BEFORE THE
PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION
U.S. DEPARTMENT OF TRANSPORTATION

Advance Notice of Proposed Rulemaking

Hazardous Materials:
Rail Petitions and Recommendations To Improve the
Safety of Railroad Tank Car Transportation

PHMSA-2012-0082 (HM-251)
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Comments of the Natural Resources Defense Council,
Sierra Club and Oil Change International on behalf of

Earthjustice
ForestEthics
Public Citizen
Friends of the Earth
Spokane Riverkeeper
Columbia Riverkeeper
Puget Soundkeeper Alliance
Friends of Grays Harbor
Natural Resources Council of Maine
Benicia Good Neighbor Steering Committee
Community In-power and Development Association
Vermont Chapter of the Sierra Club
Audubon Society of New Hampshire

Submitted December 5, 2013

I. INTRODUCTION

These comments are submitted, in response to the above-captioned Advance Notice of Proposed Rulemaking by the Sierra Club, Oil Change International and the Natural Resources Defense Council on behalf of their millions of members and active supporters, and on behalf of Earthjustice, ForestEthics, Public Citizen, Friends of the Earth, Spokane Riverkeeper, Columbia Riverkeeper, Puget Soundkeeper Alliance, Friends of Grays Harbor, Natural Resources Council of Maine, Benicia Good Neighbor Steering Committee, Community In-power and Development

Association, Vermont Chapter of the Sierra Club and Audubon Society of New Hampshire. These comments respond to: (1) Petitions P-1577, P-1587, P-1595 (regarding retrofitting of DOT-111 tank cars) and (2) the invitation of the Pipeline and Hazardous Materials Safety Administration ("PHMSA") to address whether other "operations enhancements" are called for in the context of rail shipments of crude oil.

II. BACKGROUND

Crude Oil, particularly fracked crude, is highly toxic and dangerous

Crude oil is a hazardous material as defined by the U.S. Department of Transportation.[1] Notably, crude has certain properties that make it uniquely dangerous. First, it is a liquid that can migrate away from the site of an accident or other release and travel into communities, down waterways, and the like. Crude oil is also generally less flammable than other hazardous liquids (like ethanol and gasoline), meaning that it is more likely to migrate some distance before reaching an ignition source and catching fire.[2]

Unlike other liquids transported by rail, unrefined crude oil contains a wide range of contaminants: sulfur and arsenic; toxic metals like mercury, nickel, and vanadium; organic compounds like phenols, ketones and carboxylic acids.[3] Hydraulic fracturing, or "fracking" contributes an additional suite of contaminants, including hydrochloric acid and in some cases hydrogen sulfide. [4] Indeed, the Federal Railroad Administration has observed "an increasing number of incidents involving damage to tank cars in crude oil service in the form of severe corrosion of the internal surface of the tank, manway covers, and valves and fittings," and suggested that this may involve contaminated oil.[5]

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[1] 49 C.F.R. § 172.101. Hazardous materials are materials that have been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce 49 C.F.R. § 171.8.

[2] *See* BP West Coast Products LLC, "Material Safety Data Sheet – Crude Oil," http://oilspill.fsu.edu/images/pdfs/msds-crude-oil.pdf, May 13, 2002. (flash point of 20° - 90° F).

[3] *See* U.S. EPA, "Screening-Level Hazard Characterization, Crude Oil Category," http://www.epa.gov/chemrtk/hpvis/hazchar/Category_Crude%20Oil_March_2011.pdf March, 2011.

[4] *Enbridge Pipelines (North Dakota), LLC*, FERC Docket No. IS13-273-000, 2013. (FERC order granting pipeline operator authority to reject certain Bakken crude oil supplies, due to evidence that hydrogen sulfide levels can rise to dangerous or even lethal levels.). See also Abrams, L., "*Fracking chemicals may be making oil more dangerous,"* http://www.salon.com/2013/08/13/fracking_chemicals_may_be_making_oil_more_dangerous/ , August 13, 2013.

[5] *See* Herrmann, T., FRA, Letter to Jack Gerard, American Petroleum Institute, July 29, 2013 at 4 (reproduced in Attachment 1).

North American crude production is increasing exponentially, with a corresponding boom in shipments of crude-by-rail

Domestic crude oil production is undergoing a major boom, chiefly because of the increase in fracking. U.S. Energy Information Administration ("EIA") Administrator Adam Sieminski recently testified that:

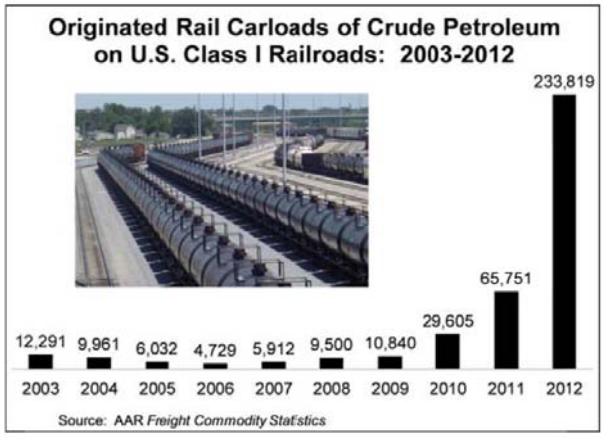
> Domestic oil production in the United States has increased significantly, and at 7.4 million barrels per day as of April 2013 is now at the highest level since October 1992. Over the five year period through calendar year 2012, domestic oil production increased by 1.5 million barrels per day, or 30%. Most of that growth occurred over the past 3 years. Lower 48 onshore production (total U.S. Lower 48 production minus production from the federal Gulf of Mexico and federal Pacific) rose more than 2 million barrels per day (bbl/d), or 64%, between February 2010 and February 2013, *primarily because of a rise in productivity from oil-bearing, low-permeability rocks.*[6]

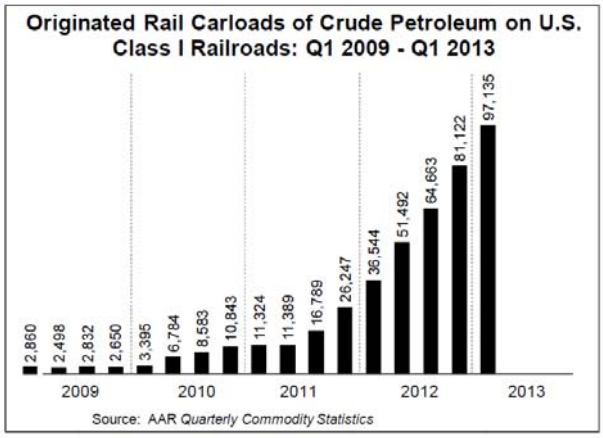
This dramatic increase in production has caused a corresponding boom in crude-by-rail. In May 2013, AAR profiled how crude production and crude-by-rail are undergoing twin booms:

> Historically, most crude oil has been transported via pipelines. However, in places like North Dakota that have seen huge recent increases in crude oil production, the existing crude oil pipeline network lacks the capacity to handle the higher volumes being produced. Pipelines also lack the operational flexibility and geographic reach to serve many potential markets. Railroads, though, have capacity, flexibility, and reach to fill the gap.
>
> Small amounts of crude oil have long been transported by rail, but since 2009 the increase in rail crude oil movements has been enormous. As recently as 2008, U.S. Class I railroads (including the U.S. Class I subsidiaries of Canadian railroads) originated just 9,500 carloads of crude oil. By 2011, carloads originated were up to nearly 66,000, and in 2012 they surged to nearly 234,000. Continued large increases are expected in 2013. In the first quarter of 2013, Class I railroads originated a record 97,135 carloads of crude oil, 20 percent higher than the 81,122 carloads originated in the fourth quarter of 2012 and 166 percent higher than the 36,544 carloads originated in the first quarter of 2012.
>
> Crude oil accounted for 0.8 percent of total Class I carload originations for all of 2012, 1.1 percent in the fourth quarter of 2012, and 1.4 percent in the first quarter of 2013. It was just 0.03 percent in 2008.

[6] *Hearings Before the Committee on Energy and Natural Resources, U. S. Senate*, July 16, 2013 (Statement of EIA Administrator Sieminski, at 2).

Figure 1: The growth of rail as a means of crude transport





[…]

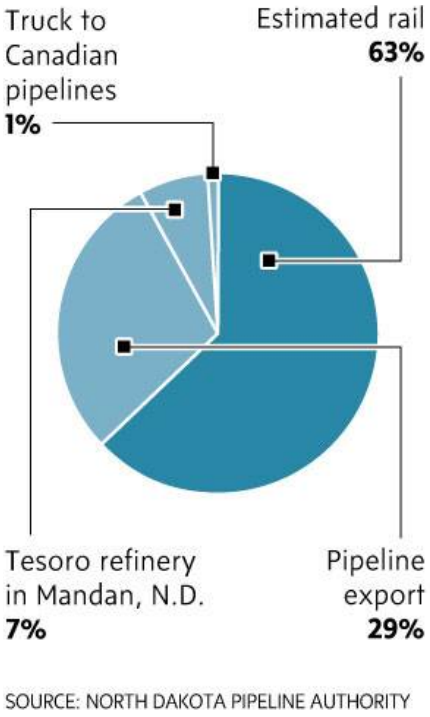
> Assuming, for the sake of simplicity, that each rail tank car holds about 30,000 gallons (714 barrels) of crude oil, the 97,135 carloads originated in the first quarter of 2013 equal approximately 762,000 barrels per day moving by rail. As a point of reference, according to EIA data, total U.S. domestic crude oil production was approximately 7.1 million barrels per day, so the rail share is around 11 percent – up from a negligible percentage a few years ago. [7]

As also noted by AAR, "North Dakota, and the Bakken region more generally, have accounted for the vast majority of new crude oil originations."[8] During 2013, crude-by-rail shipments out of North Dakota have fluctuated between 600,000 to 700,000 barrels per day, transporting 61-75% of total Bakken production: [9]

[7] American Association of Railroads, "Moving Crude Petroleum by Rail," https://www.aar.org/keyissues/Documents/Background-Papers/Crude-oil-by-rail.pdf May 2013, at 3-5.
[8] Id., p. 5.
[9] See North Dakota Pipeline Authority http://northdakotapipelines.com/directors-cut/ Monthly Updates for April 2013-November 2013 (February 2013-September 2013 data); "How oil is transported from North Dakota's Williston Basin," The Globe and Mail, http://www.theglobeandmail.com/news/national/how-oil-is-transported-from-north-dakotas-williston-basin/article15711682/ December 2, 2013.

Figure 2: The growth of rail in transporting crude oil from the Bakken

How Crude is Transported (September 2013) Williston Basin Oil Output



ND Oil Export Volumes by Rail (June 2008-September 2013) High-Low Estimates[10]

As shown in the data from North Dakota[11] and AAR,[12] crude-by-rail volumes increased rapidly from 2009 into the second quarter of 2013, then dipped for several months as a result of crude pricing that encouraged a shift to pipeline transport. [13] Later in 2013, pricing was again

[10] Rail volumes are estimated as a range based on estimates of total crude production, less volumes to pipeline, truck, and local refining. http://northdakotapipelines.com/rail-transportation

[11] See Figure 2 and North Dakota Pipeline Authority. Ibid.

[12] U.S. Class I railroads (including the U.S. Class I subsidiaries of Canadian railroads) originated 108,605 carloads of crude oil in the second quarter of 2013 (12 percent higher than the 97,135 carloads in the first quarter) and 93,312 carloads in the third quarter. See American Association of Railroads, "AAR Reports Record Second Quarter Crude-by-Rail Data; Decreased Weekly Rail Traffic," https://www.aar.org/newsandevents/Freight-Rail-Traffic/Pages/2013-08-29-railtraffic.aspx August 29, 2013; "AAR Reports October and Weekly Rail Traffic Gains, 3Q Crude Oil Up Year Over Year," https://www.aar.org/newsandevents/Freight-Rail-Traffic/Pages/2013-11-07-railtraffic.aspx November 7, 2013.

[13] Fielden, Sandy, RBN Energy, "On the Rails Again? – Bakken Crude Rail Shipments Return to April Highs." http://www.rbnenergy.com/on-the-rails-again-bakken-crude-rail-shipments-return-to-april-highs October 30, 2013. See also Figure 1

favorable for rail and crude production continues to increase, such that crude-by-rail volumes have rebounded.[14]

Unit Trains account for most of the expansion in crude-by-rail

Unit trains are long freight trains composed of at least 50 and sometimes 100 or more cars used to transport single bulk products between two points. Unit trains are unloaded on arrival and returned for another load. Unit trains cut costs (and save time) by eliminating the need for intermediate yarding and switching between origin and destination.[15]

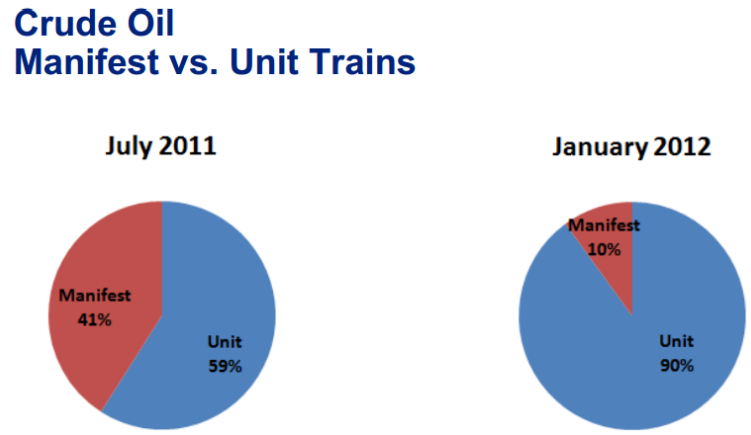
These cost savings, combined with the boom in mid-continent production of crude oil have driven a corresponding boom in the construction of rail terminals designed to handle unit trains. According to one recent industry analysis:

> The number of rail terminals in producing regions loading crude oil onto rail tank cars has increased from a handful at the end of 2011 to 88 and growing today. A further 66 crude oil unloading terminals have been built or are under construction.[16]

Various industry reports indicate that unit trains account for the vast majority of the recent boom in crude-by-rail transportation. A presentation by Union Pacific at a recent industry conference offered one example of the central role unit trains have played in recent years:[17]

[14] Ibid. See also Figure 2.
[15] AAR May 2013. Ibid, at.7; Titterton, Paul, GATX, "Crude Oil Tank Cars: Economics, Specification, Supply, Regulation, and Risk," http://www.crude-by-rail-destinations-summit.com/media/downloads/127-paul-titterton-vice-president-and-group-executive-fleet-management-marketing-and-government-affairs.pdf February 27, 2013, at 5.
[16] Fielden, Sandy, RBN Energy, "Crude Loves Rock'n Rail," http://www.rbnenergy.com/154-terminals-operating-bnsf-the-dominant-railroad May 12, 2013.
[17] The full presentation is included as Attachment 2.

Figure 3: Slide from a presentation by Craig Johnson, Gen. Director – CTS, Union Pacific Railway at the Crude-in-Motion Conference 2013



Reliable information on the total number of unit trains currently transporting crude oil are hard to find. But a reasonable estimate is that there are now on the order of 200 unit trains operating in the U.S. rail system.[18] At any time, about 100 trains (half of the total) are transporting crude from loading to unloading facilities; the other 100 trains are returning for another load of crude, so tank cars are empty (or backhauling another commodity such as condensate/diluent). Significant amounts of crude oil continue to be moved in non-unit train shipments, so there are also sizable numbers of manifest trains transporting crude oil tank cars.[19]

Accidents and releases of crude-by-rail have jumped proportionally

Predictably, the rise in crude transportation by rail has resulted in soaring numbers of crude oil releases to the environment in the form of both accidents and "non-accident" releases such as leaks. PHMSA incident records underscore these growing risks. The number of incidents" involving crude oil transportation by rail are as follows:

2009: 0
2010: 9
2011: 34

[18] In 2013, the crude fleet is estimated to be in the order of 30,000 tank cars, providing a crude-by-rail capability in North America of at least 1 million barrels per day. (Paul Titterton. Ibid at 12-13). Assuming two-thirds of the crude fleet is in U.S. unit trains (with the remainder of cars in manifest trains, Canada, and out of service for bad orders/etc.) and 100 cars per train, there would in the order of 20,000 tank cars comprising 200 unit trains.

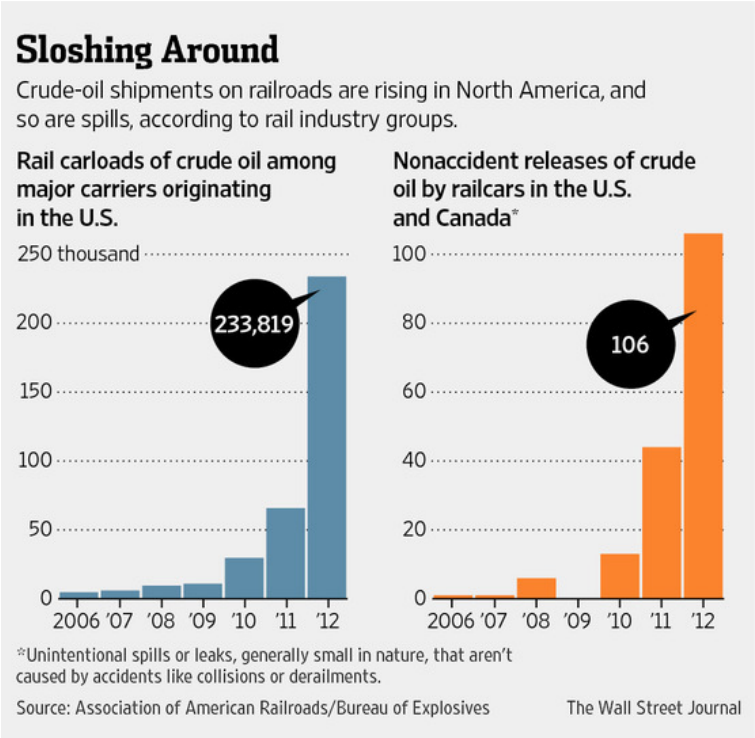
The above estimate for number of unit trains is consistent with assuming that 11 unit trains are loaded daily with an average turn time of 18 days (11 trains x 18 days per roundtrip = 198 unit trains). Available information (see sources in footnotes 7-18) indicates that 10+ unit trains are loaded daily, with turn times up to 20+ days.

[19] AAR May 2013. Ibid, at.7.

2012: 86
2013: 85 (partial)[20]

Similar statistics were published by the Wall Street Journal, based on data generated by the Association of American Railroads ("AAR"):[21]

Figure 4: Industry shipment and incident reports



Unfortunately, the surge of incidents and releases has not been matched by an increase in the resources available to responders and regulators. The same has been true in Canada.[22]

Lac-Mégantic

On July 5, 2013, a train hauling 72 tanker cars loaded with 2.0 million gallons of crude from the Bakken shale oil field in North Dakota slammed into Lac-Mégantic, a town of 6,000

[20] Data derived from PHMSA incident reports - http://www.phmsa.dot.gov/hazmat/library/data-stats/incidents.
[21] The Wall Street Journal, "Officials Tighten Crude-Shipping Standards," http://online.wsj.com/news/articles/SB10001424127887323838204578654463632065372 Aug. 7, 2013.
[22] Budget reductions for Canada's rail safety and hazardous materials transportation program are reviewed in Canadian Centre for Policy Alternatives, *The Lac-Mégantic Disaster* (October, 2013) at 9.

located in Quebec. Owned by an American company – Montreal, Maine and Atlantic Railway – the train had only a single staffer, who abandoned the train in order to sleep in a motel before a replacement crew arrived to complete the train's journey to an oil refinery on Canada's east coast. The brakes on the five-locomotive train malfunctioned, and it began a seven-mile roll toward the small town. Reaching a speed in excess of 60 m.p.h, the train reached a bend in the tracks, derailing and dumping 1.6 million gallons of its contents, which caught fire and incinerated dozens of buildings. Forty-seven people were killed.[23]

Figure 5: Post-accident aerial photo of Lac- Mégantic (Reuters)

Information regarding the Lac-Mégantic accident is provided in Attachment 3, "Analysis of the Potential Costs of Accidents/Spills Related to Crude by Rail."[24] This analysis demonstrates that the costs of crude-by-rail accidents/spills can be very large, and that a major unit train accident/spill could cost $1 billion or more for a single event.

As explained in Attachment 3, the Lac-Mégantic rail accident/spill will likely have costs on the order of $500 million to $1 billion excluding any civil or criminal damages. Costs/damages for a similar incident could have been substantially higher had it occurred in a more populated area. Lac-Mégantic is also relevant in that it shows how an accident involving highly flammable light crude (such as the Bakken crude) can have devastating consequences even in a small town in terms of loss of human life and widespread explosion and fire damage to surrounding property.

Attachment 3 also analyzes the spill of tar sands dilbit from Enbridge's Line 6B in Marshall, Michigan: This rupture in 2010 had costs of about $1 billion for Enbridge. The spill volumes at Marshall (840,000 gallons) were within the range of the amount of spill possible

[23] Transportation Safety Board of Canada, "Railway Investigation R13D0054," http://www.bst-tsb.gc.ca/eng/enquetes-investigations/rail/2013/R13D0054/R13D0054.asp#sal September 11, 2013.

[24] This analysis was prepared by The Goodman Group, Ltd, a consulting firm specializing in energy and regulatory economics, on behalf of Oil Change International.

(and, in fact, substantially less than the maximum spill) if a crude by rail unit train released much of its cargo. Costs/damages for similar incident could have also been substantially higher had it occurred in a more populated area. Marshall is also relevant in showing the high potential cost of dilbit spills into water (and rail lines are often highly proximate to water).

Alabama

On November 8, 2013, a 90-car unit train carrying 2.7 million gallons of crude oil derailed and exploded in a rural wetland in western Alabama, spilling crude oil into the surrounding wetlands and igniting a fire that burned for several days.[25] No injuries resulted from the accident, but a similar accident in a more populated location would certainly have caused serious risk to public safety.

Figure 6: Aerial photo of Alabama derailment and explosion (Reuters)

Crude oil is a security risk

The explosions in Lac-Megantic and Alabama were accidents, but they could easily have been created by terrorists. The fact that terrorists haven't yet targeted rail tank cars carrying crude oil doesn't mean it won't occur in the future. The recent Canadian accidents demonstrate the amount of death and destruction that can happen if a rail tank car overturns. Terrorists will have read about these accidents. Without any additional security precautions, crude oil tank cars will be seen as a soft target for an attack.

[25] Karlamangla, Soumya, "Train in Alabama oil spill was carrying 2.7 million gallons of crude." Los Angeles Times, http://www.latimes.com/nation/nationnow/la-na-nn-train-crash-alabama-oil-20131109,0,780637.story November 9, 2013.

Community Emergency Preparedness Response

When a crude oil spill occurs, local response assets are generally the first ones on scene. These assets will include those provided by police departments, fire fighters, and emergency managers. Many times however, these response individuals are unaware of the nature of, and the threat posed by the materials that are being transported through their communities.

