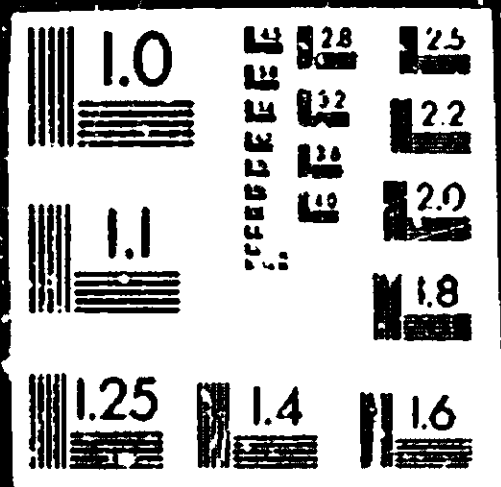


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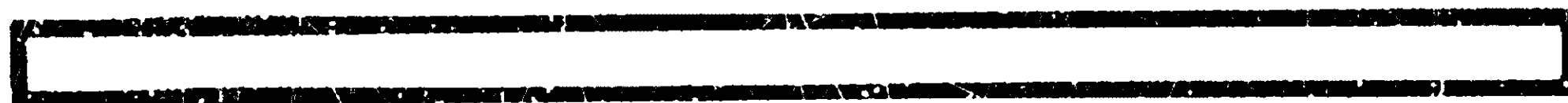
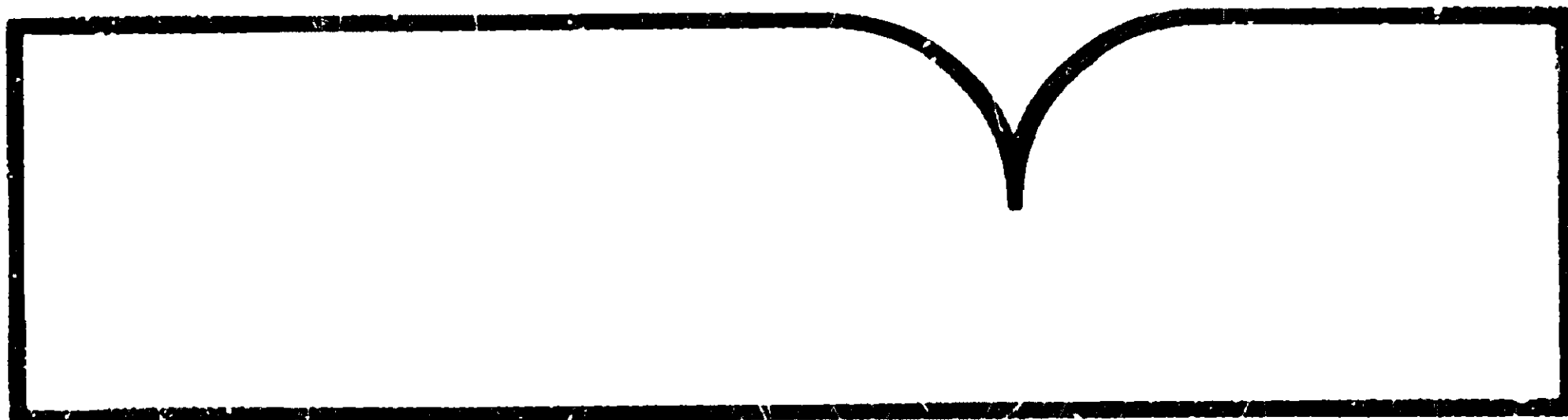


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Safety Study - Transport of Hazardous Materials by Rail

(U.S.) National Transportation Safety Board, Washington, DC

16 May 91



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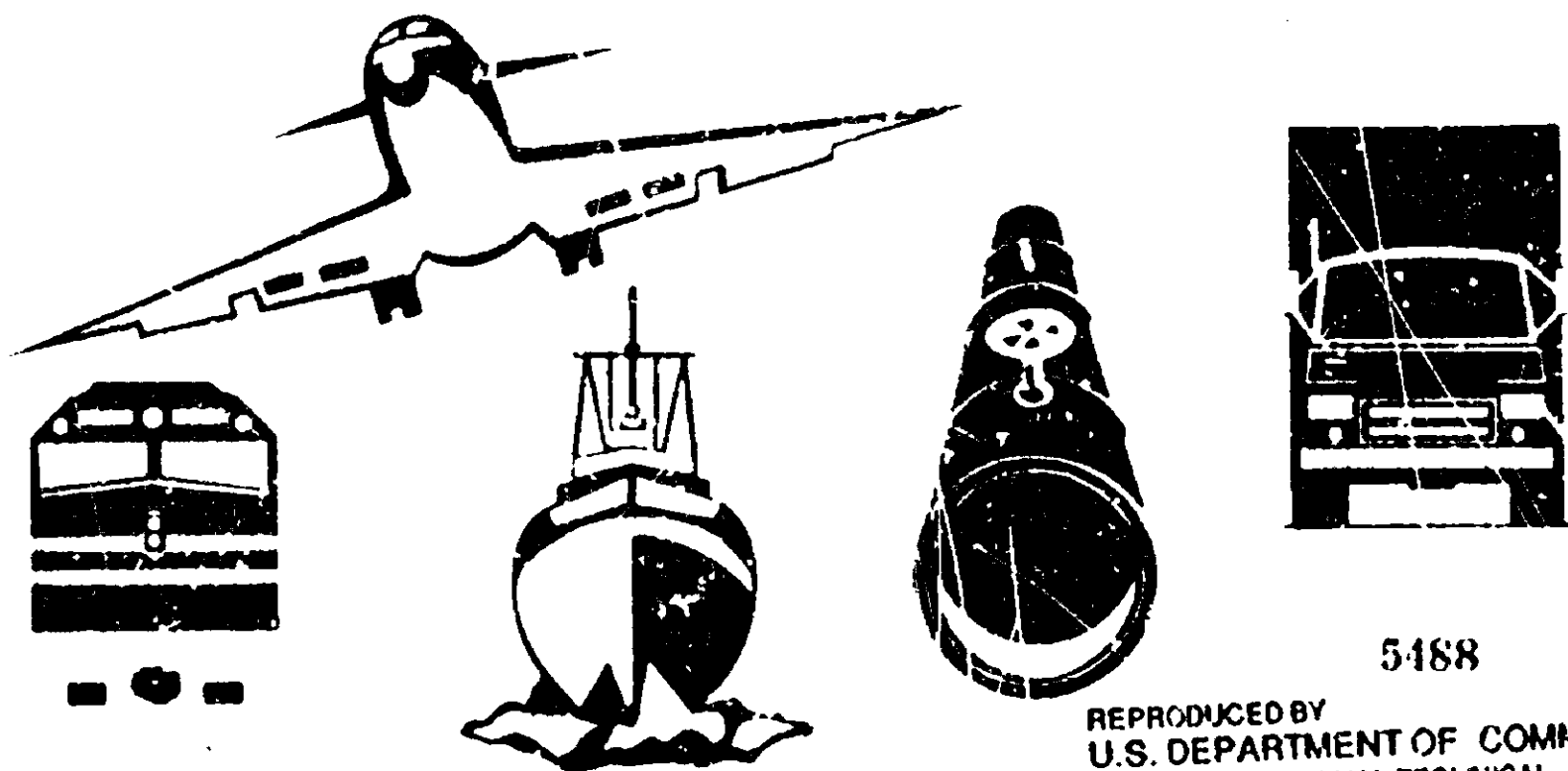
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**NATIONAL
TRANSPORTATION
SAFETY
BOARD**

WASHINGTON, D.C. 20594

SAFETY STUDY

TRANSPORT OF HAZARDOUS MATERIALS BY RAIL



5488

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The National Transportation Safety Board is an independent Federal agency dedicated to promoting aviation, railroad, highway, marine, pipeline, and hazardous materials safety. Established in 1967, the agency is mandated by the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable cause of accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation.

The Safety Board makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews. Copies of these documents may be purchased from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161. Details on available publications may be obtained by contacting:

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NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

SAFETY STUDY

TRANSPORT OF HAZARDOUS MATERIALS BY RAIL

ADOPTED: MAY 16, 1991
NOTATION: 5488

National Transportation Safety Board

Abstract: For this study, the Safety Board conducted investigations of 45 selected railroad accidents or incidents that occurred during a 1-year period that began in March 1988, and reviewed reports of its past major accident investigations and special studies related to the transport of hazardous materials by rail, studies performed by other organizations, and the training on hazardous materials provided by some rail carriers. The safety issues discussed in the report are the adequacy of the protection provided by some tank cars for the risks associated with certain products transported in these tank cars; emergency response planning for railroad accidents involving hazardous materials; and training of railroad personnel in the handling of a hazardous materials emergency. Recommendations concerning these issues were made to rail carriers, railroad industry associations, public safety groups, and Federal agencies.

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ACRONYMS USED IN THE REPORT

AAR	Association of American Railroads
ASLRA	American Short Line Railroad Association
ATSF	The Atchinson, Topeka & Santa Fe Railway Company
BN	Burlington Northern Railroad Company
CFR	Code of Federal Regulations
CHEMTEC	Chemical Transportation Emergency Center
CMNW	Chicago, Missouri & Western Railway Co.
CR	Consolidated Rail Corporation (Conrail)
CSX	CSX Transportation, Inc.
DOT	Department of Transportation
FEMA	Federal Emergency Management Agency
FR	Federal Register
FRA	Federal Railroad Administration
IACP	International Association of Chiefs of Police
IAFC	International Association of Fire Chiefs
IAIS	Iowa Interstate Railroad, Ltd.
IC	Illinois Central Railroad Company
ICG	Illinois Central Gulf Railroad Company
ISFSI	International Society of Fire Service Instructors
KCS	Kansas City Southern Railway
LA	Louisiana & Arkansas Railway Company
MRL	Montana Rail Link, Inc.
MSRC	MidSouth Rail Corporation
NLC	National League of Cities
NPRM	Notice of Proposed Rulemaking
NS	Norfolk Southern Corporation
NTSB	National Transportation Safety Board
PAL	Paducah & Louisville Railway, Inc.
PTRA	Port Terminal Railroad Association
RPI	Railway Progress Institute
RSPA	Research and Special Programs Administration
SGLR	Seminole Gulf Railway, Inc.
SOO	SOO Line Railroad Company
SP	Southern Pacific Transportation Company
UP	Union Pacific Railroad Company
WC	Wisconsin Central Ltd.

EXECUTIVE SUMMARY

The transport of hazardous materials is a rapidly growing segment of the railroad industry. In 1989, for example, more than 1.52 million carloads of poisons, chemicals, pesticides, and other hazardous materials were transported by rail, an increase of 66 percent over the 0.92 million carloads transported by rail in 1985. Because the volume of hazardous materials transported by rail is high and because many of the materials, if released, can pose a substantial danger to life, property, and the environment, their transport must be made as safe as possible.

The National Transportation Safety Board has had a long-standing concern about the safe transport of hazardous materials by rail. In 1978, the Safety Board held a public hearing on tank car safety, and in 1980, the Board conducted a special investigation on tank car performance. These activities resulted in recommendations for improved protection on certain tank cars. Between January 1985 and February 1988, the Safety Board investigated 80 railroad accidents involving hazardous materials, which resulted in additional recommendations to Federal and State agencies, railroads, and safety-related organizations urging various actions to improve the safety of the transport of hazardous materials by rail.

In 1988, the Safety Board began a safety study to determine whether the recurring problems seen in the earlier accidents were continuing. As part of this study, the Safety Board conducted investigations of 45 selected railroad accidents or incidents that occurred during a 1-year period that began in March 1988. The Board also reviewed reports of its past major accident investigations and special studies, studies performed by other organizations, and the training on hazardous materials provided by some railroads. The study addresses needed safety improvements for the transport of hazardous materials by rail.

The safety issues discussed in the study are as follows:

- The adequacy of the protection provided by some tank cars for the risks associated with certain products transported in these tank cars;
- Emergency response planning for railroad accidents involving hazardous materials; and
- Training of railroad personnel in the handling of a hazardous materials emergency.

As a result of the safety study, recommendations were issued to the Research and Special Programs Administration and Federal Railroad Administration of the U.S. Department of Transportation; the Association of American Railroads; Class I railroads and railroad systems; Guilford Transportation, Inc.; MidSouth Rail Corporation; the American Short Line Railroad Association; the Chemical Manufacturers Association; the American Petroleum Institute; the National Fire Protection Association; the National

League of Cities; the National Association of Counties; the International Association of Fire Chiefs; the International Association of Chiefs of Police, and the National Sheriffs' Association.

The recommendations focused on the following safety concerns:

- The need to transport the more dangerous hazardous materials in tank cars that provide better accident protection;
- The need for railroads and communities to develop and coordinate written emergency response plans and procedures for handling releases of hazardous materials;
- The need for railroads to improve hazardous materials training for employees; and
- The need to establish methods to evaluate a railroad employee's level of knowledge of emergency procedures and the ability to apply such knowledge.

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

SAFETY STUDY

TRANSPORT OF HAZARDOUS MATERIALS BY RAIL

INTRODUCTION

**The Transport of Hazardous Materials
in the Railroad Industry**

The transport of hazardous materials is a rapidly growing segment of the railroad industry. The percentage of chemicals and allied products transported, by tons, and the resulting revenues generated for railroad companies have increased steadily since 1984 (appendix A). In 1989, for example, more than 1.52 million carloads of poisons, chemicals, pesticides, and other hazardous materials were transported by rail in about 107,000 tank cars and in other types of containers (appendix B). This volume represents a 66-percent increase over the 0.92 million carloads of hazardous materials transported by rail in 1985 (Association of American Railroads 1990a).

There are more than 30,000 hazardous materials regulated by the U.S. Department of Transportation (DOT); however, 25 hazardous materials or commodity groups account for 77 percent of the total volume transported by rail (see appendix E). The makeup of the shipments moving by rail varies considerably: for example, from extremely hazardous poisons, such as chlorine, to nonflammable but poisonous liquids, such as perchloroethylene (a dry-cleaning solvent, also called tetrachloroethylene). Although perchloroethylene poses no acute hazards in small quantities, large releases can pose long-term environmental threats. Because the volume of hazardous materials transported by rail is high and because many of the materials, if released, can pose a risk to life, property, and the environment, their transport must be made as safe as possible.

**Occurrence of Rail Accidents/Incidents
Involving Hazardous Materials**

The data system of the Federal Railroad Administration (FRA), an agency within the DOT, recorded 14,969 railroad accidents between 1985 and 1989. Of those accidents, 2,121 involved derailed or damaged cars transporting hazardous materials (table 1).¹ In 254 of these accidents, hazardous materials were released.

¹ The FRA defines a train accident as any event involving the movement of railroad on-track equipment that results in a death, a reportable injury, or a reportable illness, or in which railroad property damage exceeds the reporting threshold. (In 1988, the threshold was \$5,200.) The FRA does not define a hazardous materials release.

Table 1.--Information from the Federal Railroad Administration related to train accidents involving hazardous materials, 1985-89

Item	1985	1986	1987	1988	1989	Total
Number of accidents involving hazardous materials	415	364	351	475	516	2,121
Number of train consists carrying hazardous materials ^a	431	370	364	497	530	2,192
Number of cars in consists	29,362	26,083	26,251	32,821	36,305	150,822
Number of cars containing hazardous materials	2,310	1,803	2,292	3,841	3,489	13,735
Number of accidents in which car(s) containing hazardous materials was damaged or derailed	245	185	186	237	251	1,104
Number of cars damaged that contained hazardous materials	647	453	495	630	636	2,861
Number of accidents in which hazardous materials were released	54	51	50	44	55	254
Number of cars that released hazardous materials	109	79	89	74	84	435
Number of accidents that resulted in evacuation	22	32	28	32	28	142
Number of people reported by railroads as evacuated	11,879	39,701	24,345	16,164	13,922	106,011

^a The number of train consists is greater than the number of accidents because some accidents involved a collision of 2 trains.

Source: U.S. Department of Transportation, Federal Railroad Administration, Office of Safety.

The data system of the Research and Special Programs Administration (RSPA), another agency within the DOT, recorded 4,810 rail incidents involving hazardous materials between 1985-89:²

<u>Year</u>	<u>Number of incidents</u>
1985	842
1986	856
1987	899
1988	1,018
1989	1,195

The reporting criteria differ for these data bases; therefore, comparisons cannot be made. However, both data bases show an increase in the number of accidents/incidents involving hazardous materials reflecting the increase in shipments during this 5-year period (see appendix A).³

Accidents and Incidents Investigated by the Safety Board

Although many accidents/incidents occur that involve hazardous materials, the consequences of most of these events are not serious. However, because hazardous materials pose a substantial danger to public safety if released, the consequences of accidents/incidents involving hazardous materials can be serious or catastrophic.⁴

The Safety Board has had a long-standing concern about the transport of hazardous materials in tank cars that do not provide protection commensurate with the risks posed by the products. In 1978, the Safety Board held an en-banc public hearing (a hearing before all 5 Board members) at which 32 witnesses testified on tank car safety. Results of this hearing included accelerated application of head shields, thermal protection, and top and

² The RSPA defines a hazardous materials incident as any release of a hazardous material (in quantities as small as 1 pint).

³ The data base maintained by the Association of American Railroads (AAR), which records releases of hazardous materials (such as leaks, splashes, venting from safety relief devices on tank cars, and releases from rail accidents) recorded 1,165 releases from tank cars in 1989 (AAR 1990a). Nearly all (96 percent) of the releases resulted from loose or defective fittings, and most of the releases involved small quantities of hazardous materials (usually less than 100 gallons of product). Corrosive and flammable liquids accounted for 67 percent of the non-accident releases.

⁴ As used in this report, an incident refers to a release of hazardous materials, such as a leak, that was not the result of an accident.

bottom shelf couplers⁵ for DOT-112 and -114 tank cars that carry flammable and/or toxic hazardous materials (NTSB 1978).⁶ In 1980, the Safety Board conducted a special investigation on the performance of DOT-105 tank cars (NTSB 1980a). Since then, improvements have been made as a result of action taken, especially in the performance of DOT specification tank cars. For example, shelf couplers are now required on all DOT tank cars that transport hazardous materials. Further, head shields and thermal protection are also now required on most DOT-105 tank cars, as well as on DOT-112 and -114 tank cars.

The added protection has contributed to a reduction in the frequency and severity of failures of these tank cars. For example, a study recently published by the Railway Progress Institute (RPI) and the Association of American Railroads (AAR) concluded that the addition of shelf couplers and head shields on DOT-112 and -114 tank cars had reduced the probability of a head puncture by 91 percent (RPI and AAR 1989). Other studies by the RPI and AAR conclude that thermal protection, head shields, and shelf couplers are "clearly associated with the reduced spillage of hazardous materials in recent years" (RPI and AAR 1990b) and that pressure tank cars equipped with head shields and thermal protection (DOT-105, -112, and -114) have excellent puncture resistance (RPI and AAR 1990a).

Although DOT-111A tank cars generally do not contain protection similar to that on the DOT-105, -112, and -114 tank cars, they are, nevertheless, used to carry hazardous materials that can pose a substantial danger to life, property, and the environment.⁷ Further, because the shells of DOT-111A tank cars are thinner than the shells of DOT-105, -112, and -114 tank cars, the DOT-111A tank cars are more susceptible to damage than are DOT-105, -112, and -114 tank cars, even when those tank cars are not protected by head shields and thermal protection.⁸ As a result, the tank car section of this report focuses on the adequacy of the protection provided by DOT-111A tank cars for the type of products they transport.

⁵ Diagrams of tank cars, and information on tank car structure and specifications are in appendix C.

⁶ Of the nearly 107,000 tank cars that transport hazardous materials, 104,000 (97 percent) comprise the following specifications: DOT-105 (19,700 tank cars); -111A (62,000 tank cars); and -112/-114 (22,000 tank cars). Most hazardous materials are transported in these specification tank cars.

⁷ The DOT-111A tank cars, which are still being manufactured, are general service, non-pressure tank cars made of steel, nickel, or aluminum. Generally, DOT-111A tank cars are non-insulated, have bottom outlets and multiple fittings, and do not have jacketed thermal protection or head shields.

⁸ DOT-111A tank cars have a minimum shell and head thickness of 7/16 inch; DOT-105, -112, and -114 tank cars have shells and heads with a minimum thickness of 9/16 inch.

Between January 1985 and February 1988, the Safety Board investigated 80 railroad accidents⁹ (7 major¹⁰ and 73 field investigations) involving hazardous materials. The accidents involved collisions (between trains or a train and a motor vehicle), derailments, and leaks from standing or stored tank cars resulting in violent thermal explosions, fires, and public evacuations. The investigations of these accidents revealed several safety issues concerning the transport of hazardous materials, including the adequacy of (1) the protection provided by some tank cars for the risks associated with products transported in them, (2) emergency preparedness, and (3) training of railroad personnel. As a result of the seven major investigations, the Safety Board issued 38 safety recommendations to Federal and State agencies, railroads, and safety-related organizations urging various actions to improve the safety of the transport of hazardous materials by rail.

Description of the Safety Study

Because the Safety Board observed evidence of problems related to the adequacy of DOT-111A tank cars for the shipment of certain hazardous materials, emergency response planning for railroad accidents involving hazardous materials, and the training of railroad employees in the handling of a hazardous materials emergency, the Safety Board began a safety study, in 1988, on the transport of hazardous materials by rail. The purpose of the study was to determine whether the recurring problems seen in the earlier accidents were continuing, and if so, to identify remedial actions and to issue safety recommendations requesting remedial action.

As a part of the study, the Safety Board conducted investigations of 45 selected railroad accidents or incidents that occurred in a 1-year period, March 1988 through February 1989; these accidents involved trains transporting hazardous materials and standing cars containing hazardous materials. The Board also reviewed reports of its past major accident investigations and special studies, studies performed by other organizations, and the training on hazardous materials provided by some railroads.

During the 1-year period, the Safety Board investigated the accidents and incidents (a) for which it received notification from the DOT National Response Center, and (b) that occurred in a location that enabled Safety Board investigators to respond in time to collect data that were perishable.

⁹ The accidents generally were railroad accidents as defined in 49 CFR Part 840: Any collision, derailment, or explosion involving railroad trains, locomotives, and cars; or any other loss-causing event involving the operation of such railroad equipment that results in a fatality to a passenger or employee, or the emergency evacuation of persons.

¹⁰ The severity of some accidents is such that the Safety Board conducts comprehensive investigations that result in more detailed information than is collected from the investigations of less severe accidents. These more comprehensive investigations are called major investigations.

Forty-five accidents/incidents were investigated; the sample is not statistically representative of hazardous materials accidents or incidents.¹¹ Table 2 lists the locations and dates of the accidents and incidents. Three of the events were severe enough to result in major investigations (see footnote 10); consequently, more detailed information is available regarding those three events: Altoona, Iowa; Helena, Montana; and Akron, Ohio. For each of the 45 accidents/incidents (hereinafter called cases), the Safety Board determined those factors that either caused or contributed to the event. (Brief reports of the 45 cases are in appendix D.)

The 45 cases, which involved 149 tank cars, were of the following types:

<u>Type</u>	<u>Number</u>
Derailment ¹²	31
Collision:	
Between trains ¹²	2
Railroad/highway grade crossing	1
Releases of hazardous materials from standing or stored cars ¹²	11
Total	45

¹¹ FRA accident data for the period March 1988 through February 1989 indicate that railroad carriers reported 489 accidents involving hazardous materials, 50 of which (with and without evacuations) involved releases of hazardous materials. Of the 50 accidents involving releases, 20 (40 percent) were among the 45 cases investigated by the Safety Board during the 1-year period. Also of the 50 accidents reported to the FRA, 22 accidents involved both a release of hazardous materials and subsequent evacuation; 18 (82 percent) of these accidents were among the Safety Board's 33 cases that had evacuations.

¹² Evacuations were conducted in 33 of the 45 cases: after 28 of the derailments, 2 of the collisions, and 3 of the releases from standing tank cars. Hazardous materials were not released in all 33 cases; however, evacuations were ordered because local emergency response personnel perceived that there was a threat of the release of product. (Of the 33 cases with evacuations, releases of hazardous materials occurred in 25. Of the 12 cases without evacuations, releases occurred in 11.)

