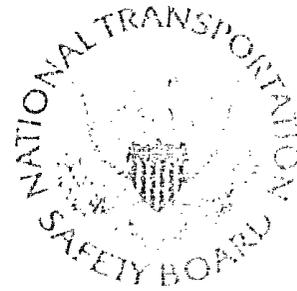


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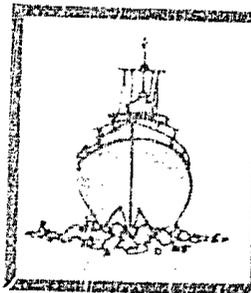
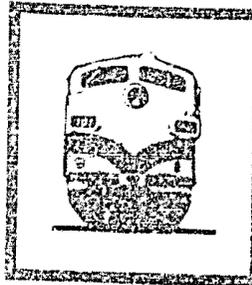
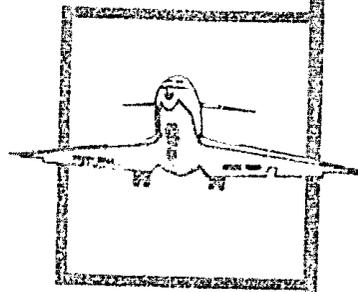
RAILROAD ACCIDENT REPORT

HEAD-ON COLLISION BETWEEN
IOWA INTERSTATE RAILROAD EXTRA 470 WEST
AND EXTRA 406 EAST WITH RELEASE OF
HAZARDOUS MATERIALS
NEAR ALTOONA, IOWA
JULY 30, 1988

NTSB/RAR-89/04

UNITED STATES GOVERNMENT

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16. Abstract: About 11:40 a.m. central daylight saving time on July 30, 1988, Iowa Interstate Railroad Ltd. (IAIS) freight trains Extra 470 West and Extra 406 East collided head-on within the yard limits of Altoona, Iowa, about 10 miles east of Des Moines, Iowa. All 5 locomotive units from both trains; 11 cars of Extra 406 East; and 3 cars, including two tank cars containing denatured alcohol, of Extra 470 West derailed. The denatured alcohol, which was released through the pressure relief valves and the manway domes of the two derailed tank cars, was ignited by the fire resulting from the collision of the locomotives. Both crewmembers of Extra 470 West were fatally injured; the two crewmembers of Extra 406 East were only slightly injured. The estimated damage (including lading) as a result of this accident exceeded \$1 million.			
The major safety issues in the accident include operational methods employed by the IAIS, training and selection of train and engine personnel, supervisory oversight by the IAIS, design of closure fittings on hazardous materials rail tanks, and oversight of regional railroads by the Federal Railroad Administration.			
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CONTENTS

EXECUTIVE SUMMARY	v
INVESTIGATION	
Events Preceding the Accident	1
Extra 406 East	1
Extra 470 West	5
The Accident	5
Emergency Response	10
Salvage of the Tank Cars	11
Injuries	13
Damages	13
Extra 406 East	13
Extra 470 West	13
Track and Signal Information	15
Track	15
Signals	16
Train Information	18
Extra 406 East	18
Extra 470 West	18
Method of Operation	21
Personnel Information	25
Extra 406 East	25
Extra 470 West	25
Other IAIS Personnel	27
Training of Operating Employees	27
Operating Rules Classes	27
Training Program for Engineers	28
Operating Rules of the CNW	29
Management Oversight	29
Federal Activity	30
Federal Oversight	30
Accident Reporting Criteria and Previous Accidents	32
Meteorological Information	34
Medical and Toxicological Information	34
Survival Aspects	34
Transportation of Hazardous Materials	35
Tank Car Design Standards	35
Product Shipping Information	35
Tank Car Securement Procedures at the ADM Cedar Rapids Plant	36
Tests and Research	39
Sight Distance Tests	39
A-1 Charging Cut-Off Pilot Valve	39
Air Brake Tests	39
Postaccident Inspection and Pressure Tests of Tank Cars	40
Manway Gaskets	41
Other Information	41
Disaster Preparedness	41
Shelf Couplers	41
Tank Car Fittings	42
Railroad Event Recorders	42
The American Short Line Railroad Association	43

ANALYSIS	
General	44
The Accident	44
Operation of Extra 406 East	44
Operation of Extra 470 West	47
IAIS Method of Operation and Management Oversight	48
Failure to Resolve Status of Signal System	48
Failure to Verify Train Orders Issued	49
Failure to Maintain a Record of Train Movements	50
Failure to Install Yard Limit Signs	50
Failure to Provide Instructions on Air Brake Tests	51
Failure to Provide Adequate Training on the Operating Rules	51
Failure to Provide Effective Training for Engineer Trainees	52
Failure to Qualify Crews on Operating Rules of Other Railroads	53
Failure to Conduct Operational Tests and Inspections	54
Failure to Properly Abandon Signal System	54
Lack of Cooperation by IAIS in Safety Board's Investigation	55
Federal Activity	55
Federal Oversight of IAIS	55
Accident Reporting Criteria	57
Transportation of Hazardous Materials	58
Release and Ignition of Denatured Alcohol	58
Mode of Release	59
Tank Car Performance during Postaccident Testing	60
Tank Car Securement Procedures and Training at ADM's Cedar Rapids Plant	61
Federal Regulations Regarding Performance and Design of Closure Fittings on Hazardous Materials Rail Tanks	62
Positioning of Tank Cars Within a Train	63
Emergency Response	64
Survival Aspects/Crashworthiness	64
Event Recorders	65
Toxicological Testing	65
 CONCLUSIONS	
Findings	66
Probable Cause	69
 RECOMMENDATIONS	69
 APPENDIXES	
Appendix A--Investigation and Hearing	75
Appendix B--Personnel Information	76
Appendix C--Iowa Interstate Railroad Timetable No. 2 (Excerpts)	77
Appendix D--Chicago Rock Island and Pacific Railroad Company Rules and Instructions for Train Handling and Operation of the Air Brakes (Excerpts)	83
Appendix E--49 CFR Part 217 (Excerpts)	87
Appendix F--Safety Board Letter Dated December 7, 1988, and FRA Letter Dated January 18, 1989	89
Appendix G--National Transportation Safety Board Accident Reporting Criteria	93
Appendix H--Federal Railroad Administration Accident Reporting Criteria	95
Appendix I--Bench Test Results of Pressure Relief Valves	98

EXECUTIVE SUMMARY

About 11:44 a.m. central daylight savings time on July 30, 1988, Iowa Interstate Railroad Ltd. (IAIS) freight trains Extra 470 West and Extra 406 East collided head on within the yard limits of Altoona, Iowa, about 10 miles east of Des Moines, Iowa. All 5 locomotive units from both trains; 11 cars of Extra 406 East; and 3 cars, including 2 tank cars containing denatured alcohol, of Extra 470 West derailed. The denatured alcohol, which was released through the pressure relief valves and the manway domes of the two derailed tank cars, was ignited by the fire resulting from the collision of the locomotives. Both crewmembers of Extra 470 West were fatally injured; the two crewmembers of Extra 406 East were only slightly injured. The estimated damage (including lading) as a result of this accident exceeded \$1 million.

The major safety issues in the accident include:

- o operational methods employed by the IAIS,
- o training and Selection of train and engine personnel;;
- o supervisory oversight by the IAIS;
- o design of closure fittings on hazardous materials rail tanks; and
- o oversight of regional railroads by the Federal Railroad Administration (FRA).

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the traincrew of Extra 406 East to comply with the wait provisions of train order 213 and Iowa Interstate Railroad's (IAIS) inadequate oversight and enforcement of its operating rules. Contributing to the traincrew's failure to comply with the wait provisions was a combination of fatigue induced by irregular work/rest schedules, preoccupation with completing their assignment prior to exceeding duty time limits, inexperience, "mental set" or expectations based on previously issued train orders, the work activities which intervened since they received the train order, and the IAIS's inadequate training of its crews. Contributing to the accident was the Federal Railroad Administration's inadequate surveillance and enforcement of compliance by the IAIS with Federal regulations. Contributing to the length of the emergency was the release and burning of hazardous materials from pressure relief valves and manways on the tank cars.

As a result of its investigation, the Safety Board issued recommendations to the Iowa Interstate Railroad, the Federal Railroad Administration, the Research and Special Programs Administration, the Archer Daniels Midland Company, the Chemical Manufacturers Association, the National Industrial Transportation League, the American Short Line Railroad Association, the Association of American Railroads, the Chicago North Western Transportation Company, the CSX Transportation Company, and METRA. The Safety Board also reiterated Safety Recommendation R-87-17 to the Research and Special Programs Administration.

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

RAILROAD ACCIDENT REPORT

HEAD-ON COLLISION BETWEEN
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INVESTIGATION

Events Preceding the Accident

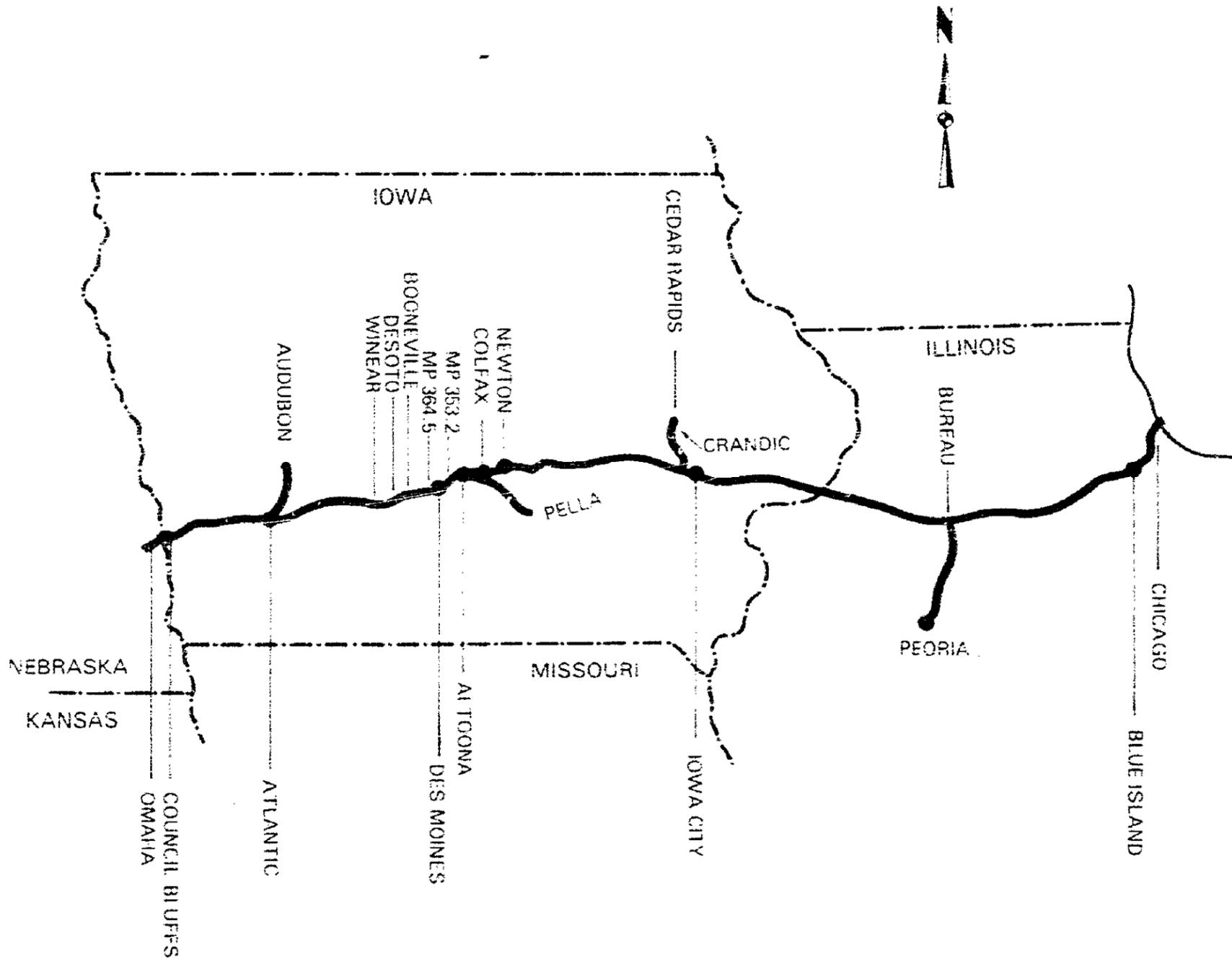
Extra 406 East. -- About 1:30 a.m., central daylight savings time on July 30, 1988, the traincrew, which consisted of an engineer and conductor, of Iowa Interstate Railroad (IAIS) Extra 406 East reported for duty at their away-from-home terminal in Council Bluffs, Iowa, for a return trip to Newton, Iowa. (See figure 1.) The traincrew had gone off duty at Council Bluffs the preceding day at 5:30 p.m. and had been off duty for 8 hours, in accordance with the Hours of Service Act, when they reported for duty.

The conductor stated that when they arrived at the yard office, he called the dispatcher who instructed them to add a fourth locomotive unit in anticipation of the tonnage that would be picked up en route to Newton. After coupling the locomotive units to their train, which had been made up by a switchcrew, and receiving an air pressure reading from the end-of-train device,¹ the crew departed Council Bluffs about 2:35 a.m. with 32 cars.

Extra 406 East proceeded to Atlantic, Iowa, a distance of 48.1 miles, where the crew picked up 25 more cars. After the crew recoupled their locomotive units to the train, the crew discovered a mechanically defective car which they then set out. Extra 406 East departed Atlantic about 5:30 a.m. and proceeded to Winuar, Iowa, a distance of 54.4 miles, where the crew picked up an additional 14 cars. At the next stop, Desoto, Iowa, a distance of 5.7 miles, the crew set out eight cars and picked up six empty cars.

According to a copy of the dispatcher's train order book for July 30, 1988, Extra 406 East received and acknowledged via radio train order 205 at 3:37 a.m., when it was near Atlantic, Iowa. Train order 205 read: "Extra 430 West meet Extra 406 East at Booneville, Extra 430 take siding." Westbound train Extra 430 West received and acknowledged the order at 6:08 a.m.

¹IAIS Extra 406 East was a caboosless train equipped with an end-of-train (EOT) device that provided a red marker light at the end of the train. Additionally, by radio telemetry, the EOT provides the engineer a digital readout of the train line air pressure at the end of the train, and of any changes in air pressure.



SOURCE: IOWA INTERSTATE

Figure 1.--Iowa Interstate Railroad.

At 8:37 a.m., the crew of Extra 430 West received and acknowledged via radio train order 209, which instructed them that train order 205 was annulled and that they could operate from Altoona to milepost (MP) 353.2, and await the arrival of Extra 406 East at MP 364.5.² At 9:16 a.m., when Extra 406 East was near DeSoto, the crew received and acknowledged via radio train order 211 which instructed the crew that train order 205 was annulled and that after Extra 430 West arrived at MP 353.2, Extra 406 East could operate from MP 353.2 to Newton. (In accordance with timetable instructions, the crews of Extra 406 East and Extra 430 West upon arriving at the mileposts designated in their respective train orders would contact the CNW yardmaster for instructions as to which track to take into and to leave the yard.) At 9:18 a.m., shortly after leaving DeSoto, Extra 406 East received and acknowledged via radio train order 212, which instructed crews of eastbound trains between MP 353.2 and Newton, except Extra 406 East, to wait at MP 353.2 until 2 p.m.

At 9:39 a.m., while in the vicinity of Booneville, Iowa, Extra 406 East received train order 213, which stated: "Extra 406 East has right over³ Extra 470 West MP 353.2 to Newton and wait at Altoona [MP 346.9] until 1201 [12:01 p.m.] for Extra 470 West." The conductor said he copied and repeated the order to the dispatcher. The conductor stated that he did not discuss the train order with the engineer or provide him with a copy. The engineer stated, however, that he clearly heard the transmission and the conductor repeat the train order.

Extra 406 East proceeded through the yard limits at Des Moines, Iowa, over trackage of the CNW, en route to Altoona, a distance of approximately 6.2 miles from the east end of the yard limits at Des Moines. In testimony after the accident, the engineer of Extra 406 East stated that "we met this [westbound] train down the DMU connection [CNW yard]. They were in the clear there for us." The engineer further stated that he did not remember the engine number of that train. The conductor of Extra 406 East stated following the accident that, "as we left the CNW we both compared our times. We figured...we've got about 2 hours and 35 minutes to get to Newton. We were always trying to make it in within our hours." When asked if he was concerned about this, he stated, "yes."

The crew estimated that they arrived at Altoona shortly before 11:30 a.m. Extra 406 East consisted of 4 locomotive units and 68 cars when it arrived at Altoona. The crew, after uncoupling the locomotive with one car and leaving the remainder of the train on the main track, proceeded through Altoona yard on the Pella line track to set out the car on the "sawdust" track. (See figure 2.) After the crew set out the car the

² IAIS operates over trackage of the Chicago North Western (CNW) and the Des Moines Union (DMU) through the Des Moines area. MP 353.2 and MP 364.5 are, respectively, the east and west end of the CNW yard limits at Des Moines.

³ The "right over" in the train order establishes the superiority of movement of a designated train (Extra 406 East) over another designated train (Extra 470 West).

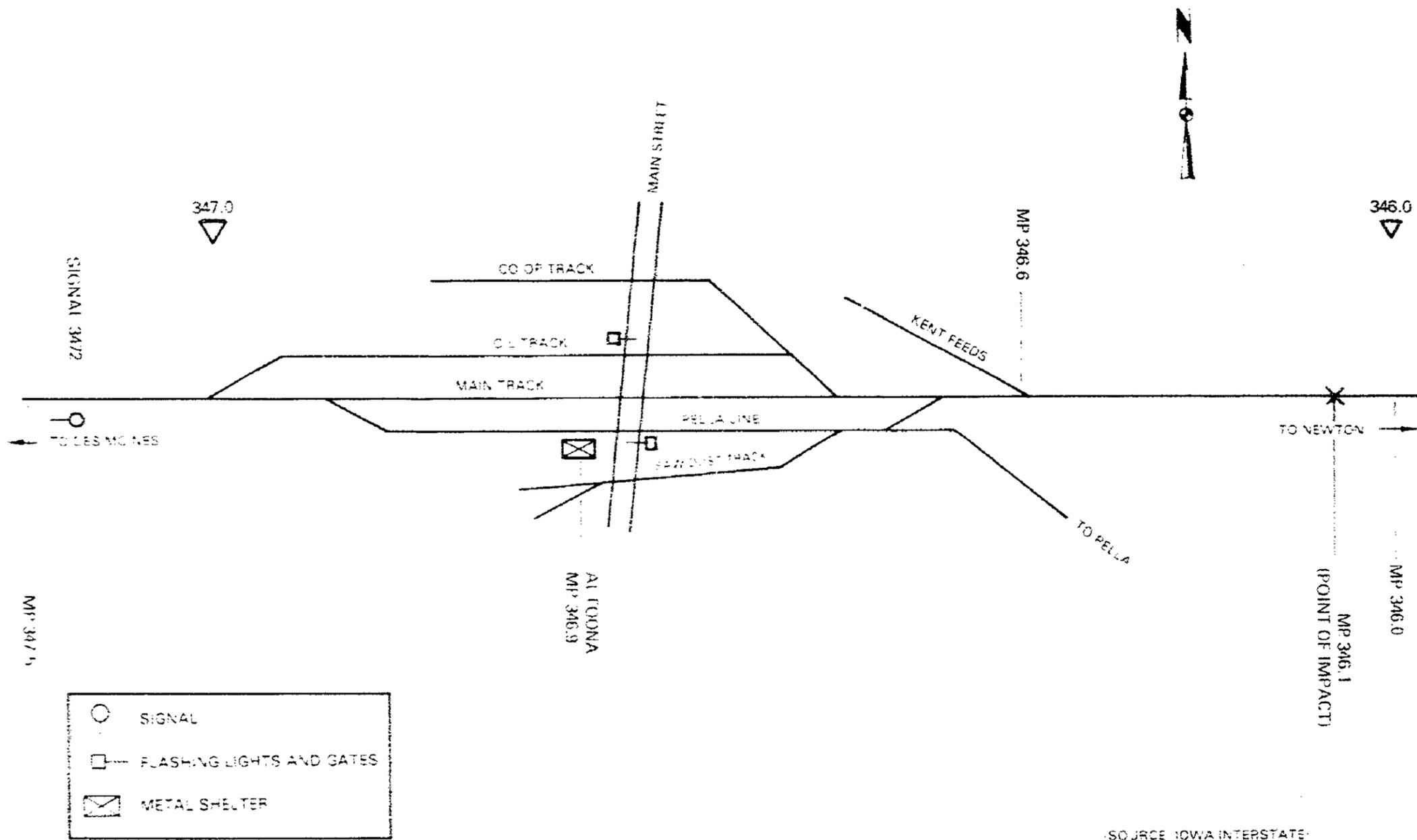


Figure 2.--Layout of Altoona Yard Track.

conductor, who was off the train to line the switches, stopped to talk briefly with an IAIS communications worker. When he finished his conversation, the traincrew returned to the portion of the train that had been left on the main track, coupled the locomotive to the train, and departed eastward past Altoona Station prior to the time stated in train order 213. The engineer stated that he did not look at his watch before departing. The conductor stated that he thought he wrote down 11:30 - 11:40 [a.m.] as the time of departure.

Extra 470 West.--The engineer and conductor of Extra 470 West reported for duty at 8 a.m. on July 30, 1988, to operate the westbound train between Newton, approximately 25 miles east of Altoona, to Des Moines and return. The crew picked up the train consist list in the yard office and proceeded to a siding east of Newton to make up their train from a consist of 49 cars that earlier had been left in the siding. When Extra 470 West was ready to depart Newton, it consisted of one locomotive unit and eight cars, including two placarded tank cars. According to IAIS officials, the conductor of Extra 470 West was responsible for the proper placement of cars in the train. The tank cars were the third and fourth cars behind the locomotive when Extra 470 West departed Newton.

The dispatcher's train order book for July 30, 1988, indicates that train orders for Extra 470 West were received in Newton by the assistant superintendent of operations who was performing the duties of train order operator on that date, as he occasionally did. He testified that he copied the orders, placed them on a desk for the traincrew to pick up, and saw a crewmember pick up the orders shortly after 10:30 a.m. Among the orders placed on the desk, according to the assistant superintendent of operations, were train orders 213 and 215, the second of which authorized Extra 470 West to run from Newton to MP 353.2, the east end of the CNW yard limits at Des Moines, and to return to Newton.

According to the assistant superintendent of operations, the conductor of Extra 470 West did not report the time his train departed Newton and no one observed or reported the departure of Extra 470 West to the dispatcher. IAIS officials stated that it was at the option of the conductor to report the departure time of his train.

En route to Altoona, Extra 470 West made only one stop at Colfax, where the second car behind the locomotive was set out in a siding at that location. The placarded tank cars, each of which were loaded with approximately 29,100 gallons of denatured ethyl alcohol, then became the second and third cars behind the locomotive.

The Accident

Departing Altoona, Extra 406 East traveled eastward and began descending on a 0.85 percent grade. The engineer stated that he made a "first service" reduction (5-7 pounds) of brakepipe pressure, using the automatic brake valve, which applied the brakes while moving down the hill, and that he then moved the throttle to the fifth position. While the train was moving in a left hand (direction of movement) 1 degree curve, the

engineer observed Extra 470 West approaching. He estimated the two trains were about 300 feet apart and that his train was traveling between 15 and 20 mph at the time. He stated that "I thought I put the train in emergency. I shut the throttle down, put the train in emergency...." He stated that he left the engine through the cab door on the left (north) side of the cab of the engine, crossing over in front of the conductor who was sitting on that side of the cab doing paper work. He stated that as he was leaving the cab, he yelled at the conductor, "There's a train. Let's jump." The conductor stated that he did not hear the engineer say anything to him and that when he saw Extra 470 West coming around the curve, he positioned himself on the cab floor, braced his feet, and wrapped his arms around the control stand. A few seconds later, Extra 406 East and Extra 470 West collided head on within yard limit territory near MP 346.1. (See figure 3.)

All four locomotive units of Extra 406 East derailed but remained upright and in line with the track. The lead unit of Extra 406 East overrode the locomotive unit of Extra 470 West. (See figure 4.) Eleven cars of Extra 406 East also derailed with the lead car overriding and striking the trailing locomotive unit.

The first three cars of Extra 470 West, including the two placarded tank cars, derailed and overturned. (See figure 5.) Both tank cars overturned into a shallow ditch on the north side of the tracks with the top of each car facing north. Both tank cars were positioned about 90 degrees from the vertical. The lead car of Extra 470 West overrode the locomotive unit of that train.

A log from the Polk County Sheriff's department indicates that three calls were received between 11:44 a.m. and 11:49 a.m. notifying the sheriff's department of the accident. A nearby resident, who stated that he heard the accident and saw a couple of cars "flip over," estimated that the accident occurred about 11:44 a.m. He notified the sheriff's department, and then he and his wife, an emergency medical technician, went to the accident scene where they arrived about 11:50 a.m. About the same time, an Iowa state trooper and a lieutenant from the Altoona police department, both of whom had been notified of the accident through the sheriff's department, arrived at the railroad grade crossing at NE 54th Avenue east of the accident. They left their vehicles and ran west down the railroad tracks to the accident site. When the state trooper reached the accident site, he encountered the engineer of Extra 406 East whom he described as "real upset."

The trooper stated that the engineer informed them that he was unable to locate other crewmembers. In an effort to locate survivors, the lieutenant, the trooper, and the engineer climbed onto a "flat platform," which was what remained of the westbound locomotive. (According to the officers, they were not aware that this was the platform of the locomotive unit, Extra 470 West, until the engineer informed them.) The officers then climbed onto one of the derailed tank cars, ADMX 29477. At this point, the officers observed the body of one crewmember under one of the tank cars. The lieutenant stated that he noticed "... some leakage from a spout on the one tanker," on which



Figure 3.--Extra 406 East (left) and Extra 470 West (right).

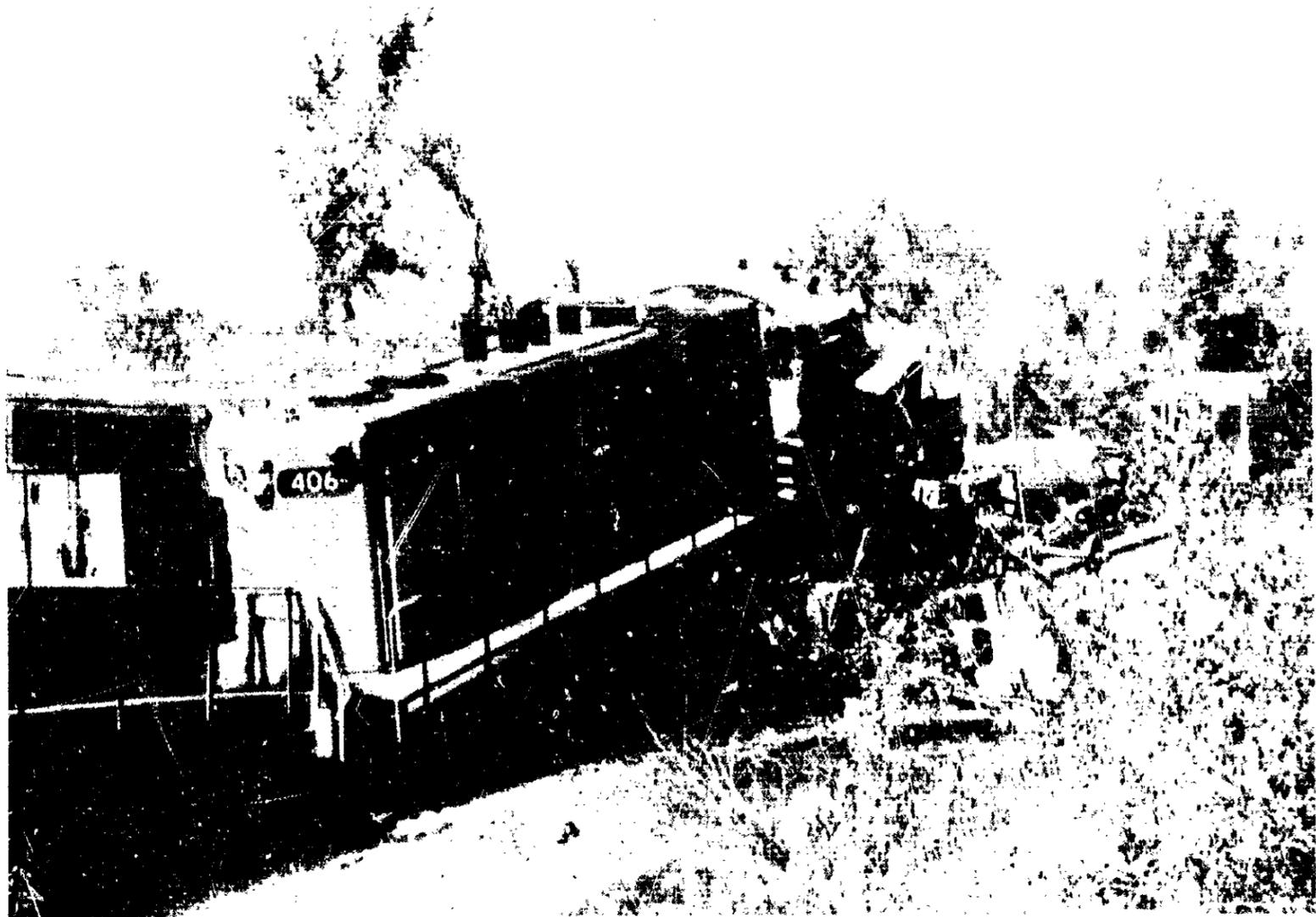


Figure 4.--Unit 406 Overriding Unit of 470 West.

the two officers were standing. They then copied the number from the placard on the side of the car and radioed the information to Polk County officials. The officers stated that they also observed a fire in the vicinity of the locomotive of Extra 470 West. According to the officers, the fire had not reached the two tank cars at the time. Because they believed that an explosion was possible, they left the immediate area. The officers, along with the emergency medical technician, the engineer, and the communications worker, who had heard the accident from her location at Altoona station and walked to the accident site, proceeded east toward the railroad grade crossing at NE 54th Avenue.