Congress, recognizing a gap in communication, mandated in the "9/11 Act"[26] that rail companies transporting security sensitive materials, including toxic-by-inhalation materials, but not including crude oil, improve communication with local officials. Rail carriers are now required to identify a point of contact and to provide information to (1) state and/or regional "Fusion Centers" that have been established to coordinate with state, local and tribal officials on security issues and which are located within the area encompassed by the rail carrier's rail system; and (2) state, local, and tribal officials in jurisdictions that may be affected by a rail carrier's routing decisions and who directly contact the railroad to discuss routing decisions.[27] This knowledge enables local communities to have a better understanding of what is being transported near their homes and schools.

According to the mandate of the 9/11 Act, rail carriers transporting security sensitive materials are required to select lower-risk routes, based on an analysis of the safety and security risks presented various routes, railroad storage facilities and proximity of high-consequence targets along the route. The results of this analysis could dictate the rerouting of the security sensitive materials to other locations

Crude oil is not currently defined as "security sensitive" so the additional reporting requirement does not apply to rail carriers transporting crude oil, despite its obvious hazards.

The lack of regulatory guidance on communication about the movement of crude oil via rail with local officials, neighbors and local businesses is inconsistent with the Administration's initiatives goal to improve preparedness. President Obama issued a proclamation on August 30, 2013 stating that September 2013 was National Preparedness Month. In this document, the President also stated that Americans should "refocus our efforts on readying ourselves, our families, our neighborhoods, and our Nation for any crisis we may face." Additionally he directed the Federal Emergency Management Agency to "launch a comprehensive campaign to build and sustain national preparedness with private sector, non-profit, and community leaders and all levels of government."[28] Private sector and community preparedness can't occur if the federal government fails to require the disclosure of information that could help communities become more prepared.

The failure to share information also contradicts the mission of the Citizen Corps, a

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[26] Implementing Recommendations of the 9/11 Commission Act of 2007, Pub. L. 110-53; 121 Stat. 266.
[27] http://www.gpo.gov/fdsys/pkg/FR-2008-11-26/html/E8-27826.htm.
[28] http://community.fema.gov/gf2.ti/f/280514/8233733.1/PDF/-/Presidential_Proclamation__National_Preparedness_Month_2013.pdf

FEMA-managed initiative. Its mission "is to harness the power of every individual through education, training, and volunteer service to make communities safer, stronger, and better prepared to respond to the threats of terrorism, crime, public health issues, and disasters of all kinds." http://www.ready.gov/citizen-corps. Disasters of all kinds include spills created by overturned rail tank cars carrying crude oil.

FEMA released a report on the Citizen Corps in September 2012. In this document entitled "Citizen Corps Councils Registration and Profile Data FY2011 National Report," FEMA Administrator Fugate stated that the Citizen Corps Councils provide "'the table'" for collaboration to "(i)ntegrate whole community representatives with emergency managers to ensure disaster preparedness and response planning represents the whole community and integrates nontraditional resources."[29] Again, without access to accurate information, the whole community is unable to adequately plan and integrate resources for disaster response and preparedness in line with FEMA objectives.

Finally, the failure to share information also contradicts recommendations provided by former Director of EPA's Office of Emergency Management Deborah Dietrich regarding coordination between the Citizen Corps and Local Emergency Planning Committees (LEPC). Ms. Dietrich sent an August 2009 letter to all State Emergency Response Commission (SERC) Chairs recommending that all LEPCs work more closely with the Citizen Corps regarding the Emergency Planning and Community Right to Know Act of 1986 (EPCRA). She told them to consider "whether working more closely with the Citizen Corps could make your EPCRA and RMP work more effective."[30] Without basic knowledge about crude oil moving through their communities by rail, these planning committees are unable to accomplish their intended goal.

Safety Rules Are Out of Date

When the 9/11 Act was enacted in 2007, just 5,897 carloads of crude petroleum originated on U.S. Class I railroads. Last year, that number grew to 233,819 carloads – a growth of more than 3865%.[31] In 2013, that number has grown again, totaling 299,052 through the first 3 quarters (averaging about 100,000 per quarter). Assuming volumes will be similar in the fourth quarter, there will be about 400,000 carloads for all of 2013 – a growth of about 6700% relative to carloads in 2007.[32] This exponential growth in unit shipments of crude by rail and associated incidents, as well as the recent Lac-Mégantic disaster, compel the conclusion that unit shipments of crude oil demand enhanced safety standards and should be subjected to the re-routing standards as "security sensitive" materials as set forth in the 9/11 Act.

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[29] FEMA, "Citizen Corps Councils Registration and Profile Data FY2011 National Report," https://s3-us-gov-west-1.amazonaws.com/dam-production/uploads/20130726-1854-25045-2121/citizen_corps_councils_final_report_9_27_2012.pdf. September 2012.
[30] Dietrich, Deborah, Letter to SERC Chairpersons, ftp://tbrpc.org/dri/Documents/LEPC/MISCELLANEOUS/EPA's%20EPCRA%20Letter.pdf. August 20, 2009.
[31] AAR May 2013. Ibid
[32] AAR August 29, 2013. Ibid; AAR November 7, 2013. Ibid.

III. SPECIFIC COMMENTS

A. The Existing Fleet of DOT-111 Tank Cars Needs to Be Replaced or Upgraded

As has been acknowledged by the AAR, the existing fleet of DOT-111 tank cars is simply unsafe for transporting crude oil or other hazardous materials. This is evident from Petition P-1577, in which the AAR calls for higher construction standards for this class of rolling stock. Among many other deficiencies, the head and shells of DOT-111s are paper thin, and they lack many other vital safety features, such as head shields and protection for top fittings.

Rail tank cars should be able to withstand "rollover" accidents. But when DOT-111s are involved in accidents, even at low speeds, almost all of the tank cars rupture and release their contents. This was documented by the National Transportation Safety Board ("NTSB") in its "Cherry Valley accident report," cited in the ANPR. In that low-speed accident (36 mph), 13 of 15 tank cars ruptured. *Ibid*. at 76. The NTSB noted that similar disastrous failure rates had been observed in other accidents (New Brighton, PA – 12 of 23 cars were breached; Arcadia, OH – 28 of 32 were breached). *Ibid*.

These dangerous deficiencies, and the many lethal consequences thereof, have been the status quo for decades. More than 25 years ago, the NTSB wrote to the U.S. Department of Transportation's ("USDOT's") Research and Special Programs Administration, complaining that the then-existing standards for tank cars were inadequate for transporting hazardous materials. In a 1991 study the NTSB noted that in a series of hazmat-by-rail accidents in 1988, 54 percent of DOT-111s were destroyed, twice the percentage of DOT-112s and other models. See Attachment 4. The NTSB again scolded: "The inadequacy of the protection provided by DOT-111A tank cars has been evident for many years in accidents investigated by the Safety Board." Ibid. at p. 11.

B. PHMSA Should Accept the AAR's Recommendation to Phase Out Substandard Tankers.

In its November 14, 2013 comments to PHMSA, the AAR reversed its position regarding the retrofit of the existing DOT-111 fleet and now concedes that new and existing DOT-111s should be held to higher standards. This meets with the longstanding recommendation of the NTSB to apply upgraded safety standards to the entire existing fleet, retroactively. *See* the 1988 NTSB letter included in Attachment 5, at "171," in which the Safety Board urged USDOT to:

> "Establish a specific date by which the 'grandfather clauses' no longer permit hazardous materials to be transported in railroad tank cars that do not meet present safety requirements."

Given the imminent and significant risk to public safety and the environment posed by the growth in crude oil transportation by unit trains containing unsafe tankers, we encourage PHMSA to follow the recommendations of AAR and the NTSB by identifying the soonest-possible date by which DOT-111 can reasonably be removed from crude oil service, beginning with the immediate removal of these tankers from service in unit trains transporting crude oil.

C. Regulatory Changes Are Needed

1. Unit Trains of Crude Oil and Other Hazardous Materials Should be Placed in the Highest Risk Category

Traditionally, the federal hazardous materials regulations have placed the most stringent controls on rail cargoes carrying only "ultrahazardous" materials, e.g., poisons-by-inhalation ("PIH"), toxics-by-inhalation ("TIH"), the most highly kinetic categories of explosives, and radioactive materials.[33] This is based chiefly on the estimated consequences of the rupture of single tank car and the consequent release of its contents. Evidently, little research has been conducted as to the likely consequences of an accident involving two or more such cars.

This single-car risk-assessment methodology underwent a significant evolution last summer, when the AAR revised Circular No. OT-55, its long-standing guidance regarding "Recommended Railroad Operating Practices for Transportation of Hazardous Materials." In Revision N, issued August 5, 2013 (one month after the Lac-Mégantic disaster), the AAR changed its definition of "Key Trains" – those which are subject to the highest standards for transport (*e.g.*, speed limits), equipment (only cars with roller bearings) and track (Class II or above). In revision N, "key trains" are defined as those with a single car of PIH or TIH chemicals, a single car of radioactive waste, or 20 cars of any other hazardous material (including crude oil).

This change is important because it recognizes that trains with dozens of hazmat cars pose environmental and public safety risks that are disproportionately higher than those posed by a single tank car. The AAR circular recognizes that when the contents of many breached tank cars are accumulated and mixed there is a much higher likelihood of conflagrations. With different kinds of hazardous materials involved, there is a possibility of synergistic reactions that are beyond prediction. Trains with multiple hazmat tank cars are also much more likely to trigger acts of terrorism.

We endorse the AAR's analytical approach. All hazmat unit trains – or at least those with 20 cars of hazardous materials or more – should be required by PHMSA to comply with the operating standards set out in OT-55-N.

Defining unit train movements of crude oil as security sensitive will also require carriers to comply with the security measures mandated by the 9/11 Act. These measures include additional threat assessments, vetting, and possible rerouting of cargo.

[33] **Error! Main Document Only.***See* U.S. Governmental Accountability Office, *FREIGHT RAIL SECURITY, Actions Have Been Taken to Enhance Security, but the Federal Strategy Can Be Strengthened and Security Efforts Better Monitored*, GAO-09-243 (April 2009), in which the GAO recommends that the Transportation Safety Administration (TSA) alter its dominant focus on the risks associated with rail transportation of TIH chemicals, and instead prioritize other types of hazardous materials moving along the nation's rails.

2. Expanded Right-to-Know for Communities at Risk

The nation's principal right-to-know law, the Emergency Planning and Community Right-to-Know Act ("EPCRA"), exempts rail shipments of hazardous materials from its disclosure requirements.[34] Nothing prevents PHMSA, in the context of this proceeding, from remedying this derogation of the public's right to understand the risks to which they are subject by virtue of living and/or working near a rail line. At a minimum, PHMSA should require railroads and shippers, working cooperatively, to reveal to the at-risk public:

1. the nature, volumes and frequency of hazmat (including crude oil) shipments moving regularly through their communities;
2. the risks associated with exposure to these materials in the event of a release;
3. what people should do in the event of a release;
4. where people can get more information.

This information should be distributed to local emergency responders, to local residents by mail, and posted on an easily accessible website.

Canada is already moving in this direction. Responding to the Lac Mégantic incident, Transport Canada has adopted new rules requiring rail companies transporting dangerous goods including crude oil to provide municipalities with regular reports on the nature and volume of the dangerous goods that the company transports by rail through that municipality. [35] PHMSA should provide the American public with no lesser protection.

3. Emergency Preparedness and Training for Crews, Responders and Communities

Carriers and shippers should provide training for all people at risk from exposure to hazmat shipments, including crews, responders, and potentially affected residents. Of these, crew training is the most important, as crews are in a position to prevent many accidents and releases. Over the decades, the industry has earned a shameful record in this regard. In 2007 the NTSB noted this long history of substandard emergency planning, dating back to the mid-1980s. See NTSB, Safety Recommendation R-07-4 and -5 (2007) at 4. Therein the Board stated:

> It is the Safety Board's position that effective emergency planning between railroads and local communities should foster the voluntary exchange of emergency response plans, the maintenance of the plans by all parties, and the evaluation of the plans' effectiveness. Further, effective planning demands that the railroads and local communities jointly organize and participate in drills and exercises as a way of becoming familiar with each other's plans and as a means of testing the plans' overall effectiveness. *Ibid.* at 6.

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[34] Codified at 42 U.S.C. § 11001 *et seq*. The transportation exemption is found at 42 U.S.C. § 11047.

[35] Transport Canada, "Protective Direction No. 32" http://www.tc.gc.ca/eng/mediaroom/backgrounders-protective-direction-no32-7428.html. November 20, 2013.

Now is the time for PHMSA and the industry to take on this responsibility in a meaningful way. Lac-Mégantic was a wake-up call. We cannot delay this work until another disaster occurs.

4. Additional Federal Resources Should be Allocated to Assuring the Safety of Crude Oil Shipments

The Departments of Homeland Security and Transportation should devote more assets and personnel to reviewing the security plans and assessments conducted by carriers transporting crude oil. TSA does not currently have enough personnel to adequately perform its rail safety mission and with the projected increase in crude oil shipments, these resources will be further strained.

TSA, FRA, and PHMSA should also provide to the relevant congressional committees a detailed accounting of the rail networks currently used to transport crude oil and other petroleum products in every state, identifying any weaknesses in existing infrastructure, and describing best practices to address any deficiencies. Congress can then use this information when determining TSA, FRA, and PHMSA's budgets. Identifying the gaps in resources will help Congress close such gaps.

5. Two-person Staffing Should Be Required for All Unit Trains

A unit train carrying crude oil can weigh up to 15,000 tons and extend for well over a mile in length. Directing such a vehicle from the point of origin to the destination is an inordinately demanding task, especially given the enormous risks involved if a mistake is made. The range of tasks and responsibilities imposed on train staff is far too great to identify here, but they include powering up, maintaining speed (in compliance with ever-changing speed limits, changing grades, and track conditions), constant visual surveillance of the track and traffic control signals, continuously operating the radio, completing required paperwork, and remaining aware of other rail traffic. FRA rules require that each car in a hazmat train be inspected visually for defects, signs of tampering, and/or the presence of improvised explosive devices. 49 C.F.R. 174.9(b). This could require over a mile of visual tank car inspections, thus requiring a solo staffer to be away from the locomotive for a long period of time.

Naturally, the task of conducting a train becomes vastly more difficult in the event of a derailment, vehicular collision, mechanical breakdown, etc. Under such conditions, such a massive piece of equipment cannot be safely operated by one individual. Some redundancy in staffing is also needed to maintain safe operations in the event that one of the crew should become injured or incapacitated. This has been recognized by the Federal Aviation Administration, which requires two pilots for all commercial flights. Crude-by-rail operations should be subject to the same requirement.

The evident need for two-person staffing was underscored in a report released by the FRA last year: “Cognitive and Collaborative Demands of Freight Conductor Activities: Results and Implications of a Cognitive Task Analysis – Human Factors in Railroad Operations.” Among the

report's key findings were these:

> *Locomotive Engineer and Conductor Function As a Joint Cognitive System*
> From interviews with conductors and locomotive engineers ... it is clear that both employees function as a joint cognitive system. They closely coordinate tasks with each other, adaptively share perceptual and cognitive load, and rely on each other to successfully accomplish the mission of the train. The conductor and locomotive engineer not only serve as an extension of "eyes" and "ears" for each other, catching and communicating information that the other may have missed, but they also extend each other cognitively—filling in knowledge gaps, providing reminders for upcoming tasks, and contributing jointly to problem-solving and decision-making situations that arise. This is especially true when a less experienced crewmember is paired with a more experienced crewmember."

Earlier this year, the Canadian Ministry of Transport issued an order requiring railroads to "[e]nsure that no locomotive coupled with one or more loaded tank cars transporting [hazardous materials] is operated on main track or sidings with fewer than two persons qualified under their company's requirements for operating employees.[36] Americans deserve the same level of protection.

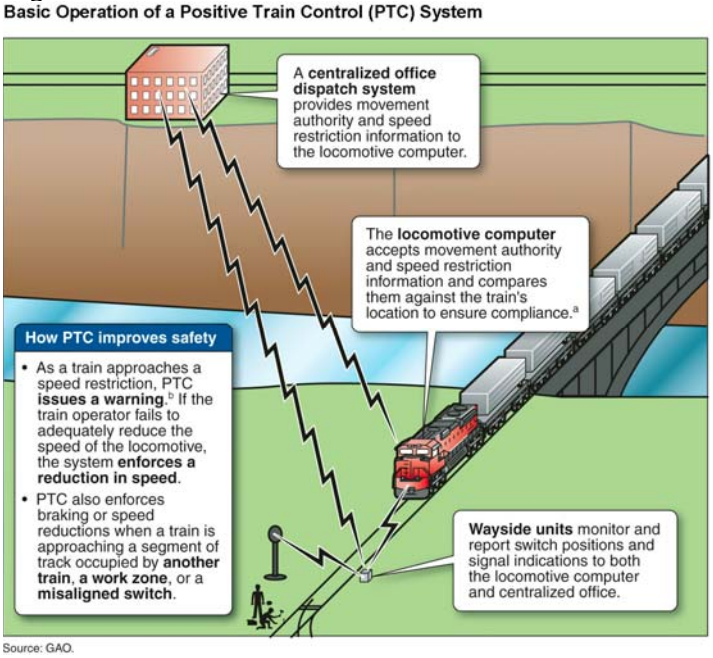
6. "Positive Train Control" Should Be Mandatory for All Unit Trains of Crude and Other Hazmats

The Rail Safety Improvement Act of 2008 ("RSIA"), Pub. L. No. 110-432, div. A, 122 Stat. 4848, mandated the implementation of positive train control (PTC) systems by December 31, 2015, on "mainlines" used to transport inter-city rail passengers, commuters, or any amount of certain highly toxic materials. It should similarly be required for unit train shipments of crude oil and other hazardous materials.

PTC is a communications-based system designed to prevent certain types of rail accidents caused by human factors, including train-to-train collisions; trains entering established work zones, derailments caused by exceeding safe speeds, and other kinds of operator error. When certain dangerous conditions are recognized by the PTC system, the train is slowed and/or stopped automatically.

[36] Canadian Ministry of Transport, Emergency Directive Pursuant to Section 33 of the Railway Safety Act, July 23, 2013 (appended as Attachment 6).

Figure 7: Positive Train Control



As noted above, the railroads are committed to installing PTC, at an estimated cost of $8 billion. Extending the reach of this technology to unit train shipments of crude oil and other hazardous materials will entail little in the way of marginal costs, and yield a substantial public benefit in terms of public safety and environmental protection.

7. Audio and Video Recorders Should Be Installed in the Cabs of all Unit Trains Carrying Crude Oil or Other Hazardous Materials

The benefits of locomotive cab recorders are obvious. They provide a way to reconstruct the events surrounding an accident in cases where the staff were killed or absent. At the urging of the NTSB, the Federal Aviation Administration began requiring the use of cockpit voice recorders in commercial aircraft in 1977. *See* 49 C.F.R. § 121.359. The NTSB has been calling for the use of voice recorders in locomotives since at least 1997. *See* NTSB Safety Recommendation 97-9. The FRA refused. The NTSB reiterated its demand in 2007 – see Safety Recommendation R-07-3. Still there was no action by the FRA.

In 2010 the NTSB revisited this problem, this time expanding its demand to call for:

> the installation, in all controlling locomotive cabs and cab car operating environments, of crash- and fire-protected inward- and outward-facing image and audio recorders capable of providing recordings to verify that train crew actions are in accordance with regulations and procedures that are essential to safety as well as train operating conditions. The devices should have a continuous 12-hour recording capability …

Safety Recommendation 10-1 (2010) at 67.

Of the many lessons offered by Lac-Mégantic, one is that the NTSB's pleas regarding audio and voice recorders should finally be honored.

IV. CONCLUSION

Rail shipments of crude oil throughout the United States have clearly risen to unprecedented levels and are likely to increase further in the near future. The regulatory regime currently in place requires significant improvements in order that the public be protected from threats associated with this burgeoning trade. This must include the following:

1. The existing fleet of DOT-111 tank cars must be replaced or upgraded. PHMSA should follow the recommendations of the AAR and the NTSB by identifying the soonest-possible date by which DOT-111 can reasonably be removed from crude oil service, beginning with the immediate removal of these tankers from unit trains transporting crude oil.
2. Unit trains of crude oil and other hazardous materials should be placed in the highest risk category of Hazmat shipments.
3. The exemption for rail shipments of hazardous materials including crude oil from the disclosure requirement of the Emergency Planning and Community Right-to-Know Act ("EPCRA") must be removed. Information regarding the content of all shipments and relevant risks and emergency procedures should be distributed to local emergency responders, to local residents by mail, and posted on an easily accessible website.
4. Emergency preparedness and training for crews, responders and communities at risk from an incident involving hazardous materials including crude oil should be carried out among all communities at risk.
5. Additional federal resources should be allocated to assuring the safety of crude oil shipments. Greater coordination between PHMSA and the Department of Homeland Security is essential for assuring public safety in light of the vulnerability to terrorist attack of hazardous material transport via rail through the United States.
6. Two-person staffing should be required for all unit trains.
7. "Positive Train Control" should be mandatory for all unit trains of crude oil and other hazardous materials.
8. Audio and video recorders should be installed in the cabs of all unit trains carrying crude oil or other hazardous materials.

Thank you for consideration,

David Pettit
Senior Attorney
Natural Resources Defense Council

Devorah Ancel
Staff Attorney
Sierra Club

Lorne Stockman
Research Director
Oil Change International

Bart Mihailovich
Director
Spokane Riverkeeper

Kristen L. Boyles
Staff Attorney
Earthjustice

Lauren Goldberg
Staff Attorney
Columbia Riverkeeper

Charles McKenna
Chair
Vermont Chapter of the
Sierra Club

Michael J. Bartlett,
President
Audubon Society of New
Hampshire

Chris Wilke
Executive Director
Puget Soundkeeper
Alliance

Marcie Keever
Program Director
Friends of the Earth

Hilton Kelley
Executive Director /
Founder
Community In-power and
Development Association

Matt Krogh
Campaign Director
ForestEthics

Arthur Grunbaum
Friends of Grays Harbor

Dylan Voorhees
Clean Energy Director
Natural Resources Council
of Maine

Tyson Slocum
Energy Program Director
Public Citizen

Marilyn Bardet
Founder
Benicia Good Neighbor
Steering Committee

ATTACHMENT 1

U.S. Department of Transportation

Federal Railroad Administration

1200 New Jersey Avenue, SE
Washington, DC 20590

JUL 29 2013

Mr. Jack Gerard
American Petroleum Institute
1220 L Street NW
Washington, DC 20005

Dear Mr. Gerard:

The Federal Railroad Administration (FRA) is reviewing potential safety issues related to the transportation of crude oil by rail. FRA has specific safety concerns about the proper classification of crude oil being shipped by rail, the subsequent determination or selection of the proper tank car packaging used for transporting crude oil, and the corresponding tank car outage requirements. This letter presents the basis for FRA's concerns regarding these potential safety issues, notifies you of our intended path forward, and provides recommendations to help ensure compliance with the Department of Transportation's (DOT) applicable Hazardous Materials Regulations (HMR; Title 49 Code of Federal Regulations (CFR) Parts 171–180). In addition, we request that you distribute this letter to those of your members that ship crude oil via rail.