Table 2.--Location and date of the accidents/incidents investigated by the National Transportation Safety Board during its safety study on the transport of hazardous materials by rail, March 1988 to February 1989

Event number	Location of accident	Date of accident	Railroad	NTSB accident number
1	Claude, TX	03/04/88	BN	FTW88FRZ13
2	Punta Gorda, FL	03/10/88	SGLR	ATL88FRZ13
3	Pasco, WA	04/08/88	BN	CHI88FRZ17
4	Jeffersonville, IN	04/26/88	CR	CHI88FRZ18
5	Wilmington, CA	04/27/88	UP	LAX88FRZ10
6	Roodhouse, IL	05/03/88	CMNW	CHI88FRZ20
7	Denver, CO	05/04/88	UP	DEN88FRZ11
8	Gulfport, MS	05/07/88	MSRC	ATL88FRZ15
9	Sheridan, WI	05/14/88	WC	CHI88FRZ22
10	Las Vegas, NV	05/23/88	UP	LAX88FRZ12
11	Columbus, OH	06/11/88	CSX	ATL88FRZ16
12	Crofton, KY	06/22/88	CSX	ATL88FRZ19
13	Deer Park, TX	07/22/88	PTRA	FTW88FRZ23
14	Farnum, NE	07/22/88	BN	DEN88FRZ17
15	White Bluff, TN	07/24/88	CSX	FTW88FRZ24
16	Altoona, IA	07/30/88	IAIS	DCA88MRZ06
17	Umbarger, TX	07/30/88	ATSF	FTW88FRZ25
18	Ohioyle, PA	08/01/88	CSX	FTW88FRZ26
19	Brazoria, TX	08/02/88	UP	FTW88FRZ27
20	Loudonville, OH	08/04/88	CR	LAX88FRZ15
21	Elsberry, MO	08/06/88	BN	FTW88FRZ28
22	Elberton, GA	08/08/88	CSX	ATL88FRZ20
23	Elm Grove, WI	08/10/88	SOO	CHI88FRZ27
24	Athens, GA	08/13/88	CSX	ATL88FRZ21
25	Memphis, TN	08/18/89	IC	ATL88FRZ22
26	Jacksonville, FL	09/15/88	CSX	ATL88FRZ23
27	Summit, IL	09/25/88	IC	CHI88FRZ29
28	Rineyville, KY	10/13/88	PAL	ATL89FRZ02
29	Easley, SC	10/16/88	HS	ATL89FRZ03
30	Peari, IL	10/26/88	CMNW	CHI89FRZ05
31	Morganza, LA	10/26/88	LA	FTW89FRZ01
32	Newcastle, CA	11/02/88	SP	LAX89FRZ02
33	Lyndon Station, WI	11/09/88	SOO	CHI89FRZ06
34	Bangor, AL	11/19/88	CSX	ATL89FRZ05
35	Lanagan, MO	11/20/88	KCS	CHI89FRZ07
36	Fruitvale, TX	11/25/88	UP	FTW89FRZ04
37	Palmyra, MO	11/29/88	BN	CHI89FRZ08
38	Edison, NJ	12/09/88	CR	NYC89FRZ03
39	Flagstaff, AZ	12/14/88	ATSF	LAX89FRZ05
40	Bonnors Ferry, ID	01/28/89	UP	LAX89FRZ13
41	Helena, MT	02/02/89	MRL	DCA89MRZ01
42	Kansas City, KS	02/02/89	ATSF	CHI89FRZ11
43	Manteca, CA	02/20/89	SP	LAX89FRZ15
44	Bordulac, ND	02/20/89	SOO	CHI89FRZ14
45	Akron, OH	02/26/89	CSX	DCA89MZ004

Of the 45 cases, 35 cases (78 percent) involved Class I railroads:¹³

<u>Railroad</u>	<u>Number of cases</u>
Class I Railroads:	
CSX Transportation, Inc.	9
Union Pacific Railroad Company	6
Burlington Northern Railroad Company	5
Atchinson, Topeka & Santa Fe Railway Company	3
Consolidated Rail Corporation (Conrail)	3
Soo Line Railroad Company	3
Illinois Central Railroad Company	2
Southern Pacific Transportation Company	2
Kansas City Southern Railway	1
Norfolk Southern Corporation	1
Other Classes:	
Chicago, Missouri & Western Railway Company	2
Iowa Interstate Railroad, Ltd.	1
Louisiana & Arkansas Railway Company	1
MidSouth Rail Corporation	1
Montana Rail Link, Inc.	1
Paducah & Louisville Railway, Inc.	1
Port Terminal Railroad Association	1
Seminole Gulf Railway, Inc.	1
Wisconsin Central Ltd.	1
Total	45

¹³ The Interstate Commerce Commission defines Class I railroads based on the carrier's annual operating revenue for each year; there are 16 Class I railroads. All other railroads are defined by the AAR as one of two types: regional or local railroad.

The 45 cases occurred in 25 States; 20 of the 45 cases (44 percent) occurred in 6 States: Texas, California, Illinois, Missouri, Ohio, and Wisconsin:

<u>State</u>	<u>Number of cases</u>
Texas	5
California	3
Illinois	3
Missouri	3
Ohio	3
Wisconsin	3
Florida	2
Georgia	2
Kentucky	2
Tennessee	2
Other States (Alabama, Arizona, Colorado, Idaho, Iowa, Indiana, Kansas, Louisiana, Mississippi, Montana, North Dakota, Nebraska, Nevada, New Jersey, Pennsylvania, South Carolina, Washington ¹⁴)	17
Total	45

Evacuations were conducted in 33 of the 45 cases. The estimated number of persons evacuated by accident location follows:

<u>Location of accident</u>	<u>Estimated number of persons evacuated</u>
Crofton, Kentucky	4,000
Helena, Montana	3,500
Akron, Ohio	1,785
Altoona, Iowa	1,500
Bangor, Alabama	1,000
Roodhouse, Illinois	1,000
Elsberry, Missouri	600
Flagstaff, Arizona	500
Bonnars Ferry, Idaho	500
Jacksonville, Florida	400
Punta Gorda, Florida	300
Gulfport, Mississippi	300
Elberton, Georgia	300
Elm Grove, Wisconsin	300
Morganza, Louisiana	300
Newcastle, California	300
Ohiopyle, Pennsylvania	200

¹⁴ Each of these States had one accident.

Manteca, California	150
Easley, South Carolina	130
Bordulac, North Dakota	125
Brazoria, Texas	70
Fruitvale, Texas	60
Rineyville, Kentucky	50
Sheridan, Wisconsin	50
Summit, Illinois	30
Loudonville, Ohio	30
Lanagan, Missouri	20
Edison, New Jersey	10
Other locations (Umbarger, Texas; Memphis, Tennessee; White Bluff, Tennessee; Lyndon Station, Wisconsin; Athens, Georgia ¹⁵)	<u>19</u>
Total	17,529

Recent Legislation Related To Hazardous Materials Transportation

Improvements in the transportation of hazardous materials have recently been prompted by Congressional and Federal regulatory action. The Hazardous Materials Transportation Uniform Safety Act (Public Law 101-615, signed into law in November 1990) is a comprehensive amendment and expansion of the Hazardous Materials Transportation Act. Major provisions of the new Act address tank car design and emergency response training. A summary of those provisions that are applicable to rail safety are described in appendix E.

Federal regulatory actions related to the safety issues addressed in this safety study are discussed in subsequent sections of the report.

¹⁵ Each location had fewer than 10 persons evacuated.

TRANSPORT OF HAZARDOUS MATERIALS IN DOT-111A TANK CARS**Performance of DOT-111A Tank Cars
Involved in Accidents**

The decision to transport a hazardous material in a selected tank car is complex and is based on many factors, including, but not limited to, volume capacity and availability of tank cars, cost of shipping, location of outlets, weight restrictions, and specialized requirements (such as maintaining the purity of the products). The inadequacy of the protection provided by DOT-111A tank cars for certain dangerous products has been evident for many years in accidents investigated by the Safety Board. Some of the problems are illustrated by accidents that occurred at Livingston, Louisiana; Denver, Colorado; and Jackson, South Carolina.

Livingston, Louisiana. On September 28, 1982, 36 tank cars in an Illinois Central Gulf Railroad freight train derailed in Livingston, Louisiana (NTSB 1983). Of the derailed cars, 5 contained flammable petroleum products and 29 contained various hazardous materials or toxic chemicals. A total of 20 tank cars leaked, were punctured, or otherwise breached in the derailment; 17 were DOT-111A tank cars. Fires broke out in the wreckage, and smoke and toxic gases were released into the atmosphere. Thermally-induced explosions occurred in two DOT-105 tank cars that had not been punctured. About 3,000 persons within a 5-mile radius of the accident site were evacuated for up to 2 weeks, and 19 residences and other buildings were destroyed or severely damaged. More than 14,000 gallons of perchloroethylene, released from a DOT-111A tank car, were absorbed into the ground and required extensive excavation of contaminated soil. The accident resulted in a long-term closure of the railroad line and an adjacent highway. Property damage was estimated at more than \$20 million.

Denver, Colorado. On April 3, 1983, the tank head of a DOT-111A tank car was punctured when freight cars were being switched in a Denver and Rio Grande Western Railroad Company rail yard at Denver, Colorado. Fuming nitric acid escaped from the car, ignited small fires involving the railroad track crossties, and formed a vapor cloud that dispersed over the area. About 9,000 persons were evacuated from the area, 34 persons sustained injuries, and property damage was estimated at \$341,000.

The Safety Board's investigation concluded that the fuming nitric acid would not have been released had the tank car been better protected (for example, with head shields) (NTSB 1985a).

Jackson, South Carolina. On February 23, 1985, a Seaboard System Railroad freight train derailed at Jackson, South Carolina. Of the 27 cars that derailed, 8 were tank cars--all of which were DOT-111A tank cars containing cyclohexane (a volatile flammable liquid). The heads of five of the eight tank cars were penetrated; none of the eight tank cars had head shield protection. Cyclohexane was subsequently released and it ignited immediately. Residents within a 1-mile radius of the accident site were

evacuated; damage was estimated at \$1.3 million. No fatalities or injuries resulted from the accident.

The Safety Board's investigation concluded that the volatile hazardous materials would not have been released or ignited had the derailed DOT-111A tank cars been better equipped (NTSB 1985b).

The release of products from the DOT-111A tank cars observed by the Safety Board in the investigations of these accidents were also found in the 45 cases investigated by the Safety Board from March 1988 through February 1989. These 45 cases involved 149 tank cars: 84 cars (57 percent) were DOT-111A tank cars, 32 cars (21 percent) were DOT-105 tank cars, 29 cars (19 percent) were DOT-112/114 tank cars, and 4 cars (3 percent) were other specifications.

Of the 61 DOT-105, -112, and -114 tank cars involved, 14 tank cars (23 percent) released products: 11 leaked (18 percent), and 3 ignited or exploded (5 percent). The products were released as a result of head punctures or failures in two of the tank cars and shell punctures or failures in five (a total of 11 percent).

Of the 84 DOT-111A tank cars involved, 46 tank cars (54 percent) released product: 31 leaked (37 percent), and 15 ignited or exploded (18 percent) (table 3). The products were released as a result of head punctures or failures in 5 of these tank cars, and shell punctures or failures in 13 (a total of 22 percent).¹⁶

These data indicate that 23 percent of the DOT-105, -112 and -114 tank cars involved in the 45 cases released product whereas 54 percent of the DOT-111A tank cars released product. Further, the rate at which the DOT-111A tank cars experienced head or shell puncture or failure was also double that of the DOT-105, -112 and -114 tank cars. Although the accidents were not selected on a basis such that they are statistically representative of hazardous materials accidents, the rate of failure of the DOT-111A tank cars (double that of the non-DOT-111A cars) strongly suggests that DOT-111A tank cars do not provide as much protection for their products in accidents as do the DOT-105, -112, and -114 tank cars.

¹⁶ One of the tank cars that exploded was involved in the 1989 accident in Helena, Montana. In its investigation of the accident, the Safety Board concluded that the tank car was probably punctured during the accident sequence, but the location(s) of the puncture(s) could not be determined. Although that tank car has been counted as 1 of the 15 that ignited or exploded, it has not been included as 1 of the 5 with head punctures or failures, or as 1 of the 13 with shell punctures or failures.

Table 3.--Type of tank car failure in DOT-111A tank cars that released hazardous materials in the accidents/incidents investigated March 1983 to February 1989 during the safety study, and hazardous materials released, by location and type of accident

Event number	Location of accident	Type of accident	DOT tank car specification	Type of tank car failure	Hazardous material released
3	Pasco, WA	Deraillment	111A100V3 111A100V1 111A100V1	Fitting damage, leaked Fitting damage, leaked Shell puncture, leaked	Sodium chlorate Sodium hydroxide Sodium hydr zide
4	Jeffersonville, IN	Standing car	111A60ALV1	Fitting damage, leaked	Acetic acid
6	Roodhouse, IL	Deraillment	111A100V2	Fitting damage, leaked	Sulfuric acid
10	Las Vegas, NY	Standing car	111A100V2	Fitting damage, leaked	Sulfuric acid
11	Columbus, OH	Deraillment	111A100V1	Fitting damage, leaked	Toluene
12	Crofton, KY	Deraillment	111A100V1	Fitting damage, leaked, ignited	Phosphorus
13	Deer Park, TX	Standing car	111A100V6	Exploded, rocketed	Methyl methacrylate
15	White Bluff, TN	Deraillment	111A100V1	Shell puncture, leaked	Petroleum sulfite waste
16	Altrona, IA	Collision	111A100V1	Fitting damage, leaked, ignited	Ethyl alcohol
			111A100V1	Fitting damage, leaked, ignited	Ethyl alcohol
19	Brazoria, TX	Deraillment	111A100V1	Shell puncture, leaked, ignited	Acetaldehyde
			111A100V1	Exploded, rocketed	Acetaldehyde
			111A100V1	Shell failure, leaked, ignited	Acetaldehyde
			111A100V1	Shell failure, leaked, ignited	Acetaldehyde
			111A100V1	Shell failure, leaked, ignited	Acetaldehyde
			111A100V1	Head puncture, leaked, ignited	Acetaldehyde
20	Loudonville, OH	Deraillment	111A100V1	Shell failure, leaked Ignited, rocketed	Hexamethylene diamine
			111A100V1	Shell severed, leaked, ignited	Octanol
22	Elberton, GA	Deraillment	111A60V1 111A60V1 111A60V1 111A60V1 111A100V3 111A100V5	Head puncture, leaked Fitting damage, leaked Fitting damage, leaked Fitting damage, leaked Head puncture, leaked Fitting damage, leaked	Xylene Xylene Xylene Xylene Ferric chloride
25	Memphis, TN	Standing car	111A100V5	Head failure, leaked	Muriatic acid
26	Jacksonville, FL	Deraillment	111A100V1	Fitting damage, leaked	Potassium hydroxide
27	Summit, IL	Deraillment	111A100V1	Fitting damage, leaked	Phosphoric acid
28	Rineyville, KY	Deraillment	111A50ALV1 111A100V1 111A100V1	Fitting damage, leaked Shell puncture, leaked Fitting damage, leaked	Acetic acid Sodium hydroxide Hydrochloric acid
29	Easley, SC	Deraillment	111A60V1 111A100V1 111A100V1	Shell puncture, leaked Fitting damage, leaked Fitting damage, leaked	Sodium hydroxide Sodium hydroxide Sodium hydroxide
30	Pearl, IL	Deraillment	111A100V1	Fitting damage, leaked	Isopropanol
31	Morganza, LA	Deraillment	111A60V1	Shell puncture, leaked	Toluene diisocyanate
32	Newcastle, CA	Deraillment	111A100V1	Shell puncture, leaked	Ethyl alcohol
33	Lyndon Station, WI	Deraillment	111A100V1	Shell puncture, leaked	Carbolic acid
34	Bangor, AL	Deraillment	111A100V2 111A100V1	Fitting damage, leaked Shell puncture, leaked	Sulfuric acid Diethylene glycol
37	Palmyra, MO	Standing car	111A60V7	Overpressure, leaked	Sulfuric acid
41	Helena, MT	Collision	111A60V1	Head puncture, leaked, ignited	Isopropyl alcohol/acetone ^a
			111A60ALV2	Valve leaked, ignited	Hydrogen peroxide
			111A50ALV2	Exploded, rocketed ^b	Hydrogen peroxide
42	Kansas City, KS	Standing car	111A60ALV1	Fitting damage, leaked	Acetic anhydride

^a The hazardous materials were in dual tanks.

^b The investigation of this accident concluded that this tank car was probably punctured during the collision and deraillment, but the location(s) of the puncture(s) could not be determined.

The 46 DOT-111A tank cars that released hazardous materials were transporting 24 different products, 12 of which (a) could cause serious injury, temporary or long-term, from brief exposure even when medical attention is promptly given; and/or (b) are highly flammable at ambient temperature conditions.

The RPI and AAR, in their 1990 study that analyzed the performance of the DOT-111A tank cars and other tank cars (RPI and AAR 1990a), reported a greater incidence of head and shell punctures in DOT-111A (insulated and non-insulated), DOT-112A/114A, and aluminum tank cars (fig. 1)--none of which have the improved tank head resistance protection and/or thermal protection as required for the DOT-112S, J, and T tank cars, the DOT-114S, J, and T tank cars, and for the DOT-105S, J, and T tank cars (see footnote 5). The incidence of head and shell punctures in tank cars damaged in accidents to the total number of tank cars damaged in accidents during a 22-year period (1965-86) is also shown in figure 1.

The DOT-111A tank cars often have been unable to withstand the forces of an accident, even when the train was traveling at slow speeds. The poor performance of DOT-111A tank cars documented in the RPI-AAR study is consistent with the poor performance of DOT-111A tank cars involved in accidents/incidents investigated by the Safety Board.

Safety risks posed by the release of hazardous materials from DOT-111A tank cars are well illustrated by 3 of the 45 cases: Brazoria, Texas; Elberton, Georgia; and Helena, Montana. Although the investigations could not conclusively identify the mechanism that caused the tank damage, the Safety Board remains concerned that some of the more dangerous materials, such as those released in these accidents, continue to be transported in tank cars with less protection than is needed.

Brazoria, Texas. On August 2, 1988, a Union Pacific Railroad Company freight train derailed near Brazoria, Texas. There were 13 tank cars in the train, containing various hazardous materials. During the derailment, five DOT-111A tank cars containing acetaldehyde (a flammable liquid that easily ignites and can polymerize¹⁷) were severely damaged and released about 133,000 gallons of product. A large fire ignited, and a sixth DOT-111A tank car loaded with 30,000 gallons of acetaldehyde exploded. The explosive force rocketed the tank head from the tank car into an open field about 700 feet from the derailment. The fire scorched vegetation up to 900 feet from the accident site. About 70 persons were evacuated from a 1-mile area, and 4 persons were treated for minor eye and skin irritations and then released from a local hospital. Of the six DOT-111A tank cars involved in this

¹⁷ A material that can polymerize is one in which, under certain conditions, a chemical reaction can occur such that two or more small molecules combine to form larger molecules that contain repeating structural units of the original molecule, often releasing heat in the process.

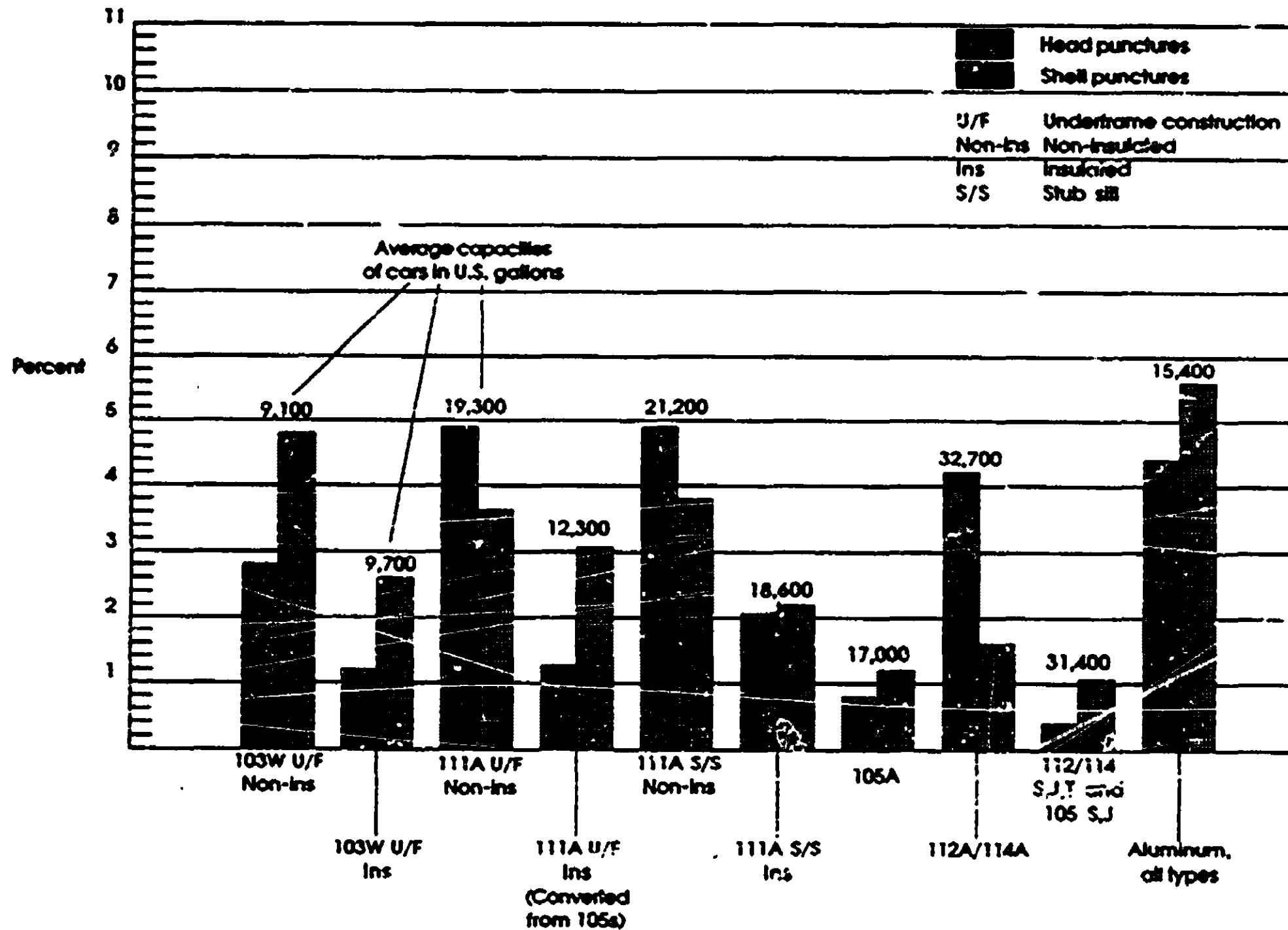


Figure 1.--Incidence of head and shell punctures to total number of tank cars damaged in accidents, 1965-86. (Source: Railway Progress Institute and Association of American Railroads 1990a.)

accident, one had a tank head puncture, one had a shell puncture, three had shell tears, and one exploded. Had the acetaldehyde been transported in tank cars with better protection, such as head shields or thermal protection, the product might not have been released.

Elberton, Georgia. On August 8, 1988, 61 cars from a CSX Transportation, Inc. (CSX) freight train derailed near Elberton, Georgia. Five DOT-111A tank cars containing xylene (a flammable liquid) and one DOT-111A tank car containing ferric chloride solution (a corrosive) were damaged and released product. Although no fire resulted from the accident, 23 persons were treated for chemical exposure then released from a local hospital, and 2 persons with more serious exposure were admitted for observation. Also as a result of the accident, 300 persons were evacuated from a 3-mile area, and the ground water and portions of a lake 1/2 mile from the accident site were contaminated. Environmental damage was estimated at \$3 million. Of the six DOT-111A tank cars involved in this accident, one had a tank head puncture, one had a shell puncture, and four had damage to fittings. The DOT-111A tank cars provided inadequate protection for the xylene in this accident.

Helena, Montana. In the February 2, 1989, accident at Helena, Montana, two aluminum DOT-111A tank cars containing hydrogen peroxide (a strong oxidizer) and one steel DOT-111A tank car containing acetone and isopropyl alcohol (in dual compartments) were severely damaged and released their products. Fire and explosions resulted, dispersing fragments of one of the aluminum tank cars as far away as 1/2 mile. About 3,500 persons were evacuated, 2 persons were injured, and damage and cost of cleanup exceeded \$6 million.

