster than they had thought they would be. However, this was not a valid reason for their failure to get adequate sleep as their conductor had done. They should have rechecked the rate at which crews were being called and recalculated their estimate of when they would be recalled to duty. Instead, they chose to spend their time in other activity. The Safety Board believes that this may have been characteristic of these men. When they were last at their home terminal of Edgemont, the engineer had been off duty for nearly 17 hours, but had slept only 2 1/2 hours; the head brakeman had slept only 3 to 3 1/2 hours of the 10 hours he had been off duty.

Of all the crewmembers of Extra 7843 East, the engineer had worked the least during the 72 hours preceding the accident--20 hours 16 minutes. He had worked 11 hours, 15 minutes going from Edgemont to Gillette, but he had worked only 3 hours 5 minutes on his previous trip. It cannot be said that the engineer had been overworked--he had only worked 17 trips in the 30 days before the accident and a number of these were of only a few hours duration. (See appendix D.) Although the head brakeman had worked 22 trips during the 30 days preceding the accident, he, too, had been afforded periods of time off during this period. The most recent of these, during April 16-19, had spanned 58 hours. During subsequent off-duty periods between trips, he had failed to get adequate sleep as a matter of choice. It is not surprising that he fell asleep after leaving Gillette, and as with the head brakeman of Extra 6714 West in the Wiggins accident, it was probably not an isolated incident of irresponsible behavior.

It is characteristic of a busy railroad division's extra board that it is staffed by the employees with the least seniority, and extra board brakemen will usually get only minimal time off between work assignments. They know this and need to get rest when they are off. As illustrated by these accidents, they sometimes catch up on their sleep on the job, particularly if they are on a through train and have little or nothing to do. A fast-moving extra board is usually an indication that the men who hold regular assignments are being permitted to take time off their jobs. This was certainly the case with the Edgemont-Gillette pool and is borne out by the work records of the engineer, head brakeman, and conductor of Extra 7843 East.

In summary, the Safety Board concludes that a contributing cause of both accidents was the head-end crewmembers' fatigue resulting, in part, from their voluntary lack of sleep during their off-duty time. In the Wiggins case, the fatigue was aggravated by the irregular work/rest cycle to which the men were subjected. In the Newcastle case, the work/rest cycle was somewhat irregular; however, the work schedule was much more unpredictable than that of the Wiggins crew. The Newcastle crew had plenty of opportunity to obtain rest, but the unpredictability of when they would be called for work was more of a problem than it was for the Wiggins crew.

The Safety Board recognizes that traincrew work hours are dictated by union-management agreements, and changing the current duty-time agreements would be an enormous undertaking. However, shift work and its impact from the standpoint of fatigue is a fact of life for many trainmen. The Safety Board believes that the railroad industry in general has failed to consider properly the adverse effects of irregular and unpredictable work/rest cycles on their traincrews, exemplified by the BN extra board and pool crews. Other transportation industry operators are exposed to shift work, but railroad extra board and pool traincrews' work/rest cycles are often even more irregular and unpredictable.

Airline pilots and air traffic controllers are similarly exposed to shift work as a reality, and at times, they are exposed to irregular/rest cycles. However, the aviation industry has taken steps to educate its operators about the seriousness of the effects of irregular work/rest cycles. For instance, self-monitoring of sleep and eating patterns and the effects of alteration of the body's circadian rhythms are some of the items taught to aviation operators. NASA is currently conducting research on the effects of irregular sleep and work schedules on long and short haul flights of commercial and military pilots. Moreover, studies in Sweden and Japan have illustrated performance decrement and fatigue in train operators.

The Safety Board believes there is an apparent lack of awareness on the parts of railroad management and the labor organizations that this problem exists. This was certainly borne out by the prevailing work conditions involved in the Wiggins and Newcastle accidents. The Safety Board urges railroad management and the railroad labor organizations to review the latest scientific data regarding operator fatigue and expand the existing employee training and supervisory programs to include education in this area of concern.

Crewmember Use of Alcohol and Drugs

A significant factor in both accidents was the manner in which the engineer and fireman of Extra 6714 West in the Wiggins accident and the engineer and head brakeman of Extra 7843 East in the Newcastle accident spent their off-duty hours before the accidents. Because all had gone without sleep, or at least had failed to get adequate restful sleep when they had the opportunity, they were critically fatigued when they went to work.

The 34-year old engineer of Extra 6714 West had been off duty for more than 25 hours before being transported as a passenger to Akron on April 12. This relatively long period of rest coupled with the fact that the trip to Akron was made in a little more than 2 hours increased the likelihood that the engineer would spend his time in Akron engaging in activity other than sleeping. Friends and coworkers of the engineer told Safety Board investigators that he was a habitual drinker; he probably had a "few beers" every day at home or at layover points. The engineer was well known by name and appearance to the employees, proprietors, and customers of the taverns in Akron. On the night of the accident, he and the fireman had each consumed at least 6 or 7 beers in Akron taverns between the hours of 8 p.m. and about 1:45 a.m. The engineer was observed by the on-duty proprietor of the railroad contracted crew rest facilities between 2 and 2:30 a.m., visibly affected by his drinking. The proprietor, who was very familiar with him, thought his speech was a little slow, "like his tongue was a little bit heavy," and he later remarked to the fireman that the engineer "seemed a little bit high." The proprietor was concerned enough to ask the fireman if he was going to run the train in the engineer's place. By the time he drove the crew to their train, the engineer had apparently used mouthwash to clear his breath and his speech seemed normal. If the conductor or any other crewmember thought the engineer was less than his usual self, they evidently took no action to ensure that he did not operate the train.

The investigation failed to develop sufficient factual information to establish with certainty the quantitative level of alcohol in the engineer's body or its effect on his behavior when and after he boarded the train. The available evidence indicated that he had consumed about 1 ounce of alcohol per hour over a period of 6 to 7 hours. Alcohol is eliminated from the system at an average constant rate of 0.015 percent per hour, and on that basis the engineer would have had an approximate blood alcohol level of 0.10 percent when he stopped drinking, and a blood alcohol level of 0.070 percent at the time of the accident. A postmortem toxicological scan of the engineer's blood indicated the presence of alcohol, although the sample tested was insufficient for quantitative analysis.

Having spent the evening making the rounds with the engineer, the fireman's intake of alcohol was probably about the same as that of the engineer. At least that is the testimony of witnesses. He, too, had gone without sleep. Unlike the engineer, he seemingly did not exhibit outward indications of intoxication, at least while he was with the motel proprietor. However, the toxicological scan of blood and urine samples

recovered from the fireman yielded findings of 0.056 percent blood alcohol level and .09 percent urine alcohol concentration. The fact that the urine level was more than 35 percent greater than the blood concentration indicates that the fireman was in the postabsorbtive state at the time of his death and that blood alcohol would have been higher at an earlier time. Assuming that the fireman had nothing to drink after leaving the Akron bar about 2 hours before the accident, it is calculated that his blood alcohol level was about .085 percent when he received the call to report for duty and about .070 percent when he boarded the train.

A blood alcohol concentration in the .07 to .09 percent range in the typical individual can cause impaired response to both audible and visual stimuli, even though outward appearance may be normal. Given the known propensity for alcohol to complicate the effects of fatigue caused by lack of sleep and irregular work/rest cycles, its use by the engineer and fireman of Extra 6714 West must be considered a major contributing factor to the reason they fell asleep, and therefore, it relates directly to the cause of the Wiggins accident.

The blood and urine samples obtained from all the surviving train crewmembers in the Newcastle accident and the blood and tissue samples obtained from the men who had been killed were submitted to toxicological testing. All the samples were negative for alcohol and illicit drugs other than cannabinoids. Positive findings for cannabinoids were reportedly found through the Enzyme Immunoassay Technique (EMIT) by one laboratory in the urine samples obtained from the engineer and conductor of Extra 7843 East; the head brakeman of Extra ATSF 8112 East; and the engineer and rear brakeman of Extra 5533 East. These findings were confirmed in every case (except that of the conductor of Extra 7843 East) by means of Thin-Layer Chromatography testing at the same laboratory. The latter findings were also confirmed through the use of the more sensitive and reliable Gas-Liquid Chromatography/Mass Spectrometry (GC/MS) method of screening at the Armed Forces Institute of Pathology (AFIP).

Subsequent testing of portions of the whole blood samples was performed at the University of Utah Center for Human Toxicology. Testing for the presence of cannabinoids in the blood is the most definitive procedure and the quantitative level of positive results gives an accurate indication of recency of usage. Three different cannabinoids were tested for in the blood samples - Delta 9 Tetrahydrocannabinoid (THC), Hydroxy Acid (OH) metabolite, and Carboxylic Acid (COOH) metabolite (the first two named are psychoactive substances in the blood). Delta 9 THC peaks rapidly, then diminishes from about 100 ng/ml to about 1 ng/ml 23/ in 6 hours. The OH metabolite is undetectable after about 3 hours. The COOH metabolite diminishes gradually and has been detected in the blood for up to 1 week after marijuana use. If this metabolite is detected in the urine, it should also be present in the blood. The blood testing detected cannabinoids in the samples as follows: THC and COOH in the engineer of Extra 7843 East; COOH in the rear brakeman of Extra 7843 East; THC, OH, and COOH in the head brakeman of Extra ATSF 8112 East; COOH in the rear brakeman of Extra ATSF 8112 East; COOH in the engineer of Extra 5533 East; and THC and COOH in the rear brakeman of Extra 5533 East. No trace of cannabinoids was found in the sample taken from the conductor of Extra 7843 East, or any of the other crewmembers of the three trains.

23/ Nanograms/milliliter.

The associate director of the Center for Human Toxicology testified as an expert witness at the Safety Board's public hearing. He stated that the most common effect of marijuana use is euphoria. "There's a feeling of high, spaced if you want to call it that; that type of feeling, euphoric." He also stated that during experiments he had observed none of the subjects fall asleep during the first hours after using marijuana, and he related that there are no firm studies in the area of the effects after euphoria ends. He did not think there was as yet sufficient data to extrapolate levels of cannabinoids in the human system to presumptive effects on performance and behavior; however, he said that research of which he was aware revealed measurable human performance degradation up to 6 hours after marijuana use. There is also experimental evidence that marijuana impairs psychomotor performance, such as reaction time, coordination, and tracking tasks, for as long as 4 to 8 hours after use. 24/ Research has not established that adverse behavioral effects do not occur for longer periods. Further, the metabolic characteristics of marijuana are such that it may actively affect the nervous system long after it is no longer detectable in the blood. Moreover, the long-term behavioral effects of casual and/or chronic use of marijuana have not been confirmed or eliminated by research.

The expert witness also gave his interpretation of the test results shown in Table 1 on page 30. In his opinion, the statements of the engineer of Extra 7843 East, as to how often he smoked marijuana and when he had last smoked it, were inconsistent with the test results. According to the expert witness, the test results indicated that, if the engineer was a casual user of marijuana, as he testified, then he had smoked a marijuana cigarette 4 to 6 hours before his blood was drawn for testing. Since nearly 4 hours had elapsed between the sample collection and the accident, this indicated the engineer had smoked marijuana some time during the 2 hours preceding the accident. Even if the engineer was a heavy user and had used marijuana more than 4 to 6 hours before being tested, the presence of THC in his blood indicates that he was still under the influence of marijuana at the time of the accident. The Safety Board concludes that, on this basis, the engineer was under the influence of THC at the time of the accident, and therefore, his failure to respond to the signals may have been the result of his use of marijuana.

In light of the fact that EMIT testing of the urine sample taken from the conductor of Extra 7843 East was positive for cannabinoids, whereas GC/MS testing of the sample at AFIP and testing of blood at the Center for Human Toxicology were negative for cannabinoids, the expert witness explained that the EMIT test of urine has been known to give positive results when the more definitive GC/MS testing of the same specimen produces negative results. He added that on the basis of the full range of tests, he did not consider the conductor to be a marijuana user. According to the conductor, he had never smoked marijuana. The Safety Board, therefore, concludes that the positive EMIT result was a "false positive."

The rear brakeman of Extra 7843 East said he had tried marijuana about 3 years before the accident, but had not used it since. The expert witness interpreted the low but positive detection of COOH in the brakeman's blood as inconsistent with his testimony. He said that if the brakeman was an infrequent user, he had last used marijuana about 6 days before the accident.

24/ "Marijuana and Health: Report of a Study by a Committee of the Institute of Medicine, Division of Health Sciences Policy, National Academy Press, Washington, D.C., 1982.

The head brakeman of Extra 8112 East stated that he had been using marijuana for 6 to 7 years, currently used it once or twice a week, and recalled last using it 5 to 6 days before the accident. The expert witness also found this testimony inconsistent with the test results which revealed concentrations of THC, OH, and COOH in the man's blood. The levels detected, according to the expert witness, indicated usage of a highly potent grade of marijuana about 3 hours before the samples were taken, or about 1 1/2 hours after the accident occurred. From 6 to 8 a.m., April 22, the head brakeman was away from the accident site and had yet to be contacted and instructed by a supervisor to submit to testing. Therefore, he had ample opportunity to use marijuana unobserved during that period.

Testing of the blood sample recovered from the body of the rear brakeman of Extra ATSF 8112 East detected the presence of COOH. In the expert witness opinion, the low level of the metabolite indicated use of marijuana by the brakeman about 6 days before the accident.

According to the engineer of Extra 5533 East, he had used marijuana for 2 to 3 years, and had used it about 10 times during that period. He also stated that he had last used marijuana about 10 days before the accident. The expert witness' testified that these contentions were not consistent with test findings that indicated use of marijuana 24 to 48 hours before the accident.

The rear brakeman of Extra 5533 East related that he had used marijuana since 1969, currently used it once or twice a week, and had last used it a week before the accident. The expert witness again disagreed, stating that the current and recent usage statements were not borne out by the detection of THC and COOH in the man's blood. He said the levels detected indicated the brakeman used a very potent grade of marijuana and had last used it 4 to 6 hours before his blood sample was obtained. As with the engineer of Extra 7843 East, this indicated usage during the 2-hour period preceding the accident.

Given the expert witness interpretation of the time implications of the levels of cannabinoids found in the samples of 6 of the 12 BN train crewmembers involved in the Newcastle accident, it can be concluded that 3 were relatively casual or infrequent users of marijuana, 1 had used marijuana shortly after the accident (and conceivably could have been under the influence of THC at or before the time of the accident), and two had used marijuana within a period of 2 hours before the accident (and were under the influence of THC before and at the time of the accident). During the Safety Board's investigation, it was not possible to develop sufficient data to establish whether the 12 crewmembers in the Newcastle accident were representative of the Alliance Division as a whole, other than the fact that they were from the standpoint of median age. Nevertheless, the Safety Board believes that the fact that half of this group were marijuana users is a strong indication that the use of illicit drugs was a serious problem among train service employees on the division.

About 3 months before the Newcastle accident, the Denver Region counselor for BN's EAP became sufficiently concerned by what he perceived to be a serious drug abuse problem on the Alliance Division to organize a special program to attack it. His plan was to gain participation in the program by the division's employees and supervisors, the division safety committee, the union representatives, and the staffs of the safety and rules department and claim department. "Marathon" safety meetings were held which stressed the alcohol and drug issue. The counselor devoted much of his time to these meetings and

to being available to counsel potential clients for the EAP. During February, March, and April 1984, the biennial rules examinations were also conducted at Edgemont, and 8 of the 12 employees involved in the accident attended these. (See appendix B.) The trainmaster at Edgemont helped conduct all of the rules examinations that the eight crewmembers attended.

BN's assistant vice president of safety and rules testified at the Safety Board's public hearing that he interpreted BN's Rule G as meaning that before employees go on duty, they must be entirely free of the effects of the substances covered by the rule, namely "alcoholic beverages, intoxicants, narcotics, marijuana, and other controlled substances." He said, "When they come on duty, they must be free from the effects of these substances." He further stated that he thought this required freedom from the substances in the employees' systems, necessitating total abstinence from the use of marijuana, and at times, total abstinence from the use of alcohol. However, the rule prohibits the use of the substances by employees on duty and when they are subject to duty, and it states employees must not report for duty under the influence of the substances. It does not say they must be totally free of the effects of the substances, nor does it define "influence" or "subject to duty." The Safety Board's investigation left little doubt that BN Denver Region employees had been left to interpret for themselves the rule and its fine points, particularly the "subject to duty" provision. None of the surviving crewmembers involved in the accidents recalled discussion of the provision at biennial rules examinations or safety meetings, despite the fact that safety and rules department supervisors usually took part in those functions. The assistant superintendent at Gillette testified that he had never heard an interpretation given at a safety meeting on the Alliance Division.

The Safety Board's investigation established that BN's Denver Region employees were required to attend rules classes every two years and that the classes were essentially limited to an examination on the rules usually preceded by a slide presentation covering changes to the rules and instructions. The lack of discussion on critical rules and their provisions failed, in the opinion of the Safety Board, to comply with Federal regulations 25/ which required the railroads to periodically instruct each employee governed by the rules "on the meaning and application" of those rules. (See appendix G.) Further, an examination composed of multiple-choice questions that could be passed with a relatively low mark and taken repeatedly until it was passed was not necessarily an accurate gauge of the employees' knowledge of the rules. Since not all the employees were tested simultaneously, some could always find out what was in the test from those who had taken it. When an employee failed a test and then passed it later without retraining other than "boning up," there is little reason to expect long-term improvement in his knowledge. If an employee may miss one-fourth the questions and still be passed, he may have missed many questions dealing with critical areas such as Rule G, the signal aspects, and defined speeds. Although BN's director of safety and rules stated that the employee would be failed in such an instance, the judgment was probably left to the immediate supervisor who gave and graded the test. The Safety Board's investigation of another BN accident indicated that such a decision was entirely discretionary and could permit an employee to continue to be qualified on a job without any knowledge of rules critical to that assignment. While this form of inadequate training may not be endemic to the railroad industry, Safety Board investigations of major accidents in the past strongly suggest that it is relatively widespread and representative in the industry.

25/ 49 CFR, Part 217.11.

The Safety Board believes that the Wiggins and Newcastle accidents dramatically illustrate how imperfectly BN's operating employees and line supervisors understand "subject to duty" under Rule G. At the time of these accidents, BN comprised the largest single or combination railroad system in North America and operated virtually from coast to coast in the U.S. and Canada. 26/ It had a policy and a rule concerning the use of alcohol and drugs by its employees. There was a mechanism within BN's organization for developing and disseminating a uniform understanding of what that policy and rule required. BN had a safety and rules department with regional directors and field staff which had the responsibility of carrying the understanding and requirement to line supervisors and employees through the vehicle of training and safety programs. Yet, the Safety Board's investigations have shown that there was a complete breakdown somewhere in this line of communication. Obviously, unless supervisors have a uniform understanding of the rule, they cannot enforce it properly.

Testimony at the Safety Board's public hearing produced a broad range of conflicting opinions on the part of train service employees and line supervisors as to the meaning of subject to duty under Rule G. While some of this testimony may have been self-serving, the Safety Board believes that the situation was confused and that little effective effort had been made to give the employees and their supervisors a clear and uniform understanding of management's interpretation of the rule. This was particularly unfortunate on the Alliance Division which had one of the worst safety performances of any BN division during the first part of 1984, and where the EAP counselor had called for an all out attack on what he perceived to be a serious drug abuse problem on the division. During the 3 months preceding the Newcastle accident, safety meetings and rules examinations were held across the division, but no one used these opportunities to cover central questions such as, "When does the rule apply?" or "When are you under the influence?" and "When do you stop?" It was management's responsibility to make certain that all employees understood its interpretation of the correct answers to these critical questions and to enforce Rule G with an adequate supervisory staff.

The older and more experienced survivors of the Wiggins accident seemed to understand that they were subject to duty under Rule G and should abstain from drinking when they were "marked up," that is they were available to work whenever fully rested under the 8-hour rule. This could be construed to mean that they understood that they had to refrain from drinking early enough for them to be fit once they could be called to work. But even among these men, it was obvious that there was no common understanding on the subject. The veteran engineer of Extra 7820 East said that he had never heard a time specified in his experience, and that he really didn't know what was meant by subject to duty under Rule G.

Of the younger men who survived the Newcastle accident, 6 said that they thought they were subject to duty under Rule G when "the phone rang," or 90 minutes before they had to report to duty. They believed that their use of the prohibited substances had to cease 90 minutes before going on the job, providing of course that their call gave them the requisite lead time. The engineer of Extra 7843 East said it meant 4 to 5 hours before going to work, although he stated it was difficult to predict or to find out for certain when he would be called to work. The engineer of Extra 5533 East thought it

26/ BN's mileage was 28,835; the nearest systems to it in terms of size were Canadian National Railways (22,518) and Union Pacific-Missouri Pacific (22,068).

meant when he was marked up, fully rested, and could be called. The conductor of Extra 7843 East called the subject, "a very gray area" that he had never heard defined. The trainmaster at Edgemont and his immediate supervisor, the assistant superintendent at Gillette, disagreed with those who said subject to duty started when the phone rang. Their interpretation was similar to that of the engineer of Extra 5533 East, that employees were subject to duty under Rule G after they had "received rest as provided by the hours of service law." Since the law permits putting a train service employee back to work 8 hours after he last went off work, this interpretation could conceivably permit his continued usage of a prohibited substance right up to the minute he reports for duty. As has so often been tragically demonstrated, users of alcohol or drugs characteristically fail to recognize that they are adversely influenced by whatever substance they have been using. Railroad users of alcohol appear to be as prone to this inclination as those from any other segment of society, and their lack of proper judgment in this regard can result in potentially catastrophic impact on their fellow employees and the public.