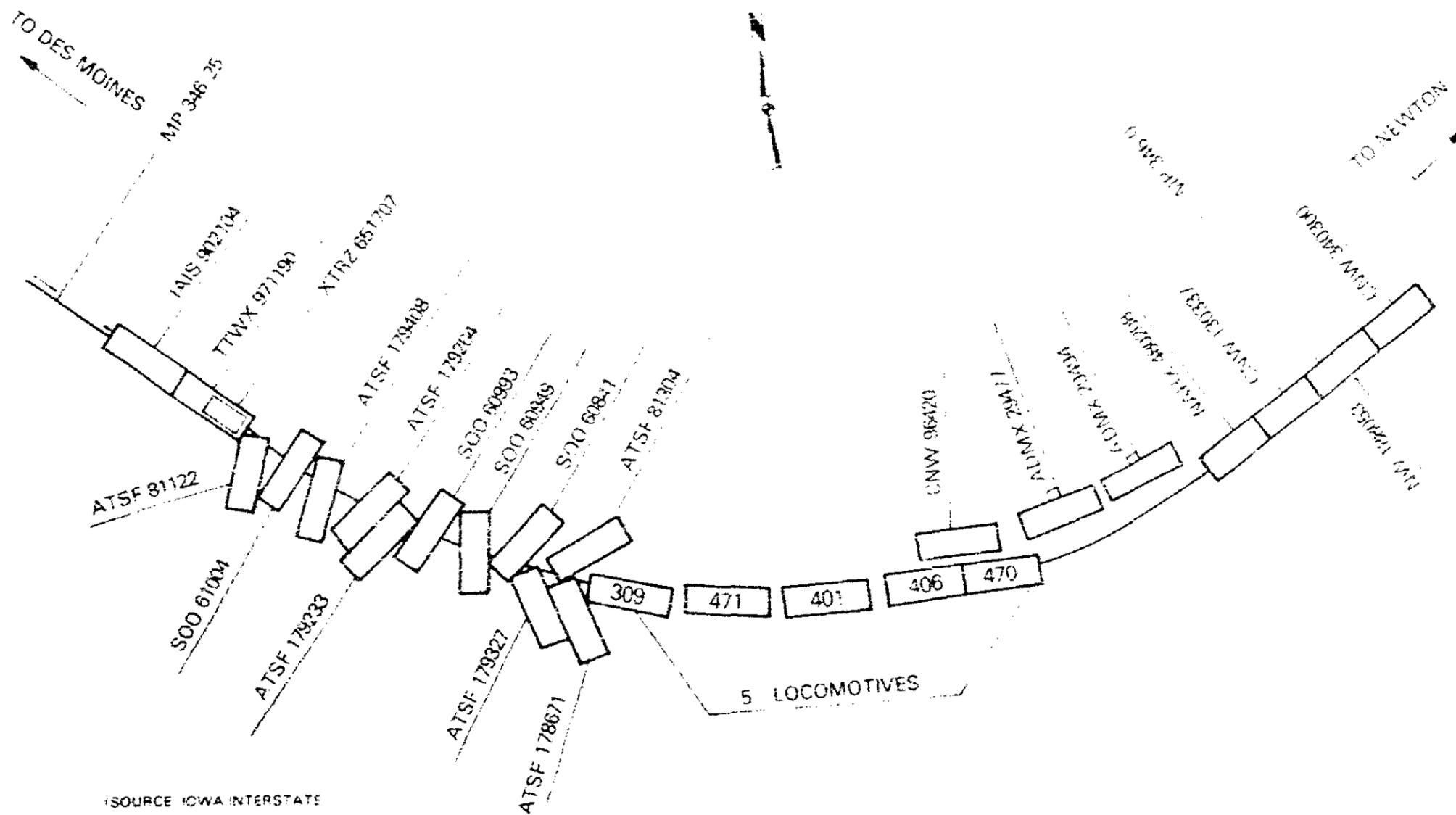


Figure 5.--Sketch of Derailment.

The engineer was helped by the emergency medical technician into an ambulance that had arrived at the grade crossing. The conductor, who had extricated himself from the cab and immediately left the wreckage area, was already in the ambulance.

The communications worker later testified that the engineer stated, "Yeah it is [my fault]...Why do you think I feel so bad? We had orders to wait at Altoona until noon, but we finished our work early, so we left at ten till." When questioned later about train order #213, both the engineer and conductor of Extra 406 East stated that the train order did not authorize them to leave Altoona before 12:01 p.m., that they did not wonder about the whereabouts of Extra 470 West, and that they could offer no explanation as to why they departed Altoona before the designated time.

Emergency Response

After receiving a call from the Polk County Dispatch, personnel from the Altoona fire department were dispatched to the railroad grade crossing at NE 54th Avenue. The state trooper and the police lieutenant warned the fire department personnel who had just arrived at the grade crossing that product was leaking from one of the tank cars. The firefighters then proceeded down the tracks toward the wreckage. The firefighters observed at this time that the fire had now impinged upon the locomotive of the westbound train. The two fire units that had responded to the call were then directed to a location in a bean field about 1/8 to 1/4 mile southwest of the accident site, a location that the fire chief decided would be more accessible to fight the fire.

From the number reported on the placard, the Altoona fire department was able to identify the product in the tank cars from the 1987 Department of Transportation's Emergency Response Guidebook. About 1:30 p.m., the fire department had one of the two trucks approach the accident site from the bean field and extinguish a grass fire on the south embankment about 40 yards west of the lead locomotive of Extra 406 East. One firefighter climbed on top of a derailed car from Extra 406 East and observed a flame at the west end of the west tank car, ADMX 29477. He stated that he realized it was product burning from the tank car because of the "flame's color and erratic movement." The firefighters then left the area of the tank cars because of the potential for an explosion of the tank car.

At 12:53 p.m., the Polk County dispatcher notified the Des Moines fire department and requested assistance from the department's hazardous materials team. The five-man team arrived at the command post at 1st Avenue and Adventureland (NE 54th Avenue)⁴ about 1:08 p.m. Shortly afterward, two members of the hazardous materials team, wearing protective clothing and self-contained breathing apparatus, proceeded to the grade crossing at NE 54th Avenue and approached the accident site along the tracks. They were unable to observe the west tank car, ADMX 29477, because trees obstructed

⁴ Adventureland is the name of the street within the city limits of Altoona and the street becomes NE 54th Avenue in the county.

their view. However, they did observe the east tank car, ADMX 29494. One of the two team members stated that ADMX 29494 was on fire at one of the two pressure relief valves located on the top of the car. Although the second team member did not identify the specific location, he stated that product was venting and burning from ADMX 29494. He also noted that flame was impinging on the top of the tank car which was lying on its side. The hazardous materials team then withdrew from the accident site and returned to the command post. About 2:30 p.m. two members of the hazardous materials team, the superintendent of operations of the IAIS, a second IAIS employee, and the Altoona police chief approached the accident site from the south and west end of the tracks. The police chief and the two hazardous materials team members crossed to the north embankment and approached within 30 yards of the two tank cars. The two hazardous materials team members reported that they observed that both tank cars were burning from the pressure relief valves and that flames were impinging upon both tanks.

Shortly after the second approach, representatives from the IAIS, the Iowa State Patrol, the Polk County sheriff's office, and the Altoona police and fire departments met and agreed to permit the tank cars to burn and initiate an evacuation of those residents living within a 1 1/2-mile radius of the burning tank cars. An approximate 3/4-mile radius evacuation was eventually established to allow for traffic flow around the area. The 1987 Emergency Response Guidebook recommends to "isolate for 1/2 mile in all directions if the tank car...is involved in fire." The evacuation area was bordered on the east by 88th Street SE and 80th Street, on the west by First Avenue North, on the north by NE 62nd Avenue, and on the south by US Route 6. (See figure 6.) An estimated 1,500 citizens were evacuated.⁵

A field inspector for the Association of American Railroads (AAR) arrived in Altoona about 9:20 p.m. on July 30, at the request of the IAIS to provide technical assistance. Upon arrival, he proceeded to the accident site to inspect the tank cars and noted that both cars were burning "from the dome areas and out of the safety valves."

During the period from late evening on July 30 to the early morning hours of August 1, the tank cars were left to burn. Police department personnel continued to man control points around the area and kept the area clear of sightseers. During this time, the railroad made arrangements with a contractor, Hulcher Services, Inc., to clear the wreckage. On July 31, the contractor began positioning equipment needed to clear the wreckage.

Salvage of the Tank Cars

Hulcher began clearing the wreckage about 7 a.m., on August 1, from the west end of the wreckage and worked east toward the tank cars.

⁵ The Altoona police chief estimated 75 percent compliance with the evacuation on Saturday, July 30, and 50 percent compliance on July 31. The evacuation was lifted at 6:00 p.m. on Monday, August 1.

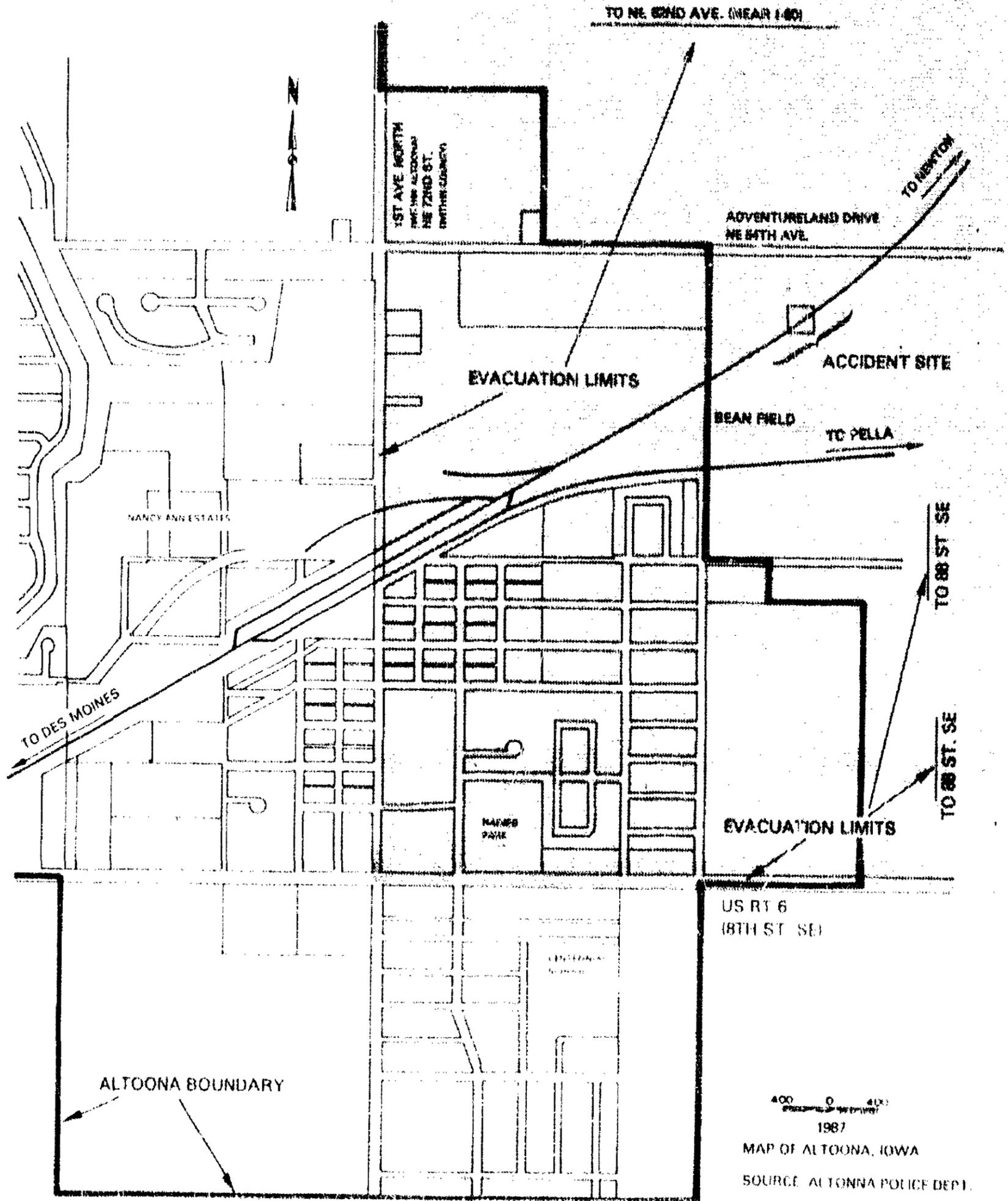


Figure 6. --Evacuation Area of Altoona.

Before Hulcher personnel reached the tank cars, a Safety Board investigator and representatives from the IAIS and the Archer Daniels Midland Company (ADM), the owner of the tank cars, approached the accident site about 9:00 a.m. to observe the tank cars. The fire at ADMX 29477 had extinguished itself during the night of July 31 and the morning of August 1. The group observed that tank car ADMX 29494 was burning around the manway cover (see figure 7) and that liquid was leaking from the manway opening in a steady drip. Liquid was observed leaking from the center of the pressure relief valve on the "A" end or leading end of ADMX 29494, but was not burning. Moments before the tank cars were to be righted, ADMX 29494 was sprayed with alcohol foam to extinguish the fire burning around the manway cover.

Once the tank cars were upright, IAIS decided to mount the tank cars on trucks and move them just west of the crossing at NE 54th Avenue where the remaining alcohol in each car could be off loaded. West Side Salvage, the company contracted to off load the alcohol, estimated that approximately 21,000 to 23,000 gallons were recovered from ADMX 29494 and 13,000 to 15,000 gallons from ADMX 29477.

Injuries

Injuries	Extra 406 East	Extra 470 West	Total
Fatal	0	2	2
Serious	0	0	0
Minor	2	0	2
None	0	0	0
Total	2	2	4

Damages

Extra 406 East.--The lead unit of Extra 406 East received major crush damage to the front with sheet metal displacement that extended 2.5 feet to the rear. The interior of the cab of this unit was destroyed by the post-accident fire. The remaining units received light to moderate damage. The trailing unit received damage when it was struck and overridden by the first car of the consist. Three of the 11 cars that derailed were destroyed.

Extra 470 West.--The only locomotive unit in the consist of Extra 470 West was completely destroyed by impact.

The postaccident visual inspection of the two tank cars on the afternoon of August 2 revealed a dent in the tank shell head at the B-end, or leading end, of ADMX 29477, the lead tank car (second car from the head end) in the train. When facing the B-end, there was a crease on the left side of the tank shell just forward of the first circumferential weld seam in the side shell. The tank shell was scorched and burned around the manway and the pressure relief valve toward the A-end. The scorched and burned area extended about 2/3 the tank length from the manway toward the A-end and on the side of the tank that faced up on the overturned tank. The paint around the manway had been burned away, or was blistered. There was no visible



Figure 7.--Burning at Manway Cover of ADMX 29477 (foreground) and ADMX 29494.

warping, buckling, or other obvious indications of structural damage to the tank shell observed. The bottom outlet valve extension and cap did not have any obvious damage. The manway cover and nozzle were not visibly warped. The area where the gasket contacted the manway cover had some unknown residue that had burned, but had no visible scars or marks.

The A-end of ADMX 29494, which had been the leading end of the car, had no visible damage. A small crease was found in the tank shell on the side that had been on the ground toward the B-end of the tank car. The tank shell was scorched around the manway opening and the pressure relief valve toward the A-end of the car. The scorched area extended around the side of the overturned tank that faced up, but it did not extend toward either end of

the tank. The paint in areas adjacent to the scorching was blistered. The bottom outlet valve extension and cap showed no visible damage. The manway nozzle and lid were not visibly warped or deformed.

The initial damage estimate by IAIS (based on depreciated value) was:

Equipment	\$552,000
Track (600 feet)	60,000
Wreckage/Clearance	60,000

Total damages including lading were expected to exceed \$1 million. Although the Safety Board requested the IAIS to provide its final estimate of damages, this information has not been provided.

Track and Signal Information

Track.--The accident occurred on the single mainline track within yard limits about .8 mile east of Altoona, Iowa, near MP 346.1. The Altoona station is located at MP 346.9⁶, and is listed in IAIS Timetable No. 2, dated April 15, 1987. The IAIS established the Altoona yard limits by general order No. 2, dated January 1, 1988, from MP 346.0 to MP 347.5. By general order No. 22, dated July 8, 1988, the railroad designated the roadway signs that were to be installed.⁷ On the day of the accident, no roadway signs had been installed.

The track was constructed of 119-pound RE continuous welded rail (CWR). The rails were laid on tie plates with two rail holding spikes per plate on 7-inch by 9-inch by 8-foot 6-inch treated timber crossties at about 21-inch centers. The CWR east and west of the derailment site was box anchored every fourth tie. The track within the accident location was on a 1 degree curve to the left (based on the direction of movement of Extra 406 East) and had 1 1/2-inch superelevation. The length of the curve is about 1,429 feet. There was heavy foliage on both sides of the track in this area. The track profile at the point of collision (MP 346.1) was level with a 0.85 percent ascending grade for westward trains and a 0.76 percent ascending grade for eastward trains. About 600 feet of track were destroyed in the derailment.

According to IAIS Timetable No. 2, the authorized maximum timetable speed for subdivision 3 was 40 mph. (In 1986, the track had been rehabilitated to meet the minimum standards for a Federal Railroad Administration (FRA) designation of class 3 track. The maximum operating speeds for FRA class 3 track are 40 mph for freight trains and 60 mph for passenger trains.) However, the engineering officer stated that because of high temperatures, train order 610 had been issued on July 11, 1988.

⁶ Altoona station is designated by a sign on a small metal building near the Main Street grade crossing.

⁷ The roadway signs to be installed included a "Yard Limit Approach" sign to indicate that the yard limits were located 1 mile in advance of the yard limits, and a "Yard Limit" sign to indicate the yard limits.

instructing trains not to exceed 25 mph between MP 325.0 and MP 350.8; this order had been in effect 24 hours per day since that date. Extra 470 West and Extra 406 East had both been issued train order 610 on the day of the accident.

In accordance with the FRA requirements for class 3 track, the IAIS had inspected the track weekly. On July 20, 1988, the Iowa Department of Transportation (DOT), which was responsible for performing FRA oversight inspections for Track Safety Standards, conducted a track inspection of the IAIS system through the Altoona area between MP 325 and MP 350.8; no defects were noted.

Signals.--Between 1980, when the Chicago, Rock Island, and Pacific Railroad declared bankruptcy and ceased operations, and 1984, when the IAIS began operations, two other railroads (the CNW and the Iowa Railroad) had requested and received authority from the FRA to operate over portions of this territory without use of the block signal system.

The CNW filed a block signal application, in accordance with 49 CFR Part 235, with the FRA in 1980 and requested that the FRA grant authority for the CNW to discontinue the use of the traffic control system between Des Moines and Newton, Iowa, and to discontinue the use of the automatic block signal system between Newton and Iowa City and between MP 355.6 and MP 351.7 at Des Moines, Iowa. The CNW reported that the proposed method of operation was to be by timetable and train orders except at Newton and Des Moines where "yard limit rules" would apply. Existing train traffic was reported as one switching move per day with no following or opposing train movements and with no scheduled passenger trains.

The FRA held a public hearing regarding the CNW's request, and similar requests by other railroads, and conducted a field investigation of the CNW territory in question. The FRA field investigation report noted that when the Chicago, Rock Island, and Pacific Railroad ceased operations all "power supply meters" were removed. The report noted further that the signal system was well maintained until operations ceased but since that time vandalism across the entire area had been extensive, numerous signals had been shot out, cases broken into damaging relays, cabinets and wiring and that all copper line wires had been stolen with the exception of a few isolated areas. Based on the recommendation in the field investigation report and the lack of objection in the public hearing, a brief was prepared and sent to an internal FRA safety board. The FRA subsequently granted the CNW the authority requested.

When the Iowa Railroad began operations, it also filed a block signal application with the FRA in May 1982 requesting authority to discontinue use of the automatic block signal system from Des Moines to Iowa City, Iowa, and that the approvals granted to the CNW be amended to include the Iowa Railroad. The proposed operation was reported to be two trains a day. The IAIS also stated to the FRA that when traffic increased the signal system would be made operative. No passenger trains were anticipated. The FRA did not hold a public hearing on the Iowa Railroad's request (nor was it required to) but did conduct a field investigation and prepared a brief that was

presented to an internal FRA safety board. Based on the information presented, the FRA granted the Iowa Railroad temporary approval until November 18, 1984.

Before the Iowa Interstate Railroad began operations in November 1984, it requested, in a letter dated October 14, 1984, that the FRA grant authority for the IAIS to operate without the use of the existing block signal system, and requested further that all previously granted relief for the territory from Council Bluffs, Iowa, to Bureau, Illinois, be transferred to them. The IAIS did not file a block signal application. IAIS officials informed the FRA that their operations would be similar to that of the Iowa Railroad and that an application for "permanent discontinuance" of the block signal system would be made at a later date. The IAIS Superintendent of Operations stated to Safety Board investigators that "...the signals were still there, but they were inoperative. They had been vandalized. All of the relays and batteries and all the necessary equipment for the signal system had been vandalized to a point that it was cost prohibitive to restore them...."

The FRA Associate Administrator for Safety responded to the IAIS on November 23, 1984, informing the IAIS that FRA's previous approvals to operate without use of the block signal system had been granted on a temporary basis.⁸ The letter stated further, "...I strongly urge that you take immediate steps to make application for FRA approval of whatever action you intend to take in the matter of the retention or disposition of the signal system on the tracks of the former Chicago, Rock Island, and Pacific Railroad between Council Bluffs, Iowa, and Davenport, Iowa...."

The FRA informed the Safety Board that it should not have addressed in its letter to the IAIS the need to consider the abandonment of the signal system from Des Moines to Newton because the previously granted approval to the CNW would have transferred automatically to the IAIS.

The IAIS provided Safety Board investigators an unsigned copy of a letter dated April 14, 1987, in which the IAIS requested that the FRA grant the IAIS authority to operate permanently without using the block signal system. The IAIS stated that it has not received a response to its letter. The FRA Standards Division Chief for Signals informed the Board that the FRA has no record of having received a request from the IAIS regarding permanent operation without use of the block signal system.

Safety Board investigators observed that signal No. 3472, located approximately 0.3 mile west of the Altoona station (see figure 2), had not been removed, covered, or turned away from the track.

⁸ For the area at Altoona, FRA's approval to the Iowa Railroad to operate without the signal system expired on November 18, 1984.

Train Information

Extra 406 East.--At the time of the accident, Extra 406 East was a caboosless train that consisted of 67 freight cars and 4 diesel-electric locomotive units, with a trailing tonnage of approximately 7,000 tons. All the locomotive units of Extra 406 East and the locomotive unit of Extra 470 West were manufactured by the Electro Motive Division (EMD) of General Motors Corporation, were previously owned by the Illinois Central Gulf Railroad (ICG), and were rebuilt with a low profile short hood. The IAIS does not use event recorders in their locomotive units.

The lead unit of Extra 406 East was equipped with a new radio unit that was being tested by IAIS. Based on statements of the crew of Extra 406 East, the radio on their train was operative.

During the postaccident inspection of locomotive unit 406, the controlling locomotive of Extra 406 East, the cab controls and the 26L air brake valve were found in the following positions: control stand reverser in the forward position; throttle in eighth position; automatic brake valve in emergency position; independent brake valve in applied position; the left side emergency valve in the closed position; MU-2-A valve in the lead position;⁹ and the operating switches in the "on" position.

Extra 470 West.--When Extra 470 West departed Newton, it consisted of one diesel-electric locomotive unit, 3 loaded cars and 5 empty cars.¹⁰ It is unknown if an initial air brake test was conducted at Newton.

Postaccident inspection of unit 470, the only locomotive unit of Extra 470 West, found the automatic brake in the service position with the handle broken off, and the MU-2-A valve in the lead position. The throttle stand was not located following the accident. Due to the extensive destruction, the condition of the air brake valves could not be ascertained. The A-1

⁹ This air brake control valve must be in either the lead or trailing position (depending on the location of the locomotive unit, i.e., lead unit or trailing unit) for the operation of the independent brake.

¹⁰ Extra 470 West was configured from the front end as follows: locomotive unit, 2 empty covered hoppers, 2 loaded tank cars, 1 loaded covered hopper, and 3 empty gondolas.

charging cut-off pilot valve¹¹ was removed for inspection and testing. (See Tests and Research.)

With the exception of the hand set, the radio equipment on the locomotive unit of Extra 470 West was mounted in the short hood. There is no record of radio communications involving Extra 470 West on the day of the accident.

Tank cars ADMX 29477 and ADMX 29494, both U.S. Department of Transportation (DOT) specification 111A100W1 tank cars, were built in 1985 by American Car Foundry (ACF) Industries, Inc. for the Archer Daniels Midland Transportation Company (ADM). The tank cars were approved for the transportation of ethanol and products authorized in 49 CFR Part 173 for which there "are no special commodity requirements."¹²

Both tank cars had an inside length of 53 feet 10 1/2 inches and an inside diameter of 9 feet 11 1/8 inches. The 7/16-inch tank shell of the cars was fabricated from Association of American Railroads (AAR) TC-128 Grade B tank car steel, and the 15/32-inch tank heads were fabricated from American Society for Testing and Materials (ASTM) A-515 Grade 70 steel. The full capacity of each shell was 30,000 gallons based on a lading of 29,400 gallons and a 2 percent outage¹³ of 600 gallons. The AAR design specification indicated that the test pressure for the tanks was 100 psig. Each tank car was equipped with 100-ton trucks and type E top and bottom shelf couplers. The light weights of ADMX 29477 and ADMX 29494 were 67,800 pounds and 67,200 pounds, respectively. Neither tank car was equipped with head shield protection, nor required to be by federal regulations.

¹¹ When an emergency application occurs regardless of whether it was initiated from the automatic or emergency brake valve, from an undesired separation of locomotive units or cars, from the caboose valve or any other sources, the A-1 charging cut-off pilot valve responds by going to application position where it (1) delivers air pressure to the brake valve which immediately cuts off air flow to the brake pipe, (2) delivers air pressure to a pressure switch which nullifies dynamic brake, (3) delivers air pressure to a pressure switch which causes power to be cut off, (4) and delivers air pressure to initiate sanding for a specific time period (if so equipped).

¹² Based on this regulation, the tank cars could have transported any nonregulated commodity or any regulated commodity that does not have any special handling requirements, such as insulated tanks or a cargo heating system.