The Safety Board's investigation determined that the steel DOT-111A tank car sustained a head puncture; the investigation also concluded that one of the aluminum DOT-111A tank cars probably was punctured during the collision and derailment, but the disintegration of the tank car from the explosion precluded an exact determination of the number and locations of the punctures. Because of its past concern about the transport of hazardous materials that pose severe threats to public safety in tank cars that do not have puncture resistant protection, such as head shields, the Safety Board reiterated to the RSPA, AAR, and FRA safety recommendations that called for a testing and evaluation program to develop head shield protection for the aluminum tank cars and requirements for the installation of the head shield. The recommendations (R-85-61, R-85-63, and R-85-64, originally issued as a result of the 1983 accident involving fuming nitric acid at Denver), were reiterated because testing being done by the FRA, in response to the recommendations, and rulemaking action to implement tank car head puncture protection had not been completed. Safety Recommendations R-85-61 and -64 to the RSPA and FRA, respectively, remain classified as "Open--Acceptable Response" pending issuance by the RSPA of a final rule from Docket HM-175A, Specifications for Tank Car Tanks (discussed in appendix G). Safety Recommendation R-85-63 to the AAR is classified as "Open--Acceptable Response" pending issuance of car interchange rules requiring head shields for aluminum tank cars.

In its report on the Helena accident, the Safety Board also expressed concern regarding the methods that have been used by the DOT agencies to evaluate the performance of tank cars carrying hazardous materials because the methods used have been the basis for determining the safety standards of tank cars and, thereby, the protection provided to hazardous materials (NTSB 1989). The changes made by the RSPA between 1977 and 1989, in the regulations that provided protection to hazardous materials by tank cars, primarily were made in response to specific safety problems identified through the investigations of individual tank car accidents. The Safety Board believes that the DOT should establish safety standards based on a safety analysis that considers the severity of the danger to public safety posed by the release of hazardous materials and that identifies the level of protection necessary to provide an acceptable level of risk. As a result of the Helena accident, the Safety Board issued the following safety recommendation to the RSPA:

R-89-80

Evaluate present safety standards for tank cars transporting hazardous materials by using safety analysis methods to identify the unacceptable levels of risk and the degree of risk from the release of a hazardous material, then modify existing regulations to achieve an acceptable level of safety for each product/tank car combination.

On June 13, 1990, the DOT replied that a working group, comprising representatives of the RSPA and the FRA, has developed a course of action to address the Safety Board's concerns: a safety analysis will be initiated using "deterministic risk analysis methods" to classify high-risk materials and to analyze postaccident histories. Upon completion of the effort, the RSPA and the FRA will review the results of the analysis to determine if rulemaking action is necessary to shift the transport of hazardous materials to improved tank cars. Based on the response from the DOT, the Safety Board classified Safety Recommendation R-89-80 as "Open--Acceptable Response." The need for evaluating present safety standards for tank cars that transport hazardous materials is so important that the Safety Board has placed Safety Recommendation R-89-80 to the DOT on its "Most Wanted" list of safety improvements.¹⁸

While the Safety Board is extremely concerned about the level of protection that is provided by tank cars that transport materials that are potentially hazardous to human life and property, the Board is also concerned about the level of protection provided to the hazardous materials that can harm the environment. The potential harm to humans through deleterious effects on the environment is illustrated by the accidents in Livingston,

¹⁸ In October 1990, the Safety Board adopted a program to identify the "Most Wanted" safety improvements. The purpose of the Safety Board's "Most Wanted" list, which is drawn up from safety recommendations previously issued, is to bring special emphasis to the safety issues the Board deems most critical.

Louisiana (involving perchloroethylene, 1982); Jackson, South Carolina (involving cyclohexane, 1985); and Elberton, Georgia (involving xylene, 1988). According to the AAR, the railroad industry has recognized this issue and, in conjunction with the chemical and tank car industries, is developing a "quantitative risk assessment methodology" that incorporates chemical risks to the environment as well as other risks. The industries have also developed a list of hazardous materials that, because of their potential to contaminate soil and ground water, would be candidates for early action for improved packaging. Perchloroethylene, cyclohexane, and xylene are included in the list; however, action for improved packaging has not been initiated. Further, the U.S. Environmental Protection Agency has identified perchloroethylene and xylene as being among the hazardous materials most likely to cause a serious threat to human health and has banned land disposal of materials contaminated with perchloroethylene, xylene, and cyclohexane.¹⁹ Because the release of hazardous materials can also threaten health through contamination of the environment, the Safety Board urges the DOT to consider environmental hazards when conducting its deterministic risk analysis.

Action Needed

The Safety Board is concerned that dangerous materials are being transported in tank cars without puncture protection, thermal protection, and/or the benefit of thicker shells. The July 22, 1989, derailment of a CSX freight train near Freeland, Michigan, is yet another example of the importance of transporting hazardous materials in tank cars with adequate protection. Six of the tank cars involved in the derailment contained hazardous materials: styrene monomer, acrylic acid, and acrylonitrile (all of which can polymerize and become explosive), petroleum naphtha (a flammable liquid), and chlorosilane compounds (a flammable and corrosive liquid). Three of the six tank cars released their products: acrylic acid and chlorosilane compounds (from a DOT-111A and a DOT-105, respectively, that sustained head punctures), and petroleum naphtha (from a DOT-111A that sustained a side puncture). The products released from the tank cars ignited, and the fire burned for several days; the mixture of chlorosilanes was especially difficult to extinguish once it ignited. The accident resulted in the evacuation of about 1,000 residents for 7 days; 11 persons were treated for injuries.

None of the six tank cars was equipped with a head shield, nor were the tank cars required by safety regulations to be equipped with head shields to transport these products. Nevertheless, except for the petroleum naphtha, most of the materials posed multiple hazards. At the time this report was written, the report on the Freeland accident had not been adopted by the Safety Board; therefore, no conclusions can be drawn. However, the Freeland accident illustrates that hazardous materials are still being transported in DOT-111A tank cars with protection that is inadequate for the dangers posed to the public by the materials.

¹⁹ 52 FR 12866-12874 (1987), 53 FR 41280-41285 (1988), and 40 CFR 268.35(a).

Rulemaking activity for tank cars is currently underway by the RSPA: Performance-Oriented Packaging Standards (Docket HM-181, discussed in appendix F), and Specifications for Tank Car Tanks (Docket HM-175A, discussed in appendix G). Both rulemaking actions address the protection needed for some hazardous materials now being transported in DOT-111A tank cars. Additional rulemaking will probably be needed after the DOT completes its deterministic risk analysis (in response to Safety Recommendation R-89-80). However, the Safety Board is concerned that it may take several years until final rules are issued as a result of Docket HM-175A and even longer until final rules are issued in response to Safety Recommendation R-89-80. Thus, the Safety Board is concerned that, in the interim, many hazardous materials that pose severe threats to public safety will continue to be transported in tank cars with inadequate protection.

Following its investigation of the 1995 derailment at Jackson, South Carolina, the Safety Board issued Safety Recommendation R-85-105 to the RSPA to require that all tank car shipments of hazardous materials with an isolation radius of 1/2 mile or more, as recommended by the U.S. Department of Transportation Emergency Response Guidebook, be transported in tank cars equipped with head shield or full tank head protection (NTSB 1985b). However, in its 1986 reply to the safety recommendation, the RSPA pointed out that head protection might be beneficial for tank cars carrying a broader class of hazardous materials. Further, the RSPA staff has also indicated to the Safety Board that many products listed in the DOT Emergency Response Guidebook as requiring a 1/2-mile evacuation radius do not really require greater protection than that provided by DOT-111A tank cars. In its latest reply, dated April 1990, the RSPA indicated that advanced notice of proposed rulemaking (Docket HM-175A) addresses head shield protection for new and existing tank cars that are used to transport critical hazardous materials such as flammable gases, certain non-flammable gases, reactive materials, and materials that are poisonous by inhalation. (These products currently may be transported in DOT-111A tank cars.) The RSPA indicates that it expects to issue a Notice of Proposed Rulemaking for Docket HM-175A, in the summer 1991. Safety Recommendation R-85-105 is currently classified as "Open--Acceptable Response."

The Safety Board recognizes there is some merit in RSPA's position that use of the 1/2-mile-radius criteria (per the DOT Emergency Response Guidebook) may not be the most appropriate means to determine which hazardous materials need to be provided full head shield and thermal protection. The Safety Board believes that fulfilling the intent of Safety Recommendation R-89-80, which asks that the RSPA conduct a safety analysis, is the most appropriate way to determine how to properly protect hazardous materials for shipment by rail tank cars.

However, because of the substantial amount of time that will be required to fulfill the intent of Safety Recommendation R-89-80, the Safety Board believes that immediate action is needed to identify the most harmful materials (those that pose the greatest consequences) and to have these materials transported in stronger tank cars that are protected by head shields and thermal jackets. The RSPA believes, and the Safety Board agrees, that using the 1/2-mile-radius criteria in the DOT Emergency Response

Guidebook is not the most appropriate method to determine the products that require greater protection than is provided by DOT-111A tank cars. Therefore, the Safety Board classifies R-85-105 as "Closed--Acceptable Action/Superseded" by Safety Recommendation R-91-11, and urges the RSPA, in cooperation with the FRA, AAR, Chemical Manufacturers Association, the American Petroleum Institute, and the National Fire Protection Association, to establish a working group to expeditiously improve the packaging of the more dangerous products (such as those that are highly flammable or toxic, or pose a health hazard through contamination of the environment) by (a) developing a list of hazardous materials that should be transported only in pressure tank cars with head shield protection and thermal protection (if needed); and (b) establishing a working agreement to ship the listed hazardous materials in tank cars that provide adequate protection. Companion recommendations are being issued to the FRA (R-91-12), the AAR (R-91-14), the Chemical Manufacturers Association (R-91-19), the American Petroleum Institute (R-91-20), and the National Fire Protection Association (R-91-21).

Another issue of concern to the Safety Board is damage to tank car fittings. Of the 84 DOT-111A tank cars involved in the 45 cases investigated during the study, 22 (26 percent) sustained fitting damage (see table 3). Damage occurred at many different locations, including, but not limited to, top and/or bottom nozzle outlets, manway covers, induction pipe, and measuring stick aperture. Of the DOT-105, -112, and -114 tank cars, 3 of the 61 tank cars (5 percent) involved in the 45 cases sustained fitting damage: one DOT-105 released product from top outlets, one DOT-112 released product from a packing gland, and another DOT-112 released product from unspecified fitting damage.²⁰ For all the tank cars with fitting damage, there was no definitive fitting location that could be consistently identified for a specific safety correction.

Although the data are not statistically representative, the greater number of fittings damaged among the DOT-111A tank cars suggests that they may be more susceptible to damage than fittings of the better protected DOT-105, -112, and -114 tank cars. The Safety Board will continue to examine fitting damage in future accident investigations to determine the extent of the problem and whether a specific safety correction may be appropriate.

²⁰ Bottom outlets are prohibited on DOT-105 and -112 tank cars but are optional on DOT-114 tank cars (49 CFR 179.101-1).

EMERGENCY RESPONSE PLANNING FOR RAILROAD ACCIDENTS INVOLVING HAZARDOUS MATERIALS

The Need for Emergency Response Planning Between Railroads and Communities

For over a decade, the Safety Board has been concerned with emergency response management of railroad accidents involving hazardous materials. Between 1977 and 1987, the Safety Board investigated several railroad accidents and incidents involving hazardous materials in which the lack of adequate written emergency response plans and the lack of practice with the emergency response procedures between the railroads and the community presented major safety problems.²¹ In these accidents/incidents, the lack of planning (a) hindered efforts made by the community response personnel to handle the emergency and to minimize the risk to the public, (b) increased the severity of the damage or consequences resulting from the accident, and/or (c) lengthened the duration of the evacuation period and disruption to businesses.

As a result of problems seen in its investigation of the 1977 accident in Rockingham, North Carolina, the Safety Board conducted a special investigation to address on-scene coordination among agencies at hazardous materials accidents. Based on the findings of the special investigation (NTSB 1979), the Safety Board recommended that the DOT develop and disseminate guidelines for planning emergency response to transportation accidents involving hazardous materials; the plan should address the on-scene command structure, establishment of a command post and communications, the structure of coordination of efforts, and control of access to the accident site. In the recommendation (Safety Recommendation I-79-5), the Board also asked that the DOT clearly identify the responsibilities of the responding Federal, State, local, and private agencies.

Two DOT agencies took action in response to the recommendation. In August 1980, the RSPA completed a study entitled "A Community Model for Handling Hazardous Material Transportation Emergencies," which includes a users manual for small communities and rural areas to conduct risk assessments. In September 1980, the Federal Highway Administration published "Guidelines for Applying Criteria To Designate Routes for Transporting Hazardous Materials." Further, in July 1981, the Federal Emergency Management Agency (FEMA) published "Planning Guide and Checklist for Hazardous Materials Contingency Plans." FEMA also contracted with the International Association of Fire Chiefs to prepare the planning guide "Disaster Planning Guidelines for Fire Chiefs." Based on the actions taken

²¹ The events occurred in Rockingham, North Carolina (1977); Crestview, Florida (1979); Somerville, Massachusetts (1980); Livingston, Louisiana (1982); North Little Rock, Arkansas (1984); Elkhart, Indiana (1985); Pine Bluff, Arkansas (1985); Miamisburg, Ohio (1986); and New Orleans, Louisiana (1987).

by the Federal agencies, the Safety Board classified Safety Recommendation I-79-5 as "Closed--Acceptable Action" on August 11, 1982.

Despite the actions taken by the Federal agencies to develop and publish guidelines addressing on-scene coordination for emergency response, the Safety Board continued to see problems related to the lack of planning for emergency response between communities and railroads. In 1985, in its special investigation report on railroad yard safety, the Board addressed the need for coordinated emergency response planning for railroad yards, through which pass a high volume of hazardous materials and where the release of the materials pose great threats to public safety (NTSB 1985c). The special investigation identified many accidents/incidents in which the coordination needed to handle the emergency was inadequate and in which the inadequacy resulted from a lack of planning and joint disaster drills between the railroad and emergency response personnel. Based on its special investigation, on June 6, 1985, the Safety Board issued the following safety recommendation to all railroads that operate rail yards:

R-85-53

In coordination with communities adjacent to your railroad yards, develop and implement emergency planning and response procedures for handling releases of hazardous materials. These procedures should address, at a minimum, initial notification procedures, response actions for the safe handling of releases of the various types of hazardous materials transported, identification of key contact personnel, conduct of emergency drills and exercises, and identification of the resources to be provided and the actions to be taken by the railroad and the community.

Of the 54 railroads that received the recommendation, 9 no longer exist because of mergers or other corporate changes and 29 did not respond to the Safety Board:²²

Alton & Southern Railroad Company
 Atlanta & Saint Andrews Bay Railway Company
 Bangor and Aroostock Railroad Company
 Belt Railway Company of Chicago
 Bessemer and Lake Erie Railroad Company
 Boston and Maine Corporation
 Colorado and Southern Railway Company
 Duluth, Missabe and Iron Range Railway Company
 Florida East Coast Railway Company
 Grand Trunk Western Railroad Company

²² The railroads that no longer exist are: Chessie System; Clinchfield Railroad Co.; Detroit, Toledo, and Short Line Railroad Co.; Ft. Worth and Denver Railway Co.; Georgia Railroad; Illinois Terminal Railroad Company; Norfolk Franklin and Danville Railway Co.; Seaboard System Railroad, Inc., and Washington Terminal Company.

Green Bay and Western Railroad Company
 Kansas City Southern Railway Company
 Lake Superior & Ishpeming Railroad Company
 Maine Central Railroad Company
 Milwaukee Road
 Minneapolis, Northfield and Southern Railroad Company
 Monogahela Railway Company
 Norfolk and Portsmouth Belt Line Railroad Company
 Norfolk and Western Railway Company
 Pittsburg & Shawmut Railroad Company
 Pittsburgh and Lake Erie Railroad Company
 Soo Line Railroad Company
 Southern Pacific Transportation Company
 Terminal Railroad Association of St. Louis
 Texas Mexican Railway Company
 Toledo, Peoria & Western Railway Company
 Union Pacific Railroad Company
 Union Railroad Company
 Vermont Railway, Inc.

Only 16 railroads responded; the status of the recommendation, based on the response of each rail carrier, is as follows:

<u>Railroad</u>	<u>Status</u>
Alaska Railroad Corp.	Closed--Acceptable Action
Atchinson, Topeka & Santa Fe Railway Co.	Closed--Acceptable Action
Burlington Northern Railroad Company	Closed--Acceptable Action
Cambria and Indiana Railroad Co.	Closed--Reconsidered ²³
CSX Transportation, Inc.	Open--Acceptable Response
Chicago and Illinois Midland Railroad Co.	Closed--Acceptable Action
Chicago and North Western Transportation Co.	Open--Acceptable Response
Consolidated Rail Corporation	Open--Response Received
Delaware and Hudson Valley Railway Co.	Open--Acceptable Response
Denver and Rio Grande Western Railroad Co.	Open--Acceptable Response
Detroit and Mackinac Railway Co.	Open--Acceptable Response
Elgin, Joliet and Eastern Railway Co.	Open--Response Received
Illinois Central Railroad Company	Open--Acceptable Response
Indiana Harbor Belt Railroad Co.	Closed--Acceptable Action
Missouri-Kansas-Texas Railroad Co.	Open--Unacceptable Response
Richmond, Fredericksburg & Potomac Railroad Co.	Closed--Acceptable Action

²³ Cambria and Indiana Railroad responded that it did not transport any hazardous materials. Based on this information, the Safety Board classified the Safety Recommendation R-85-53 to the railroad as "Closed--Reconsidered."

Only 6 of the 54 railroads that operate rail yards indicated that they have been in contact with communities to develop and implement emergency planning and response procedures. Consequently, the Safety Board believes that action is still needed between most railroads that operate rail yards and the communities in which the yards are located.

The Safety Board has also addressed its concerns about the need for emergency response planning to non-Federal agencies. In 1985, as a result of a derailment at Murdock, Illinois, the Safety Board urged the International Association of Fire Chiefs (IAFC), the International Association of Chiefs of Police (IACP), and the International Society of Fire Service Instructors (ISFSI) to notify their members that evacuation zones may need to be larger than the initial distances recommended in the DOT Emergency Response Guidebook for Hazardous Materials Incidents because parts of tank cars carrying liquids or gases may be propelled a distance far beyond the recommended evacuation zone; thus a larger evacuation zone may be necessary to protect against injury (Safety Recommendation I-85-15).²⁴ Based on the actions taken by the IACP and ISFSI to notify their members, the Safety Board classified Safety Recommendation I-85-15 to those organizations as "Closed--Acceptable Action." In its 1989 response, the IAFC stated it had notified its members and had also requested that DOT revise the distances in the guidebook. The DOT revised the "protective action" distances in the guidebook, which was distributed to IAFC members. Based on the action taken, the Safety Board classifies Safety Recommendation I-85-15 to the IAFC as "Closed--Acceptable Action."

In 1988, the Safety Board recommended that the National League of Cities (NLC) (a) advise its membership of events of the 1987 hazardous materials accident in New Orleans, Louisiana, in which butadiene leaked from a tank car and ignited (NTSB 1988), and (b) urge its membership to develop and implement, in coordination with rail yard management, emergency response procedures for handling releases of hazardous materials from tank cars (Safety Recommendation R-88-69). In September 1989, the Board sent a followup letter to the NLC. No response was received.

The Safety Board is concerned that so few of the railroads that were recipients of Safety Recommendation R-85-53 have acted in a positive manner. Likewise, the Safety Board is concerned that the NLC has not responded to Safety Recommendation R-88-69, especially because the Board learned in its investigations of the 45 cases that many communities and the railroads that operate trains carrying hazardous materials through those communities either do not have proper emergency response plans or are not properly exercising the plans.

²⁴ After the accident, which occurred on September 2, 1983, a tank car loaded with flammable compressed gas exploded and rocketed 3,630 feet from the derailment site. That distance is nearly 1,000 feet beyond the 1/2-mile evacuation zone recommended in the DOT Emergency Response Guidebook. Safety Recommendation I-85-15 was issued in a letter dated April 19, 1985, to the IAFC, the IACP, and the ISFSI.

In at least 21 of the 45 cases (47 percent), the incident commander did not have a hazardous materials emergency response plan to follow (table 4). In these accidents, the decisions of emergency response personnel to evacuate were generally based on their visual observation of the accident sites and on various emergency response guidebooks published by Federal or State agencies. In 9 of the 45 cases, personnel responding to the emergency did not use an emergency response plan because either evacuations were not conducted or the emergency was resolved quickly.²⁵ Emergency response plans were followed in 15 of the 45 cases.

Major problems did not occur in most of the cases in which the incident commander relied on various emergency response guidebooks. However, the value of an emergency response plan is illustrated by the 1988 accident in Punta Gorda, Florida.

Punta Gorda, Florida. On March 10, 1988, 40 cars in a Seminole Gulf Railway, Inc., freight train derailed in Punta Gorda, Florida. One of the derailed cars, a covered hopper car, contained ammonium nitrate (an oxidizer). Because the product was potentially explosive, and two tank cars containing liquified petroleum gas (a flammable gas) were in the immediate area, local authorities ordered a precautionary evacuation of 300 persons in the vicinity of the derailment.

The local community did not have an emergency response plan, and the railroad and local emergency response agencies had not previously participated in any planning activity to prepare for an emergency. No one answered a published telephone number for the railroad, which is usually call-forwarded to the railroad agent's residence after the close of business, and the railroad had not published an emergency telephone number. Consequently, the local fire chief did not know how to contact the railroad to obtain information about the ammonium nitrate. Unable to obtain information from the railroad, local fire officials used the 1987 Federal Emergency Guidelines for Hazardous Materials (DOT P5800.4) to contact CHEMTREC²⁶ for information. Fire officials were unable to supply CHEMTREC with the name of the shipper or consignee as CHEMTREC required because the railroad could not be reached to provide the necessary information. As a result, CHEMTREC did not initially respond to the fire department's request for information. Based on its investigation, the Safety Board concluded

²⁵ For example, the leak of hazardous materials from the fitting on a standing tank car, which was quickly stopped.

²⁶ CHEMTREC, the Chemical Transportation Emergency Center, is operated by the Chemical Manufacturers Association. The Center was established to provide initial and immediate information on handling hazardous materials and other chemicals.

Table 4.--Occurrence of evacuations and community emergency response plans in accidents/incidents investigated March 1968 to February 1989 during the safety study, and occurrence of emergency response planning and disaster drills between railroad personnel and emergency response agencies, by location and type of accident

Event number	Location of accident	Railroad	Type of accident	Evacuation conducted	Documented plans	Planning activity	Disaster drills
1	Claude, TX	BN	Derailment	N	--	N	N
2	Punta Gorda, FL	SGLR	Derailment	Y	N	N	N
3	Pasco, WA	BN	Derailment	N	--	Y	N
4	Jeffersonville, IN	CR	Standing car	N	--	--	--
5	Wilmington, CA	UP	Standing car	N	Y	--	N
6	Reodhouse, IL	CPMRY	Derailment	Y	N	N	N
7	Denver, CO	UF	Standing car	N	--	--	--
8	Gulfport, MS	MSRC	Derailment	Y	Y	Y	Y
9	Sheridan, WI	WC	Derailment	Y	N	N	N
10	Las Vegas, NV	UP	Standing car	N	Y	Y	Y
11	Columbus, OH	CSX	Derailment	N	N	N	Y
12	Crofton, KY	CSX	Derailment	Y	Y	Y	N
13	Deer Park, TX	PTRA	Standing car	N	--	--	--
14	Farnum, NB	BN	Grade crossing	N	--	--	--
15	White Bluff, TN	CSX	Derailment	Y ^a	N	Y	N
16	Altoona, IA	IAIS	Collision	Y	Y	--	--
17	Umbarger, TX	ATSF	Standing car	Y	N	N	N
18	Ohlerville, PA	CSX	Derailment	Y	N	N	N
19	Brazoria, TX	UP	Derailment	Y	Y	Y	Y
20	Loudonville, OH	CR	Derailment	Y	N	Y	N
21	Elsberry, MO	BN	Derailment	Y	N	N	N
22	Elberton, GA	CSX	Derailment	Y	Y	N	N
23	Elm Grove, WI	SOO	Derailment	Y	Y	Y	Y
24	Athens, GA	CSX	Derailment	Y	N	--	--
25	Memphis, TN	IC	Standing car	Y	Y	Y	N
26	Jacksonville, FL	CSX	Derailment	Y	Y	Y	Y
27	Summit, IL	IC	Derailment	Y	N	N	Y
28	Rineyville, KY	PAL	Derailment	Y	N	Y	N
29	Easley, SC	NS	Derailment	Y	N	N	N
30	Pearl, IL	CPMRY	Derailment	N	--	--	--
31	Morganza, LA	LA	Derailment	Y	N	N	N
32	Newcastle, CA	SP	Derailment	Y	N	N	N
33	Lyndon Station, WI	SOO	Derailment	Y	N	Y	Y
34	Bangor, AL	CSX	Derailment	Y	N	N	N
35	Lanagan, MO	KCS	Derailment	Y	N	N	N
36	Fruitvale, TX	UP	Derailment	Y	N	N	N
37	Palmyra, MO	BN	Standing car	N	--	--	Y
38	Edison, NJ	CR	Standing car	Y	Y	Y	Y
39	Flagstaff, AZ	ATSF	Derailment	Y	Y	Y	Y
40	Bonnets Ferry, ID	UP	Standing car	Y	Y	N	N
41	Helena, MT	MRL	Collision	Y	Y	N	N
42	Kansas City, KS	ATSF	Standing car	N	--	--	--
43	Manteca, CA	SP	Derailment	Y	N	--	--
44	Bordulac, MD	SOO	Derailment	Y	N	N	N
45	Akron, OH	CSX	Derailment	Y	Y	Y	N

-- = Not applicable, or railroad did not answer Safety Board inquiry; Y = Yes; N = No.