Industry statistics demonstrate that, in terms of rail originations, crude oil shipments are the fastest growing of all hazardous materials shipped by rail. According to the Association of American Railroads' (AAR) Annual Report of Hazardous Materials Transported by Rail for 2012, the number of crude oil originations has increased by 443 percent since 2005.

Table 1: Annual number of originations of tank cars containing crude oil, hazardous materials in tank cars, and all hazardous materials

Year	Crude Oil (4910165)	Crude Oil (4915165)	Total HM in tank cars	Total HM
2005	2,626 (71)	4,472 (45)	1,355,070	1,587,469
2006	2,573 (71)	3,510 (61)	1,370,674	1,571,665
2007	2,235 (79)	4,772 (46)	1,440,341	1,988,294
2008	7,524 (34)	4,368 (51)	1,444,194	1,999,757
2009	7,961 (28)	4,940 (42)	1,379,949	1,895,066
2010	27,979 (8)	5,746 (40)	1,525,540	2,085,361
2011	74,057 (4)	6,117 (40)	1,616,580	2,242,389
2012	257,450 (2)	7,096 (48)	1,789,529	2,474,356

In addition, crude oil transportation presents unique operating considerations because, in general, crude oil is transported in units of cars (blocks of crude oil cars within a train) and by entire unit trains consisting wholly of tank cars containing crude oil. Tank cars containing crude oil are typically loaded by one of two methods: transloading (where crude oil from cargo tanks is transferred directly into tank cars) or bulk loading operations (where crude oil is delivered to a bulk storage facility and the crude oil is then transferred from storage tanks to the railroad tank cars). In both operations, there is a blend of crude oil from a variety of sources in each tank car and the properties of the materials may vary depending on the constituent crude oils.

The HMR require that an offeror (shipper) of a hazardous material properly classify and describe the hazardous material. See 49 CFR § 171.1. To attest compliance with the HMR, a shipper of a hazardous material must also certify that the hazardous material being offered into transportation is offered in compliance with the HMR. Further, the HMR prohibit a shipper from offering hazardous material for transportation unless a tank car being used to transport such hazardous material meets the applicable HMR requirements. See, for example, 49 CFR § 171.2. Only after the properties of a hazardous material are determined and the material is properly classified can a shipper ensure compliance with the HMR. In the case of crude oil, relevant properties to properly classify the material include: flash point, corrosivity, specific gravity at loading and reference temperatures, and the presence and concentration of specific compounds such as sulfur (as found in sour crude oil). This information enables a shipper to properly classify a hazardous material and select the proper HMR-authorized packaging for transportation of that hazardous material. Such information and determination of the authorized packaging also ensures that the required tank car outage can be maintained.

FRA's safety concerns stem from the following three considerations.

1. Crude oil transported by rail often derives from different sources and is then blended, so it is critical that shippers determine the proper classification of the crude oil per the HMR. FRA audits of crude oil loading facilities indicate that the classification of crude oil being transported by rail is often based solely on Material Safety Data Sheet (MSDS) data that only provides a material classification and a range of material properties. This MSDS information is typically provided by the consignee to the shipper, and the shipper is unaware of validation of the values of the crude oil properties. Further, FRA's audits indicate that MSDS information is not gleaned from any recently conducted tests or from testing for the many different sources (wells) of the crude oil. For example, a shipper provided information to FRA showing that crude oil being transported by rail had a flash point of 68° F, or a Packing Group I hazardous material. However, the crude oil had been improperly classified as a Packing Group III material and was being transported in AAR class tank cars that were not equipped with the required design enhancements. This constituted a misuse of the crude oil HMR packaging exceptions and subsequent violations of the HMR.

The HMR contain exceptions that allow for the use of non-DOT-specification tank cars for the transportation of crude oil in certain circumstances. Title 49 CFR § 173.150(f)(1) states, "A flammable liquid with a flash point at or above 38 °C (100 °F) that does not meet the definition of any other hazard class may be reclassified as a combustible liquid." Further, 49 CFR § 173.150(f)(3) allows materials that are classified as combustible liquids to be transported in non-DOT-specification bulk packagings.[1] As such, AAR 211 class cars are permitted to be used to transport crude oil that has been classified as a Packing Group III material with a relatively high flash point. These cars are not built and/or maintained to the standard of a DOT-specification tank car. This distinction has safety implications if the crude oil being transported has been improperly classified and actually has a lower flash point and is a Packing Group I flammable liquid hazardous material. If improperly classified, the crude oil might then be shipped in a lesser standard tank car, as occurred in the above example.

Unfortunately, the AAR standard transportation commodity code data does not distinguish between the different packing groups within the hazard class. Without further information in that regard, and in relation to the accuracy of crude oil classifications being made, FRA can only speculate as to the number of potential crude oil shipments that are being made in AAR class tank cars in violation of the HMR. Recently, the AAR Tank Car Committee introduced new requirements for tank cars constructed for ethanol and crude oil (Packing Groups I and II) service. The new requirements are intended to improve the crashworthiness of the tank cars and include a thicker shell, head protection, top fittings protection, and relief valves with a greater flow capacity. Clearly, any improper classification of crude oil and subsequent shipment in an unauthorized tank car contravenes these industry efforts to improve the safety of transporting hazardous materials, and it also contravenes the requirements of the HMR.

2. Title 49 CFR § 173.24b(a) sets the minimum tank car outage for crude oil at 1 percent at a reference temperature based on the existence of tank car insulation. A crude oil shipper must know the specific gravity of the hazardous material at the reference temperature as well as the temperature and specific gravity of the material at that temperature when loaded. This information is then used to calculate the total quantity that can be safely loaded into the car to comply with the HMR's 1-percent outage requirement. Because it is likely that the temperature of the hazardous material loaded into the car is lower than the reference temperature, the outage after the car is loaded will likely be greater than 1 percent. If the outage is not properly calculated because the material's specific gravity is unknown (or is provided only as a range), the tank car could be loaded such that if the temperature increases during transportation, the tank will become shell-full and the material will leak from the valve fittings or manway.

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[1] Section 172.102, Special Provision B1, states, "If the material has a flash point at or above 38 °C (100 °F) and below 93 °C (200 °F), then the bulk packaging requirements of § 173.241 of this subchapter are applicable."

Since 2004, approximately 10 percent of the one-time movement approval (OTMA) requests that FRA has received have been submitted to move overloaded tank cars.[2] Of these requests, 33 percent were tank cars containing flammable liquids. FRA notes that tank cars overloaded by weight are typically identified when the tank cars go over a weigh-in-motion scale at a railroad's classification yard. As indicated above, crude oil is typically moved in unit trains, and the cars in a unit train do not typically pass over weigh-in-motion scales in classification yards. Therefore it is unlikely that FRA would receive many OTMA requests for overloaded tank cars containing crude oil. Moreover, crude oil accounted for the most nonaccident releases (NARs) by commodity in 2012, nearly doubling the next highest commodity (alcohols not otherwise specified, which accounts for a comparable annual volume transported by rail). FRA's data indicates that 98 percent of the NARs involved loaded tank cars. Also, less than 2 percent of the NARs occurred at the bottom outlet valve. Product releases through the top valves and fittings of tank cars when the hazardous material expands during transportation suggest that loading facilities may not know the specific gravity of the hazardous materials loaded into railroad tank cars, resulting in a lack of sufficient outage.

3. FRA's review of the OTMA data also indicates an increasing number of incidents involving damage to tank cars in crude oil service in the form of severe corrosion of the internal surface of the tank, manway covers, and valves and fittings. A possible cause is contamination of the crude oil by materials used in the fracturing process that are corrosive to the tank car tank and service equipment. Therefore, when crude oil is loaded into tank cars, it is critical that that the existence and concentration of specific elements or compounds be identified, along with the corrosivity of the materials to the tank car tanks and service equipment. Proper identification of these elements will enable a shipper to ensure the reliability of the tank car. Proper identification also enables a shipper to determine if there is a need for an interior coating or lining, alternative materials of construction for valves and fittings, and performance requirements for fluid sealing elements, such as gaskets and o-rings.

As a result of the concerns outlined above, FRA is investigating whether crude oil is being properly classified and, subsequently, whether the proper tank car packagings are being used for transportation. As part of this investigation, FRA will be requesting analytical data supporting the current classification of a shipper's crude oil, as well as information related to shipper crude oil loading practices. If analytical data regarding the current classification of crude oil is not available, FRA, in partnership with the Pipeline and Hazardous Materials Safety Administration (PHMSA), may use PHMSA's Hazardous Materials Testing Program. Under this program, a sample of a shipper's hazardous material is sent to a certified laboratory for testing, and the results of the laboratory testing are then shared with the shipper. FRA may also consider exercising its authority under 49 CFR § 109.9 to determine whether crude oil is being properly classified and transported in HMR-authorized packaging. If an investigation reveals that crude oil is not being properly classified per the HMR, FRA may use its enforcement tools to address noncompliance. Some of these enforcement tools

[2] Per 49 CFR § 174.50, an OTMA is required to move a nonconforming DOT-specification bulk packaging for cleaning and/or repair.

include the issuance of compliance orders, emergency orders, and civil penalties. See 49 CFR Parts 209 and 211.

FRA recommends that shippers evaluate their processes for testing, classifying, and packaging the crude oil that they offer into transportation via railroad tank car. The frequency and type of testing should be based on a shipper's knowledge of the hazardous material, with specific consideration given to the volume of hazardous material shipped, the variety of sources that the hazardous material is generated from, and the processes that generate the hazardous material.

FRA welcomes the opportunity to assist crude oil shippers in their efforts to comply with the HMR. Please contact Mr. Karl Alexy, Staff Director, Hazardous Materials Division, at (202) 493-6245 or Karl.Alexy@dot.gov to discuss this matter further.

Sincerely,

Thomas J. Herrmann
Acting Director, Office of Safety Assurance and Compliance

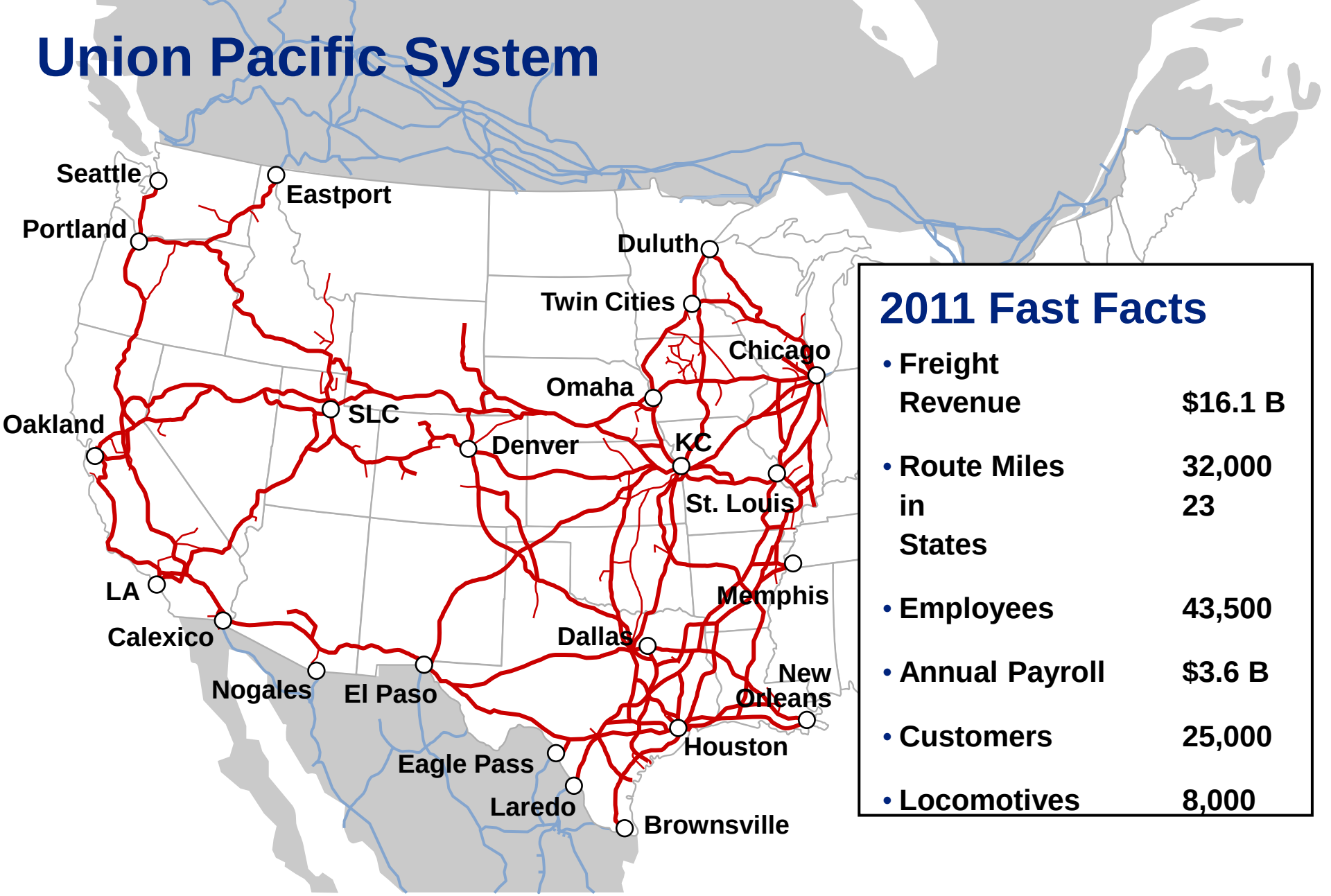
ATTACHMENT 2

Crude Oil Tank Car Securement Training

Craig Johnson – Gen. Director - CTS

UNION PACIFIC BUILDING AMERICA®

Union Pacific System



2011 Fast Facts

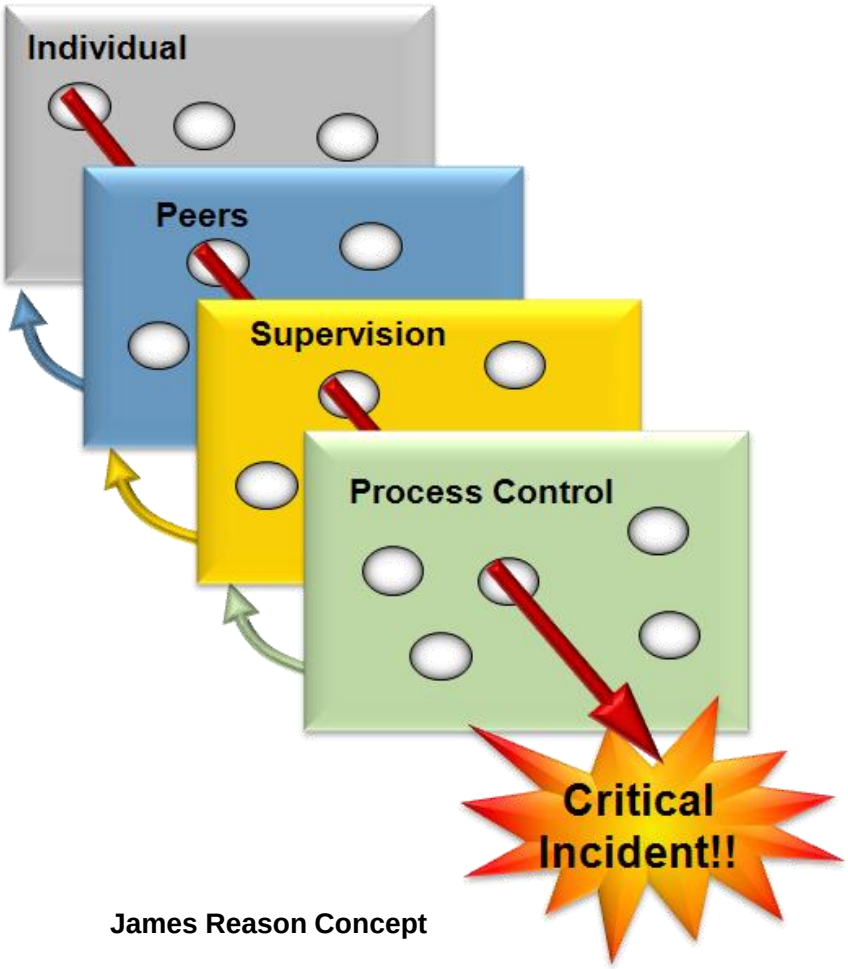
• Freight Revenue	$16.1 B
• Route Miles in States	32,000 23
• Employees	43,500
• Annual Payroll	$3.6 B
• Customers	25,000
• Locomotives	8,000

Safety Strategy

Consistent Approach

- **Risk Identification & Mitigation**
- **Engagement**
- **Standardized Work / Training**
- **Technology**
- **Capital Investment**

"Zero Tolerance" Model

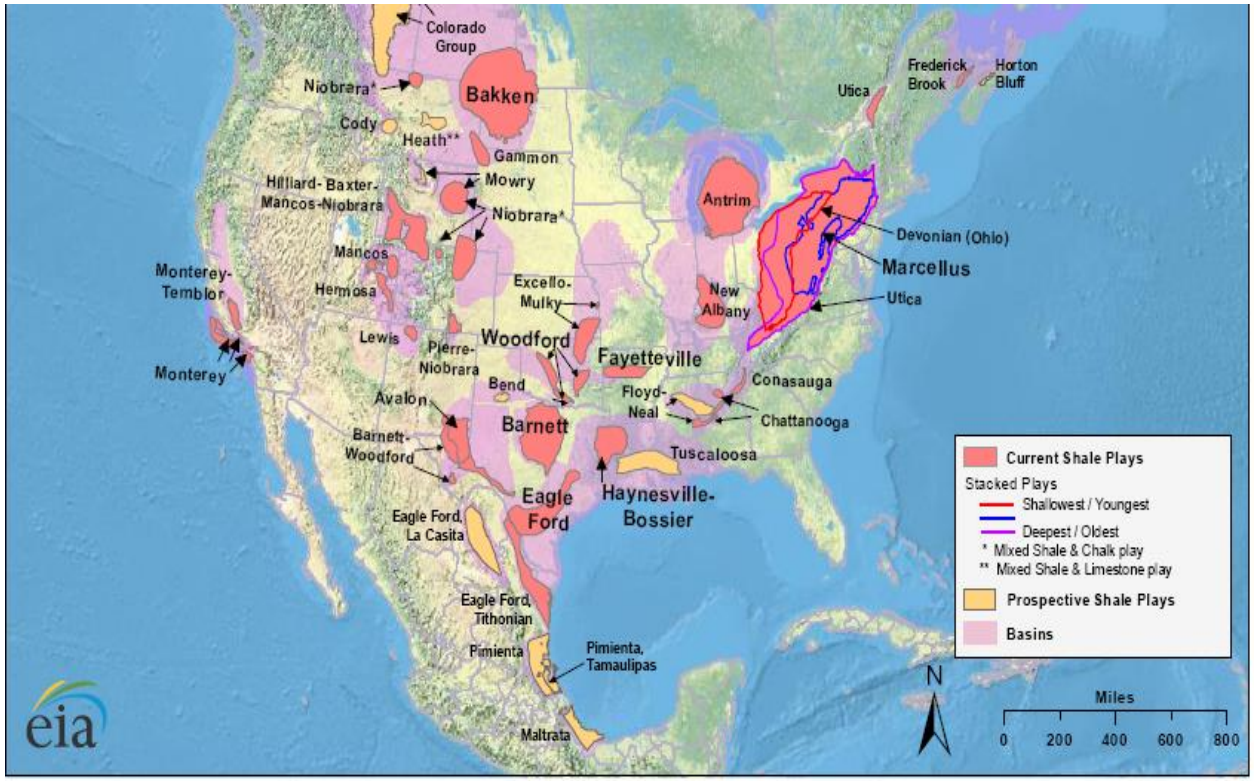


James Reason Concept


Lower 48 states shale plays
Niobrara*
Montana Thrust Belt
Heath**
Bakken***
Cody
Williston Basin
Big Horn Basin
Powder River Basin
Gammon
Hilliard-Baxter-Mancos
Mowry
Greater Green River Basin
Niobrara*
Park Basin
Forest City Basin
Michigan Basin
Antrim
Appalachian Basin
Devonian (Ohio)
Marcellus
Utica
Illinois Basin
Uinta Basin
Manning Canyon
Mancos
Hermosa
Piceance Basin
Denver Basin
San Joaquin Basin
Monterey-Temblor
Paradox Basin
Pierre
Excello-Mulky
Cherokee Platform
New Albany
Lewis
San Juan Basin
Raton Basin
Woodford
Anadarko Basin
Fayetteville
Chattanooga
Ardmore Basin
Arkoma Basin
Black Warrior Basin
Conasauga
Monterey
Santa Maria, Ventura, Los Angeles Basins
Palo Duro Basin
Bend
Floyd-Neal
Valley & Ridge Province
Avalon-Bone Spring
Permian Basin
Barnett
Ft. Worth Basin
TX-LA-MS Salt Basin
Barnett-Woodford
Marfa Basin
Tuscaloosa
Eagle Ford
Haynesville-Bossier
Pearsall
Western Gulf
Miles
0 100 200 300 400
N
Shale plays
Current plays
Prospective plays
Stacked plays
Shallowest/ youngest
Intermediate depth/ age
Deepest/ oldest
Basins
* Mixed shale & chalk play
** Mixed shale & limestone play
***Mixed shale & tight dolostone-siltstone-sandstone
eia

Gas/Oil Shale Deposits

- "New" US Oil & Gas
  - **Bakken Formation** (ND/MT/ and SK)
  - **Eagle Ford Formation** San Antonio Laredo /Corpus Christi Hondo
  - **Permian Basin** Midland/Odessa
  - **Niobrara/DJ Basin** NE, CO, d WY
  - **Unita Basin** Rock Springs, WY/W. CO
- Add. large developments
  - **Haynesville Shale** Shreveport, LA area
  - Western Colorado area
  - **Woodford Shale** (W. OK)
  - **Marcellus Shale** (PA/NY)
  - **Canadian Oil Sands** Northern AB and SK

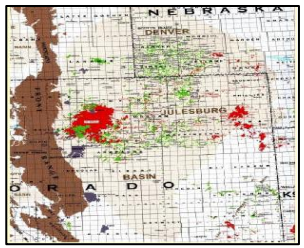


Source: Energy Information Administration based on data from various published studies.
Updated: March 21, 2011