In a 1983 incident at Union Station in Washington, D.C., a Baltimore and Ohio Railroad engineer was removed, minutes before its scheduled departure, from the locomotive of a Maryland Department of Transportation commuter train occupied by about 400 passengers. Although the engineer was found to have a blood alcohol level of .222 percent, he protested that he believed he had stopped drinking early enough for the alcohol to "wear off" and that he was perfectly fit and capable of running the train. 27/ Evidence developed as a result of the Wiggins investigation indicates that neither the engineer nor the fireman of Extra 6714 West considered themselves to be impaired by drinking they had done just before reporting for duty. Nor did the engineer of Extra 7843 East in the Newcastle accident believe that his use of marijuana would affect his performance in operating the train, even though he said he knew his use of marijuana typically altered his mood.

BN's Rule G, and the like rule of North America's entire railroad industry, is based on the Uniform Code of Operating Rules (UCOR). In recent years, BN and some other railroads have modified and expanded their Rule G, but some of the most critical aspects of the rule remain couched in ambiguous language that leaves far too much to individual interpretation. This is particularly true of the subject to duty provision which has never prescribed specific mandatory periods of abstinence from the use of alcohol and other prohibited substances. The railroad industry management and the railroad brotherhoods, as well as FRA, seem unable and/or disinclined to provide railroad employees with specific timespan guidelines to follow. An example of this attitude was expressed by the assistant vice president in charge of BN's safety and rules department in his testimony that he didn't think the employees could live up to BN's Rule G unless they observed an abstinence period, but he didn't believe that the period needed to be specified "in light of our present Rule G." The Safety Board believes, however, that the interests of the railroad companies, railroad employees, and the public at large demand that the subject to duty provision of Rule G be thoroughly defined, and that its definition be disseminated to and interpreted for railroad employees. Inaction and "band-aid" remedies are not going to solve this problem.

27/ Railroad Accident Report--"Derailment of Illinois Central Gulf Railroad Freight Train Extra 9629 East (GS-2-28) and Release of Hazardous Materials at Livingston, Louisiana, September 28, 1982" (NTSB/RAR-83-05).

The Safety Board's concern about alcohol- and drug-induced impairment of train crewmembers dates from its investigation of a 1973 collision between two Southern Pacific Transportation Company freight trains resulting from an alcohol-impaired engineer's failure to control his train. 28/ As a result of the investigation, the Safety Board recommended that FRA promulgate regulations prohibiting the use of intoxicants and narcotics by railroad employees for a specified period before they go to work and while they are on duty. FRA never took the recommended regulatory action. Following the derailment of an Illinois Central Gulf Railroad train and resultant release of hazardous materials at Livingston, Louisiana, on September 28, 1982, and the collision of two Missouri Pacific Railroad trains at Glaise Junction, Arkansas, on October 3, 1982, 29/ both involving alcohol-impaired engineers who turned over the operation of their trains to unqualified employees, the Safety Board made the following recommendations to FRA:

> Immediately promulgate a specific regulation with appropriate penalties prohibiting the use of alcohol and drugs by employees for a specified period before reporting for duty and while on duty. (Class II, Priority Action) (R-83-30)
>
> With the assistance of the Association of American Railroads and the Railway Labor Executives Association, develop and promulgate effective procedures to ensure that timely toxicological tests are performed on all employees responsible for the operation of the train after a railroad accident which involves a fatality, a passenger train, releases of hazardous materials, an injury, or substantial property damage. (Class II, Priority Action) (R-83-31)

The Safety Board reiterated both of these recommendations on May 14, 1984, as a result of its investigation of a rear-end collision between two Seaboard System Railroad trains at Sullivan, Indiana, on September 14, 1983; 30/ the collision had been the result of an alcohol-impaired engineer and head brakeman falling asleep.

FRA responded to Recommendations R-83-30 and R-83-31 on June 5, 1983, by stating that it was fully committed to combating the misuse of alcohol and drugs by railroad employees and was directing its efforts to develop a comprehensive national program in close working relationship with the railroads, rail unions, the Safety Board, and other agencies. On July 5, 1983, FRA issued an Advance Notice of Proposed Rule Making (ANPRM) to address the alcohol and drug problem. Subsequently, FRA held public hearings at several locations throughout the country.

28/ Railroad Accident Report--"Rear-end Collision of Two Southern Pacific Transportation Company Freight Trains, Indio, California, June 25, 1983" (NTSB-RAR-74-1).

29/ Railroad Accident Reports--"Derailment of Illinois Central Freight Train Extra 9629 East (GS-2-28) and Release of Hazardous Materials at Livingston, Louisiana, September 28, 1982" (NTSB /RAR-83/05) and "Side Collision of Two Missouri Pacific Railroad Company Freight Trains at Glaise Junction, Near Possum Grape, Arkansas, October 3, 1982" (NTSB/RAR-83/06).

30/ Railroad Accident Report -- "Rear-end Collision of Seaboard System Railroad Freight Trains Extra 8051 North and Extra 1751 North, Sullivan, Indiana, September 14, 1983" (NTSB/RAR-84/-02).

On June 12, 1984, the FRA issued an NPRM which proposed to:

a) Prohibit the use of alcohol and drugs in railroad operations.

b) Require toxicological testing of employees following major accidents and incidents.

c) Require pre-employment drug urine screens for applicants for certain positions.

d) Authorize the railroads to require employees to cooperate in breath and urine tests administered by or for the railroad in certain circumstances that would be deemed to constitute just cause for testing.

e) Require the railroads to institute policies that will encourage the identification of employees troubled by alcohol and drug abuse.

f) Institute improvements in the accident/incident reporting system that will assist in better documenting the extent of alcohol and drug involvement in train accidents.

While the Safety Board supports the concept of FRA's proposed rule, the Board believes certain technical improvements need to be made to it. On August 2, 1984, the Board testified before the FRA in Washington, D.C., on FRA's proposed rule and suggested changes to improve it. Formal written comments were provided to FRA on August 15, 1984. (See Appendix F). In summary, the Board proposed the following technical improvements to the rule:

a) All employees directly involved in an accident should be covered by the rule.

b) Specific reference should be made to the fact that marijuana is a controlled substance as defined by 21 U.S.C. 802.

c) The rule should not convey the message that a blood alcohol level, such as 0.05 percent, in an operator is permissible for safe operation of a train.

d) Testing for marijuana use must be based on a reliable blood analysis for THC and its metabolites.

e) Postaccident toxicological testing of railroad employees involved in rail-highway grade crossing accidents should not be excluded.

f) Railroad employees who refuse to be tested under the proposed rule should be terminated from railroad employment.

The Safety Board believes that FRA's proposed rule, if amended in response to these concerns of the Board, will provide some positive measures that will begin to control the use of alcohol and drugs in railroad operations. However, the rule will only be a start in the right direction. The Board is concerned that the final rule has not yet been issued by

FRA, and that FRA's resolve in addressing this serious safety problem may be eroding or weakening. The Board believes that the action FRA has publicly promised to take should be taken without further delay.

Supervision of BN Train Operations

Akron, Colorado, is a rural village with little commerce other than that provided as a result of its being a crew-change point on the BN Chicago-Denver main line. It is the away-from-home layover point for traincrews operating out of Denver, Colorado, and McCook, Nebraska. Recreational activity available to these crews at Akron was limited and seasonal in nature. There were, however, a substantial number of taverns, considering the town's size, where video games and pool could be played and where alcoholic beverages were served. The Safety Board believes that only substantial patronage by railroad employees could support so many such establishments, and given the dearth of alternatives, BN's supervisors had little reason to expect otherwise. In addition to several bars, the town also had several carry-out stores, making it easy for railroad employees to obtain alcoholic beverages and consume them in their rooms.

When the proprietors of the motel contracted with BN to house its employees, they set forth a set of rules of conduct, one of which absolutely forbade alcoholic beverages and illegal drugs on the motel premises. Because BN's employees wanted to drink beer in their rooms at the motel, they complained about the rule to their union representatives. In response, the superintendent and trainmaster in charge of the Denver-Akron main line asked the motel proprietors to drop the rule, as well as the others. At the insistence of the proprietors, the alcohol-drug rule was still in force at the time of the accident. However, there appears to be a serious conflict between BN management's interpretation of the subject to duty provision of Rule G and the supervisors' efforts to remove a restriction to employees' consuming alcoholic beverages at a time they were supposed to be getting their rest and might be subject to being called to work.

Unlike most railroad crew change points, Akron was not the headquarters of a trainmaster, road foreman of engines, or other BN operating department supervisor. After BN closed its dormitory and contracted with the motel, the only local employee was the agent who worked the daylight shift. Crews received their calls to duty and were transported as necessary by the motel proprietors. The trainmasters and road foremen of engines responsible for supervising the crews on both sides of Akron were headquartered at the crews' home terminals of Denver and McCook. The crews that worked between Denver and Akron worked under a trainmaster and a road foreman, both of whom worked nominally daylight tours of duty. No supervisor was assigned to work the territory at night. The trainmaster and road foreman had many administrative duties which took up much of their time and kept them relatively close to Denver. Although the road foreman had been instructed to get out and meet his subordinates, he had only been able to ride about 20 trains in the 3 1/2 months preceding the Wiggins accident, and none of these were between the hours of midnight and 6 a.m. The road foreman had ridden only 6 trains into Akron, and the proprietor of the motel recalled seeing him only 4 or 5 times in the 3 1/2 month period. Even though warned by his predecessor that the engineer of Extra 6714 West might be a problem, the road foreman had yet to contact him and he was not aware that the engineer was used at times on Amtrak passenger trains between Denver and Akron. The Safety Board believes that this was the result of the road foreman's need to set priorities rather than his personal oversight or neglect.

The trainmaster rarely rode trains over the Akron end of his territory, and he never checked out Akron's taverns to see if his crew was drinking there. Although he said he made surprise checks at Akron once or twice a month, the motel proprietors said they only saw him once every 2 months on the average. Before the accident, the trainmaster and road foreman usually made their efficiency checks together, and these were habitually made at the same location. If traincrews knew where and when their supervisors were most likely to make "surprise" efficiency checks, then there was little element of surprise and the purpose of the checks was nullified. If the supervisors predictably rode trains on the Denver end, there was not much chance they would be encountered at Akron. The crew of Extra 6714 West had no reason to fear that a supervisor might observe their off-duty activity at Akron or be on hand to check their fitness when they reported to work. The Safety Board considers that this was a relative certainty and that it contributed to the irresponsible behavior of the crew.

The lack of adequate supervision was also a critical factor in the Newcastle accident. As in the Wiggins scenario, the crew of Extra 7843 East had little contact with supervisors between Edgemont and Gillette -- virtually none at night. They had no reason to think they might encounter their trainmaster at night, because they could be reasonably certain that he was at home in bed on any normal night when no emergency existed. The trainmaster at Edgemont was also burdened with many administrative functions, and for more than 2 months prior to the Newcastle accident, he had been the only supervisor overseeing the performance of about 250 train crewmembers over 160 miles of railroad, including 116 miles of one of the busiest single-track railroads in the world. During this period, he had no days off duty and nominally worked a 12-hour day from about 6 a.m. to 6 p.m. In the absence of an emergency, there was no supervision of the trains moving over his territory at night. The trainmaster was able to meet his requirement of riding two trains a month which he usually did during his normal daylight hours of duty.

The Edgemont trainmaster realized that he had far too little contact with his employees, but there was little he could do about it. He also had too little training on the rules -- his interpretations of Rules G, 34, and 804(b) were improper, judged in the light of their interpretations by higher management. This was unfortunate since the majority of employees working under the trainmaster were young and relatively inexperienced, and the trainmaster had a key role in the conducting of safety meetings and rules examinations for the employees during the critical months preceding the accident. Traditionally, the trainmaster is a teacher as well as an enforcer. He must understand the rules if he is to interpret them correctly for his employees.

Given the Alliance Division's poor safety record and the concern over the perceived drug problem on the division, the Safety Board questions the BN's failure to provide the Edgemont trainmaster with the assistance of another supervisor while the Edgemont road foreman of engines was ill and could not work. Both the assistant superintendent at Gillette and the superintendent at Alliance should have made the necessary provisions to do this. The Safety Board believes that their failure to do so is an indication that they were more concerned with supervisory economy than they were with operational safety. If they had been impressed by the EAP counselor's warnings about the division's drug-abuse problem, they apparently did not perceive that greater supervisory activity might alleviate it. This sense is reinforced by the fact that traffic had at least doubled in the 5 years preceding the accident, yet two supervisory positions added at Edgemont during this period had been abolished. Even before the road foreman became ill, there

were no more supervisors than when the traffic level was half that at the time of the accident. The situation was exacerbated by the fact that traffic growth had necessitated the hiring or transfer to the division of hundreds of youthful and inexperienced employees.

Traffic also had greatly increased on the Denver-Akron territory without any increase in the number of supervisors. These failures to keep supervisory levels apace of traffic appear to be a direct result of BN management policy. The senior vice president of regional operations said he believed BN ought to rely more heavily on conductors and engineers for the management of its train operations and, thus, avoid over-managing the employees. On the other hand, he stated that supervising a railroad's operations was much more difficult than overseeing a stationary work operation, such as a factory. On the basis of figures he provided at the Safety Board's public hearing, the average BN line operating officer, excluding those assigned to terminals, supervises 220 miles of railroad 24 hours a day. The same imbalance between day and night supervision evident in the territories involved in the Wiggins and Newcastle accidents probably exists elsewhere on the BN system. While the senior vice president said BN was "looking at" the possibility that such an imbalance might exist, the Safety Board is convinced that BN does have serious inadequacies in this area.

The Safety Board believes that it is absurd for BN management to charge its supervisors with the responsibility for training and testing the employees to gain their increased compliance with its rules, and then justify reducing the supervisory force on the premise that the employees ought to be able to supervise themselves.

As a result of the Safety Board's investigation of the Glaise Junction, Arkansas, accident previously referenced, the following recommendation was made to all member railroads of the Association of American Railroads:

> Establish supervisory procedures at crew-change terminals to insure that all operating department employees coming on duty at any hour of the day are physically fit and capable of complying with all pertinent operating rules. (Class II, Priority Action) (R-83-60)

On July 27, 1983, BN responded that it had recently increased its efficiency testing program, including checks of employees prior to their departure on trains, as well as stopping trains en route and checking their crews. However, BN replied that, "To establish supervisory procedures at all points where crews change or at all outlying terminals where crews go on duty would prove extremely difficult. . .and would necessitate many additional supervisors." BN said, however, that it would continue the program of making checks more frequently where supervisors were not on duty.

The investigations of these accidents indicated that, contrary to BN's response to Recommendation R-83-60, there was no increase in the checks being made at Akron. Indeed, fewer rather than more tests were being made. The ability of supervision to maintain even a modicum of nighttime activity at Edgemont and on the line between there and Gillette was significantly reduced by the failure to replace the Edgemont road foreman while he was unable to work. The Safety Board believes BN's policy of reducing its supervisory force in the face of increasing traffic is self-defeating and unrealistic. This tendency, along with the failure to make adequate provision for night supervision, particularly at outlying points, were probably factors in both the Wiggins and Newcastle accident.

BN's Employee Assistance Program (EAP)

The investigation indicated that the Denver counselor in BN's employee rehabilitation program (EAP) was very active and had a much higher percentage of clients to total employee population than the program had system-wide. Many self-referred employee clients of EAP had been discharged for violating Rule G and could only be reinstated in their jobs if they entered the program and submitted to evaluation and treatment. However, this may have been an indication that the number of employees with problems was higher on the Denver Region than elsewhere. There is no reliable way to accurately determine how effective the program really was. In any event, its outreach was apparently inadequate insofar as employees with alcohol- and drug-related problems was concerned. The overall utilization rate on the region for alcohol and drug users was only about 3.7 percent of the total employee population, whereas the EAP counselor thought that as many as 50 percent of the employees might be users based on the low median employee age and use within the population as a whole. Moreover, the irregular work assignments of many BN employees might have resulted in an even higher percentage of users within the employee population.

It was evident that EAP had been insufficiently publicized before the accidents occurred, since many employees were unaware of it. One reason for this was probably inadequate staffing. Although the Denver counselor had been informed that the fireman of Extra 6714 West liked to drink when away from home, he never followed up on the lead. This factor may help explain the program's relatively poor outreach performance. Since the accidents, BN has increased the Denver staff to two counselors. This is a commendably positive response and is probably an indication that BN recognizes the need to strengthen EAP in the region. In this regard, EAP would probably be considerably more effective were first line supervisors required to become more thoroughly involved in the program. Given what the Safety Board views as a critical situation resulting from BN's policy of reducing line supervisor strength and the burdens now being borne by the supervisors, placing this added responsibility on them would be unrealistic at present levels of supervisory staffing.

A significant aspect to the Denver EAP outreach performance was the fact that no employee client had been referred to the program by another employee. Since the accidents, BN has created a new prevention and referral program on the Denver Region which is to utilize peer committees to identify those employees with alcohol and drug problems and to encourage them to become EAP clients. This so-called "Rule G By-pass" program has been highly favored by the labor organizations as the ultimate solution to the alcohol and drug problem. It will be, however, a voluntary program that, like EAP itself, can only help those who recognize that they need help and accept it. Of course, the Safety Board strongly supports any program which will ultimately alleviate the alcohol and drug problem on the BN and other railroads. Nevertheless, it remains to be seen whether Rule G Bypass can overcome the historic, industry-wide inclination of railroad employees to ignore the impairment of a fellow employee, even when he may be in a position to jeopardize their own lives. The Safety Board supports strongly the intent of the EAP programs and the envisioned intent of Rule G Bypass programs; however, neither should be considered singularly, or in combination, as alternatives to specific mandatory abstinence from use, intensified supervisory oversight, and mandatory postaccident toxicological examination. The Safety Board urges a multi-faceted approach to resolving the alcohol and drug issue in railroad operations.

CONCLUSIONS

Findings

Wiggins Accident

1. It was critical that Extra 6714 West and Extra 7820 East be operated in strict accordance with the signal system; radio instructions, visibility, mechanical condition of the trains, and proper functioning of the signal system were not causal factors in the accident.

2. The crewmembers of Extra 7820 East were alert and responded properly to signal aspects and other conditions affecting the safety of their train.

3. The crewmembers of Extra 6714 West failed to comply with restrictive signal aspects and they took no action to stop their train before the accident.

4. The head-end crewmembers of Extra 6714 West did not observe the signals, nor did they see Extra 7820 East, because they were asleep.

5. The engineer and fireman of Extra 6714 West fell asleep because they had failed to use any of their rest period for sleeping and because they had used alcohol.

6. Before the engineer and fireman were observed at the restaurant where they had breakfast before they reported for duty, one witness, the motel proprietor, thought the engineer was intoxicated; two restaurant employees thought both men were intoxicated.

7. The conductor rode to the train with the engineer and fireman. He either failed to recognize their impaired condition or he chose to ignore it and took no action to prevent their boarding and operating the train.

8. The conductor did not have adequate rest during his off-duty hours; while it appears he probably stayed awake, he was not alert and he did not act when the head-end crewmembers failed to respond to his radio calls.

9. BN rules 34 and 804(b) required conductors and other crewmembers riding in the cabooses of train to take action, including the use of the emergency brake valve, if the engineer failed to respond properly to the signals. Although the conductor of Extra 6714 West should have seen the restrictive signals at Wiggins, he did not act when the engineer did not respond to them.

Newcastle Accident

10. The crewmembers of Extra 7843 East knew that they were following other trains and overheard radio transmissions indicating one of the trains was stopping at Pedro to pick up the crew of another train. Because of this, they should have anticipated encountering restrictive signal aspects and should have been alert and on the lookout for them.

11. Extra 7843 East had to descend Y.T. Hill, a long downgrade between Osage and Pedro, which required the use of dynamic braking and the automatic air brakes to control speed even if no restrictive signals were encountered.

12. The engineer of Extra 7843 East failed to respond to restrictive aspects displayed by home signal 534.11 at East Osage and intermediate signals 532.4 and 530.6 between East Osage and Pedro. As a result, he did not initiate the braking needed to control the train's speed and it accelerated rapidly as it descended Y.T. Hill.

13. The head brakeman of Extra 7843 East fell asleep after the train passed West Osage and failed to take the action required by BN rules to bring the restrictive signal aspects to the engineer's attention, which might have resulted in a proper response by the engineer, or failing that, action by the brakeman, to stop the train by using the emergency brake valve.

14. The engineer and head brakeman of Extra 7843 East had reported for duty suffering from acute sleep loss and fatigue resulting from their failure to sleep in company-provided facilities and time to do so at Gillette and previously during their off-duty hours at Edgemont. Their fatigue probably was aggravated by the time of the day, locomotive noise and vibration, and particularly in the case of the head brakeman, by a constantly changing work/rest cycle.

15. The engineer used marijuana while operating Extra 7843 East from Eagle Butte Mine to Pedro; this probably impaired his performance and was a causative factor in the accident.

16. The conductor of Extra 7843 East expected to experience the effect of braking action well before the caboose reached Y.T. Hill. No indication of braking occurred; instead, the train began to accelerate as it descended the hill. Had the conductor contacted the engineer when braking failed to occur, there would have been sufficient time and distance to stop the train short of Pedro passing track.

17. By the time the conductor acted and woke the engineer, the entire train was on the downgrade and it was moving about 65 mph. There was now only about two miles separating Extra 7843 East and Extra ATSF 8112 East, and it was too late to prevent a collision between them.