^a Self-evacuated.

that had the community had an emergency response plan that listed an emergency number for the railroad, the problems experienced by responding personnel in obtaining information about the hazardous materials could have been avoided.²⁷

As a result of this accident, the Safety Board issued Safety Recommendation R-89-27 to the American Shortline Railroad Association (ASLRA) asking that member railroads be urged to maintain a 24-hour telephone number and a point of contact in the event of an emergency. Based on the action taken by the ASLRA to advise its members of the recommendation, the Board classified R-89-29 as "Closed--Acceptable Action" on May 29, 1990. As a result of this recommendation, the Safety Board believes that communities with a written emergency response plan are more likely to have reliable information (including telephone numbers) to use in the event of an accident involving hazardous materials. However, the Safety Board remains concerned that communities without such a plan may experience similar problems to those that occurred in the Punta Gorda accident.

The accident in Helena, Montana, illustrates the importance of considering all the potential complications that could affect a community's ability to effectively handle the emergency.

Helena, Montana. During the emergency response to the February 2, 1989, accident in Helena, Montana, the incident commander was unable to effectively exercise control over the multiple command posts established, some responding agencies were unaware that a centralized command center had been established or that an incident commander had been designated, and some responding agencies could not coordinate their activities.²⁸ As a result of its investigation of the accident, the Safety Board concluded that the hazardous materials emergency response plan used by the city of Helena did not provide for adequate coordination between participating agencies, did not define the role of the participating agencies or the duties and authority of the incident commander, and did not provide for training of personnel to implement the plan (NISB 1989). The Safety Board issued several site specific safety recommendations to correct deficiencies noted.²⁹

²⁷ Since the accident, CHEMREC has implemented new procedures that allow the emergency center to provide product information to emergency response personnel in the early minutes of an emergency even when the railroad, the shipper, or the consignee cannot be located or identified.

²⁸ A summary of the accident appears in the section "Performance of 001-111A Tank Cars Involved in Accidents."

²⁹ The current classifications are as follows: Safety Recommendations R-89-84, -85, and -87 to the city of Helena are "Open--Acceptable Response"; R-89-86 to the city of Helena is "Closed--Acceptable Action"; and R-89-88 to the State of Montana and R-89-89 to the Lewis and Clark Disaster Emergency Services are "Open--Await Response." Followup letters were sent to the State of Montana and the Lewis and Clark Disaster Emergency Services on May 7, 1991.

In the cases in which the incident commander followed emergency response plans, the plans contributed to the effectiveness of the emergency response. The benefit of written emergency response plans is illustrated by the accident at Elberton, Georgia.

Elberton, Georgia. Emergency agencies of Elbert County, in which Elberton is located, were notified immediately after the August 8, 1988, derailment.³⁰ Within 10 minutes, personnel from the responding fire department made contact with the train's conductor, who supplied the fire department with information about the hazardous materials. The evacuation followed the guidelines of the Elberton-Elbert County Emergency Operations Plan.

The investigation of the accident concluded that the effective and efficient emergency response, which followed the emergency response plan, limited the number of persons who would have been exposed to the potential harmful effects of the product xylene (which had been released from damaged tank cars) had the product ignited, and also limited the number of injuries resulting from exposure to the xylene.

The accidents in Punta Gorda, Florida; Helena, Montana; and Elberton, Georgia, provide examples of the importance of having a coordinated, well-managed response to an accident involving a release of hazardous materials. In at least 19 of the 45 cases (42 percent), the local incident commanders and the railroads had not been in contact before the accidents to plan actions to take in the event of a train accident involving hazardous materials (see table 4).

Rail carriers transport a variety of hazardous materials that, if released, pose great threats to public safety of the communities along their routes. The ability of community response agencies to respond effectively to a railroad accident involving hazardous materials depends on the adequacy of the information that is available to them. Development of a written emergency response plan is the most efficient means to ensure that the incident commander (whose role it is to coordinate the emergency response) has the information needed to respond effectively, whether the accidents involve a single, standing tank car or many tank cars scattered over a large area and posing multiple hazards. The incident commander should be knowledgeable of the content of the community emergency response plan, which should include up-to-date information on items such as key railroad personnel and means of contact, procedures to identify the hazardous materials being transported, identification of resources for technical assistance that may be needed during the response effort, and procedures for coordination of activities between railroad officials and emergency response agencies after an accident. In addition, rail carriers that routinely transport hazardous materials through communities have a responsibility to provide to the community current information that would enable the community to establish

³⁰ A summary of the accident appears in the section "Performance of DOT-111A Tank Cars Involved in Accidents."

appropriate emergency response procedures to cope with a release of, or fire or explosion involving, hazardous materials.

In a similar manner, the railroad's emergency response plan should document appropriate and up-to-date information from the community, including the identification of the local emergency response personnel for hazardous materials emergencies, sources of specialized equipment (such as foam equipment) within the local area, and resource capabilities of the local emergency response agencies and organizations. However, results of the last official survey on emergency response planning reported by the FEMA and conducted by the FRA hazardous materials staff in October 1986 indicate that only 110 of 408 operating railroads responding to the survey have published emergency response plans that address railroad accidents/incidents involving hazardous materials. (About 100 additional railroads did not respond or were not surveyed.) Because most railroads handle at least some hazardous materials, these data suggest that many of the operating railroads that responded to the survey have not addressed the issue of the safe transport of hazardous materials in published emergency response plans.

Drills Of Simulated Emergencies

It is important for railroad personnel and local emergency response organizations to exercise or "test" the procedures outlined in a documented emergency response plan. A joint, full-scale disaster drill of a simulated emergency could identify any shortcomings in the plan and would better prepare responding personnel for emergencies involving hazardous materials. In at least 26 of the 45 cases (58 percent), the local emergency response coordinators and railroad personnel had not participated in joint disaster drills (see table 4). The accidents in Akron, Ohio, and in Elm Grove, Wisconsin, illustrate the positive effects of disaster drills. The accident in Akron also illustrates the need for disaster drills with railroad and emergency response personnel.

Akron, Ohio. On February 26, 1989, 21 freight cars in a CSX train derailed in a rail yard in Akron, Ohio. Of the 21 cars, 9 were tank cars filled with butane (a flammable gas); these tank cars came to rest adjacent to a B.F. Goodrich Chemical Company plant. Butane, released from two breached tank cars, immediately caught fire; some of the butane burned for 5 days before the fire could be extinguished. About 1,750 residents were evacuated from the area. As a result of the accident, 5 emergency response personnel received minor injuries, and 50 residents and passersby were treated for complaints of coughing, conjunctivitis, eye irritation, and anxiety. Damage to the freight cars was estimated at \$521,000; damage to the chemical plant was estimated at \$1 million.

The Akron fire department and the B.F. Goodrich Chemical Company had participated in disaster drills and planning for an emergency. Fire department personnel responded to the emergency situation at the chemical plant in a well-organized manner: the fire department knew the potential hazards at the plant and the persons to contact, and communications and coordination between fire department and plant personnel were efficient. In

contrast, the communications and coordination between the fire department and railroad personnel in the early stages of the emergency response were not well organized: inadequate communications between emergency response personnel and railroad personnel about vital information regarding the tank cars and hazardous materials involved in the derailment resulted in a delay for the emergency response personnel in obtaining timely information needed to attack the fire. Based on its investigation, the Safety Board concluded that the inadequate communications may have resulted, in part, from the lack of jointly conducted disaster drills between city agencies and the railroad (NTSB 1990).

As a result of its investigation, the Safety Board recommended that the CSX should complete, as soon as possible, drills for handling releases of hazardous materials with all communities through which CSX operates trains transporting hazardous materials (Safety Recommendation R-90-29). On November 15, 1990, CSX responded to the recommendation stating that since 1978, CSX had provided training for 30,000 non-company personnel. According to materials provided by CSX to the Safety Board, the current training includes classroom instruction, videotapes, and an occasional drill or "hands-on" exercise. The Safety Board stated in its reply to CSX on May 7, 1991, that although the type of training the railroad provides is useful, that type of training may not be as effective by itself as it would be in combination with drills and it therefore did not meet the intent of the recommendation. The Board also emphasized the need for joint disaster drills to bring about improvements in coordination and communication between the railroad and communities during an actual emergency. Because the CSX had not taken appropriate action, the Board classified Safety Recommendation R-90-29 as "Open--Unacceptable Response."

Elm Grove, Wisconsin. On August 10, 1988, 24 of 116 cars in a SOO Line Railroad Company freight train derailed at Elm Grove, Wisconsin. Of the derailed cars, one was a tank car loaded with isobutane (a flammable gas) and two were tank cars loaded with methanol (a flammable liquid); the tank cars did not release their products. Two other tank cars involved in the accident contained hazardous materials residue (sodium hydroxide). Emergency response personnel were immediately notified of the accident. Within 5 minutes after the accident the command post was set up, from which the actions of three fire departments were coordinated. Because of the hazards of the isobutane and methanol, emergency response personnel evacuated 300 persons from the area; the evacuation remained in effect for 30 hours until the tank cars containing hazardous materials were re-railed. Responding personnel followed the community's documented emergency response plan. In addition, railroad and emergency response personnel had participated in joint disaster drills prior to the accident. The Safety Board believes that the results of proper emergency planning, including the conduct of joint disaster drills, facilitated the management of the emergency, demonstrating the value of such planning and testing.

The severity of these accidents and the potential for catastrophic results emphasizes the importance of having an emergency response plan and the testing of the emergency response procedures.

The AAR also has recognized the need for adequate hazardous materials emergency response plans. In guidelines prepared under contract for the FRA, the AAR cited several problems addressed in Safety Board reports, including (1) a lack of coordination among governmental organizations, (2) the inability of emergency response crews to quickly obtain the description of the cargo from the shipping papers on the train, (3) a lack of sufficient involvement by railroads in the emergency response planning and preparedness of local organizations, and (4) inadequate communication between railroad and public officials at the accident site (AAR 1989). The AAR also urged railroads to coordinate their plans with local organizations so that emergency response personnel of the railroad and the local organizations will be familiar with one another's plans. In addition, the AAR believes that railroads should consider periodic drills to evaluate the emergency response capabilities of the railroads and of the State and local emergency response agencies.

Further, an Inter-Industry Task Force on the Safe Transportation of Hazardous Materials, comprising representatives of the AAR and the Chemical Manufacturers Association, has designated hazardous materials routes as routes on which railroads should focus training and assistance related to community contingency planning. (The recommended railroad operating practices for the transport of hazardous materials, based on recommendations of the Inter-Industry Task Force, are presented in appendix H).

Recent legislation also recognizes the importance of emergency preparedness for transportation accidents involving hazardous materials. The Hazardous Materials Transportation Uniform Safety Act of 1990 provides grants to States for training emergency response personnel and requires the establishment of standards in emergency preparedness for personnel responding to accidents involving the transportation of hazardous materials (see appendix E).

The Safety Board believes that the railroads have a responsibility to coordinate with communities to assist them in developing a written emergency response plan and keeping its content up-to-date. In addition, the Safety Board also believes that communities have a responsibility to their citizens to contact the railroads to obtain the information needed for developing a comprehensive emergency response plan and for keeping its content current.

Action Needed

The continuation of problems related to the lack of coordinated emergency response planning as seen in the accidents investigated by the Safety Board indicates that not all communities and railroads have taken the necessary actions to adequately plan for hazardous materials emergencies in rail yards and along hazardous materials routes. Accordingly, the Board

classifies Safety Recommendation R-85-53 as Closed--[Various Actions]/Superseded³¹ by Safety Recommendations R-91-15 to Class I and two large regional railroads (Guilford Transportation Industries, Inc., and MidSouth Rail Corporation), and R-91-17 to the ASLRA (for local and other regional railroads), urging the railroads to develop, implement, and keep current, in coordination with communities adjacent to the railroad yards and along hazardous materials routes, written emergency response plans and procedures for handling releases of hazardous materials. The procedures should address, at a minimum, key railroad personnel and means of contact, procedures to identify the hazardous materials being transported, identification of resources for technical assistance that may be needed during the response effort, procedures for coordination of activities between railroad and emergency response personnel, and the conduct of disaster drills or other appropriate methods to test emergency response plans.

The Safety Board also believes that the NLC, National Association of Counties, IAFC, IACP, and the National Sheriffs' Association should encourage their members to (a) develop, implement, and keep current, in coordination with each other and the railroads, written emergency response plans and procedures for handling releases of hazardous materials; and (b) urge the incident commanders to stay knowledgeable of the written content. Accordingly, the Board classifies Safety Recommendation R-88-69 to the NLC as "Closed--Unacceptable Action--No Response Received/Superseded" by Safety Recommendation R-91-22 asking that these actions be taken by the organizations named above.

³¹ Based on the current status of the recommendation issued to the individual railroads and indicated in the tabulation in the section "The Need for Emergency Response Planning Between Railroads and Communities."

RAILROAD EMPLOYEE TRAINING FOR HAZARDOUS MATERIALS EMERGENCIES

Emergency response planning between railroads and the community, discussed in the previous section, is but one aspect of preparedness for hazardous materials emergencies. Another aspect is the training needed by railroad employees who operate trains transporting hazardous materials and who must take appropriate actions immediately after an accident that involves hazardous materials.

The Need for Improved Railroad Employee Training

The Safety Board first addressed the need for improved railroad employee training for emergencies in its report about the 1975 accident involving the collision of three passenger trains in Wilmington, Delaware (NTSB 1S76). In its 1980 report of a special study on railroad emergency procedures, a composite of 10 accidents involving hazardous materials investigated between 1970 and 1980, the Safety Board issued recommendations urging the FRA to develop and establish guidelines for procedures to be used by railroad personnel in the event of an emergency, and to require that rail carriers test their emergency response procedures using simulated emergencies (Safety Recommendations R-80-6 and -7) (NTSB 1980b). In the 1980 special study report, the Safety Board also reiterated a similar recommendation (R-76-29), issued to the FRA in 1976 as a result of the passenger train collision in Wilmington, to address railroad employee training for emergencies. Because the FRA did not take action, in June 1986, the Board classified Safety Recommendations R-76-29, R-80-6 and R-80-7 as "Closed--Unacceptable Action."

After the 1980 safety study, the Safety Board continued to issue recommendations about railroad employee training to various rail carriers whose personnel were involved in hazardous materials accidents. Two such accidents--in Livingston, Louisiana, and in Miamisburg, Ohio--further illustrate the need for improved railroad employee training.

Livingston, Louisiana. The Safety Board's investigation of the September 28, 1982, accident in Livingston, Louisiana, revealed that immediately after the accident, the conductor took the train's waybills and consist with him, but he left an emergency response hazardous materials guidebook locked up in the caboose (NTSB 1983).³² Had he provided the guidebook to emergency response personnel, it could have aided the responding personnel in identifying actions to take to manage the emergency and to protect the public. Fortunately, an off-duty State police officer arrived 45 minutes later with an emergency response guidebook. Had the officer not arrived with a guidebook, initial actions to manage the emergency could have been even further delayed. As a result of its investigation, the Safety Board recommended that the rail carrier, Illinois

³² A summary of the accident appears in the section "Performance of DOT-111A Tank Cars Involved in Accidents."

Central Gulf Railroad Company (ICG), include in its training curricula thorough reviews and explanations of the timetable special instructions pertaining to the handling of hazardous materials emergencies (Safety Recommendation R-83-86, issued August 12, 1983). The ICG did not respond to the recommendation, so the Safety Board wrote the carrier again in October 1984. Because there was still no response, the Board classified the recommendation as "Closed--Unacceptable Action" and in a letter to ICG dated December 1, 1986, stated that it would reconsider the classification if the ICG had information or documentation to indicate action had been taken on the recommendation. The ICG did not respond.

Miamisburg, Ohio. On July 8, 1986, 15 cars in a Baltimore and Ohio Railroad Company freight train derailed in Miamisburg, Ohio. Of the 15 cars, 2 were tank cars containing hazardous materials: yellow phosphorus (a highly flammable, solid material that ignites on contact with air and that is toxic by inhalation) and molten sulfur (a product that can produce toxic gases when burned). These tank cars were extensively damaged, released their products, and were involved in the subsequent fire. About 7,000 persons were evacuated as a safety precaution. During the next 48 hours, a 3-square-mile area was evacuated, affecting 30,000 persons; 569 persons were treated for various medical complaints during the incident. Property damage and cost of cleanup were estimated at \$3.5 million.

The Safety Board concluded from its investigation that the crew's ineffective actions made it more difficult for emergency response personnel to coordinate their efforts: (a) The conductor did not dispatch a crewmember to inspect the rear of the train; consequently, he could provide emergency response personnel only limited information about the number of cars derailed and hazardous materials involved; (b) the conductor lost valuable time retrieving the waybills and reassembling them to identify all the cars in the derailment; (c) when the conductor left the locomotive, he inadvertently left behind an emergency guidebook, which contained information that could have aided emergency response personnel in immediately identifying actions to take to manage the emergency and to protect the public (NTSB 1987). As a result of the investigation, the Safety Board recommended that CSX³³ reemphasize to all operating personnel the importance of directing their initial activities following a derailment to local emergency response agencies (Safety Recommendation R-87-56). The CSX responded that it had revised its hazardous materials training schedule, emphasized the procedures spelled out in its emergency response guide, and issued bulletins addressing the CSX yard and terminal hazardous materials program. Based on the action taken by the railroad, the Safety Board classified Safety Recommendation R-87-56 as "Closed--Acceptable Action."

³³ At the time of the accident, the Baltimore and Ohio Railroad Company was a subsidiary of the Chesapeake and Ohio Railway Company. During the investigation, the B&O merged into the C&O and became CSX Transportation, Inc., a wholly owned subsidiary of CSX Corporation.

Results of interviews with crewmembers involved in 31 of the 45 cases indicate that 16 of 31 conductors and 15 of 31 engineers had not received any hazardous materials training apart from rules examinations (table 5). The accident at Akron, Ohio, illustrates some deficiencies in railroad employee training.

Akron, Ohio. During the investigation of the accident that occurred February 26, 1989, in Akron, Ohio,³⁴ CSX crewmembers stated that the only hazardous materials training they received had been provided in routine railroad operating rules class. Also, the crewmembers had not been given efficiency checks on actions to take following emergencies involving hazardous materials.

Based on its investigation, the Safety Board concluded that the failure of the traincrew to immediately contact and provide emergency response personnel with train papers and information about hazardous materials involved in the derailment, and the failure of first-arriving railroad supervisory personnel to verify that necessary information had been provided to emergency response personnel, were probably the result of inadequate instruction and training on actions to take immediately following an emergency involving hazardous materials (NTSB 1990). On September 25, 1990, the Safety Board issued the following safety recommendation to CSX:

R-90-28

Provide training, in addition to operating rules classes, to operating crews and supervisors on the actions they are to take immediately following an accident involving hazardous materials; this training should include, at a minimum, (1) the responsibility of crewmembers to identify themselves to emergency response personnel and to provide accurate information, including onboard documentation, of hazardous materials involved in the accident, (2) the responsibility of supervisory personnel to verify that emergency response personnel have all needed information and that it is accurate, and (3) the means by which supervisors are to determine if employees understand fully their responsibilities.

In a response dated November 15, 1990, the CSX outlined action it was taking as a result of the recommendation: (1) The operating rules classes for traincrews have been increased from 4 hours biennially to 8 hours annually; of the 8 hours, 3 are devoted to hazardous materials training provided by the company's hazardous materials personnel; (2) the operating rules examination for traincrews now include two specific questions that address responsibilities of traincrews to assist emergency response personnel in a hazardous materials incident; and (3) efficiency tests are to be given by company officials to determine the operating traincrews' understanding of their responsibilities to emergency response personnel.

³⁴ A summary of the accident appears in the section "Drills of Simulated Emergencies."

Table 5.--Occurrence of training related to hazardous materials emergencies provided to the conductors and engineers involved in the accidents/incidents investigated March 1988 to February 1989 during the safety study, by location of accident railroad^a

Event number	Location of accident	Railroad	Training for conductor	Training for engineer
1	Claude, TX	BN	N	N
2	Punta Gorda, FL	SCLR	N	Y
3	Pasco, WA	BN	N	N
4	Jeffersonville, IN	CR	n/a	n/a
5	Wilmington, CA	UP	n/a	n/a
6	Roodhouse, IL	CPM	N	N
7	Denver, CO	UP	n/a	n/a
8	Gulfport, MS	MSRC	N	N
9	Sheridan, WI	WC	N	N
10	Las Vegas, NV	UP	n/a	n/a
11	Columbus, OH	CSX	Y	Y
12	Crofton, KY	CSX	Y	Y
13	Deer Park, TX	PTRA	n/a	n/a
14	Farnum, NB	BN	--	--
15	White Bluff, TN	CSX	N	N
16	Altoona, IA	IAIS	N(2) ^b	N(2) ^b
17	Umberger, TX	ATSF	Y ^c	Y ^c
18	Ohlerville, PA	CSX	Y	Y
19	Brazoria, TX	UP	Y	Y
20	Loudonville, OH	CR	Y	Y
21	Elsberry, MO	BN	Y	Y
22	Elberton, GA	CSX	--	--
23	Elm Grove, WI	SOO	Y	Y
24	Athens, GA	CSX	--	--
25	Memphis, TN	IC	n/a	n/a
26	Jacksonville, FL	CSX	--	--
27	Summit, IL	IC	N	N
28	Rineyville, KY	PAL	Y	Y
29	Easley, SC	NS	--	--
30	Pearl, IL	CPM	N	N
31	Morganza, LA	LA	N	N
32	Newcastle, CA	SP	Y	Y
33	Lyndon Station, WI	SOO	Y	Y
34	Bangor, AL	CSX	Y	Y
35	Lanagan, MO	KCS	N	N
36	Fruitvale, TX	UP	N	N
37	Palmyra, MO	BN	n/a	n/a
38	Edison, NJ	CR	n/a	n/a
39	Flagstaff, AZ	ATSF	Y	Y
40	Bonnets Ferry, ID	UP	n/a	n/a
41	Helena, MT	MRL	N	N
42	Kansas City, KS	ATSF	n/a	n/a
43	Manteca, CA	SP	Y	Y
44	Bordulac, MO	SOO	Y	Y
45	Akron, OH	CSX	N	N

-- = Railroad did not answer Safety Board inquiry; Y = Yes; N = No; n/a = not applicable (the accident/incident involved the release of hazardous materials from standing tank cars rather than from trains being operated by traincrews).

^a Training other than that provided by the railroad in operating rules examinations.

^b The accident/incident involved the collision of 2 trains; therefore, 2 traincrews were also involved.

^c The accident was categorized as a standing car accident; it involved hazardous materials in a standing train with traincrew on board.

The Safety Board is pleased that CSX is taking action to improve its employee training program. However, in a reply to CSX on May 7, 1991, the Safety Board highlighted the need for the railroad to train supervisors on their responsibilities to verify that emergency response personnel have complete and accurate information after a hazardous materials incident, and to determine if railroad personnel fully understand their individual responsibilities. The Safety Board also expressed concern about the effectiveness of previous efforts taken by the rail carrier to implement an improved training program for train crewmembers. (The efforts taken by the carrier were in response to Safety Recommendation R-87-56, issued as a result of the Miamisburg, Ohio, accident. Those efforts are described earlier in this section.) The Safety Board consequently requested additional information about the CSX hazardous materials training program, including a description of subject matter covered, the method of instruction, evaluation of the employees' understanding of the subject material, and plans for hazardous materials training specific to supervisory personnel. Based on the positive actions taken by the railroad, and pending additional information on the training program, the Board has classified Safety Recommendation R-90-28 as "Open--Acceptable Response."