¹³ The amount of unfilled volume remaining inside the tank car after the tank has been loaded to allow for the product to expand in case of changes in the ambient temperature.

Both tank cars had a top manway entrance with an inside diameter of 20 inches. A hinged lid covered the manway opening and was secured by 8 bolts and nuts around the circumference. A vacuum relief valve was mounted in the center of the manway lid. The ACF design drawing for the manway arrangement specified that the manway gasket be white neoprene, with an outside diameter of 21 7/8 inches, an inside diameter of 18 7/8 inches, and a thickness of 1/8 inch. The ACF design drawing did not include any specifications for gasket hardness or compressibility. ACF also specified that Bostick 1142 cement be used to secure the gasket to the cover.

Both tank cars were also equipped with two pressure relief valves, located on each side of the manway, and a bottom outlet valve. The relief valves were rated to discharge at 75 psig.¹⁴ The relief valves on ADMX 29477 and ADMX 29494 were tested by the manufacturer, Midland Manufacturing Corporation (Midland), in September 1985 and October 1985, respectively. The test certificate indicates that all four relief valves opened at 75 psig and were vapor tight at 60 psig.¹⁵ The test certificate also indicates that the tanks were hydrostatically tested at 100 psig without evidence of leakage. The president of Midland stated that the two relief valves are tested in a vertical position only but that, in the absence of pressure, the relief valves should be vapor and liquid tight regardless of the position or orientation of the valves with respect to the vertical. The bottom outlet valves are designed to function and effectively shut off the flow of liquid even if exposed to fire. The manufacturer has stated that these type valves are intended for use with flammable and other hazardous materials. The bottom outlet valves are rated for absolute pressures to 285 psi and for temperatures ranging from -20 degrees F to 500 degrees F.

¹⁴ Psig - pounds per square inch gage. Gage pressure is the difference between the total absolute pressure within a container and atmospheric pressure (14.7 pounds per square inch absolute), and measures the magnitude of the net pressure exerted on the container.

¹⁵ As the internal tank pressure increases, the valves are designed to start opening at 60 psig and be completely opened at 75 psig.

Method of Operation

The IAIS is a regional railroad,¹⁶ which began operations in November 1984.¹⁷ The Heartland Corporation,¹⁸ with the assistance of major freight shippers who faced uncertainty about continued rail service, acquired certain property and trackage rights from the trustees of the estate of the Rock Island. The Iowa Interstate Railroad then acquired the right to use this property and track through a long-term lease with a fixed buy-out option at the end of the lease period, and operations were initiated.

The IAIS is a nonsignaled (dark) single track, mainline railroad operated by timetable, train orders, and special instructions. Trains are operated by two crewmembers--an engineer and conductor. IAIS normally operates two through trains daily, one in each direction between Blue Island, Illinois, and Council Bluffs, Iowa, and local trains that originate at various intermediate terminals. The IAIS also operates five branch lines. During the investigation, IAIS officials made reference to train operations that had been announced for special passenger train excursions over the IAIS.

The dispatcher's office, located in Iowa City, Iowa, is staffed by one dispatcher on each 8-hour shift 24 hours a day who handles the 488 miles of railroad between Blue Island and Council Bluffs.

General orders, general notices, and special instructions are issued by, and over the signature of, the Superintendent of Operations. On April 14, 1987, general order No. 26 was issued to all employees adopting Timetable No. 2, dated April 15, 1987, and the General Code of Operating Rules, to be

¹⁶ Although there is no set definition, a regional railroad is considered a railroad larger than a short line railroad (usually with more than 200 route miles), but smaller than a Class I railroad and usually considered a Class II railroad. Within the last 15 years, approximately 19 regional railroads have begun operation as newly created railroads or with new ownership.

¹⁷ According to testimony of the president of IAIS, when the IAIS was granted authority on October 10, 1984, by the Interstate Commerce Commission to conduct operations, the Rock Island lines were being used by tenants (the Milwaukee Railroad Company and the Iowa Railroad Company) with short-term leases.

¹⁸ The Heartland Corporation is a holding company controlled by on-line shippers and the Cedar Rapids & Iowa City Railroad. The Cedar Rapids & Iowa City Railroad is a 50-mile railroad owned by the Iowa Electric Light and Power Company.

effective April 22, 1987.¹⁹ On January 1, 1988, general order No. 1 was issued outlining changes in the General Code of Operating Rules as they would apply on the IAIS. On January 10, 1988, general order No. 10 was issued cancelling all general orders Nos. 1 through 70 for 1987 in their entirety. According to the IAIS Superintendent of Operations, the General Code of Operating Rules, although annulled by general order No. 10, remained in effect on the IAIS.

Rule 93 of the General Code of Operating Rules governs the movement of trains within yard limits. Rule 93 states, in part: "...movements within yard limits must be made at restricted speed..." Restricted speed is defined as follows:

A speed that will permit stopping within one half the range of vision; short of train, engine, railroad car, stop signal, derail or switch not properly lined, looking out for broken rail, not exceeding 20 mph.

When the engineer of Extra 406 East was asked about the application of rule 93 and the yard limits at Altoona, he stated, "...I never really thought of...how far east of Altoona it [yard limits] went. I knew that we had a yard limit rule at Altoona, but I never did know exactly where--how far it extended."

Federal regulations address the designation of yard limits. 49 CFR 218.35, states, in part:

- (a) After August 1, 1977, yard limits must be designated by--
- (1) Yard limit signs, and
 - (2) Timetable, train orders, or special instructions.

The dispatcher was able to communicate with trains by radio or by crewmembers calling from a wayside telephone. The radio system was a repeater type system with transmitters being located at strategic locations to facilitate coverage (intended eventually to be complete coverage) of the railroad. On the date of the accident, installation of the entire system had not yet been completed and "dead spots" (locations where reception was poor or nonexistent) existed on some parts of the railroad. Preparatory work was in progress for installing a radio repeater transmitter at Altoona to improve radio reception in the future. Stations where telephones were located, which included Altoona and Newton, were designated in the timetable. The crew of Extra 406 East testified that before departing Altoona, they did not attempt to radio the dispatcher or Extra 470 West, nor were they required to do so by company rules.

¹⁹ Prior to April 22, 1987, the IAIS operated under the Uniform Code of Operating Rules, which had been in effect on the former Rock Island property.

A "standard" clock²⁰ was located in the enginehouse office at Council Bluffs. Rule 3 of the General Code of Operating Rules states, in part:

Time comparison: the watches of employees designated must be compared with a standard clock before commencing each days work...Conductors must, when practicable, compare time with their engineers before starting each trip or days work.

Although the conductor testified that he compared his watch with the standard clock in Council Bluffs, neither crewmember could recall if they compared time with each other before commencing the trip. The engineer testified that he did not know the location of the standard clock at Council Bluffs.

When asked if anyone was assigned the duty of reporting the times trains departed Newton, the assistant superintendent of operations in Newton stated, "I think it is. Sometimes I will do it, sometimes the agent does it. It's nobody's specific duty." When the dispatcher on duty at the time of the accident was asked how dispatchers receive information on the arrival and departure times of trains moving over the territory, he stated, "...if there's someone on duty at the station...they will call in...or else the crew will call on the radio..." There were no departure times recorded on the train sheets for Extra 470 West on July 30, 1988, when it departed Newton, its initial terminal. The dispatcher further stated that because train order 213 "...was a right over order...I don't have to follow it [Extra 470 West] as carefully."

Dispatchers are required to maintain a record of train movements, in accordance with 49 CFR 228.17, which states, in part:

(a) each carrier shall keep, for each dispatching district, a record, of train movements made under the direction and control of a dispatcher who uses telegraph, telephone, radio, or any other electrical or mechanical device to dispatch, report, transmit, receive, or deliver train orders pertaining to train movements. The following information shall be included in the record:(9) direction of movement and the time each train passes all reporting stations. (10) arrival and departure times of trains at all reporting stations.

Newton and Council Bluffs are designated by the IAIS as reporting stations.

Rule 521, paragraph 4, of the General Code of Operating Rules requires that, before a train order is acted upon, both the conductor and engineer must have a written copy of the train order and make certain that the train order is read and understood by other members of the crew.

²⁰ A clock designated by the railroad as one which provides the correct time.

The IAIS had no procedures or rules to require that train order operators verify to dispatchers that train orders have been received by traincrews.

Rule 93 of the General Code of Operating Rules also states, in part, "Trains must clear other trains which are superior as prescribed by Rules 86 and S-87." This statement was annulled by rule 7 of the special instructions in IAIS timetable No. 2, which read: "Rule 93: 3rd paragraph does not apply." The superintendent of operations stated that the third paragraph of rule 93 had been deleted to enable trains to operate within yard limits without concern as to the superiority of trains. Rule S-87 states that "An inferior train must clear the main track not less than 5 minutes before the timetable schedule leaving time or train order waiting time of an opposing superior train."

The IAIS operates over trackage of the DMU and the CNW between MP 353.2 and MP 364.5. Special instructions in IAIS timetable No. 2 for the third subdivision in which Newton, the home terminal and initial station of crews operating over this territory, is located states, in part, "Between MP 350²¹ and MP 364.5, trains and engines will be governed by timetable and rules of the CNW Transportation Co. and DMU R.R. Permission from the CNW yardmaster must be obtained before entering these limits."²² The IAIS also operates over trackage of METRA²³ between Blue Island and Joliet, Illinois, and over trackage of the CSX Transportation Company between Joliet and Bureau, Illinois.

Rule 4 (c) of the General Code of Operating Rules states, in part, that general orders, bulletins, notices and circulars will be posted in books and/or on bulletin boards at stations designated in the timetable. IAIS timetable No. 2 designated Newton as a station where general order boards or books were located. Current general orders, general notices, and special instructions of the CNW were not posted on the bulletin board at Newton. At the Safety Board's deposition proceedings, IAIS officers stated that information on operations over CNW trackage was now being posted at Newton.

Company rules and Federal regulations require that when a train is originally made up (initial terminal) and when a train consist is changed by picking up or setting out cars (intermediate locations), a test of the train air brake system must be conducted in accordance with prescribed procedures.

²¹ IAIS officers testified that trackage recently had been acquired by the Heartland Corporation from the CNW between MP 350 and MP 353.2.

²² As noted previously, MP 353.2 and MP 364.5 are, respectively, the east end and the west end of CNW's yard at Des Moines. CNW rules govern the movement of trains within the yard. CNW had not deleted the third paragraph of Rule 93 of the General Code of Operating Rules.

²³ METRA is the former Northeast Illinois Railroad Corporation now under the authority of the Chicago Commuter Rail Service Board.

(See appendix D.) The conductor of Extra 406 East testified that an initial terminal air brake test of the train had been performed by the switchcrew at Council Bluffs, and that the enginecrew had received a written note to that effect before they departed. He further stated that no tests were made after they coupled the locomotive units to the train at that location. The crew of Extra 406 East testified that no air brake tests were performed at any of the locations where cars were set out or picked up en route from Council Bluffs to Altoona.

The positioning of tank cars within a train is addressed in 49 CFR 174.91, which states, in part:

Except for a tank car placarded "COMBUSTIBLE,"²⁴ a loaded placarded tank car in a moving or standing train may not be nearer than the sixth car from the engine, occupied caboose, or passenger car. When the length of the train will not permit a loaded placarded car to be so placed, the tank car must be placed as near the middle of the train as possible, and not nearer than the second car from the engine, occupied caboose, or passenger car.

The IAIS had included the requirement of 49 CFR 174.91 in the special instructions in timetable No. 2 that was in effect at the time of the accident. (See appendix C.)

Both the superintendent of operations and an assistant superintendent of operations assigned to the Newton yard stated that based on their understanding of rules the two tank cars should have been positioned as the sixth and seventh cars behind the locomotive, i.e., the last two cars of the train.

Personnel Information

Extra 406 East. --The engineer of Extra 406 East had been off duty from Monday evening, July 25, through Thursday, July 28, and spent the last day working on a family construction project. He slept between 10:30 p.m. Thursday and 5:00 a.m. Friday. The engineer stated that he usually worked from "8 in the morning until five or six."

The conductor of Extra 406 East had been off duty on Thursday, July 28, and spent the day at home performing various chores. He reported that he went to bed at 9:30 p.m. that evening and slept well until 5 a.m. the following morning.

Both the engineer and conductor of Extra 406 East reported for duty at 7 a.m. on July 29, 1988, and worked a 10 1/2-hour shift on an extra train

²⁴ There are no placement or separation criteria in the federal regulations for tank cars placarded as "COMBUSTIBLE."

movement before going off duty at 5:30 p.m. in Council Bluffs, where they each were provided a hotel room. The engineer and conductor stated that after eating dinner they slept a maximum of 5 and 4 hours, respectively, before being called by the IAIS dispatcher at 12:30 a.m. to report for duty at 1:30 a.m. for a return trip to Newton. They had been on duty for about 10 hours when the accident occurred. When the engineer was asked after the accident what time he thought they would have finished up on the day of the accident, he stated, "I figured our 12 hours would be close. It would be after one."

When the engineer was asked after the accident about being tired or fatigued, he stated, "I'm not used to staying awake all night, I was tired but not ---." When asked if either he or the conductor had been tired enough to nod off or to actually show the signs of fatigue, he replied, "He [the conductor] might have nodded off but not sleep. I remember looking over there and you could see his head bobbing...but he never slept, no." The conductor stated that he "wasn't really tired, no" and that he didn't have any trouble staying awake.

The engineer of Extra 406 East had 23 years of experience in railroad operations having been employed by the Rock Island and the CNW as a brakeman and conductor. He was hired by the IAIS in November 1986 as a part-time conductor and worked in that position until January 6, 1988, when he became a full-time conductor. According to IAIS training records, he began training for the position of locomotive engineer in January 1988 and was promoted to engineer on July 25, 1988, 5 days before the accident. (See additional discussion under Training Program for Engineers.)

The conductor of Extra 406 East had 32 years of experience in railroad operations, of which 23 years were as a conductor. He had been employed previously by the Rock Island and the Iowa Railroad as a brakeman and conductor.

Extra 470 West. --The engineer and conductor of Extra 470 West reported for work at 7 a.m. on July 29, and returned to their homes at 6 and 7 p.m., respectively, that evening. Each reportedly had slept about 8 hours during the night before the accident. On the day of the accident, they reported for duty at 8 a.m. at Newton and operated Extra 470 West until the time of the accident.

The engineer of Extra 470 West had more than 8 years of experience in railroad operations. Prior to being hired by the IAIS on October 25, 1986, as an engineer/conductor, he had been employed as an engineer with the Rock Island.

The conductor of Extra 470 West had 28 years of experience in railroad operations. He had been employed previously in the positions of track laborer, brakeman, and conductor by the CNW and as a conductor by the Rock Island.

Based on their experience with the Rock Island, the operating crews of Extra 406 East and Extra 470 West were considered by the IAIS superintendent of operations to be qualified for their respective positions.

Other IAIS Personnel. --The chief dispatcher on duty at the time of the accident was initially hired by the IAIS as a dispatcher in November 1984. He had no prior experience as a dispatcher but had worked part-time as a clerk with the Iowa Railroad for 4 months during the summer of 1983 before returning to school. When he began employment with the IAIS, he received no formal training on the duties of dispatcher. In addition to issuing train orders, the chief dispatcher issues general orders according to the superintendents' instructions and performs various clerical duties. He attended the rules class in April 1987 and was qualified on the General Code of Operating Rules.

The assistant superintendent of operations at Newton was employed with the IAIS in October 1984. He had been employed previously by the Rock Island and had more than 20 years of experience working as a brakeman and conductor. On the day of the accident, he performed the duties of a train order operator at Newton in addition to his regular duties. He was qualified on the General Code of Operating Rules, according to the superintendent of operations. (See appendix B.)

Training of Operating Employees

Operating Rules Classes. --The IAIS conducted training classes on the operating rules for its employees in April 1987, before issuing general order No. 26 for use of the General Code of Operating Rules and Timetable No. 2. There is no record that the company had conducted training on operating rules prior to April 1987. Based on the information provided by the IAIS, 70 percent of its operating employees attended the classes in April 1987; all those who attended the classes completed successfully what the railroad calls an "oral examination" on the General Code of Operating Rules. The superintendent of operations stated that questions for the "oral examinations" were randomly chosen and posed to the class as a whole and were discussed by the group. No written examinations were conducted. Although requested by the Safety Board, the IAIS did not provide any documentation on instructions given to the various rules examiners on how to conduct rules classes. There is no record of training or examination on the operating rules for the remaining 30 percent of the employees listed on the roster.

The engineer and conductor of Extra 406 East and the engineer of Extra 470 West attended the rules classes in April 1987; the conductor of Extra 470 West was hired after that date and received no training on the IAIS operating rules before he began working on the railroad. With the exception of the engineer of Extra 406 East (see Training Program for Engineers), there is no record of the other crewmembers receiving any other type of training.

The superintendent of operations stated that when the IAIS began operations the railroad had adopted the "Rules and Instructions for Train Handling and Operation of Air Brakes," which had been in effect on the former Rock Island since 1974 and that no updates had been made to that

document. He stated further that the train and engine crews had received copies of the manual while formerly employed with the Rock Island, and he assumed that they had retained their copies of the manual. Testimony from the crew of Extra 406 East indicated, however, that all traincrews did not have copies of the manual. There was no record that these rules and instructions had been adopted in writing. The superintendent of operations stated that the rules in the manual were taught in the rules classes. Instructions in the manual for performing the proper train air brake tests are consistent with the provisions for conducting air brake tests required in 49 CFR Part 232. The instructions in the manual, however, do not address conducting air brake tests with an end-of-train device in caboosless operations.

Training Program for Engineers.--The superintendent of operations stated that in November 1985 the IAIS implemented a formal program, which had been patterned after one used on the former Rock Island, for the promotion of operating employees from the position of conductors to the position of locomotive engineers. The program begins with a 1-day classroom indoctrination, followed by three phases of on-the-job training (OJT) during which various aspects of locomotive operations are addressed. A 1-day classroom session is held following each phase to prepare the student engineer for the next phase and the final examination. The program is to be completed within 6 months, but the timeframe may be shortened depending on the student engineer's previous experience and progress during training.

During the three phases of OJT, the student engineer is assigned to the crew as the conductor and is responsible for performing the duties of that position while simultaneously receiving instruction on the position of engineer. According to the superintendent of operations, it is the policy of the IAIS to have each train crewmember qualified as both conductor and engineer. The superintendent of operations stated that this practice is advantageous because it reduces the number of employees required for train operations and that at the time of the accident, 80 percent of the operating personnel were qualified for both positions. He stated further that all engineers on the IAIS could be assigned to serve as an instructor for a student engineer. He further stated that the instructors were provided with "a guideline...they should use" during the training. Two engineers who had served as instructors for the engineer of Extra 406 East testified that they had not been given any guidance or instructions as to what material should be covered during the training program before the accident. One of the engineers stated that he received the booklet on the training program 3 to 4 weeks before the Safety Board's deposition proceedings, which were held on November 11, 1988.

According to the training program, the assistant superintendent of operations is required to make at least one trip with each student engineer during each phase of the training to evaluate personally the progress of the student engineer. The assistant superintendent of operations is required further to certify that each student engineer is qualified to function as an engineer. This certification and the successful completion of two written examinations--one on mechanical and air brake subjects and one on operating,

safety and radio rules--are mandatory, according to the program, before a candidate can be promoted to the position of engineer.

The engineer of Extra 406 East entered the engineer training program in January 1988. His training records indicate that he served as a conductor on a yard switch engine assignment between January and May 1988. According to the engineer, there were few occasions he experienced over-the-road training from another engineer because "my job for the first 6 months was there in the Newton yard just switching...." In yard operations, the conductor has many duties and is often off the train performing switching operations. He stated that he was not evaluated by a supervisor or company official during this period of training. Although required by the program, there is no document certifying that he was qualified to be promoted to the position of engineer. The assistant superintendent of operations stated that he had not personally certified that the engineer of Extra 406 East was qualified and that he had never certified for promotion any trainee he supervised.

The superintendent of operations testified that the assistant superintendent of operations, who, according to the program, was responsible for evaluating the performance of the student engineers, was not a qualified engineer on the IAIS.

The engineer of Extra 406 East completed successfully a written examination on July 25, 1988, which also served as an operating rules examination, according to the superintendent of operations. Based on this examination and the observations of other engineers, the superintendent of operations, without ever accompanying the engineer of Extra 406 East, promoted him to the position of engineer on July 25, 1988. According to one of the instructors, the trains handled by the engineer of Extra 406 East during his training program were, on the average, 17 to 25 cars in length with a trailing tonnage of about 1,800 tons. The accident occurred during the first road trip and the second train movement to which the engineer had been assigned following his completion of training and promotion to locomotive engineer.

Operating Rules of the CNW.--The superintendent of operations of the IAIS stated that operating crews had been qualified on CNW rules to operate over trackage of the CNW at Des Moines. The engineer of Extra 406 East stated that he had not been qualified by a company official to operate over CNW trackage. The transportation superintendent of the CNW informed the Safety Board that an IAIS officer had been qualified as a rules examiner on the CNW rules. The Safety Board requested a list of IAIS employees qualified on the CNW rules and the date and method by which they were qualified, and the name of the company official qualifying IAIS employees on the CNW operating rules. The IAIS has not provided this information.

Management Oversight

The assistant superintendent of operations stated that it was company policy not to conduct efficiency testing. IAIS officers stated that they did not perform operational tests and inspections for various reasons: 1) "when the IAIS applied with the Interstate Commerce Commission, we did not indicate

we would do operational testing; 2) the company had waivers from the ICC and the FRA permitting the IAIS not to perform operational tests; and 3) the company has historically been exempt from 49 CFR Part 217.9 pursuant to Part 217.13." The IAIS could not provide documentation for an exemption or waiver. (See further discussion under Federal Regulations and FRA Oversight.)

Testimony from operating employees indicated that very little on-line supervision of the day-to-day operations of train and enginecrews outside the terminals was provided and that supervisors rarely rode trains. There were 11 supervisors for 78 train and enginemen scattered over approximately 488 miles of railroad, and the supervisors were often required to perform the duties of operating personnel. The position of road foreman of engines, who is responsible for overseeing enginecrew operations, was vacant at the time of the accident. According to the assistant superintendent of operations, this position had been vacant since "shortly after the first of the year [1988]."

A review of the IAIS personnel records of the employees involved in this accident indicated that only the chief dispatcher and the conductor of Extra 406 East had a prior record of disciplinary action while employed by the IAIS. The chief dispatcher was issued a letter of reprimand in October 1986, for accepting a transfer of train orders that failed to give a train order (running order) to a train on September 26, 1986, between Newton and Atlantic. The conductor was issued two letters of reprimand: one in October 1986 for operating a train from Newton to Atlantic without a train order (running order) on September 26, 1986, and one in December 1987, which described and cited his failure to obey a wait order on December 14, 1987, 8 months before the accident. According to the superintendent of operations, the IAIS policy regarding disciplinary action was that three letters of reprimand could constitute grounds for dismissal.

Federal Activity

Federal Oversight.--The provisions of 49 CFR Part 217 require each railroad (1) to file a copy of its operating rules, timetables, and timetable instructions and any amendments to these documents, (2) to file a program for conducting operational tests and inspections to determine compliance with operating rules, timetables, and timetable instructions, and (3) to file a program of instruction on operating rules. Furthermore, each railroad, except for a railroad with fewer than 400,000 manhours, is required to file annually with the FRA a report on these activities for the previous year. (See appendix E.)

On September 7, 1988, a Safety Board investigator was informed by FRA personnel of the Operations Practice Division that the IAIS (1) did not have a rule book on file, (2) did not have an operating procedure and inspection plan on file, and (3) had reported over 400,000 manhours for 1987.

Information obtained from the FRA indicated that on October 24, 1986, at the Council Bluffs yard, an FRA inspector noted a defect on an inspection report with regard to 49 CFR Part 217, with the remark which stated, in part:

Check train orders, general orders, rules books (none available) safety, rules book timetable (none available)[superintendent of operations] advised had ordered rule books and is printing new timetable....

Information obtained from the FRA's Headquarters System Support Division indicated that on September 2, 1987, at Blue Island, Illinois, an FRA inspector noted defects on an inspection report with regard to 49 CFR 217.9 and that he found, through discussion with company officials, that the IAIS did not periodically conduct operational tests and inspections to determine the extent of compliance with its code of operating rules, timetable, and timetable special instructions. During the Safety Board's deposition proceedings, the IAIS claimed no knowledge of the report filed on September 2, 1987. According to the FRA, a defect on an inspection report only indicates that an FRA inspector took exception to some aspect of the carrier's operations; there is no fine imposed or violation reported at that time. The FRA indicated further that an inspector can note a defect on an inspection report rather than a violation, if in his opinion, a violation is not warranted.

On August 2, 1988, an FRA field inspector filed a report on the IAIS with the following remarks:

Dispatcher's records of train movements failed to show weather condition at 6-hour intervals.

Dispatcher's record of train movements failed to show departure time of train at a reporting station.

Dispatcher's record of train movements failed to show unusual events affecting movement of trains including the head end collision of Extra 406 West and Extra 470 East on July 30, 1988.

Discussions with FRA field and headquarters personnel indicate that FRA personnel differ on what action takes place after field personnel notes defects on inspection reports. Field personnel indicated that for a violation to be levied, action would have to be initiated by headquarters personnel. Headquarters personnel indicated that defects do not result in enforcement action; violations are recommended by the field personnel and then evaluated at headquarters for sufficiency of legal basis to enforce the violation. Based on FRA records, the IAIS has never been cited for a violation of operating practices or had a penalty imposed.

On December 7, 1988, the Safety Board wrote to the FRA's Associate Administrator for Safety and requested specific information regarding the IAIS' compliance with 49 CFR Part 217 and any action contemplated by the FRA to assure compliance. (See appendix F.)

In a letter dated January 18, 1989, the FRA responded to the Safety Board's letter concerning the IAIS' compliance with 49 CFR Part 217. The FRA stated that (1) the IAIS had not been granted an exemption or waiver from the

provisions of 49 CFR Part 217 which addresses railroad operating rules, (2) the IAIS was not in compliance with 49 CFR Part 217, (3) the IAIS has not petitioned for an exemption from 49 CFR Part 217, (4) the IAIS did file a copy of its operating rules, as required by 49 CFR 217.7, and (5) the IAIS has not filed a program of instructions on operating rules, as required by 49 CFR 217.11. With respect to filing a program of operational tests and inspections, as required by 49 CFR 217.9, the FRA stated that the "IAIS, in December 1988, filed a program of operational tests and inspections with the FRA's Washington, D.C., Office of Safety." With respect to filing an annual report, as required by 49 CFR 217.13, the FRA stated that an annual "report was filed but not in a timely manner." In response to the Board's question as to how the defect that was filed in September 1987 was resolved, the FRA stated that "Carrier officials were admonished to bring the IAIS programs required under 49 CFR 217 into compliance." The FRA stated further that it "has initiated an enforcement action against the IAIS through the procedures of the Federal Claims Collection Act."

FRA headquarters personnel told Safety Board investigators that the FRA relies, primarily, on its field staff to determine if defects noted on inspection reports have been corrected by the carriers. The FRA also relies heavily on its district and regional personnel to notice trends that indicate a particular carrier may need special attention. Defects and violations noted on inspection reports are entered into a computer data base. However, the FRA does not have a formal process for the systematic evaluation of this data base. According to FRA, ad hoc reviews of portions of the data base are occasionally performed.

Accident Reporting Criteria and Previous Accidents.--The National Transportation Safety Board's rules pertaining to notification of railroad accidents are outlined in 49 CFR Part 840. (See appendix G.) By a final rule published in the Federal Register on December 6, 1988, the Safety Board amended Section 840.3 to reduce the period of time during which notification of certain railroad accidents is mandatory: 2 hours for any accident that results in a fatality or serious injury to two or more crewmembers or passengers, the emergency evacuation of a passenger train, or the release of hazardous materials; and 4 hours for any accident that requires an evaluation of property damage.²⁵ The rule change became effective on February 6, 1989. Prior to that date, a 6-hour limit was in effect.

Under 49 CFR 171.16, each carrier that transports hazardous materials must submit within 15 days to the Research and Special Programs Administration (RSPA) of the U.S. DOT a written report about each transportation incident that involves the unintentional release of hazardous materials and meets other criteria, including property damage exceeding \$50,000.