18. The crewmembers in the caboose of Extra ATSF 8112 East did not have enough warning of the impending accident to escape since the engineer of Extra 7843 East apparently failed to sound his locomotive's whistle, and the caboose battery of Extra ATSF 8112 East was not providing sufficient power for their radio to receive the warnings transmitted by the engineer on his radio.

19. Tests indicated the conductor of Extra 7843 East had not used marijuana. Although tests indicated the rear brakeman of Extra 7843 East had used marijuana at some fairly recent time previous to the accident, he was not under its influence and his use was not a factor in the accident.

20. Tests indicated two crewmembers of Extra ATSF 8112 East, and two crewmembers of Extra 5533 East were marijuana users, but their usage had no bearing on the accident or the events that preceded it.

21. Traincrews operating between Edgemont and Gillette are subjected to irregular and relatively unpredictable work schedules, mostly as a result of the heavy traffic volume, traffic congestion, and factors related to coal mining operations over which BN has little control. As a result, it is not possible to operate trains on a published schedule or predictable basis.

22. Regular pool crewmembers were permitted to take time off from work on a reasonably liberal basis; younger employees assigned to the extra board were expected to be available to fill temporary vacancies in pool crews. This type of employee utilization is a traditional and commonplace element in railroading.

23. Despite the fact that the Alliance Division had one of the poorest safety records on the BN system, and the Denver EAP counselor had warned the division's officers that the drug problem among their employees was serious, the superintendent and assistant superintendent failed to fill temporarily the vacant road foreman or engines jobs at Edgemont during the 2 months preceding the accident.

24. As the only supervisor at Edgemont, the trainmaster had to oversee the operation of 40 to 50 trains daily and monitor the activities of more than 250 train service employees. This meant that his duties and responsibilities in these areas had been increased more than four-fold from their level two years before when there was less traffic on his territory. This made it necessary to "let some things slide," including personal contact with his employees. This was a causal factor in the Newcastle accident.

General Findings

25. Train crewmembers were afforded at least the minimum rest time required by Federal regulations, and when away from home they were provided rest facilities. It was the responsibility of the employees to utilize the time and facilities to obtain proper bed rest and to report for work fit for duty.

26. There was a reluctance of BN conductors and brakemen to interfere with the engineer's operation of their trains evidenced by the investigations of these accidents. It is an indication that BN has not stressed their responsibility to do so under Rules 34 and 804(B). BN cannot expect its employees to develop a uniform and accurate understanding of what is required without proper training.

27. There was much professed conflict of interpretation of the "subject to duty" provision of BN's Rule G on the part of employees involved in these accidents and their supervisors.

28. Although BN had a safety and rules department staffed by supervisors with operating department backgrounds, it was apparent that on the Denver Region they did not regularly ride with traincrews or observe and monitor the performance and fitness of traincrews in conjunction with line supervisors. There also seemed to be a breakdown in the line of communication between safety supervisors, line supervisors, and employees in ensuring that all had a uniform understanding of critical operating rules.

29. Except at terminals, there was very little supervisory activity at night, since the supervisors all worked nominally daylight jobs and had no counterparts at night. This imbalance between day and night supervision may be characteristic of the BN as a whole.

30. These accidents occurred between midnight and 6 a.m. when human performance is typically at it lowest point, and when traincrews could be virtually certain they would encounter no supervisor en route or at outlying points such as Akron and Edgemont.

31. Although the Safety Board had recommended to BN that it provide supervision to check crews' fitness at all points where they report for duty, no effort had been made to do this at Akron or Edgemont. Indeed, the level of occasional or part-time supervision at these locations had been reduced.

32. BN's stated policy of placing greater responsibility for the safe operation of its trains on its engineers and conductors in lieu of supervisory oversight is unrealistic and self-defeating. Train crewmembers need to know that their performance will be monitored routinely and that they may expect to be checked for fitness at any time where they report to work and while they are en route on trains.

33. Had the locomotives of Extra 6714 West at Wiggins and of Extra 7843 East at Newcastle been equipped with functional automatic train control and/or alerter devices, the accidents would not have occurred.

34. The Federal Railroad Administration's proposed rule to control alcohol and drug use in railroad operations has not been promulgated. The accidents demonstrated that there remains a critical need for Federal Regulations that prohibit the use of alcohol and drugs by railroad employees on duty, provide for specific mandatory periods of abstinence from use prior to reporting for duty, and require postaccident toxicological tests of train crewmembers.

35. The outreach of BN's EAP program is minimal because of inadequate publicity and limited staffing, and it relies heavily on self-referral. Since alcohol and drug abusers rarely recognize their problem, such a program will not have a high utilization rate among this group of employees without greater involvement of BN supervisors and the EAP's staff.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the Wiggins accident was the engineer and other head-end crewmembers of Extra 6714 West falling asleep and failing to comply with restrictive signal aspects. Contributing to the failure of the engineer and fireman was their consumption of alcohol and fatigue resulting from their voluntary lack of sleep during their off-duty time, aggravated by irregular work/rest cycles.

The National Transportation Safety Board determines that the probable cause of the Newcastle accident was the failure of the engineer and head brakeman of Extra 7843 East to operate their train in compliance with restrictive signal aspects because they were asleep or, in the case of the engineer, otherwise impaired. Contributing to their failure was the use of marijuana by the engineer, as well as the fatigue of the engineer and head brakeman due to their voluntary lack of sleep and unpredictable working hours.

Contributing to both accidents were (1) the conductors' failure in both instances to protect their trains in compliance with operating rules 34 and 804(B); and (2) Burlington Northern's failure to supervise properly its train operations.

RECOMMENDATIONS

As a result of its investigations of these accidents, the National Transportation Safety Board made the following recommendations:

—to the Burlington Northern Railroad Company:

Provide enhanced nighttime supervision of train operations. (Class II, Priority Action) (R-85-37)

Define the "subject to duty" provision of Rule G and provide all train service employees a uniform interpretation of its requirements. (Class II, Priority Action) (R-85-38)

Improve its capability to provide accurate and timely information as to when traincrews laying over at Gillette, Wyoming, and other outlying points may expect to be called to duty. (Class II, Priority Action) (R-85-39)

Improve its training program to provide first line supervisors with a uniform understanding of the meaning and application of BN operating rules. (Class II, Priority Action) (R-85-40)

Modify its program of periodic training of train service employees to include instruction on the meaning and application of the operating rules as required under 49 CFR, Part 217.11. (Class II, Priority Action) (R-85-41)

Equip its locomotive units with crew alerters or other backup devices that will stop a train in the event its engineer becomes incapacitated or impaired. (Class II, Priority Action) (R-85-42)

—to the Association of American Railroads:

Encourage its member railroads to define the "subject to duty" provision of their Rules G to stipulate a defined period of required abstinence from the use of alcohol and other substances by train crewmembers prior to their accepting calls to duty. (Class II, Priority Action) (R-85-21)

In addition to these recommendations, the Safety Board reiterates and reemphasizes the importance of the following recommendations which were made to the Federal Railroad Administration as a result of the investigations of other train collisions:

Promulgate regulations which require an adequate backup system for mainline freight trains that will insure that a train is controlled as required by the signal system in the event that the engineer fails to do so. (R-76-3)

Immediately promulgate a specific regulation with appropriate penalties prohibiting the use of alcohol and drugs by employees for a specified period before reporting for duty and while on duty. (R-83-30)

With the assistance of the Association of American Railroads and the Railway Labor Executives Association, develop and promulgate effective procedures to ensure that timely toxicological tests are performed on all employees responsible for the operation of the train after a railroad accident which involves a fatality, a passenger train, releases of hazardous materials, an injury, or substantial property damage. (R-83-31)

Develop and promulgate a requirement that locomotives operated in main track service be equipped with an alerting device which will stop a train if the engineer fails to respond to an alarm indicating that he or she has fallen asleep or has become incapacitated. (Class II, Priority Action) (R-84-31)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JIM BURNETT
Chairman

/s/ PATRICIA A. GOLDMAN
Vice Chairman

G. H. PATRICK BURSLEY, Member, Concurring and Dissenting:

I believe that the essential facts and conclusions have been accurately developed, analyzed and reported. The report supports all of the elements which we have found were central to these accidents. I believe, however, that the report is too expansive in going from the particular to the general in the areas of alcohol involvement, drug involvement, and crew scheduling. The first two of these areas (and perhaps the third) are in need of intensive attention from the Federal Railroad Administration (FRA) and the railroad industry. It is important that the Safety Board's reports of railroad accident investigations exert pressure on the FRA and the industry to take necessary remedial action. In my view, this calls for methodical, carefully knit reports building on specifically identified circumstances. Merely saying over and over again, in increasingly encompassing terms, that the alcohol situation, the drug situation, and the crew scheduling situation, etc., are deplorable, will cease--if it has not already--in attracting interest from the parties who will count in effecting a solution to the problems, i.e., the FRA, rail management, and rail labor. Public pressure can do only so much and the audience which is responsive to generalities is not the group that is going to solve the problems we have identified.

I want to emphasize that I view the problem of crew impairment by reason of alcohol consumption or use of drugs as one of serious proportions in the railroad industry. I believe, also, that supervision of train operations -- particularly in nighttime train operations -- is in need of a major overhauling. The railroad accidents that the Board has been investigating in depth recently have taken on an almost monotonous pattern in respect to these factors. Accordingly, I have voted for the adoption of Safety Recommendations R-85-21 and R-85-31 through R-85-42 which address these problems as they have arisen on the Burlington Northern Railroad.

While I have some minor reservations, I join in the adoption of the probable cause. However, I cannot join in the adoption of the underlying report because I believe that it goes beyond the facts and circumstances of the accidents in its analysis and draws conclusions which the Board has yet to document adequately through its accident investigations. This is not to say that the conclusions are untenable, but rather that it is my belief that our analyses must be built on hard facts rather than informed extrapolation.

/s/ G. H. PATRICK BURSLEY
Member

April 1, 1985

APPENDIXES

APPENDIX A

INVESTIGATIONS AND HEARING

Investigations

Wiggins Accident

The National Transportation Safety Board was notified of the accident about 7:00 a.m., on April 13, 1984, and immediately dispatched an investigator from the Denver Field Office to the scene. The investigator-in-charge and additional members of the investigative team were subsequently dispatched to the scene from Washington, D.C. and Los Angeles, California. Investigative groups were established for operations, mechanical, signal, and human performance factors.

Newcastle Accident

The National Transportation Safety Board was notified of the accident about 9:30 a.m., on April 22, 1984, and immediately dispatched an investigator from the Denver Field Office to the scene. The investigator-in-charge and additional members of the investigative team were subsequently dispatched from Washington, D.C. and Los Angeles, California. Investigative groups were established for operating, mechanical, track and signals, and human performance factors.

Hearing

The Safety Board convened a 5-day public hearing as part of its investigation of these accidents on June 4, 1982. Parties to the hearing included the Burlington Northern Railroad Company, the State of Colorado Public Utilities Commission, the Federal Railroad Administration, the Brotherhood of Locomotive Engineers, and the United Transportation Union. Testimony was taken from 40 witnesses and 70 exhibits were accepted into the record.

APPENDIX B

TRAIN PERSONNEL INFORMATION

WIGGINS ACCIDENT

Extra 6714 West

Conductor John G. Irons

Conductor John G. Irons, 32, was employed as a helper in the Burlington Northern Railroad's (BN) track department on June 8, 1970, and transferred to the position of brakeman/switchman at Lincoln, Nebraska, on August 29, 1973. He was promoted to conductor on December 14, 1977, and was transferred to Denver, Colorado, on September 20, 1978. Mr. Irons last passed a company physical examination on August 9, 1983, and he passed the biennial rules examination on January 21, 1984.

Engineer Larry Dean Reed

Engineer Larry Dean Reed, 34, was employed as a switchman by the Burlington Northern Railroad on August 7, 1974, and transferred to the position of locomotive fireman on March 24, 1976. On January 1, 1977, he entered BN's engineer's training program and as part of this program completed 3 weeks of formal training at St. Paul, Minnesota, on February 19, 1977. On September 2, 1977, he passed the promotional examination and was formally promoted to locomotive engineer. Mr. Reed had last passed a company physical examination on June 22, 1982, and he had most recently passed a combination Union Pacific Burlington Northern rules examination on January 16, 1984.

Fireman Larry Vincent Alishio

Fireman Larry Vincent Alishio, 31, was employed as a brakeman by the Burlington Northern Railroad on July 5, 1977, at Trinidad, Colorado. On December 21, 1977, he transferred to Denver, Colorado, and on January 10, 1979, he transferred into the Locomotive Engineer's Training Program as a locomotive fireman. On March 3, 1979, he began pre-requisite engineer training and on April 20, 1979, completed 3 weeks of formal classroom training at St. Paul, Minnesota. He passed final examinations and was promoted to locomotive engineer on July 26, 1979. According to his service record, Mr. Alishio last passed a company physical examination on June 24, 1977, prior to being initially employed by BN. At the time he entered the BN engineer training program in January 1979, physical examination was waived as not necessary. He last passed examination on BN rules on March 13, 1982, and on Union Pacific rules on February 17, 1984.

Rear Brakeman Bruce D'Wayne Fierstein

Brakeman Bruce D'Wayne Fierstein, 27, was employed as a switchman by Burlington Northern Railroad on April 13, 1976, and subsequently worked as a brakeman or switchman at Hastings, McCook, and other locations in Nebraska. On April 1, 1984, he transferred to Denver, Colorado. Mr. Fierstein was not promoted. According to his service record, he last passed a company physical examination at the time he was first employed, and he last passed examination on BN rules on March 2, 1983.

Head Brakeman James Joseph Yoch

Brakeman James Joseph Yoch, 40, was employed as a switchman by Burlington Northern Railroad on December 2, 1976. On March 6, 1978, he transferred to BN's engineer Training Program as a locomotive fireman and subsequently completed prerequisite training, but was subsequently given a 120-day leave of absence beginning on August 29, 1978, due to hearing problems. On January 10, 1979, he was physically disapproved for completion of the engineer training program and returned to service as a brakeman. On May 2, 1979, Mr. Yoch was promoted to conductor. He last passed a company physical on August 2, 1982, and he passed reexamination on BN rules on March 29, 1984, after previously failing the examination on February 16, 1984.

NEWCASTLE ACCIDENT

Extra 7843 East

Conductor Bryan Eugene Lolley

Conductor Bryan Eugene Lolley, 37, was employed as a brakeman by Burlington Northern Railroad on May 1, 1971. He was promoted to conductor on December 18, 1973. He last passed a company physical examination on March 22, 1983, and he last passed examination on BN rules on February 8, 1984.

Engineer Jerome Michael McNulty

Engineer Jerome Michael McNulty, 27, was employed as a brakeman by Burlington Northern Railroad on September 1, 1978. He transferred to the position of locomotive fireman/engineer on March 30, 1979, and entered BN's engineer training program on May 7, 1979. He completed the program and was promoted to engineer on September 11, 1979. Mr. McNulty last passed a company physical examination on June 27, 1983, at which time he was required to wear corrective eyeglasses at all times when on duty and to carry at least one extra pair on his person. Comments on a report of a February 8, 1982, company physical examination stated, "Patient has history compatible c Diabetes Millitus, will check Glucose Tolerance." No mention of this condition was made on the 1983 report of physical examination. Mr. McNulty last passed examination on BN Rules on June 20, 1983.

Rear Brakeman Robin Octavius Baker

Brakeman Robin Octavius Baker, 27, was employed as a brakeman on the St. Louis-San Francisco Railroad 31/ in Arkansas on May 30, 1978. He transferred to Alliance, Nebraska, on September 4, 1983, and to Edgemont, South Dakota, on December 17, 1983. His service record does not indicate that Mr. Baker had ever submitted to a company physical. He passed re-examination on the BN rules on April 17, 1984, having previously failed the examination on March 13, 1984.

Head Brakeman Warren Keith Young

Brakeman Warren Keith Young, 29, was employed as a brakeman by Burlington Northern Railroad on September 1, 1978. He was not promoted. Mr. Young had last passed a company physical on March 16, 1983. At that time he was required to wear glasses "constantly" and to always carry at least one extra pair while on duty. Mr. Young last passed examination on BN rules on February 7, 1984.

31/ The St. Louis-San Francisco Railroad became a part of the Burlington Northern system in November 1980.

APPENDIX C

EXCERPTS FROM BURLINGTON NORTHERN OPERATING RULES, OCTOBER 1, 1980

GENERAL RULES

A Employes whose duties are prescribed by these rules must be conversant with and obey the rules and special instructions Rules and special instructions must be carried out intelligently to achieve an efficient operation If in doubt as to the meaning of any rule or special instruction employes must apply to the proper authority of the railroad for explanation

G The use of alcoholic beverages, intoxicants, narcotics, marijuana or other controlled substances by employes subject to duty, or their possession or use while on duty or on Company property, is prohibited

Employes must not report for duty under the influence of any alcoholic beverage, intoxicant, narcotic marijuana or other controlled substance, or medication, including those prescribed by a Doctor, that may in any way adversely affect their alertness, coordination, reaction, response or safety

34 Employes located in the cab of engine must communicate to each other in an audible and clear manner the name or aspect of each signal affecting movement of their train or engine, as soon as the signal is clearly visible or audible It is the responsibility of the engineer to have each employe comply with these requirements, including himself

It is the engineer's responsibility to have each employe located in the cab of engine maintain a vigilant lookout for signals and conditions along the track which affect the movement of the engine or train

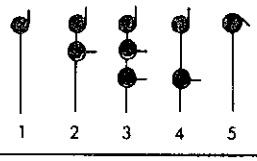
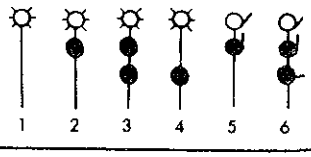
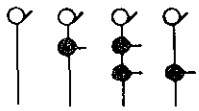
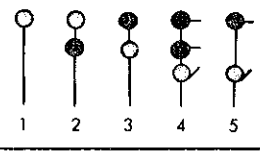
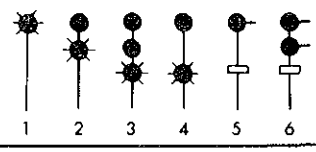
If a crew member becomes aware that the engineer has become incapacitated or should the engineer fail to operate or control the engine or train in accordance with the signal indications or other conditions requiring speed to be reduced, other members of the crew must communicate with the crew member controlling the movement at once, and if he fails to properly control the speed of the train or engine, other members of the crew must take action necessary to ensure the safety of the train or engine, including operating the emergency brake valve.

RESTRICTED SPEED —Proceed prepared to stop short of train, engine, obstruction, or switch not properly lined, looking out for broken rail or anything that may require the speed of a train or engine to be reduced, but not exceeding 20 MPH

700 Employes will not be retained in the service who are careless of the safety of themselves or others, disloyal, insubordinate, dishonest, immoral, quarrelsome or otherwise vicious, or who do not conduct themselves in such a manner that the railroad will not be subjected to criticism and loss of good will

804 (B) When conditions or signals require that the train be stopped or speed of train be reduced and the engineer or conductor fails to take proper action to do so, or should the engineer become incapacitated, other members of the crew must take immediate action to stop train, using emergency brake valve if necessary

BURLINGTON NORTHERN INC
Automatic Block, CTC and Interlocking Signal Systems

RULE	ASPECTS	CAB SIGNAL ASPECTS
501		
501C		
501E		
501I		
501K		

NAME	INDICATION
Clear	Proceed
Approach Medium	Proceed prepared to pass next signal not exceeding 35 MPH
Approach	Proceed prepared to stop at next signal Trains exceeding 35 MPH must immediately reduce to that speed
Restricting	Proceed at restricted speed
Stop and Proceed	Stop before any part of train or engine passes the signal Then proceed at restricted speed through entire block

Rule 501K - change Name and Indication to read:
NAME - Restricted Proceed

INDICATION - Proceed at restricted speed through entire block.