Types of Training Provided to Railroad Employees

Discussions between Safety Board staff and personnel of several railroads, and evidence from the Safety Board's accident investigations, indicate that the type of training currently provided to employees varies substantially among rail carriers and sometimes varies within the same company. Generally, much of the information provided to railroad employees is through the company's operating rules and timetables.³⁵ The rulebooks are publications issued by the railroad, and they include a list of the responsibilities and procedures that traincrews are to follow in a hazardous materials emergency. Although the FRA requires that railroads file their operating rules with the agency (49 CFR Part 217), the Federal rule does not identify any specific requirements regarding instruction in hazardous materials safety or procedures.³⁶ Each rail carrier, therefore, determines the types of information its employees are to be provided in the rulebook. Training provided by the carrier may include any or all of these elements as a part of the information provided to employees: classroom instruction on operating rules, procedures, and Federal regulations; efficiency checks,

³⁵ Timetables often include safety information about hazardous materials including, but not limited to, placarding, emergency procedures, switching procedures, and other company rules.

³⁶ The FRA rule requires railroads to have a general program of periodic instruction, operational tests, and inspections. The railroads with more than 40,000 total employee hours are required to report annually a summary of the number, type, and result of each operational test and inspection by operating division and per 10,000 train miles. The rule does not specify any specific hazardous materials program of instruction, operational tests, or inspections.

tests, and examinations; videotapes; and simulations and drills. Railroads require that employees be given a test on the information, termed a "rules examination." Most railroads offer a review class to help employees prepare for a rules examination; the class is often held the same day as the test to minimize time away from work. The railroad determines the frequency of the rules examination; generally the examination is given annually.

After the 1986 Miamisburg, Ohio, accident, the railroad (CSX) made efforts to improve its training program for employees. However, the actions of the CSX traincrew immediately after the 1989 Akron accident illustrated that, despite the railroad's efforts, traincrews needed specific training in addition to that provided in operating rules classes. Based on interviews with personnel from other railroads,³⁷ the Safety Board is aware that other railroads have recognized a need for additional training and have increased or have plans to increase the level of hazardous materials training provided.

As a result of its accident investigations and its interviews with personnel of other railroads, the Safety Board believes that current employee training, when limited primarily to rules examinations based on classroom instruction, has not adequately prepared railroad employees to handle an accident/incident involving hazardous materials. Railroad employees involved in or responsible for the safe transport of hazardous materials, such as traincrews and first-line supervisors, must not only know the rules, but the employees should also be able to apply the rules in simulated and in actual emergencies. The Safety Board believes that in addition to classroom instruction, railroads that transport hazardous materials should also evaluate the employee's knowledge of emergency procedures and the employee's ability to apply such knowledge in an emergency. Evaluations of employees could be performed during efficiency checks, disaster drills, or simulated emergencies.

Federal Rulemaking Activity

Currently, there are no Federal regulations that require specific hazardous materials training for employees in the railroad industry who are involved in the transportation of hazardous materials. However, on July 26, 1989, the RSPA issued HH-126F, Training for Hazardous Materials, as a notice of proposed rulemaking (NPRM) (54 FR 31144-31155). The purpose of the proposed requirements is to reduce the incidence of hazardous materials accidents caused by human error by increasing the awareness of safety considerations through a uniform level of training for persons involved in the transportation of hazardous materials. According to the RSPA staff, a final rule is expected by the end of 1991.

The RSPA defines training as a systematic program that ensures that a person has knowledge of hazardous materials and hazardous materials

³⁷ The Atchinson, Topeka & Santa Fe Railway Company; Burlington Northern Railroad Company; Conrail; Guilford Transportation Industries, Inc.; and GO Line Railroad Company.

regulations. The training requirements outlined in the NPRM include three categories of training: general awareness/familiarization, function-specific, and safety training. General awareness/familiarization training has been described in the NPRM to include an understanding of the Federal rules applicable to hazardous materials (such as the hazard communication requirements and the various classes of hazardous materials). Function-specific training has been described to include detailed training on the Federal rules specifically applicable to the functions the person performs. Safety training has been described to include several topics: (1) emergency response information; (2) general dangers presented by the various classes of hazardous materials and how persons can protect themselves from exposure to those hazards; (3) methods and procedures to avoid accidents; and (4) procedures to be followed immediately after an unintentional release of a hazardous material, including any emergency response procedures for which the person is responsible. The NPRM states that, generally, retraining is needed every 2 years, and the employer must keep records on the training received by the employee.

The Safety Board supports the NPRM issued by the RSPA. When the proposed rule becomes final, the Board urges the FRA to require rail carriers to incorporate into their railroad operating practices aspects of the final rule that relate to hazardous materials training.

CONCLUSIONS

1. Hazardous materials that are highly flammable or toxic, or that pose a threat to health through contamination of the environment are frequently transported in tank cars that provide inadequate protection even though better protected tank cars are available.
2. The DOT-111A tank cars, which are frequently used to transport hazardous materials that pose a potential threat to public safety, have a high incidence of failure when involved in accidents.
3. Evacuations were conducted in 33 of the 45 cases investigated by the Safety Board as part of this safety study; generally, the decisions by emergency response personnel to evacuate were not made as a result of written emergency response plans but were made based on their observations of the on-scene situation and reliance on various emergency response guidebooks published by Federal or State agencies.
4. The development and use of written hazardous materials emergency response plans prepared jointly by local emergency response and railroad personnel improves coordination and timely execution of necessary safety procedures to efficiently and effectively respond to a railroad accident involving hazardous materials.
5. In at least 21 of the 45 cases, the local emergency response incident commander (coordinator) did not have a hazardous materials emergency response plan to follow.
6. In at least 19 of the 45 cases, local emergency response incident commanders (coordinators) and railroad personnel had not been in contact to plan actions to take in the event of a train accident involving hazardous materials; in at least 26 of the 45 cases, local emergency response personnel and railroad personnel had not participated in joint disaster drills of simulated emergencies.
7. Many railroads and community emergency response organizations have not jointly developed written emergency response plans and procedures and have not regularly participated with community emergency response organizations in joint disaster drills of simulated emergencies.
8. Railroad employee training, when limited primarily to rules examinations based on classroom instruction, has not adequately prepared railroad employees to handle an accident or incident involving hazardous materials.

RECOMMENDATIONS

Resulting From This Study

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

--to the Research and Special Programs Administration,
U.S. Department of Transportation:

Establish a working group, with the assistance of the Federal Railroad Administration, the Association of American Railroads, the Chemical Manufacturers Association, the American Petroleum Institute, and the National Fire Protection Association, to expeditiously improve the packaging of the more dangerous products (such as those that are highly flammable or toxic, or pose a threat to health through contamination of the environment) by (a) developing a list of hazardous materials that should be transported only in pressure tank cars with head shield protection and thermal protection (if needed); and (b) establishing a working agreement to ship the listed hazardous materials in such tank cars. (Class II, Priority Action) (R-91-11) (Supersedes R-85-105)

--to the Federal Railroad Administration,
U.S. Department of Transportation:

Assist the Research and Special Programs Administration (RSPA) in the establishment of a working group--comprising the RSPA, the Association of American Railroads, the Chemical Manufacturers Association, the American Petroleum Institute, the National Fire Protection Association, and your agency--to expeditiously improve the packaging of the more dangerous products (such as those that are highly flammable or toxic, or pose a threat to health through contamination of the environment) by (a) developing a list of hazardous materials that should be transported only in pressure tank cars with head shield protection and thermal protection (if needed); and (b) establishing a working agreement to ship the listed hazardous materials in such tank cars. (Class II, Priority Action) (R-91-12)

Require, when the Research and Special Programs Administration issues the final rule on HM-126F (Training for Hazardous Materials), that rail carriers incorporate into their railroad operating practices aspects of the final rule that relate to hazardous materials training. (Class II, Priority Action) (R-91-13)

--to the Association of American Railroads:

Assist the Research and Special Programs Administration (RSPA) in the establishment of a working group--comprising the RSPA, the Federal Railroad Administration, the Chemical Manufacturers Association, the American Petroleum Institute, the National Fire Protection Association, and your organization--to expeditiously improve the packaging of the more dangerous products (such as those that are highly flammable or toxic, or pose a threat to health through contamination of the environment) by (a) developing a list of hazardous materials that should be transported only in pressure tank cars with head shield protection and thermal protection (if needed); and (b) establishing a working agreement to ship the listed hazardous materials in such tank cars. (Class II, Priority Action) (R-91-14)

--to Class I railroads and railroad systems,
Guilford Transportation, Inc., and MidSouth Rail Corporation:

Develop, implement, and keep current, in coordination with communities adjacent to your railroad yards and along your hazardous materials routes, written emergency response plans and procedures for handling releases of hazardous materials. The procedures should address, at a minimum, key railroad personnel and means of contact, procedures to identify the hazardous materials being transported, identification of resources for technical assistance that may be needed during the response effort, procedures for coordination of activities between railroad and emergency response personnel, and the conduct of disaster drills or other appropriate methods to test emergency response plans. (Class II, Priority Action) (R-91-15) (Supersedes R-85-53)

Establish, for employees responsible for the safe transport of hazardous materials (such as traincrews and first-line supervisors), methods to evaluate (a) the employee's level of knowledge of emergency procedures, and (b) the employee's ability to apply such knowledge in an actual emergency. Evaluations of employees could be performed during efficiency checks, disaster drills, or simulated emergencies. (Class II, Priority Action) (R-91-16)

--to the American Short Line Railroad Association:

Encourage the regional and local railroads in your membership that transport hazardous materials to develop, implement, and keep current, in coordination with communities adjacent to their railroad yards and along their hazardous materials routes, written emergency response plans and procedures for handling releases of hazardous materials. The procedures should address, at a minimum, key railroad personnel and means of contact, procedures to identify the hazardous materials being transported, identification of resources for technical assistance that may be needed during the response effort, procedures for coordination of activities between railroad and emergency response personnel, and the conduct of disaster drills or other appropriate methods to test emergency response plans. (Class II, Priority Action) (R-91-17) (Supersedes R-85-53)

Encourage the regional and local railroads in your membership that transport hazardous materials to establish, for employees responsible for the safe transport of hazardous materials (such as traincrews and first-line supervisors), methods to evaluate (a) the employee's level of knowledge of emergency procedures, and (b) the employee's ability to apply such knowledge in an actual emergency. Evaluations of employees could be performed during efficiency checks, disaster drills, or simulated emergencies. (Class II, Priority Action) (R-91-18)

--to the Chemical Manufacturers Association:

Assist the Research and Special Programs Administration (RSPA) in the establishment of a working group--comprising the RSPA, the Federal Railroad Administration, the Association of American Railroads, the American Petroleum Institute, the National Fire Protection Association, and your organization--to expeditiously improve the packaging of the more dangerous products (such as those that are highly flammable or toxic, or pose a threat to health through contamination of the environment) by (a) developing a list of hazardous materials that should be transported only in pressure tank cars with head shield protection and thermal protection (if needed); and (b) establishing a working agreement to ship the listed hazardous materials in such tank cars. (Class II, Priority Action) (R-91-19)

--to the American Petroleum Institute:

Assist the Research and Special Programs Administration (RSPA) in the establishment of a working group--comprising the RSPA, the Federal Railroad Administration, the Association of American Railroads, the Chemical Manufacturers Association, the National Fire Protection Association, and your organization--to expeditiously improve the packaging of the more dangerous products (such as those that are highly flammable or toxic, or pose a threat to health through contamination of the environment) by (a) developing a list of hazardous materials that should be transported only in pressure tank cars with head shield protection and thermal protection (if needed); and (b) establishing a working agreement to ship the listed hazardous materials in such tank cars. (Class II, Priority Action) (R-91-20)

--to the National Fire Protection Association:

Assist the Research and Special Programs Administration (RSPA) in the establishment of a working group--comprising the RSPA, the Federal Railroad Administration, the Association of American Railroads, the Chemical Manufacturers Association, the American Petroleum Institute, and your organization--to expeditiously improve the packaging of the more dangerous products (such as those that are highly flammable or toxic, or pose a threat to health through contamination of the environment) by (a) developing a list of hazardous materials that should be transported only in pressure tank cars with head shield protection and thermal protection (if needed); and (b) establishing a working agreement to ship the listed hazardous materials in such tank cars. (Class II, Priority Action) (R-91-21)

--to the National League of Cities, the National Association of Counties, the International Association of Fire Chiefs, the International Association of Chiefs of Police, and the National Sheriffs' Association:

Urge your members to (a) develop, implement, and keep current, in coordination with each other, and with the Class I, regional, and local railroads that transport hazardous materials through the members' areas, written emergency response plans and procedures for handling releases of hazardous materials; and (b) encourage incident commanders to stay knowledgeable of the written content. The procedures should address, at a minimum, key railroad personnel and means of contact, procedures to identify the hazardous materials being transported, identification of resources for technical assistance that may be needed during the response effort, procedures for coordination of activities between railroad and emergency response personnel, and the conduct of disaster drills or

other appropriate methods to test emergency response plans.
(Class II, Priority Action) (R-91-22) (Supersedes R-88-69)

Closed

As a result of this study, the National Transportation Safety Board classified the following recommendations as "Closed."

R-85-53

In coordination with communities adjacent to your railroad yards, develop and implement emergency planning and response procedures for handling releases of hazardous materials. These procedures should address, at a minimum, initial notification procedures, response actions for the safe handling of releases of the various types of hazardous materials transported, identification of key contact personnel, conduct of emergency drills and exercises, and identification of the resources to be provided and the actions to be taken by the railroad and the community.

Status: "Closed--(Various actions as indicated below)/Superseded" by Safety Recommendations R-91-15 and R-91-17

Unacceptable Action--No Response Received:

Alton & Southern Railroad Company
Atlanta & Saint Andrews Bay Railway Company
Bangor and Aroostock Railroad Company
Belt Railway Company of Chicago
Bessemer and Lake Erie Railroad Company
Boston and Maine Corporation
Colorado and Southern Railway Company
Duluth, Missabe and Iron Range Railway Company
Florida East Coast Railway Company
Grand Trunk Western Railroad Company
Green Bay and Western Railroad Company
Kansas City Southern Railway Company (now part of Kansas City Southern Lines)
Lake Superior & Ishpeming Railroad Company
Maine Central Railroad Company
Milwaukee Road
Minneapolis, Northfield and Southern Railroad Company
Missouri-Kansas-Texas Railroad Co.
Monogahela Railway Company
Norfolk and Portsmouth Belt Line Railroad Company
Norfolk and Western Railway Company (now part of Norfolk Southern Corporation)
Pittsburg & Shawmut Railroad Company
Pittsburgh and Lake Erie Railroad Company
SOO Line Railroad Company

Southern Pacific Transportation Company (now part of
The Southern Pacific Lines)
Terminal Railroad Association of St. Louis
Texas Mexican Railway Company
Toledo, Peoria & Western Railway Company
Union Pacific Railroad Company
Union Railroad Company
Vermont Railway, Inc.

Acceptable Action:

CSX Transportaton, Inc.
Chicago and North Western Transportation
Consolidated Rail Corporation (Conrail)
Delaware and Hudson Valley Railway Co.
Denver and Rio Grande Western Railroad Co. (now part of
The Southern Pacific Lines)
Detroit and Mackinac Railway Co.
Elgin, Joliet and Eastern Railway Co.
Illinois Central Railroad Company

R-85-105

Require that all tank car shipments of hazardous materials with an isolation radius of one-half mile or more, as recommended by the U.S. Department of Transportation Emergency Response Guidebook, be transported in tank cars equipped with head shield or full tank head protection.

Status: "Closed--Acceptable Action/Superseded" by Safety Recommendation R-91-11.

I-85-15

Notify your members who use the U.S. Department of Transportation Emergency Response Guidebook for Hazardous Materials Incidents of the fact that parts of a rail tank car carrying liquids or gases may be propelled unpredictable distances should it rupture violently, that parts of such tank cars have been known to travel far greater distances than the recommended initial evacuation zones, and that far greater evacuation distances may be necessary to protect against injury.

Status: "Closed--Acceptable Action."

R-88-69

Advise your membership of the hazardous materials/railroad accident in New Orleans, Louisiana, on September 8, 1987, and urge your members, in coordination with rail yard management, to develop and implement emergency response procedures for handling releases of hazardous materials from railroad vehicles.

Status: "Closed--Unacceptable Action--No Response Received/Superseded" by Safety Recommendation R-91-22.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

JAMES L. KOLSTAD
Chairman

SUSAN M. COUGHLIN
Vice Chairman

JOHN K. LAUBER
Member

JIM BURNETT
Member

CHRISTOPHER A. HART
Member

Adopted: May 16, 1991

Member Burnett would classify Safety Recommendations R-85-61 and -64 as "Open--Unacceptable Response" because 6 years have passed without the completion of regulatory action by the RSPA and the FRA. Member Burnett notes that Safety Recommendations R-85-61 and -64 expanded on the need to address the protection provided for certain hazardous materials, which was first brought to the attention of the DOT in Safety Recommendation R-80-12 issued 10 years ago. Member Burnett also would classify Safety Recommendation R-85-105 as "Open--Unacceptable Response" because the RSPA has taken no positive action in response to the recommendation; Member Burnett believes the Safety Board should provide an alternative criteria to the isolation radius of 1/2 mile as stated in the recommendation.

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APPENDIX A

**SIZE OF THE HAZARDOUS MATERIALS SEGMENT
WITHIN THE RAILROAD INDUSTRY, 1984-89**

Table 6.--Chemicals and allied products transported by
Class I railroads, 1984-89

Year	Tons originated		Revenue	
	Tons	Portion of all products	Dollars	Portion of all products
	<u>Million</u>	<u>Percent</u>	<u>Billion</u>	<u>Percent</u>
1984	107.4	7.5	3.4	11.3
1985	106.4	8.1	3.3	11.8
1986	105.6	8.1	3.3	12.3
1987	115.9	8.5	3.5	12.6
1988	123.4	8.6	3.8	12.8
1989	122.5	8.7	3.8	12.9

Source: Association of American Railroads (1985-90).

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APPENDIX 9

VOLUME OF HAZARDOUS MATERIALS TRANSPORTED BY RAIL, 1989

Table 7.--Top 25 hazardous materials transported by rail, by number of carloads originated, 1989

Rank and commodity	Number of carloads originated
1 Mixed shipments	327,106
2 Liquified petroleum gas	175,080
3 Sodium hydroxide	102,809
4 Molten sulfur	75,002
5 Anhydrous ammonia	66,526
6 Sulfuric acid	64,903
7 Chlorine	60,910
8 Fuel oil	39,140
9 Methyl alcohol	33,486
10 Vinyl chloride	31,591
11 Phosphoric acid	31,543
12 Ammonium nitrate fertilizer	20,952
13 Styrene monomer, inhibited ^a	18,299
14 Carbon dioxide, refrigerated liquid	15,894
15 Hydrochloric acid	14,838
16 Fuel oil, diesel	13,323
17 Crude oil, petroleum	12,580
18 Gasoline	11,726
19 Denatured alcohol	11,537
20 Hazardous substance, n.o.s. ^b	10,707
21 Phenol/carbolic acid	7,822
22 Petroleum naphtha	7,603
23 Hexamethylamine diamine solution	7,327
24 Adipic acid	7,296
25 Ethylene oxide	7,276
Total, top 25 commodities	1,175,281
All the hazardous materials	348,493
All hazardous materials	1,523,774

^a An inhibitor added to a commodity is a chemical compound that retards or stops an undesired chemical reaction.

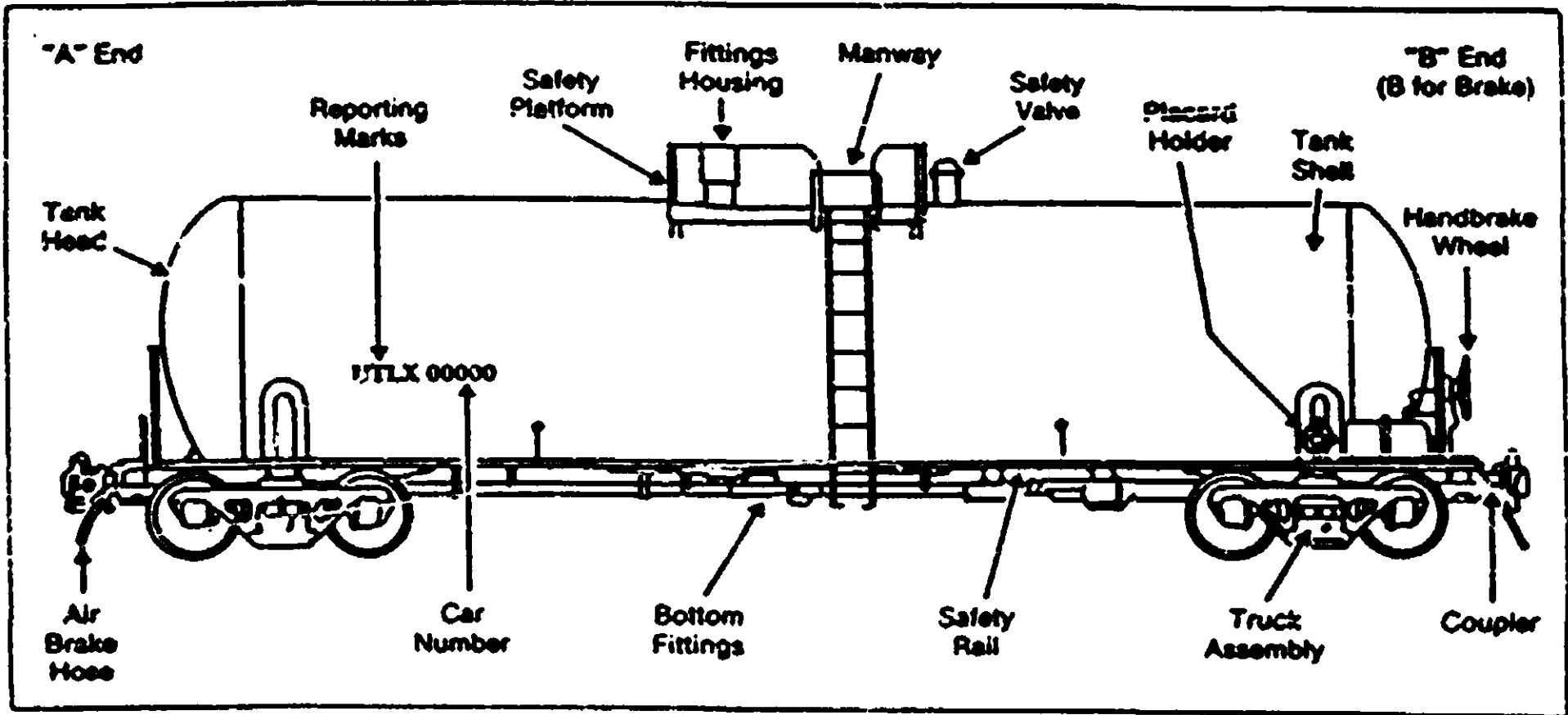
^b Not otherwise specified.

Source: Association of American Railroads (1990a).

APPENDIX C

DIAGRAMS OF TANK CARS AND
TANK CAR SPECIFICATIONS

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Schematic of a tank car.
(Source: American Association of Railroads.)

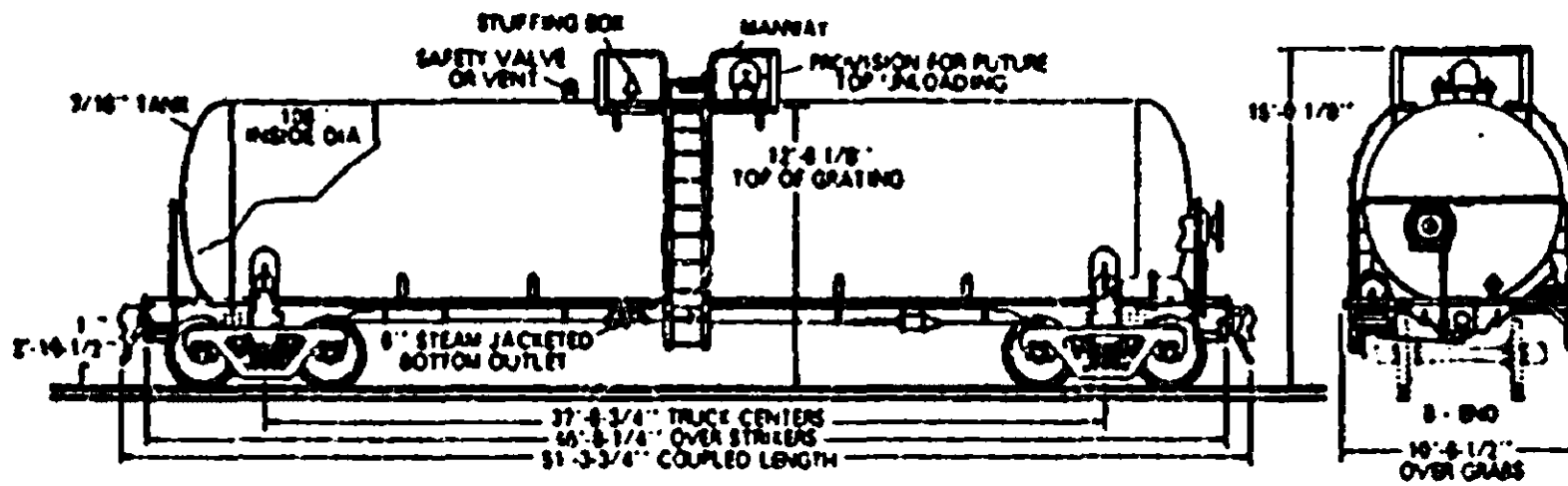
20,000 GALLON CAPACITY - NON INSULATED

DOT - 111A100W

FOR GENERAL SERVICE COMMODITIES

6° SLOPE TO STRAIGHT COVERED SECTION.