²⁵ Notification to the National Transportation Safety Board is through a toll free telephone number of the National Response Center (800 424-0201).

FRA accident/incident reporting criteria are addressed at 49 CFR Part 225. (See appendix H.)

In addition to the accident at Altoona on July 30, 1988, four other rail equipment accidents in which damages exceeded \$150,000.00, as reported by the IAIS, have occurred on the IAIS since it began operation. These accidents occurred on May 8, 1987; August 2, 1987; May 12, 1988; and May 20, 1988. In the accident on May 20, 1988, six tank cars transporting alcohol derailed and two released product. Although each of the four accidents met the Safety Board's accident notification criteria, the Board was not notified of any of the accidents. The chief operating officer of the IAIS stated that he was not aware of the Safety Board's accident notification criteria.

The IAIS did file an FRA rail equipment incident report for the accident at Altoona on July 30, 1988, and for each of the four previous accidents on its property. The incident report submitted by IAIS for the accidents on July 30, 1988, and on May 20, 1988, indicated that hazardous materials were involved. However, the FRA's computer generated report on the accident of May 20, 1988, did not indicate that hazardous materials were involved.

RSPA informed the Safety Board that the required reports were not received for either the accident on May 20, 1988, or the accident at Altoona on July 30, 1988, both of which involved the release of hazardous materials.

The chief operating officer of the IAIS stated that the company official responsible for filing reports to the FRA is also responsible for filing any hazardous materials incident reports. In a certified letter dated November 7, 1988, the Safety Board requested that the IAIS submit copies of written company procedures for reporting hazardous materials incidents. The Safety Board also requested information on the qualifications of the individual responsible for reporting the hazardous materials incidents. The Safety Board did not receive a response from the IAIS.

Testimony of the chief dispatcher indicated that there were no written procedures or list of numbers to call in the event of an accident. His statement further indicated that on the day of the accident, he believed that he was calling the FRA to notify that agency of the accident, when, in fact, he was calling the National Response Center. The chief dispatcher stated that he now has a "list of numbers to call" in the event of an accident.

Between April 1983 and April 1988, RSPA received from various carriers 27 reports of hazardous materials incidents in which tank cars shipped by ADM have released hazardous materials. The failure in 26 of these reports was attributed to either loose or defective fittings. ADM's Cedar Rapids plant, the shipper of record for ADMX 29477 and ADMX 29494, was the shipper in 2 of the 26 incident reports.

ADM's plant manager in Cedar Rapids stated that he has not received any formal notification from any carrier about problems with tank cars loaded at Cedar Rapids. The superintendent of alcohol production at the Cedar Rapids plant stated that he had been notified by some carriers about leaking valves and fittings on tank cars released from the Cedar Rapids plant but indicated

that the problems usually are with "older cars that had the top valves [top operated bottom valve] on them." He also mentioned problems with bottom valves, but stated he had no knowledge of carriers refusing to accept a tank car because the manway bolts were not tightened.

IAIS did not contact ADM about the accident on July 30, until the following day after a Safety Board investigator suggested that the railroad do so.

Meteorological Information

At 11:52 a.m., on July 30, 1988, at the Des Moines, Iowa international airport, it was sunny with a temperature of 91 degrees F. Winds were west to southwest at 7 to 8 mph. Visibility was reported to be 12 miles.

Medical and Toxicological Information

The conductor of Extra 406 East sustained a laceration to the bridge of his nose. He was admitted and later released from the hospital on July 30, 1988. The engineer of Extra 406 East sustained several abrasions on his right arm when he jumped from the locomotive just prior to the collision.

The medical examiner's office performed autopsies on August 1, 1988, on the operating crew of Extra 470 West. The report noted compression crushing and blunt traumatic injuries for both crewmembers. The report also noted "moderate decomposition" and "moderately advanced decomposition" for the bodies of the engineer and conductor, respectively. The bodies were not recovered until about 5 p.m. on August 1, more than 48 hours after the accident.

Toxicological specimens of blood and urine were obtained from the crewmembers of Extra 406 East approximately 4 hours after the accident. The samples were obtained under current FRA requirements and were forwarded to, and examined by, the Center for Human Toxicology (CHT), Salt Lake City, Utah, for the FRA. No alcohol or other drugs were detected in any of the specimens.

Tissue specimens were obtained from the bodies of the deceased crewmembers of Extra 470 West by the medical examiner two days after the accident. These samples also were forwarded to CHT for examination. Ethanol was detected by CHT in the samples of both crewmembers; no other drugs were detected. According to CHT, the ethanol was a result of bacterial contamination.

Neither the dispatcher nor the train order operator on duty at the time of the accident were requested to submit to toxicological testing.

Survival Aspects

Unit 406, the lead unit of Extra 406 East, which was operating eastbound with its short hood forward, overrode the lead unit of Extra 470 West, which

was operating westbound with its long hood forward. As a result, the fuel tank on unit 406 was damaged. With the exception of slight deformation to the rear cab door, the cab compartment structure remained intact. The postcollision fire, however, destroyed the interior of the cab compartment.

The covered hopper car immediately behind unit 470 slipped by the standard type E (nonsheff) coupler used to couple the car to the locomotive and it overrode the short hood end of unit 470 and destroyed the cab and all the associated equipment at that end of the locomotive.

Transportation of Hazardous Materials

Tank Car Design Standards.--U.S. DOT design specifications for tank cars are contained in 49 CFR Part 179. Under 49 CFR 179.3, the AAR Committee on Tank Cars has been delegated by the DOT to approve applications for the design and construction of tank cars, when "in the opinion of the Committee," the tanks and equipment are in compliance with the effective regulations and specifications of the DOT.

49 CFR Part 179 addresses several tank design details such as tank shell thickness; however, it does not require that closure fittings maintain their integrity in accident situations. For example, there are no standards such as minimum torque values and gasket specifications to assure that bolted fittings are made liquid and vapor tight. The regulations also do not require the AAR or the tank manufacturer to consider and provide protection against the internal dynamic loads (from liquid surging or sloshing, for example) to which a tank and its fittings may be subjected during a derailment or overturn. A tank car engineer at ACF Industries, the builder of ADMX 29477 and ADMX 29494, has stated that ACF does not have the expertise to "readily" calculate pressures from the dynamic loads that could have occurred in this accident.

Product Shipping Information.--ADMX 29477 and ADMX 29494 were loaded with 29,104 and 29,105 gallons, respectively, of denatured ethyl alcohol at the ADM plant in Cedar Rapids, Iowa, on July 28, 1988. The tank cars were then transported by the Cedar Rapids and Iowa City Railroad (CRANDIC) from Cedar Rapids to Iowa City for interchange and transfer to the IAIS.

The shipping papers for both tank cars identified the product as "Denatured alcohol, Flammable liquid, NA 1986 - Ethyl alcohol, anhydrous, denatured in part with petroleum products/chemicals content not to exceed 5%." The shipping papers also indicated that the tank cars were to have "Flammable" placards. Both tank cars had a flammable liquid placard bearing the number "1986" on each end and side of the tank car.

The denatured ethyl alcohol loaded in the two tank cars was a mixture of ethyl alcohol and gasoline. The concentration of the gasoline was not to exceed 5 percent. The denatured ethyl alcohol has a flash point of 58 degrees F to 60 degrees F. The Emergency Action Guides published by the AAR state that for pure ethyl alcohol:

Ethyl alcohol and its solutions can be easily ignited under warm ambient temperature conditions.

Vapors may travel some distance to a source of ignition and flash back.

Containers have some potential to rupture violently if exposed to fire or excessive heat for sufficient time duration.

Ethyl alcohol does not react with water and is stable in normal transportation.

Ethyl alcohol is generally considered to be of low toxicity.

Tank Car Securement Procedures at the ADM Cedar Rapids Plant. --The ADM plant in Cedar Rapids produces denatured ethyl alcohol, carbon dioxide, fructose, and other by-products of corn. The plant manager indicated that of the products produced, only the denatured alcohol and the carbon dioxide are hazardous materials under Federal transportation regulations.

At the Cedar Rapids plant, alcohol tank cars are loaded by operators who work under the supervision of a foreman. The foreman stated that his responsibilities include operating equipment, and overseeing the loading and the preparation for transportation of the denatured alcohol. The foreman estimated that he spends about 2 percent of his time at the alcohol loading facility, and will only "go down to the loading facility if the loader has a problem." The superintendent, who is responsible to the plant manager, has the overall responsibility for alcohol production, including the loading of the alcohol into tank cars.

The plant manager oversees all plant operations and reports to the individual in ADM's corporate office who is responsible for production and engineering at ADM's corn processing facilities. The plant manager also stated that the only direction given by the corporate office concerning loading operations was when the plant originally started production. The plant manager indicated that the directions might have been in writing, although he had no recollection or written record of the directions.

In addition to the Cedar Rapids plant, three other ADM plants produce denatured alcohol. The plant manager stated that the four plants are individually run. He did not know how the corporate office ensures that the individual plants employ consistent safety practices.

When the accident occurred, the only written directives concerning alcohol tank car loading operations at the Cedar Rapids plant were two interoffice memos from the superintendent to the operators and the foremen. The first memo, dated March 27, 1985, concerned the outage required for alcohol tank cars. The second memo dated December 9, 1985, contained instructions to the operators and foremen concerning loading procedures, and states in part;

Follow all safety regulations while loading.

Manway and outlet cap must be tight with no leakage.

Tank car must be properly sealed; bottom valve handle and manway.

Both memos were posted for the operators and foremen in their work areas.

The superintendent stated that most instructions concerning the loading of tank cars had been given verbally. ADM submitted step-by-step written loading procedures after the accident and after the Safety Board requested that copies of written procedures be submitted. ADM officers stated that although the loading procedures were not in written form before the accident, these procedures had been followed at the Cedar Rapids plant since 1980. ADM also stated that the procedures were written down only because the Safety Board had requested that written procedures be submitted, and not because these procedures needed to be in writing.

The step-by-step procedures list the tasks that an operator must complete when loading an alcohol tank car but do not provide direction as to how a particular task should be completed. The procedures state, in part:

Open top manway. Check 3/4 inch unload vent to be sure it is closed.

Check bottom for leaks periodically while filling.

When full be sure pump has shut off before removing spout. Check gasket for top and close lid. Tighten bolts evenly for proper fit of lid to sealing gasket.

Seal top manway. Close drop gate from platform and print out weight on ticket.

Remove ground cables and turn placards on rail cars to full side.

The ADM operator who loaded ADMX 29477 and ADMX 29494 on July 28 had been employed in the position about 2 1/2 years and had been employed by ADM for 14 years. He stated that he has loaded rail tank cars only and that he loads a maximum of two cars at one time. He estimated that during his shift he may load an average of two to four tank cars with alcohol or carbon dioxide. However, if there are no tank cars to be loaded, he is assigned to other work.

The superintendent stated that operators have been instructed orally to replace a manway gasket if they questioned whether a gasket is "good or bad," and specifically if the gasket shows evidence of weather-related cracking. The operator who loaded the tank cars involved in the accident stated that while gaskets were changed frequently, he could not specify how often.

Before the accident, ADM did not maintain written records on manway gasket replacements or other routine maintenance. According to ADM officers, since the accident, the Cedar Rapids plant has started to maintain a written log to record when manway gaskets are replaced and other routine maintenance work is performed on the alcohol tank cars. ADM stated that it does not concede to a need for recording the replacement of gaskets or other "routine, minor maintenance work," but has implemented the recordkeeping procedure at Cedar Rapids "as a result of the NTSB's investigation."

The operator stated that after loading a tank car, he inspects and replaces the manway gasket if necessary, closes the manway cover, and tightens the bolts using a 24-inch wrench. He secures the manway cover by tightening the bolts in pairs, starting with the bolts opposite the hinge, proceeding to the bolts on either side of the hinge, and then to the bolts on the side. The operator stated that the procedure for tightening bolts was "known knowledge of tightening anything down." He does not use a torque wrench to tighten the bolts to a specified torque but tightens the bolts until he cannot tighten them further. After tightening the manway opening, he places a seal²⁶ on the manway. He then replaces the cap for the bottom outlet valve and also places a seal on the valve.

The foreman indicated that the operator was the only ADM employee with the responsibility to inspect the manway or the valves of a tank car before the tank car is released to the railroad. The superintendent stated that neither he nor the foreman follow up with the operators to determine that manway gaskets are being replaced when they should. The superintendent further stated that he observes the operators on a continuous basis and that he depends upon the competency of the operator and the foreman to ensure that tank cars are properly prepared for shipment.

Title 49 CFR 173.1(b) states that it is the responsibility of each person who offers hazardous materials for transportation to instruct each agent, officer, or employee having any responsibility for preparing hazardous materials for shipment as to the applicable regulations. Section 173.31(b) states that when tank cars are loaded and prior to shipping, the shipper must determine that the tank, safety appurtenances, and fittings are in proper condition for the safe transportation of the lading. Section 173.31(b)(3) requires that all closures of openings in tank cars and of their protective housings must be properly secured in place. Manway covers must be made tight against leakage of vapor and liquid, by use of gaskets of suitable materials. All closures of openings in tank cars must be inspected to the extent practical for corrosion of or damage to the gasket seating surface.

Initial training and qualification of ADM operators is accomplished through OJT which lasts 6 to 8 weeks. Trainees work with different qualified operators during the training period. To qualify for the position of operator, the trainees must pass an oral evaluation and test on an operator's duties, including those involving tank loading operations, administered by

²⁶ This seal is for detection of tampering, not for protection from leakage.

the superintendent. Once operators are considered qualified, they are not required to requalify for the position or take any recurrent training.

Tests and Research

Sight Distance Tests.--Sight distance tests were performed from 11:30 a.m. to 1 p.m. on August 4, 1988. The tests were performed using two IAIS locomotives operated in configurations to represent Extra 406 East (short hood forward) and Extra 470 West (long hood forward). Distance to the long end and to the short end of the locomotive from the cab is 46 feet and 14 feet, respectively. The locomotives were operated by two IAIS management employees. Representatives from the Safety Board, the FRA, the United Transportation Union (UTU), and the IAIS were present in the operating compartment of the locomotives. A UTU representative, who was an IAIS engineer and was familiar with and had frequently operated through this area, was positioned in the conductor's seat of the locomotive representing Extra 470 West.

Before any equipment was removed from the scene of the accident, investigators established that the point of impact, based on the physical evidence, was at MP 346.1.

The fire that followed the accident destroyed the ground cover and foliage in the area of the impact, and the cleanup operation resulted in the removal of some of the embankment on the north side of the track. An IAIS green hy-rail van was positioned near the point of impact, on the north side of the track, to simulate the visual obstruction that the embankment and foliage might have presented to the crewmembers of the trains involved in the accident.

Four tests were conducted to approximate the available sight distance between locomotives. The first two tests were conducted having the locomotives slowly and simultaneously back away from the point of impact. The last two tests were conducted with both locomotives slowly approaching each other after having first backed out of sight of the other, each to a point about 650 to 700 feet from the point of impact. The minimum distance between the locomotives that was measured during the four tests was 1,016 feet.

A-1 Charging Cut-Off Pilot Valve.--On October 18, 1988, the A-1 charging cut-off valve, which had been removed from the locomotive unit of Extra 470 West, was taken to the manufacturer, Westinghouse Air Brake, in Wilmerding, Pennsylvania, for postaccident testing and inspection, in accordance with the manufacturer's Test Specification T-2617-0, dated January 26, 1988. The testing and inspection determined that the valve was functioning as designed and that Extra 470 West experienced an emergency application of the train line air brakes as a result of a "break-in-two," or train line separation, and not as a result of an emergency application by the head-end crew.

Air Brake Tests.--On July 31, 1988, the equivalent of an initial terminal air brake test was performed on the 56 cars of Extra 406 East that

did not derail. Exception was taken to the brake cylinder piston travel on 6 of the 56 cars tested.

Representatives from the FRA, the IAIS, and the Safety Board, and the chief mechanical officer of the IAIS noted that the IAIS engineer who was operating the automatic brake valve during the postaccident air brake test was not familiar with the Federal requirements for an initial terminal air brake test and was unable to perform the test properly. He had to be instructed on various points during the test. During the test of brake pipe leakage, the initial reduction was exceeded because the engineer was looking at the brake pipe pressure gage instead of the equalizing reservoir pressure gage. Also, the observers noted that the engineer was about to cut in the brake pipe cut-off valve without reducing the equalizing reservoir to a pressure equal to the brake pipe, an action that would have resulted in the brakes releasing prior to completion of the test.

On August 1, 1988, the equivalent of an initial terminal air brake test was performed on the four undamaged cars of Extra 470 West. No exception was taken to the operation or condition of the brakes on these cars.

Postaccident Inspection and Pressure Tests of Tank Cars.--On November 1 and 2, 1988, representatives from the Safety Board, the FRA, the AAR, ADM, and ACF Industries,²⁷ convened at the rail car repair facility of RESCAR, Inc., in Longview, Texas, where both tank cars had been shipped following the accident, to inspect the tank cars externally and internally, document any damage, assess whether or not hydrostatic tests could be conducted safely and, if so, to conduct the hydrostatic tests to determine the general integrity of the tank cars and the function of the valves.

An interior inspection of the tank cars revealed no deficiencies or defects. All weld seams and areas of attachments appeared to be in excellent condition. The gaskets in the bottom outlet valves were slightly off center, but were within normal tolerances. While some creases and areas where paint had been burned off were noted during the external inspection, there was insufficient damage, such as cracks or spalling, to preclude conducting the hydrostatic tests. Before the tests were conducted, gaskets made of white neoprene were installed in the manway openings. The ADM representative advised that gaskets of white neoprene are used by ADM. The safety valves were removed for bench testing and the valve openings were sealed for the hydrostatic tests.

When the hydrostatic tests began and the internal tank pressure slowly built toward 100 psig, several small leaks were noted around the safety valve mounts and the manway openings on both cars. At this point, the bolts around the manway covers were further tightened to the physical ability of the two workers involved with the testing. This involved the workers sitting down, bracing themselves, and forcing the wrench with their feet. The leaks stopped and both cars successfully held 100 psig for over 10 minutes, as

²⁷ IAIS was invited to participate, but did not send a representative to observe the inspection and testing.

required by Federal regulations. Although the tests were determined to be successful, on-scene witnesses expressed concern over the inordinate amount of effort expended by the two workers to tighten the bolts and obtain the required seal.

When the pressure relief valves were removed from the tank cars for bench testing, the torque required to loosen each of the 8 mounting bolts for an individual valve was recorded. (See appendix I.) The B-end valve on ADMX 29477 had one loose bolt, and the B-end valve on ADMX 29494 had two loose bolts.

Bench tests were conducted to determine the pressures at which the relief valves would open and then reseal. (See appendix I.) The pressure relief valves were tested in a vertical position only since the testing facilities were not designed for other orientations. Manufacturer's specifications stipulate that the valves be fully open at 75 psig, and reseal at 60 psig.

Manway Gaskets.--The manway gaskets installed in the two tank cars at the time of the accident showed evidence of heat damage but no other obvious signs of deterioration. The gaskets were submitted to the U.S. Customs Laboratory for chemical analysis of the material and surface deposits. The results disclosed that the gaskets were composed of a polymer having the characteristics of silicon rubber. There was no evidence of any sealants on the gaskets. No detectable changes in the properties of the gaskets occurred after immersion in a 95 percent ethanol/5 percent gasoline mixture for one week. Thermal analysis of the gaskets indicated that the gasket material can withstand temperatures of 250 degrees C (480 degrees F) without weight loss.

Other Information

Disaster Preparedness.--The city of Altoona had an up-to-date disaster plan and it was implemented during the accident. Control points around the perimeter of the accident site were manned for the duration of the accident by the Iowa State Patrol, the Polk County Sheriff's office, and the Altoona Police Department. Two churches and an elementary school were opened for shelter purposes, and the Salvation Army provided food and beverages throughout the incident.

Polk County had 19 fire departments with 25 rescue units available. Polk County also had mutual aid agreements with surrounding counties. It was not necessary to exercise these agreements during the accident.

According to the Altoona fire chief, local emergency response personnel had never been contacted by the railroad regarding actions to be taken in the event of a hazardous materials incident.

Shelf Couplers.--In 1982, the National Space Technology Laboratories prepared a report, "Analysis of Locomotive Cabs," at the request of the FRA. One goal of the report was to "...analyze concepts that are currently

available for mitigating the car override problem and identify improved concepts...."

The report stated:

When considering the override problem, locomotive coupler design is an area of concern. The use of coupler designs, such as E or F shelf couplers, would tend to prevent climbing at the coupler during a collision. Also, increasing the strength of the coupler/draft gear steel to near that of the locomotive underframe would tend to decrease climbing during impact by containing the collision energy in the couplers and undersill areas.

The report concluded that "One promising candidate concept [in terms of override mitigation] that is determined to be technically acceptable and economically feasible involves the installation of shelf couplers on locomotives."

Tank Car Fittings.--A 1986 study²⁸ analyzed RSPA's Hazardous Materials Information System database. The study attributed the two most frequent sources of failure leading to the release of hazardous materials, for the rail mode, to defective and loose fittings. Together, these two failure modes accounted for 6,567 reported incidents out of a total of 10,465 incidents reported from 1976 to 1984, or about 63 percent. Individually, reports of defective fittings numbered 2,883, or 28 percent of the total. Reports of loose fittings numbered 3,684, or 35 percent of the total. Also, the study stated that many reportable incidents are not reported and therefore not counted in the database.

Railroad Event Recorders.--Section 10 of the Rail Safety Improvement Act of 1988, passed by Congress, directs the Secretary of Transportation to "issue such rules, regulations, standards, and orders as may be necessary to enhance safety by requiring trains to be equipped with event recorders" within a specified time frame. On November 23, 1988, the FRA issued an Advanced Notice of Proposed Rulemaking (ANPRM) on railroad event recorders. The stated purpose of this ANPRM was to determine "whether Federal regulatory intervention is necessary to ensure the presence of event recorders on train movements within FRA's jurisdiction, and whether such regulations would be cost beneficial." The legislation discussed above was not mentioned in the ANPRM.

At the FRA's January 10, 1989, public hearing on the issues outlined in the ANPRM, the Safety Board made an oral presentation and later submitted more detailed written comments in response to the ANPRM. The Board's oral presentation stated, in part:

²⁸ Transportation of Hazardous Materials, Congress of the United States, Office of Technology Assessment, (OTA-SET-304), July 1986, page 84.

With respect to recorders, the Safety Board's views are shaped by years of experience in using recorders to help reconstruct and "solve" aircraft accidents.....The Board's unique perspective with the use of voice and data recorders in aviation as accident investigation tools have convinced it to call for the use of event recorders on trains.

The Safety Board's recommendation history regarding recorders on train movements began on October 6, 1969. As a result of a train accident in Laurel, Mississippi, on January 25, 1969, the Safety Board issued Safety Recommendation R-69-18 to the FRA. This recommendation requested that FRA impose regulations requiring that all mainline trains be equipped with speed recorders. Following an accident at Glendora, Missouri, on September 11, 1969, the Safety Board further recommended, in Safety Recommendation R-70-15 on August 19, 1970, that FRA develop and implement instrumentation to record train braking performance. The FRA responded with an ANPRM on February 4, 1974, which outlined the development of proposed regulations to require speed recorders. On November 9, 1977, a train accident occurred at Pensacola, Florida, and the Safety Board issued Safety Recommendation R-78-44 on July 31, 1978, to the FRA. The Safety Board recommended that FRA require event recorders on all trains operating on main tracks. On May 21, 1979, the FRA finally published the outcome of the deliberations initiated by the ANPRM in 1974. The FRA determined that speed recorders were neither justified nor, based on the state-of-the-art, feasible. The FRA maintained that position in responding to Safety Board followup letters in 1980, 1981, and twice in 1985. In fact, in its response letter of August 8, 1985, the FRA emphatically stated that it intended to give no further consideration to the issue of event recorder requirements and requested that the Safety Board close Safety Recommendation R-78-44. The Safety Board did close Safety Recommendation R-78-44 on November 29, 1985, and placed it in the "Unacceptable Action" category.

If the Rail Safety Improvement Act of 1988 mandates rules requiring event recorders, which we believe is the most logical interpretation of that statute, the FRA is not free to decide whether Federal regulatory intervention on this subject is necessary.

From the outset of the development of the legislation which resulted in the inclusion of the provision on event recorders, the Congressional proponents of event recorders shared the Safety Board's recognition that the information derived from event recorders proved invaluable in determining the cause of train accidents and preventing more accidents.

The American Short Line Railroad Association. --The American Short Line Railroad Association (ASLRA) was organized in 1917 and by 1918, 177 railroads

were members. The purpose of the ASLRA is "...to provide cooperative action in the consideration and solution of problems of management and policy affecting the operation or welfare of shortline railroads, to promote federal legislation of benefit, and to resist enactment of legislation that would be detrimental to the railroad industry."

A directory of small railroads published in 1986 contained information on 412 shortline railroads.²⁹ About 40 percent or 167 of these railroads had started operations or had changed owners since 1973. Twenty of these railroads, including the IAIS, listed mileage in excess of 100 miles. Since 1986, several other railroads have started operation from property spun-off from Class I carriers (for example, the Montara Rail Link from the Burlington Northern, and the Wisconsin Central from the Soo line). According to the Official Railway Guide, in 1988 there were 318 regional and shortline railroads in operation. The Federal Railroad Administration has oversight responsibility for all railroads, including the shortline and regional carriers.

ANALYSIS

General

No mechanical defects on the equipment of either train were found that would have contributed to the accident. No anomalies or deficiencies in the track structure or track geometry were noted that would have contributed to the accident. Weather was not a factor in this accident.

The Accident

The provisions of train order 213 prohibited Extra 406 East from departing Altoona until 12:01 p.m. unless Extra 470 West arrived prior to that time. Witness testimony and statements by the crew of Extra 406 East indicate that Extra 406 East departed Altoona around 11:40 a.m. and that the trains collided about 11:44 a.m., 0.8 mile east of Altoona station. Based on the time of the accident and the location of the accident, Extra 470 West had more than sufficient time to travel the distance before the expiration of the time designated in the train order. The Board, therefore, concludes that the primary causal factor of the accident was the premature departure of the traincrew of Extra 406 East from Altoona in violation of the provisions of train order 213. Postaccident statements of both the conductor and engineer of Extra 406 East indicate that they understood the provisions of train order 213, but they could not offer any explanation as to why they departed Altoona before the designated time of 12:01 p.m. Accordingly, the Safety Board's investigation attempted to determine why the crew failed to comply with the provisions of train order 213.

Operation of Extra 406 East. --The Safety Board considered the possibility that the crew could have recklessly intended to leave Altoona when they did and ignored the dangers and consequences of doing so. No drugs

²⁹ American Shortline Railway Guide, 3rd edition, 1986, Edward A. Lewis, Kalmbach Publishing (ISBN 0-89024-073-6).

or alcohol were detected in any of the specimens of the engineer or conductor of Extra 406 East during postaccident toxicological testing; the Safety Board, therefore, rules out the possibility that drugs or alcohol were a factor on the crew's decision to depart Altoona before the designated time. The crew had set out and picked up cars en route to Altoona and while at Altoona, and had complied with the provisions of a meet order with Extra 430 West while in the CNW yard limits, all apparently without incident. There is no evidence to suggest that the crew was operating the train in a reckless manner before the accident; therefore, the Safety Board concludes that the crew did not deliberately depart Altoona early, cognizant of the dangers and consequences of doing so. Consequently, the Safety Board examined various factors that may have caused the crew to leave Altoona prematurely.

When the accident occurred, the crew of Extra 406 East had been on duty for just over 10 hours, having reported for work at 1:30 a.m. on the morning of the accident. They had worked 10 hours the previous day and were then allotted a period of 8 hours of "rest" in accordance with the Hours of Service Act. During this period, they checked into a hotel, ate a meal, and reportedly received between 4 and 5 hours of sleep before the dispatcher called them at 12:30 a.m. to report for work at 1:30 a.m. On Thursday, July 28, both crewmembers had been off duty and had experienced a normal sleep-wake cycle at home, being awake during daylight hours and sleeping during the night. In order to accommodate their work assignment for their train movement from Council Bluffs on the day of the accident, the crew adjusted their sleep-wake cycle so that they would sleep in preparation for the overnight return train movement to Newton. Even though, as previously mentioned, the crew performed various work en route to Altoona and while at Altoona without incident, it is nevertheless possible that the crew was fatigued by the time they reached Altoona. This work could also have placed increased demands on the memories of the crew and could have diminished the likelihood of their recalling the "wait" provision of the train order.