EXCERPTS FROM BURLINGTON NORTHERN
DENVER REGION TIMETABLE NO. 2
OCTOBER 30, 1983

ALLIANCE DIVISION

J D Yeager—Division Superintendent

C P EVANS	Asst Supt Transportation	Alliance
J E DOUGHMAN	Asst Supt Transportation	Gillette
J. A PINKEPANK	Asst Supt Administration	Alliance
T J DEMOPOULOS	Asst Supt Roadway Maintenance	Alliance
L R. TAYLOR	Asst. Supt , Roadway Maintenance	Alliance
J W MILLER	Chief Dispatcher	Alliance
E F HATZENBUHLER	Trainmaster	Alliance
G L SHIRE	Trainmaster	Alliance
A. B CROSS, JR	Trainmaster	Alliance
E B MAMER	Trainmaster	Guernsey
K C WILKOWSKI	Trainmaster	Guernsey
B A TURNER	Trainmaster	Edgemont
J. L HILL	Trainmaster	Gillette
K. C. SPRADLIN	Trainmaster	Gillette
W G. LONNGREN	Trainmaster	Sterling
D. L BAINTER	Road Foreman	Alliance
W H WASSERBERGER	Road Foreman	Alliance
D L. TREMBLAY	Road Foreman	Edgemont
D W HILL	Road Foreman	Gillette
C E GRANKE	Trainmaster-Road Foreman	Sterling

ALLIANCE YARD

W T REILLY	Terminal Superintendent	Alliance
T N. BISSEN	Terminal Trainmaster	Alliance
J. W HARTWIG	Terminal Trainmaster	Alliance
G A LAVALLEY	Terminal Trainmaster	Alliance
M J ARITA	Terminal Trainmaster	Alliance
J C KLAUS	Asst Terminal Trainmaster	Alliance

COLORADO DIVISION

J. C. Pohl—Division Superintendent

K. D WALTON	Asst Supt Transportation	McCook
D H SHAFER	Asst Supt Administration	Denver
S. K KLUTHE	Asst. Supt. Roadway Maintenance	Denver
L H. COX	Trainmaster	Denver
C W WILSON	Trainmaster	McCook
R HODGSON	Trainmaster Agent	Golden
J. P. HOLLAND	Trainmaster	Cheyenne
H NICHOLAS	Trainmaster Agent	McCook
R R HANCOCK	Road Foreman	McCook
R E CHRISTENSEN	Road Foreman	Denver
K R. MATZICK	Road Foreman	Denver
M D POTTHOFF	Chief Dispatcher	McCook

DENVER YARD

D K WATTS	Terminal Superintendent	Denver
C E WENDT	Asst. Terminal Superintendent	Denver
G A. WHITE	Terminal Trainmaster	Denver
T I. MCCANN	Terminal Trainmaster	Denver
L E HAHN	Terminal Trainmaster	Denver
R F LOUKOTA	Terminal Trainmaster	Denver
J B WRIGHT	Terminal Trainmaster	Denver
R R FAY	Terminal Trainmaster	Denver

FORT WORTH DIVISION

T. H. Lynch—Division Superintendent

W A. GIBSON	Asst Supt Transportation	Fort Worth
J. N LOCKLIN	Asst Supt Administration	Fort Worth
C L. BROTHERTON	Asst. Supt , Roadway Maintenance	Fort Worth
B G GILBERT	Chief Dispatcher	Fort Worth
S P. MALLORY	Trainmaster	Houston
J W WOOD	Trainmaster	Teague
L D TACKITT	Trainmaster	Wichita Falls
J T THOMPSON	Trainmaster	Amarillo
F. R. GILLEDGE	Trainmaster	Trinidad
W D LINGBLOOM	Trainmaster-Road Foreman	Trinidad
J E. SMITH	Road Foreman	Teague
K R LARSEN	Road Foreman	Wichita Falls
C N JACKSON	Road Foreman	Amarillo
D L CHRISTIAN	Trainmaster-Agent	Wichita Falls
E S. HUFFMAN	Asst. Trainmaster-Agent	Galveston
I. W TAYLOR	Asst. Trainmaster-Agent	Amarillo
E H HENDRICKS	Asst. Trainmaster-Agent	Lubbock

FORT WORTH—IRVING TERMINAL

P C KEIM	Terminal Superintendent	Fort Worth
J. W SPIVEY	Terminal Trainmaster	Fort Worth
K S PETERSON	Terminal Trainmaster	Fort Worth
E A CHESTER	Asst Trainmaster	Irving
D. L STULL	Asst. Terminal Trainmaster	Fort Worth
M R EVANS	Trainmaster-Road Foreman	Fort Worth
R L MCWILLIAMS	Asst Trainmaster-Agent	Fort Worth

Printed in U.S.A.

BURLINGTON NORTHERN RAILROAD CO.

DENVER REGION

ALLIANCE, COLORADO AND FORT WORTH DIVISIONS

TIMETABLE AND SPECIAL INSTRUCTIONS NO. 2

IN EFFECT AT 12:01 A.M.
Central Standard Time
Mountain Standard Time

Sunday, October 30, 1983

Including National Railroad Passenger Corporation (NRPC) Trains

Vice President
And General Manager
W. L. ARNTZEN

Assistant
General Manager
E. M. MARTIN

Vice President
Transportation—System
E. H. HARRISON

COLORADO DIVISION

WESTWARD

Rule 6(A) Signs	Length of Siding in Feet	Station Numbers	FIRST CLASS 5 NRPC Daily	Line Segment	Mile Post Location	Distance From McCook		2nd Subdivn MAIN LINE STATIONS Office Calls		FIRST CLASS 6 NRPC Daily
BKRT	7,875	20724	2:35AM		287 8	0 0	MC	McCOOK		As 1:10AM
								11 2		
J	6,765	20735			299 0	11 2		CULBERTSON		
								10.2		
	7,220	20745			309 3	21 4		TRENTON		
								11 8		
	6,845	20757			321 1	33 2		STRATTON		
								9 6		
	6,800	20767			330 7	42.8		MAX		
								8 4		
	7,310	20775			339 1	51 2		BENKELMAN		
								10 5		
	7,080	20785			349 5	61 7		PARKS		
								11 5		
	6,925	20797			361 1	73 2		HAIGLER		
								16 4		
	9,170	20813			377.5	89 6		WRAY		
								7 4		
	6,460	20821			385 6	97 0		ROBB		
								7 2		
	7,190	20828			392 2	104 2		ECKLEY		
								12 6		
	6,765	20841			404 8	116 8		YUMA		
								9 6		
	6,635	20850			414 0	126 4		CALHOUN		
								8 7		
	6,725	20859			423 0	135 1		PLATNER		
								7 8		
BKRT	8,290	20867	s 4:35		430 8	142 9	AK	AKRON		s 11:16
								6 8		
	4,250	20873			437 7	149 7		XENIA		
								6 3		
	5,780	20880		2	444 3	156 0		PINNEO		
								9 8		
JT					453 1	165 8		EAST BRUSH		
								1 1		
BJKRT	N7,287 S7,117	20891			454 9	166 9	BU	BRUSH CENTER	CTC	
								1 5		
					456 5	168 4		WEST BRUSH		
								1 5		
J		20894			458 0	169 9		PAWNEE JCT		
								1 2		
	4,035	20895			459 1	171 1		LODI		
								5 3		
	6,560	20900	s 5:05		464 3	176 4	JN	FT MORGAN		s 10:45
								4 1		
	7,925	20904			468 5	180 5		BIJOU		
								10 5		
	7,291	20915			478 9	191 0		WIGGINS		
								10 1		
	7,375	20924			489 1	201 1		CREST		
								6 3		
	7,057	20932			495 7	207 4		ROGGEN		
								9 9		
	7,121	20941			505 4	217 3		KEENESBURG		
								7 6		
	6,152	20949			513 0	224 9		HUDSON		
								5 5		
	7,191	20954			518 5	230 4		TONVILLE		
								6 0		
	7,610	20960			524 5	236 4		BARR		
								7 4		
	7,905	20968			531 7	243 8		IRONDALE		
								4 9		
I		20973			536 9	248 7		SAND CREEK		
								4 3		
					541 2					
BKRTU		20977			0 3	253 0	W	31st ST. YARD		
				476				1 2		
					0 0					
BIJKR		20979	As 7:00AM		0 0	254.2		DENVER UD		9:20PM
				477				2 2		
JXY					2.2	256 4	DT	SOUTH PARK JCT		
								1 9		
IY					4 1	258 3		SOUTH DENVER		

EASTWARD

BN Radio Channel No 1 in service on this Subdivision

BN Radio Channel No 2 in service at Denver Yard

4th Subdivn MAIN LINE STATIONS

WESTWARD | EASTWARD

Rule 6(A) Signs	Length of Siding in Feet	Station Numbers	Line Segment	Mile Post Location	Distance From Sterling		Office Calls	
BJKRTY		84081	21	115 1	0 0		ST STERLING	CTC
						23 5		

BETWEEN STERLING AND UNION UPRR RULES TIMETABLE AND SPECIAL INSTRUCTIONS GOVERN.

J		84105		138.6	23 5		UNION	
							26	
	7 256	84109	21	141 2	26 1		NEW HILLROSE	CTC
							68	
JT				148 0	32 9		BRUSH JCT	
							20	
BJKRT		20891		150.0	34.9		BU BRUSH CENTER	

3rd Subdivn MAIN LINE STATIONS

WESTWARD | EASTWARD

Rule 6(A) Signs	Length of Siding in Feet	Station Numbers	Line Segment	Mile Post Location	Distance From Edg emont		Office Calls	
BKRT		30475		476 1	0 0		MR EDGEMONT	
						2MT	06	
JT		30476		476 7	0 6		DEADWOOD JCT	
							76	
		30483		484 3	8 2		MARIETTA	
							115	
	8,143	30494		495 8	19 7		DEWEY	
							113	
				507 1	31 0		OWENS	
						2MT	68	
				513 9	37 8		SPENCER	
							54	
				519 3	43 2		EAST NEWCASTLE	
							14	
		30519		520 7	44 6		NC NEWCASTLE	
							01	
				520 8	44 7		WEST NEWCASTLE	
							72	
	8 146	30527		528 0	51 9		PEDRO	
							74	
	8 296	30534		535 4	59 3		OSAGE	
			4				118	CTC
				547 2	71 1		EAST UPTON	
							09	
	9 976	30548		548 1	72 0		RO UPTON	
						2MT	21	
				550 2	74 1		WEST UPTON	
							61	
	3 296	30555		556 3	80 2		THORNTON	
							57	
				562 0	85 9		KARA	
						2MT	70	
		30568		569 0	92 9		MOORCROFT	
							125	
		30581		581 5	105 4		ROZET	
							50	
JT		30587		586 5	110 4	2MT	DONKEY CREEK	
							14	
JT		30588		587 9	111 8		CAMPBELL	
							34	
		30589		591 3	115 2		WYODAK	
							40	
				595 3	119 2		EAST GILLETTE	
							19	
BKRTY		30596		597.2	121 1		X GILLETTE	

10th Subdivn MAIN LINE STATIONS

WESTWARD | EASTWARD

Rule 6(A) Signs	Length of Siding in Feet	Station Numbers	Line Segment	Mile Post Location	Distance From Campbell		Office Calls	
JT		30588		0.0	0.0		CAMPBELL	
							13	
	7,650			13	13		PORTIN	
							17	
J			188	30	30		CLOVIS POINT JCT To Clovis Point 1.6	CTC
							30	
J				60	60		FT. UNION JCT To Ft. Union 1.0	
							35	
J		33309		9.5	9.5		EAGLE BUTTE JCT To Rawhide 1 7 To Eagle Butte 4.8 To Buckskin 8.0	

SPECIAL INSTRUCTIONS

ALL SUBDIVISIONS

1	Speed Restrictions—	Maximum Speeds Permitted
	All speeds are subject to modification by speed restrictions indicated under Individual Subdivision Special Instructions	
	Passenger trains will be governed by freight train speeds if passenger train speed is not specified under Individual Subdivision Special Instructions	
	Freight trains up to 100 Tons/OB*	60 MPH
	Freight trains over 100 Tons/OB*	50 MPH
	*Tons per operative brake (Tons/OB) is defined as the gross trailing tonnage of the train divided by the total number of cars having operative brakes	
	To determine if train exceeds 100 tons per operative brake, add two zeros to the number of cars having operative brakes If train has greater trailing tonnage than the resulting figure, train exceeds 100 tons per operative brake Example: 85 cars with operative brakes plus two zeros equals 8500 An 85 car train with 9182 tons would exceed 8500 and hence would exceed 100 tons per operative brake	
	Unless otherwise provided—	
	Loaded unit ore, ballast, and potash trains	40 MPH
	Loaded unit coal and grain trains	45 MPH
	Empty unit coal trains	50 MPH
	Light locomotive consist or caboose hop	50 MPH
	All trains and engines through turnouts, except as specified under Individual Subdivision Special Instructions or where fixed signals indicate otherwise	12 MPH

COLORADO DIVISION

(McCook to South Denver)

SECOND SUBDIVISION

1	Speed Restrictions— Zone—Between	Maximum Speeds Permitted Passenger	Freight
	Passenger trains	79 MPH	
	Freight trains:		
	63-163 (including sections originating Chicago)		60 MPH
	OAC DNM 100 (including sections originating Denver)		60 MPH
	BDX 163LC		60 MPH
	Eastward trains handling loaded R9C beer cars in groups of three *(3) or more*		*50 MPH*
	All other freight trains		50 MPH
	MP 430 5 and MP 431 5	*50 MPH*	*40 MPH*
	MP 431 5 and MP 434	60 MPH	50 MPH
	East Brush to Brush Jct	25 MPH	25 MPH
	Brush Center—Entering Sterling main tracks	15 MPH	15 MPH
	Head end or leading car over 72nd Avenue crossing MP 535 3	40 MPH	40 MPH
	MP 535.3 and MP 537.2	40 MPH	40 MPH
	Over UP crossing MP 537 3	30 MPH	30 MPH
	MP 537 4 to signal MP 539 7	40 MPH	30 MPH
	Signal MP 539 7 to signal MP 541.2	30 MPH	15 MPH
	Signal 541 2 to 21st Street MP 541 9	15 MPH	15 MPH
	Bridge 541 28 (Wye Bridge) to Bridge *86 (North leg of Wye) at 23rd Street*	*10 MPH*	*10 MPH*
	Speed through turnouts off main line, coal 1 and 2 and south lead at 38th Street	20 MPH	20 MPH
	Locomotives in Groups H and I on siding Wray		20 MPH
	Through Denver Union Terminal Limits	10 MPH	10 MPH
	Crossover MP 0 6	10 MPH	10 MPH
	Ladora yard tracks—On tangent track between gate and classification yard		10 MPH
	Engines in the Colorado Blvd area and Market Street line		10 MPH
	Trains through turnouts of controlled sidings	25 MPH	25 MPH

ALLIANCE DIVISION

(Edgemont to Gillette)

THIRD SUBDIVISION

1. **Speed Restrictions—**

Zone—Between	Maximum Speeds Permitted Freight
Edgemont and Gillette trains up to 100 Tons/OB	50 MPH
Edgemont and Gillette trains over 100 Tons/OB	45 MPH
Edgemont between east and west highway crossings, head end of train	25 MPH
Over Upton siding bridge 549 44	10 MPH
Gillette yard tracks	10 MPH.
Edgemont yard tracks	10 MPH
Through turnouts beginning and end of two main tracks, all controlled sidings and crossovers equipped with dual control switches	35 MPH.

Item 1A, all subdivisions, applies MP 570.8 to MP 563 7 and MP 526 1 to MP 519 4 to eastward trains only

2. **Bridge, Engine and Heavy Car Restrictions—**

Bridge 549 44 on Upton siding must not be used by trains over 100 Tons/OB

3. **Train Register Exceptions**—None

4. **Clearance Provisions and Exceptions Rule 83(B)—**

Campbell and Donkey Creek—Rule 83(B) will not apply

5. **Rule 99**—When flagging is required, distance will be 2 miles.

6. **The following Failed Equipment Detectors protect bridges, tunnels or other structures**—None

Other Failed Equipment Detector Locations—

MP 573 8 MP 539 5

7 **Rule 268A**—Switches on the following tracks are not equipped with electric locks:

Marietta Back Track	Osage Chip Track
Dewey Back Track	Clay Spur
Spencer Back Track	Upton Back Track
Newcastle Sawmill Track	Bentley Back Track
Energy Spur	Moorcroft Back Track
Black Hills Power and Light	Moorcroft Stock Track

8. **Local Crossing Ordinance—**

Edgemont, Newcastle and Gillette: Standing trains must not occupy crossings for over five minutes

9. **CTC**—Two Main Tracks between the following locations:

MP 476 1-MP 484 3	MP 562 0-MP 569 0
MP 507 0-MP 513 9	MP 581 5-MP 587 9
MP 547 2-MP 556 3	

20 SPECIAL INSTRUCTIONS

Failed Equipment Wayside Display—

This device must be observed by the crew on rear of train, and they must be governed by the information shown immediately after the rear of the train has passed

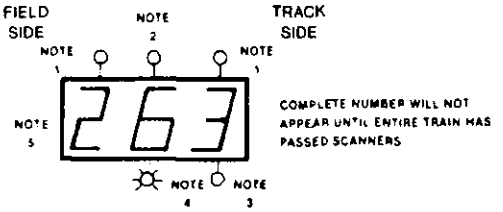
Enginemen must alert crew members on rear of train when approach ing detector site

Entire train must not move beyond failed equipment sign until authorization to proceed is received from rear of train. If communica tion between head end and rear end of train fails or is not provided train may continue to move unless crew member on rear stops the train by use of caboose brake valve

When failed equipment is indicated engine crew must be notified to stop train for inspection Advise train dispatcher reason for delay by first available means of communication

FAILED EQUIPMENT DISPLAY

AS VIEWED FROM PASSING TRAIN



Note 1—Hot bearing indicator light When illuminated hot bearing detected. The hot bearing is located on right side of train when right light is illuminated, and on left side when left light is illuminated

Note 2—Multiple hot bearing or dragging equipment indicator light When illuminated inspect train for more than one hot bearing or dragging equipment

Note 3—Dragging equipment indicator light When illuminated dragging equipment has been detected

Note 4—Flashing train inspection light When flashing train is being checked for hot bearing and dragging equipment After rear of train has passed, if train inspection light is not flashing while numbers are displayed, stop and inspect train

Note 5—Journal number display panel Number shown is axle count from rear of train to first hot bearing or dragging equipment detected When making inspection, check at least eight (8) axles both directions from indicated number

All journals on the train must be inspected whenever hot bearing indicator light, dragging equipment indicator light, multiple hot bearing or dragging equipment indicator light is illuminated and there is no count shown on failed equipment display panel or when digital readout displays false indication such as numbers totaling more then train axle count

Failed Equipment Radio Reporter—

Failed equipment detectors at locations shown under Individual Sub division Special Instructions convey information to train and engine crews by Burlington Northern radio

Each radio message from these devices will contain the site identifica tion such as: "Burlington Northern (Town, State)"

A four second warning tone is issued immediately upon each defect detected

This type of device must be monitored by train and engine crew and they must be governed by the information conveyed immediately after the train has passed

Detector Status Message	Train Crew Response
" No defects"	Proceed
" Integrity failure"	Stop train for inspection
" First hot box right side XXX"	Stop train for inspection near indicated axle
" First dragging equipment near axle XXX"	Stop train for inspection near indicated axle
" First hot wheel near axle XXX"	Stop train for inspection near indicated axle
" (No detector status message)"	Stop train for inspection*

Detector status messages may descibe more than one defect such as:
" First hot box left and right side XXX '
" First hot wheel near axle XXX'
" Second hot box right side XXX '
" Third hot box left side XXX"

All detector status messages will be repeated in order of detection

XXX is the axle count from the rear of the train to the defect indi cated When making inspection check at least eight (8) axles both directions from indicated number

*When incomplete message or no message is received stop train for inspection

Train must not move beyond failed equipment sign unless a proceed message is received from the detector site or until inspection is completed

When failed equipment is indicated, train crew must stop train for inspection and advise train dispatcher reason for delay by first availa ble means of communication

Failed Equipment Alarm Indicator—

Alarm Indicator Assembly employing radio for defect location

This device must be observed by the crew on the rear of the train and they must be governed by the information shown immediately after the rear of the train has passed

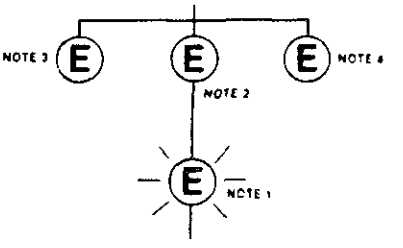
Enginemen must alert crew members on rear of train when approach ing detector site

Entire train must not move beyond failed equipment sign until authorization to proceed is received from rear of train. If communica tion between head end and rear end of train fails or is not provided train may continue to move unless crew member on rear stops the train by use of caboose brake valve

When failed equipment is indicated, engine crew must be notified to stop train for inspection. A walking inspection must be made of both sides of entire train and also a walking inspection must be made if there is evidence of dragging equipment Advise train dispatcher reason for delay by first available means of communication

Rules 501S and 501T are in effect

ALARM INDICATOR ASSEMBLY



Note 1—Failed equipment indicator light When illuminated contin uously or when not illuminated, stop train and inspect for hot bearing or dragging equipment When flashing, no defect has been detected

Note 2—Dragging equipment indicator light When illuminated stop train and inspect for dragging equipment

Note 3—Left hot bearing indicator light When illuminated defect is on left side of train

Note 4—Right hot bearing indicator light When illuminated, defect is on right side of train