PFB 1983B

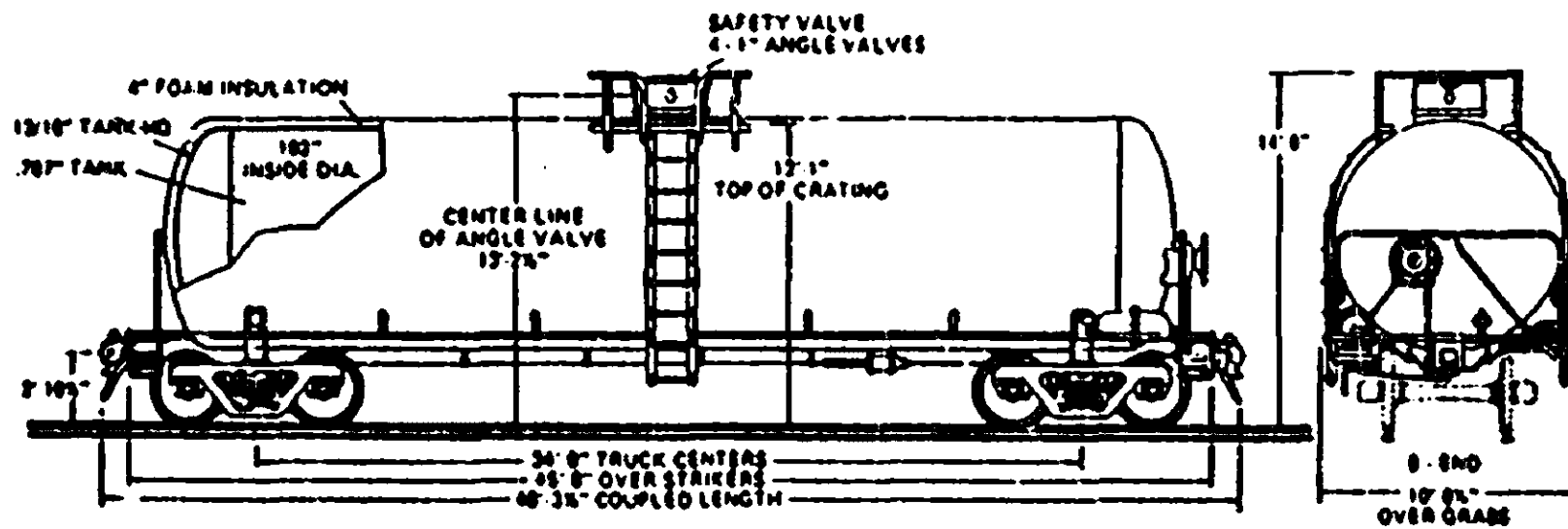


80 TON CAPACITY - INSULATED

DOT - 105A500W

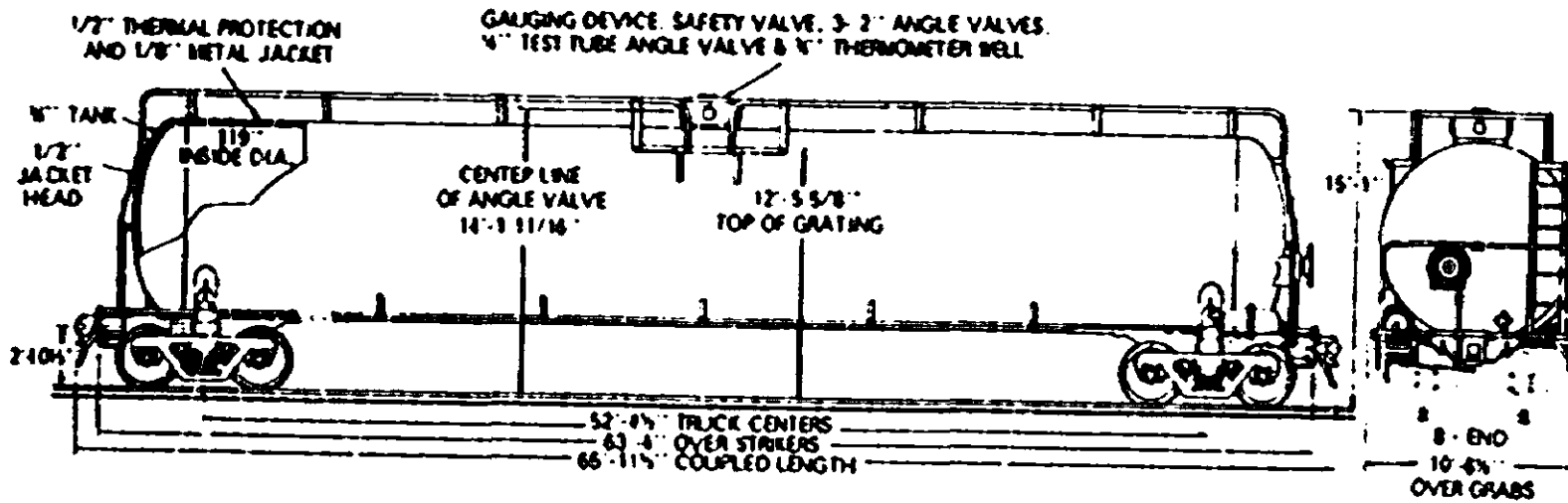
FOR CHLORINE SERVICE

POST 1982I



General features of a DOT-111A (top) and DOT-105 (bottom) tank car.
(Source: General American Transportation Corporation 1985.)

33,500 GALLON CAPACITY - NON INSULATED
 DOT - 112/400B
 FOR PROPYLENE, LIQUEFIED PETROLEUM GAS
 AND ANHYDROUS AMMONIA SERVICE



General features of a DOT-112 tank car. Features of a DOT-114 tank car are similar to those of the DOT-112. (Source: General American Transportation Corporation 1985.)

Association of American Railroads
Manual of Standards and Recommended Practices
Specifications for Tank Cars

The specification of a tank car is the specific designation within a class, for example "Spec. DOT-111A100W2."

The type of a tank car designates the approving authority such as AAR, ARA, ICC, DOT, or USG. Preferred usage is, for example, "DOT tank cars."

A tank consists of a shell and heads together with connections welded directly thereto. As used in these specifications, "tank" means tank car tank. The head of a tank is one of the end closures.

"Shell-full" refers to the volume corresponding to a liquid level at the inside top of the shell at the manway opening or dome ring opening. This shell-full volume is not to be used when calculating the filling density of the lading. A tank is "calibrated" to accurately measure its capacity. A tank is "gaged" to determine the quantity of liquid loaded into it. Shell full stamping on tank car tank heads is net volume with allowance for tank internals.

A stub sill tank car (or a tank car without continuous center sill) has draft sills at each end of the tank instead of a continuous center sill and utilizes its tank as a part of the car structure.

A certified car is a stub sill, non-pressure, non-exterior coiled car built prior to July 1, 1974 and meeting the requirements of 1.4.5.

1.2.3. TANK CAR DEFINITIONS

Tank cars currently in service are of four types: DOT, AAR, ICC, and USG. See 1.1.3. for specifications in effect for new construction.

1.2.3.1. DOT TANK CARS

DOT tank car specification numbers consist of a class designation followed by identifying letters and numbers. The second number, where present, indicates tank test pressure in psi. In all classes except Classes 103, 104 and 113, the two number series are separated by an "A" which has no special significance. Suffix "W" denotes a fusion welded tank; suffix "F" denotes a forge welded tank and suffix "X" has special significance as discussed below. The absence of a suffix indicates seamless tank construction.

Class DOT-103*W tank cars are insulated or uninsulated non-pressure cars with an expansion dome. The expansion capacity in the dome is listed below. Class 103*W cars built for specific services or requiring special fittings or materials of construction are designated by letters interposed for the asterisk.

	Tank	Bottom Outlet	Bottom Washout	Minimum % Expansion
(No Ltr.)	carbon steel			2
A	carbon steel	No		1
AL	aluminum alloy			2
A-AL	aluminum alloy	No		1
AN	nickel	No		1
B	carbon steel, elastomer lined	No	No	1
C	alloy steel	No	No	1
D	alloy steel			2
E	alloy steel	No		1

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Class DOT-104W tank cars are insulated carbon steel non-pressure cars with an expansion dome and having a minimum expansion capacity of 2% in the dome.

Class DOT-105A, J or S***W tank cars are insulated carbon steel pressure cars, with a manway nozzle, designed for top loading and unloading; bottom outlet or washout prohibited. Class 105A or J***ALW tank cars are similar except that they have aluminum alloy tanks. Class 105A***F has forge welded tanks.

A = equipped with top-and-bottom shelf couplers

J = equipped with jacketed thermal protection, tank head puncture resistance and top-and-bottom shelf couplers

S = equipped with tank head puncture resistance and top-and-bottom shelf couplers

Class DOT-106A***X tanks are uninsulated carbon steel tanks designed to be removed from the car structure for filling or emptying, and designed to a maximum stress level in the shell.

X = Fusion welded longitudinal tank seam and forge welded head seams

XNC = Nickel clad

NCI = Nickel—Chromium—Iron

Class DOT-107A**** tank cars are uninsulated high pressure service cars having several permanently mounted seamless forged and drawn steel tanks designed to a maximum stress level in the shell.

Class DOT-109A***W tank cars are insulated or uninsulated carbon steel pressure cars, with a manway nozzle and an optional bottom washout designed for top loading and unloading.

Class DOT-109A***ALW tank cars are similar except they have aluminum alloy tanks.

Class DOT-110A***W tanks are uninsulated carbon steel tanks designed to be removed from the car structure for filling or emptying, and designed to a burst pressure.

Class DOT-111A***W* tank cars are insulated or uninsulated non-pressure cars without an expansion dome. The expansion capacity in the tank is two percent. Class DOT-111A***W* tank cars built for specific services or requiring special fittings or materials of construction are designated by suffix letters or numerals. Class DOT-111A***F* have forge welded tanks converted from Spec. ICC-105A300, 450, or 500. Suffix letters are:

	Tank	Bottom Outlet	Bottom Washout
ALW1	aluminum alloy		
ALW2	aluminum alloy	No	
W1	carbon steel		
W2	carbon steel	No	
W3†	carbon steel		
W4†	carbon steel	No	No
W5	carbon steel, elastomer lined	No	No
W6	alloy steel		
W7	alloy steel	No	No
F1	carbon steel		
F2	carbon steel	No	

†Insulation required.

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Class DOT-112A, J, S, or TW** tank cars are uninsulated carbon steel pressure cars, with a manway nozzle and without bottom connections, designed for top loading and unloading. They are designed for loading of liquefied compressed gases or flammable liquids.

A = equipped with top-and-bottom shelf couplers

J = equipped with jacketed thermal protection, tank head puncture resistance, and top-and-bottom shelf couplers

S = equipped with head shields and top-and-bottom shelf couplers

T = equipped with non-jacketed thermal protection system, top-and-bottom shelf couplers, and head shields

Note: Class 112A, J, S, or T**F tank cars are similar except they are forge welded tanks converted from Class ICC-105A.

Class DOT-113*W** tank cars are vacuum insulated cars having an inner container and carbon steel outer shell; the insulation system is designed for a holding time. Class DOT-113 cars are designed for specific loading and shipping temperatures and have certain materials and fittings requirements as designated by the intermediate letter:

A = Minus 423F (-253°C) loading; high alloy steel inner container; special fittings and insulation for refrigerated (cryogenic) liquid hydrogen.

C = Minus 260F (-162°C) loading; high alloy steel inner container; special fittings for refrigerated (cryogenic) liquid natural gas, refrigerated (cryogenic) liquid methane (DOT exemption required), or refrigerated (cryogenic) liquid ethylene.

D = Minus 135F (-104°C) loading; nickel alloy steel inner container; special fittings for refrigerated liquid ethane (DOT exemption required) or refrigerated (cryogenic) liquid ethylene.

Class DOT-114A, J, S or TW** tank cars are uninsulated carbon steel pressure cars with a manway nozzle and optional non-circular cross section. An additional group of valves and fittings may be provided in another location. They are designed for loading of liquefied compressed gases or flammable liquids.

A = equipped with top-and-bottom shelf couplers

J = equipped with jacketed thermal protection, tank head puncture resistance, and top-and-bottom shelf couplers

S = equipped with head shields and top-and-bottom shelf couplers

T = equipped with non-jacketed thermal protection system, top-and-bottom shelf couplers, and head shields

Class DOT-115A*W*** tank cars are insulated non-pressure cars having an inner container and carbon steel outer shell with optional bottom connections. Suffix letters are:

W1 = Steel inner container

W6 = Alloy steel inner container

ALW = Aluminum inner container

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Proposed Class DOT-120***W tank cars are insulated pressure cars designed for ambient temperature loading of liquefied compressed gases and/or flammable liquids. Proposed Class DOT-120***ALW tank cars are similar except that they have aluminum alloy tanks.

1.2.3.2. AAR TANK CARS

AAR tank cars are for non-regulated commodity services. Most AAR tank cars have DOT counterparts, the main specification differences being that only partial postweld heat treatment is required and radiography is not required for carbon steel tanks. The second number, where present, indicates tank test pressure in psi. Suffix "W" denotes a fusion welded tank.

Class AAR-201A**W tank cars, now obsolete for new construction, are insulated or uninsulated aluminum non-pressure cars with an expansion dome.

Class AAR-203*W tank cars are insulated or uninsulated non-pressure cars with an expansion dome. These cars conform, with certain exceptions, to Class DOT-103W.

(No letter) = carbon steel

D = alloy steel

Class AAR-204 tank cars are vacuum insulated cars having an inner container and carbon steel outer shell. They are designed for loading of liquid argon, nitrogen or oxygen. Spec. AAR-204W tank cars are similar in concept to Class DOT 113****W cars. Suffix letters are:

X = Conversion from XT boxed tank cars

W = Fusion welded alloy steel inner container and carbon steel outer shell

Spec. AAR-205A300W tank cars are now designated DOT-109A300W

Spec. AAR-206W tank cars are insulated non-pressure cars having an inner container and carbon steel outer shell. These cars conform, with certain exceptions, to Class DOT-115A***W*.

Class AAR-207A**W* tank cars are designed for 15 psig (103 kPa) minimum internal pressure and are used for the transportation of granular commodities that are unloaded pneumatically. Suffix letters are:

W = Carbon steel fusion welded tank

ALW = Aluminum alloy fusion welded tank

W6 = Alloy steel fusion welded tank

Spec. AAR-208 tank cars are non-pressure cars having wood-staved metal hooped tanks for the transportation of certain food-grade materials.

Class AAR-211A**W* tank cars are insulated or uninsulated non-pressure cars without an expansion dome. The numeral after "W" designates specific outlet and bottom connection options. These cars conform, with certain exceptions, to Class DOT-111A***W*. Suffix letter, or numerals are:

W1 = Carbon steel tank; 2% minimum expansion capacity in tank; optional bottom outlet or washout

W6 = Alloy steel, optional bottom outlet or bottom washout

W7 = Alloy steel, no bottom outlet or bottom washout

ALW = Aluminum alloy tank

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1.2.3.3. ICC TANK CARS

ICC tank car specifications, in general, were redesignated DOT specifications. Those tank cars not so redesignated have riveted or forge welded tanks, but conform in other respects to corresponding DOT classes.

Class ICC-103 and Class ICC-104 have riveted tanks.

Spec. ICC-103 CAL has a triple-riveted aluminum tank with 1% minimum expansion capacity dome.

Class ICC-105A*** have forge welded carbon steel tanks.

Class ICC-106A*** tanks are identical to DOT-106A***X except they have forge welded longitudinal seams.

1.2.3.4. EMERGENCY USG TANK CARS

Emergency USG* tank cars are insulated or uninsulated carbon steel non-pressure cars with 2% capacity expansion domes. They were built during World War II for transportation of petroleum products limited to eight pounds per gallon (0.959 kg L), and vapor pressure not exceeding 16 psia at 100F (110 kPa [abs.] at 37.8°C). They became obsolete for new construction in 1965.

APPENDIX D

BRIEFS OF THE CASES
INVESTIGATED DURING THE SAFETY STUDY

Event number	Location of accident	Date of accident	Railroad	NTSB accident number
1	Claude, TX	03/04/88	BN	FTW88FRZ13
2	Punta Gorda, FL	03/10/88	SGLR	ATL88FRZ13
3	Pasco, WA	04/08/88	BN	CHI89FRZ17
4	Jeffersonville, IN	04/26/88	CR	CHI89FRZ18
5	Wilmington, CA	04/27/88	UP	LAX88FRZ10
6	Rodhouse, IL	05/03/88	CMNW	CHI88FRZ20
7	Denver, CO	05/04/88	UP	DEN88FRZ11
8	Gulfport, MS	05/07/88	MSRC	ATL88FRZ15
9	Sheridan, WI	05/14/88	WC	CHI88FRZ22
10	Las Vegas, NV	05/23/88	UP	LAX88FRZ12
11	Columbus, OH	06/11/88	CSX	ATL88FRZ16
12	Crofton, KY	06/22/88	CSX	ATL88FRZ19
13	Deer Park, TX	07/22/88	PTRA	FTW88FRZ23
14	Farnum, NE	07/22/88	BN	DEN88FRZ17
15	White Bluff, TN	07/24/88	CSX	FTW88FRZ24
16	Altoona, IA	07/30/88	IAIS	DCA88MRZ06
17	Urbarger, TX	07/30/88	ATSF	FTW88FRZ25
18	Ohlerville, PA	08/01/88	CSX	FTW88FRZ26
19	Brazoria, TX	08/02/88	UP	FTW88FRZ27
20	Loudonville, OH	08/04/88	CR	LAX88FRZ15
21	Elsberry, MO	08/06/88	BN	FTW88FRZ28
22	Elberton, GA	08/08/88	CSX	ATL88FRZ20
23	Elm Grove, WI	08/10/88	SOO	CHI88FRZ27
24	Athens, GA	08/13/88	CSX	ATL88FRZ21
25	Memphis, TN	08/18/88	IC	ATL88FRZ22
26	Jacksonville, FL	09/15/88	CSX	ATL88FRZ23
27	Summit, IL	09/25/88	IC	CHI88FRZ29
28	Rineyville, KY	10/13/88	PAL	ATL89FRZ02
29	Easley, SC	10/16/88	NS	ATL89FRZ03
30	Pearl, IL	10/26/88	CMNW	CHI89FRZ05
31	Morganza, LA	10/26/88	LA	FTW89FRZ01
32	Newcastle, CA	11/02/88	SP	LAX89FRZ02
33	Lyndon Station, WI	11/09/88	SOO	CHI89FRZ06
34	Bangor, AL	11/19/88	CSX	ATL89FRZ05
35	Lanagan, MO	11/20/88	KCS	CHI89FRZ07
36	Fruitvale, TX	11/25/88	UP	FTW89FRZ04
37	Palmyra, MO	11/29/88	BN	CHI89FRZ08
38	Edison, NJ	12/09/88	CR	NYC89FRZ03
39	Flagstaff, AZ	12/14/88	ATSF	LAX89FRZ05
40	Bonnars Ferry, ID	01/28/89	UP	LAX89FRZ13
41	Helena, MT	02/02/89	MRL	DCA89MRZ01
42	Kansas City, KS	02/02/89	ATSF	CHI89FRZ11
43	Manteca, CA	02/20/89	SP	LAX89FRZ15
44	Bordulac, ND	02/20/89	SOO	CHI89FRZ14
45	Akron, OH	02/26/89	CSX	DCA89MZ004

NATIONAL TRANSPORTATION SAFETY BOARD
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APPENDIX D

NTSB # FTW88FRZ13

BRIEF OF ACCIDENT

RUNDATE: 03/23/90

File No. - 22

03/04/88

CLAUDE, TX

Time (Lcl) - 0820 CST

---Basic Information---

Reporting Railroad - BN	Property Losses	Injuries			
Type of Accident - DERAILMENT	Railroad - \$ 380,734.00	Fatal	Serious	Minor	None
Operating Phase - EN ROUTE	Non-Railroad - \$ 0.00	Employees 0	0	0	4
Method of Operation - TIMETABLE	Fire - NO	Passengers 0	0	0	0
TRAIN ORDERS		Motorist 0	0	0	0
		Other 0	0	0	0

BN - BURLINGTON NORTHERN RAILROAD COMPANY

---Railroad/Personnel Information---

Train Data	Train Consist/Damage	Crew Information
Railroad - BN	No. Loco. Units - 4	Front End - 4
Type of Train - FREIGHT	No. Cars/Caboose - 79/0	Rear End - 0
Train ID - EXTRA 3000 WEST	End of Train Monitor - MONITOR	Toxicology Performed - NO
Direction - WEST	Length (Feet) - 4809	Radio Communications
Speed (Est.) - 39	Trailing Tons - 5973	Radio Available - YES
Speed (Auth.) - 49	Loco. Destroy/Derailed - N/A	Operational - YES
	Cars Destroy/Derailed - 15/28	

BN - BURLINGTON NORTHERN RAILROAD COMPANY

---Environment/Operations Information---

Weather Data	Itinerary	Hazardous Materials
Weather Condition - CLOUDY	Last Departure Point	Involved - YES
Condition of Light - DAYLIGHT	WICHITA FALLS, TX	Cars Involved - 4
	Destination	Track Information
Evacuation - NO	AMARILLO, TX	Type/No. of Tracks - MAIN/1
		Gradient - ASC. 0.97
		Alignment - CURVE 1 D 0 M

---Narrative---

BN FREIGHT TRAIN EXTRA 3000 WEST HAD 24 CARS DERAIL WHILE MOVING 39 MPH. THE FIRST CAR TO DERAIL WAS THE 4TH CAR BEHIND THE LOCOMOTIVE. INVESTIGATION REVEALED A CONTINUOUSLY WELDED RAIL BROKE AS THE TRAIN PASSED OVER IT. THE RAIL BROKE WHERE THERE WAS A PRE-EXISTING 46% FRACTURE THROUGH THE RAIL HEAD. A TANK CAR CRACKED, LEAKING ANHYDROUS AMMONIA, BUT DUE TO THE REMOTENESS OF THE DERAILMENT AREA, NO EVACUATION WAS NECESSARY. ABOUT 7 MONTHS BEFORE THE ACCIDENT, A RAIL DEFECT CAR PASSED OVER THE SITE AND DID NOT DETECT ANY RAIL DEFECTS.