The crew of Extra 406 East received a number of train orders during the morning hours, the first of which was a meet order (train order 205) with a westbound train, Extra 430 West; this order was received and acknowledged by the crew of Extra 406 East at 3:37 a.m. Nearly 6 hours later, the crew received another train order (211) which instructed the crew that train order 205 was annulled and that after Extra 430 West arrived at MP 353.2, Extra 406 East could operate from MP 353.2 to Newton. In essence, with the issuance of train order 211, Extra 406 East was given authority to operate from MP 353.2 to Newton, which included the area through Altoona. About 2 minutes later, this information was reinforced when Extra 406 East received and acknowledged train order 212, which instructed crews of eastbound trains between MP 353.2 and Newton, except Extra 406 East, to wait at MP 353.2 until 2 p.m. Approximately 20 minutes later, Extra 406 East received train order 213, which again instructed the crew that it could operate from MP 353.2 to Newton but that now it would have to wait at Altoona until 12:01 p.m. for Extra 470 West. Although the engineer stated that he heard and understood the train order when the conductor copied the order, there was no further discussion between the crewmembers concerning the order. Nearly 2 hours elapsed from the time the traincrew received train order 213 and the time the crew departed Altoona. Had the crew been prudent and acted in accordance

with operating rules, they would have reviewed and verified with each other the train orders received before departing Altoona.

The Safety Board is concerned with the dispatcher's issuance of train order 213 to Extra 406 East in terms of the wording and the contents of the train order. Prior to issuing train order 213, the dispatcher had issued two other train orders to Extra 406 East that gave the train authority to operate to Newton. The wording of the first part of train order 213 (Extra 406 East has right over Extra 470 West MP 353.2 to Newton) would indicate to the crews that they have the authority to operate between those points. However, the wording of the last part of the train order (and wait at Altoona until 1201 for Extra 470 West) stipulates a condition which, in essence, nullifies the authority of Extra 406 East to operate beyond Altoona until 1201 or the arrival of Extra 470 West, whichever occurs first. The Safety Board is concerned that train order 213, in conjunction with the two previously issued train orders, may have further developed a "mind set" on the part of the crew of Extra 406 East that they were cleared to operate to Newton. Moreover, the Safety Board is concerned that Extra 406 East was granted authority to operate in an area where there was an opposing train movement. The Safety Board believes that this accident could have been prevented by a modification of the train order or if a type of track warrant system had been in place. In either case, Extra 406 East should then have been given authority to operate only as far as Altoona. Once the crew reached Altoona, they would have then been required to contact the dispatcher and obtain permission to proceed east of Altoona.

The engineer and conductor of Extra 406 East both expressed concern about exceeding the 12-hour duty time limit although the crew should have had sufficient time to travel the approximately 24 1/2 miles from Altoona to Newton before 1:30 p.m., the time when their 12 hours would have expired. Furthermore, the engineer was on his second train movement since being promoted to engineer and had never operated a train of the weight and length of Extra 406 East. Given that he had operated this train without incident to Altoona and given the crewmembers' statements expressing concern about the 12-hour, on-duty limit, it is possible that the crew was preoccupied with reaching Newton and finishing their first tour of duty with the engineer operating the train.

The crew of Extra 406 East made no attempt to radio the dispatcher or the crew of Extra 470 West to determine the whereabouts of that train and apparently was not concerned with the location of the train. After receiving a number of train orders in the early morning hours and then passing an IAIS train in the CNW yard, the crew of Extra 406 East might have believed that they had passed Extra 470 West, when indeed it was Extra 430 West, and that they had a clear track to Newton.

While there is a lack of sufficient evidence for the Safety Board to conclude positively why the crew departed Altoona without regard to the provisions of train order 213, the Safety Board believes that a combination of fatigue, preoccupation with completing their assignment, and the work activities that intervened between the time the crew received the train order

and departed Altoona, were factors that caused the crew to forget the "wait" provision of train order 213.

The engineer stated that he moved the throttle as far as the fifth position when operating the train leaving Altoona, and that the train was traveling between 15 and 20 mph when he observed Extra 470 West approaching at a distance he estimated to be about 300 feet. The exact speed of the train could not be determined because IAIS does not equip its locomotive units with event recorders. However, since the accident occurred within yard limits, Extra 406 East should have been traveling at restricted speed, a speed which would have permitted the crew to stop the train within 1/2 the range of vision, short of an approaching train. As of the date of the accident, yard limit signs had not been installed and the yard limits were not listed in the timetable, train orders, or special instructions. The engineer stated that he was aware that yard limits had been established at Altoona, but that he did not know how far they extended. Postaccident observation of the automatic brake valve in the "emergency" position indicated that the engineer did apply the train brakes with an emergency application before exiting the cab. Postaccident sight distance tests indicated that the greatest distance at which the crews of the two trains could have seen each other was 1,016 feet. However, since the foliage and the embankments were extensively altered when the wreckage was cleared, the Safety Board cannot consider the results of the sight distance tests as conclusive. Therefore, the Board was unable to determine the precise distance at which Extra 406 East would have been able to see Extra 470 West.

Operation of Extra 470 West.--Because neither crewmember of Extra 470 West survived the accident and since the IAIS did not equip its locomotive units with event recorders, the Safety Board was unable to determine the speed of the train at the time of the accident.

The assistant superintendent of operations, who was performing the duties of a train order operator in Newton on the day of the accident, stated that he saw one of the crewmembers of Extra 470 West pick up the orders that had been placed on a desk in that office. However, since he did not discuss the train orders with the crewmember, he had no way of knowing if the crewmember fully understood the train orders or if the crew discussed the orders before departing Newton.

By Rule S-87, Extra 470 West had until 11:56 a.m. to reach Altoona before Extra 406 East was to depart that location. If the traincrew of Extra 470 West did receive and understand train order 213, they had no reason to expect to encounter Extra 406 East before arriving at Altoona. Based on the time of the accident and the location of the accident, as previously noted, Extra 470 West had more than sufficient time to travel the distance to Altoona before Extra 406 was to depart. Had the crew of Extra 470 West been delayed en route to Altoona and not been able to reach Altoona before 11:56 a.m., they would have been required by Rule S-87 to be clear of the main

track by 11:56 a.m., either at Colfax or Mitchelville,³⁰ and Extra 406 East, departing at 12:01 p.m., could expect the main track to be clear to Newton.

Since the accident occurred within yard limit territory, Extra 470 West should have been traveling at restricted speed. Since yard limit signs had not been installed before the accident and given the testimony of the engineer of Extra 406 East that indicated he did not know how far the yard limits at Altoona extended, it is reasonable to assume that the crew of Extra 470 West may also have been unaware of the yard limits and had not yet reduced speed from the authorized track speed of 25 mph.

Postaccident testing and inspection of the A-1 charging cut-off pilot valve from the locomotive unit of Extra 470 West indicated that the valve was functioning as designed and that Extra 470 West experienced an emergency application of the train line air brakes as a result of a "break-in-two," or train line separation, and not as a result of an emergency application by the head-end crew. This evidence could suggest that the engineer of Extra 470 West was unaware of the impending collision or had too little notice to place his train's brakes in emergency. It is also possible, however, that the crew may have made a service application of the brakes to reduce speed to restricted speed, an act which could have been verified had event recorders been used on IAIS locomotives. In summary, there is insufficient evidence for the Safety Board to make any definitive conclusions regarding the operation of Extra 470 West prior to the collision other than the crew had sufficient time to reach Altoona before the designated time and were not expecting to encounter a train before reaching that location, and the crew did not place the train's brakes into emergency.

IAIS Method of Operation and Management Oversight

While paramount in this accident was the failure of the traincrew of Extra 406 East to comply with the "wait" provision of a train order, the Safety Board's investigation revealed numerous violations of the company's operating rules and provisions of the Federal regulations and deficiencies in the IAIS method of operations. Accordingly, the Board attempted to determine how these violations affected the safe operation of trains on the IAIS and what factor they might have played in the cause of this accident.

Failure to Resolve Status of Signal System.--The IAIS was operating trains over nonsignaled territory between Newton and Des Moines, Iowa, and according to the FRA had authority to do so for the area where the accident occurred; however, the IAIS was never formally informed of this by the FRA. Furthermore, communication from the FRA regarding the previously granted approvals to the CNW and the Iowa Railroad was not accurate. Before the IAIS began operations in 1984, it requested that the FRA extend to the IAIS all previously granted relief to operate without the signal system. The FRA's letter in response to this request indicated that the relief extended to the Iowa Railroad had expired on November 18, 1984. If the IAIS believed that

³⁰ IAIS Timetable No. 2 shows other track at these locations and a siding at Colfax.

they had permanent authority, the FRA's letter discussing temporary reliefs should have raised some concerns on the part of the IAIS. The IAIS claimed, however, that it had made a request to the FRA to operate permanently without use of the block signal system on April 14, 1987, nearly 2 1/2 years later, but did not receive a reply. The FRA Standards Division Chief for Signals stated to the Safety Board that the FRA had not received this request. The Safety Board believes that since the temporary relief had expired on November 18, 1984, the FRA and the IAIS should have resolved the block signal applications before the IAIS was authorized to begin operations. The Safety Board believes that the IAIS knew or should have known that the temporary relief to operate trains without use of a signal system had expired and it should not have waited nearly 2 1/2 years before asking the FRA, as the IAIS claims it did, to permit the permanent operation without use of a signal system.

Failure to Verify Train Orders Issued. -- When trains are being operated over nonsignaled (dark) territory, the need for up-to-date timetables, special instructions, specific procedures for issuing and verifying train orders, as well as compliance with train orders becomes critical to the safe operation of trains. The assistant superintendent of operations, who was serving as a train order operator in Newton on the day of the accident, testified that he received and copied the train orders for Extra 470 West from the dispatcher in Iowa City, placed them on a desk in the office, and observed a crewmember pick up the train orders. Because the IAIS had no operating rules or procedures in place that required the train order operator to verify to the dispatcher that train orders have been received by the traincrews, on the day of the accident the dispatcher had no way of knowing if the crew of Extra 470 West had received their train orders.

The Safety Board has previously addressed the problem of train orders being issued but not verified. In its investigation of the head-on collision of CSX Transportation freight trains Extra 4443 North and Extra 4309 South at East Concord, New York, on February 6, 1987,³¹ the Safety Board found that "CSX management failed to issue and enforce specific procedures for traincrews to verify the accuracy of train orders before departing...." The dispatcher involved in that accident was issuing train orders via telecopier to an unmanned location and, consequently, had no way of knowing if traincrews were receiving updated orders.

The Safety Board believes that the accident at Altoona again illustrates the shortcomings of not having a procedure in place for dispatchers to verify that train orders have been received and understood by the traincrews. Accordingly, the Safety Board believes that the IAIS should develop and enforce the use of a procedure that will require the train order operator to verify to the dispatcher that train orders issued have been received by traincrews.

³¹ Railroad Accident Report -- "Head-On Collision of CSX Transportation Freight Trains Extra 4443 North and Extra 4309 South, East Concord, New York, February 6, 1987" (NTSB/RAR-88/03).

Failure to Maintain a Record of Train Movements.--Not only could the dispatcher not be assured that the traincrew of Extra 470 West received their train orders, on the day of the accident he had no way of knowing when or if Extra 470 West had departed its initial terminal. The traincrew did not report its departure from Newton, and there were no departure times recorded on the train sheets for Extra 470 West on July 30, 1988. According to testimony, the arrival and departure times of trains were reported only if an agent or "someone" at a station took the initiative to do so or if the crew remembered to call the dispatcher. By Federal regulations, dispatchers are required to maintain a record of train movements including the direction of movement and the time each train passes all reporting stations, and the arrival and departure times of trains at all reporting stations. Newton was designated by the IAIS as a reporting station.

The Safety Board is concerned about the ability of a train dispatcher to move trains safely over his territory if he is unaware of the whereabouts of the trains. Accordingly, the Safety Board believes that the IAIS should take immediate action to require that train dispatchers maintain an accurate record of train movements, in accordance with Federal regulations.

Failure to Install Yard Limit Signs.--By general order No. 2, dated January 1, 1988, the IAIS had established the Altoona yard limits from MP 346.0 to MP 347.5 and had designated the yard limit signs to be installed by a general order, dated July 8, 1988. Federal regulations require that yard limits be designated by yard limit signs and listed in timetable, train orders, or special instructions. However, the investigation revealed that yard limit signs had not been installed and that the yard limits for Altoona were not shown in the timetable or in the special instructions and were not listed on train orders. Therefore, the general order was the only means by which traincrews could have been aware of the yard limits at Altoona. Testimony from the engineer of Extra 406 East indicated that he was aware that yard limits existed at Altoona, but he was not certain how far the yard limits extended. While the Safety Board believes that traincrews should certainly be aware and familiar with general orders, the on-board documents to which traincrews readily refer are timetables, special instructions and train orders, and these documents should reflect the most up-to-date information pertaining to train operations.

The speed of Extra 470 West at the time of the accident could not be determined. As previously noted, however, it is not unreasonable to assume that, as was the crew of Extra 406 East, the crew of Extra 470 West may not have been aware of the yard limits at Altoona. Had a "Yard Limit Approach" sign been installed 1 mile east of where the yard limits began on the east side of Altoona, the sign might have alerted the crew to be prepared to reduce speed to restricted speed. Based on the definition of restricted speed, had both trains been operated at restricted speed, the accident should have been avoided. Nevertheless, the Safety Board believes that if traincrews are expected to operate trains within yard limits in accordance with certain operating rules, it is reasonable to expect management to provide the traincrews with all the necessary information to do so. The Safety Board further believes that the management of IAIS should not have

issued the general order establishing yard limits until it was prepared to install the appropriate signs.

Failure to Provide Instructions on Air Brake Tests.--Although company rules and Federal regulations require that when a train is originally made up and when a train consist is changed en route a test of the train air brake system must be conducted, the investigation revealed that the air brake tests were not being conducted on a regular basis. Testimony of the crew of Extra 406 East indicated that an air brake test was not performed at any of the locations where cars were set out or picked up en route from Council Bluffs to Altoona. The IAIS engineer who was operating the automatic brake valve during the postaccident air brake test was not familiar with the Federal requirements and was unable to perform the test properly. The Safety Board is concerned that not only were air brake tests not being conducted in accordance with company rules and Federal regulations, but that management did not provide any guidance or instructions for conducting air brake tests with an end-of-train device in caboosless operations. Although the IAIS had adopted the "Rules and Instructions for Train Handling and Operation of Air Brakes," which had been in effect on the former Rock Island since 1974, management made no effort to determine that all traincrews had copies of the manual. More importantly, however, the IAIS operates caboosless trains, with an end-of-train device, and management did not update the manual which contains no instructions for conducting air brake tests with an end-of-train device in caboosless operations.

Failure to Provide Adequate Training on the Operating Rules.--The IAIS began operations in November 1984. In April 1987, the railroad adopted the General Code of Operating Rules as its book of rules. During the interim period, the railroad operated under the Uniform Code of Operating Rules that had been used on the former Rock Island. Testimony of IAIS officials indicated that operating employees, by virtue of their previous experience with the Rock Island, were considered qualified for the positions for which they were hired on the IAIS. Employees were given no training when the IAIS began operations in 1984 or during the interim period before the railroad adopted the General Code of Operating Rules. The company apparently believed that these employees were sufficiently competent and that training was not needed. The Safety Board believes that IAIS management was remiss in not providing recurrent training on the operating rules for the more than 2 years that the railroad operated under the Uniform Code of Operating Rules.

IAIS records indicate that after adopting the General Code of Operating Rules in April 1987, the railroad provided classroom instruction on the rules to 70 percent of its operating employees. The crew of Extra 406 East and the engineer of Extra 470 West had attended this classroom instruction. The conductor of Extra 470 West, who was hired by the IAIS several months later, did not attend the training or receive any formal rules training following his employment. Likewise, 30 percent of the operating employees on the IAIS had not received training on the General Code of Operating Rules.

The superintendent of operations and other railroad officials conducted the training classes in 1987 and indicated that an "oral examination" was given to employees following each class. When asked to describe how the oral

examinations were administered, the superintendent of operations stated that questions were randomly chosen and posed to the class as a whole and were discussed by the group. A written examination was not administered, and no other method was used to measure an individual employee's knowledge and understanding of the operating rules. Since the training provided by the railroad failed to require each employee to demonstrate an adequate knowledge of the operating rules, management could not be assured that operating employees could satisfactorily and safely perform train movements. IAIS management was apparently willing to accept this risk, even though it was operating a "dark railroad" which relied solely on compliance with train orders and operating rules. The Safety Board concludes that the operating rules training program used on the IAIS was ineffective and failed to determine that operating employees were sufficiently knowledgeable of the operating rules.

Failure to Provide Effective Training for Engineer Trainees. --The IAIS had adopted a training program used by a predecessor railroad for the promotion of operating employees to the position of locomotive engineer. While the Safety Board's investigation indicated that in general the program was well conceived, management failed to implement fully the program as outlined and failed to provide the framework necessary for an effective training program.

Student engineers were afforded the opportunity to experience the hands-on aspects of locomotive operations during the three phases of the program which were to be completed in a 6-month timeframe. This opportunity was limited, however, because the trainee was responsible for performing the duties of the conductor, and at times this required the trainee to be on the ground and away from the locomotive. The investigation revealed that the engineer of Extra 406 East had few opportunities to experience over-the-road training because he was assigned to the Newton yard during most of his training period performing switching movements. Furthermore, the Safety Board believes that a student engineer cannot receive adequate instruction on the full-time duties of an engineer while at the same time performing the full-time duties of a conductor.

Further, the railroad did not determine if the training was effective or adequate because it did not monitor the progress of student engineers or evaluate their performance during training. Although required by the program, engineer instructors did not submit timely progress reports, observations, and comments in written form. The assistant superintendent of operations, the immediate supervisor of the engineer of Extra 406 East, failed to evaluate the engineer during each phase of his training and did not certify that he was qualified for the position of engineer upon completion of training, as outlined in the program. Testimony indicated that the assistant superintendent of operations, who, according to the program, was required to evaluate the performance of student engineers and certify that they were qualified to function as a locomotive engineer, had never been qualified as a locomotive engineer. The Safety Board is concerned that an individual who has never performed the duties of an engineer may not be capable of adequately evaluating the performance of a trainee for that position.

The superintendent of operations stated that any engineer on the IAIS roster could serve as an instructor and be assigned to train a student engineer. Testimony from engineers who had served as instructors indicated, however, that they had not read the manual which outlined the training program and had not been given any guidance or instruction on the material that should be covered during the various phases of training. The Safety Board is concerned about the quality of training that trainees could receive when instructors were not provided any guidance by management and were not evaluating the performance of the trainees assigned to them. Moreover, the Safety Board believes that there is an inherent conflict in having the trainee perform the duties of conductor, who according to the operating rules is in charge of the train, and at the same time be instructed on the duties of engineer.

The engineer of Extra 406 East was on his first trip and second train movement following his promotion to engineer 5 days earlier. The engineer had been trained primarily in yard switching operations and had not previously handled a train of the tonnage and length of Extra 406 East. The Safety Board believes that training must be conducted in a way in which employees can demonstrate their ability to operate trains over the territory in which they will be operating and with the type of trains they will be expected to handle.

In summary, the Board believes that the training program instituted by the IAIS to promote individuals to the position of engineer was deficient because (1) the trainee's exposure to and observation of locomotive operations during the three phases of OJT was unacceptably limited because he was required to perform the duties of conductor during this time; (2) management failed to evaluate the performance of the trainees to assess their knowledge of operating rules and ability to handle a locomotive; and (3) management failed to provide adequate instructions and guidance to the engineer instructors on the material to be covered during the phases of OJT.

Failure to Qualify Crews on Operating Rules of Other Railroads.--The Safety Board received conflicting testimony regarding whether IAIS traincrews had been qualified on the Chicago North Western (CNW) operating rules to operate over trackage of the CNW at Des Moines. The superintendent of operations of the IAIS stated that crews had been qualified on the CNW rules. However, the engineer of Extra 406 East stated that he had not been qualified on the CNW rules. The Safety Board requested but did not receive from the IAIS a list of employees qualified on the CNW and the method by which the employees were qualified. The investigation revealed that IAIS also operates over trackage of METRA and the CSX. The Safety Board believes that the IAIS should require its operating employees to be properly qualified on the operating rules for the territory of the other railroads over which they operate before they are allowed to operate as the engineer and conductor. Furthermore, the CNW, the CSX, and METRA are responsible for determining if crews of other railroads operating over their territory are qualified on the respective company rules. The Safety Board believes that these railroads should determine if IAIS crews operating over their territory are properly qualified.

The IAIS operates over trackage of the Des Moines Union and the Chicago North Western Transportation Company (CNW) between MP 353.2 and MP 364.5. Newton is the initial station of crews operating over this territory. According to the IAIS operating rules, general orders, bulletins, notices and circulars will be posted in books and/or on bulletin boards at stations designated in the timetable. IAIS timetable No. 2 designated Newton as a station where general order boards or books were located. The investigation revealed, however, that current general orders, general notices, and special instructions of the CNW were not posted on the bulletin board at Newton.

Failure to Conduct Operational Tests and Inspections.--The Safety Board's investigation found little evidence that IAIS supervisors monitored crew compliance with operating rules, even though the ratio of supervisors to employees suggests that each supervisor would not be charged with overseeing a large group of employees. In fact, operational efficiency checking was not performed. IAIS officials cited various reasons for not performing operational tests and inspections including that the company had waivers from the FRA permitting the IAIS to not perform operational tests. The IAIS, however, could not provide documentation for an exemption or waiver. The assistant superintendent of operations stated that he did not perform efficiency testing "on orders from the superintendent of operations." Testimony from operating employees indicated that there was very little supervision of the day-to-day operations of trains and enginecrews outside the terminals and that supervisors rarely rode trains. When operating personnel believe that they will rarely encounter supervisors and that management is not concerned with strict adherence to operating rules, a diminishment of inducements for operating personnel to comply with these rules can occur. By not filling the position of road foreman of engines, a position that has responsibility for overseeing the enginecrews, management indicated to operating personnel that it was not overly concerned with the oversight of day-to-day operations.

According to the personnel records of the employees involved in this accident, only the chief dispatcher and conductor of Extra 406 East had a prior record of disciplinary action while employed with the IAIS. Both employees had been given letters of reprimand, and according to the superintendent of operations, the IAIS policy regarding disciplinary action was that three letters of reprimand could constitute grounds for dismissal. The conductor was issued a letter of reprimand for violation of a train order--leaving a waiting point before the designated time. This letter of reprimand apparently, however, had little effect on the conductor's adherence to operating rules, specifically compliance with train orders. If management is lax in consistently citing rules violations with appropriate disciplinary action, there is no incentive for employees to adhere to operating rules.

Failure to Properly Abandon Signal System.--During the investigation of this accident, it was noted that signal No. 3472, located 0.3 mile west of the Altoona station sign, had not been removed, covered, or turned away from the track. When an out-of-service signal is left in place, the common industry practice (there is no Federal guidance on this issue) is to cover the signal head or turn the signal away from the track that it would govern. Signal No. 3472, although inoperable, displayed a dark aspect, which,

according to the operating rules, should be interpreted by the crew as its most restrictive signal indication requiring the train to stop. The failure to have this signal covered or turned away from the track was not corrected by IAIS officials even though the deficiency should have been detected during operating inspections. Further, the deficiency apparently was not raised with the IAIS by the FRA, although it too should have performed inspections that should have revealed the deficiency. Either these inspections were not performed or the IAIS and the FRA considered it an acceptable situation.

In summary, the Safety Board believes that the failure of IAIS management to comply with its own rules and Federal regulations, to oversee its train operations and enforce compliance with operating rules, and to adequately train and qualify its operating personnel fostered an atmosphere of complacency by operating personnel toward compliance with operating rules and this contributed to the cause of the accident.

Lack of Cooperation by IAIS in Safety Board's Investigation.--The Safety Board is concerned with the lack of cooperation demonstrated by the IAIS during this accident investigation, particularly since the railroad was made a party to the Safety Board's investigation and deposition proceedings. Four IAIS officers required a federal court order before they would present testimony at the Safety Board's deposition proceedings held on October 18, 19, and 21, 1988, at Des Moines, Iowa. At the close of the deposition proceedings, all parties were invited to submit to the Safety Board their proposed findings and conclusions regarding the accident. The Safety Board did not receive any submissions from any of the parties, including the IAIS. During the course of the investigation, the Safety Board requested additional information from the IAIS that the Board believed was vital to the investigation. The IAIS did not provide all the information requested. On March 29, 1989, a technical review of the Safety Board's factual report of the accident was conducted at Cedar Rapids, Iowa, approximately 10 miles from the railroad's headquarters. All parties to the investigation were invited to present comments either in writing or by attending the meeting. The IAIS did not attend or respond. The Safety Board met on May 9, 1989, in Washington, D.C. to consider the full report and determine the probable cause of the accident. Although informed 2 weeks prior to the date of the meeting, the IAIS did not attend. The Safety Board does not believe that the attitude reflected in the aforementioned actions of the IAIS promotes transportation safety and, in fact, could be interpreted as indicative of management's approach to the safety of train operations.

Federal Activity

Federal Oversight of IAIS.--The IAIS was operating a "dark" (nonsignaled) territory, and apparently had authority to do so for the area in which the accident occurred, but had never been formally informed of this by the FRA. While the FRA has a process in place for granting authority to discontinue the use of signal systems and was implemented with the CNW and the Iowa Railroad, there were deficiencies in the FRA's communication with the IAIS that did not reflect the status of authorities previously granted. After granting authority to the IAIS to operate without use of the signal system only on a temporary basis, the FRA failed to follow up with the IAIS

to determine the status of the IAIS' request regarding use of the signal system. On-site inspection of IAIS operations by FRA personnel should have indicated readily that the IAIS was not operating with a signal system. The Safety Board believes that the FRA should reevaluate and resolve the status of block signal applications for the IAIS based on the current operations which now include two daily through trains, several local trains, consists which include hazardous materials, and the operation of passenger excursions.

The provisions of 49 CFR Part 217 outline the FRA's requirements for railroads (1) to file a copy of its operating rules, timetables, and special instructions, (2) to file a program for conducting operational tests and inspections to determine compliance with operating rules, and (3) to file a program of instruction on operating rules. Based on information received during a meeting with FRA personnel on September 7, 1988, and in a letter dated January 18, 1989, the IAIS was not in compliance with the provisions of 49 CFR 217 and had not been granted an exemption or waiver from these provisions. On September 2, 1987, at Blue Island, Illinois, an FRA inspector had noted a defect on an inspection report with regard to 49 CFR 217.9 and that he found, through discussion with company officials, that the IAIS did not periodically conduct operational tests and inspections to determine compliance with its operating rules, timetables and special instructions. There was no fine imposed or violation reported at that time, and apparently there was a lack of understanding between FRA and field personnel as to the action to be taken after a defect has been noted on an inspection report. In response to the Safety Board's request as to how this defect was resolved, the FRA, in its January 18, 1989, letter indicated that carrier officials had been admonished to bring the IAIS programs into compliance with the provisions of 49 CFR Part 217.

Although FRA inspectors noted defects on inspection reports in October 1986 that rule books were not available and in September 1987 that the IAIS did not conduct operational tests or inspections, there is no record that the FRA noted any defects on inspection reports that the IAIS failed to install yard limit signs, even though Federal regulations require that yard limit signs be installed and that yard limits be designated in the timetable, train orders, and special instructions. The FRA informed the Safety Board in its January 18, 1989, letter that it has now initiated an enforcement action against the IAIS for violation of Federal regulations pertaining to operating rules. Notwithstanding this enforcement action, the Safety Board concludes that for more than 3 years the FRA failed to exercise its statutory responsibility to oversee adequately railroad operations on the IAIS.

Because of the Safety Board's concern about the FRA's lack of oversight of IAIS operations, the Safety Board believes that the FRA should take immediate action to conduct a safety audit of the operating practices of the IAIS.