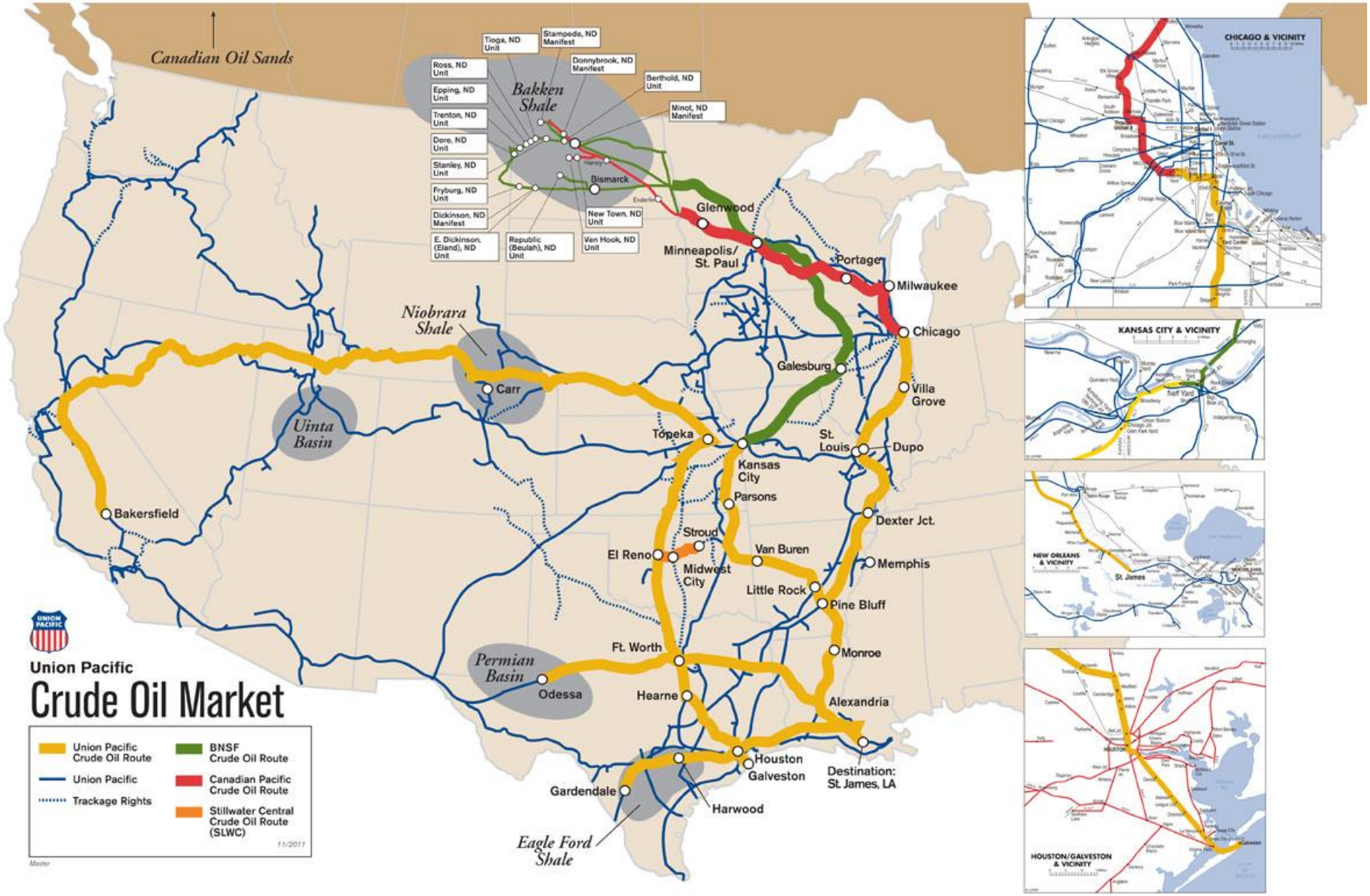
Eagle Ford

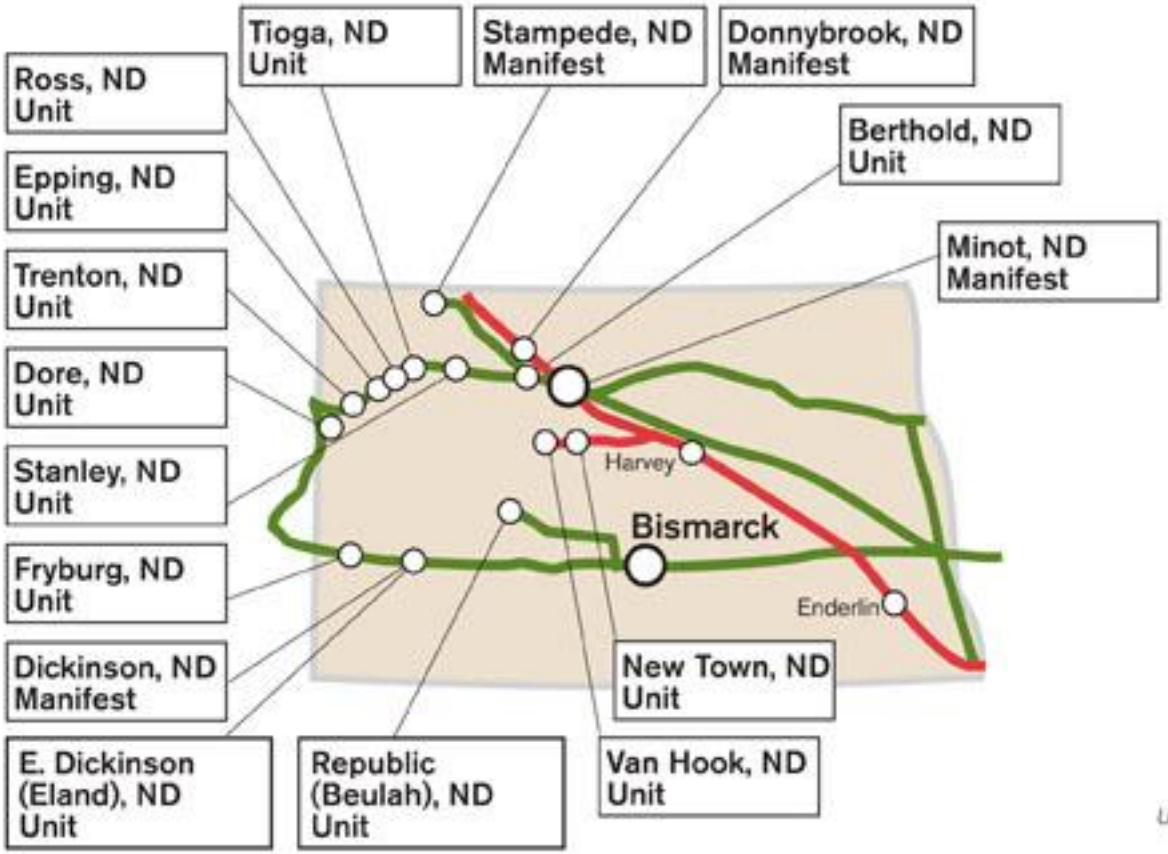
Permian

Haynesville



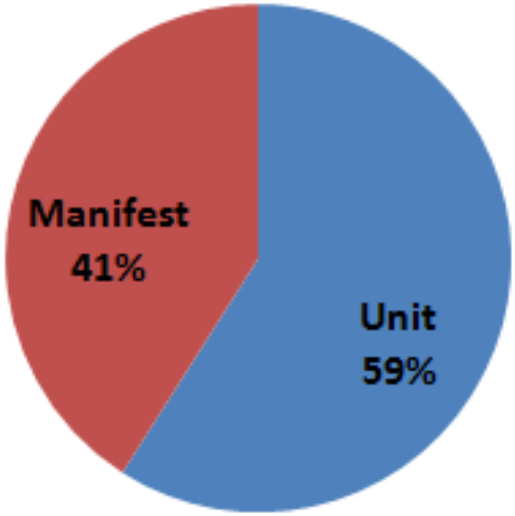
Niobrara


Canadian Oil Sands
Tioga, ND Unit
Stampede, ND Manifest
Donnybrook, ND Manifest
Ross, ND Unit
Epping, ND Unit
Trenton, ND Unit
Dore, ND Unit
Stanley, ND Unit
Fryburg, ND Unit
Dickinson, ND Manifest
E. Dickinson, (Eland), ND Unit
Republic (Beulah), ND Unit
Bakken Shale
Berthold, ND Unit
Minot, ND Manifest
Bismarck
New Town, ND Unit
Van Hook, ND Unit
Glenwood
Minneapolis/ St. Paul
Portage
Milwaukee
Chicago
Galesburg
Villa Grove
Niobrara Shale
Carr
Uinta Basin
Topeka
St. Louis
Dupo
Kansas City
Parsons
Bakersfield
Dexter Jct.
Stroud
El Reno
Van Buren
Midwest City
Memphis
Little Rock
Pine Bluff
Ft. Worth
Monroe
Permian Basin
Odessa
Hearne
Alexandria
Houston
Galveston
Destination: St. James, LA
Gardendale
Harwood
Eagle Ford Shale
CHICAGO & VICINITY
KANSAS CITY & VICINITY
NEW ORLEANS & VICINITY
St. James
HOUSTON/GALVESTON & VICINITY
Union Pacific
Crude Oil Market
Union Pacific Crude Oil Route
Union Pacific
Trackage Rights
BNSF Crude Oil Route
Canadian Pacific Crude Oil Route
Stillwater Central Crude Oil Route (SLWC)
11/2011

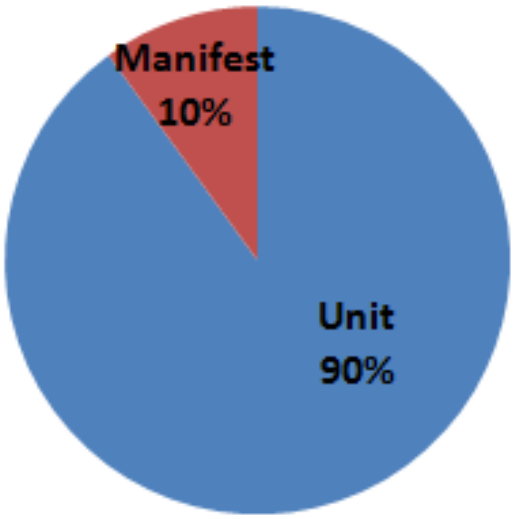

Tioga, ND Unit
Stampede, ND Manifest
Donnybrook, ND Manifest
Ross, ND Unit
Berthold, ND Unit
Epping, ND Unit
Minot, ND Manifest
Trenton, ND Unit
Dore, ND Unit
Harvey
Stanley, ND Unit
Bismarck
Fryburg, ND Unit
Enderlin
Dickinson, ND Manifest
New Town, ND Unit
E. Dickinson (Eland), ND Unit
Republic (Beulah), ND Unit
Van Hook, ND Unit
UPND 11/2011

Crude Oil
Manifest vs. Unit Trains

July 2011



January 2012



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- Documented loading procedures
- Recognition program for safest loaders
- Pre-trip inspection and testing
- Incident investigation
- Strategic NAR prevention efforts


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ATTACHMENT 3

Analysis of the Potential Costs of Accidents/Spills Related to Crude by Rail

Prepared

by

Ian Goodman
Brigid Rowan

on behalf of
Oil Change International

Before the
Pipeline and Hazardous Materials Safety Administration
in the Context of
Hazardous Materials: Rail Petitions and Recommendations to Improve the Safety of Railroad Tank Car Transportation
Docket No. PHMSA-2012-0082 (HM-251)

the goodman group, ltd.
http://www.thegoodman.com/

November 8, 2013

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1. Introduction

This analysis was prepared by The Goodman Group, Ltd. (TGG), a consulting firm specializing in energy and regulatory economics,[1] on behalf of Oil Change International. Any findings, conclusions or opinions are those of TGG and the authors and do not necessarily reflect those of Oil Change International.

The costs of crude by rail (CBR) accidents/spills can be very large. This analysis demonstrates that a major crude by rail (CBR) unit train accident/spill could cost $1 billion or more for a single event.

The following examples provide key support for our findings:

1. The explosion, fire and spill of Bakken crude from a train derailment in Lac-Mégantic, QC (2013): The Lac-Mégantic rail accident/spill will likely have costs in the order of $500 million to $1 billion. Costs/damages for a similar incident could have been substantially higher had it occurred in a more populated area. Lac-Mégantic is also relevant in that it shows how an accident involving highly flammable light crude (such as the Bakken crude) can have devastating consequences even in a small town in terms of loss of human life and widespread explosion and fire damage to surrounding property.

2. The spill of tar sands dilbit[2] from Enbridge's Line 6B in Marshall, MI (2010): This rupture had costs of about $1 billion for Enbridge. The spill volumes at Marshall were within the range of the amount of spill possible (and, in fact, substantially less than the maximum spill) if a crude by rail unit train released much of its cargo. Costs/damages for similar incident could have also been substantially higher had it occurred in a more populated area. Marshall is also relevant in

[1] www.thegoodman.com This analysis was co-authored by Ian Goodman and Brigid Rowan.
[2] Diluted bitumen. Raw bitumen (a very heavy asphalt-like crude produced from the Alberta tar sands) is diluted for the purposes of rail and pipeline transport. Bitumen is transported in various forms, including a) SCO (raw bitumen upgraded to light synthetic crude oil), b) raw bitumen mixed with a petroleum-based diluent (such as naphtha or condensate) to make it less viscous, or c) raw bitumen (no diluent). SCO and dilbit (diluted bitumen to pipeline specifications, 25–30% diluent) can be transported in standard (non-coiled and non-insulated) tank cars and pipelines. Railbit (bitumen with 15–20% diluent) and raw bitumen can be transported in coiled and insulated tank cars (which are also sometimes used to transport dilbit). Keystone XL Draft Supplemental EIS, p. 1.4-49. Accessed October 30, 2013. http://keystonepipeline-xl.state.gov/documents/organization/205654.pdf

> showing the high potential cost of dilbit spills into water (and rail lines are often highly proximate to water).[3]

The AAR petition for rulemaking states:[4]

> AAR surveyed its members for information on derailments involving packing group I and II materials from '2004-2008. The derailments resulted in one fatality and eleven injuries, the release of approximately 925,000 gallons of these hazardous materials, and cleanup costs totaling approximately $63 million.

The Village of Barrington petition for rulemaking responds:[5]

> Furthermore, while AAR claims that derailment costs totaled approximately $64 million over the past five years, including equipment, lading, response and environmental remediation costs," [footnote 17 in original: March 9, 2011 Petition for Rulemaking letter to Dr. Magdy EI-Sibae from Michael Rush of the Association of American Railroads at page 2, footnote 7.] Petitioners question the accuracy of industry's cost-benefit claims. In reviewing the derailment cost chart at Attachment B of AAR's petition, PHMSA should note that there is no apparent accounting for costs associated with civil litigation in the wake of derailments. However, in the Cherry Valley/Rockford derailment, CN paid over $36 million in October of 2011 to settle a lawsuit brought by the family of only one victim. AAR's chart, however, reflects costs of only $8 million for that incident. [footnote 18 in original: At the very least, Petitioners believe it would make sense for the PHMSA to ascertain the costs stemming from civil litigation for the entire list of derailments incidents that the AAR provided to your office on March 9, 2011. Even if it doesn't yet completely balance the cost-benefit equation in favor of public safety, Petitioners would guess that the plaintiffs' bar would look forward to securing ever higher awards for future victims of derailments based on the public record demonstrating that industry chose to do nothing meaningful in terms of investing in a retrofit program of tank cars that are known to be dangerous and that are increasingly serving as a rolling pipeline for the ethanol and crude oil industries.]

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[3] The discussion of the costs of the Lac-Mégantic disaster and the Marshall, MI pipeline rupture is partly based on excerpts from a TGG report filed as written expert testimony at Canada's National Energy Board:
"The Relative Economic Costs and Benefits of the Line 9B Reversal and Line 9 Capacity Expansion," August 8, 2013, pp. 38-41. Accessed October 23, 2013.
https://www.neb-one.gc.ca/ll-eng/livelink.exe?func=ll&objId=985663&objAction=Open

[4] See http://www.regulations.gov/#!documentDetail;D=PHMSA-2012-0082-0005 p. 2. Accessed October 29, 2013.

[5] See http://www.regulations.gov/#!documentDetail;D=PHMSA-2012-0082-0006 p. 8. Accessed October 29, 2013.

In fact, even a single accident relating to a crude by rail unit train can have dramatically higher costs than the costs taken into account in the AAR's cost-benefit claims. As further explained in this briefing, this analysis will demonstrate that a major crude by rail unit train accident/spill, involving either dilbit or a very light crude such as Bakken, could cost $1 billion or more for a single event.

We have limited our cost analysis to environmental and socio-economic impacts that directly affect economic activity and can be somewhat readily (albeit approximately) quantified using market economics. These costs escalate very quickly in more densely populated urban areas. Moreover, as we have witnessed firsthand in Quebec, in summer 2013, unconventional crudes (such as Bakken and dilbit) have hazardous characteristics (notably flammability), such that their unsafe transport can result in the loss of human life. We have not attempted to assign a cost to potential effects on human health and safety or to broader effects on ecosystems (notably residual effects).[6]

As noted above, two relevant examples to support our findings that a single unit-train accident/spill could result in very large costs are the following:

1. the explosion, fire and spill of Bakken crude from a train derailment in Lac-Mégantic, QC (2013).
2. the spill of tar sands dilbit from Enbridge's Line 6B in Marshall, MI (2010).

For each example, TGG will provide:

1. description of the disaster;
2. the cost and sources of the cost data;
3. the relevance of the example to estimating the potential costs of CBR accidents/spills.

[6] Residual effects are those effects remaining after implementation of mitigation measures, such as emergency response and decontamination efforts.

2. Estimated Costs of the Crude by Rail Disaster at Lac-Mégantic

2.1. Description of Disaster

According to the Transportation Safety Board of Canada (TSB), "[o]n July 6 2013, a unit train carrying petroleum crude oil operated by Montreal, Maine & Atlantic Railway (MMA) derailed numerous cars in Lac-Mégantic, Quebec, and a fire and explosions ensued."[7]

The train with five locomotives was pulling 72 DOT-111 tanker cars full of light crude oil from the Bakken shale play in North Dakota to the Irving Oil refinery in Saint John, New Brunswick. The train was operated by Montreal Maine & Atlantic Railway. The train broke away and derailed, unleashing an explosive ball of burning Bakken crude, which incinerated the downtown core of this small Quebec town.[8]

Quebec's Department of Sustainable Development, Environment and Parks reports that this rail accident released 6.0 million litres[9] of crude oil into the environment (affecting soil, water and air).[10] Among its other findings (as of October 28, 2013):

> A total of 7.7 million litres[11] of crude oil were on the runaway MMA train
>
> from a total of 72 tankers, 63 spilled and 9 avoided spilling during the accident
>
> 43 million litres of oily water have been recovered from Lac-Mégantic's city centre (sewer system, lake, and grounds)
>
> 52,000 litres of oily water removed from the nearby Chaudière River

---

[7] See TSB website, Railway investigation R13D0054. Accessed October 29, 2013. http://www.bst-tsb.gc.ca/eng/enquetes-investigations/rail/2013/R13D0054/R13D0054.asp

[8] "Lac-Mégantic: What we know, what we don't," Montreal Gazette, July 22, 2013. Accessed August 2, 2013. http://www.montrealgazette.com/news/M%C3%A9gantic+What+know+what+know/8626661/story.html

[9] Equivalent to 1.6 million gallons.

[10] See Quebec Department of Sustainable Development, Environment and Parks website, Train Accident in Lac-Mégantic (content in French: *Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs (MDDEFP), Accident ferroviaire à Lac-Mégantic*),.Accessed November 8, 2013 http://www.mddep.gouv.qc.ca/lac-megantic/index.htm; and specifically Summary Table on quantities of oil estimated as of October 28, 2013 (*Tableau-Synthèse: Estimation au 28 octobre 2013 des quantités de pétrole brut léger impliquées dans l'accident à Lac-Mégantic*) http://www.mddefp.gouv.qc.ca/lac-megantic/20131028-tableau-synthese-petrole.pdf

[11] Equivalent to 2.0 million gallons.

the oily water recovered has concentrations of oil ranging from 2% to 50%, and it is not possible to determine the exact amount of oil actually recovered.

"The catastrophe killed 47 residents and levelled more than 40 buildings." [12]

According to a September 11, 2013 TSB news release, "TSB test results indicate that the level of hazard posed by the petroleum crude oil transported in the tank cars on the accident train was not accurately documented." The crude was "offered for transport, packaged, and transported as a Class 3, PG III product, which represented it as a lower hazard, less volatile flammable liquid."[13]

2.2. Costs and Sources of Cost Data

The TSB investigation into the accident is still ongoing.[14] It is still too early to know the final costs for this disaster (including decontamination, town reconstruction, economic recovery, and compensation for victims' families); but **TGG estimates these costs to be in the hundreds of millions (in the order of $500 million to $1 billion)**.

Preliminary clean-up bills for damage to the town doubled in the weeks following the accident from $4 million to almost $8 million. The MM&A Railway stated at the end of July that it was unable to pay clean-up costs because it was not getting funds from its insurers. At the time, MM&A had outstanding bills for $7.8 million. MM&A also publicly raised the concern that it could go bankrupt.[15] In response, the Quebec government ordered World Fuel Services Corp. to assist with the clean-up. World Fuel "purchased the oil from producers in North Dakota's Bakken region, then leased and loaded rail

[12] McNish, Jacquie and Justin Giovanetti, "Oil Company Disputes Lac-Méganitc Cleanup Order," Globe and Mail. Accessed August 4.
http://www.theglobeandmail.com/news/national/oil-company-disputes-lac-megantic-cleanup-order/article13518237/

[13] "TSB calls on Canadian and U.S. regulators to ensure properties of dangerous goods are accurately determined and documented for safe transportation," TSB News release, September 11, 2013. Accessed October 29, 2013.
http://www.bst-tsb.gc.ca/eng/medias-media/communiques/rail/2013/r13d0054-20130911.asp
The news release further explains that this misclassification may partly explain why the crude ignited so quickly following the rupture.

[14] See the TSB active investigation page for Lac-Mégantic:
http://www.bst-tsb.gc.ca/eng/enquetes-investigations/rail/2013/R13D0054/R13D0054.asp.

[15] Blatchford, Andy, "Railway says it can't pay for Lac-Mégantic disaster cleanup"
http://www.theglobeandmail.com/news/national/mma-lays-off-nearly-one-third-of-quebec-workforce-union/article13496970/#dashboard/follows/

cars and arranged for their transport to an Irving Oil refinery in New Brunswick."[16] World Fuel is disputing the cleanup order.

> "In the end, says one expert in civil responsibility, taxpayers could be stuck with a bill in the hundreds of millions of dollars.
>
> Quebec law professor Daniel Gardner says he highly doubts MM&A has enough coverage to absorb the massive, combined financial liabilities of damages like environmental cleanup, emergency-crew salaries and lawsuits.
>
> In fact, he believes the Lac-Megantic derailment could have more financial consequences than any other land disaster in North American history.
>
> "The whole cost of this will be far closer to $1 billion than to $500 million," said the Universite Laval academic, adding he would be surprised if the railway had a total of $500 million in coverage.
>
> "What will probably happen? ...The company will go bankrupt, insurance coverage won't be enough."
>
> Gardner expects governments will wind up covering the difference.[17]

On August 7, 2013, MM&A filed for bankruptcy in both Canada (Quebec) and the US (Maine).[18]

> "It has become apparent that the obligations of both companies now exceed the value of their assets, including prospective insurance recoveries," MM&A chairman Edward Burkhardt said in a statement Wednesday.
>
> Filing for bankruptcy is "the best way to ensure fairness of treatment to all in these tragic circumstances," he said.
>
> The decision means the company will start a judge-supervised process to determine how much money will be paid to its various creditors. The process, which allows the company to tackle its unmanageable debt load and remain viable, can be lengthy and typically places secured creditors ahead of those seeking compensation through a lawsuit.