BRIEF OF ACCIDENT, continued

File No. - 22

03/04/88

CLAUDE, TX

Time (Lc) - 0820 CST

Occurrence #1 - DERAILMENT
Phase - MAINTAINING SPEED

Finding(s)

1. RAIL, CONTINUOUSLY WELDED - DEFECT, INTERNAL
 2. RAIL, CONTINUOUSLY WELDED - BROKEN
-

Occurrence #2 - HAZARDOUS MATERIALS LEAK/SPILL (FUMES/SMOKE)
Phase - STOPPING

---Probable Cause---

The National Transportation Safety Board determines that the probable Cause(s) of this accident is/are finding(s) 1, 2

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APPENDIX D

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

APPENDIX D

NTSB # ATL88FR213

BRIEF OF ACCIDENT

RUNDATE: 03/23/90

File No. - 23

03/10/88

PUNTA GORDA, FL

Time (Lcl) - 1455 EST

---Basic Information---

Reporting Railroad - SGLR	Property Losses	Injuries			
Type of Accident - DERAILMENT	Railroad - \$ 4,960.00	Fatal	Serious	Minor	None
Operating Phase - EN ROUTE	Non-Railroad - \$ 0.00	Employees 0	0	0	2
Method of Operation - MANUAL BLOCKS	Fire - NO	Passengers 0	0	0	0
		Motorist 0	0	0	0
		Other 0	0	0	0

SGLR - SEMINOLE GULF RAILROAD

---Railroad/Personnel Information---

Train Data	Train Consist/Damage	Crew Information
Railroad - SGLR	No. Loco. Units - 2	Front End - 2
Type of Train - FREIGHT	No. Cars/Caboose - 40/0	Rear End - 0
Train ID - EXTRA 573 SOUTH	End of Train Monitor - MARKER	Toxicology Performed - NO
Direction - SOUTH	Length (Feet) - 2405	Radio Communications
Speed (Est.) - 20	Trailing Tons - 1715	Radio Available - YES
Speed (Auth.) - 20	Loco. Destroy/Derailed - N/A	Operational - YES
	Cars Destroy/Derailed - 0/1	

SGLR - SEMINOLE GULF RAILROAD

---Environment/Operations Information---

Weather Data	Itinerary	Hazardous Materials
Weather Condition - CLEAR	Last Departure Point	Involved - YES
Condition of Light - DAYLIGHT	ARCADIA, FL	Cars Involved - 1
	Destination	Track Information
Evacuation - YES	FT. MYERS, FL	Type/No. of Tracks - MAIN/1
		Gradient - LEVEL
		Alignment - CURVE 3 D 30 M

---Narrative---

A SEMINOLE GULF RAILWAY FREIGHT TRAIN HAD ONE OF ITS 40 CARS DERAIL NEAR PUNTA GORDA, FL. THE CAR DERAILED ON CURVED TRACK, AND DURING A POST ACCIDENT INSPECTION WAS FOUND TO HAVE TRUCK SIDE BEARINGS IN CONSTANT TIGHT CONTACT WITH THE CAR BODY. THE DERAILED CAR CONTAINED AMMONIUM NITRATE WHICH DID NOT SPILL. A PRECAUTIONARY EVACUATION OF ABOUT 300 PERSONS WAS ORDERED BY LOCAL PUBLIC SAFETY OFFICIALS. THERE WAS NO FIRE OR PERSONAL INJURY AS A RESULT OF THE DERAILMENT.

BRIEF OF ACCIDENT, continued

File No. - 23

03/10/88

PUNTA GORDA, FL

Time (Lcl) - 1455 EST

Occurrence #1 - DERAILMENT
Phase - MAINTAINING SPEED

Finding(s)
1. SIDE BEARING - BINDING (MECHANICAL)

---Probable Cause---

The National Transportation Safety Board determines that the probable Cause(s) of this accident is/are finding(s) 1

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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

APPENDIX D

NTSB # CHI88FRZ17

BRIEF OF ACCIDENT

RUNDATE: 03/23/90

File No. - 32

04/08/88

PASCO, WA

Time (Lcl) - 1230 PDT

---Basic Information---

Reporting Railroad - BN	Property Losses	Injuries			
Type of Accident - DERAILMENT	Railroad - \$ 1,292,853.00	Fatal	Serious	Minor	None
Operating Phase - EN ROUTE	Non-Railroad - \$ 0.00	Employees	0	0	0
Method of Operation - TRAFFIC CONTROL	Fire - NO	Passengers	0	0	0
TIMETABLE		Motorist	0	0	0
		Other	0	0	0

BN - BURLINGTON NORTHERN RAILROAD COMPANY

---Railroad/Personnel Information---

Train Data	Train Consist/Damage	Crew Information
Railroad - BN	No. Loco. Units - 7	Front End - 4
Type of Train - FREIGHT	No. Cars/Caboose - 135/1	Rear End - 0
Train ID - EXTRA 6810 EAST	End of Train Monitor - MONITOR	Toxicology Performed - YES
Direction - EAST	Length (Feet) - 7895	Radio Communications
Speed (Est.) - 28	Trailing Tons - 10518	Radio Available - YES
Speed (Auth.) - 45	Loco. Destroy/Derailed - N/A	Operational - YES
	Cars Destroy/Derailed - 13/24	

BN - BURLINGTON NORTHERN RAILROAD COMPANY

---Environment/Operations Information---

Weather Data	Itinerary	Hazardous Materials
Weather Condition - CLEAR	Last Departure Point	Involved - YES
Condition of Light - DAYLIGHT	WISHRAM, WA	Cars Involved - 4
	Destination	Track Information
Evacuation - NO	PASCO, WA	Type/No. of Tracks - MAIN/2
		Gradient - LEVEL
		Alignment - TANGENT

---Narrative---

BN FREIGHT TRAIN EXTRA 6810 EAST HAD 24 CARS DERAIL. THE TRAIN WAS GOVERNED BY THE SIGNAL INDICATIONS OF A CENTRALIZED TRAFFIC CONTROL SYSTEM. AS THE TRAIN APPROACHED THE CTC SIGNAL AT THE WEST END OF A SIDING, THE SIGNAL ASPECT CHANGED FROM "CLEAR" TO "STOP". THE ENGINEER STOPPED THE TRAIN WITH AN EMERGENCY APPLICATION OF THE BRAKES. THIS CAUSED THE DERAILMENT OF AN UNOCCUPIED CABOOSE 42 CARS BEHIND THE ENGINE. THE SIGNAL THEN CHANGED BACK TO "CLEAR", AND THE TRAIN PROCEEDED WITHOUT BEING INSPECTED BY THE CREW. BN RULES DO NOT REQUIRE THIS INSPECTION. THE GENERAL DERAILMENT OCCURRED WHEN THE DERAILED CABOOSE STRUCK THE SWITCH AT THE WEST END OF THE SIDING. A HIGHWAY-RAIL VEHICLE WAS SPRAYING WEEDS IN THE AREA OF THE WEST END OF THE SIDING. THE MAINTENANCE OF WAY EMPLOYEE IN CHARGE KNEW OF THE APPROACHING TRAIN, AND STATED THEY PERFORMED NO ACTION THAT WOULD HAVE CAUSED THE SIGNAL ASPECT TO CHANGE, ALTHOUGH PUTTING THE WEED SPRAYER ON THE TRACK WOULD CHANGE THE SIGNAL TO "STOP".

BRIEF OF ACCIDENT, continued

File No. - 32

04/08/88

PASCO, WA

Time (Lcl) - 1230 PDT

Occurrence #1 - ABRUPT MANEUVER
Phase - MAINTAINING SPEED

Finding(s)

1. HIGH RAIL VEHICLE - ON TRACK
2. BLOCK SIGNAL - INITIATED - MAINTENANCE OF WAY LABORER
3. INATTENTIVE - MAINTENANCE OF WAY LABORER

Occurrence #2 - DERAILMENT, INITIAL
Phase - STOPPING

Occurrence #3 - DERAILMENT, SECONDARY
Phase - ACCELERATING

Finding(s)

4. INADEQUATE PROCEDURE - COMPANY OPERATOR/MGMT

Occurrence #4 - HAZARDOUS MATERIALS LEAK/SPILL (FUMES/SMOKE)
Phase - STOPPING

---Probable Cause---

The National Transportation Safety Board determines that the probable Cause(s) of this accident is/are finding(s) 1, 2, 3

Factor(s) relating to this accident is/are finding(s) 4

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APPENDIX D

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

APPENDIX D

NTSB # CHI88FRZ18

BRIEF OF ACCIDENT

RUNDATE: 03/23/90

File No. - 35

04/26/88

JEFFERSONVILLE, IN

Time (Lcl) - 1645 EDT

---Basic Information---

Reporting Railroad - CR	Property Losses	Injuries			
Type of Accident - HAZ. MAT. RELEASED	Railroad - \$ 832.00	Fatal	Serious	Minor	None
Operating Phase - STANDING	Non-Railroad - \$ 0.00	Employees 0	0	0	3
Method of Operation - VERBAL PERMISSION	Fire - NC	Passengers 0	0	0	0
		Motorist 0	0	0	0
		Other 0	0	0	0

CR - CONSOLIDATED RAIL CORPORATION

---Railroad/Personnel Information---

Train Data	Train Consist/Damage	Crew Information
Railroad - CR	No. Loco. Units - 1	Front End - 3
Type of Train - YARD	No. Cars/Caboose - 39/0	Rear End - 0
Train ID - INTERCHANGE	End of Train Monitor - NO	Toxicology Performed - NO
Direction - NORTH	Length (Feet) - 2400	Radio Communications
Speed (Est.) - 0	Trailing Tons - 3000	Radio Available - NO
Speed (Auth.) - 0	Loco. Destroy/Derailed - N/A	Operational - N/A
	Cars Destroy/Derailed - N/A	

CR - CONSOLIDATED RAIL CORPORATION

---Environment/Operations Information---

Weather Data	Itinerary	Hazardous Materials
Weather Condition - CLEAR	Last Departure Point	Involved - YES
Condition of Light - DAYLIGHT	LOUISVILLE, KY	Cars Involved - 1
	Destination	Track Information
	JEFFERSONVILLE, IN	Type/No. of Tracks - YARD/15
Evacuation - NO		Gradient - LEVEL
		Alignment - TANGENT

---Narrative---

A CUT OF CARS WAS RECEIVED IN INTERCHANGE BY CONRAIL FROM THE PADUCAH & LOUISVILLE RAILWAY AT LOUISVILLE, KY. AFTER PULLING THE CARS INTO CONRAIL'S JEFFERSONVILLE YARD, IT WAS FOUND THAT ONE CAR WAS LEAKING FROM THE BOTTOM OUTLET. CHEMTREC, FIRE DEPARTMENT, STATE AND FEDERAL OFFICIALS WERE PROMPTLY NOTIFIED. THE SHIPPER CONTRACTED WITH A LOCAL HAZMAT COMPANY AND THE LEAK WAS PLUGGED AT ABOUT 8 PM. THE COMMODITY WAS ACETIC ACID AND THE LOSS WAS BETWEEN 10 AND 200 GALLONS. NO INJURIES OR EVACUATIONS WERE ASSOCIATED WITH THIS INCIDENT. REPAIR OF THE CAR SHOWED AN EXCESSIVE AMOUNT OF WELDING SLAG IN THE BOTTOM OUTLET AREA ALONG WITH A 6 INCH PIECE OF WELDING ROD MATERIAL. A RECENT REPAIR TO A HEATER COIL BRACKET WAS EVIDENT.

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BRIEF OF ACCIDENT, continued

File No. - 35

04/26/88

JEFFERSONVILLE, IN

Time (Lcl) - 1645 EDT

Occurrence #1 - HAZARDOUS MATERIALS LEAK/SPILL (FUMES/SMOKE)
Phase - STANDING

Finding(s)

1. BOTTOM OUTLET VALVES - LEAK
2. EQUIPMENT REPAIR - POOR - COMPANY MAINTENANCE

---Probable Cause---

The National Transportation Safety Board determines that the probable Cause(s) of this accident is/are finding(s) 1, 2

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NATIONAL TRANSPORTATION SAFETY BOARD
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APPENDIX D

NTSB # LAX88FRZ10

File No. - 38

04/27/88

BRIEF OF ACCIDENT
WILMINGTON, CA

RUNDATE: 03/23/90

Time (Lcl) - 0435 PDT

---Basic Information---

Reporting Railroad - UP	Property Losses	Injuries			
Type of Accident - HAZ. MAT. RELEASED	Railroad - \$ 0.00	Fatal	Serious	Minor	None
Operating Phase - STANDING	Non-Railroad - \$ 0.00	Employees 0	0	2	2
Method of Operation - YARD RULES	Fire - NO	Passengers 0	0	0	0
TIMETABLE		Motorist 0	0	0	0
		Other 0	0	0	0

UP - UNION PACIFIC RAILROAD COMPANY

---Railroad/Personnel Information---

Train Data	Train Consist/Damage	Crew Information
Railroad - UP	No. Loco. Units - 1	Front End - 4
Type of Train - YARD	No. Cars/Caboose - 4/0	Rear End - 0
Train ID - SWITCH ENGINE 2013	End of Train Monitor - NC	Toxicology Performed - NO
Direction - EAST	Length (Feet) - 280	Radio Communications
Speed (Est.) - 0	Trailing Tons - 250	Radio Available - YES
Speed (Auth.) - 10	Loco. Destroy/Derailed - N/A	Operational - YES
	Cars Destroy/Derailed - N/A	

UP - UNION PACIFIC RAILROAD COMPANY

---Environment/Operations Information---

Weather Data	Itinerary	Hazardous Materials
Weather Condition - CLOUDY	Last Departure Point	Involved - YES
Condition of Light - DARK	WILMINGTON, CA	Cars Involved - 1
	Destination	Track Information
Evacuation - NO	WILMINGTON, CA	Type/No. of Tracks - YARD/1
		Gradient - LEVEL
		Alignment - TANGENT

---Narrative---

A UP SWITCH ENGINE CREW WAS PREPARING TO MOVE A TANK CAR FROM AN INDUSTRIAL SIDING WHEN THE CONDUCTOR AND BRAKEMAN BEGAN HAVING DIFFICULTY BREATHING AND BECAME DIZZY. THE ENGINEER SAW THEM AND RADIOED FOR HELP. THE TWO CREWMEN HAD INHALED SULPHUR DIOXIDE FUMES. AN IMPROPERLY CLOSED UNLOADER VALVE WAS FOUND ON THE TANK CAR. IT WAS REPORTED TO BE EMPTY, BUT HAD BEEN FILLED WITH SULPHUR DIOXIDE. THE TWO CREWMEN WERE TAKEN TO A LOCAL HOSPITAL, TREATED, AND RELEASED. NO FIRES OR EVACUATION OCCURRED AND THERE WERE NO OTHER INJURIES. THE VALVE WAS CLOSED AND SECURED BY UP PERSONNEL. THE YARD IS ABOUT 2500 FEET FROM LONG BEACH HARBOR.

BRIEF OF ACCIDENT, continued

File No. - 38

04/27/88

WILMINGTON, CA

Time (Lcl) - 0435 PDT

Occurrence #1 - HAZARDOUS MATERIALS LEAK/SPILL (FUMES/SMOKE)
Phase - PICKUP NOT IN YARD

Finding(s)

1. TANK CAR(S) - LEAK
2. EQUIPMENT MAINTENANCE - INADEQUATE - OTHER PERSON
3. COMPLACENCY - OTHER PERSON

---Probable Cause---

The National Transportation Safety Board determines that the probable Cause(s) of this accident is/are finding(s) 1, 2

Factor(s) relating to this accident is/are finding(s) 3

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APPENDIX D

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

APPENDIX D

NTSB # CHI88FRZ20

BRIEF OF ACCIDENT

RUNDATE: 03/23/90

File No. - 41

05/03/88

ROODHOUSE, IL

Time (Lc) - 0830 CDT

---Basic Information---

Reporting Railroad - CMNW	Property Losses	Injuries			
Type of Accident - DERAILMENT	Railroad - \$ 32,000.00	Fatal	Serious	Minor	None
Operating Phase - EN ROUTE	Non-Railroad - \$ 0.00	Employees 0	0	0	3
Method of Operation - TIMETABLE	Fire - NO	Passengers 0	0	0	0
TRAIN ORDERS		Motorist 0	0	0	0
		Other 0	0	0	0

CMNW - CHICAGO MISSOURI & WESTERN RAILWAY

---Railroad/Personnel Information---

Train Data	Train Consist/Damage	Crew Information
Railroad - CMNW	No. Loco. Units - 5	Front End - 3
Type of Train - FREIGHT	No. Cars/Caboose - 60/0	Rear End - 0
Train ID - EXTRA 3014 EAST	End of Train Monitor - MARKER	Toxicology Performed - YES
Direction - EAST	Length (Feet) - 4260	Radio Communications
Speed (Est.) - 15	Trailing Tons - 6040	Radio Available - YES
Speed (auth.) - 25	Loco. Destroy/Derailed - N/A	Operational - YES
	Cars Destroy/Derailed - 0/5	

CMNW - CHICAGO MISSOURI & WESTERN RAILWAY

---Environment/Operations Information---

Weather Data	Itinerary	Hazardous Materials
Weather Condition - CLOUDY	Last Departure Point	Involved - YES
Condition of Light - DAYLIGHT	KANSAS CITY, MO	Cars Involved - 3
	Destination	Track Information
Evacuation - YES	E. ST. LOUIS, IL	Type/No. of tracks - MAIN/1
		Gradient - ASC. 0.71
		Alignment - CURVE 0 D 0 M

---Narrative---

CMNW FREIGHT TRAIN EXTRA 3014 EAST DERAILED ONE CAR AT A LOCATION OF CROSS LEVEL ELEVATION VARIANCE. THE TRAIN WAS TRAVELING AT AN ESTIMATED 15 MPH WHEN A SUSPECTED HARMONIC ROCK SITUATION BEGAN AND ONE WHEELSET ON THE 45TH CAR CLIMBED THE SOUTH RAIL AND DERAILED. THE TRAIN TRAVELED THIS WAY FOR OVER 3 MILES BEFORE BEING STOPPED AT ROODHOUSE, ILLINOIS, FOR A CREW CHANGE. THE NEW OUTBOUND CREW DID NOT MAKE THE MANDATORY AIR BRAKE TEST/INSPECTION BEFORE DEPARTURE. AS THEY WERE DEPARTING ROODHOUSE, THE DERAILED WHEELSET STRUCK A CLOSURE RAIL AT A SWITCH AND THE CAR WAS FORCED DOWN AN EMBANKMENT, DERAILING 4 OTHER CARS. TWO HAZMAT CARS DERAILED AND TURNED OVER, SPILLING THEIR CONTENTS OF AMMONIUM NITRATE AND SULFURIC ACID. ABOUT 1000 RESIDENTS WERE EVACUATED VOLUNTARILY AS A PRECAUTIONARY MEASURE, BUT SOON RETURNED TO THEIR HOMES.

BRIEF OF ACCIDENT, continued

File No. - 41

05/03/88

ROODHOUSE, IL

Time (Lcl) - 0830 CDT

Occurrence #1 - DERAILMENT, INITIAL
Phase - MAINTAINING SPEED

Finding(s)

1. CROSS ELEVATION - IRREGULAR
2. INADEQUATE INSPECTION - MAINTENANCE OF WAY INSPECTOR
3. WHEEL - RAISED

Occurrence #2 - DERAILMENT, GENERAL
Phase - STARTING

Finding(s)

4. WHEEL(S) - OFF TRACK
5. GENERAL RULES - NOT COMPLIED - ROAD FREIGHT CONDUCTOR (through freight)
6. INADEQUATE INSPECTION - ROAD FREIGHT CONDUCTOR (through freight)

Occurrence #3 - HAZARDOUS MATERIALS LEAK/SPILL (FUMES/SMOKE)
Phase - STOPPING

---Probable Cause---

The National Transportation Safety Board determines that the probable Cause(s) of this accident is/are finding(s) 1, 2, 5, 6

Factor(s) relating to this accident is/are finding(s) 3

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APPENDIX D

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

APPENDIX D

NTSB # DEN88FRZ11

BRIEF OF ACCIDENT

RUNDATE: 03/23/90

File No. - 42

05/04/88

DENVER, CO

Time (Lcl) - 0900 MDT

---Basic Information---

Reporting Railroad - UP	Property Losses		Injuries			
Type of Accident - HAZ. MAT. RELEASED	Railroad - \$	840.00	Fatal	Serious	Minor	None
Operating Phase - LOADING/UNLOADING	Non-Railroad - \$	0.00	Employees	0	0	0
Method of Operation - TRAFFIC CONTROL	Fire - NO		Passengers	0	0	0
TIMETABLE			Motorist	0	0	0
			Other	0	0	1

UP - UNION PACIFIC RAILROAD COMPANY

---Railroad/Personnel Information---

Train Data	Train Consist/Damage	Crew Information
Railroad - UP	No. Loco. Units - 3	Front End - 4
Type of Train - FREIGHT	No. Cars/Caboose - 83/U	Rear End - 0
Train ID - EXTRA 2519 WEST	End of Train Monitor - MONITOR	Toxicology Performed - NO
Direction - WEST	Length (Feet) - 6772	
Speed (Est.) - 0	Trailing Tons - 6444	Radio Communications
Speed (Auth.) - 0	Loco. Destroy/Derailed - N/A	Radio Available - YES
	Cars Destroy/Derailed - N/A	Operational - YES

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UP - UNION PACIFIC RAILROAD COMPANY

---Environment/Operations Information---

Weather Data	Itinerary	Hazardous Materials
Weather Condition - CLEAR	Last Departure Point	Involved - YES
Condition of Light - DAYLIGHT	NORTH PLATTE, NE	Cars Involved - 1
	Destination	Track Information
	DENVER, CO	Type/No. of Tracks - INDUSTRIAL/6
Evacuation - NO		Gradient - LEVEL
		Alignment - TANGENT

---Narrative---

A UNION PACIFIC TRUCK HOSTLER WAS DERAMPING A TRAILER FROM A FLATCAR IN UP FREIGHT TRAIN EXTRA 2519 WEST WHEN HE NOTICED LIQUID LEAKING OUT THE TRAILER DOOR. INSPECTION OF THE TRAILER REVEALED ONE OF THE 72 55-GALLON DRUMS IN THE TRAILER WAS LEAKING. WAYBILL INFORMATION INDICATED THE DRUM CONTAINED CYTHION INSECTICIDE (PREMIUM GRADE MALATHION). INVESTIGATION REVEALED THE DRUMS HAD NOT BEEN ADEQUATELY BLOCKED, ALLOWING THE DRUMS TO SHIFT WHILE EN ROUTE. BLOCKING HAD PULLED LOOSE AND A NAIL IN THE FLOOR OF THE TRAILER PUNCTURED THE DRUM.

BRIEF OF ACCIDENT, continued

File No. - 42

05/04/88

DENVER, CO

Time (Lcl) - 0900 MDT

Occurrence #1 - HAZARDOUS MATERIALS LEAK/SPILL (FUMES/SMOKE)
Phase - UNKNOWN

Finding(s)

1. BLOCKING/BRACING/BANDING - INADEQUATE
 2. CARGO LOADING/UNLOADING - INADEQUATE - OTHER PERSON
 3. CONTAINER - PUNCTURED
 4. CONTAINER - LEAK
-

---Probable Cause---

The National Transportation Safety Board determines that the probable Cause(s) of this accident is/are finding(s) 1, 2, 3

Factor(s) relating to this accident is/are finding(s) 4

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APPENDIX D

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

APPENDIX D

NTSB # ATL88FRZ15

BRIEF OF ACCIDENT

RUNDATE: 03/23/90

File No. - 44

05/07/88

GULFPORT, MS

Time (Lcl) - 1343 CDT

---Basic Information---

Reporting Railroad - MSRC	Property Losses		Injuries			
Type of Accident - DERAILMENT	Railroad - \$ 140,000.00	Employees	Fatal	Serious	Minor	None
Operating Phase - EN ROUTE	Non-Railroad - \$ 0.00	Passengers	0	0	0	3
Method of Operation - TIMETABLE	Fire - NO	Motorist	0	0	0	0
RADIO		Other	0	0	0	0

MSRC - MID SOUTH RAIL CORP.

---Railroad/Personnel Information---

Train Data	Train Consist/Damage	Crew Information
Railroad - MSRC	No. Loco. Units - 2	Front End - 3
Type of Train - LOCAL FREIGHT	No. Cars/Caboose - 12/0	Rear End - 0
Train ID - EXTRA 1036 SOUTH	End of Train Monitor - MARKER	Toxicology Performed - NO
Direction - SOUTH	Length (Feet) - 840	Radio Communications
Speed (Est.) - 25	Trailing Tons - 1080	Radio Available - YES
Speed (Auth.) - 25	Loco. Destroy/Derailed - N/A	Operational - YES
	Cars Destroy/Derailed - 0/6	

MSRC - MID SOUTH RAIL CORP.