The Safety Board is also concerned that the FRA does not have a system in place to determine that defects noted on field inspection reports have been followed up by FRA inspectors to verify that corrective action has been taken by the carrier. Furthermore, while defects noted on inspection reports

are entered into a computer data base, there is no formal process for the systematic evaluation of this data base. Given the FRA's reliance on its field personnel to notice trends in a carrier's operations but the lack of communication and coordination between field and headquarters personnel, the Safety Board is concerned that a carrier's noncompliance with Federal regulations is not receiving the attention it needs from top FRA officials. Accordingly, the Safety Board urges the FRA to take immediate action to implement a program that will (1) provide consistent followup of defects noted on inspection reports to verify that corrective action has been taken, (2) outline in detail the responsibilities of field and headquarters personnel regarding defects and violations noted, and (3) alert FRA officials of a carrier's noncompliance with Federal regulations and of trends in carriers' operations.

Accident Reporting Criteria.--In addition to the accident at Altoona, on July 30, 1988, four other rail equipment accidents in which damages exceeded \$150,000 have occurred on the IAIS since it began operations. One of the accidents involved the release of hazardous materials. Although each of the four accidents met the Safety Board's accident notification criteria, the Board was not notified of any of the accidents. The chief operating officer of the IAIS stated that he was not aware of the Safety Board's accident notification criteria. Testimony of the chief dispatcher indicated there were no written procedures or list of numbers to call in the event of any emergency. Although required by Federal regulations, the carrier failed to report the two accidents that involved the release of hazardous materials to RSPA of the U.S. DOT. The IAIS did file a report with the FRA for each of the five accidents, and, according to the chief operating officer, the company official responsible for reporting to the FRA would also be responsible for reporting any hazardous materials reports.

The foregoing suggests that the senior management of the IAIS was not familiar with all Federal reporting requirements and, consequently, provided no guidance or written procedures on the reporting of accidents on the IAIS property. Although the chief dispatcher stated that he now has prepared "a list of numbers to call," as a result of the Safety Board's investigation, the Safety Board remains concerned that IAIS management has not provided adequate guidance in this area. The Safety Board believes that IAIS should develop explicit written procedures concerning the Federal agencies to be contacted in the event of a railroad accident on the IAIS. The Safety Board is further concerned that this situation may exist on other regional railroads and that accidents, including those involving the release of hazardous materials, may not be reported in accordance with Federal regulations. While the Safety Board recognizes that it is the responsibility of railroad management to know the requirements of Federal regulations, the Safety Board believes that the American Short Line Railroad Association could address this issue by disseminating information to its membership regarding Federal agencies' accident notification criteria.

Although RSPA has received hazardous materials incident reports filed by various carriers in which tank cars shipped by ADM's Cedar Rapids plant have released hazardous materials, ADM's plant manager at Cedar Rapids stated that he had not received any formal notification from carriers regarding problems

with tank cars loaded at his facility. The investigation of this accident revealed that IAIS had not planned to contact the shipper of the hazardous materials until urged to do so by a Safety Board investigator. The shipper has the responsibility under Federal regulations to properly prepare the hazardous materials for transportation. The Safety Board is concerned, however, that without specific direction, a carrier is not obligated to contact a shipper if a problem occurs during transportation with the shipper's tank car or other type of container. If shippers are unaware of problems involving their containers during shipment, they cannot be expected to take corrective action. Shippers could be easily notified of hazardous materials incidents involving their containers if the carriers provided the shippers with a copy of the Hazardous Materials Incident Report that carriers are now required to submit to RSPA. The Safety Board believes that such action would make shippers aware of problems, and urges RSPA to amend 49 CFR 71.16 to require carriers to provide the shippers with a copy of the written incident report submitted to RSPA.

Transportation of Hazardous Materials

Safety Board investigators examined closely the tank cars involved in this accident. The Safety Board found that the tank cars involved in this accident had minimal structural damage, as documented during the postaccident inspections and testing; yet, product was released through their fittings even before being exposed to heat or fire. The Board believes that, based on the minimal damage to the tank cars, they should not have leaked and released the denatured alcohol.

The leaking and burning tank cars, while not a factor in the cause of the accident, increased the danger and severity of the accident, prompting local emergency response personnel to evacuate nearby residents. Also, recovery of the two fatalities and wreckage removal was made more hazardous by the burning tank cars, and the emergency response personnel were confronted with a higher degree of danger.

Release and Ignition of Denatured Alcohol.--The descriptions by the two police officers who climbed on top of the overturned ADMX 29477 indicate that at least one pressure relief valve was leaking alcohol before the grass fire reached the tank car. It is unknown, however, whether the initial leakage occurred through the valve itself or at the bolted flange connection of the pressure relief valve assembly and the support flange on the tank car. Although the two police officers only observed the one pressure relief valve leaking before the tank cars caught fire, it is likely that more than one of the pressure relief valves were leaking. The observations of the firefighters, the hazardous materials team members and the AAR field inspector on the afternoon and evening of the accident indicate that both tank cars were burning at the pressure relief valves. Further, the pressure relief valve on the A-end of ADMX 29494, which during the bench tests opened and reseated nearly at the manufacturer's specifications, was observed by a Safety Board investigator to be leaking through the valve on August 2.

Although the police officers did not observe the manway on either car to be leaking, both manways likely were leaking after the accident. Photographs

of the two tank cars while they were burning and the scorched and burned areas found on the two tank cars after the fires were out indicate that the fires were fueled by alcohol leaking from the manway on each car.

The grass fire that started from the burning locomotives progressed to the tank cars and ignited the leaking alcohol from the manway and pressure relief valves. Aerial photographs clearly indicate a blackened area of ground extending from the area of the locomotives back toward the two tank cars. The fire, upon reaching the two tank cars, ignited the alcohol leaking from the manways and the pressure relief valves. With the exception of the pressure relief valve on the B-end of ADMX 29494, all of the pressure relief valves and the manway showed evidence of heat damage, which further compromised the integrity of these closures.

Mode of Release.--Since the tank cars were leaking before they were exposed to any fire, and since the pressure relief valves and the manway on each car had no external impact damage, these fittings were either subjected to excessive internal forces generated during the derailment, or these fittings were not properly secured when the tank cars were released from the shipper.

When the accident occurred, ADMX 29477 was loaded with 29,104 gallons or to 96.6 percent of capacity, and ADMX 29494 was loaded with 29,105 gallons or to 96.5 percent of capacity. After the tank cars overturned but before they caught fire, the manways and the pressure relief valves were subjected to dynamic and static internal forces from the liquid and vapor in the tank. Calculations indicate that the static pressure on the manways and the pressure relief valves would have been about 5.6 psig, assuming that the temperature in each tank was 120 degrees F, at the time of the accident. Since the air temperature was about 90 degrees F when the accident occurred, internal tank temperatures were probably the same or slightly higher than the ambient air temperature. Therefore, it is likely that the actual static internal tank pressure would have been less than the calculated value of 5.6 psig. Thus, the calculated tank pressure provides a reasonable upper limit of the static internal pressure in each tank. Since the pressure relief valves were rated to open at 75 psig, the static pressure in either tank car was far below that needed to open the pressure relief valves and result in the discharge of the alcohol. Similarly, the manways, if properly secured, should withstand the rated pressure of the tanks, 100 psig, and should not have leaked under the static pressure calculated.

During the collision and derailment, both tank cars were subjected to dynamic forces that would have caused the alcohol in each tank car to surge toward the leading end. The void spaces of the manway and the leading pressure relief valve would be instantaneously filled with the surging alcohol and subjected to increasing pressure as the liquid continued to surge forward. The two pressure relief valves observed to be leaking were both on the leading end of the two tank cars - the pressure relief valve observed by the two police officers moments after the accident was the leading valve on ADMX 29477, and the pressure relief valve observed to be leaking by a Safety Board investigator on August 2 was the leading valve on ADMX 29494.

However, the magnitude of the internal dynamic forces generated in this accident are unknown. Calculation of dynamic loading forces on manway, pressure relief valves, and other closure fittings on a tank car is not required or done as part of the tank design or certification process. Further, the tank car manufacturer has indicated that dynamic loading calculations could not be "readily" done to estimate the dynamic loads in this accident. Consequently, not only are the dynamic loading forces generated in this accident unknown, but whether the fittings on either tank could have withstood dynamic loading forces encountered in this accident is also unknown.

Since the manways on the two cars were opened during the salvage operations, and all of the fittings on the top of the tank cars had been exposed to heat and fire, it is unknown whether the pressure relief valves and the manways had been properly secured at the time of the accident.

Tank Car Performance during Postaccident Testing.--During the post-accident hydrostatic tests conducted on the tank cars at Longview, Texas, it was noted that considerable effort was expended by the workers to tighten bolts around the manway cover to a point that both cars successfully held 100 psig for over 10 minutes. Given the effort required to seal the manway during this test, the Safety Board questions the effectiveness of the securement design, and is concerned that the typical loader may not exert the effort required during the hydrostatic tests to secure the manway.

The recorded torque to loosen each of the pressure relief mounting bolts indicate that three of the four valves were not seated evenly when the pressure relief valves were being removed for bench testing. Since the pressure relief valves had been exposed to fire and there was some degradation of the gaskets at the mounting interfaces, the uneven torque values do not precisely reflect the pre-accident condition of the mounting bolts and flanges. The torque values do indicate, however, that the mounting bolts for the pressure relief valves likely were not evenly torqued when the accident occurred. Without specified torque values to obtain a liquid/vapor seal, it cannot be determined whether a proper seal existed at any of the mounting surfaces for the pressure relief valves.

The results of the bench tests of the pressure relief valves indicate that three of the four valves opened and reseated close to design specifications. The fourth valve, which was on the A-end of ADMX 29477, opened at 73 psig, but did not reseat until pressure had fallen to 30 psig. The valve should reseat at 60 psig. Since this particular valve was located in an area where the tank shell had been scorched and subjected to heat, the failure of the valve to reseat within specifications may have been the result of heat damage.

The pressure relief valves (with one exception) operated satisfactorily when they were oriented in a vertical position. However, without testing the valves in different orientations, the performance of the valve in positions other than the vertical cannot be ascertained.

Consequently, the Safety Board cannot positively conclude that the leakage was caused by excessive internal forces generated during the derailment, improperly secured manways, improperly mounted pressure relief valves, or a performance deficiency of the pressure relief valves. However, because of the minimal structural damage to the tanks and the leakage that did occur, the Safety Board assessed the adequacy of ADM's procedures for loading and preparing tank cars for transportation, and the adequacy of Federal regulations regarding the performance and design of closure fittings on hazardous materials rail tanks.

Tank Car Securement Procedures and Training at ADM's Cedar Rapids Plant

The investigation of this accident revealed that the loading of hazardous materials into tank cars at ADM's Cedar Rapids plant was performed by operators with minimum supervision from their immediate supervisor, the foreman of alcohol production at the plant. The foreman acknowledged that, aside from the operator loading the tank car, no other employee at the plant routinely inspects the manway or valves on the tank cars before the tank car is released to the railroad. The foreman's statement that he will go to the loading area only if there is a problem, and the superintendent's statement that he depends upon the competency of the foreman and the loader to properly load the tank cars suggest that there is no effective supervision and evaluation of the loader's performance.

The investigation also revealed that written procedures for loading tank cars that existed at the time of the accident were minimal. Further, even the procedures put in writing following the accident do not provide sufficient guidance to be effective. For example, there are no criteria for operators to determine when manway gaskets should be changed, and the written guidance for securing the manways does not specify whether manway bolts should be evenly torqued or how much torque should be applied. The written procedures also do not require the operator to check whether the mounting bolts for the pressure relief valves are torqued, or otherwise provide guidance about the pressure relief valves. While ADM does not concede that it is necessary to have loading procedures in writing and the corporate office has provided little guidance on this issue to any of its plants, the Safety Board is concerned that without detailed written procedures, the loading of tank cars becomes a far too subjective activity. The Safety Board believes that this is particularly true when the only type of training given to the operators is on-the-job training.

The Safety Board found in its investigation of a vinyl chloride monomer tank car fire at the Formosa Plastics Corporation plant in Baton Rouge, Louisiana, on July 30, 1983,³² that the failure to provide written procedures for its loading employees contributed to the cause of the accident. The Safety Board, consequently, recommended that the Formosa Plastics Corporation:

³² Railroad Accident Report--"Vinyl Chloride Monomer Release from a Railroad Tank Car and Fire, Formosa Plastics Corporation Plant, Baton Rouge, Louisiana, July 30, 1983" (NTSB/RAR-85/08).

R-85-65

Establish a training program and loading turnover procedures for supervisors and employees assigned to load hazardous materials for transportation.

The Formosa Plastics Corporation subsequently developed a training program and developed procedures and a checkoff list to be used for its employees in the loading of the tank cars. As a result, the Safety Board placed the recommendation in a "Closed--Acceptable Action" status.

While the Board cannot conclude whether the manways had been adequately secured by ADM before releasing ADMX 29477 and ADMX 29494 for transportation, or that the pressure relief valves were mounted securely, the Safety Board believes that the absence of detailed written procedures, of an adequate employee training and evaluation program, and of appropriate corporate oversight increases the likelihood of future releases of hazardous materials. The Board believes that ADM should develop detailed written procedures for loading and preparing rail tank cars for transportation and to develop and implement employee training and evaluation programs consistent with the written procedures. Furthermore, in view of the deficiencies noted at the Formosa Plastics Corporation's plant and at ADM's Cedar Rapids plant, the Safety Board is concerned that the problems may be widespread in the industry. Accordingly, the Safety Board believes that the Chemical Manufacturers Association and the National Industrial Transportation League should inform its membership of the circumstances of this accident and encourage its members to develop written procedures for loading and preparing tank cars for transportation and to implement employee training and evaluation programs consistent with the written procedures.

Federal Regulations Regarding Performance and Design of Closure Fittings on Hazardous Materials Rail Tanks

Existing tank car design specifications in 49 CFR Part 179 do not address accident performance standards, particularly with respect to closure fittings on tank cars, or require that dynamic loads be calculated to determine if a tank car and its fittings can withstand the dynamic forces generated by liquid surging or sloshing in a derailment or overturning. Since calculation of the loading forces on the manways and other closures is not required or done as part of the tank design or approval process, the Safety Board could not determine if the dynamic forces generated in this accident exerted pressures that would have exceeded the rated pressures of the relief valves and the manways, had they been properly secured. Secondly, the performance of the pressure relief valves has been tested only in a vertical position. The performance of these relief valves in positions other than the vertical has not been proven, particularly since one pressure relief valve observed to be leaking in a horizontal position later performed nearly to manufacturer's specifications in a vertical position during the bench tests. The Safety Board believes that in accidents that are survivable by the rail tank, particularly with the small amount of structural damage as seen in this accident, it is reasonable to expect the closure fittings on the

rail tank to maintain their integrity as well. Accordingly, the Safety Board urges that the FRA, with the cooperation and assistance of RSPA, amend 49 CFR Part 179 to require that closure fittings on hazardous materials rail tanks be designed to maintain their integrity in accidents that are typically survivable by the rail tank.

The ability to mount bolted supports for fittings such as pressure relief valves and or to secure bolted fittings such as manway openings to provide a liquid or vapor tight seal depends upon tightening the fastening bolts not just so that they appear secure, but to the proper torque levels. Further, this requires the use of gaskets of the proper dimensions, thickness, and material. Therefore, the Safety Board also urges that the FRA, with the cooperation and assistance of RSPA, amend 49 CFR Part 179 to require that tank car designers and manufacturers determine and provide the specifications to secure closure fittings, such as minimum torque values for sealing bolted closures and gasket specifications.

Positioning of Tank Cars Within a Train

When the crew of Extra 470 West made up the train in Newton on the morning of the accident, they failed to position properly the two alcohol tank cars. After setting out a car in Colfax, the crew again failed to reposition the two tank cars in the middle of the train leaving the two tank cars even closer to the locomotive. Since the cars immediately following the two tank cars did not derail during the collision, it is reasonable to assume that the two tank cars, had they been the fourth and fifth cars behind the locomotive upon leaving Newton, may not have derailed. Although the positioning of the tank cars was not a factor in the cause of the accident, the position of the tank cars resulted in their derailment, the subsequent release of hazardous materials, and the resulting fire. The release of the alcohol and the fire prolonged the duration of the emergency and increased risk to life and property. Further, the bodies of the crewmembers of Extra 470 West were found under the tank cars, and the autopsy reports attributed the cause of death to crushing. Since the Safety Board could not determine if the crewmembers of Extra 470 West jumped from their locomotive prior to the collision or were thrown from the locomotive during the collision sequence, the Safety Board could reach no conclusion concerning what role the positioning of the tank cars had in terms of the death of the crewmembers.

Federal regulations address the positioning of placarded tank cars in trains, and the IAIS had included these instructions in its timetable. Both the superintendent of operations and the assistant superintendent of operations at Newton stated, however, that, based on their interpretation of the regulations, the tank cars should have been the last two cars of the train. The Federal regulations as currently written, however, do not address the positioning of placarded tank cars in a cabooseless train. The IAIS officials' interpretation of the regulations gives credence to the Safety Board's position that current regulations need to be revised to address the placement of tank cars carrying hazardous materials on cabooseless trains.

The Safety Board believes that positioning placarded cars at the end of a cabooseless train poses significant hazards. One purpose of positioning placarded cars in the middle of a train is to separate them from the occupied locomotive and caboose. With the elimination of cabooses, the rear of the train does provide the greatest separation from the crew in the locomotive. However, the Safety Board believes that there is a need to buffer placarded cars not only from head-on collisions but from rear-end collisions as well to protect the head-end crew of the striking train. The Safety Board has previously expressed concern about placement of hazardous materials cars at the rear of cabooseless trains and recommended that RSPA:

R-87-17

Change the current railroad hazardous material car placement regulations in 49 CFR Part 174, Subpart D, to read "end-of-train" in lieu of "occupied caboose."

RSPA, in its response of March 1, 1988, to the recommendation, indicated that it would work with the FRA to develop and issue an Advance Notice of Proposed Rulemaking (ANPRM) on the subject of the safety recommendation. Based on this indication, the safety recommendation was classified as "Open--Acceptable Action" on April 25, 1988, pending the change in the regulations. As of this report, RSPA has not issued an ANPRM, and no date has been provided for the issuance of the ANPRM. In view of the lack of progress to achieve the intent of this safety recommendation, it is now being held in an "Open--Unacceptable Action" status. Because this accident again indicates the need for RSPA to act, the Safety Board reiterates Safety Recommendation R-87-17.

Emergency Response

The emergency response to the accident was timely, and the various emergency response agencies coordinated their efforts and activities throughout the incident. The City of Altoona had an up-to-date disaster plan which was successfully implemented.

Survival Aspects/Crashworthiness

The locomotive cab compartment of unit 470 was destroyed when it was overridden in the front by unit 406 and in the rear by the trailing covered hopper car. The Board's investigation could not determine if the crewmembers of Extra 470 West jumped before the collision or were thrown from the locomotive cab during the collision sequence. Regardless of the scenario, because of the damages to the locomotive unit, the accident was not survivable for the crewmembers of Extra 470 West.

The crewmembers of Extra 406 East survived the accident. The engineer jumped before the collision and cleared the immediate area before the initial impact. The conductor remained inside the cab compartment during the collision sequence. Since unit 406 was the overriding unit, there was sufficient survivable area within the cab and the conductor sustained only

minor injuries. He was able to extricate himself from the cab compartment before the postcollision fire impinged upon the locomotive unit.

The covered hopper car behind unit 470 apparently elevated on impact, slipped by the standard type E (nonshelf) coupler and overrode the short hood of the locomotive, completely destroying the cab area. A 1982 study prepared for the FRA concluded that one possible means of mitigating the override problem was to install shelf couplers on locomotives. The Safety Board cannot definitively conclude that had the locomotive been equipped with a shelf coupler the fatalities would have been prevented. However, the Safety Board believes that the FRA should promulgate regulations requiring that locomotives be equipped with shelf couplers compatible in strength with the main frame sill of the locomotive.

Event Recorders

The lack of event recorders on the IAIS locomotives prevented the Safety Board from determining the speed of either train at the time of the accident, whether the trains were being operated according to the operating rules, and, thus, whether the speed of either train contributed to the accident or its severity. The Safety Board's position regarding the use of event recorders in the railroad industry has been well documented in previous accident investigations, through the issuance of safety recommendations to the industry and the FRA, and in comments on Federal rulemaking proposals. The Safety Board continues to believe that event recorders are not only an invaluable investigative tool in determining the cause of accidents and preventing future accidents but a management tool that can be used to monitor compliance with operating rules, particularly speed restrictions.

The Safety Board believes that the Rail Safety Improvement Act of 1988 mandates rules requiring event recorders and that it does not give the FRA freedom to decide whether Federal regulatory intervention on this subject is necessary. The Board is concerned, based on the FRA's past considerations of this issue, that FRA will arbitrarily decide that Federal regulations are not justified or warranted. The Board believes that the intent of Congress is explicit and that the FRA should take immediate action and issue the rulemaking requiring event recorders in the railroad industry.

Toxicological Testing

The results of the toxicological testing of the crewmembers of Extra 406 East were negative. Ethanol was detected in the tissue samples of both crewmembers of Extra 470 West but was attributed to bacterial contamination. The dispatcher and train order operator working on the day of the accident were not requested to submit to toxicological testing. While there is no evidence to indicate that these individuals were or were not impaired, the Safety Board is concerned that all individuals in safety sensitive positions were not requested to submit to toxicological testing, as required by Federal regulations. The positions of dispatcher and train order operator are critical to the safe operation of trains, particularly on a "dark" railroad. Management's failure to require that these individuals submit to

toxicological testing may have been the result of management not being thoroughly familiar with Federal regulations.

CONCLUSIONS

Findings

1. No mechanical defects were evident on the equipment of either train that would have contributed to the accident.
2. No anomalies or deficiencies were evident in the track structure or track geometry that would have contributed to the accident.
3. The crew of Extra 406 East departed Altoona before the time permitted in train order 213.
4. Alcohol and drugs were not a factor in this accident.
5. Having been on duty for nearly 10 hours and having received only 4 or 5 hours of sleep the night before, the crew of Extra 406 East could have been fatigued and preoccupied with going off duty when they departed Altoona.
6. The crew of Extra 406 East did not discuss and verify the contents of train order 213, as required by company rules.
7. The Iowa Interstate Railroad does not equip its locomotive units with event recorders; consequently, the speed of either train at the time of the collision could not be determined.
8. Because of the extensive alteration of the foliage and the embankment in the accident area during the wreckage clearing, the precise distance at which the crews of Extra 406 East and Extra 470 West would have been able to see each other could not be determined.
9. The operation of Extra 470 West was not a causal factor in the accident.
10. Based on the time of the accident and the location of the accident, Extra 470 West had more than sufficient time to travel the distance to Altoona before Extra 406 East was to depart from that location.
11. The Federal Railroad Administration failed to follow up with the Iowa Interstate Railroad (IAIS) to resolve the status of the IAIS request regarding the signal system.
12. The Iowa Interstate Railroad, knowing that it had only received temporary relief from the Federal Railroad Administration to operate without a signal system, failed to follow up with the Federal Railroad Administration and request permanent relief.

13. Had Extra 406 East been given authority in the train order to operate only as far as Altoona and then been required to contact the dispatcher and obtain permission to proceed east of Altoona, the accident could have been prevented.
14. The process by which train orders were issued to Extra 470 West on the day of the accident did not enable the dispatcher, who is responsible for the movement of trains over the territory, to be certain that the train orders were received by the crewmembers.
15. The Iowa Interstate Railroad did not maintain a record of train movements, as required by Federal regulations. Consequently, on the day of the accident, the dispatcher had no way of knowing when and if Extra 470 West had departed its initial terminal.
16. Yard limits for Altoona Yard had only been established by a general order, but no yard limit signs had been installed to designate the physical limits of the yard.
17. Management had not installed yard limit signs at Altoona to alert crews of where to begin to operate at restricted speed.
18. Although required by company rules and Federal regulations, tests of the train air brake system were not being conducted by Iowa Interstate Railroad operating crews on a regular basis.
19. Iowa Interstate Railroad management did not provide any guidance or instructions for conducting air brake tests with an end-of-train device in cabooseless operations.
20. The operating rules training program used on the Iowa Interstate Railroad was ineffective and failed to determine that operating employees were sufficiently knowledgeable of the operating rules.
21. The training program instituted by the Iowa Interstate Railroad to promote individuals to the position of engineer was deficient because (1) the trainee's exposure to locomotive operations was limited since he was required to perform the duties of conductor during this time, (2) management failed to evaluate the performance of trainees, and (3) management failed to provide adequate instructions and guidance to the engineer instructors.
22. Iowa Interstate Railroad management provided inadequate supervision of its train operations and failed to perform efficiency testing of its operating employees.
23. The Federal Railroad Administration failed to oversee adequately railroad operations on the Iowa Interstate Railroad and failed to take enforcement action against the Iowa Interstate Railroad for noncompliance with Federal regulations.

24. The Federal Railroad Administration did not have a system in place to follow up on defects noted on field inspection reports to verify that corrective action has been taken or to alert Federal Railroad Administration officials of a carrier's noncompliance with Federal regulations or trends in a carrier's operations.
25. Although Iowa Interstate Railroad crews operated over trackage of the Chicago North Western, the CSX, and METRA, these railroads had not determined if Iowa Interstate Railroad crews were qualified to operate over their respective territories.
26. Management of the Iowa Interstate Railroad was not familiar with Federal accident/incident reporting requirements and, as a result, provided no guidance or written instructions on the reporting of accidents.
27. Shippers of hazardous materials are often unaware of problems or incidents involving their containers because existing regulations do not require carriers to notify shippers of reportable hazardous materials incidents.
28. The leaking and burning of product from the tank cars, while not a factor in the cause of the accident, increased the danger and severity of the accident, prompting local emergency response personnel to evacuate nearby residents.
29. Written procedures for loading and securing tank cars at Archer Daniels Midland's Cedar Rapids plant that existed at the time of the accident were minimal and the procedures put in writing following the accident do not provide sufficient guidance to be effective.
30. Management at Archer Daniels Midland's Cedar Rapids plant had not taken sufficient actions to ensure that tank cars leaving its facility were properly prepared for transportation as required by Federal regulations.
31. Current Federal regulations do not adequately address the positioning of loaded placarded tank cars in cabooseless train operations.
32. Denatured alcohol leaked from the manways and the pressure relief valves on two tank cars during the derailment and overturning despite the minimal damage to the rail tanks.
33. Existing tank design specifications for closure fittings on hazardous materials tank cars do not adequately ensure the integrity of fittings in accidents that are survivable for the tank.

34. The emergency response was timely and the various emergency response agencies coordinated their efforts and activities throughout the accident.
35. Had the locomotive of Extra 470 West been equipped with a shelf coupler, the overriding of the locomotive by the covered hopper car would probably not have occurred and the fatalities may have been prevented.
36. The accident was not survivable for the crewmembers of Extra 470 West.

Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the traincrew of Extra 406 East to comply with the wait provisions of train order 213 and Iowa Interstate Railroad's (IAIS) inadequate oversight and enforcement of its operating rules. Contributing to the traincrew's failure to comply with the wait provisions was a combination of fatigue induced by irregular work/rest schedules, preoccupation with completing their assignment prior to exceeding duty time limits, inexperience, "mental set" or expectations based on previously issued train orders, the work activities which intervened since they received the train order, and the IAIS's inadequate training of its crews. Contributing to the accident was the Federal Railroad Administration's inadequate surveillance and enforcement of compliance by the IAIS with Federal regulations. Contributing to the length of the emergency was the release and burning of hazardous materials from pressure relief valves and manways on the tank cars.