[16] See footnote 12.
[17] See footnote 15.
[18] Mackrael, Kim and Tu Thanh Ha, "MM&A files for creditor protection after Lac-Mégantic rail disaster" Globe and Mail. Accessed August 7. http://www.theglobeandmail.com/news/national/rail-company-involved-in-megantic-disaster-files-for-bankruptcy/article13644535/#dashboard/follows/

> MM&A's insurance provider, XL Group, has so far declined to cover the cleanup bills, leaving the province to step in and pay more than $8-million to ensure the work continues.
>
> The court documents indicate that XL has no plans to contribute to continuing environmental recovery costs because it has decided to prioritize claims from victims affected by the disaster. MM&A's insurance policy with XL covers the company for up to $25-million, according to the court documents.
>
> Because of the number of claims and the amounts being claimed, the insurer "cannot provide for payment of covered environmental cleanup costs to the detriment of the third-party claimants, especially where the amounts of the claims exceed the limit of the coverage," the documents state.

Based on the information provided above, the now bankrupt MM&A has liabilities in excess of assets, minimal insurance coverage ($25 million); and the insurer has so far refused to pay environmental cleanup costs.

Ongoing squabbling has recently intensified between Quebec and the Canadian federal government over who should pay for the clean-up, economic recovery and town reconstruction. Quebec is insisting that the federal government pitch in more than the $60M they have committed to. In the October 2013 Throne Speech, the federal government promised to help more with decontamination and reconstruction but have yet to commit to an exact amount.

The Quebec government has still not supplied the federal government with a cost estimate for the cleanup and reconstruction. Federal officials refuse to commit to a fixed amount without a final bill.[19]

While MM&A is bankrupt, some **$25 million** in derailment insurance policy is earmarked by the US bankruptcy trustee for the victim's families. There is a possibility that additional compensation could be obtained for the families from a second insurance policy or from the sale of the company's assets, but these amounts are uncertain.[20]

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[19] The Globe and Mail, "Throne Speech to promise help with Lac-Mégantic cleanup, but not a 'blank cheque,' insiders say," October 15, 2013.
http://www.theglobeandmail.com/news/politics/throne-speech-to-promise-help-with-lac-megantic-cleanup-but-not-a-blank-cheque-insiders-say/article14883079/#dashboard/follows/

[20] Montreal Gazette, "Quebec rail victims could begin to see compensation in mid-2014: U.S. trustee," October 22, 2013.
http://www.montrealgazette.com/business/Quebec+rail+victims+could+begin+compensation+mid2014/9066861/story.html

Certainly, even individual victims of derailment have recently received compensation greater than $25 million,[21] therefore higher compensation, if available, would be justifiable.

On the **decontamination costs alone** there are a series of estimates:

- In late July 2013, a Quebec-based Ecotoxicologist, Emilien Pelletier, estimates that the bill just for decontamination would be **$500 million** and that doesn't include town reconstruction.[22]

- In early August 2013, MM&A was reported to have estimated the decontamination costs at **$200 million** in court documents.[23]

- In an October 2013 article, the Quebec government recently estimated the **soil decontamination costs alone at $150 million**.[24]

Overall costs estimates vary from several hundred million dollars to $1 billion:

- As indicated above, Quebec law professor, Daniel Gardner, estimated in August that the costs would far closer to **$1 billion than $500 million**.[25]

- In September 2013, the Toronto Star reported that cleanup costs are pegged as high as **$500 million by some estimates**.[26]

- On October 15, 2013, the Globe and Mail (Canada's National paper), indicated that "[e]xperts and government officials expect that **the bill will easily reach $200-million, and could even end up in the vicinity of $1-billion**."[27]

In light of the above, it would appear that the minimum decontamination costs would be $200 million and the minimum total costs (decontamination, town reconstruction and

[21] See footnote 5.
[22] See http://www.ledevoir.com/environnement/actualites-sur-l-environnement/383941/blanchet
[23] See http://www.theglobeandmail.com/news/national/quebec-could-still-be-on-hook-for-cleanup-bill/article13680378/#dashboard/follows/ and http://www.thestar.com/news/canada/2013/08/09/lac_megantic_cleanup_to_stretch_into_next_year.html
[24] See http://www.thestar.com/news/canada/2013/10/03/lacmegantic_ottawa_to_pitch_in_more_money_for_cleanup_of_train_derailment.html
[25] See footnote 15.
[26] See http://www.thestar.com/news/canada/2013/09/24/lac_megantic_cleanup_quebec_asks_federal_government_to_share_bill.html#
[27] See footnote 19.

economic recovery, and compensation for victims' families) would be approximately $500 million. The total bill could escalate to $1 billion and beyond. The updated information is consistent with TGG's August 2013 estimate from the NEB expert report:

"It is far too early to know the final costs for this disaster but they are estimated to be in the hundreds of millions, and possibly exceed $1 billion." [28]

2.3. Relevance of Lac-Mégantic to Estimating the Costs of CBR Accidents/Spills

The Lac-Mégantic tragedy is directly relevant to an estimation of the costs of a major CBR accident/spill for the following reasons:

1. It demonstrates the consequences of a CBR accident in a small town by a lake, thus proximate to people, water and economic activity.
2. The Lac-Mégantic tragedy demonstrates the effect of a rupture of 63 tank cars on a unit train with a total of 72 tankers, all carrying Bakken crude.
3. Bakken crude, which caused the explosion, is very light, and has hazardous characteristics (notably flammability).
4. Rail is now transporting over 600,000 barrels per day (and over 60% of the total) from Bakken production.[29]
5. More generally, the rapid expansion of CBR results from the rapid expansion in production and transport of unconventional crudes (Bakken and other light crudes from shale/tight oil plays and dilbit and other heavy crudes from Canadian tar sands).[30]

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[28] See footnote 3, p. 39.

[29] See North Dakota Pipeline Authority website. Accessed October 30, 2013. http://northdakotapipelines.com/directors-cut/.
Monthly Updates for April 2013-October 2013 (February 2013-August 2013 data), reporting transport by rail ranging from 600,000 to 700,000 barrel per day, comprising 61-75% of total Bakken production.

[30] To date, a sizable proportion of overall recent CBR activity relates to Bakken production. The Keystone XL Draft Supplemental EIS (KXL DSEIS) assumes that CBR could be rapidly expanded to transport expanded Canadian tar sands production of dilbit and other heavy crudes, so as to provide a viable alternative to expanded pipeline capacity. The KXL DSEIS analysis of tar sands CBR is flawed and potentially misleading because it assumes that CBR can be quickly and vastly scaled up, with no significant operating, logistical, economic or regulatory constraints. Nonetheless, some Western Canadian production is already being transported by rail into the US (including dilbit, railbit, and raw bitumen, from both tar sands and non-tar sands), and there is a potential for further expansion of CBR transport of unconventional Canadian crudes.
See footnote 29; Titterton, Paul, Tank Car Update: Presentation to SWARS, February 28, 2013. Accessed October 30, 2013.
http://www.swrailshippers.com/swars_pdfs/2013_gatx_presentation.pdf;
(footnote continued on next page)

6. In addition to the devastation of the Lac-Mégantic town center, there has been significant release of crude oil (6.0 million liters or 1.6 million gallons) into the environment (affecting soil, water and air).[31]
7. There are very serious concerns about who will bear the financial responsibility for the disaster.

Although the Lac-Mégantic accident/spill was devastating and will likely have costs in the order of $500 million to $1 billion, it is nowhere near a worst-case scenario for a CBR accident.

Costs/damages for a similar incident could have been substantially higher had it occurred in a more populated area. Lac-Mégantic demonstrates how an accident involving highly flammable light crude (such as the Bakken crude) can have devastating consequences even in a small town in terms of loss of human life and widespread explosion and fire damage to surrounding property. In an urban area, the effects of such an accident could be catastrophic and costs could easily escalate to the multi-billion dollar range.[32]

(footnote continued from previous page)
Keystone XL Draft Supplemental EIS, pp. 1.4-33 – 1.4-60. Accessed October 30, 2013. http://keystonepipeline-xl.state.gov/documents/organization/205654.pdf;
Goodman, Ian and Brigid Rowan, Report evaluating the adequacy of the Keystone XL (KXL) Draft Supplemental Environmental Impact Statement (DSEIS) Market Analysis, April 22, 2013, pp. 33-50, Adobe pp. 267-284
http://switchboard.nrdc.org/blogs/aswift/Comments%20of%20Sierra%20Club%2C%20et.%20al.%2C%20on%20the%20Keystone%20XL%20DSEIS.4.22.13.pdf

[31] There have been concerns that the spill affected water quality and drinking water in Lac-Mégantic and nearby towns. Authorities continue to monitor water quality.
"Government Examining Lac-Mégantic Health Risks," The Record, July 31, 2013. Accessed August 2, 2013.
http://www.sherbrookerecord.com/content/gov%E2%80%99t-examining-lac-megantic-health-risks;
see also footnote 10.

[32] In the context of the PHMSA rulemaking and elsewhere, some may submit that the Lac-Mégantic accident is an exceptional and possibly worst-case scenario that is unlikely to be repeated. And this particular accident certainly has some attributes that may be atypical or even unique. That said, this accident also occurred in a relatively small town. A similar explosion and fire in a more dense urban area could have had even worse consequences and higher costs. In an urban area, the particular factors in Lac-Mégantic (unattended train rolling down steep grades to crash at high speeds) may be far less likely to occur. On the other hand, in an urban area, there are other risk factors, such as increased danger of collisions with other trains (or other vehicles), as well as proximity to large populations and other infrastructure.

It may also be pointed out that the Lac-Mégantic accident occurred in Canada and that the estimated costs are in Canadian dollars. But in fact, the Lac-Mégantic accident is very relevant for the US. First, US and Canadian dollars now have similar value, so the cost estimates for Lac-Mégantic accident would be similar if presented in US dollars. Second, the accident occurred very close to the US border, on a train that had originated in the US (North Dakota), traveled through numerous US states and cities, and would have again passed through the US (Maine) on its intended routing between Quebec and New Brunswick.

3. Estimated Costs of Enbridge's Line 6B Spill in Marshall, MI

3.1. Description of Disaster

According to the NTSB, following its investigation of the Enbridge Line 6B Spill (emphasis added):[33]

> On Sunday, July 25, 2010, at about 5:58 p.m., a 30 inch-diameter pipeline (Line 6B) owned and operated by Enbridge Incorporated ruptured and spilled crude oil into an ecologically sensitive area near the Kalamazoo River in Marshall, Mich., for 17 hours until a local utility worker discovered the oil and contacted Enbridge to report the rupture.
>
> The NTSB found that the material failure of the pipeline was the result of multiple small corrosion-fatigue cracks that over time grew in size and linked together, creating a gaping breach in the pipe measuring over 80 inches long.
>
> "This investigation identified a complete breakdown of safety at Enbridge. Their employees performed like Keystone Kops and failed to recognize their pipeline had ruptured and continued to pump crude into the environment," said NTSB Chairman Deborah A.P. Hersman. "Despite multiple alarms and a loss of pressure in the pipeline, for more than 17 hours and through three shifts they failed to follow their own shutdown procedures."
>
> […]
>
> Over 840,000 gallons of crude oil - enough to fill 120 tanker trucks - spilled into hundreds of acres of Michigan wetlands, fouling a creek and a river. A Michigan Department of Community Health study concluded that over 300 individuals suffered adverse health effects related to benzene exposure, a toxic component of crude oil.
>
> Line 6B had been scheduled for a routine shutdown at the time of the rupture to accommodate changing delivery schedules. Following the shutdown, operators in the Enbridge control room in Edmonton, Alberta, received multiple alarms indicating a problem with low pressure in the pipeline, which were dismissed as

[33] NTSB Press Release, "Pipeline Rupture and Oil Spill Accident Caused by Organizational Failures and Weak Regulations," July 10, 2012. Accessed August 3, 2012. http://www.ntsb.gov/news/2012/120710.html

being caused by factors other than a rupture. "Inadequate training of control center personnel" was cited as contributing to the accident.

The investigation found that Enbridge failed to accurately assess the structural integrity of the pipeline, including correctly analyzing cracks that required repair. The NTSB characterized Enbridge's control room operations, leak detection, and environmental response as deficient, and described the event as an "organizational accident."

Following the first alarm, Enbridge controllers restarted Line 6B twice, pumping an additional 683,000 gallons of crude oil, or 81 percent of the total amount spilled, through the ruptured pipeline. The NTSB determined that if Enbridge's own procedures had been followed during the initial phases of the accident, the magnitude of the spill would have been significantly reduced. Further, the NTSB attributed systemic flaws in operational decision-making to a "culture of deviance," which concluded that personnel had a developed an operating culture in which not adhering to approved procedures and protocols was normalized.

The NTSB also cited the Pipeline and Hazardous Materials Safety Administration's weak regulations regarding pipeline assessment and repair criteria as well as a cursory review of Enbridge's oil spill response plan as contributing to the magnitude of the accident.

The investigation revealed that the cracks in Line 6B that ultimately ruptured were detected by Enbridge in 2005 but were not repaired. A further examination of records revealed that Enbridge's crack assessment process was inadequate, increasing the risk of a rupture.

"This accident is a wake-up call to the industry, the regulator, and the public. Enbridge knew for years that this section of the pipeline was vulnerable yet they didn't act on that information," said Chairman Hersman. "Likewise, for the regulator to delegate too much authority to the regulated to assess their own system risks and correct them is tantamount to the fox guarding the hen house. Regulators need regulations and practices with teeth, and the resources to enable them to take corrective action before a spill. Not just after."

As a result of the investigation, the NTSB reiterated one recommendation to PHMSA and issued 19 new safety recommendations to the Department of the Transportation, PHMSA, Enbridge Incorporated, the American Petroleum Institute, the International Association of Fire Chiefs, and the National Emergency Number Association.

3.2. Costs and Sources of Cost Data

As of March 31, 2013, Enbridge indicated in its First Quarter Interim Report to Shareholders that the total clean-up for the spill is now estimated to cost approximately $1 billion. Enbridge's civil penalty for the spill was only $3.7 million.[34] Enbridge also points out that there is a possibility that the clean-up bill will continue to increase as the clean-up is still ongoing.

No lives were lost, but as the NTSB citation above indicates: "over 300 individuals suffered adverse health effects related to benzene exposure, a toxic component of crude oil." Furthermore, "[o]ver 840,000 gallons of crude oil - enough to fill 120 tanker trucks - spilled into hundreds of acres of Michigan wetlands, fouling a creek and a river."

3.3. Relevance of Marshall, MI to Estimating the Costs of CBR Accidents/Spills

The Marshall, MI pipeline disaster is also highly relevant to an estimation of the costs of a major CBR accident/spill for the following reasons:

1. It demonstrates the costs of a dilbit spill in an environmentally sensitive area (with wetlands and proximity to waterways and human population) in a non-urban area.[35] Marshall, MI is not dissimilar to the many areas through which trains are also routed (along waterways in order to minimize elevation and through population centers throughout the US).

2. The spill volumes at Marshall were within the range of the amount of spill possible (and, in fact, substantially less than the maximum spill) if a crude by rail unit train released much of its cargo. 840,000 gallons (or 3.3 million liters) were spilled at Marshall, the equivalent of the full cargo release of 27 tank cars (carrying 31,000 gallons) or 34 tank cars (carrying 25,000 gallons).[36] With

[34] Enbridge First Quarter Interim Report to Shareholders for the Three Months Ended March 31, 2013, Section 11 Contingencies, Adobe p. 67. Accessed August 3, 2013.
See http://www.enbridge.com/InvestorRelations/FinancialInformation/InvestorDocumentsandFilings.aspx and then click on FIRST QUARTER REPORT under 2013.
[35] The population of Marshall is approximately 7,000.
[36] Maximum capacity per tank car typically varies between 25,000 and 31,800 gallons of crude, based on factors including maximum weight limits, tank car design, and type of crude. Capacity will generally be lower for heavy crudes (such as the dilbit spilled at Marshall), which weigh more per gallon than light crudes (such as the Bakken crude spilled at Lac-Mégantic). Likewise, capacity will be lower for tank cars
(footnote continued on next page)

transport by unit trains on the rise, and unit trains carrying up to 100+ tank cars, it would be possible for a unit train to spill significantly higher volumes than the 840,000 gallons (or 3.3 million liters) released at Marshall. The 6.0 million liters released at Lac-Mégantic (almost twice the amount released at Marshall) provide support for this finding.

3. In light of recent findings regarding the Line 6B spill, the EPA has recently expressed concerns regarding the additional impacts of tar sands crude spills (versus conventional oil), with a particular concern about spills on waterways.[37]

Regarding the need for improved safety regulation for CBR, there are a number of regulatory lessons from the Marshall, MI rupture that should be considered:

1. The NTSB investigation also clearly indicates that in the case of Enbridge, and with respect to the regulation of pipeline operators, "trust us" isn't good enough. Chair Hersman has insightfully pointed out that "for the regulator to delegate too much authority to the regulated to assess their own system risks and correct them is tantamount to the fox guarding the hen house."[38] Chair Hersman's words are even more relevant for the regulation of transport of hazardous materials by rail, which is in many ways both weaker and more fragmented than the regulation of liquid pipelines.[39]

2. The NTSB investigation pointed out that the Marshall rupture was "a wake-up call" to industry, the regulator, and the public." Enbridge knew for years that the

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(footnote continued from previous page)
which have higher tare (unloaded) weights (such as those with heater coils and insulation, which are also sometimes used to transport dilbit).

[37] Comments of EPA on the Department of State's Keystone XL Draft Supplement Environmental Impact Statement (DSEIS). Accessed October 30, 2013.
http://epa.gov/compliance/nepa/keystone-xl-project-epa-comment-letter-20130056.pdf

[38] See footnote 33.

[39] As described in various other documents in the current proceeding, there is a long history of problems in regard to transport of hazardous materials (notably flammable liquids) by rail, with only a very slow and partial response to tighten standards to insure public safety. See Village of Barrington, Illinois and The Regional Answer to Canadian National (TRAC) - Petition for Rulemaking (P-1587); National Transportation Safety Board - Accident Report - Derailment of CN Freight Train U70691-18 With Subsequent Hazardous Materials Release and Fire Cherry Valley, Illinois June 19, 2009; and National Transportation Safety Board - Safety Recommendation - R-12-5 through -8, R-07-4 (Reiteration)

In the case of liquid pipelines, the pipeline owner/operator is typically responsible for construction and operation of all facilities within its transport system that are handling hazardous materials (notably flammable liquids), including pipes, valves, and pumping stations. By contrast, in the case of rail, the railroads provide motive power and crews to move hazardous materials (notably flammable liquids) in tank cars which are typically owned, loaded, and unloaded by shippers and other entities besides the railroads.

pipeline was vulnerable; much as the rail industry knows that another CBR spill is only a matter of time.

Although the Line 6B rupture caused widespread devastation to the Kalamazoo and surrounding wetlands and, at $1 billion in clean-up costs, holds the record for the single most expensive onshore spill in US history,[40] it is nowhere near the worst-case scenario for a CBR disaster. Similar to the Lac-Mégantic tragedy involving a CBR release of Bakken, the costs/damages for a CBR dilbit spill could be substantially higher in a more populated area, and costs could easily escalate to the multi-billion dollar range. The clean-up of dilbit, especially in waterways is particularly problematic and expensive. Moreover, the condensate can be highly flammable when spilled and this flammability could have catastrophic consequences in a more densely populated area.

[40] See footnote 33.

4. Conclusion

As the examples of the Lac-Mégantic CBR tragedy and the Marshall, MI pipeline rupture have demonstrated, a major CBR unit train accidents/spill could cost $1 billion or more for a single event.

Unit trains now transport unconventional crude, including both dilbit and Bakken, through densely populated urban areas, and this form of transport is rapidly growing. An accident/spill in an urban area could damage and disrupt major infrastructure, result in serious and widespread water and soil contamination, and possibly cause loss of life. The costs of a major unit train derailment in an urban centre could easily escalate into the multi-billion dollar range.

ATTACHMENT 4

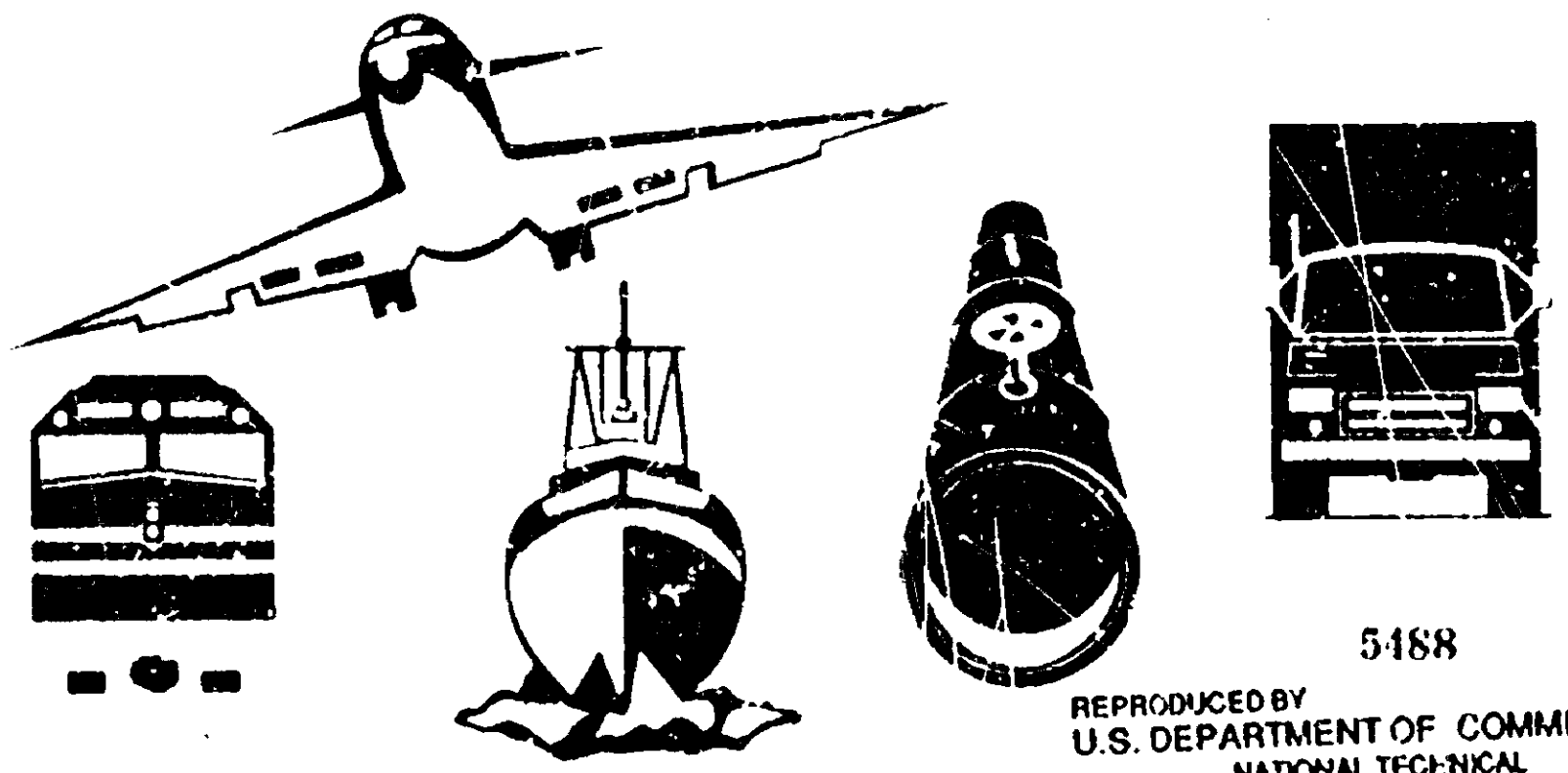
PB91-917002
NTSB/SS-91/01

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

SAFETY STUDY

TRANSPORT OF HAZARDOUS MATERIALS BY RAIL



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:

National Transportation Safety Board
Public Inquiries Section, RE-51
800 Independence Avenue, S.W.
Washington, D.C. 20594
(202)382-6735

NTSB/SS-91/01 PB91-917002

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

SAFETY STUDY

TRANSPORT OF HAZARDOUS MATERIALS BY RAIL

ADOPTED: MAY 16, 1991
NOTATION: 5488

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.