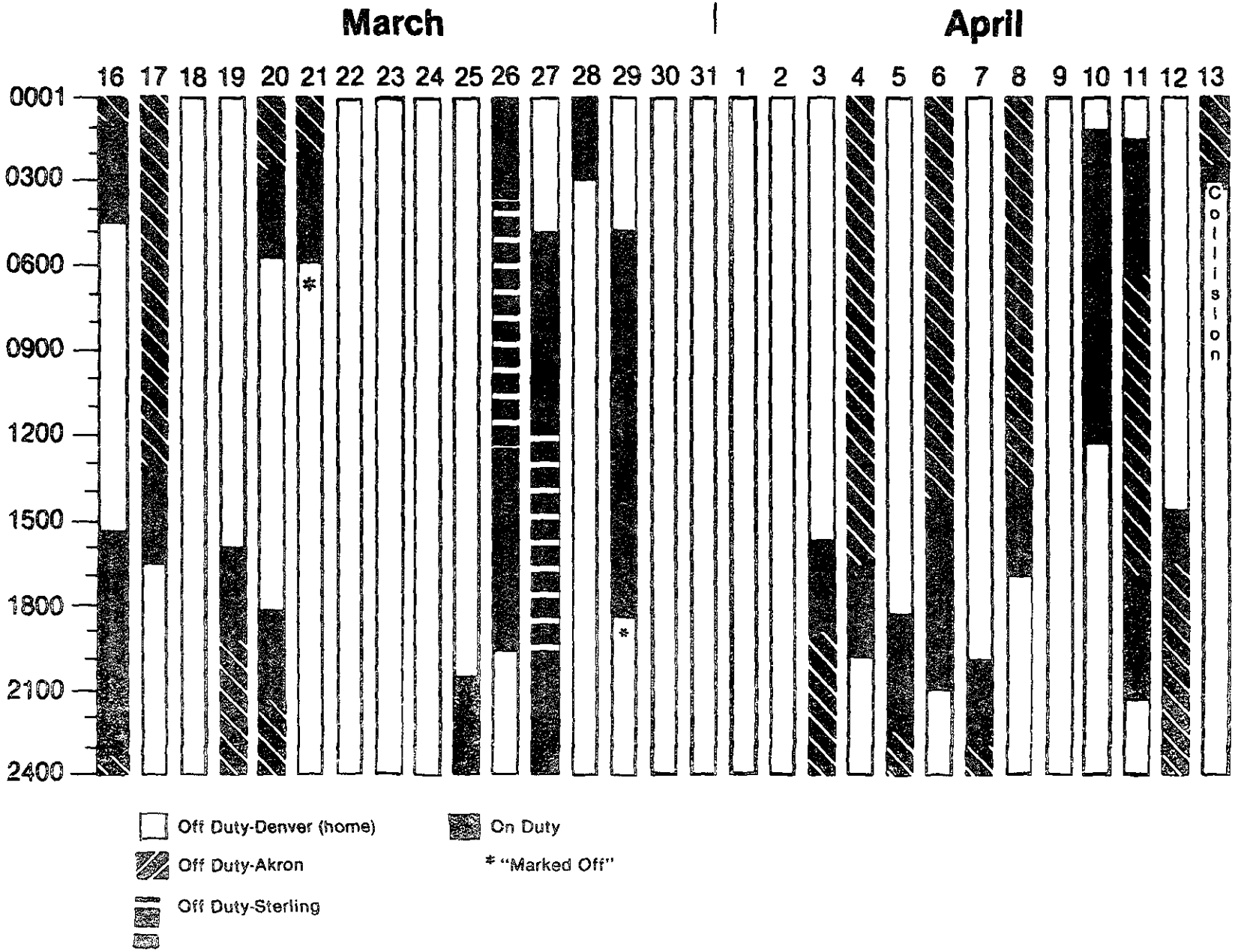
APPENDIX D

TRAIN CREWMEMBER DUTY AND REST RECORDS

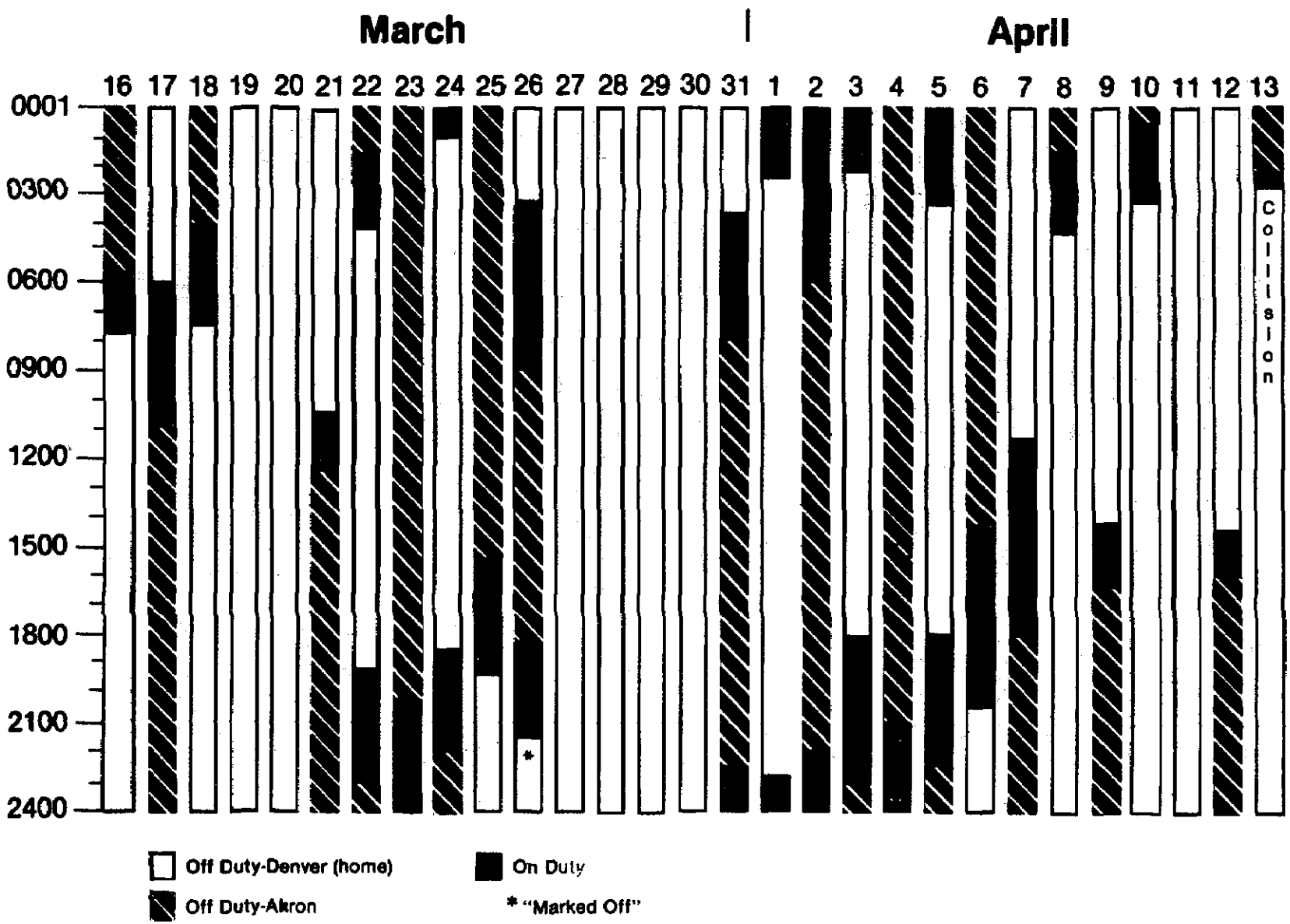
WIGGINS ACCIDENT

Duty and Rest Schedule, 1984

John Irons, Conductor/Brakeman

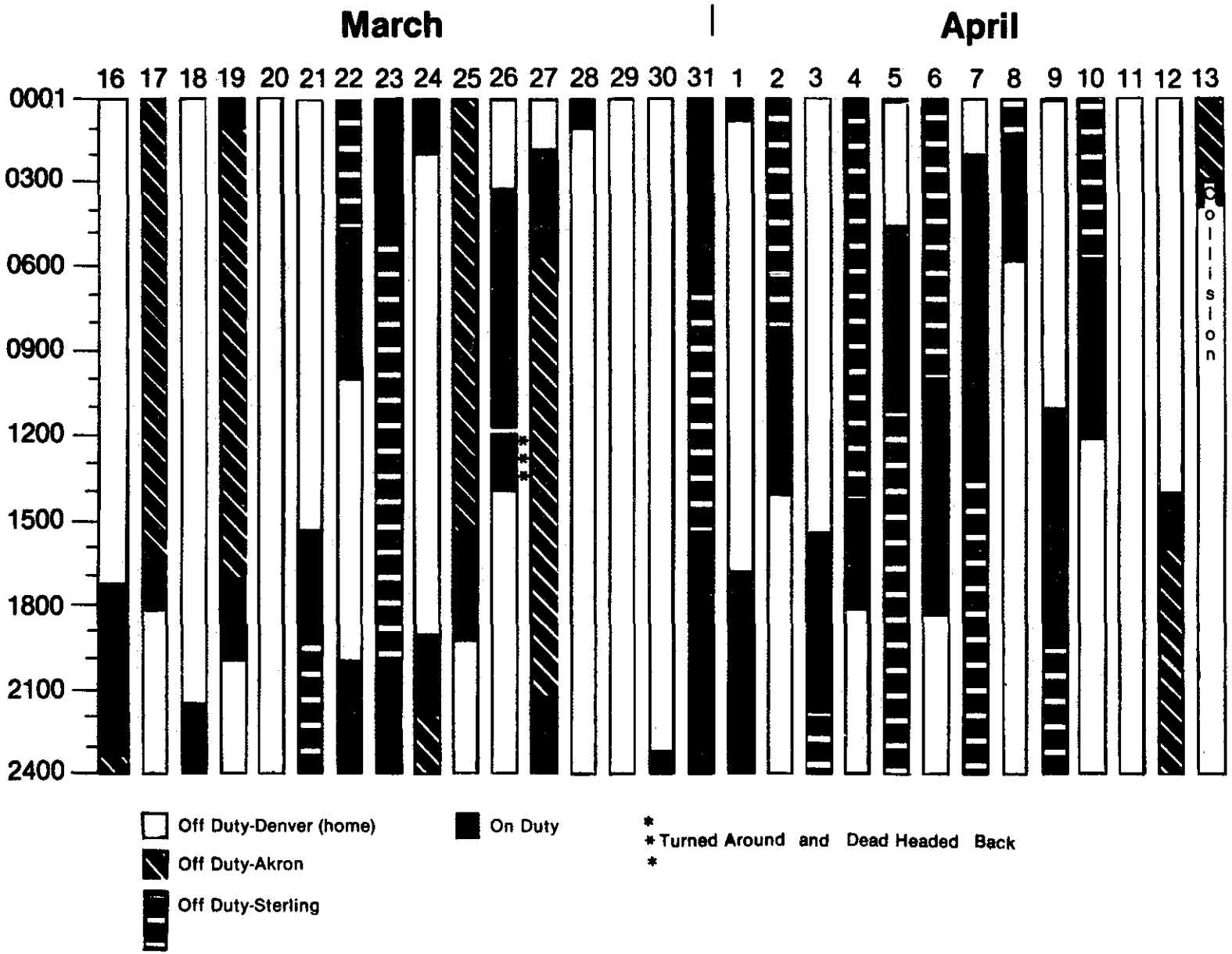


Larry Alishio, Fireman/Engineer



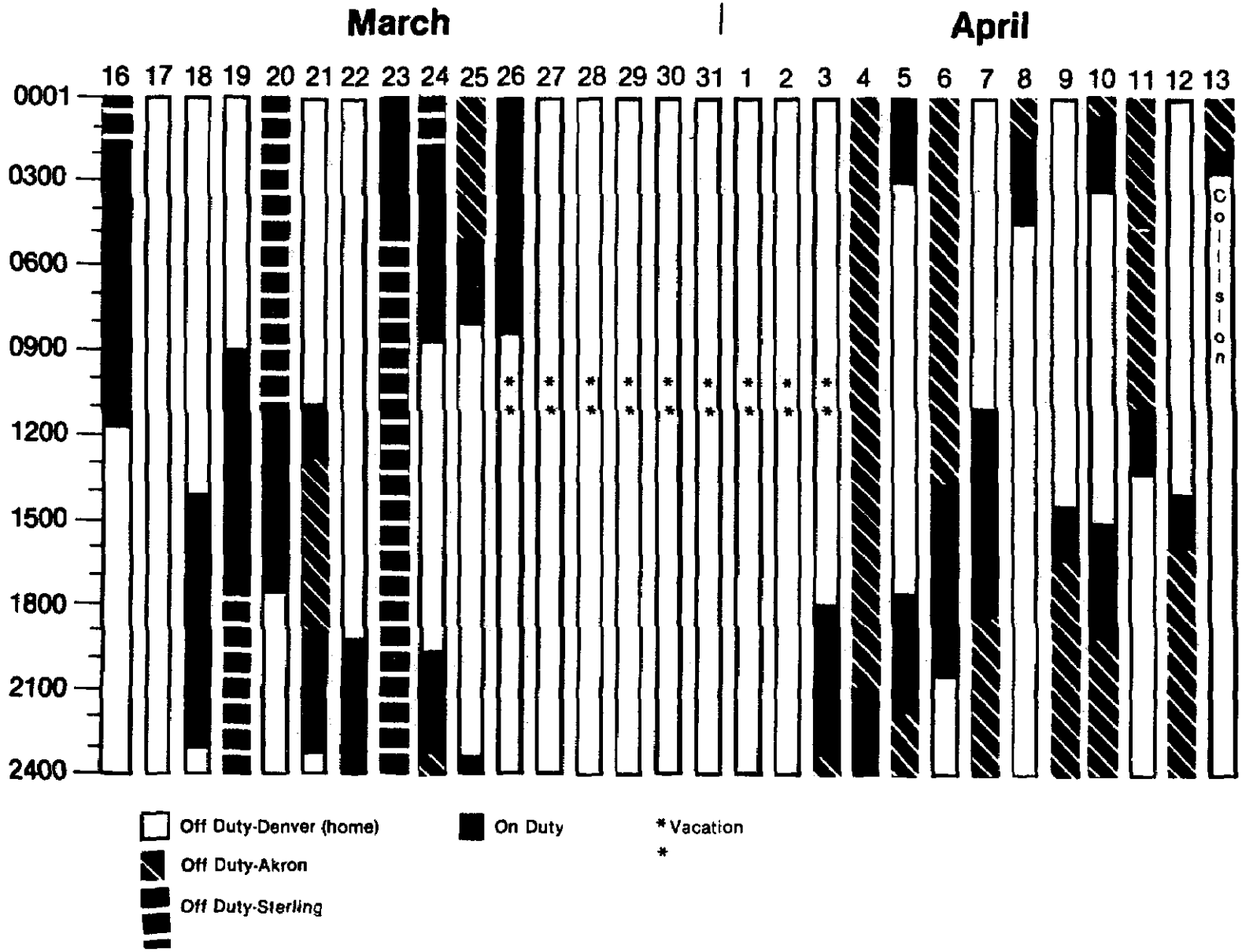
Duty and Rest Schedule, 1984

James Yoch, Brakeman



Duty and Rest Schedule, 1984

Larry Reed, Engineer



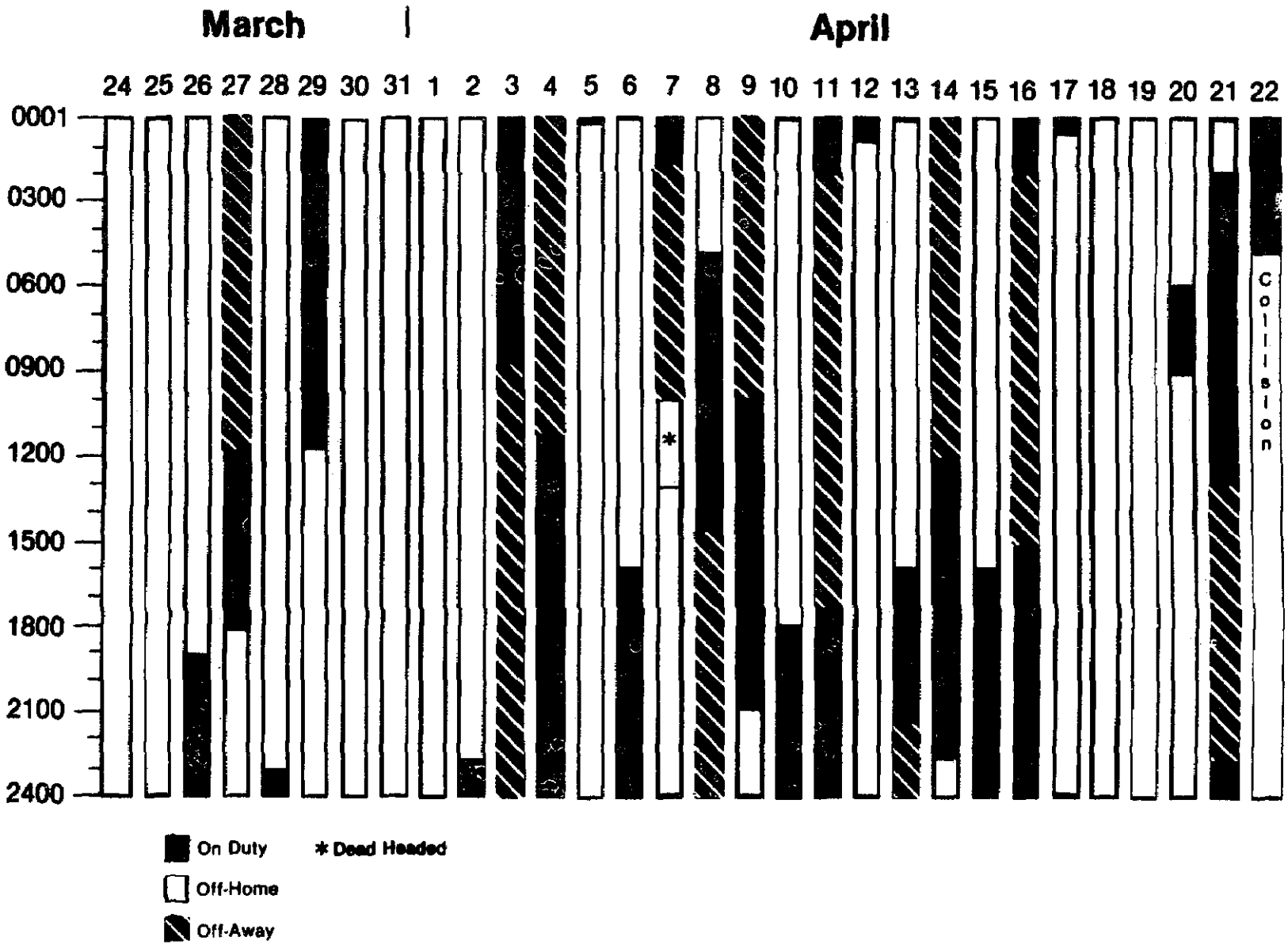
APPENDIX D

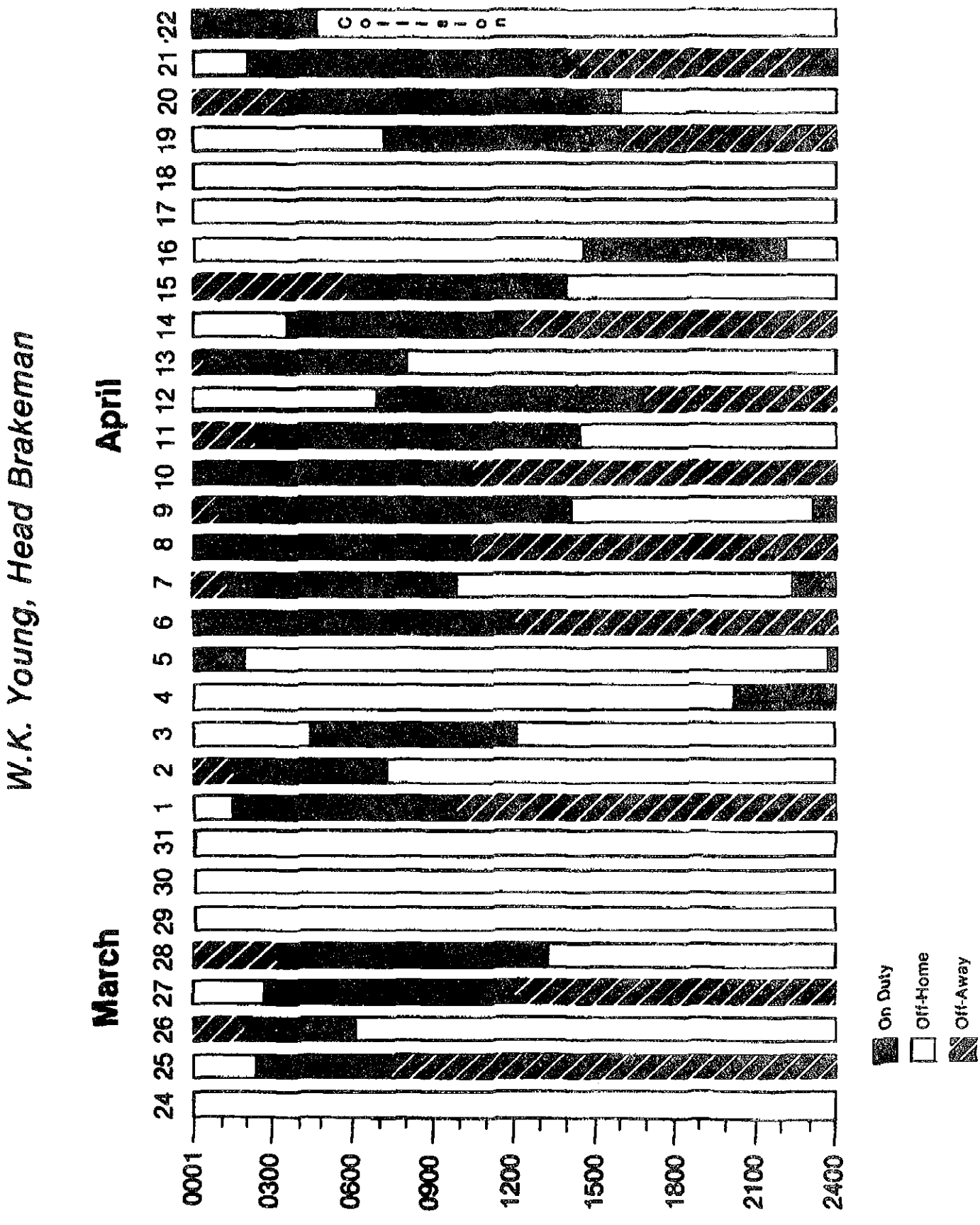
TRAIN CREWMEMBER DUTY AND REST RECORDS

NEWCASTLE ACCIDENT

Duty and Rest Schedule, 1984

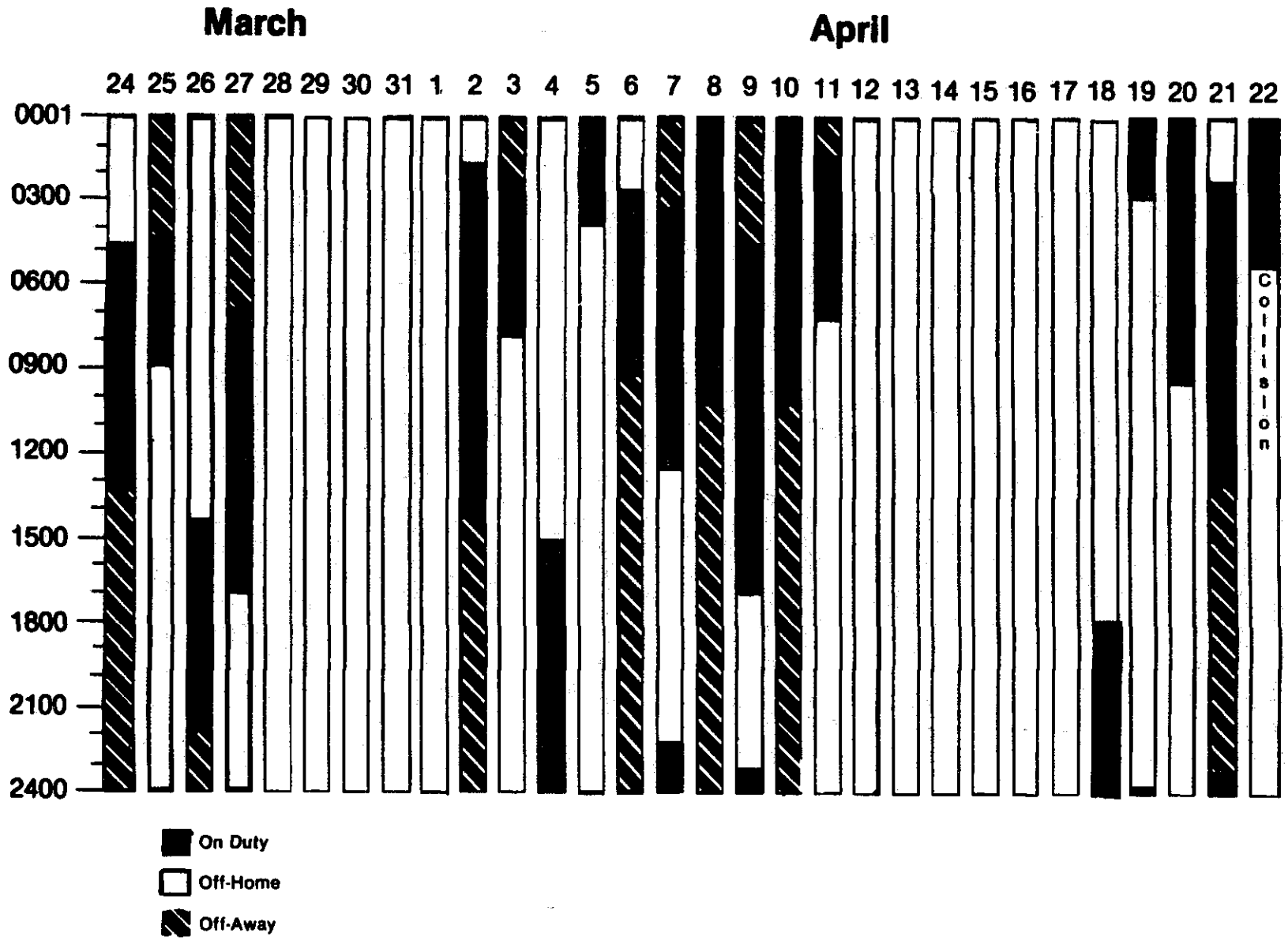
J.M. McNulty, Engineer



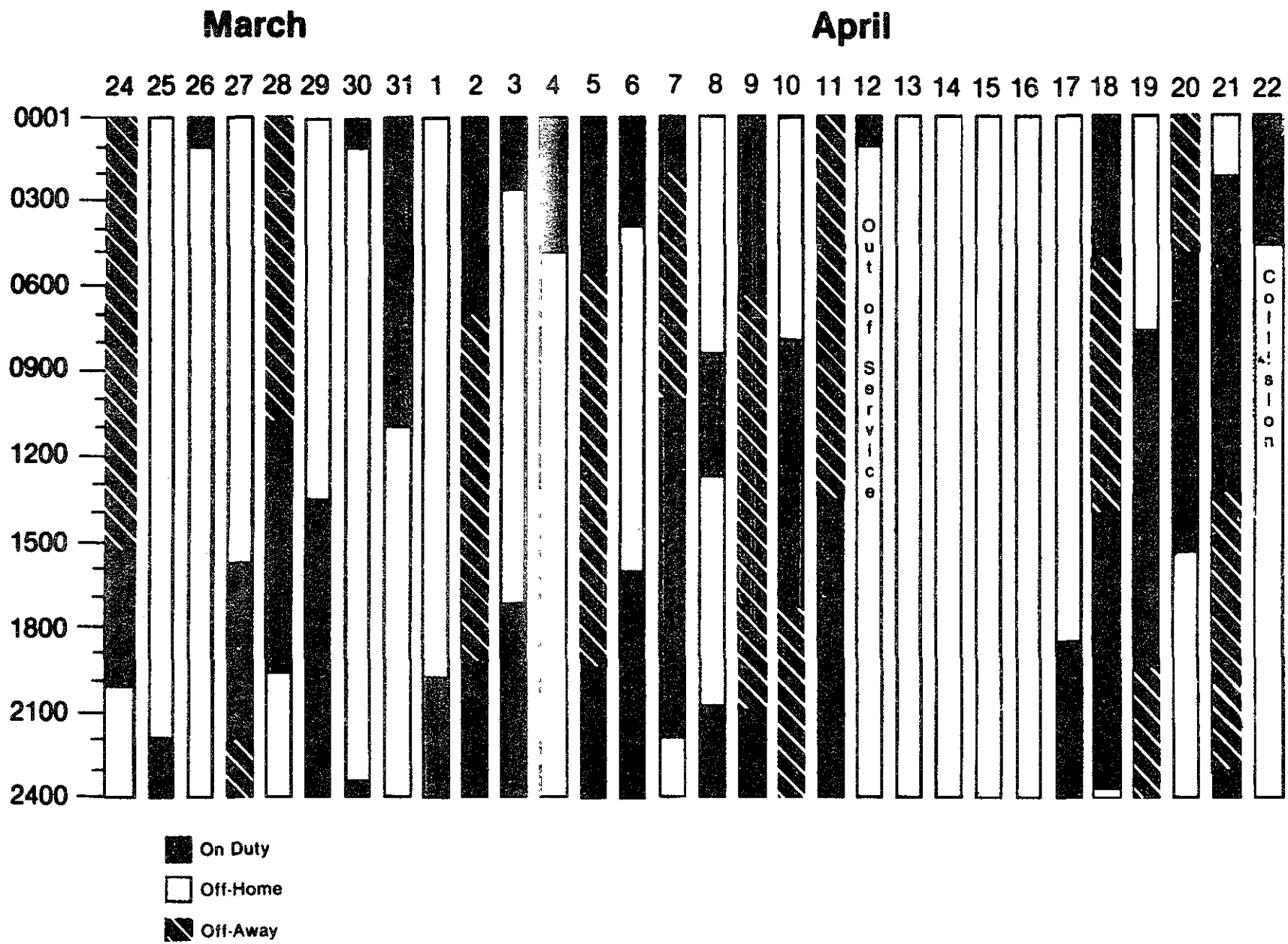

W.K. Young, Head Brakeman
March
April
24 25 26 27 28 29 30 31 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
0001 0300 0600 0900 1200 1500 1800 2100 2400
On Duty
Off-Home
Off-Away

Duty and Rest Schedule, 1984

B.E. Lolley, Conductor



R.O. Baker, Rear Brakeman



APPENDIX E

TRAIN CREWMEMBER TOXICOLOGICAL RESULTS

WIGGINS ACCIDENT

APPENDIX E

Forensic Pathology Consultants
P O Box 419
Loveland, Colorado 80537

Robert L Ueyens M D
Patrick C Allen M D

Telephone
(303) 669 464
Ext 459

April 17, 1984

Pat Jolliffe, Morgan County Coroner
Jolliffe Funeral Home
Fort Morgan, Colorado 80701

Dear Mr. Jolliffe:

Re: Wiggins train crash victims 4/13/84

For your records, the following specimens were drawn by me on the evening of April 13, 1984 from the five train crash victims:

#1) Identified as James Yoch: one tube of blood from the heart.
Alcohol & Drugs Negative — Carbon Monoxide less than 1%
#2) Identified as Mark Agee: one tube of heart blood and one container of bloody urine. Drugs & alcohol - negative · less than 1%

#3) Identified as Larry Reed: one container of coagulated blood from pulmonary arteries and one container of pieces of liver.
Homogenous specimen - alcohol found but not measurable.
#4) Identified as Larry Alishio: one container of urine and one tube of bloody fluid from the heart-pericardial region.
alcohol - Blood. 0.056% Urine .091 Drugs negative.
#5) Identified as Dennis Krugmin: two tubes of blood from the right ventricle.
alcohol & Drugs - negative Carbon Monoxide less than 1%.
All specimens were labeled with the decedent's number, name, and origin of the specimen. All were placed in an F.A.A. "crash kit" styrofoam container. As per verbal instructions to you, the container was to have ice placed in a metallic paint can which was supplied, the container sealed, and mailed to the F.A.A. address supplied with the kit.

If I may be of any further assistance, please do not hesitate to contact me.

Sincerely,

Patrick C Allen, M.D.

Patrick C. Allen, M.D.
Pathologist

PCA: kk

These specimens were turned over to Mr. Gordon Inglis, Railroad saftey specialist. These results were not those of Dr. Allen but were added by me as received by telephone from Mr. Inglis. The written reports will follow and will be made a part of each individuals Coroner report.

WILBUR B. RICHIE, D.D.S
FORENSIC ODONTOLOGY

April 18, 1984

Case I James Yoch

4=Xrays and single sheet dental record .
Xrays dated 2-5-80, no date on record.
Complete match with all teeth (27) and correct missing teeth to received record.
Xrays were of 17 teeth, all restorations match our charting of Case I
Therefore, Case I is James Yoch.

Case II Mark Agee

4 anterior Xrays dated 8-24-81
4 posterior Xrays dated 9-2-83
Upper anterior teeth missing, but lower anterior teeth agree.
Xrays of 18 posterior teeth, all restorations match except lower right second molar which shows caries and I charted a restoration, if records had been sent they would agree.
Therefore, Case II is Mark Agee.

Case III Larry Reed

3 Xrays and copy of dental record dated 9-26-77
No dental matching possible.
Maxilla, mandible and anterior head missing.
By elimination, Case III is Larry Reed.

Case IV Larry Alishio

2 posterior Xrays dated 2-8-74. Dr. Ferrendelli
10 full mouth Xrays dated 11-16-79. Dr. Biber
Chart dated 9-11-78 Dr. Biber
All remaining of maxilla was teeth upper right posterior to the cuspid.
All remaining of the mandible was lower right molars.
The restorations in these teeth present and missing match the above records.
Therefore, Case IV is Larry Alishio.

Dennis Dean Krugman would be Case V, he was identified prior to our arrival by personal effects and billfold. He had not burned as the other 4 did

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
MIKE MONRONEY AERONAUTICAL CENTER

TOXICOLOGY REPORT

DATE: April 20, 1984 CASE: R-1

ACCIDENT OR EVENT:

Railroad accident which occurred near Wiggins, Colorado, on April 13, 1984.

RECEIVED BY:

W. A. McCabe from FAA mailroom on April 17, 1984, at 9:00 a.m.

SAMPLES:

One blood clod and one bottle of liver tissue labeled #3, Larry Reed.
One tube and one bottle of heart blood labeled #1, James Yoch.
One tube of heart blood and one bottle of urine labeled #2, Mark Agee.
One tube of blood and one bottle of urine labeled #4, Larry Alisho.
Two tubes of heart blood labeled #5, D. Krugman.

Specimens were cool.

RESULTS:

ACIDIC & NEUTRAL DRUGS (Acid-Ether Extractions, UV Scan):

Reed - None detected - blood hemogenate.
Yoch - None detected - blood.
Agee - Insufficient sample for analysis.
Alisho - None detected - urine.
Krugman - None detected - blood.

BASIC DRUGS (Alkaline-Ether Extraction, UV Scan):

Reed - None detected - blood hemogenate.
Yoch - None detected - blood.
Agee - Insufficient sample for analysis.
Alisho - None detected - urine.
Krugman - None detected - blood.

ETHYL ALCOHOL (Gas Chromatography):

Reed - Alcohol found in blood clod hemogenate.
Yoch - None detected - blood.
Agee - None detected - blood and urine.
Alisho - 0.056% (56mg%) - blood.
0.091% (91mg%) - urine.
Krugman - None detected - blood.

Continued on Page 2

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
MIKE MONRONEY AERONAUTICAL CENTER
TOXICOLOGY REPORT

DATE: April 20, 1984 CASE: R-1 (Continued) Page 2

RESULTS: (Continued)

CARBON MONOXIDE (Conway Diffusion, Palladium Chloride):

Reed - None detected in blood hemogenate with a hemoglobin concentration of 24 grams%.
Yoch - Less than 1% saturation in blood with a hemoglobin concentration of 14 grams%.