RECOMMENDATIONS

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

--to the Iowa Interstate Railroad:

Install yard limit roadway signs at Alloona and other areas designated in general orders and show designated limits in the timetable. (Class II, Priority Action) (R-89-37)

Remove, cover, or turn away from the track, all out of service signals. (Class II, Priority Action) (R-89-38)

Require that train order operators verify to the dispatcher that train orders have been received by operating crews. (Class II, Priority Action) (R-89-39)

Establish and enforce procedures for dispatchers to maintain an accurate and up-to-date record of train movements, as required by Federal regulations. (Class II, Priority Action) (R-89-40)

Provide written instructions and training to operating personnel for conducting air brake tests with an end-of-train device in cabooseless operations. (Class II, Priority Action) (R-89-41)

Develop and implement a comprehensive program of training and testing of the company's operating rules, in accordance with the provisions of the Federal regulations. (Class II, Priority Action) (R-89-42)

Develop and implement a program of supervision and management of train operations to include efficiency checks of traincrews, as required by Federal regulations. (Class II, Priority Action) (R-89-43)

Develop explicit written procedures concerning the Federal agencies to be contacted in the event of a railroad accident/incident on the Iowa Interstate Railroad. (Class II, Priority Action) (R-89-44)

--to the Federal Railroad Administration:

Conduct a safety audit of the Iowa Interstate Railroad. (Class II, Priority Action) (R-89-45)

Resolve the status of the signal system on the Iowa Interstate Railroad. (Class II, Priority Action) (R-89-46)

Develop and implement a program that will (1) provide consistent followup of defects noted on inspection reports to verify that corrective action has been taken, (2) outline in detail the responsibilities of field and headquarters personnel regarding defects and violations noted, and (3) alert FRA officials of carriers' noncompliance with Federal regulations and trends in carriers' operations. (Class II, Priority Action) (R-89-47)

Assist and cooperate with the Research and Special Programs Administration in amending 49 CFR Part 179 to require that closure fittings on hazardous materials rail tanks be designed to maintain their integrity in accidents that are typically survivable by the rail tank. (Class II, Priority Action) (R-89-48)

Assist and cooperate with the Research and Special Programs Administration in amending 49 CFR Part 179 to require that specifications for securing closure fittings, such as minimum torque values for sealing bolted closures and gasket specifications, be determined and provided by tank car designers and manufacturers. (Class II, Priority Action) (R-89-49)

Expedite the rulemaking requiring the use of event recorders in the railroad industry. (Class II, Priority Action) (R-89-50)

Promulgate regulations requiring that locomotives be equipped with shelf couplers compatible in strength with the main frame sill of the locomotive. (Class II, Priority Action) (R-89-51)

--to the Research and Special Programs Administration:

Establish procedures that require carriers reporting hazardous materials incidents under the provisions of 49 CFR 171.16 to notify shippers whose hazardous materials shipments are involved. (Class II, Priority Action) (R-89-52)

Assist and cooperate with the Federal Railroad Administration in amending 49 CFR Part 179 to require that closure fittings on hazardous materials rail tanks be designed to maintain their integrity in accidents that are typically survivable by the rail tank. (Class II, Priority Action) (R-89-53)

Assist and cooperate with the Federal Railroad Administration in amending 49 CFR Part 179 to require that tank car designers and manufacturers determine and provide the specifications to secure closure fittings, such as minimum torque values for sealing bolted closures and gasket specifications. (Class II, Priority Action) (R-89-54)

--to the Archer Daniels Midland Company:

Develop written procedures for loading and preparing rail tank cars for transportation at the various plants and develop and implement employee training and evaluation programs consistent with the written procedures. (Class II, Priority Action) (R-89-55)

--to the Chemical Manufacturers Association and the National Industrial Transportation League:

Inform its membership of the circumstances of the train accident and the release of hazardous materials at Altoona, Iowa, on July 30, 1988, and encourage its members to develop written procedures for loading and preparing rail tank cars for transportation and to develop and implement employee training and evaluation programs consistent with the written procedures. (Class II, Priority Action) (R-89-56)

--to the American Short Line Railroad Association:

Inform its membership of the circumstances of the train accident and the release of hazardous materials at Altoona, Iowa, on July 30, 1988. (Class II, Priority Action) (R-89-57)

Disseminate to its membership accident/incident notification criteria of all Federal agencies. (Class II, Priority Action) (R-89-58)

--to the Association of American Railroads:

Inform its membership of the circumstances of the train accident and the release of hazardous materials at Altoona, Iowa, on July 30, 1988. (Class II, Priority Action) (R-89-59)

Cooperate with the Federal Railroad Administration in promulgating regulations requiring the installation of shelf couplers on locomotives. (Class II, Priority Action) (R-89-60)

--to the Chicago North Western Transportation Company, the CSX Transportation Company, and METRA:

Determine that operating employees of other railroads are appropriately qualified to operate over trackage of your railroad. (Class II, Priority Action) (R-89-61)

As a result of its investigation of this accident, the Safety Board also reiterated the following Safety Recommendation to the Research and Special Programs Administration:

Change the current railroad hazardous material car placement regulations in 49 CFR Part 174, Subpart D, to read "end-of-train" in lieu of "occupied caboose." (Class II, Priority Action) (R-87-17)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ James L. Kolstad
Acting Chairman

/s/ John K. Lauber
Member

/s/ Joseph T. Nall
Member

/s/ Lemoine V. Dickinson, Jr.
Member

July 6, 1989

Member Burnett filed the following dissenting statement:

I do not concur in the adoption of the report and its probable cause because we have not yet satisfactorily completed the investigation. Our investigation establishes that the Federal Railroad Administration (FRA) failed to do its job, which in turn led to this accident. Until we interview the appropriate officials within the FRA and until we probe and assess the FRA's decisionmaking processes that allowed the Iowa Interstate Railroad to operate in noncompliance with Federal regulations, this investigation will fall short of the standard that it should achieve.

We should have awaited the completion of the investigation before adopting the probable cause.

/s/ Jim Burnett
Member

July 12, 1989

APPENDIXES

APPENDIX A

INVESTIGATION AND HEARING

Investigation

The National Transportation Safety Board was notified at 2:30 p.m., eastern daylight time, on July 30, 1988, of a head-on collision and derailment of two Iowa Interstate Railroad freight trains with a fire and evacuation in progress at Altoona, Iowa. The investigator-in-charge and other members of the investigative team were dispatched from the Washington, D.C. office and field offices in Atlanta, Georgia, and Fort Worth, Texas. Investigative groups were established for engineering, mechanical, operations, human performance, survival factors, and hazardous materials.

Hearing

The Safety Board staff conducted a deposition proceeding as a part of its investigation of this accident on October 18, 19, and 21, 1988, at Des Moines, Iowa. Parties to this proceeding included the Iowa Interstate Railroad, the Federal Railroad Administration, the United Transportation Union, and the Archer Daniels Midland Company. The Iowa Interstate Railroad chose not to appoint a party spokesperson during the proceedings. Four Iowa Interstate Railroad officers required a federal court order before presenting testimony. Twelve witnesses testified.

APPENDIX B

PERSONNEL INFORMATION

Engineer, Extra 406 East

Engineer Dennis L. Schrader, age 47, advised that he had been diagnosed as having coronary artery disease in 1987, for which he successfully underwent coronary angioplasty. His IAIS physical examination record, dated November 11, 1986, disclosed no adverse medical condition, and reported that his vision and hearing were within normal limits.

Conductor, Extra 406 East

Conductor Orville E. Harger, age 51, underwent a physical examination on November 13, 1984. The record disclosed no adverse medical condition and reported that his hearing and corrected vision were within normal limits.

Engineer, Extra 470 West

Engineer Larry D. Buckingham, age 35, underwent a physical examination, dated October 24, 1986. The IAIS record disclosed no medical problems and reported vision and hearing to be within normal limits.

Conductor, Extra 470 West

Conductor William J. Peers, age 54, certified on his employment application, dated August 7, 1987, that he had no physical or mental condition which limited or impaired his ability to perform his duties. There was no IAIS record of a physical examination on file for Conductor Peers.

APPENDIX C

IOWA INTERSTATE RAILROAD TIMETABLE NO. 2 (EXCERPTS)

**IOWA INTERSTATE
RAILROAD LTD.**

**SYSTEM
TIMETABLE
NO. 2**



**Effective 0001
Wednesday, April 15, 1987
Central Standard Time**

**FOR THE GOVERNMENT OF
EMPLOYEES CONCERNED.**

SAFETY — FIRST . . . ALWAYS

SPECIAL INSTRUCTIONS

current train location line-up will be permitted to enter the limits of such line-up during the time the line-up is in effect.

In emergency situations, when it becomes necessary to operate a train or engine during time line-up is in effect and such train or engine is not shown on current line-up an officer should ride the engine whenever possible and dispatcher must issue Train Order to the train or engine as follows:

"Track car operators have no notice of your train (or engine) on line-up. "Run watching for track cars sounding whistle freely."

Dispatcher must take necessary action to prevent trains or engines running in advance of the figures shown at the stations designated on line-up when necessary, protecting the figures shown by Form "E" Train Order (Time Order).

Train dispatchers shall issue line-ups for all concerned at times specified by the Superintendent and will be written in train order book numbered consecutively beginning at midnight. Additional line-ups will be issued upon request. When line-ups previously issued are still in effect when dispatchers are relieved, transfer must show numbers of line-ups in effect and relieving Dispatchers will be responsible for trains operating not shown on line-up or trains operating ahead of line-up figures. Line-up must be repeated by one or more of those copying it. Each person copying line-up must observe whether line-up is repeated correctly and, if not, will immediately call attention to any mistakes.

At designated intervals, copies of line-up will be sent to a designated supervisory officer for checking.

Persons copying line-ups shall make as many copies as necessary. When an operator copies line-up, a file copy shall be retained bearing signature of all persons to whom copies were issued, and when relayed by phone or other communication, notation will be made on file copy.

When necessary, foreman shall obtain extra copies of line-ups for use by employees under their supervision. Such employees shall acknowledge receipt and understanding of the line-up by signing the foreman's copy.

ITEM (5) All Subdivisions:

1. Hi rail equipment may be operated with one man.
2. The Following Letters and Symbols Indicate:
 - A Automatic Interlocking
 - B General Order Boards or Books
 - C Standard Clock
 - F Fuel Station
 - M Manual Interlocking
 - P Telephone
 - T Turntable
 - UX Railroad crossing not protected by interlocking
 - W Water station
 - Y Wye
 - YD Station where yard limits are maintained.
 - Wayside Radio
 - BR Base Radio

3. Train or enginemen will communicate with dispatcher within (10) ten minutes after arrival at meeting points unless expected train is heard or seen approaching.

SPECIAL INSTRUCTIONS

A green resume speed sign will be displayed to the right of each track at the limit of restriction. Restricted speed must not be exceeded through the territory named in the order unless a different speed is orally authorized by foreman in charge. Prescribed speed will not be exceeded until entire train has passed the resume speed sign.

A train or engine within limits of a Form y example (3) order at effective time of order, must not proceed unless orally authorized by foreman in charge of work, or a proceed signal with green flag or light is received.

Where "PROCEED PREPARED TO STOP" and "CONDITIONAL STOP" signs are displayed, they must be respected even though no Form y example (3) train order is held. Where a Form y example (3) is in effect and the "Conditional Stop" sign is not displayed, or when proceed prepared to stop sign is displayed and no Form y example (3) is in effect, stop must be made at location where "CONDITIONAL STOP" sign should be located, and train must not proceed until orally authorized or receives a proceed signal with a green flag or light.

Before orally authorizing train to proceed, foreman must inform the engineer the speed permitted over the restricted track.

Oral authorization and acknowledgment between foremen and engineers for trains to pass "CONDITIONAL STOP" signs must be made in the manner prescribed by form shown in special instructions.

Where the term "foreman" is used in these rules, general order, special instructions, and Form y example (3) train orders, it will also apply to the employee in charge of work.

Where switching or work is to be performed, where it is necessary to pass the "CONDITIONAL STOP" several times, engineer must have an understanding with foreman in charge of work, as to work to be performed, limits, and time his train or engine may work within these limits.

When restricted track is less than two miles from terminal or junction point and distance does not permit "PROCEED PREPARED TO STOP" sign to be displayed as required by the rules, sign will be displayed as far as possible from "conditional stop" sign but not farther than the first switch through which train leaves the terminal and not beyond the clearance at junction point. The location of such yellow sign so placed must be designated by train order.

5. RULE 11: UNATTENDED FUSEE:

A train finding an unattended fusee burning on or near its track must stop and after stopping, train must proceed at restricted speed for a safe flagging distance from where fusee was displayed.

6. RULE 12: TORPEDOES:

The explosion of one or more torpedo(es) requires train to immediately reduce to restricted speed for a safe flagging distance from the point where exploded.

7. RULE 93: 3rd paragraph does not apply.

8. RULE 97(A): Does not apply.

9. RULE 99: The flagging distance is shown in the station page of each subdivision.

10. RULE 100: Returning movement must be made at restricted speed.

SPECIAL INSTRUCTIONS

However, if a car occupied by guards or technical escorts is equipped with a lighted heater or stove, it must be the fourth car behind any car requiring "EXPLOSIVES A" placards.

Position in Train and Notification to Conductor and Engineer on Trains Containing Cars Placarded "EXPLOSIVES A" and/or "POISON GAS"

112. In a moving or standing train, a car placarded "EXPLOSIVES A" or "POISON GAS" may not be placed nearer than the sixth car from the engine or an occupied caboose. However, when the length of the train will not permit this car to be so placed, it must be placed as near the middle of the train as possible, but not less than the second car from the engine or occupied caboose.

At each point where trains are made up or switched by crews other than the crew which will handle the departing movement, the conductor and Engineer must be issued information showing the location in train of each car placarded "EXPLOSIVES A" or "POISON GAS."

At points where crews are relieved, the form must be transferred to the relieving crew.

Position in Train of Cars Placarded "RADIOACTIVE"

113. In a moving or standing train, a car placarded "RADIOACTIVE" may not be placed next to any other loaded placarded car (other than one placarded "COMBUSTIBLE") an engine, occupied caboose, or carload of undeveloped film. Cars placarded "RADIOACTIVE" may be placed next to each other.

Separating Cars Placarded "EXPLOSIVES A" or "POISON GAS" From Other Cars in Trains

114. (a) In a moving or standing train, a car placarded "EXPLOSIVES A" or "POISON GAS" may not be placed next to:

1. A passenger car or combination car that may be occupied except as provided in Rule 111.
2. Any loaded placarded car other than a car placarded with the same placard or one placarded "COMBUSTIBLE";
3. An engine;
4. A loaded flatcar, except that loaded cars placarded "EXPLOSIVES A" may be placed next to each other. A flatcar equipped with permanently attached ends of rigid construction is considered to be an open-top car;

5. An open-top car when any of the lading protrudes beyond the car ends or when any of the lading extending above the car ends is liable to shift so as to protrude beyond the car ends;

6. A car with automatic refrigeration or heating apparatus in operation, or a car with open-flame apparatus in service, or with an internal combustion engine in operation;

7. A car containing lighted heaters, stoves, or lanterns; or

8. A car occupied by any person, including any attendant for the cargo contained therein, except as provided in Rules 111.

(b) In a moving or standing train, a car placarded "EXPLOSIVES A" may not be placed next to a car placarded "POISON GAS."

Position in Train of Loaded Placarded Tank Car Other Than Car Placarded "COMBUSTIBLE"

115. Except for a tank car placarded "COMBUSTIBLE", a loaded placarded tank car in a moving or standing train may not be nearer than the sixth car from the engine, occupied caboose, or passenger car. However, when the length of the train will not permit a loaded placarded tank car to be so placed, it must be placed as near the middle of the train as possible and not nearer than the second car from the engine, occupied caboose, or passenger car.

The Conductor and Engineer must be furnished information as to the location of all placarded cars in train. This information may be furnished on Train Consist or message.

TRAIN PLACEMENT — SWITCHING RESTRICTIONS FOR PLACARDED CARS

Issue Jan. 1987

			HAZARDOUS MATERIAL IDENTIFICATION INFORMATION																					
			Hazardous materials are assigned a "UN" or "NA" 4-digit number to identify a specific commodity or group of commodities. These 4-digit numbers are for emergency response and must be displayed on orange panels along with a standard placard or an alternate rate placard with the identification number in the center of each placard as follows:																					
			<p>In addition, hazardous material commodities are grouped into hazard classes using a hazard class number which is displayed in the lower triangle of each placard. The Hazard Classes are as follows:</p> <table border="0"> <tr> <td>1 Explosives</td> <td>5.2 Organic Peroxides</td> </tr> <tr> <td>2 Compressed Gases</td> <td>6 Poisons</td> </tr> <tr> <td>3 Flammable/Combustible Liquids</td> <td>7 Radioactive materials</td> </tr> <tr> <td>4 Flammable Solids</td> <td>8 Corrosives</td> </tr> <tr> <td>5.1 Oxidizers</td> <td>9 Miscellaneous (ORs) Other Regulated Commodities</td> </tr> </table>												1 Explosives	5.2 Organic Peroxides	2 Compressed Gases	6 Poisons	3 Flammable/Combustible Liquids	7 Radioactive materials	4 Flammable Solids	8 Corrosives	5.1 Oxidizers	9 Miscellaneous (ORs) Other Regulated Commodities
1 Explosives	5.2 Organic Peroxides																							
2 Compressed Gases	6 Poisons																							
3 Flammable/Combustible Liquids	7 Radioactive materials																							
4 Flammable Solids	8 Corrosives																							
5.1 Oxidizers	9 Miscellaneous (ORs) Other Regulated Commodities																							
			<p>Note: Missing placards must be replaced. Locations where cars are inspected shall have a supply of alternate placards for this purpose. Identification numbers shall be added to placards with a black marking pen. Correct numbers shall be obtained from existing placards on car or shipping papers.</p>																					
			<p>POSITION IN TRAIN RESTRICTION/EXCEPTION: NOTES IN PLACEMENT CHART</p> <p>(1) A rail car placarded EXPLOSIVES A or POISON GAS in a moving or standing train must be next to and ahead of any car occupied by the guards or technical escorts accompanying the car. However, if a car occupied by guards or technical escorts is equipped with a lighted heater or stove, it must be the fourth car behind any car placarded EXPLOSIVES A.</p> <p>(2) Restriction applies only when any of the lading protrudes beyond the car ends or when any of the lading extending above the car ends is liable to shift so as to protrude beyond the car ends.</p> <p>(3) Cars placarded EXPLOSIVES A may be placed next to each other.</p> <p>(4) Restriction applies only to loaded flatbed or open-top trucks and trailers and to loaded trucks and trailers without securely closed doors.</p> <p>(5) Restriction does NOT apply to a car loaded with vehicles secured by a device designated for that purpose and permanently installed on the car and of a type generally accepted for handling in interchanges between railroads.</p> <p>(6) Cars placarded RADIOACTIVE must not be placed next to carloads of undeveloped film.</p> <p>NOTE: Cars with same placards may be placed next to each other.</p>																					
Cars placarded:	Cars placarded:	Cars placarded:	Tank	LOADED PLACARDED CARS	TOFC/COFC	Other than TOFC/COFC or Tank	RESIDUE Placarded Tank Cars	Cars placarded:																
				POSITION IN TRAIN RESTRICTIONS																				
X	X		X	Must not be nearer than the sixth car from the engine, occupied caboose or passenger car																				
X	X		X	When train length does not permit, must be placed as near the middle of train as possible but not nearer than the second car from the engine, occupied caboose or passenger car																				
X ⁽¹⁾	X ⁽¹⁾		X ⁽¹⁾	Engine, occupied caboose or passenger car			X	N O R E S T R I C T I O N S																
X	X		X	Car occupied by guard or escort																				
X ⁽²⁾	X ⁽²⁾		X ⁽²⁾	Loaded plain flat car																				
X ⁽²⁾	X ⁽²⁾		X ⁽²⁾	Loaded bulkhead flat car																				
X ⁽²⁾	X ⁽²⁾		X ⁽²⁾	Loaded TOFC/COFC flat car																				
X ⁽²⁾	X ⁽²⁾		X ⁽²⁾	Car loaded with vehicles																				
X ⁽²⁾	X ⁽²⁾		X ⁽²⁾	Open top car with shiftable load																				
X	X		X	Car with internal combustion engine in operation																				
X	X		X	Car with any heating apparatus or any lighted stove, heater or lantern																				
X	X		X	Car placarded EXPLOSIVES A			X																	
X	X		X	Car placarded POISON GAS			X																	
X	X		X	Car placarded RADIOACTIVE			X																	
X	X		X	Any loaded placarded car (other than COMBUSTIBLE or same placard)			X																	
SWITCHING RESTRICTIONS																								
X	X			Must not be cut off in motion or be impacted by cars rolling under their own momentum			X																	
X				Must be separated from engine by at least one non placarded car																				
			X	Where use of hand brakes is necessary, must not be cut off in motion until preceding car is clear of lead, also, restricted car must be clear of lead before another car is allowed to follow																				



APPENDIX D

CHICAGO, ROCK ISLAND AND PACIFIC RAILROAD COMPANY
 RULES AND INSTRUCTIONS FOR TRAIN HANDLING AND OPERATION OF THE AIR BRAKES
 (EXCERPTS)

TRAIN AIR TEST

Rule 1

NOTE TO INITIAL TERMINAL:

Where the term initial terminal is used in these Train Air Test rules, it refers to that terminal where the train is originally made up. It may or may not be the initial terminal on a sub-division, as defined in the UNIFORM CODE OF OPERATING RULES.

Rule 2

CAUTION: During brake pipe leakage test, with 26 L equipment, after determining the amount of leakage, the engineer must make a reduction of equalizing pressure that will equal brake pipe pressure before cutting in the double heading cock. Then cut in the double heading cock and immediately complete a full service brake pipe reduction.

Rule 3

§ Train air-brake system tests.

- (a) Supervisors are jointly responsible with inspectors, enginemen and trainmen for condition of air brake and air signal equipment on motive power and cars to the extent that it is possible to detect defective equipment by required air tests.
- (b) Communicating signal system on passenger equipment trains must be tested and known to be in a suitable condition for service before leaving terminal.

1

Train Air Tests

- (c) Each train must have the air brakes in effective operating condition, and at no time shall the number and location of operative air brakes be less than permitted by Federal requirements. When piston travel is in excess of 10 inches, the air brakes cannot be considered in effective operating condition.
- (d) Condensation must be blown from the pipe from which air is taken before connecting yard line or motive power to train.

INITIAL TERMINAL ROAD TRAIN
AIR BRAKE TESTS

Rule 4

- (a) Except for run-through and unit run-through trains covered under Rule 10, each train must be inspected and tested as specified in this section at points--
 1. Where the train is originally made up (initial terminal);
 2. Where train consist is changed, other than by adding or removing a solid block of cars, and the train brake system remains charged; and
 3. Where a train is received in interchange.
- (b) Each carrier shall designate additional inspection points not more than 500 miles apart where intermediate inspection will be made to determine that--
 1. Brake pipe pressure leakage does not exceed 5 pounds per minute;
 2. Brakes apply on each car in response to a 20 pound service brake pipe pressure reduction; and

2

Train Air Tests

3. Brake rigging is properly secured and does not bind or foul.
- (c) Train airbrake system must be charged to required air pressure, angle cocks and cutout cocks must be properly positioned, air hose must be properly coupled and must be in condition for service. An examination must be made for leaks and necessary repairs made to reduce leakage to a minimum. Retaining valves and retaining valve pipes must be inspected and known to be in condition for service.
- (d) (1) After the airbrake system on a freight train is charged to within 15 pounds of the setting of the feed valve on the locomotive, but to not less than 60 pounds, as indicated by an accurate gauge at rear end of train, and on a passenger train when charged to not less than 70 pounds, and upon receiving the signal to apply brakes for test, a 15 pound brake pipe service reduction must be made in automatic brake operations, the brake valve lapped, and the number of pounds of brake pipe leakage per minute noted as indicated by the brake pipe gauge, after which brake pipe reduction must be increased to full service. Inspection of the train brakes must be made to determine that angle cocks are properly positioned, that the brakes are applied on each car, that piston travel is correct, and that all parts of the brake equipment are properly secured. When this inspection has been completed, the release signal must be given and brakes released and each brake inspected to see that all have released.
- (2) Omitted intentionally.

Train Air Tests

- (3) When a locomotive used to haul the train is provided with a means for maintaining brake pipe pressure at a constant level during service application of the train brakes, this feature must be cut out during train air brake tests.
- (e) Brake pipe leakage must not exceed 5 pounds per minute.
- (f) (1) At initial terminal piston travel of body-mounted brake cylinders which is less than 7 inches or more than 9 inches must be adjusted to nominally 7 inches.
- (2) Minimum brake cylinder piston travel of truck-mounted brake cylinders must be sufficient to provide proper brake shoe clearance when brakes are released. Maximum piston travel must not exceed 6 inches.
- (3) Piston travel of brake cylinders on freight cars equipped with other than standard single capacity brake, must be adjusted as indicated on badge plate or stenciling on car located in a conspicuous place near brake cylinder.
- (g) When test of airbrakes has been completed the engineman and conductor must be advised that train is in proper condition to proceed.
- (h) During standing test, brakes must not be applied or released until proper signal is given.
- (i) (1) When train airbrake system is tested from a yard test plant, an engineer's brake valve or a suitable test device must be used to provide increase and reduction of brake pipe air pressure at the same or a slower rate as with engineer's brake valve and

Train Air Tests

yard test plant must be connected to the end which will be nearest to the hauling road locomotive.

- (2) When yard test plant is used, the train airbrakes system must be charged and tested as prescribed by paragraphs (c) to (g) of this section inclusive, and when practicable should be kept charged until road motive power is coupled to train, after which, an automatic brake application and release test of airbrakes on rear car must be made.
- (3) If after testing the brakes as prescribed in subparagraph (2) of this paragraph the train is not kept charged until road motive power is attached, the brakes must be tested as prescribed by paragraph (d) (1) of this section.
- (j) Before adjusting piston travel or working on brake rigging, cutout cock in brake pipe branch must be closed and air reservoirs must be drained. When cutout cocks are provided in brake cylinder pipes, these cutout cocks only may be closed and air reservoirs need not be drained.

ROAD TRAIN AND INTERMEDIATE TERMINAL TRAIN AIR BRAKE TESTS

Rule 5

- (a) Passenger trains: Before motive power is detached or angle cocks are closed on a passenger train operated in either automatic or electro-pneumatic brake operation, except when closing angle cocks for cutting off one or more cars from the rear end of

Train Air Tests

train, automatic air brake must be applied. After recoupling, brake system must be recharged to required air pressure and before proceeding and upon receipt of proper request or signal, application and release tests of brakes on rear car must be made from locomotive in automatic brake operation. Inspector or trainmen must determine if brakes on rear car of train properly apply and release.

- (b) Freight trains: Before motive power is detached or angle cocks are closed on a freight train, brakes must be applied with not less than a 20 pound brake pipe reduction. After recoupling and angle cocks are opened, it must be known that brake pipe air pressure is being properly restored as indicated by the caboose gauge and that brakes on rear car are released. In the absence of a caboose gauge, air brake test must be made as prescribed by that portion of paragraph (a) of this section pertaining to automatic brake operation.
- (c) (1) At a point other than initial terminal where locomotive or caboose is changed, or where one or more consecutive cars are cut off from rear end or head end of train with consist otherwise remaining intact, after train brake system is charged to within 15 pounds of feed valve setting on locomotive but not less than 60 pounds as indicated at rear of freight train, and on a passenger train to at least 70 pounds, a 20-pound brake pipe reduction must be made and it must be determined that brakes on rear car apply and release properly.

Train Air Tests

- (2) Before proceeding it must be known that brake pipe pressure as indicated at rear of freight train is being restored
- (d) (1) At a point other than a terminal where one or more cars are added to a train, and after the train brake system is charged to not less than 60 pounds as indicated by a gauge at the rear of freight train and on a passenger train to not less than 70 pounds, tests of air brakes must be made to determine that brake pipe leakage does not exceed five (5) pounds per minute as indicated in the brake pipe gauge after a 15 pound brake pipe reduction. After the leakage test is completed, brake pipe reduction must be increased to full service, and it must be known that the brakes on each of these cars and on the rear car of train apply and release. Cars added to train which have not been inspected in accordance with § Rule 4 (c) to (j) must be so inspected and tested at next terminal where facilities are available for such attention.
- (2) (i) at a terminal where a solid block of cars which has been previously charged and tested as prescribed by § Rule 4 (c) to (j) is added to a train, test must be made to determine that brakes on the rear car of train apply and release.
- (ii) When cars which have not been previously charged and tested as prescribed by § Rule 4 (c) to (j) are added to a train, such cars

Train Air Tests

- may either be given inspection and tests in accordance with § Rule 4 (c) to (j), or tested as prescribed by subparagraph (1) of this paragraph prior to departure in which case these cars must be inspected and tested in accordance with § Rule 4 (c) to (j) at next terminal.
- (3) Before proceeding it must be known that the brake pipe pressure at the rear of freight train is being restored.
- (e) (1) Transfer train and yard train movements not exceeding 20 miles, must have the air brake hose coupled between all cars, and after the brake system is charged to not less than 60 pounds, a 15 pound service brake pipe reduction must be made to determine that the brakes are applied on each car before releasing and proceeding.
- (2) Transfer train and yard train movement exceeding 20 miles must have brake inspection in accordance with § Rule 4 (c) to (j).
- (f) The automatic air brake must not be depended upon to hold a locomotive, cars or train, when standing on a grade, whether locomotive is attached or detached from cars or train. When required, a sufficient number of hand brakes must be applied to hold train, before air brakes are released. When ready to start, hand brakes must not be released until it is known that the air brake system is properly charged.