CONTENTS

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
CHEMTREC	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.

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[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]

Year	Number of incidents
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

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[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 couplers[5] 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.

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[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 accidents[9] (7 major[10] 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.

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[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:

Type	Number
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

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[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	Ohiopyle, 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	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	Bonners 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]

Railroad	Number of cases
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

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[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:

State	Number of cases
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:

Location of accident	Estimated number of persons evacuated
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
Bonners 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])	19
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.

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[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.

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[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	Derailment	111A100W3	Fitting damage, leaked	Sodium chlorate
			111A100W1	Fitting damage, leaked	Sodium hydroxide
			111A100W3	Shell puncture, leaked	Sodium hydroxide
4	Jeffersonville, IN	Standing car	111A60W1	Fitting damage, leaked	Acetic acid
6	Roodhouse, IL	Derailment	111A100W2	Fitting damage, leaked	Sulfuric acid
10	Las Vegas, NV	Standing car	111A100W2	Fitting damage, leaked	Sulfuric acid
11	Columbus, OH	Derailment	111A100W1	Fitting damage, leaked	Toluene
12	Crofton, KY	Derailment	111A100W1	Fitting damage, leaked, ignited	Phosphorus
13	Deer Park, TX	Standing car	111A100W6	Exploded, rocketed	Methyl methacrylate
15	White Bluff, TN	Derailment	111A100W1	Shell puncture, leaked	Petroleum sulfite waste
16	Altoona, IA	Collision	111A100W1	Fitting damage, leaked, ignited	Ethyl alcohol
			111A100W1	Fitting damage, leaked, ignited	Ethyl alcohol
19	Brazoria, TX	Derailment	111A100W1	Shell puncture, leaked, ignited	Acetaldehyde
			111A100W1	Exploded, rocketed	Acetaldehyde
			111A100W1	Shell failure, leaked, ignited	Acetaldehyde
			111A100W1	Shell failure, leaked, ignited	Acetaldehyde
			111A100W1	Shell failure, leaked, ignited	Acetaldehyde
			111A100W1	Head puncture, leaked, ignited	Acetaldehyde
20	Loudonville, OH	Derailment	111A100W1	Shell failure, leaked ignited, rocketed	Hexamethylene diamine
			111A100W1	Shell severed, leaked, ignited	Octanol
22	Elberton, GA	Derailment	111A60W1	Head puncture, leaked	Xylene
			111A60W1	Fitting damage, leaked	Xylene
			111A60W1	Fitting damage, leaked	Xylene
			111A60W1	Fitting damage, leaked	Xylene
			111A100W3	Head puncture, leaked	Xylene
			111A100W5	Fitting damage, leaked	Ferric chloride
25	Memphis, TN	Standing car	111A100W5	Head failure, leaked	Muriatic acid
26	Jacksonville, FL	Derailment	111A100W1	Fitting damage, leaked	Potassium hydroxide
27	Summit, IL	Derailment	111A100W1	Fitting damage, leaked	Phosphoric acid
28	Rineyville, KY	Derailment	111A50ALW1	Fitting damage, leaked	Acetic acid
			111A100W1	Shell puncture, leaked	Sodium hydroxide
			111A100W1	Fitting damage, leaked	Hydrochloric acid
29	Easley, SC	Derailment	111A60W1	Shell puncture, leaked	Sodium hydroxide
			111A100W1	Fitting damage, leaked	Sodium hydroxide
			111A100W1	Fitting damage, leaked	Sodium hydroxide
30	Pearl, IL	Derailment	111A100W1	Fitting damage, leaked	Isopropanol
31	Morganza, LA	Derailment	111A60W1	Shell puncture, leaked	Toluene dissocyanate
32	Newcastle, CA	Derailment	111A100W1	Shell puncture, leaked	Ethyl alcohol
33	Lyndon Station, WI	Derailment	111A100W1	Shell puncture, leaked	Carbolic acid
34	Bangor, AL	Derailment	111A100W2	Fitting damage, leaked	Sulfuric acid
			111A100W1	Shell puncture, leaked	Diethylene glycol
37	Palmyra, MO	Standing car	111A60W7	Overpressure, leaked	Sulfuric acid
41	Helena, MT	Collision	111A60W1	Head puncture, leaked, ignited	Isopropyl alcohol/acetone[a]
			111A50ALW2	Valve leaked, ignited	Hydrogen peroxide
			111A50ALW2	Exploded, rocketed[b]	Hydrogen peroxide
42	Kansas City, KS	Standing car	111A60ALW1	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 derailment, 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 polymerize[17]) 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

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[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.

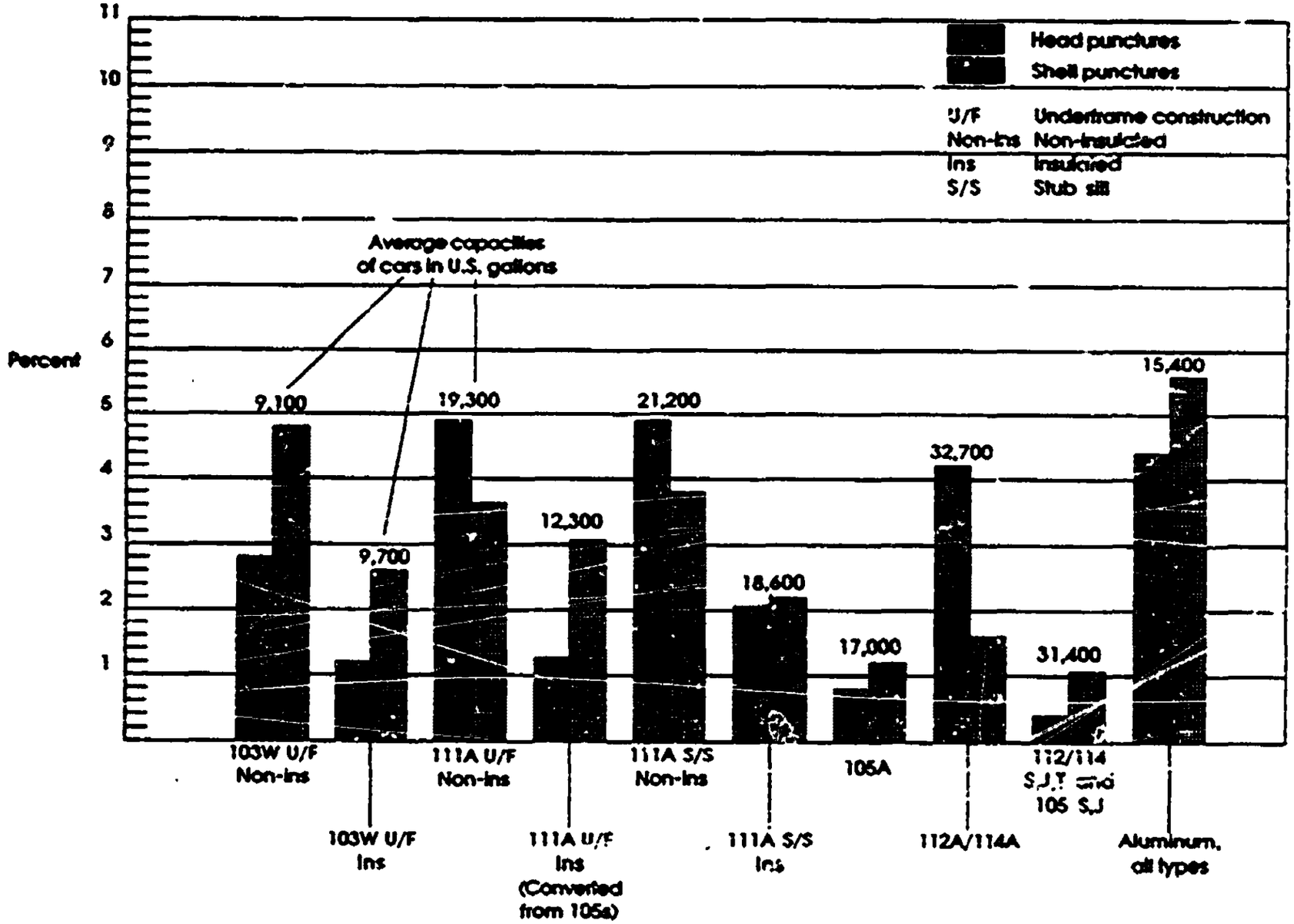

Figure 1.--Incidence of head and shell punctures to total number of tank cars damaged in accidents, 1965-86. (Source: Railway Progress Institute and Association of American Railroads 1990a.)

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, 1983, 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,

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[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 naptha (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 naptha (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 naptha, 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.

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[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.

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[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

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[21] The events occurred in Rockingham, North Carolina (1977); Crestview, Florida (1979); Sommerville, 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

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[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:

Railroad	Status
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 & Potomoc Railroad Co.	Closed--Acceptable Action

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[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.

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[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 CHEMTREC[26] 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

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[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 1988 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 conjucted	Documented plans	Planning activity	Disaster drills
1	Claude, TX	BN	Derailment	N	--	N	N
2	Punta Gorda, Ft	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	Roodhouse, IL	CMNV	Derailment	Y	N	N	N
7	Denver, CO	UP	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	Ohiopyle, 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	--	--
5	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	CMNV	Derailment	N	--	--	--
31	Morganza, LA	LA	Derailment	Y	N	N	N
32	Newcastle, CA	SP	Derailment	Y	N	N	K
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	N
39	Flagstaff, AZ	ATSF	Derailment	Y	Y	Y	Y
40	Bonners 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, ND	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-89-29 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 (NTSB 1989). The Safety Board issued several site specific safety recommendations to correct deficiencies noted.[29]

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[27] Since the accident, CHEMTREC 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 DOT-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

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[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]/Superseded"[31] 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.

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[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 1976). In its 1980 report of a special study on railroad emergency procedures, a compo.ite 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

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[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 CSX[33] 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."

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[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.

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[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	CNW	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	Umbarger, TX	ATSF	Y[c]	Y[c]
18	Ohiopyle, 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	CNW	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	Bonners 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, ND	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,

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[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 HM-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

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[37] The Atchinson, Topeka & Santa Fe Railway Company; Burlington Northern Railroad Company; Conrail; Guilford Transportation Industries, Inc.; and SOO 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
	Million	Percent	Billion	Percent
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).

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	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

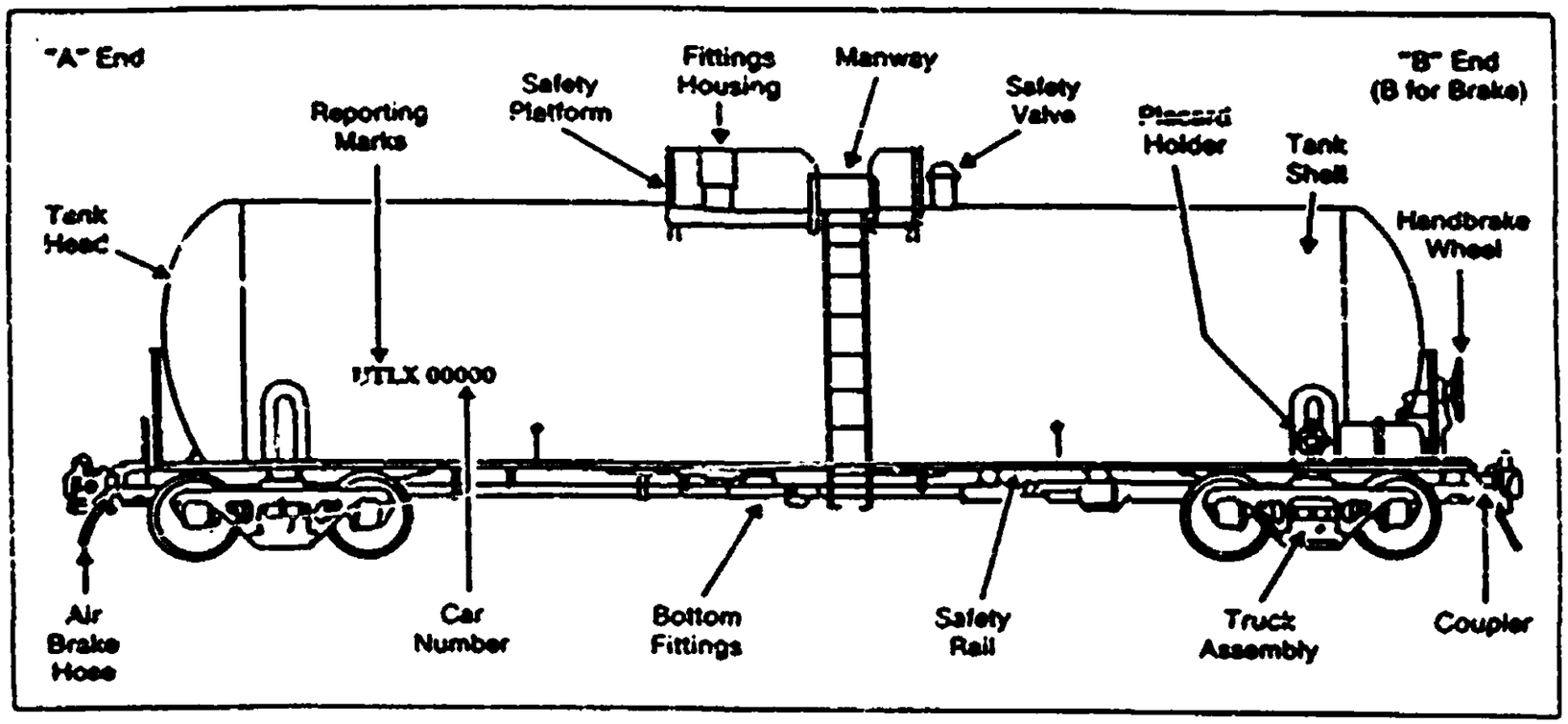
[a] An inhibitor added to a commodity is a chemical compound that retards or stops an undesired chemical reaction.

[b] Not otherwise specified.

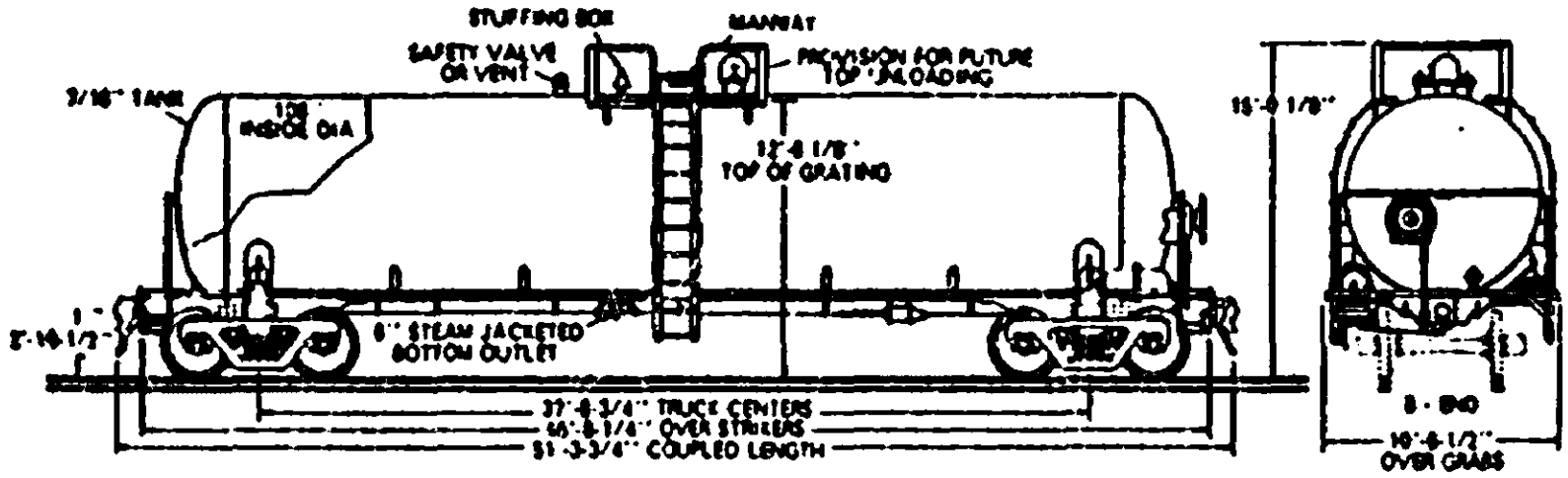
Source: Association of American Railroads (1990a).

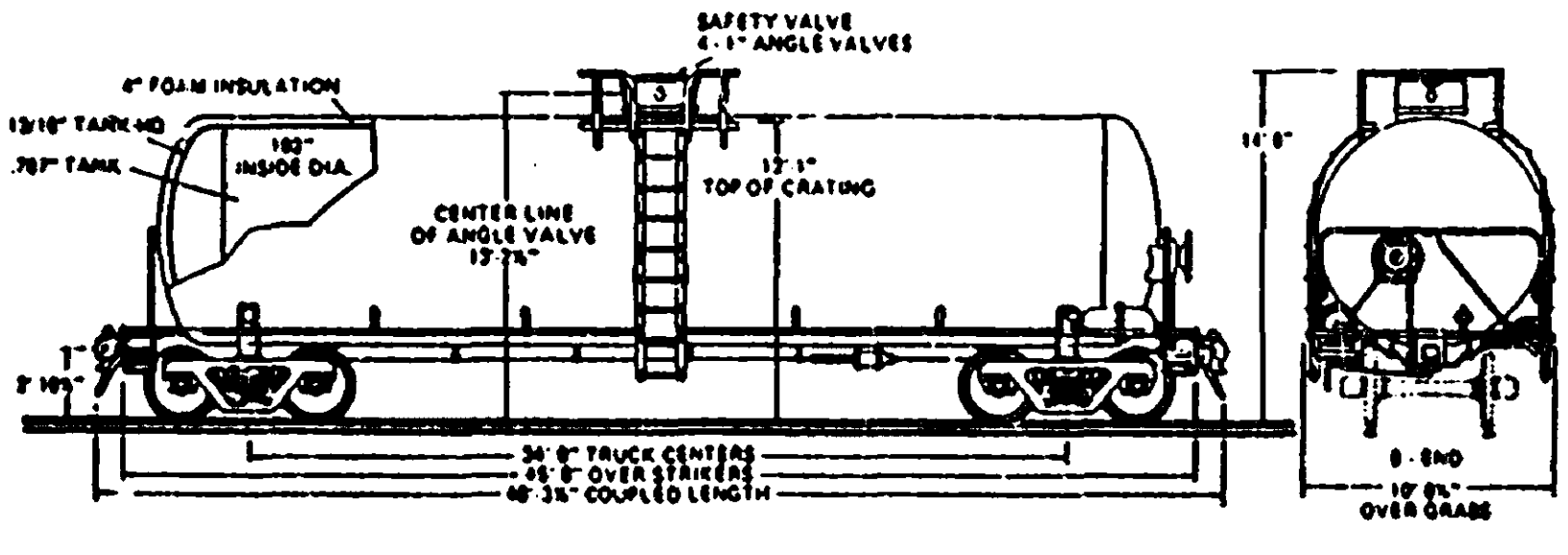
APPENDIX C

DIAGRAMS OF TANK CARS AND TANK CAR SPECIFICATIONS

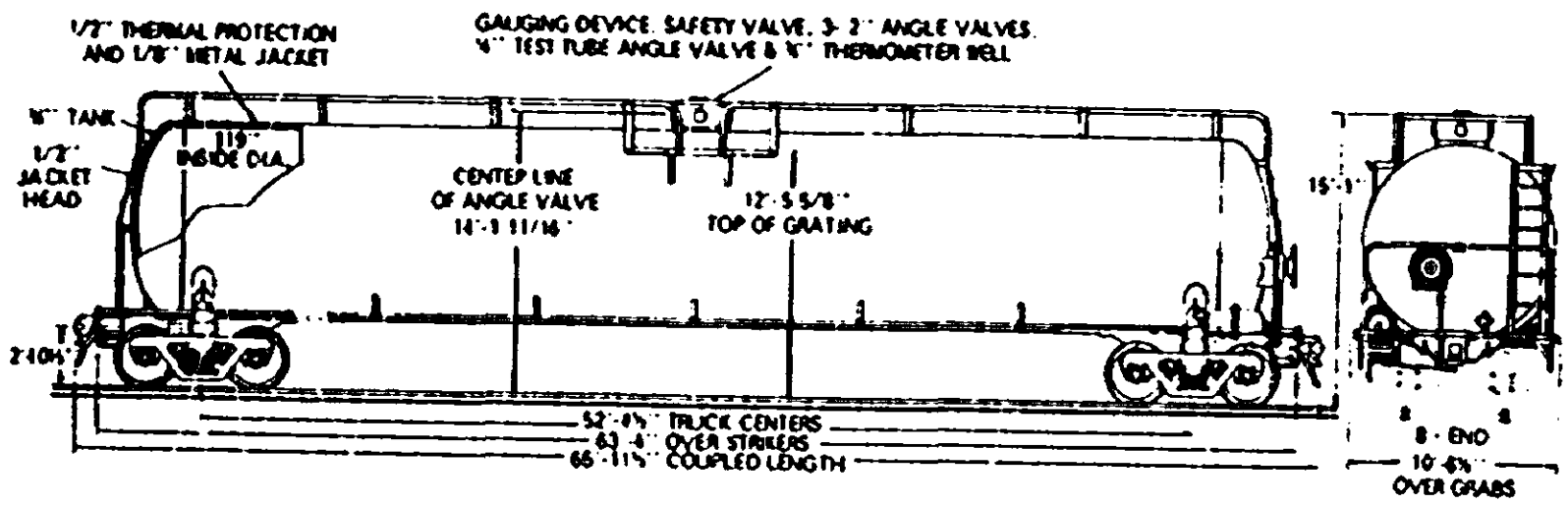


Schematic of a tank car.
(Source: American Association of Railroads.)