---Environment/Operations Information---

Weather Data	Itinerary	Hazardous Materials
Weather Condition - CLEAR	Last Departure Point	Involved - YES
Condition of Light - DAYLIGHT	HATTIESBURG, MS	Cars Involved - 6
	Destination	Track Information
	GULFPORT, MS	Type/No. of Tracks - MAIN/1
Evacuation - YES		Gradient - LEVEL
		Alignment - TANGENT

---Narrative---

LOCAL FREIGHT TRAIN EXTRA 1036 SOUTH, TRAVELING AT 25 MPH, DERAILED SIX CARS OF THE TRAIN'S 12 CAR CONSIST AT MILEPOST 7.6 NEAR GULFPORT, MISSISSIPPI. THE DERAILED CARS CONTAINED HAZARDOUS MATERIAL, HOWEVER, THERE WAS NO LEAKAGE. A PRECAUTIONARY EVACUATION WAS INITIATED DURING THE TIMES THAT THE CARS WERE BEING RERAILED. A BROKEN RAIL WAS FOUND AT THE POINT OF THE DERAILMENT. THE TRACK WAS LAST INSPECTED ON MAY 2, 1988, 5 DAYS BEFORE THE DERAILMENT. AT THE TIME OF THAT INSPECTION, A DEFECTIVE RAIL WAS CHANGED OUT AT MILEPOST 7.9, BUT THE RAIL DEFECT AT THE ACCIDENT SITE WAS NOT DETECTED.

BRIEF OF ACCIDENT, continued

File No. - 44

05/07/88

GULFPORT, MS

Time (Lcl) - 1343 CDT

Occurrence #1 - DERAILMENT
Phase - MAINTAINING SPEED

Finding(s)

1. RAIL BASE - BROKEN
 2. TRACK INSPECTION - INADEQUATE - MAINTENANCE OF WAY INSPECTOR
 3. INADEQUATE PROCEDURE - COMPANY OPERATOR/MGMT
-

---Probable Cause---

The National Transportation Safety Board determines that the probable Cause(s) of this accident is/are finding(s) 1, 2

Factor(s) relating to this accident is/are finding(s) 3

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APPENDIX D

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

APPENDIX D

NTSB # CHI88FRZ22

BRIEF OF ACCIDENT

RUNDATE: 03/23/90

File No. - 49

05/14/88

SHERIDAN, WI

Time (Lcl) - 1830 CDT

---Basic Information---

Reporting Railroad - WC	Property Losses	Injuries			
Type of Accident - DERAILMENT	Railroad - \$ 277,113.00	Fatal	Serious	Minor	None
Operating Phase - EN ROUTE	Non-Railroad - \$ 10,000.00	Employees 0	0	0	2
Method of Operation - AUTOMATIC BLOCK	Fire - NO	Passengers 0	0	0	0
TRAFFIC CONTROL		Motorist 0	0	0	0
		Other 0	0	0	0

WC - WISCONSIN CENTRAL LTD. (ALSO RAILWAY)

---Railroad/Personnel Information---

Train Data	Train Consist/Damage	Crew Information
Railroad - WC	No. Loco. Units - 2	Front End - 2
Type of Train - FREIGHT	No. Cars/Caboose - 70/0	Rear End - 0
Train ID - EXTRA 6517 WEST	End of Train Monitor - MARKER	Toxicology Performed - NO
Direction - WEST	Length (Feet) - 3940	Radio Communications
Speed (Est.) - 40	Trailing Tons - 4812	Radio Available - YES
Speed (Auth.) - 40	Loco. Destroy/Derailed - N/A	Operational - YES
	Cars Destroy/Derailed - 8/20	

WC - WISCONSIN CENTRAL LTD. (ALSO RAILWAY)

---Environment/Operations Information---

Weather Data	Itinerary	Hazardous Materials
Weather Condition - CLEAR	Last Departure Point	Involved - YES
Condition of Light - DUSK	FOND DU LAC, WI	Cars Involved - 1
	Destination	Track Information
Evacuation - YES	STEVENS POINT, WI	Type/No. of Tracks - MAIN/1
		Gradient - LEVEL
		Alignment - CURVE 1 D 0 M

---Narrative---

WC FREIGHT TRAIN EXTRA 6517 WEST PASSED A HOT BOX DETECTOR WHICH RECORDED A LOW READING, BUT NOT ENOUGH TO REQUIRE ACTION. ABOUT 10 MILES BEYOND, A BEARING ON THE 20TH CAR EXPERIENCED A TOTAL FAILURE, BURNED OFF THE AXLE, AND STARTED A DERAILMENT. ONE CAR OF CHLORINE WAS INCLUDED IN THE 20-CAR DERAILMENT, BUT IT DID NOT OVERTURN OR LEAK. A PRECAUTIONARY EVACUATION OF ABOUT 50 RESIDENTS FOR ABOUT 2 HOURS WAS INITIATED BY LOCAL AUTHORITIES WHILE AN INSPECTION TOOK PLACE. THERE WERE NO INJURIES ASSOCIATED WITH THE DERAILMENT OR EVACUATION. THE BEARING WAS TOTALLY DESTROYED AND COULD NOT BE EXAMINED.

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BRIEF OF ACCIDENT, continued

File No. - 49

05/14/88

SHERIDAN, WI

Time (Lcl) - 1830 CDT

Occurrence #1 - TRAIN COMPONENT SYSTEM/FAILURE/MALFUNCTION
Phase - MAINTAINING SPEED

Finding(s)

1. ROLLER BEARING - OVERHEATED
2. AXLE JOURNAL - BURN-OFF
3. DETECTOR - OBSERVED - TRAIN DISPATCHER

Occurrence #2 - DERAILMENT
Phase - MAINTAINING SPEED

---Probable Cause---

The National Transportation Safety Board determines that the probable Cause(s) of this accident is/are finding(s) 1, 2

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APPENDIX D

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

APPENDIX D

NTSB # LAX88FRZ12

File No. - 54

05/23/88

BRIEF OF ACCIDENT

LAS VEGAS, NV

RUNDATE: 03/23/90

Time (Lcl) - 0700 PDT

---Basic Information---

Reporting Railroad - UP	Property Losses	Injuries			
Type of Accident - HAZ. MAT. RELEASED	Railroad - \$ 0.00	Fatal	Serious	Minor	None
Operating Phase - STANDING	Non-Railroad - \$ 0.00	Employees 0	0	0	3
Method of Operation - YARD RULES	Fire - NO	Passengers 0	0	0	0
TRAFFIC CONTROL		Motorist 0	0	0	0
		Other 0	0	0	0

UP - UNION PACIFIC RAILROAD COMPANY

---Railroad/Personnel Information---

Train Data	Train Consist/Damage	Crew Information
Railroad - UP	No. Loco. Units - 3	Front End - 3
Type of Train - FREIGHT	No. Cars/Caboose - 101/0	Rear End - 0
Train ID - EXTRA 3403 WEST	End of Train Monitor - MARKER	Toxicology Performed - NO
Direction - WEST	Length (Feet) - 5657	Radio Communications
Speed (Est.) - 0	Trailing Tons - 8250	Radio Available - YES
Speed (Auth.) - 50	Loco. Destroy/Derailed - N/A	Operational - YES
	Cars Destroy/Derailed - N/A	

UP - UNION PACIFIC RAILROAD COMPANY

---Environment/Operations Information---

Weather Data	Itinerary	Hazardous Materials
Weather Condition - CLEAR	Last Departure Point	Involved - YES
Condition of Light - DAYLIGHT	MILFORD, UT	Cars Involved - 1
	Destination	Track Information
Evacuation - NO	LOS ANGELES, CA	Type/No. of Tracks - MAIN/8
		Gradient - LEVEL
		Alignment - TANGENT

---Narrative---

UP FREIGHT TRAIN EXTRA 3403 WEST HAD A TANK CAR LOADED WITH SULFURIC ACID THAT WAS OBSERVED TO HAVE LIQUID ON THE SIDE OF THE CAR. THE CAR HAD BEEN LOADED AT KENNECOTT CORPORATION'S GARFIELD, UTAH, FACILITY, AND WAS ENROUTE TO CONSIGNEE, THATCHER CHEMICAL COMPANY IN HENDERSON, NEVADA, WHEN THE LEAK WAS DISCOVERED. THE INVESTIGATION REVEALED THAT THE VENT VALVE DISC WAS RUPTURED AND WAS THE SOURCE OF THE LEAK. AFTER THE DISC WAS REPLACED THE CAR WAS PLACED IN ANOTHER TRAIN TO ITS DESTINATION. NO INJURIES, FIRES, EVACUATION OR DAMAGE OCCURRED. THERE WAS NO ENVIRONMENTAL CONSEQUENCE OR CONTAMINATION AS A RESULT OF THIS INCIDENT.

BRIEF OF ACCIDENT, continued

File No. - 54

05/23/88

LAS VEGAS, NV

Time (Lcl) - 0700 PDT

Occurrence #1 - HAZARDOUS MATERIALS LEAK/SPILL (FUMES/SMOKE)

Phase - STANDING

Finding(s)

1. TANK CAR(S) - LEAK
 2. SAFETY RELIEF VALVES - RUPTURED
-

---Probable Cause---

The National Transportation Safety Board determines that the probable Cause(s) of this accident is/are finding(s) 2

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APPENDIX D

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

APPENDIX D

NESB # ATLBRFRZ16

BRIEF OF ACCIDENT

RUNDATE: 03/23/90

File No. - 61

06/11/88

COLUMBUS, OH

Time (Lcl) - 1215 EDT

---Basic Information---

Reporting Railroad - CSX	Property Losses	Injuries			
Type of Accident - DERAILMENT	Railroad - \$ 235,000.00	Fatal	Serious	Minor	None
Operating Phase - EN ROUTE	Non-Railroad - \$ 0.00	Employees 0	0	1	4
Method of Operation - TIMETABLE	Fire - NO	Passengers 0	0	0	0
RADIO		Motorist 0	0	0	0
		Other 0	0	1	0

CSX - CSX TRANSPORTATION

---Railroad/Personnel Information---

Train Data	Train Consist/Damage	Crew Information
Railroad - CSX	No. Loco. Units - 2	Front End - 4
Type of Train - FREIGHT	No. Cars/Caboose - 111/0	Rear End - 0
Train ID - EXTRA 2684 WEST	End of Train Monitor - MONITOR	Toxicology Performed - YES
Direction - WEST	Length (Feet) - 6987	Radio Communications
Speed (Est.) - 26	Trailing Tons - 5977	Radio Available - YES
Speed (Auth.) - 30	Loco. Destroy/Derailed - N/A	Operational - YES
	Cars Destroy/Derailed - 11/14	

CSX - CSX TRANSPORTATION

---Environment/Operations Information---

Weather Data	Itinerary	Hazardous Materials
Weather Condition - CLEAR	Last Departure Point	Involved - YES
Condition of Light - DAYLIGHT	COLUMBUS, OH	Cars Involved - 6
	Destination	Track Information
Evacuation - NO	TOLEDO, OH	Type/No. of Tracks - MAIN/2
		Gradient - LEVEL
		Alignment - CURVE 3 D 24 M

---Narrative---

CSX FREIGHT TRAIN EXTRA 2684 WEST, TRAVELING ABOUT 26 MPH, HAD THE 24TH CAR DERAIL IN A 3-DEGREE CURVE. THE TRAIN WENT ABOUT 400 FT TO A GRADE CROSSING WHERE THE DERAILED TRUCK WAS TORN FROM THE CAR AND THROWN TO THE SIDE. THE TRAIN CONTINUED A SHORT DISTANCE TO A BRIDGE WHICH THE DETRUCKED CAR STRUCK AND STARTED A DERAILMENT INVOLVING 14 CARS. SMALL AMOUNTS OF TOLUENE AND BUTANE LEAKED FROM TANK CARS. AFTER THE DERAILMENT, A RAILROAD SUPERVISOR AND A FIREFIGHTER RECEIVED MINOR INJURIES. THE FIRST CAR TO DERAIL HAD CLIMBED OVER THE OUTSIDE RAIL IN THE CURVE. THIS CAR REPORTEDLY HAD EXCESSIVE SIDE BEARING CLEARANCE THAT HAD NOT BEEN DETECTED.

BRIEF OF ACCIDENT, continued

File No. - 61

06/11/88

COLUMBUS, OH

Time (Lcl) - 1215 EDT

Occurrence #1 - DERAILMENT, INITIAL
Phase - ACCELERATING

Finding(s)

1. SIDE BEARING CLEARANCE - EXCESSIVE
2. EQUIPMENT INSPECTION - IMPROPER - CARMAN
3. VISUAL/AURAL PERCEPTION - CARMAN
4. INADEQUATE METHOD OF COMPLIANCE/NO RECORDKEEPING - COMPANY OPERATOR/MGMT

Occurrence #2 - DERAILMENT, GENERAL
Phase - ACCELERATING

Occurrence #3 - HAZARDOUS MATERIALS LEAK/SPILL (FUMES/SMOKE)
Phase - STOPPING

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---Probable Cause---

The National Transportation Safety Board determines that the probable Cause(s) of this accident is/are finding(s) 1

Factor(s) relating to this accident is/are finding(s) 2

APPENDIX D

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

APPENDIX D

NTSB # ATL88FRZ19

BRIEF OF ACCIDENT

RUNDATE: 03/23/90

File No. - 67

06/22/88

CROFTON, KY

Time (Lcl) - 1820 CDT

---Basic Information---

Reporting Railroad - CSX	Property Losses	Injuries			
Type of Accident - DERAILMENT	Railroad - \$ 861,265.00	Fatal	Serious	Minor	None
Operating Phase - EN ROUTE	Non-Railroad - \$ 300,000.00	Employees 0	0	0	3
Method of Operation - TRAFFIC CONTROL	Fire - NO	Passengers 0	0	0	0
TIMETABLE		Motorist 0	0	0	0
		Other 0	12	181	0

CSX - CSX TRANSPORTATION

---Railroad/Personnel Information---

Train Data	Train Consist/Damage	Crew Information
Railroad - CSX	No. Loco. Units - 3	Front End - 3
Type of Train - FREIGHT	No. Cars/Caboose - 121/0	Rear End - 0
Train ID - EXTRA 6742 NORTH	End of Train Monitor - MARKER	Toxicology Performed - YES
Direction - NORTH	Length (Feet) - 6625	Radio Communications
Speed (Est.) - 35	Trailing Tons - 5827	Radio Available - YES
Speed (Auth.) - 10	Loco. Destroy/Derailed - N/A	Operational - YES
	Cars Destroy/Derailed - 15/37	

CSX - CSX TRANSPORTATION

---Environment/Operations Information---

Weather Data	Itinerary	Hazardous Materials
Weather Condition - CLEAR	Last Departure Point	Involved - YES
Condition of Light - DAYLIGHT	NASHVILLE, TN	Cars Involved - 4
	Destination	Track Information
Evacuation - YES	EVANSVILLE, IN	Type/No. of Tracks - MAIN/1
		Gradient - DES. 0.60
		Alignment - CURVE 4 0 0 M

---Narrative---

CSX FREIGHT TRAIN EXTRA 6742 NORTH, TRAVELING 35 MPH, HAD 36 CARS DERAIL. ONE OF THE DERAILED CARS WAS A TANK CAR CONTAINING WHITE PHOSPHORUS THAT BREACHED, SPILLED SOME PRODUCT, AND IGNITED. AN INITIAL EVACUATION OF 75 FAMILIES WAS INCREASED TO INCLUDE ABOUT 2000 PERSONS WHEN A TOXIC CLOUD FORMED AND MOVED NORTHWARD. 193 PERSONS CLAIMED INJURIES FROM SMOKE INHALATION, EYE IRRITATION, AND RESPIRATORY COMPLAINTS. A 10 MPH SPEED RESTRICTION (DUE TO TRACK CONDITIONS) IN THE AREA OF THE DERAILMENT WAS NOT COMPLIED WITH. THE MESSAGE INFORMING THE CREW OF THIS CONDITION WAS CLEARLY MISSING FROM THE BULLETIN. THE CREW DID NOT CHECK WITH THE DISPATCHER ABOUT THE MISSING MESSAGE, WHICH THEY ARE REQUIRED TO DO. THERE WAS A NEW CENTRALIZED DISPATCHING SYSTEM GOVERNING THIS AREA THAT HAD ONLY BEEN IN EFFECT FOR LESS THAN 2 WEEKS. IT CONSISTED OF A SYSTEM OF COMPUTER TRANSMITTED MESSAGES AND BULLETINS.

BRIEF OF ACCIDENT, continued

File No. - 67

06/22/88

CROFTON, KY

Time (Lcl) - 1820 CDT

Occurrence #1 - TRACK COMPONENT SYSTEM/FAILURE/MALFUNCTION
Phase - UNKNOWN

Finding(s)

1. ALIGNMENT - IRREGULAR

Occurrence #2 - DERAILMENT
Phase - SLOWING

Finding(s)

2. EXTRA TRAIN - OVERSPEED
3. BULLETIN/MESSAGE - NOT COMPLIED - ROAD FREIGHT ENGINEER/MOTORMAN (through freight)
4. BULLETIN/MESSAGE - NOT OBTAINED - ENTIRE TRAIN CREW
5. INATTENTIVE - ROAD FREIGHT CONDUCTOR (through freight)
6. INATTENTIVE - ROAD FREIGHT BRAKEMAN/FLAGMAN (through freight)

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Occurrence #3 - FIRE
Phase - STOPPING

Finding(s)

7. DOME - BREACHED

---Probable Cause---

The National Transportation Safety Board determines that the probable Cause(s) of this accident is/are finding(s) 2, 3, 5, 6

Factor(s) relating to this accident is/are finding(s) 1, 4

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

APPENDIX D

NTSB # FTW88FRZ23

BRIEF OF ACCIDENT

RUNDATE: 09/05/90

File No. - 72

07/22/88

DEER PARK, TX

Time (Lcl) - 0025 CDT

---Basic Information---

Reporting Railroad - PTRA	Property Losses		Injuries			
Type of Accident - EXPLOSION	Railroad - \$ 222,000.00	Employees	Fatal	Serious	Minor	None
Operating Phase - STANDING	Non-Railroad - \$ 33,000.00	Passengers	0	0	0	0
Method of Operation - YARD RULES	Fire - NO	Motorist	0	0	0	0
		Other	0	0	0	0

PTRA - PORT TERMINAL RAILROAD ASSOCIATION

---Railroad/Personnel Information---

Train Data	Train Consist/Damage	Crew Information
Railroad - PTRA	No. Loco. Units - 0	Front End - 0
Type of Train - SINGLE CAR	No. Cars/Caboose - 1/0	Rear End - 0
Train ID - N/A	End of Train Monitor - NO	Toxicology Performed - NO
Direction - N/A	Length (Feet) - 50	Radio Communications
Speed (Est.) - 0	Trailing Tons - 123	Radio Available - NO
Speed (Auth.) - 0	Loco. Destroy/Derailed - N/A	Operational - N/A
	Cars Destroy/Derailed - 1/4	

PTRA - PORT TERMINAL RAILROAD ASSOCIATION

---Environment/Operations Information---

Weather Data	Itinerary	Hazardous Materials
Weather Condition - CLOUDY	Last Departure Point	Involved - YES
Condition of Light - DARK	DEER PARK, TX	Cars Involved - 1
	Destination	Track Information
	DEER PARK, TX	Type/No. of Tracks - INDUSTRIAL/9
Evacuation - NO		Gradient - LEVEL
		Alignment - TANGENT

---Narrative---

AN UNATTENDED TANK CAR LOADED WITH ACID WASHED METHACRYLIC ACID STANDING ON AN INDUSTRIAL YARD TRACK VIOLENTLY RUPTURED. ROCKETING PARTS OF THE CAR AS FAR AS 1,000 FEET AWAY. AN EARLIER LABORATORY TEST REVEALED THAT AN INHIBITOR CONCENTRATION IN THE ACID WAS 15 PARTS PER MILLION (PPM). FOR EXPORT SHIPMENT, INHIBITOR CONCENTRATION MUST BE ABOUT 300 PPM. DUE TO VERBAL MISUNDERSTANDING, ADDITIONAL INHIBITOR WAS NOT ADDED. TWO DAYS LATER THE PRODUCT WAS TESTED AGAIN REVEALING AN INHIBITOR CONCENTRATION OF 0.0 PPM. EMPLOYEES CONSIDERED THIS TO BE A BAD TEST, SO NO ADDITIONAL INHIBITOR WAS ADDED. ABOUT 7 1/2 DAYS AFTER THE SECOND LABORATORY TEST, THE CAR BEGAN TO VENT VAPOR FROM THE PRESSURE RELIEF VALVE WHILE STANDING IN A REMOTE STORAGE YARD INSIDE THE R&H PLANT. EMERGENCY ACTION WAS TAKEN TO DISPERSE THE VAPORS AND KEEP THE CAR COOL, AND TO MINIMIZE DAMAGE IF THE CAR RUPTURED. THE CARGO BEGAN TO POLYMERIZE, RESULTING IN THE EXPLOSION, DERAILING 3 OTHER CARS. NEARBY POWER LINES WERE CUT OFF BY FLYING TANK CAR PARTS.

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BRIEF OF ACCIDENT, continued

File No. - 72

07/22/88

DEER PARK, TX

Time (Lcl) - 0025 CDT

Occurrence #1 - HAZARDOUS MATERIALS LEAK/SPILL (FUMES/SMOKE)
Phase - STANDING

Finding(s)

1. SPECIAL INSTRUCTIONS - DISREGARDED - SHIPPER
2. INADEQUATE PROCEDURE - MANUFACTURER
3. INADEQUATE SURVEILLANCE OF OPERATION - MANUFACTURER
4. INADEQUATE PROCEDURE - SERVICE ATTENDANT
5. INFORMATION UNCLEAR (phraseology) - MANUFACTURER
6. INADEQUATE SUBSTANTIATION PROCESS - MANUFACTURER

Occurrence #2 - RUPTURE OF TANK CAR
Phase - STANDING

Finding(s)

7. CARGO - DETERIORATED
8. CARGO - OVERHEATED
9. CARGO - PRESSURE EXCESSIVE

---Probable Cause---

The National Transportation Safety Board determines that the probable Cause(s) of this accident is/are finding(s) 1, 2, 7, 8, 9

Factor(s) relating to this accident is/are finding(s) 3, 4, 5

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APPENDIX D

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

APPENDIX D

NTSB # DEN88FRZ17

BRIEF OF ACCIDENT

RUNDATE: 03/23/90

File No. - 73

07/22/88

FARNUM, NE

Time (Lcl) - 1645 CDT

---Basic Information---

Reporting Railroad - BN	Property Losses	Injuries			
Type of Accident - HIGHWAY CROSSING	Railroad - \$ 28,800.00	Fatal	Serious	Minor	None
Operating Phase - EN ROUTE	Non-Railroad - \$ 60,000.00	Employees 0	0	0	4
Method of Operation - MANUAL BLOCKS	Fire - NO	Passengers 0	0	0	0
TIMETABLE		Motorist 0	1	0	0
		Other 0	0	0	0

BN - BURLINGTON NORTHERN RAILROAD COMPANY

---Railroad/Personnel Information---

Train Data	Train Consist/Damage	Crew Information
Railroad - BN	No. Loco. Units - 2	Front End - 4
Type of Train - FREIGHT	No. Cars/Caboose - 3/0	Rear End - 0
Train ID - EXTRA 2348 WEST	End of Train Monitor - MONITOR	Toxicology Performed - NO
Direction - WEST	Length (Feet) - 315	Radio Communications
Speed (Est.) - 30	Trailing Tons - 390	Radio Available - YES
Speed (Auth.) - 30	Loco. Destroy/Derailed - 0/2	Operations - YES
	Cars Destroy/Derailed - 0/3	

BN - BURLINGTON NORTHERN RAILROAD COMPANY

---Environment/Operations Information---

Weather Data	Itinerary	Hazardous Materials
Weather Condition - CLEAR	Last Departure Point	Involved - YES
Condition of Light - DAYLIGHT	HOLDREGE, NE	Cars Involved - 2
	Destination	Track Information
Evacuation - NO	CURTIS, NE	Type/No. of Tracks - MAIN/1
		Gradient - DES. 0.60
		Alignment - TANGENT

---Narrative---

EXTRA 2348 WEST, A TRIWEEKLY LOCAL FREIGHT TRAIN, WAS STRUCK BY A TRACTOR/SEMI-TRAILER AT A CROSSBUCK MARKED GRADE CROSSING ON NEBRASKA STATE HIGHWAY NO. 23, TWO MILES WEST OF FARNUM, NE. TWO LOCOMOTIVES AND THREE CARS WERE DERAILED AND THE TRACTOR/SEMI-TRAILER WAS DESTROYED. THE TRUCK DRIVER WAS SERIOUSLY INJURED. TWO OF THE DERAILED CARS CONTAINED ANHYDROUS AMMONIA THAT DID NOT LEAK. THE FUEL TANK ON THE 2348 WAS RUPTURED SPILLING ABOUT 2000 GALLONS OF DIESEL FUEL. THE TRUCK DRIVER HAD JUST COME OVER THE CREST OF A HILL, WHICH LIMITED HIS LINE OF SIGHT, NEAR THE GRADE CROSSING AND HAD IGNORED THE ADVANCE WARNING SIGN.