Agee - Less than 1% saturation in blood with a hemoglobin concentration of 4 grams%.
Alisho - None detected in blood with a hemoglobin concentration of 5 grams%.
Krugman - Less than 1% saturation in blood with a hemoglobin concentration of 1.5 grams%.

Alisho - A culture of the blood produced a moderate growth of E. Coli and 0.061% (61mg%) ethyl alcohol after 24 hours incubation in BHI.

SIGNATURE AND TITLE:

Delbert J. Lacefield

Delbert J. Lacefield, Ph.D.
SUPERVISOR, FORENSIC TOXICOLOGY RESEARCH UNIT, AAC-114B

cc:
Dr. Phyllis Kayton, TE-50, NTSB, Washington, D.C.
Gordon Inglis, NTSB (DEN), Aurora, Colorado (Original & cc)
Leon Langford, FRA, Kansas City, Missouri

ENTRY DATE/TIME | PRIORITY | DRAW DATE/TIME | UNITS | ORDER NO

4/13/84 10:10 ROUTINE 4/13 AM JLS 001

DIAGNOSIS/REQ DR/COMMENTS | SRG DATE

###OUTSIDE PHYS 5179 gk
JOHN G IRONS-505-70-~~5719~~

0719 ~~DRUG SCREEN BLOOD & URINE BN~~

CHART COPY

O/P SER 917957-3

BURLINGTON NRR,
0-115600 INF M 4/13/84
###OUTSIDE PHYS

DRAWN BY

ST LUKE'S HOSPITAL • DENVER, COLORADO
PATHOLOGISTS: M DUNLAP M.D.
K HOLLOMAN M.D. & TOM M.D. J DEFELICE M.D. P REYNOLDS M.D.

GENERAL DRUG SCREEN: NEGATIVE

URINE & BLOOD ALCOHOL: NEGATIVE

COCAINE & CANNABINOIDS: NEGATIVE

K Holloman 4-13-84
Kenneth R. Holloman, M.D.
Associate Pathologist * LIGHT GREEN *

COMPLETED BY - DATE/TIME TECH:

917957-3 BURLINGTON NRR,

~~PLAINTIFF'S~~ DEPOSITION
~~DEFENDANT'S~~ EXHIBIT K-12
CASE
DATE 5-2-84
CAL M NELSON RPR

ENTRY DATE/TIME PRIORITY DRAW DATE/TIME UNITS ORDER NO.
4/13/84 10:11 ROUTINE 4/13 AM JLS 002
DIAGNOSIS/REQ DR/COMMENTS ERS DATE
***OUTSIDE PHYS
BRUCE D. FIERSTEIN--508-78-1994

O/P SER CHART COPY 917957-3
BURLINGTON NRR,
0-115600 INF M 4/13/8
***OUTSIDE PHYS

0719 DRUG SCREEN BLOOD & URINE EN DRAWN BY

GENERAL DRUG SCREEN: NEGATIVE

URINE & BLOOD ALCOHOL: NEGATIVE

COCAINE & CANNABINOIDS: NEGATIVE

Kenneth R. Holloman, M.D. 4/13/84
Associate Pathologist LIGHT GREEN *

917957-3 BURLINGTON NRR,

COMPLETED BY - DATE/TIME TECH:

ST LUKE'S HOSPITAL • DENVER, COLORADO

DEPOSITION EXHIBIT K-9
CASE
DATE 5-7-84
GAIL M. NELSON RPR

APPENDIX E

TRAIN CREWMEMBER TOXICOLOGICAL RESULTS

NEWCASTLE ACCIDENT

From Robin O. Baker we received 60 ml of urine and 10 ml of unlabeled whole blood. The whole blood alcohol was negative, the urine drug screen was positive for nicotine, but negative for cocaine metabolite and Delta 9 THC.

From Thomas G. Covel we received 100 ml of urine and 10 ml of unlabeled whole blood. The blood alcohol was negative, the urine drug screen by thin layer chromatography was negative, cocaine metabolite was negative, and Delta 9 THC by EMIT was negative.

From David M. Mader we received 70 ml of urine and 10 ml of unlabeled whole blood. The blood alcohol, urine drug screen by thin layer chromatography, EMIT test for cocaine metabolite, and EMIT test for Delta 9 THC were all negative.

From Kurt M. Hankey we received 50 ml of urine and 10 ml of unlabeled whole blood. The blood alcohol, urine screen for cocaine, urine screen by thin layer chromatography, and Delta 9 THC by EMIT were all negative.

From W. Keith Young we received 80 ml of urine and 10 ml of labeled whole blood. The blood alcohol and urine screen for cocaine by EMIT were negative. The urine drug screen by thin layer chromatography was positive for nicotine. The EMIT screen for Delta 9 THC was negative.

Received from Michael Barney were 20 ml of sealed and unlabeled whole blood. Results include a negative blood alcohol and negative drug screen by gas liquid chromatography. The gas liquid chromatography will not detect cocaine, Delta 9 THC, or amphetamines as utilized at this time.

Received from Robert Almendinger were 20 ml of unlabeled whole blood. Results include a negative blood alcohol and a negative drug screen on plasma by gas liquid chromatography. This method as utilized at this time will not detect cocaine, Delta 9 THC, or amphetamines.

In summary, the results on Wilbert Stalvey demonstrate drugs that probably come from cigarettes and over-the-counter cough syrup, as well as marijuana metabolites. Specimens from Jerome McNulty contain nicotine and marijuana metabolite. Specimens from Anthony M. Klein contain marijuana metabolite. Specimens from Dale Faust contain marijuana metabolite. Specimens from Bryan E. Lolley showed a positive

test for marijuana metabolite, but this was not confirmed by thin layer chromatography testing. This may be due to the fact that the thin layer chromatography test is somewhat less sensitive than the EMIT test or it may be due to a false positive by EMIT. Results on Robin O. Baker were positive for nicotine, but negative for other drugs. Results on Thomas G. Covel were negative for all drugs. Results on David M. Mader were negative for all drugs. Results on Kurt M. Hankey were negative for all drugs. Results on W. Keith Young were positive for nicotine but negative for other drugs. Results on Michael Barney were negative for all drugs. Results on Robert Almendinger were negative for all drugs.

Sincerely,

Alvin A. Armstrong, Jr., M. D.

AAA:fd

APPENDIX E

ARMED FO ES INSTITUTE OF PATHOLOGY
WASHINGTON D C 20306

WPC/JDW/sg

REPLY TO: THE DIRECTOR
ATTN: AFIP-RRR -CPL-T

PATIENT IDENTIFICATION		
AFIP ACCESSION NUMBER	PLEASE USE AFIP ACCESSION NUMBER IN ALL CORRESPONDENCE	
1933194	1 DIGIT 01	SEQUENCE 00
NAME Baker, Robin O.	SSAN	
SURGICAL AUTOPS PATH ACCESSION NO.	84-1085	
PLEASE INFORM US OF ANY PATH TISSUE SPECIMENS		

National Transportation Safety Board
800 Independence Ave SW
Attn: Dr. McFarland
Washington, D.C. 20594

DATE: 8 May 1984

CONSULTATION REPORT ON CONTRIBUTOR MATERIAL

AFIP DIAGNOSIS:

Specimens Received: Blood and Urine

REPORT OF TOXICOLOGICAL EXAMINATION

1. The urine specimen was tested for amphetamines, barbiturates, cocaine, methaqualone, opiates, phencyclidine, benzodiazepines, propoxyphene, cannabinoids, salicylates, acetaminophen, and phenothiazines. None of these drugs were found.

2. The blood contained 4.9% carboxyhemoglobin saturation. Saturations of 10% or above are considered elevated values.

3. The blood and urine were examined for the presence of ethanol, methanol, acetone, acetaldehyde, isopropanol, and n-propanol. None of these compounds were found.