APPENDIX E

49 CFR PART 217 (EXCERPTS)

Federal Railroad Administration, DC/

§ 217.2

petitioner must submit a written request for a hearing within fifteen (15) days after the conference. The hearings will commence within fourteen (14) calendar days of receipt of the request and will be conducted in accordance with sections 556 and 575, Title 5, U.S.C.

(c) Unless stayed or modified by the Administrator, the requirements of each Emergency Order issued under this subpart shall remain in effect and be observed pending decision on a petition for review.

§ 217.17 Reservation of authority and discretion.

The FRA may issue Emergency Orders concerning track without regard to the procedures prescribed in this subpart whenever the Administrator determines that immediate action is required to assure the public safety.

PART 217—RAILROAD OPERATING RULES

Subpart A—General

- Sec.
 217.1 Purpose.
 217.3 Application.
 217.5 Penalty.
 217.7 Filing of operating rules.
 217.9 Program of operational tests and inspections; recordkeeping.
 217.11 Program of instruction on operating rules.
 217.13 Annual report.
 217.15 Information collection.

APPENDIX A—SCHEDULE OF CIVIL PENALTIES

Authority: Secs. 302 and 309, 84 Stat. 971 and 975 (45 U.S.C. 431 and 438), and sec. 1.45(n) of the regulations of the Office of the Secretary of Transportation, 49 CFR 1.45(n).

Source: 39 FR 41176, Nov. 25, 1974, unless otherwise noted.

Subpart A—General

§ 217.1 Purpose.

Through the requirements of this part, the Federal Railroad Administration learns the condition of operating rules and practices with respect to trains and other rolling equipment in the railroad industry, and each railroad is required to instruct its employees in operating practices.

§ 217.3 Application.

(a) Except as provided in paragraph (b) of this section, this part applies to railroads that operate trains or other rolling equipment on standard gage track which is part of the general railroad system of transportation.

(b) This part does not apply to—

- (1) A railroad that operates only on track inside an installation which is not part of the general railroad system of transportation; or
- (2) A rapid transit railroad that operates only on track used exclusively for rapid transit, commuter, or other short-haul passenger service in a metropolitan or suburban area.

140 FR 2690, Jan. 15, 1975)

§ 217.5 Penalty.

Each railroad to which this part applies that violates any requirement prescribed in this part is liable to a civil penalty of at least \$250 but not more than \$2500.

§ 217.7 Filing of operating rules.

(a) Before February 1, 1975, each railroad that is in operation on January 1, 1975, shall file with the Federal Railroad Administrator, Washington, D.C. 20590, one copy of its code of operating rules, timetables, and timetable special instructions which were in effect on January 1, 1975. Each railroad that commences operation after January 1, 1975, shall file with the Administrator one copy of its code of operating rules, timetables, and timetable instructions before it commences operations.

(b) Each amendment to a railroad's code of operating rules, each new timetable, and each new timetable special instruction which is issued after January 1, 1975, shall be filed with the Federal Railroad Administrator within 30 days after it is issued.

§ 217.9 Program of operational tests and inspections; recordkeeping.

(a) Each railroad to which this part applies shall periodically conduct operational tests and inspections to determine the extent of compliance with its code of operating rules, timetables, and timetable special instruc-

§ 217.11

tions 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 to which this part applies shall file with the Federal Railroad Administrator, Washington, D.C. 20590, three copies of a program for periodic conduct of the operational tests and inspections required by paragraph (a) of this section. The program shall—

(1) Provide for operational testing and inspection under the various operating conditions on the railroad;

(2) Describe each type of operational test and inspection adopted, including the means and procedures used to carry it out;

(3) State the purpose of each type of operational test and inspection;

(4) State, according to operating divisions where applicable, the frequency with which each type of operational test and inspection is conducted;

(5) Begin within 30 days after it is filed with the Federal Railroad Administrator; and

(6) Include a schedule for making the program fully operative within 310 days after it begins.

(c) Each amendment to a railroad's program for periodic conduct of operational tests and inspections required under paragraph (a) of this section shall be filed with the Federal Railroad Administrator within 30 days after it is issued.

(d) **Records.** Each railroad shall keep a record of the date and place of each operational test and inspection performed in accordance with its program. Each record must provide a brief description of the operational test or inspection, including the characteristics of the operation tested or inspected, and the results thereof. Records must be retained for one year and made available to representatives of the Federal Railroad Administration for inspection and copying during regular business hours.

§ 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 un-

49 CFR Ch. II (10-1-84 Edition)

derstands 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.

§ 217.13 Annual report.

Before March 1 of each year, each railroad to which this part applies, except for a railroad with fewer than 400,000 total manhours, shall file with the Federal Railroad Administrator, Washington, D.C. 20590, a written report of the following with respect to its previous year's activities.

(a) The total number of train miles which were operated over its track.

(b) A summary of the number, type, and result of each operational test and inspection, stated according to operating divisions where applicable, that was conducted as required by § 217.9.

(c) The number of operational tests and inspections conducted as required by § 217.9 per 10,000 train miles.

APPENDIX F

SAFETY BOARD LETTER DATED DECEMBER 7, 1988, and
FRA LETTER DATED JANUARY 18, 1989

**National Transportation Safety Board**

Washington, D.C. 20594

December 7, 1988

Mr. Joseph W. Walsh
Associate Administrator for Safety
Federal Railroad Administration
Room 8329A
400 7th Street
Washington, D.C. 20590

Dear Mr. Walsh:

Re: Head-On Collision Between Iowa Interstate Railroad Ltd.
Extra 470 West and Extra 406 East with Release of Hazardous
Material Near Altoona, Iowa, July 30, 1988 - DCA 88-MR-006

During the investigation of the above referenced accident the Safety Board was informed by the Iowa Interstate Railroad (IAIS) officers that they did not perform operational tests and inspections for various reasons: 1) "When the Iowa Interstate L.T.D. applied with the I.C.C., we did not indicate we would do operational testing."; 2) had waivers from the Interstate Commerce Commission (ICC) and Federal Railroad Administration (FRA) for not performing Operational Tests; 3) "...has historically been exempt from 49 CFR Part 217.9 pursuant to Part 217.13." One operating officer had stated that the IAIS had filed in accordance with 49 CFR Part 217 while another operating officer stated that the IAIS had not filed. However, the IAIS could not provide documentation for an exemption or waiver.

On September 7, 1988, the Investigator-in-Charge, E. B. Dobranetski, met with FRA headquarters personnel from the Operations Practice Division to ascertain the IAIS status with 49 CFR Part 217 and was informed: 1) the carrier had no rule book on file; 2) the carrier had no operating procedure and inspection plan on file; and 3) the carrier had reported over 400,000 manhours for 1987.

Also, the Safety Board had reviewed information from the FRA System Support Division showing that on September 2, 1987, while at Blue Island, IL, an FRA inspector filed an exception to 49 CFR Part 217.9, with the remark that he had discussed operational testing with (unnamed) company officials and that the railroad does not periodically conduct operational tests and inspections to determine the extent of the compliance with its code of operating rules, timetable and timetable special instructions. Furthermore, FRA Chief Counsel's office reported no record of a violation filed and; the IAIS claimed no knowledge of this exception report.

- 2 -

The Safety Board would appreciate the Federal Railroad Administration's response to the following:

- o Has the Iowa Interstate Railroad granted an exemption or waiver from the provisions of 49 CFR Part 217? When?
- o Is the Iowa Interstate Railroad in compliance with 49 CFR Part 217?
- o Has the Iowa Interstate Railroad petitioned for an exemption from 49 CFR Part 217? When?
- o Has the Iowa Interstate Railroad filed as required by 49 CFR Part 217.7?
- o Has the Iowa Interstate Railroad met the provisions of 49 CFR Part 217.9?
- o Has the Iowa Interstate Railroad met the provisions of 49 CFR Part 217.11?
- o Has the Iowa Interstate Railroad met the provisions of 49 CFR Part 217.13?
- o How was the exception to 49 CFR Part 217.9 that was filed on September 9, 1987, resolved?
- o What actions, if any, are being contemplated by the FRA to assure compliance by this and other regional rail carriers with 49 CFR 217 and other minimum safety regulations.

The Safety Board looks forward to a response from the Federal Railroad Administration with respect to the above concerning the Iowa Interstate Railroad and 49 CFR 217. If you have any questions regarding the above, please contact me at (202) 382-6840.

Sincerely,



William G. Zielinski
Chief
Railroad Accident Division



U.S. Department
of Transportation
Federal Railroad
Administration

400 Seventh St. S.W.
Washington, D.C. 20590

Mr. William G. Zielinski
Chief, Railroad Accident Division
National Transportation Safety Board
800 Independence Avenue, S.W.
Washington, D.C. 20594

Dear Mr. Zielinski:

Thank you for your recent letter requesting information about the Iowa Interstate Railroad Limited (IAIS).

The questions set forth in your letter are responded to in the order in which they were written.

- o Was the IAIS granted an exemption or waiver from the provisions of 49 CFR Part 2177 When?

Response: No

- o Is the IAIS in compliance with 49 CFR Part 2177

Response: No

- o Has the IAIS petitioned for an exemption from 49 CFR 2177

Response: No

- o Has the IAIS filed as required by 49 CFR Part 217.7?

Response: Yes,

- o Has the IAIS met the provisions of 49 CFR Part 217.9?

Response: The IAIS, in December 1988, filed a program of operational tests and inspections with the FRA's Washington, D.C., Office of Safety.

- o Has the IAIS met the provisions of 49 CFR 217.117

Response: No

- o Has the IAIS met the provisions of 49 CFR Part 217.137

Response: The IAIS, because more than 400,000 total manhours were worked by their employees in the calendar year 1987, was required to file a report for that period. That report was filed but not in a timely manner.

- o How was the exception to 49 CFR Part 217.9 that was filed on September 9, 1987, resolved?

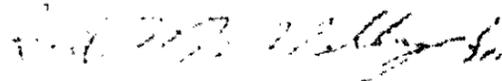
Response: Carrier officials were admonished to bring the IAIS programs required under 49 CFR 217 into compliance.

- o What actions, if any, are being contemplated by the Federal Railroad Administration to assure compliance by this and other regional rail carriers with 49 CFR 217 and other minimum safety regulations?

Response: The FRA has initiated an enforcement action against the IAIS through the procedures of the Federal Claims Collection Act.

Also, the FRA will continue to monitor, provide guidance, and initiate enforcement, if necessary, to achieve compliance with Title 49 CFR 217 and other safety regulations.

Sincerely,



J. W. Walsh
Associate Administrator
for Safety

APPENDIX G

NATIONAL TRANSPORTATION SAFETY BOARD ACCIDENT REPORTING CRITERIA

Federal Register / Vol. 53, No. 234 / Tuesday, December 8, 1988 / Rules and Regulations 49151

**NATIONAL TRANSPORTATION
SAFETY BOARD**

49 CFR Part 840

**Rules Pertaining to Notification of
Railroad Accidents**

**AGENCY: National Transportation Safety
Board.**

ACTION: Final rule.

SUMMARY: By this rule change, the Board is amending § 840.3 to reduce the period of time during which notification of certain railroad accidents is mandatory to 2 hours after the occurrence of an accident that results in a fatality or serious injury to two or more crewmembers or passengers, the emergency evacuation of a passenger train, or the release of hazardous materials, as further described herein; and to 4 hours for any accident that requires an evaluation of property damage.

EFFECTIVE DATE: February 8, 1989.

FOR FURTHER INFORMATION CONTACT:
Mr. William G. Ziolski, Chief, Railroad
Accident Division, 800 Independence
Avenue, S.W., Washington, DC 20584
[(202) 382-6840].

SUPPLEMENTARY INFORMATION: Section 840.3 requires notification to the National Transportation Safety Board of certain railroad, and, included therein, rail rapid transit accidents, at the earliest practical time. The Safety Board's rules that pertain to notification of railroad accidents, specifically Rule 840.3, provide a convenient mechanism for complying with the notification requirement in the form of a toll-free telephone number, and, prior to this amendment, those Rules imposed a six-hour time limit during which reporting was mandatory. Notwithstanding the toll-free telephone number and the six-hour time limit, the Safety Board determined that there were still numerous instances where reporting of accidents was not sufficiently expeditious as to afford Board personnel access to the accident site before the initiation of post-accident cleanup efforts. In order to remedy this situation, and after notice and public procedure (53 FR 11520 published April 7, 1988), the Board is amending its railroad accident notification rules to require notification within two hours of any railroad accident that involves a fatality (i.e., that requires admission to a hospital of two or more crewmembers or passengers, the release of hazardous materials, or an emergency evacuation) or cases that do not involve any of these eventuations but that

require a preliminary monetary estimate of damages, a four-hour limit is being placed on the notification time.

Additionally, although virtually all railroad trains and facilities are at present equipped for radio communication, the Board recognizes that in certain extraordinary circumstances, communication from the site of an accident immediately after its occurrence may be problematical. This could be the case in accidents occurring in remote areas where radio transmission is ineffective. In such instances the reporting time limits prescribed in § 840.3(a) can be computed from the time railroad personnel other than those at the accident site at the time of its occurrence, have received notice of the accident. This provision is contained in paragraph (d) of the revised regulation.

The Safety Board received five comments in response to its notice of proposed rulemaking which was published April 7, 1988 (53 FR 21320). The Board has given the views expressed in those responses its careful consideration but finds that our expressed goal of affording Board personnel access to the accident site as early as possible, and, wherever feasible, before initiation of clean-up efforts, is paramount, and that the deleterious effects of earlier reporting may in fact never materialize.

The major obstacle to the requirements for earlier reporting concerns the difficulty of arriving at a preliminary monetary estimate of damage. One commentator expressed concern that accidents that do not meet the Board's estimated damage criteria would be reported because of hasty damage evaluation. The Board considered that possibility when it proposed a 4-hour limit for any accident requiring a damage estimate. Moreover, the Board does not believe that the reporting of any accidents that do not meet those criteria will impose an undue administrative burden on either the reporting railroad or on the Safety Board's staff.

In respect to the concern that initiation of clean-up efforts should take precedence over all other activities, the

Board believes that the accident care and prevention objectives that are its investigatory goal are equally essential. It is noted that a number of tasks, each as the proper control of hazardous materials, must be undertaken at once; however, notification to the Board at the earliest practicable time after the occurrence is equally in the best interests of public safety and accident prevention, and it is imperative that the Board be notified as soon as possible if hazardous materials are involved.

As do other agencies of Government, the Department of Transportation's Research and Special Programs Administration requires immediate reporting of most hazardous materials spills by any carrier that transports them (49 CFR 171.18); accordingly, notification to the Board through the National Response Center's telephone service is not an additional burden. All other matters dealt with in the comments, especially alternative proposals, have been given consideration by the Board.

Under the criteria of section 805(b) of the Regulatory Flexibility Act, 5 U.S.C. 805(b), the Safety Board has determined that these amendments will not have a significant economic impact on a substantial number of small entities because the new rules require only a somewhat more expeditious reporting, and they do not create any increase in the number of accidents for which notification must be made. The costs of complying with the rule are not substantial, and the Safety Board has so certified.

List of Subjects in 49 CFR Part 840

Administrative practice and procedure, Investigation, Hazardous materials transportation, Railroad Safety, Reporting and recordkeeping requirements.

PART 840—(AMENDED)

1. Accordingly, the authority citation for 49 CFR Part 840 continues to read as follows:

Authority: Sec. 804 (R) (1) and (2) of the Safety Board Act of 1974, as amended (49 U.S.C. 1903).

2. Section 840.3 of Part 840, Chapter VIII, Title 49, Code of Federal Regulations, is revised to read as follows:

§ 840.3 Notification of railroad accidents.

The operator of a railroad shall notify the Board by telephoning the National Response Center at telephone 800-438-0202 at the earliest practicable time after the occurrence of any one of the following railroad accidents:

(a) No later than 2 hours after an accident which results in:

(1) A passenger or employee fatality or serious injury to two or more crewmembers or passengers requiring admission to a hospital;

(2) The evacuation of a passenger train;

(3) Damage to a tank car or container resulting in release of hazardous materials or involving evacuation of the general public; or

(4) A fatality at a grade crossing.
(b) No later than 6 hours after an accident which does not involve any of the circumstances enumerated in paragraph (a) of this section but which results in:

(1) Damage (based on a preliminary gross estimate) of \$150,000 or more for repairs or the current replacement cost, to railroad and nonrailroad property; or

(2) Damage of \$25,000 or more to a passenger train and railroad and nonrailroad property.

(c) Accidents involving joint operations must be reported by the railroad that controls the track and directs the movement of trains where the accident has occurred.

(d) Where an accident for which notification is required by paragraph (a) or (b) of this section occurs in a remote area, the time limits set forth in that paragraph shall commence from the time the first railroad employee who was not at the accident site at the time of its occurrence has received notice thereof.

Signed in Washington, DC, on November 20, 1988.

James L. Kibben,
Acting Chairman.

(FR Doc. 88-2748 Filed 11-8-88; 9:48 am)
GPO: 1988-274-88-2748

APPENDIX H

FEDERAL RAILROAD ADMINISTRATION ACCIDENT REPORTING CRITERIA

**PART 225—RAILROAD ACCIDENTS/
INCIDENTS: REPORTS CLASSIFICA-
TION, AND INVESTIGATIONS****Sec.**

- 225.1 Purpose.
225.3 Applicability.

Sec.

- 225.5 Definitions.
225.7 Public examination and use of reports.
225.9 Telephonic reports of certain accidents/incidents.
225.11 Reporting of accidents/incidents.
225.13 Late reports.
225.15 Accidents/incidents not to be reported.
225.17 Doubtful cases.
225.19 Primary groups of accidents/incidents.
225.21 Forms.
225.23 Joint operations.
225.25 Recordkeeping.
225.27 Retention of records.
225.29 Penalties.
225.31 Investigations.

**APPENDIX A—PROCEDURE FOR DETERMINING
REPORTING THRESHOLD****APPENDIX B—SCHEDULE OF CIVIL PENALTIES**

AUTHORITY. Secs. 12 and 20, 24 Stat. 383, 384, as amended (49 U.S.C. 12 and 20), secs. 1-7, 26 Stat. 380, as amended, (45 U.S.C. 38-43), secs. 202, 203 and 209, 84 Stat. 971 and 975, (45 U.S.C. 431, 437 and 438), secs. 8(c) and (f), 80 Stat. 930, (49 U.S.C. 1655(e) and (f)), 49 CFR 1.49(b)(11), (h) and (i), secs. 5(b) and (m), 80 Stat. 935, (49 U.S.C. 1654(b) and (m)), 14 CFR 400.43(c).

SOURCE. 39 FR 43224, Dec. 11, 1974, unless otherwise noted.

EDITORIAL NOTE. For an interpretation of Part 225 see 40 FR 5368, Feb. 6, 1975.

§ 225.1 Purpose.

The purpose of this part is to provide the Federal Railroad Administration (FRA) with information concerning hazardous conditions on the Nation's railroads. FRA needs this information to carry out effectively its regulatory responsibilities under the Federal Railroad Safety Act of 1970 and the Accidents Reports Act. Although this part is issued under the authority of both Acts, reliance is primarily based upon the authority of the Federal Railroad Safety Act because of its broader scope. Issuance of these regulations under the Federal Railroad Safety Act preempts States from prescribing accident/incident reporting requirements. Reliance on the Federal Railroad Safety Act will facilitate the application and enforcement of the requirements of this part by allowing imposition of civil rather than criminal penalties. Any State may, however, require railroads to submit to it copies of accident/incident reports filed with

FRA under this part, for accidents/incidents which occur in that State. The reporting and recordkeeping requirements prescribed in this part have been approved by the Office of Management and Budget in accordance with the Federal Reports Act of 1942.

§ 225.3 Applicability.

This part applies to all railroads except those railroads whose entire operations are confined within an industrial installation.

§ 225.5 Definitions.

As used in this part—

(a) "Railroad" means any system of surface transportation of persons or property over rails. It includes line-haul freight and passenger railroads, switching and terminal railroads, and passenger-carrying railroads including, but not limited to, rapid transit, commuter, scenic, subway, elevated, cable, and cog railways.

(b) "Accident/Incident" means:

(1) Any impact between railroad on-track equipment and an automobile, bus, truck, motorcycle, bicycle, farm vehicle or pedestrian at a rail-highway grade crossing;

(2) Any collision, derailment, fire, explosion, act of God, or other event involving operation of railroad on-track equipment (standing or moving) that results in more than \$4,500 in damages to railroad on-track equipment, signals, track, track structures, and roadbed.

(3) Any event arising from the operation of a railroad which results in:

- (i) Death of one or more persons;
- (ii) Injury to one or more persons, other than railroad employees, that requires medical treatment;
- (iii) Injury to one or more employees that requires medical treatment or results in restriction of work or motion for one or more days, one or more lost work days, transfer to another job, termination of employment, or loss of consciousness, or

(iv) Occupational illness of a railroad employee as diagnosed by a physician.

(c) "Joint operations" means rail operations conducted on a track used jointly or in common by two or more railroads subject to this part or oper-

ation of a train, locomotive, car or other on-track equipment by one railroad over the track of another railroad.

(d) "Occupational illness" means any abnormal condition or disorder of a railroad employee, other than one resulting from injury, caused by environmental factors associated with his or her railroad employment, including, but not limited to, acute or chronic illnesses or diseases which may be caused by inhalation, absorption, ingestion or direct contact.

(e) "Medical treatment" means treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment (one-time treatment), precautionary measures such as tetanus shots, and subsequent observation of minor scratches, cuts, bruises or splinters which do not require medical care, even though these services are performed by a physician or registered professional personnel.

(f) "Lost workdays" means any full day or part of a day (consecutive or not) other than the day of injury, that a railroad employee is away from work because of injury or occupational illness.

(g) "Restriction of work or motion" means the inability of a railroad employee to perform all normally assigned duties because of injury or occupational illness, and includes the assignment of a railroad employee to another job or to less than full time work at a temporary or permanent job.

(h) "Rail-highway grade crossing" means a location where one or more railroad tracks cross a public highway, road, or street or a private roadway, and includes sidewalks and pathways at or associated with the crossing.

(i) "Arising from the operation of a railroad" includes all activities of a railroad which are related to the performance of its rail transportation business.

(Secs. 11144 and 11145, subtitle IV of Title 49 (49 U.S.C. 11144 and 11145); secs. 1 and 6, Accident Reports Act (45 U.S.C. 431 and 437); sec. 3(e) and (f), Department of Transportation Act (49 U.S.C. 1655(e) and (f)); sec. 1.49(g) and (m), regulations of the

Office of the Secretary of Transportation (49 CFR 1.49(g) and (m))

(39 FR 43274, Dec. 11, 1974, as amended at 40 FR 29548, July 14, 1975; 47 FR 64334, Dec. 16, 1982)

§ 221.7 Public examination and use of reports.

(a) Accident/incident reports made by railroads in compliance with these rules shall be available to the public in the manner prescribed by Part 7 of this Title. Accident/incident reports may be inspected at the Office of Safety, Federal Railroad Administration, 3100 Second Street, S.W., Washington, D.C. 20590. Written requests for a copy of a report should be addressed to the Office of Chief Counsel, FRA, 400 Seventh Street, S.W., Washington, D.C. 20590, and be accompanied by the appropriate fee prescribed in Part 7 of this Title. To facilitate expedited handling, each request should be clearly marked "Request for Accident/Incident Report".

(b) Section 4 of the Accidents Reports Act (36 Stat. 351, 45 U.S.C. 41) provides that monthly reports filed by railroads under § 225.11 may not be admitted as evidence or used for any purpose in any action for damages growing out of any matters mentioned in these monthly reports.

§ 225.9 Telephonic reports of certain accidents/incidents.¹

(a) Each railroad must report immediately by toll free telephone, Area Code 300-424-0201, whenever it learns of the occurrence of an accident/incident arising from the operation of the railroad that results in the: (1) Death of rail passenger or employee; or (2) death or injury of five or more persons.

(b) Each report must state the:

(1) Name of the railroad;

¹The National Transportation Safety Board requires certain railroad accidents to be reported by telephone at the same toll free number (See Title 49, Code of Federal Regulations Part 840).

²FRA Locomotive Inspection Regulations require certain locomotive accidents to be reported by telephone at the same toll free number (See Title 49, Code of Federal Regulations, §§ 230.55, 230.162, 230.335 and 230.454).

(3) Name, title, and telephone number of the individual making the report;

(3) Time, date, and location of accident/incident;

(4) Circumstances of the accident/incident; and

(5) Number of persons killed or injured.

(39 FR 43221, Dec. 11, 1974, as amended at 41 FR 15647 Apr. 15, 1976)

§ 225.11 Reporting of accidents/incidents.

(a) Each railroad subject to this part must submit to FRA a monthly report of all railroad accidents/incidents described in § 225.19. The report must be made on the forms prescribed in § 225.21 and must be submitted within 30 days after expiration of the month during which the accidents/incidents occurred. Reports must be completed as required by the current FRA Guide for Preparing Accident/Incident Reports. A copy of this guide may be obtained from the Office of Safety, Federal Railroad Administration, 2100 Second Street, S.W., Washington, D.C. 20590.

(b) As part of each monthly report, each Class I railroad and switching and terminal company must include a copy of its "Monthly Report of Employees, Service and Compensation" (ICC Wage Statistics, Forms A and B) submitted to the Interstate Commerce Commission for the same month.

(c) As part of its monthly reports for March, June, September and December of each year, each Class I railroad and switching and terminal company must include copies of the current quarterly Form OS-A report required by the Interstate Commerce Commission. As part of its monthly reports for April, July, October, and January of each year, each Class I railroad and switching and terminal company must include copies of current quarterly Form OS-B report required by the Interstate Commerce Commission.

(43 FR 1221, Jan. 6, 1977)

§ 225.13 Late reports.

Whenever a railroad discovers that a report of an accident/incident, through mistake or otherwise, has been improperly omitted from or im-

properly reported on its regular monthly accident/incident report, a report covering this accident/incident together with a letter of explanation must be submitted immediately.

§ 225.15 Accidents/incidents not to be reported.

A railroad need not report:

(a) Casualties which occur at rail-highway grade crossings that do not involve the presence or operation of on-track equipment, or the presence of railroad employees then engaged in the operation of a railroad;

(b) Casualties in or about living quarters not arising from the operation of a railroad;

(c) Suicides as determined by a coroner or other public authority; or

(d) Attempted suicides.

APPENDIX I

BENCH TEST RESULTS OF PRESSURE RELIEF VALVES

BREAKING VALUE RANGE
Safety Valve Hold Down Bolts
in Inch-Pounds

ADMX 29477				ADMX 29494	
Bolt	A-end	Bolt		Bolt	B-end
1	2000-2500	1		1	1000-1500
2	2000-2500	2		2	2500
3	2000-2500	3		3	Loose, <1000
4	1500-2000	4		4	1500-2000
5	1500-2000	5		5	2500-3000
6	2000-2500	6		6	1000-1500
7	2000-2500	7		7	1000-1500
8	2000-2500	8		8	Loose, <1000

ADMX 29477				ADMX 29494	
Bolt	A-end	Bolt		Bolt	B-end
1	2000-2500	1		1	1000-1500
2	2000-2500	2		2	2500
3	2000-2500	3		3	Loose, <1000
4	1500-2000	4		4	1500-2000
5	1500-2000	5		5	2500-3000
6	2000-2500	6		6	1000-1500
7	2000-2500	7		7	1000-1500
8	2000-2500	8		8	Loose, <1000

The torque wrench used, SN REX - C10, is normally used to secure roller bearing end cap screws and was calibrated against a mounted torque wrench gage for that purpose in the RESCAR Longview Shop.

SAFETY VALVE BENCH TEST RESULTS
in Pounds per Square Inch

Note: These safety valves were designed to be fully open at 75 psi and completely closed at 60 psi.

ADMX 29477		ADMX 29494	
A-end	open	73	64
	seated	30	59
B-end	open	65	72
	seated	54	65