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



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

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, 400, 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.

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

Class DOT-112A, J, S, or T***W 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 155F (−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 T***W 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

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 radioscopy 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 materals.

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

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	CHI88FRZ17
4	Jeffersonville, IN	04/26/88	CR	CHI88FRZ18
5	Wilmington, CA	04/27/88	UP	LAX88FRZ10
6	Rochhouse, IL	05/03/88	CNNW	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	Ohiopyle, 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	CNNW	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	Bonners 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
WASHINGTON, D.C. 20594

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
Type of Accident - DERAILMENT
Operating Phase - EN ROUTE
Method of Operation - TIMETABLE
TRAIN ORDERS

Property Losses
Railroad - $ 380,734.00
Non-Railroad - $ 0.00

Fire - NO

	Injuries			
	Fatal	Serious	Minor	None
Employees	0	0	0	4
Passengers	0	0	0	0
Motorist	0	0	0	0
Other	0	0	0	0

BN - BURLINGTON NORTHERN RAILROAD COMPANY

---Railroad/Personnel Information---

Train Data
Railroad - BN
Type of Train - FREIGHT
Train ID - EXTRA 3000 WEST
Direction - WEST
Speed (Est.) - 39
Speed (Auth.) - 49

Train Consist/Damage
No. Loco. Units - 4
No. Cars/Caboose - 79/0
End of Train Monitor - MONITOR
Length (Feet) - 4809
Trailing Tons - 5973
Loco. Destroy/Derailed - N/A
Cars Destroy/Derailed - 15/28

Crew Information
Front End - 4
Rear End - 0
Toxicology Performed - NO

Radio Communications
Radio Available - YES
Operational - YES

BN - BURLINGTON NORTHERN RAILROAD COMPANY

---Environment/Operations Information---

Weather Data
Weather Condition - CLOUDY
Condition of Light - DAYLIGHT

Evacuation - NO

Itinerary
Last Departure Point
WICHITA FALLS, TX

Destination
AMARILLO, TX

Hazardous Materials
Involved - YES
Cars Involved - 4

Track Information
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.

File No. - 22 | 03/04/88 | CLAUDE, TX | Time (Lcl) - 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

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

NTSB # ATL88FRZ13 — 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
Type of Accident - DERAILMENT
Operating Phase - EN ROUTE
Method of Operation - MANUAL BLOCKS

Property Losses
Railroad - $ 4,960.00
Non-Railroad - $ 0.00

Fire - NO

	Injuries			
	Fatal	Serious	Minor	None
Employees	0	0	0	2
Passengers	0	0	0	0
Motorist	0	0	0	0
Other	0	0	0	0

SGLR - SEMINOLE GULF RAILROAD

---Railroad/Personnel Information---

Train Data
Railroad - SGLR
Type of Train - FREIGHT
Train ID - EXTRA 573 SOUTH
Direction - SOUTH
Speed (Est.) - 20
Speed (Auth.) - 20

Train Consist/Damage
No. Loco. Units - 2
No. Cars/Caboose - 40/0
End of Train Monitor - MARKER
Length (Feet) - 2405
Trailing Tons - 1715
Loco. Destroy/Derailed - N/A
Cars Destroy/Derailed - 0/1

Crew Information
Front End - 2
Rear End - 0
Toxicology Performed - NO

Radio Communications
Radio Available - YES
Operational - YES

SGLR - SEMINOLE GULF RAILROAD

---Environment/Operations Information---

Weather Data
Weather Condition - CLEAR
Condition of Light - DAYLIGHT

Evacuation - YES

Itinerary
Last Departure Point
ARCADIA, FL

Destination
FT. MYERS, FL

Hazardous Materials
Involved - YES
Cars Involved - 1

Track Information
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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APPENDIX D

APPENDIX D

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

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
Type of Accident - DERAILMENT
Operating Phase - EN ROUTE
Method of Operation - TRAFFIC CONTROL TIMETABLE

Property Losses
Railroad - $ 1,292,853.00
Non-Railroad - $ 0.00

Fire - NO

	Injuries			
	Fatal	Serious	Minor	None
Employees	0	0	0	4
Passengers	0	0	0	0
Motorist	0	0	0	0
Other	0	0	0	0

BN - BURLINGTON NORTHERN RAILROAD COMPANY

---Railroad/Personnel Information---

Train Data
Railroad - BN
Type of Train - FREIGHT
Train ID - EXTRA 6810 EAST
Direction - EAST
Speed (Est.) - 28
Speed (Auth.) - 45

Train Consist/Damage
No. Loco. Units - 7
No. Cars/Caboose - 135/1
End of Train Monitor - MONITOR
Length (Feet) - 7895
Trailing Tons - 10518
Loco. Destroy/Derailed - N/A
Cars Destroy/Derailed - 13/24

Crew Information
Front End - 4
Rear End - 0
Toxicology Performed - YES

Radio Communications
Radio Available - YES
Operational - YES

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BN - BURLINGTON NORTHERN RAILROAD COMPANY

---Environment/Operations Information---

Weather Data
Weather Condition - CLEAR
Condition of Light - DAYLIGHT

Evacuation - NO

Itinerary
Last Departure Point
WISHRAM, WA

Destination
PASCO, WA

Hazardous Materials
Involved - YES
Cars Involved - 4

Track Information
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".

File No. - 32 | 04/08/88 | PASCO, WA | Time (Lcl) - 1230 PST

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

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

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
Type of Accident - HAZ. MAT. RELEASED
Operating Phase - STANDING
Method of Operation - VERBAL PERMISSION

Property Losses
Railroad - $ 832.00
Non-Railroad - $ 0.00

Fire - NO

	Injuries			
	Fatal	Serious	Minor	None
Employees	0	0	0	3
Passengers	0	0	0	0
Motorist	0	0	0	0
Other	0	0	0	0

CR - CONSOLIDATED RAIL CORPORATION

---Railroad/Personnel Information---

Train Data
Railroad - CR
Type of Train - YARD
Train ID - INTERCHANGE
Direction - NORTH
Speed (Est.) - 0
Speed (Auth.) - 0

Train Consist/Damage
No. Loco. Units - 1
No. Cars/Caboose - 39/0
End of Train Monitor - NO
Length (Feet) - 2400
Trailing Tons - 3000
Loco. Destroy/Derailed - N/A
Cars Destroy/Derailed - N/A

Crew Information
Front End - 3
Rear End - 0
Toxicology Performed - NO

Radio Communications
Radio Available - NO
Operational - N/A

CR - CONSOLIDATED RAIL CORPORATION

---Environment/Operations Information---

Weather Data
Weather Condition - CLEAR
Condition of Light - DAYLIGHT

Evacuation - NO

Itinerary
Last Departure Point
LOUISVILLE, KY

Destination
JEFFERSONVILLE, IN

Hazardous Materials
Involved - YES
Cars Involved - 1

Track Information
Type/No. of Tracks - YARD/15
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.

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

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

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
Type of Accident - HAZ. MAT. RELEASED
Operating Phase - STANDING
Method of Operation - YARD RULES TIMETABLE

Property Losses
Railroad - $ 0.00
Non-Railroad - $ 0.00

Fire - NO

Injuries	Fatal	Serious	Minor	None
Employees	0	0	2	2
Passengers	0	0	0	0
Motorist	0	0	0	0
Other	0	0	0	0

UP - UNION PACIFIC RAILROAD COMPANY

---Railroad/Personnel Information---

Train Data
Railroad - UP
Type of Train - YARD
Train ID - SWITCH ENGINE 2013
Direction - EAST
Speed (Est.) - 0
Speed (Auth.) - 10

Train Consist/Damage
No. Loco. Units - 1
No. Cars/Caboose - 4/0
End of Train Monitor - NC
Length (Feet) - 280
Trailing Tons - 250
Loco. Destroy/Derailed - N/A
Cars Destroy/Derailed - N/A

Crew Information
Front End - 4
Rear End - 0
Toxicology Performed - NO

Radio Communications
Radio Available - YES
Operational - YES

UP - UNION PACIFIC RAILROAD COMPANY

---Environment/Operations Information---

Weather Data
Weather Condition - CLOUDY
Condition of Light - DARK

Evacuation - NO

Itinerary
Last Departure Point
WILMINGTON, CA

Destination
WILMINGTON, CA

Hazardous Materials
Involved - YES
Cars Involved - 1

Track Information
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.

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

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

NTSB # CHI88FRZ20 — BRIEF OF ACCIDENT — RUNDATE: 03/23/90

File No. - 41 — 05/03/88 — ROODHOUSE, IL — Time (Lcl) - 0830 CDT

---Basic Information---

Reporting Railroad - CMNW
Type of Accident - DERAILMENT
Operating Phase - EN ROUTE
Method of Operation - TIMETABLE
TRAIN ORDERS

Property Losses
Railroad - $ 32,000.00
Non-Railroad - $ 0.00

Fire - NO

Injuries	Fatal	Serious	Minor	None
Employees	0	0	0	3
Passengers	0	0	0	0
Motorist	0	0	0	0
Other	0	0	0	0

CMNW - CHICAGO MISSOURI & WESTERN RAILWAY

---Railroad/Personnel Information---

Train Data
Railroad - CMNW
Type of Train - FREIGHT
Train ID - EXTRA 3014 EAST
Direction - EAST
Speed (Est.) - 15
Speed (Auth.) - 25

Train Consist/Damage
No. Loco. Units - 5
No. Cars/Caboose - 60/0
End of Train Monitor - MARKER
Length (Feet) - 4260
Trailing Tons - 6040
Loco. Destroy/Derailed - N/A
Cars Destroy/Derailed - 0/5

Crew Information
Front End - 3
Rear End - 0
Toxicology Performed - YES

Radio Communications
Radio Available - YES
Operational - YES

CMNW - CHICAGO MISSOURI & WESTERN RAILWAY

---Environment/Operations Information---

Weather Data
Weather Condition - CLOUDY
Condition of Light - DAYLIGHT

Evacuation - YES

Itinerary
Last Departure Point
KANSAS CITY, MO

Destination
E. ST. LOUIS, IL

Hazardous Materials
Involved - YES
Cars Involved - 3

Track Information
Type/No. of Tracks - MAIN/1
Gradient - ASC. 0.71
Alignment - CURVE O D O 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.

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)

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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

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
Type of Accident - HAZ. MAT. RELEASED
Operating Phase - LOADING/UNLOADING
Method of Operation - TRAFFIC CONTROL TIMETABLE

Property Losses
Railroad - $ 840.00
Non-Railroad - $ 0.00

Fire - NO

	Injuries			
	Fatal	Serious	Minor	None
Employees	0	0	0	0
Passengers	0	0	0	0
Motorist	0	0	0	0
Other	0	0	0	1

UP - UNION PACIFIC RAILROAD COMPANY

---Railroad/Personnel Information---

Train Data
Railroad - UP
Type of Train - FREIGHT
Train ID - EXTRA 2519 WEST
Direction - WEST
Speed (Est.) - 0
Speed (Auth.) - 0

Train Consist/Damage
No. Loco. Units - 3
No. Cars/Caboose - 83/0
End of Train Monitor - MONITOR
Length (Feet) - 6772
Trailing Tons - 6444
Loco. Destroy/Derailed - N/A
Cars Destroy/Derailed - N/A

Crew Information
Front End - 4
Rear End - 0
Toxicology Performed - NO

Radio Communications
Radio Available - YES
Operational - YES

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UP - UNION PACIFIC RAILROAD COMPANY

---Environment/Operations Information---

Weather Data
Weather Condition - CLEAR
Condition of Light - DAYLIGHT

Evacuation - NO

Itinerary
Last Departure Point
NORTH PLATTE, NE

Destination
DENVER, CO

Hazardous Materials
Involved - YES
Cars Involved - 1

Track Information
Type/No. of Tracks - INDUSTRIAL/6
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.

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

APPENDIX D

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

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
Type of Accident - DERAILMENT
Operating Phase - EN ROUTE
Method of Operation - TIMETABLE
RADIO

Property Losses
Railroad - $ 140,000.00
Non-Railroad - $ 0.00

Fire - NO

	Injuries			
	Fatal	Serious	Minor	None
Employees	0	0	0	3
Passengers	0	0	0	0
Motorist	0	0	0	0
Other	0	0	0	0

MSRC - MID SOUTH RAIL CORP.

---Railroad/Personnel Information---

Train Data
Railroad - MSRC
Type of Train - LOCAL FREIGHT
Train ID - EXTRA 1036 SOUTH
Direction - SOUTH
Speed (Est.) - 25
Speed (Auth.) - 25

Train Consist/Damage
No. Loco. Units - 2
No. Cars/Caboose - 12/0
End of Train Monitor - MARKER
Length (Feet) - 840
Trailing Tons - 1080
Loco. Destroy/Derailed - N/A
Cars Destroy/Derailed - 0/6

Crew Information
Front End - 3
Rear End - 0
Toxicology Performed - NO

Radio Communications
Radio Available - YES
Operational - YES

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MSRC - MID SOUTH RAIL CORP.

---Environment/Operations Information---

Weather Data
Weather Condition - CLEAR
Condition of Light - DAYLIGHT

Evacuation - YES

Itinerary
Last Departure Point
HATTIESBURG, MS

Destination
GULFPORT, MS

Hazardous Materials
Involved - YES
Cars Involved - 6

Track Information
Type/No. of Tracks - MAIN/1
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.

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

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

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
Type of Accident - DERAILMENT
Operating Phase - EN ROUTE
Method of Operation - AUTOMATIC BLOCK TRAFFIC CONTROL

Property Losses
Railroad - $ 277,113.00
Non-Railroad - $ 10,000.00

Fire - NO

	Injuries			
	Fatal	Serious	Minor	None
Employees	0	0	0	2
Passengers	0	0	0	0
Motorist	0	0	0	0
Other	0	0	0	0

WC - WISCONSIN CENTRAL LTD. (ALSO RAILWAY)

---Railroad/Personnel Information---

Train Data
Railroad - WC
Type of Train - FREIGHT
Train ID - EXTRA 6517 WEST
Direction - WEST
Speed (Est.) - 40
Speed (Auth.) - 40

Train Consist/Damage
No. Loco. Units - 2
No. Cars/Caboose - 70/0
End of Train Monitor - MARKER
Length (Feet) - 3940
Trailing Tons - 4812
Loco. Destroy/Derailed - N/A
Cars Destroy/Derailed - 8/20

Crew Information
Front End - 2
Rear End - 0
Toxicology Performed - NO

Radio Communications
Radio Available - YES
Operational - YES

WC - WISCONSIN CENTRAL LTD. (ALSO RAILWAY)

---Environment/Operations Information---

Weather Data
Weather Condition - CLEAR
Condition of Light - DUSK

Evacuation - YES

Itinerary
Last Departure Point
FOND DU LAC, WI

Destination
STEVENS POINT, WI

Hazardous Materials
Involved - YES
Cars Involved - 1

Track Information
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.

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

NTSB # LAX88FRZ12
File No. - S4 05/23/88

BRIEF OF ACCIDENT
LAS VEGAS, NV

RUNDATE: 03/23/90
Time (Lcl) - 0700 PDT

---Basic Information---

Reporting Railroad - UP
Type of Accident - HAZ. MAT. RELEASED
Operating Phase - STANDING
Method of Operation - YARD RULES
TRAFFIC CONTROL

Property Losses
Railroad - $ 0.00
Non-Railroad - $ 0.00

Fire - NO

	Injuries			
	Fatal	Serious	Minor	None
Employees	0	0	0	3
Passengers	0	0	0	0
Motorist	0	0	0	0
Other	0	0	0	0

UP - UNION PACIFIC RAILROAD COMPANY

---Railroad/Personnel Information---

Train Data
Railroad - UP
Type of Train - FREIGHT
Train ID - EXTRA 3403 WEST
Direction - WEST
Speed (Est.) - 0
Speed (Auth.) - 50

Train Consist/Damage
No. Loco. Units - 3
No. Cars/Caboose - 101/0
End of Train Monitor - MARKER
Length (Feet) - 5657
Trailing Tons - 8250
Loco. Destroy/Derailed - N/A
Cars Destroy/Derailed - N/A

Crew Information
Front End - 3
Rear End - 0
Toxicology Performed - NO

Radio Communications
Radio Available - YES
Operational - YES

UP - UNION PACIFIC RAILROAD COMPANY

---Environment/Operations Information---

Weather Data
Weather Condition - CLEAR
Condition of Light - DAYLIGHT

Evacuation - NO

Itinerary
Last Departure Point
MILFORD, UT

Destination
LOS ANGELES, CA

Hazardous Materials
Involved - YES
Cars Involved - 1

Track Information
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.

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 CARRYS) - 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

APPENDIX O

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

NTSB # ATL88FRZ16 — BRIEF OF ACCIDENT — RUNDATE: 03/23/90

File No. - 61 — 06/11/88 — COLUMBUS, OH — Time (Lcl) - 1215 EDT

---Basic Information---

Reporting Railroad - CSX
Type of Accident - DERAILMENT
Operating Phase - EN ROUTE
Method of Operation - TIMETABLE
RADIO

Property Losses
Railroad - $ 235,000.00
Non-Railroad - $ 0.00

Fire - NO

	Injuries			
	Fatal	Serious	Minor	None
Employees	0	0	1	4
Passengers	0	0	0	0
Motorist	0	0	0	0
Other	0	0	1	0

CSX - CSX TRANSPORTATION

---Railroad/Personnel Information---

Train Data
Railroad - CSX
Type of Train - FREIGHT
Train ID - EXTRA 2684 WEST
Direction - WEST
Speed (Est.) - 26
Speed (Auth.) - 30

Train Consist/Damage
No. Loco. Units - 2
No. Cars/Caboose - 111/0
End of Train Monitor - MONITOR
Length (Feet) - 6987
Trailing Tons - 5977
Loco. Destroy/Derailed - N/A
Cars Destroy/Derailed - 11/14

Crew Information
Front End - 4
Rear End - 0
Toxicology Performed - YES

Radio Communications
Radio Available - YES
Operational - YES

CSX - CSX TRANSPORTATION

---Environment/Operations Information---

Weather Data
Weather Condition - CLEAR
Condition of Light - DAYLIGHT

Evacuation - NO

Itinerary
Last Departure Point
COLUMBUS, OH

Destination
TOLEDO, OH

Hazardous Materials
Involved - YES
Cars Involved - 6

Track Information
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.

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

APPENDIX O

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

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
Type of Accident - DERAILMENT
Operating Phase - EN ROUTE
Method of Operation - TRAFFIC CONTROL
TIMETABLE

Property Losses
Railroad - $ 861,265.00
Non-Railroad - $ 300,000.00

Fire - NO

	Injuries			
	Fatal	Serious	Minor	None
Employees	0	0	0	3
Passengers	0	0	0	0
Motorist	0	0	0	0
Other	0	12	181	0

CSX - CSX TRANSPORTATION

---Railroad/Personnel Information---

Train Data
Railroad - CSX
Type of Train - FREIGHT
Train ID - EXTRA 6742 NORTH
Direction - NORTH
Speed (Est.) - 35
Speed (Auth.) - 10

Train Consist/Damage
No. Loco. Units - 3
No. Cars/Caboose - 121/0
End of Train Monitor - MARKER
Length (Feet) - 6625
Trailing Tons - 5827
Loco. Destroy/Derailed - N/A
Cars Destroy/Derailed - 15/37

Crew Information
Front End - 3
Rear End - 0
Toxicology Performed - YES

Radio Communications
Radio Available - YES
Operational - YES

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CSX - CSX TRANSPORTATION

---Environment/Operations Information---

Weather Data
Weather Condition - CLEAR
Condition of Light - DAYLIGHT

Evacuation - YES

Itinerary
Last Departure Point
NASHVILLE, TN

Destination
EVANSVILLE, IN

Hazardous Materials
Involved - YES
Cars Involved - 4

Track Information
Type/No. of Tracks - MAIN/1
Gradient - DES. 0.60
Alignment - CURVE 4 D O 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 PHOPHORUS 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.

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)

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

APPENDIX D

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

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
Type of Accident - EXPLOSION
Operating Phase - STANDING
Method of Operation - YARD RULES

Property Losses
Railroad - $ 222,000.00
Non-Railroad - $ 33,000.00

Fire - NO

	Injuries			
	Fatal	Serious	Minor	None
Employees	0	0	0	0
Passengers	0	0	0	0
Motorist	0	0	0	0
Other	0	0	0	0

PTRA - PORT TERMINAL RAILROAD ASSOCIATION

---Railroad/Personnel Information---

Train Data
Railroad - PTRA
Type of Train - SINGLE CAR
Train ID - N/A
Direction - N/A
Speed (Est.) - 0
Speed (Auth.) - 0

Train Consist/Damage
No. Loco. Units - 0
No. Cars/Caboose - 1/0
End of Train Monitor - NO
Length (Feet) - 50
Trailing Tons - 123
Loco. Destroy/Derailed - N/A
Cars Destroy/Derailed - 1/4

Crew Information
Front End - 0
Rear End - 0
Toxicology Performed - NO

Radio Communications
Radio Available - NO
Operational - N/A

PTRA - PORT TERMINAL RAILROAD ASSOCIATION

---Environment/Operations Information---

Weather Data
Weather Condition - CLOUDY
Condition of Light - DARK

Evacuation - NO

Itinerary
Last Departure Point
DEER PARK, TX

Destination
DEER PARK, TX

Hazardous Materials
Involved - YES
Cars Involved - 1

Track Information
Type/No. of Tracks - INDUSTRIAL/9
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.

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

APPENDIX D

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

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
Type of Accident - HIGHWAY CROSSING
Operating Phase - EN ROUTE
Method of Operation - MANUAL BLOCKS
TIMETABLE

Property Losses
Railroad - $ 28,800.00
Non-Railroad - $ 60,000.00

Fire - NO

	Injuries			
	Fatal	Serious	Minor	None
Employees	0	0	0	4
Passengers	0	0	0	0
Motorist	0	1	0	0
Other	0	0	0	0

BN - BURLINGTON NORTHERN RAILROAD COMPANY

---Railroad/Personnel Information---

Train Data
Railroad - BN
Type of Train - FREIGHT
Train ID - EXTRA 2348 WEST
Direction - WEST
Speed (Est.) - 30
Speed (Auth.) - 30

Train Consist/Damage
No. Loco. Units - 2
No. Cars/Caboose - 3/0
End of Train Monitor - MONITOR
Length (Feet) - 315
Trailing Tons - 390
Loco. Destroy/Derailed - 0/2
Cars Destroy/Derailed - 0/3

Crew Information
Front End - 4
Rear End - 0
Toxicology Performed - NO

Radio Communications
Radio Available - YES
Operational - YES

BN - BURLINGTON NORTHERN RAILROAD COMPANY

---Environment/Operations Information---

Weather Data
Weather Condition - CLEAR
Condition of Light - DAYLIGHT

Evacuation - NO

Itinerary
Last Departure Point
HOLDREGE, NE

Destination
CURTIS, NE

Hazardous Materials
Involved - YES
Cars Involved - 2

Track Information
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.