WILLIAM R. COWAN
Colonel, USAF, MC
The Director

Report and Review By:

JOHN D. WHITING, Ph.D.
Acting Chief, Division of Toxicology

ROBERT F KARNEI, JR.
CAPT MC USN
DEPUTY DIRECTOR

ARMED FORCES INSTITUTE OF PATHOLOGY
WASHINGTON D C 20306

WRC/JDW/sg

REPLY TO: THE DIRECTOR
ATTN: AFIP-RRR -CPL-T

PATIENT IDENTIFICATION		PLEASE USE AFIP ACCESSION NUMBER IN ALL CORRESPONDENCE
AFIP ACCESSION NUMBER	CHECK DIGIT	SEQUENCE
1933197	04	00
NAME	SSAN	
Covel, Thomas D.		
SURGICAL AUTOPSY PATH ACCESSION # S	84-1086	
PLEASE INFORM US OF ANY PATIENT IDENTIFICATION ERROR		

National Transportation Safety Board
800 Independence Ave SW
Attn: Dr. McFarland
Washington, D.C. 20594

DATE: 8 May 1984

CONSULTATION REPORT ON CONTRIBUTOR MATERIAL

AFIP DIAGNOSIS:

Specimens Received: Blood and Urine

REPORT OF TOXICOLOGICAL EXAMINATION

1. The urine specimen was tested for amphetamines, barbiturates, cocaine, methaqualone, opiates, phencyclidine, benzodiazepines, propoxyphene, cannabinoids, salicylates, acetaminophen, and phenothiazines. None of these drugs were found.

2. The blood contained less than 1% carboxyhemoglobin saturation. Saturations of 10% or above are considered elevated values.

3. The blood and urine were examined for the presence of ethanol, methanol, acetone, acetaldehyde, isopropanol, and n-propanol. None of these compounds were found.

WILLIAM R. COWAN
Colonel, USAF, MC
The Director

Report and Review By:

JOHN D. WHITING, Ph.D.
Acting Chief, Division of Toxicology

ROBERT F KARNEI, JR.
CAPT MC USN
DEPUTY DIRECTOR

APPENDIX E

ARMED FORCES INSTITUTE OF PATHOLOGY
WASHINGTON D C 20306

WRC/JDW/sg

REPLY TO: THE DIRECTOR
ATTN: AFIP-RRR -CPL-T

PATIENT IDENTIFICATION	PLEASE USE AFIP ACCESSION NUMBER IN ALL CORRESPONDENCE	
AFIP ACCESSION NUMBER: 1933216	CHECK DIGIT: 02	SEQUENCE: 00
NAME: Faust, Dale E.	SSAN:	
SURGICAL/AUTOPSY PATH ACCESSION #'S: 84-1082		
PLEASE INFORM US OF ANY PATIENT IDENTIFICATION ERROR		

National Transportation Safety Board
800 Independence Ave SW
Attn: Dr. McFarland
Washington, D.C. 20594

DATE: 8 May 1984

CONSULTATION REPORT ON CONTRIBUTOR MATERIAL

AFIP DIAGNOSIS:
Specimens Received: Blood and Urine

REPORT OF TOXICOLOGICAL EXAMINATION

1. The blood contained 9.2% carboxyhemoglobin saturation. Saturations of 10% or above are considered elevated values.

2. The urine specimen was tested for amphetamines, barbiturates, cocaine, methaqualone, opiates, phencyclidine, benzodiazepines, propoxyphene, salicylates, acetaminophen, and phenothiazines. None of these drugs were found.

3. Positive-Cannabinoids. The urine contained 103ng/ml (0.103mg/L) 11-nor-delta-9-tetrahydrocannabinol-9-carboxylic acid by gas chromatography/mass spectrometry.

4. The blood and urine were also examined for the presence of ethanol, methanol, acetone, acetaldehyde, isopropanol, and n-propanol. None of these compounds were found.

WILLIAM R. COWAN
Colonel, USAF, MC
The Director

Report and Review By:

JOHN D. WHITING, Ph.D.
Acting Chief, Division of Toxicology

ROBERT F KARNEI, JR.
CAPT MC USN
DEPUTY DIRECTOR

ARMED FORCES INSTITUTE OF PATHOLOGY
WASHINGTON D C 20306

WRC/JDW/sg

REPLY TO: THE DIRECTOR
ATTN: AFIP-RRR -CPL-T

PATIENT IDENTIFICATION		PLEASE USE AFIP ACCESSION NUMBER IN ALL CORRESPONDENCE
AFIP ACCESSION NUMBER 1933198	CHECK DIGIT 02	SEQUENCE 00
NAME Hankey, Kurt M.	SSAN	
SURGICAL/AUTOPSY PATH ACCESSION# S 84-1087		
PLEASE INFORM US OF ANY PATIENT IDENTIFICATION ERRORS		

National Transpcrtation Safety Board
800 Independence Ave SW
Attn: Dr. McFarland
Washington, D.C. 20594

DATE: 8 May 1984

CONSULTATION REPORT ON CONTRIBUTOR MATERIAL

AFIP DIAGNOSIS:

Specimens Received: Blood and Urine

REPORT OF TOXICOLOGICAL EXAMINATION

1. The blood contained less than 1.2% carboxyhemoglobin saturation. Saturations of 10% or above are considered elevated values.

2. The urine specimen was tested for amphetamines, barbiturates, cocaine, methaqualone, opiates, phencyclidine, benzodiazepines, propoxyphene,cannabinoids, salicylates, acetaminophen, and phenothiazines. None of these drugs were found.

3. Positive-Acetone. The urine contained 0.19g/L (19mg/dL) and the blood, 0.01g/L (1.0mg/dL) acetone by headspace gas chromatography. The presence of acetone may be the result of diet or a metabolic disorder.

4. The blood and urine were also examined for the presence of ethanol, methanol, acetaldehyde, isopropanol, and n-propanol. None of these compounds were found.

WILLIAM R. COWAN
Colonel, USAF, MC
The Director

Report and Review By:

JOHN D. WHITING, Ph.D.
Acting Chief, Division of Toxicology

ROBERT F KARNEI, JR.
CAPT MC USN
DEPUTY DIRECTOR

APPENDIX E

ARMED FORCES INSTITUTE OF PATHOLOGY
WASHINGTON D C 20306

WRC/JDW/sg

REPLY TO: THE DIRECTOR
ATTN: AFIP-RRR -CPL-T

PATIENT IDENTIFICATION		PLEASE USE AFIP ACCESSION NUMBER IN ALL CORRESPONDENCE
AFIP ACCESSION NUMBER: 1933208	CHECK DIGIT: 09	SEQUENCE: 00
NAME: Klein, Anthony M.	SSAN:	
SURGICAL AUTOPSY PATH ACCESSION #'S: 84-1090		
PLEASE INFORM US OF ANY PATIENT IDENTIFICATION ERRORS		

National Transportation Safety Board
800 Independence Ave SW
Attn: Dr. McFarland
Washington, D.C. 20594

DATE: 8 May 1984

CONSULTATION REPORT ON CONTRIBUTOR MATERIAL

AFIP DIAGNOSIS:

Specimens Received: Blood and Urine

REPORT OF TOXICOLOGICAL EXAMINATION

1. The blood contained 1.3% carboxyhemoglobin saturation. Saturations of 10% or above are considered elevated values.

2. The urine specimen was tested for amphetamines, barbiturates, cocaine, methaqualone, opiates, phencyclidine, benzodiazepines, propoxyphene, salicylates, acetaminophen, and phenothiazines. None of these drugs were found.

3. Positive-Cannabinoids. The urine contained greater than 200ng/ml (0.2mg/L) 11-nor-delta-9-tetrahydrocannabinol-9-carboxylic acid by gas chromatography/mass spectrometry.

4. The blood and urine were also examined for the presence of ethanol, methanol, acetone, acetaldehyde, isopropanol, and n-propanol. None of these compounds were found.

WILLIAM R. COWAN
Colonel, USAF, MC
The Director

Report and Review By:

JOHN D. WHITING, Ph.D.
Acting Chief, Division of Toxicology

ROBERT F KARNEI, JR.
CAPT MC USN
DEPUTY DIRECTOR

ARMED FORCES INSTITUTE OF PATHOLOGY
WASHINGTON D C 20306

WRC/JDW/sg

REPLY TO: THE DIRECTOR
ATTN: AFIP-RRR -CPL-T

PATIENT IDENTIFICATION		PLEASE USE AFIP ACCESSION NUMBER IN ALL CORRESPONDENCE
AFIP ACCESSION NUMBER: 1933220	CHECK DIGIT: 04	SEQUENCE: 00
NAME: Lolley, Bryan E.	SSAN:	
SURGICAL/AUTOPSY PATH ACCESSION #'S: 84-1083		
PLEASE INFORM US OF ANY PATIENT IDENTIFICATION ERROR		

National Transportation Safety Board
800 Independence Ave SW
Attn: Dr. McFarland
Washington, D.C. 20594

DATE: 8 May 1984

CONSULTATION REPORT ON CONTRIBUTOR MATERIAL

AFIP DIAGNOSIS:
Specimens Received: Blood and Urine

REPORT OF TOXICOLOGICAL EXAMINATION

1. The urine specimen was tested for amphetamines, barbiturates, cocaine, methaqualone, opiates, phencyclidine, benzodiazepines, propoxyphene, cannabinoids, salicylates, acetaminophen, and phenothiazines. None of these drugs were found.

2. The blood contained 7.3% carboxyhemoglobin saturation. Saturations of 10% or above are considered elevated values.

3. The blood and urine were examined for the presence of ethanol, methanol, acetone, acetaldehyde, isopropanol, and n-propanol. None of these compounds were found.

WILLIAM R. COWAN
Colonel, USAF, MC
The Director

Report and Review By:

JOHN D. WHITING, Ph.D.
Acting Chief, Division of Toxicology

ROBERT F KARNEI, JR.
CAPT MC USN
DEPUTY DIRECTOR

ARMED FORCES INSTITUTE OF PATHOLOGY
WASHINGTON D C 20306

WRC/JDW/sg

REPLY TO: THE DIRECTOR
ATTN: AFIP-RRR -CPL-T

PATIENT IDENTIFICATION		
AFIP ACCESSION NUMBER	DIGIT	SEGMENT
1933190	09	00
NAME	SSAN	
Mader, David M.		
SURGICAL AUTOPSY PATH ACCESSION # S	84-1084	

PLEASE INFORM US OF ANY PATIENT IDENTIFICATION ERROR

National Transportation Safety Board
800 Independence Ave SW
Attn: Dr. McFarland
Washington, D.C. 20594

DATE: 8 May 1984

CONSULTATION REPORT ON CONTRIBUTOR MATERIAL

AFIP DIAGNOSIS:

Specimens Received: Blood and Urine

REPORT OF TOXICOLOGICAL EXAMINATION

1. The urine specimen was tested for amphetamines, barbiturates, cocaine, methaqualone, opiates, phencyclidine, benzodiazepines, propoxyphene, cannabinoids, salicylates, acetaminophen, and phenothiazines. None of these drugs were found.

2. The blood contained 9.1% carboxyhemoglobin saturation. Saturations of 10% or above are considered elevated values.

3. The blood and urine were examined for the presence of ethanol, methanol, acetone, acetaldehyde, isopropanol, and n-propanol. None of these compounds were found.

WILLIAM R. COWAN
Colonel, USAF, MC
The Director

Report and Review By:

JOHN D. WHITING, Ph.D.
Acting Chief, Division of Toxicology

ROBERT F KARNEI, JR.
CAPT MC USN
DEPUTY DIRECTOR

ARMED FORCES INSTITUTE OF PATHOLOGY
WASHINGTON D C 20306

WRC/JDW/sg

REPLY TO: THE DIRECTOR
ATTN: AFIP-RRR -CPL-T

PATIENT IDENTIFICATION		PLEASE USE AFIP ACCESSION NUMBER IN ALL CORRESPONDENCE
AFIP ACCESSION NUMBER: 1933202	CHECK DIGIT: 02	SEQUENCE: 00
NAME: McNulty, Jerome	SSAN:	
SURGICAL AUTOPSY PATH ACCESSION# S: 84-1088		
PLEASE INFORM US OF ANY PATIENT IDENTIFICATION ERRORS		

National Transportation Safety Board
800 Independence Ave SW
Attn: Dr. McFarland
Washington, D.C. 20594

DATE: 8 May 1984

CONSULTATION REPORT ON CONTRIBUTOR MATERIAL

AFIP DIAGNOSIS:

Specimens Received: Blood and Urine

REPORT OF TOXICOLOGICAL EXAMINATION

1. The blood contained 8.4% carboxyhemoglobin saturation. Saturations of 10% or above are considered elevated values.

2. The urine specimen was tested for amphetamines, barbiturates, cocaine, methaqualone, opiates, phencyclidine, benzodiazepines, propoxyphene, salicylates, acetaminophen, and phenothiazines. None of these drugs were found.

3. Positive-Cannabinoids. The urine contained 85ng/ml (0.085mg/L) 11-nor-delta-9-tetrahydrocannabinol-9-carboxylic acid by gas chromatography/mass spectrometry.

4. The blood and urine were also examined for the presence of ethanol, methanol, acetone, acetaldehyde, isopropanol, and n-propanol. None of these compounds were found.

WILLIAM R. COWAN
Colonel, USAF, MC
The Director

Report and Review By:

JOHN D. WHITING, Ph.D.
Acting Chief, Division of Toxicology

ROBERT F. KARNEI, JR.
CAPT, MC, USN
DEPUTY DIRECTOR

ARMED FORCES INSTITUTE OF PATHOLOGY
WASHINGTON D C 20306

WRC/JDW/sg

REPLY TO: THE DIRECTOR
ATTN: AFIP-RRR -CPL-T

PATIENT IDENTIFICATION		PLEASE USE AFIP ACCESSION NUMBER ON ALL CORRESPONDENCE
AFIP ACCESSION NUMBER 1933204	CHECK DIGIT 08	SEGMENT 00
NAME Stalvey, Donald W.	SSAN	
SURGICAL AUTOPSY PATH ACCESSION #'S 84-1089		
PLEASE INFORM US OF ANY PATIENT IDENTIFICATION ERROR		

National Transportation Safety Board
800 Independence Ave SW
Attn: Dr. McFarland
Washington, D.C. 20594

DATE: 8 May 1984

CONSULTATION REPORT ON CONTRIBUTOR MATERIAL

AFIP DIAGNOSIS:

Specimens Received: Blood and Urine

REPORT OF TOXICOLOGICAL EXAMINATION

1. The blood contained 1.6% carboxyhemoglobin saturation. Saturations of 10% or above are considered elevated values.

2. The urine specimen was tested for amphetamines, barbiturates, cocaine, methaqualone, opiates, phencyclidine, benzodiazepines, propoxyphene, salicylates, acetaminophen, and phenothiazines. None of these drugs were found.

3. Positive-Cannabinoids. The urine contained 176ng/ml (0.176mg/L) 11-nor-delta-9-tetrahydrocannabinol-9-carboxylic acid by gas chromatography/mass spectrometry.

4. Positive-Acetone. The urine contained 0.25g/L (25mg/dL) and the blood, 0.03g/L (3mg/dL) acetone by headspace gas chromatography. The presence of acetone may be the result of diet or a metabolic disorder.

5. The blood and urine were also examined for the presence of ethanol, methanol, acetaldehyde, isopropanol, and n-propanol. None of these compounds were found.

WILLIAM R. COWAN
Colonel, USAF, MC
The Director

Report and Review By:

JOHN D. WHITING, Ph.D.
Acting Chief, Division of Toxicology

ROBERT F KARNEI, JR.
CAPT MC USN
DEPUTY DIRECTOR

ARMED FORCES INSTITUTE OF PATHOLOGY
WASHINGTON D C 20306

WRC/JDW/sg

REPLY TO: THE DIRECTOR
ATTN: AFIP-RRR -CPL-T

PATIENT IDENTIFICATION		PLEASE USE AFIP ACCESSION NUMBER IN ALL CORRESPONDENCE
AFIP ACCESSION NUMBER: 1933211	CHECK DIGIT: 03	SEQUENCE: 00
NAME: Young, Keith	SSAN:	
SURGICAL AUTOPSY PATH ACCESSION #'S: 84-1091		
PLEASE INFORM US OF ANY PATIENT IDENTIFICATION ERRORS		

National Transportation Safety Board
800 Independence Ave SW
Attn: Dr. McFarland
Washington, D.C. 20594

DATE: 8 May 1984

CONSULTATION REPORT ON CONTRIBUTOR MATERIAL

AFIP DIAGNOSIS:

Specimens Received: Blood and Urine

REPORT OF TOXICOLOGICAL EXAMINATION

1. The urine specimen was tested for amphetamines, barbiturates, cocaine, methaqualone, opiates, phencyclidine, benzodiazepines, propoxyphene, cannabinoids, salicylates, acetaminophen, and phenothiazines. None of these drugs were found.

2. The blood contained 5.7% carboxyhemoglobin saturation. Saturations of 10% or above are considered elevated values.

3. The blood and urine were examined for the presence of ethanol, methanol, acetone, acetaldehyde, isopropanol, and n-propanol. None of these compounds were found.

WILLIAM R. COWAN
Colonel, USAF, MC
The Director

Report and Review By:

JOHN D. WHITING, Ph.D.
Acting Chief, Division of Toxicology

ROBERT F. KARNEI, JR.
CAPT MC USN
DEPUTY DIRECTOR

CENTER FOR HUMAN TOXICOLOGY

UNIVERSITY OF UTAH • SALT LAKE CITY, UTAH 84112 (801) 581-5117

CONSULTANT CASE CC-559-84

June 1, 1984

I. REFERENCE INFORMATION (A) Barney and (B) Almendinger

TYPE EVIDENCE EXAMINED: Blood

REQUESTING AGENCY: National Transportation Safety Board
Washington, D.C.

II. EVIDENCE AND SOURCE The samples were submitted by D.J. Lacefield, Ph.D. Federal Aviation Administration, at the request of Ronald L. Schleede on May 25, 1984.

III. PURPOSE OF EXAMINATION It was requested that the samples submitted be analyzed for delta^9-tetrahydrocannabinol and its metabolites.

IV. RESULTS AND CONCLUSIONS

A. Barney - The blood contained 5 ng/ml of the carboxylic acid metabolite; no delta^9-tetrahydrocannabinol was detected.

B. Almendinger - No delta^9-tetrahydrocannabinol or its metabolites were detected in the blood.

V. DISPOSITION OF EVIDENCE The samples are retained at the Center for Human Toxicology awaiting your instructions.

Michael A. Peat, Ph.D.
Associate Director

MAP/cld

CENTER FOR HUMAN TOXICOLOGY
UNIVERSITY OF UTAH • SALT LAKE CITY, UTAH 84112 (801) 581-5117

CONSULTANT CASE CC-471-84

May 18, 1984

I. REFERENCE INFORMATION Baker, Robin #84-1085

TYPE EVIDENCE EXAMINED: Blood

REQUESTING AGENCY: National Transportation Safety Board
Washington, D.C.

II. EVIDENCE AND SOURCE The sample was submitted by the Armed Forces Institute of Pathology on May 4, 1984.

III. PURPOSE OF EXAMINATION It was requested that the sample submitted be analyzed for delta^9-tetrahydrocannabinol and its metabolites.

IV. RESULTS AND CONCLUSIONS The blood contained 3.0 ng/ml of the carboxylic acid metabolite of delta^9-tetrahydrocannabinol.

V. DISPOSITION OF EVIDENCE The sample is retained at the Center for Human Toxicology awaiting your instructions.

Michael A. Peat, Ph.D.
Associate Director

MAP/cld

CENTER FOR HUMAN TOXICOLOGY

UNIVERSITY OF UTAH • SALT LAKE CITY, UTAH 84112 (801) 581-5117

CONSULTANT CASE CC-467-84

May 18, 1984

I. REFERENCE INFORMATION — Covel, Thomas #84-1086

TYPE EVIDENCE EXAMINED: Blood

REQUESTING AGENCY: National Transportation Safety Board
Washington, D.C.

II. EVIDENCE AND SOURCE — The sample was submitted by the Armed Forces Institute of Pathology on May 4, 1984.

III. PURPOSE OF EXAMINATION — It was requested that the sample submitted be analyzed for delta^9-tetrahydrocannabinol and its metabolites.

IV. RESULTS AND CONCLUSIONS — No delta^9-tetrahydrocannabinol or its metabolites were detected.

V. DISPOSITION OF EVIDENCE — The sample is retained at the Center for Human Toxicology awaiting your instructions.

Michael A. Peat, Ph.D.
Associate Director

MAP/cld

CENTER FOR HUMAN TOXICOLOGY
UNIVERSITY OF UTAH • SALT LAKE CITY, UTAH 84112 (801) 581-5117

CONSULTANT CASE CC-469-84

May 18, 1984

I. REFERENCE INFORMATION Faust, Dale #84-1082

TYPE EVIDENCE EXAMINED: Blood

REQUESTING AGENCY: National Transportation Safety Board
Washington, D.C.

II. EVIDENCE AND SOURCE The sample was submitted by the Armed Forces Institute of Pathology on May 4, 1984.

III. PURPOSE OF EXAMINATION It was requested that the sample submitted be analyzed for delta^9-tetrahydrocannabinol and its metabolites.

IV. RESULTS AND CONCLUSIONS The blood contained 9.0 ng/ml of the carboxylic acid metabolites of delta^9-tetrahydrocannabinol.

V. DISPOSITION OF EVIDENCE The sample is retained at the Center for Human Toxicology awaiting your instructions.

Michael A. Peat, Ph.D.
Associate Director

MAP/cld

CENTER FOR HUMAN TOXICOLOGY

UNIVERSITY OF UTAH • SALT LAKE CITY, UTAH 84112 (801) 581-5117

CONSULTANT CASE CC-466-84

May 18, 1984

I. REFERENCE INFORMATION — Hankey, Kurt #84-1087

TYPE EVIDENCE EXAMINED: Blood

REQUESTING AGENCY: National Transportation Safety Board
Washington, D.C.