ATTACHMENT 5

National Transportation Safety Board

Washington, D.C. 20594

March 1, 1988

Dockets Branch
Research and Special Programs
Administration
U.S. Department of Transportation
400 Seventh Street SW
Washington, D.C. 20590

Dear Sir:

The Safety Board has reviewed your Notice of Proposed Rulemaking (NPRM), "Performance-Oriented Packaging Standards; Miscellaneous Proposals," Docket No. HM-181, which was published at 52 FR 16482 on May 5, 1987, and the revised NPRM which was published at 52 FR 42773 on November 6, 1987. We support the objectives stated in this rulemaking, that is, to simplify the hazardous materials regulations, to reduce the volume of regulations, to promote flexibility and technological advances in packaging, to promote safety through better packaging, to reduce the need for exemptions, and to facilitate international commerce.

Although it has taken 5 years for the RSPA to progress this rulemaking to an NPRM, we are pleased that the RSPA has taken action to improve the hazard classification system through quantitative definitions and to establish performance-oriented nonbulk packaging criteria. We note that the proposal still contains some inconsistent packaging requirements in the proposed regulations and that it fails to adequately address the advance notice of proposed rulemaking (ANPRM) comments on nonbulk package performance tests involving differences in the United States and European transportation environments.

The Safety Board also notes that several previously prohibited poisonous gases, e.g., phosgene, germane, and cyanogen chloride, will be permitted to be transported in bulk containers; yet, no justification has been offered for this change. We do not believe that previously prohibited gases should be transported in bulk containers unless tests and safety analyses document that this change will not unreasonably affect public safety. Nevertheless, the Board believes the NPRM contains significant improvements for the transportation of hazardous materials. Below are specific comments which we believe will help to further the stated objectives of this rulemaking.

Hazard Classification

On numerous occasions, the Safety Board has expressed concern about the deficiencies in the Department of Transportation (DOT) hazard identification and classification system. We have urged the DOT to fully identify the hazards posed to life and health by each material during normal transportation and emergencies. Additionally, the Safety Board has recommended specific improvements in this system. (See Safety Recommendations R-72-44, I-76-3, I-81-14, I-81-15, and I-81-16.) The Safety Board continues to believe that improved knowledge about the type and extent of hazards posed by materials is necessary for making correct regulatory and design decisions about the level of protection containers should be required to provide during transportation. Additionally, this more comprehensive information should influence

public safety protection measures implemented when such materials are released during transportation. Therefore, we support RSPA's actions in the NPRM to provide quantitative definitions for all classes of hazardous materials and to make those definitions consistent with the recommendations prescribed by the United Nations (UN). We believe the proposed definitions will result in an improved and more uniform system for identifying the hazard characteristics of materials in transportation.

Hazard Communication

Many transported materials exhibit multiple hazards; however, the proposed regulations do not adequately address subsidiary hazards. Subsidiary hazards should be identified in the hazardous materials table (Section 172.101), on shipping papers (as required in Canada), and on vehicles. For example, according to the precedence of the hazard table in Section 173.2a, a material that requires a packaging group I container because of its toxicity by inhalation and because of its flammability (class 3) would be classified as a poisonous material. This classification results in only the poisonous characteristics of the material being identified. The potentially equally important information on its flammability characteristics will not be disclosed on shipping papers or placards.

Also, the Safety Board is concerned that the proposed use of hazard class or division numbers and identification numbers on shipping papers, labels, and placards as the required means of identifying materials and their hazards does not effectively convey sufficient warning information to the general public. The Safety Board believes that the DOT must require all shipping papers, labels, and placards to identify in plain language the hazards of the material for domestic shipments. Any additional information, such as class or division numbers and identification numbers, should supplement rather than replace text to identify the hazards.

First, numbers require persons to be familiar with the "code," or to have references readily available to explain their meaning. Secondly, numbers can be confusing when cargo names are complicated and contain numbers themselves. For example, the cargo 3,3,6.5.9,9-Hexamethyl-1,1,2,4,5-tetracyclononane is a proper DOT shipping name with identification number UN2167. Under current requirements, the hazard class described on the shipping papers is "Organic Peroxide." Under the proposed requirements, the hazard class would be described as "5.2." During an emergency, such a multitude of numbers may easily result in confusion for emergency responders, who face very stressful situations and need very clear information.

A priority objective of this rulemaking should be to verify that the hazard warning system is capable of alerting the general public and emergency responders to the hazards of each material transported. The Safety Board has previously pointed out in recommendations to the DOT, and the DOT has agreed, that the context of the hazard warning information system should be readily intelligible to all concerned, especially to those individuals having emergency action responsibilities. We also have called upon the DOT to carefully review its hazard warning system to insure that warnings of impending danger and advice are given in an understandable manner to the general public. Since 1968, the Safety Board has made several additional recommendations concerning modification of the hazard warning system, and the DOT has implemented appropriate changes. Consequently, the Safety Board is not convinced that the present warning system should be abandoned.

APPENDIX F

The Safety Board recognizes that the use of numbers is appropriate for international shipments where a cargo may pass through several countries, each with a different language. However, this situation does not exist for domestic shipments. Therefore, the DOT should require the use of the type of warning system which is capable of alerting the majority of those affected by the transport of hazardous materials. Hazard warning and material identification are most easily communicated with words rather than numbers. The Safety Board does not believe that the proposed numeric system accomplishes this objective.

Another concern is the DOT's creation of a numeric code, "10," in column 7 of the hazardous materials table to identify when packages containing specific hazardous materials must be marked "INHALATION HAZARD." Rather than clearly stating that the package must be marked "INHALATION HAZARD," the code "10" special provision states that bulk and nonbulk peckagings shall be marked in accordance with Subpart D of Part 172. Subpart D of Part 172 then references requirements in Section 172.313, thus making it necessary for the user of these regulations to piece together several provisions to determine that a package must be marked "INHALATION HAZARD." The DOT has the capability to identify those materials in its hazardous materials table which meet the criteria established for identifying materials that pose toxic inhalation hazards. Therefore, to make compliance with its regulations easier, the Safety Board encourages the DOT to identify those materials listed in its hazardous materials table that must be marked "INHALATION HAZARD" and then to identify those materials by placing the code "10" in column 7 on the same line as the listed material.

The proposed changes would require that if a material is described by a "not otherwise specified" (n.o.s.) entry in the 172.101 table, the technical name of the material shall be entered in parentheses immediately following the proper shipping name. If the material is a mixture of two or more hazardous materials, the DOT, without justification, has proposed that the names of only the two components most predominately contributing to the hazard(s) of the mixture shall be entered in parentheses. The Safety Board believes that all components of an n.o.s. entry which contribute to the hazard(s) of the mixture should be entered on the shipping paper and sees no justification, based on safety, to limiting the entry to two components.

The need for complete information on the materials contained in waste shipments was illustrated by an accident on March 6, 1984, in Orange County, Florida, which involved a cargo tank of mixed hazardous waste acids described as waste acid liquid, n.o.s. Twelve persons who came in contact with the vapors were injured, four seriously. Based on its investigation of the accident, the Safety Board recommended that the RSPA :

I-85-10

Determine the adequacy of general shipping names on shipping papers for hazardous wastes and the need for additional information, such as technical and chemical group names, to better inform emergency response personnel about the composition and hazard of the material being shipped.

The Safety Board concluded that contributing to the accident was a "lack of information available to emergency response personnel from shipping papers, the shipper, and the carrier about the composition and hazards of the waste material." The Safety Board urges the RSPA to accomplish the safety objectives of Safety Recommendation I-85-10 in the final regulations.

Packaging Requirements

Performance Standards.--While the Safety Board supports and has previously urged the DOT to develop performance-oriented packaging standards, it is essential that any increased flexibility in the design for packagings be accompanied by increased responsibility for proving the adequacy of a packaging. Such proof must include, as a minimum, packaging tests that demonstrate that acceptable levels of safety performance will be experienced during conditions normally incident to transportation, including conditions experienced during accidents. The proposed general requirements for testing nonspecification packagings (49 CFR 178.601) state that the test procedures prescribed are intended to ensure that packages containing hazardous materials can withstand normal conditions of transportation; yet, the proposed tests are insufficient for demonstrating how packages will perform when subjected to stresses in the actual transportation environment, i.e., extended periods of vibration, abrasion, puncture, extreme temperature, and accident conditions.

Some of the proposed test acceptance criteria prescribed for performance-oriented nonbulk packages actually are less severe than the acceptance criteria presently required for specification packages. This rulemaking fails to justify or to otherwise demonstrate the adequacy of the proposed test requirements for providing an appropriate margin of safety. For example, when phosphoric acid is transported in a drum under current regulations, the drum must pass a leakproofness test at 15 psig. Under the proposal, however, that same material may be shipped in a drum that passes a leakproofness test at only 2.9 psig. The effect of this reduction on transportation safety is not defined. On the other hand, some proposed tests, such as the hydrostatic and drop tests, have incorporated improved testing procedures by requiring in the prescribed test procedures consideration of the physical characteristics of hazardous materials, such as vapor pressure and specific gravity. Those changes should help to better determine if specific packages will properly retain dangerous materials. Nevertheless, we are concerned that an appropriate safety analysis has not been performed to demonstrate that the proposed package performance tests and acceptance criteria will achieve acceptable levels of safety.

While the proposed package performance test standards generally follow the UN-recommended performance test standards, the rulemaking does not adequately address the relevancy of the UN-recommended tests to the U.S. transportation environment. The NPRM notes that a number of comments in the ANPRM questioned the applicability of UN standards in the United States. The transportation environment conditions in the United States can vary significantly from conditions in Europe, e.g., 50 or more hours of continuous package vibration is not unusual in the United States, whereas such continuous vibration would be unlikely in Europe. Furthermore, the NPRM notes that a number of comments in the ANPRM believe that vibration places abrasion and fatigue stresses on packages. Therefore, a package may prove to be unsatisfactory in spite of its ability to survive a drop test. As a result of those concerns expressed in the ANPRM, the NPRM contains a requirement in Section 173.24a that each nonbulk package be capable of withstanding a vibration test. However, the proposed vibration test is for a period of only 1 hour, and the proposed regulation does not explicitly require that the vibration test prescribed in appendix C be performed. Additionally, no other tests have been added to address abrasion, fatigue, or puncture stresses experienced in the U.S. transportation environment. Therefore, the Safety Board does not believe that the tests, as now proposed, adequately address the comments to the

APPENDIX F

ANPRM on the suitability and acceptability of the UN performance test standards when applied to the transportation environment in the United States as compared to Europe.

During a public hearing held November 17-18, 1987, several participants again questioned the suitability and adequacy of the proposed test standards for evaluating the safe performance of packagings for the U.S. transportation environment. The chairman of the board of directors of the National Barrel and Drum Association (NABADA), a trade association representing the container reconditioning industry, expressed the following concerns:

> The vibration test is too inadequate to have any relevance to steel drums and the real transportation environment; hydrostatic pressure test requirements will often be lower than current requirements; and, leak test pressures are proposed to be reduced by more than 70 percent for new containers in Packaging Group I and more than 58 percent for Packaging Group II.
>
> Five years ago, when commenting on the ANPRM, the association urged the "immediate initiation of comprehensive technical research to correlate performance standards with actual conditions encountered in U.S. transportation . . . unfortunately nothing was done. Technically, NABADA is in no position to suggest what additional performance tests might be developed to assure greater container strength to resist puncture, abrasion, and real transportation vibration (not 1 hour, but 30, 40, or even 50 hours)."

The General Counsel to the Conference on Safe Transportation of Hazardous Articles, Inc., expressed the following concerns:

> In larger packaging, . . . particularly 55-gallon drums, the UN recommendations appear to be inadequate. A packaging which meets the UN performance tests alone will not function dependably in real transportation, especially on the extensive American highway and rail systems. Many drums used today in Europe are satisfactory, but it is unclear to what extent (if at all) the European community has implemented pure UN standards and phased out other specifications. It also is unclear to what extent existing European quality results from supplemental requirements imposed by governmental testing agencies, above and beyond basic UN criteria.
>
> While all the rigid detail of today's specifications may not be necessary, until there is development of a performance standard that truly measures the transportation strength of a packaging, some elements of today's design standards should be retained. Minimum strength and thickness of materials of construction are among these elements.

The Safety Board also questions the practicality of proposed specific package minimum thickness requirements for reuse packages while no minimum thickness requirements are proposed for most of those same new packages. Before any package, new or used, is permitted to be used to transport any hazardous material, it first should be demonstrated that the package will pass all packaging performance tests. The Safety Board believes it is important that these matters be evaluated before nonbulk,

performance-oriented packaging requirements are permitted to replace specific packaging standards.

Hazardous Wastes Packaging.--The proposed regulations will permit, without further qualification, the transportation of hazardous wastes in used packages even though they may not be considered reusable for nonwaste hazardous materials. Section 173.12(c) states that "A packaging which is non-reusable according to the specification requirements of Part 178 of this subchapter or to 173.28 of this Part may be reused for the shipment of hazardous waste to designated facilities" if the "package is not offered for transportation less than 24 hours after it is finally closed for transportation, and each package is inspected for leakage and is found to be free from leaks immediately prior to being offered for transportation." The Safety Board believes that package safeguard requirements should not depend on whether a material is intended for commercial use or waste disposal. Rather, the transportation safety requirements of a material should depend on its hazard characteristics during transportation. Containers that are too thin or otherwise would fail to pass reuse performance requirements for shipments of hazardous materials also should be prohibited for wastes which possess equivalent or worse hazard characteristics. In 1985, in the supplementary information to Docket HM-183, the RSPA acknowledged "that there is no significant difference in the risks associated with the transportation of hazardous wastes and other types of hazardous materials." The Safety Board agrees that many wastes pose no less of a hazard than pure materials. However, some waste solutions, such as mixtures of hydrochloric acid and nitric acid, result in a more reactive solution than the individual pure materials. Consequently, we believe that packagings for waste materials at least should meet the same standards of performance as that required for other hazardous materials.

Bulk Packaging.--While the proposed hazard classification and identification system will group materials with like hazard characteristics more uniformly, bulk packaging safety requirements (for highway cargo tanks and rail tank cars) are sometimes inconsistent between commodities within the same hazard classification group with no apparent justification. For example, the Safety Board identified 14 poisonous gases (2.3) (including chloropicrin and methyl chloride mixtures, methyl bromine, and nitric oxide) which require packaging group I nonbulk packagings and which may be transported in cargo tanks under the current regulations. We also identified 21 other poisonous gases which require packaging group I nonbulk packagings but which may not be transported in bulk highway cargo tanks unless specifically approved by the Director, Office of Hazardous Materials Transportation (OHMT). Those materials include arsine, hydrogen selenide anhydrous, and nitrogen dioxide, liquefied. Additionally, we identified four poisonous gases which may be shipped in less stringent packaging group II nonbulk packagings but are prohibited from being transported in bulk highway cargo tanks under the proposed regulations. These include boron trifluoride, coal gas, nitrosyl chloride, and tetraethyl dithiopyrophosphate and gases in solution or with gas mixtures LC 50 $\leq$ 200 ppm.

The Safety Board also has found inconsistent requirements for bulk shipments of hazardous materials in tank cars which would result in a reduced level of safety. Section 173.314(b)(6) provides grandfather protection for tank cars built before December 30, 1971, that are used to transport flammable gases (2.1). Such tank cars would not be required to have heat-resistant gaskets for manway covers and mounting for fittings. The proposed regulation would require that tank cars manufactured after December 30, 1971, have gaskets made of heat-resistant materials approved by the Association of American Railways (AAR) Tank Car Committee; yet, the AAR has not

developed standards for gasket materials. Additionally, there are still exceptions to the regulations that permit tank cars with a capacity of 18,500 or less gallons to be used for transporting flammable gas when those tank cars do not provide equal levels of protection required for larger cars, i.e, head shields and thermal insulation. As yet, the DOT has not provided any justification for this exception. The Safety Board believes that it is time to stop permitting tank cars that fail to meet current minimum safety requirements to be used to transport dangerous materials under "grandfather clauses." As a minimum, the DOT should establish a specific date by which all tank cars would have to comply with the new requirements.

While the DOT is attempting in its rulemaking to strengthen the packaging requirements for liquids and gases which pose toxic-by-inhalation hazards, the Safety Board is concerned that the use of J-type tank cars, which are equipped with large volume pressure relief valves, may not be appropriate for transporting toxic materials since these materials should not be released to the atmosphere. Furthermore, the requirements for using J-type (tanks equipped with protection against head puncture and thermal exposure) or S-type (tanks equipped with protection against head puncture only) tank cars seem to be arbitrary as materials with equivalent hazards sometimes are assigned to J-type tank cars and sometimes to S-type tank cars.

About 30 materials previously prohibited from being transported in bulk, such as phosgene, now are permitted. However, all such previously prohibited materials are not proposed to be transported in packagings that provide the greatest protection during transportation accidents. Before these materials are permitted to be transported in bulk, the DOT must demonstrate that all proposed packagings will be constructed to minimize the risk of any release during transportation, including the elimination of exceptions which permit hazardous materials to be transported in packagings that do not meet all safety requirements. Any materials believed to pose a risk so great that no release from packagings during transportation could be considered acceptable, especially in bulk quantities, should be subject to rigorous performance tests that demonstrate the integrity of the container through severe accident conditions. such as tests currently performed on some radioactive materials packagings.

This rulemaking proposal does not address the need of requiring the use of tank cars protected by head shields and thermal insulation for transporting all materials with an isolation radius of 1/2 mile or more as specified in the DOT's Emergency Response Guidebook. (See Safety Recommendation R-85-105.) Any material, when packaged in rail tank cars, which is so hazardous as to warrant large public evacuations during emergencies also should warrant protection from release or violent rupture of its container. The Safety Board urges the RSPA to incorporate requirements into the final rule appropriate to accomplish this safety objective.

In summary, the Safety Board believes that this proposal, on the whole, is a substantial improvement and, therefore, we support adoption of most of the proposed changes. However, the proposal contains certain deficiencies which the Safety Board believes must be rectified before all aspects of the proposed rule are made final. We believe that the following corrective actions can be taken without causing any appreciable delay in the implementation schedule:

> Identify in the hazardous materials table and require the identification on shipping papers and on transportation vehicles the known subsidiary hazards of materials transported.

Maintain for domestic shipments the presently required hazard warning information on shipping papers, labels, and placards for communicating, in plain language, the hazards posed by materials. The U.N. hazard class number also could be used, but it should not replace the present hazard warning system.

Use proposed code "10" in the hazardous materials table as a positive means for denoting materials which must be marked "INHALATION HAZARD."

Require that all components of a waste or mixed material which contribute to the hazards of the material be entered on the shipping paper.

Require that packaging standards for waste materials meet the same standards as nonwaste materials which pose equivalent hazards.

Establish a specific date by which the "grandfather clauses" no longer permit hazardous materials to be transported in railroad tank cars that do not meet present safety requirements.

Require that railroad tank cars used to transport materials with a DOT Emergency Response Guidebook recommended evacuation radius of 1/2 mile or more be equipped with head shield protection and, as applicable, with thermal insulation.

Establish or adopt an existing performance standard for heat-resistant gaskets that are required for tank car manway covers and for mountings for fitting.

Based on an evaluation of the product characteristics of liquids and gases which pose toxic-by-inhalation hazards, modify the proposed tank car packaging assignments to require the use of appropriate tank car head puncture and thermal protection for materials that pose equivalent hazards.

The Safety Board recognizes that the following improvements, called for in its comments above, will require additional study and/or research and thus cannot be done expeditiously:

Conduct tests and perform appropriate safety analyses to determine whether the proposed nonbulk, performance packaging standards provide adequate protection against vibration, abrasion, puncture, extreme temperature, and accident conditions for the U.S. transportation environment.

Conduct tests and perform appropriate safety analyses to identify the risks posed and to demonstrate the containment capability of packagings proposed for transporting materials previously prohibited from transportation in bulk.

For the two above instances, the Safety Board believes that the RSPA should proceed with a final rule which leaves the present requirements in place in lieu of the relaxed

standards contained in the proposal. At a later date, when the RSPA has completed the necessary testing and has analyzed the results, a supplementary rulemaking based on its findings then could be issued. In the interim, this more conservative approach will provide greater protection for the public.

The Safety Board appreciates the opportunity to make these comments and urges RSPA to move expeditiously on this rulemaking.

Respectfully yours,

Jim Burnett
Chairman

ATTACHMENT 6

Emergency Directive Pursuant to Section 33 of the *Railway Safety Act*

Safety and Security of Locomotives in Canada

To: All Railway Companies and Local Railway Companies

Section 33 of the *Railway Safety Act* (RSA) gives the Minister of Transport the authority to issue an emergency directive to any company when the Minister is of the opinion that there is an immediate threat to safe railway operations or the security of railway transportation.

Although the cause of the tragic accident in Lac-Mégantic remains unknown at this time, and although I remain confident in the strength of the regulatory regime applicable to railway transportation in Canada, I am of the opinion that, in light of the catastrophic results of the Lac-Mégantic accident and in the interest of ensuring the continued safety and security of railway transportation, there is an immediate need to clarify the regime respecting unattended locomotives on main track and sidings and the transportation of dangerous goods in tank cars using a one person crew to address any threat to the safety and security of railway operations.

Pursuant to section 33 of the RSA, all railway companies and local railway companies are hereby ordered to:

1. Ensure, within 5 days of the issuance of the emergency directive, that all unattended controlling locomotives on main track and sidings are protected from unauthorized entry into the cab of the locomotives;
2. Ensure that reversers are removed from any unattended locomotive on main track and sidings;
3. Ensure that their company's special instructions on hand brakes referred to in Rule 112 of the *Canadian Rail Operating Rules* are applied when any locomotive coupled with one or more cars is left unattended for more than one hour on main track or sidings;
4. Ensure, when any locomotive coupled with one or more cars is left unattended for one hour or less on main track or sidings, that in addition to complying with their company's special instructions on hand brakes referred to in item 3 above, the locomotives have the automatic brake set in full service position and have the independent brake fully applied;
5. Ensure that no locomotive coupled with one or more loaded tank cars transporting "dangerous goods" as this expression is defined in section 2 of the *Transportation of Dangerous Goods Act* (TDGA) is left unattended on main track; and
6. Ensure that no locomotive coupled with one or more loaded tank cars transporting "dangerous goods" as this expression is defined in section 2 of the TDGA is operated on main track or sidings with fewer than two persons qualified under their company's requirements for operating employees.

For the purpose of this emergency directive an "unattended locomotive" or a "locomotive coupled with one or more cars that is left unattended" means that it is not in the immediate

physical control or supervision of a qualified person acting for the company operating the locomotive or car(s) in the case of items 3 and 4 above or a person acting for the company operating the locomotive or car(s) in the case of items 1, 2 and 5 above.

For the purpose of this emergency directive, “main track” and “sidings” do not include main track or sidings in yards and terminals.

For greater certainty, nothing in this emergency directive relieves a company of the obligation to comply with Rule 112 of the *Canadian Rail Operating Rules.*

Pursuant to section 33 of the RSA, this emergency directive takes effect immediately and is to remain in effect until 23:59 EST on December 31, 2013.

_____
Assistant Deputy Minister
Safety and Security

Date:_____

Related Items

July 23, 2013