II. EVIDENCE AND SOURCE — The sample was submitted by the Armed Forces Institute of Pathology on May 4, 1984.

III. PURPOSE OF EXAMINATION — It was requested that the sample submitted be analyzed for delta^9-tetrahydrocannabinol and its metabolites.

IV. RESULTS AND CONCLUSIONS — No delta^9-tetrahydrocannabinol or its metabolites were detected.

V. DISPOSITION OF EVIDENCE — The sample is retained at the Center for Human Toxicology awaiting your instructions.

Michael A. Peat, Ph.D.
Associate Director

MAP/cld

CENTER FOR HUMAN TOXICOLOGY
UNIVERSITY OF UTAH • SALT LAKE CITY, UTAH 84112 (801) 581-5117

CONSULTANT CASE CC-463-84

May 18, 1984

I. REFERENCE INFORMATION — Klein, Anthony #84-1090

TYPE EVIDENCE EXAMINED: Blood

REQUESTING AGENCY: National Transportation Safety Board
Washington, D.C.

II. EVIDENCE AND SOURCE — The sample was submitted by the Armed Forces Institute of Pathology on May 4, 1984.

III. PURPOSE OF EXAMINATION — It was requested that the sample submitted be analyzed for delta^9-tetrahydrocannabinol and its metabolites.

IV. RESULTS AND CONCLUSIONS — The blood contained 3.8 ng/ml of delta^9-tetrahydrocannabinol, 1.6 ng/ml of the hydroxy metabolite and 78 ng/ml of the carboxylic acid metabolite.

V. DISPOSITION OF EVIDENCE — The sample is retained at the Center for Human Toxicology awaiting your instructions.

Michael A. Peat, Ph.D.
Associate Director

MAP/cld

CENTER FOR HUMAN TOXICOLOGY
UNIVERSITY OF UTAH • SALT LAKE CITY, UTAH 84112 (801) 581-5117

CONSULTANT CASE CC-468-84

May 18, 1984

I. REFERENCE INFORMATION — Lolley, Bryan #84-1083

TYPE EVIDENCE EXAVINED: Blood

REQUESTING AGENCY: National Transportation Safety Board
Washington, D.C.

II. EVIDENCE AND SOURCE — The sample was submitted by the Armed Forces Institute of Pathology on May 4, 1984.

III. PURPOSE OF EXAMINATION — It was requested that the sample submitted be analyzed for delta^9-tetrahydrocannabinol and its metabolites.

IV. RESULTS AND CONCLUSIONS — No delta^9-tetrahydrocannabinol or its metabolites were detected.

V. DISPOSITION OF EVIDENCE — The sample is retained at the Center for Human Toxicology awaiting your instructions.

Michael A. Peat, Ph.D.
Associate Director

MAP/cld

CENTER FOR HUMAN TOXICOLOGY

UNIVERSITY OF UTAH • SALT LAKE CITY, UTAH 84112 (801) 581-5117

CONSULTANT CASE CC-470-84

May 18, 1984

I. REFERENCE INFORMATION — Maden, David #84-1084

TYPE EVIDENCE EXAMINED: Blood

REQUESTING AGENCY: National Transportation Safety Board
Washington, D.C.

II. EVIDENCE AND SOURCE — The sample was submitted by the Armed Forces Institute of Pathology on May 4, 1984.

III. PURPOSE OF EXAMINATION — It was requested that the sample submitted be analyzed for delta^9-tetrahydrocannabinol and its metabolites.

IV. RESULTS AND CONCLUSIONS — No delta^9-tetrahydrocannabinol or its metabolites were detected.

V. DISPOSITION OF EVIDENCE — The sample is retained at the Center for Human Toxicology awaiting your instructions.

Michael A. Peat, Ph.D.
Associate Director

MAP/cld

CENTER FOR HUMAN TOXICOLOGY
UNIVERSITY OF UTAH • SALT LAKE CITY, UTAH 84112 (801) 581-5117

CONSULTANT CASE CC-465-84

May 18, 1984

I. REFERENCE INFORMATION McNulty, Jerome #84-1088

TYPE EVIDENCE EXAMINED: Blood

REQUESTING AGENCY: National Transportation Safety Board
Washington, D.C.

II. EVIDENCE AND SOURCE The sample was submitted by the Armed Forces Institute of Pathology on May 4, 1984.

III. PURPOSE OF EXAMINATION It was requested that the sample submitted be analyzed for delta^9-tetrahydrocannabinol and its metabolites.

IV. RESULTS AND CONCLUSIONS The blood contained 1.0 ng/ml of delta^9-tetrahydrocannabinol and 79 ng/ml of the carboxylic acid metabolite.

V. DISPOSITION OF EVIDENCE The sample is retained at the Center for Human Toxicology awaiting your instructions.

Michael A. Peat, Ph.D.
Associate ~~Director~~

MAP/cld

CENTER FOR HUMAN TOXICOLOGY

UNIVERSITY OF UTAH • SALT LAKE CITY, UTAH 84112 (801) 581-5117

CONSULTANT CASE CC-464-84

May 18, 1984

I. REFERENCE INFORMATION — STALVEY Wilbert, Donald #84-1089

TYPE EVIDENCE EXAMINED: Blood

REQUESTING AGENCY: National Transportation Safety Board
Washington, D.C.

II. EVIDENCE AND SOURCE — The sample was submitted by the Armed Forces Institute of Pathology on May 4, 1984.

III. PURPOSE OF EXAMINATION — It was requested that the sample submitted be analyzed for delta^9-tetrahydrocannabinol and its metabolites.

IV. RESULTS AND CONCLUSIONS — The blood contained 1.1 ng/ml of delta^9-tetrahydrocannabinol and 35 ng/ml of the carboxylic acid metabolite.

V. DISPOSITION OF EVIDENCE — The sample is retained at the Center for Human Toxicology awaiting your instructions.

Michael A. Peat, Ph.D.
Associate Director

MAP/cld

APPENDIX E

CENTER FOR HUMAN TOXICOLOGY

UNIVERSITY OF UTAH • SALT LAKE CITY, UTAH 84112 (801) 581-5117

CONSULTANT CASE CC-462-84

May 18, 1984

I. REFERENCE INFORMATION — Young, Keith #84-1091

TYPE EVIDENCE EXAMINED: Blood

REQUESTING AGENCY: National Transportation Safety Board
Washington, D.C.

II. EVIDENCE AND SOURCE — The sample was submitted by the Armed Forces Institute of Pathology on May 4, 1984.

III. PURPOSE OF EXAMINATION — It was requested that the sample submitted be analyzed for delta^9-tetrahydrocannabinol and its metabolites.

IV. RESULTS AND CONCLUSIONS — No delta^9-tetrahydrocannabinol or its metabolites were detected.

V. DISPOSITION OF EVIDENCE — The sample is retained at the Center for Human Toxicology awaiting your instructions.

Michael A. Peat, Ph.D.
Associate Director

MAP/cld

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
MIKE MONRONEY AERONAUTICAL CENTER
Oklahoma City, OK

TOXICOLOGY REPORT

DATE: April 27, 1984 CASE: R-2

ACCIDENT OR EVENT:

Toxicology report on railroad accident which occurred near Newcastle, Wyoming, on April 22, 1984.

RECEIVED BY:

Richard Winston from Frontier air freight on April 25, 1974, at 11:45 p.m.

SAMPLES:

Three tubes of blood, one bottle of gastric, one large container of mixed tissue, identified with the names R. E. Almendinger.

Three tubes of blood, one bottle each of gastric and urine, one bag of mixed tissue, identified with the name M. L. Barney.

Specimens were cold.

RESULTS:

ACIDIC & NEUTRAL DRUGS (Acid-Ether Extractions, UV Scan):

Almendinger - None detected - blood.

Barney - None detected - blood and urine.

BASIC DRUGS (Alkaline-Ether Extraction, UV Scan):

Almendinger - None detected - blood

Barney - None detected - blood and urine.

ETHYL ALCOHOL (Gas Chromatography):

Almendinger - None detected - blood.

Barney - None detected - blood and urine.

CARBON MONOXIDE (Conway Diffusion Palladium Chloride):

Almendinger - None detected in blood with a hemoglobin concentration of 17.7 grams%

Barney - None detected in blood with a hemoglobin concentration of 11.5 grams%.

MARIJUANA:

No specimens submitted.

SIGNATURE AND TITLE:

Delbert J. Lacefield, Ph.D.
SUPERVISOR, FORENSIC TOXICOLOGY RESEARCH UNIT, AAC-114B

cc: FRA- Regional Director, Portland, Oregon; Gordon Inglis, NTSB, Denver, CO.

APPENDIX F

NTSB RESPONSE TO FRA NOTICE OF PROPOSED RULEMAKING

National Transportation Safety Board
Washington, D.C. 20594

Office of the Chairman

August 15, 1984

Docket Clerk
Office of Chief Counsel
Federal Railroad Administration
400 Seventh Street, S.W.
Washington, D.C. 20590

Ref: FRA Docket No. RSOR-6,
Notice No. 4

Dear Sir:

The National Transportation Safety Board is pleased to respond to your Notice of Proposed Rulemaking (NPRM) Docket No. RSOR-6, Notice No. 4, published June 12, 1984, regarding Federal Safety Standards for the Control of Alcohol and Drug Use in Railroad Operations. The Safety Board wholeheartedly supports the intent of this proposal. It does believe, however, that the rulemaking can be strengthened to further the achievement of the desired safety objectives. Consequently, the Safety Board offers the following general comments as well as specific proposals directed to those sections it believes should be modified or expanded.

General Comments:

a. The final rule should state clearly that it sets a minimum framework for addressing the control of alcohol and drug use in railroad operations, and that it should not be construed to limit or constrain railroads from adopting and enforcing more stringent policies and rules regarding alcohol and drugs if safety conditions on the railroad require additional management actions.

b. Historically, once the Safety Board has been able to overcome the problem of obtaining toxicological samples it has had little or no difficulty in obtaining accurate evaluations for the purpose of detecting alcohol. However, the capabilities of local laboratories for detection and quantification of drugs in toxicological samples are not uniform; specifically the sensitivity and accuracy of the equipment and the test procedures are inadequate to yield consistent results. Therefore, the Safety Board urges the FRA to prescribe standardized testing for drugs that is sensitive and specific enough to detect and quantify controlled substances, and therapeutic levels of licit drugs.

The Board approved on August 9, 1984, recommendations to the Department of Transportation and to the Federal Aviation Administration that address this concern as follows:

--to the Department of Transportation

Review the existing research and literature in this area and institute research to: (1) determine the potential effects of both licit and illicit drugs, especially marijuana, in both therapeutic and abnormal levels, on human performance; (2) obtain correlations between toxicological findings of drug levels in blood, urine, and other specimens and various behavioral measurements; (3) assess the effects of various drugs on the specific tasks performed by the operator in all transportation modes. (Class III, Longer-Term Action)(A-84-)

--to the Federal Aviation Administration

Establish at the Civil Aeromedical Institute the capability to perform toxicological tests on the blood, urine and tissue of pilots involved in fatal accidents to determine the levels of both licit and illicit drugs at both therapeutic and abnormal levels. (Class II, Priority Action)(A-84-)

c. The final rule should state clearly that the post-accident testing program supplements rather than replaces the Safety Board's authority in the Independent Safety Board Act of 1974 to order an autopsy. It should point out also that the Board has authority to seek other tests of train crews or the samples drawn from them under this rule, as well as authority to obtain or take possession of any evidence which pertains to an accident.

Specific Comments by Section:

1. Section 218.101 Definitions

Although the Safety Board recognizes the difficulty of the task of defining railroad employees to be covered by this rule, it believes FRA should include any employee who may be directly involved in an accident. This means that employees other than "covered employees" under the Hours-of-Service Act need to be subject to testing. For example, if a seriously alcohol impaired train crew reported to a supervisor who did not detect alcohol there might be a need to test the supervisor to determine if his failure to evaluate the crew properly was due to his own impairment.

a. There are varying interpretations by railroads as to who is covered by the Hours of Service Act (45 USC 61-64b). For example, some railroads do not consider their operating department officials to be covered by the Act. The definition in subparagraph 218.101(b) should be explicit in its scope.

b. In subparagraph 218.101(e) "Drug" is defined as any controlled substance (as defined by 21 U.S.C.802). The Safety Board believes that a specific reference to marijuana should be included in the definition to ensure an understanding that it is a controlled substance. Most railroad employees are not aware of the legal scope of the term "controlled substance" as defined by 21 U.S.C.802.

2. Section 218.103 Alcohol and drug use by covered employees

a. The Safety Board is concerned that the provision in subparagraph 218.103(c) which states, in part that "an employee shall be conclusively presumed to be impaired by alcohol, if the employee has a blood alcohol concentration of 0.05 percent (weight/volume) or more ..." may give rise to the impression that an amount of alcohol up to that level in an employee's system is acceptable.

The Safety Board does not agree with the conclusion in the preamble to the proposed rule which suggests that there is little evidence to indicate an immediate safety problem associated with blood alcohol concentrations below 0.049 percent (weight/volume). There is considerable research that demonstrates measurable adverse behavioral effects at blood alcohol concentrations of 0.02 percent (weight/volume) (See enclosure). Consequently, the rule should definitively prohibit an employee from having any alcohol, regardless of level, in his system while on duty. The Board recognizes the limitations of some testing systems and believes that 0.02 percent (weight/volume) for alcohol should be deemed inconclusive if breath testing is used. However, a test should not be rejected if other evidence shows alcohol was ingested while on duty.

This is consistent with the Board's recommendation to the Federal Aviation Administration which states:

> Issue a rule defining the blood alcohol concentration level that constitutes "under the influence" at the lowest possible level consistent with the capability of testing equipment to measure any ingested alcohol. (Class II, Priority Action)(A-84-45).

This recommendation was issued by the Safety Board on May 1, 1984.

As presently written, the proposed rule could suggest that an employee legally could be on duty as long as he has a blood alcohol concentration of 0.049 percent or less (weight/volume). The Safety Board's position is that the rule should convey the unmistakable message that any level of alcohol in an operator is a hazard to safe railroad operations and public safety.

b. The Safety Board believes that the prohibition in subparagraph 218.103(c)(2) should be the presence of any controlled substance as established by a reliable test method. With regard to marijuana the determinant of use must be based on a reliable blood analysis for THC and its metabolites until non-intrusive means to detect the presence and time of use are developed. The documented behavioral effects of marijuana include impaired judgment and concentration, impaired perceptual and motor skills, and reduced short-term memory. The rules should be drafted to explicitly reject the social use of controlled substances, including marijuana, by those involved in railroad operations.

3. Section 218.105 Post-accident toxicological testing

a. In subparagraph 218.105(b), Accident covered, the FRA expressly excludes post-accident toxicological testing in the case of a collision between railroad rolling stock and a motor vehicle or other conveyance at a rail/highway grade crossing. The proposed exclusion should not extend to accidents involving fatalities and/or serious injuries. The failure of a train crew to observe slow orders or to sound appropriate warnings has contributed to grade crossing accidents which resulted in deaths or serious injuries.

During the course of an investigation of a rail accident in Goldonna, Louisiana, in late 1977, the Safety Board found that the engineer had been cited by his employer in an earlier accident for failing to blow the train whistle and for operating the train while intoxicated. These circumstances had not been reported and would have remained unknown had it not been for the investigation of the later accident by the Safety Board.

b. In subparagraph 218.105(g)(2)(i) Condition on employment in covered service; sanction, the sanction for an employee who refuses to cooperate in providing a blood or urine sample following an accident or incident specified in section 218.105(a) should be no less than the sanction under Rule G for employees who are tested and found to have used alcohol or drugs, i.e., termination from employment with the railroad. The purpose of the rule would be undermined seriously if employees consistently refused to be tested with the understanding that they probably would be able to return to service after 6 months.

4. Section 218.109 Authority to test for cause

The Safety Board believes that the FRA has reached a balanced approach in addressing the supervisory testing for alcohol or drug use by employees in railroad operations.

5. Section 218.111, Identification of troubled employee

The Safety Board agrees with the intent of this Section. However, it believes that subparagraph 218.111(c)(2) should be modified. The proposed rule addresses a co-worker reporting an employee who "... was apparently unsafe to work with or was, or appeared to be, in violation of this subpart or the railroad's alcohol and drug rules." This subparagraph also should provide explicitly for situations in which the employee is observed to be impaired as he reports for work.

The National Transportation Safety Board is encouraged by the comprehensive manner in which FRA has addressed the broad scope of interests impacted by the proposed rule. Our response is based on recurrent, first-hand observations of fatalities, injuries and destructior related to alcohol and drug use by railroad employees. Therefore, the Board strongly encourages the FRA to adopt a rule which is unmistakable in its resolve to mitigate a problem which everyone agrees must be overcome.

Respectfully yours,

Jim Burnett
Chairman

Enclosure

APPENDIX G

EXCERPTS FROM TITLE 49 CODE OF FEDERAL REGULATIONS CH. II - FEDERAL RAILROAD ADMINISTRATION

APPENDIX A—REQUIREMENTS OF THE HOURS OF SERVICE ACT: STATEMENT OF AGENCY POLICY AND INTERPRETATION

First enacted in 1907, the Hours of Service Act was substantially revised in 1969 by Pub L 91-169 Further amendments were enacted as part of the Federal Railroad Safety Authorization Act of 1976, Pub L 94-348 The purpose of the law is "to promote the safety of employees and travelers upon railroads by limiting the hours of service of employees * * *" This appendix is designed to explain the effect of the law in commonly-encountered situations

The Act governs the maximum work hours of employees engaged in one or more of the basic categories of covered service treated below If an individual performs more than one kind of covered service during a tour of duty, then the most restrictive of the applicable limitations control

The Act applies to any common carrier engaged in interstate or foreign commerce by railroad It governs the carrier's operations over its own railroad and all lines of road which it uses

TRAIN AND ENGINE SERVICE

Covered Service Train or engine service refers to the actual assembling or operation of trains Employees who perform this type of service commonly include locomotive engineers, firemen, conductors, trainmen, switchmen, switchtenders (unless their duties come under the provisions of section 3) and hostlers With the passage of the 1976 amendments, both inside and outside hostlers are considered to be connected with the movement of trains Previously, only outside hostlers were covered Any other employee who is actually engaged in or connected with the movement of any train is also covered, regardless of his job title

Limitations on Hours The Act establishes two limitations on hours of service First, no employee engaged in train or engine service may be required or permitted to work in excess of twelve consecutive hours After working a full twelve consecutive hours, an employee must be given at least ten consecutive hours off duty before being permitted to return to work

Second, no employee engaged in train or engine service may be required or permitted to continue on duty or go on duty unless he has had at least eight consecutive hours off duty within the preceding twenty-four hours This latter limitation, when read in conjunction with the requirements with respect to computation of duty time (discussed below) results in several conclusions:

(1) When an employee's work tour is broken or interrupted by a valid period of interim release (4 hours or more at a designated terminal), he may return to duty for the balance of the total 12-hour work tour during a 24-hour period

(2) After completing the 12 hours of broken duty, or at the end of the 24-hour period, whichever occurs first, the employee may not be required or permitted to continue on duty or to go on duty until he has had at least 8 consecutive hours off duty

(3) The 24-hour period referred to in paragraphs 1 and 2 above shall begin upon the commencement of a work tour by the employee immediately after his having received a statutory off-duty period of 8 or 10 hours as appropriate

Duty time and effective periods of release On-duty time commences when an employee reports at the time and place specified by the railroad and terminates when the employee is finally released of all responsibilities (Time spent in deadhead transportation to a duty assignment is also counted as time on duty See discussion below) Any period available for rest that is of four or more hours and is at a designated terminal is off-duty time All other periods available for rest must be counted as time on duty under the law, regardless of their duration

Deadheading Under the Act time spent in deadhead transportation receives special treatment Time spent in deadhead transportation to a duty assignment by a train or engine service employee is considered on-duty time Time spent in deadhead transportation from the final duty assignment of the work tour to the point of final release is not computed as either time on duty or time off duty Thus, the period of deadhead transportation to point of final release may not be included in the required 8- or 10-hour off-duty period Time spent in deadhead transportation to a duty assignment is calculated from the time the employee reports for deadhead until he reaches his duty assignment

§ 217 11 Program of instruction on operating rules

(a) To ensure that each railroad employee whose activities are governed by the railroad's operating rules understands those rules, each railroad to which this part applies shall periodically instruct that employee on the meaning and application of the railroad's operating rules in accordance with a program filed with the Federal Railroad Administrator

(b) Before March 1, 1975 or 30 days before commencing operations, whichever is later, each railroad shall file with the Federal Railroad Administrator, Washington, D C 20590, three copies of a program for the periodic instruction of its employees as required by paragraph (a) of this section This program shall—

(1) Describe the means and procedures used for instruction of the various classes of affected employees,

(2) State the frequency of instruction and the basis for determining that frequency,

(3) Include a schedule for completing the initial instruction of employees who are already employed when the program begins,

(4) Begin within 30 days after it is filed with the Federal Railroad Administrator,

(5) Provide for initial instruction of each employee hired after the program begins

(c) Each amendment to a railroad's program for the periodic instruction of its employees required under paragraph (a) of this section shall be filed with the Federal Railroad Administrator within 30 days after it is issued

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