National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: March 2, 2012

In reply refer to: R-12-5 through -8
R-07-4 (Reiteration)

The Honorable Cynthia L. Quarterman
Administrator
Pipeline and Hazardous Materials
Safety Administration
Washington, D.C. 20590

About 8:36 p.m., central daylight time, on Friday, June 19, 2009, eastbound Canadian National Railway Company (CN) freight train U70691-18, traveling at 36 mph, derailed at a highway/rail grade crossing in Cherry Valley, Illinois. The train consisted of 2 locomotives and 114 cars, 19 of which derailed. All of the derailed cars were tank cars carrying denatured fuel ethanol, a flammable liquid. Thirteen of the derailed tank cars were breached or lost product and caught fire. At the time of the derailment, several motor vehicles were stopped on either side of the grade crossing waiting for the train to pass. As a result of the fire that erupted after the derailment, a passenger in one of the stopped cars was fatally injured, two passengers in the same car received serious injuries, and five occupants of other cars waiting at the highway-rail crossing were injured. Two responding firefighters also sustained minor injuries. The release of ethanol and the resulting fire prompted a mandatory evacuation of about 600 residences within a 1/2-mile radius of the accident site. Monetary damages were estimated to total $7.9 million.[1]

The National Transportation Safety Board (NTSB) determined that the probable cause of the accident was the washout of the track structure that was discovered about 1 hour before the train's arrival, and the CN's failure to notify the train crew of the known washout in time to stop the train because of the inadequacy of the CN's emergency communication procedures. Contributing to the accident was the CN's failure to work with Winnebago County to develop a comprehensive storm water management design to address the previous washouts in 2006 and 2007. Contributing to the severity of the accident was the CN's failure to issue the flash flood warning to the train crew and the inadequate design of the DOT-111 tank cars, which made the cars subject to damage and catastrophic loss of hazardous materials during the derailment.

[1] See *Derailment of Canadian National Railway Company Freight Train U70691-18 With Subsequent Hazardous Materials Release and Fire, Cherry Valley, Illinois, June 19, 2009*, Railroad Accident Report NTSB/RAR-12/01 (Washington, DC: National Transportation Safety Board, 2012) on the NTSB website at <http://www.ntsb.gov>.

Damage to Tank Heads, Shells, and Top Fittings

During a number of accident investigations over a period of years, the NTSB has noted that DOT-111 tank cars have a high incidence of tank failures during accidents. Previous NTSB investigations that identified the poor performance of DOT-111 tank cars include a May 1991 safety study[2] as well as NTSB investigations of a June 30, 1992, derailment in Superior Wisconsin;[3] a February 9, 2003, derailment in Tamaroa, Illinois;[4] and an October 20, 2006, derailment of an ethanol unit train in New Brighton, Pennsylvania.[5] In addition, on February 6, 2011, the Federal Railroad Administration (FRA) investigated the derailment of a unit train of DOT-111 tank cars loaded with ethanol in Arcadia, Ohio, which released about 786,000 gallons of product.

The fact that DOT-111 general service tank cars experience more serious damage in accidents than pressure tank cars, such as DOT-105 or the DOT-112 cars, can be attributed to the fact that pressure tank cars have thicker shells and heads. The pressure cars are also usually equipped with metal jackets, head shields, and strong protective housings for top fittings. They do not have bottom outlet valves, which have been proven to be prone to failure in derailment accidents.

Of the 15 derailed DOT-111 tank cars that piled up in this accident, 13 cars lost product from head and shell breaches or through damaged valves and fittings, or a combination of the two. This represents an overall failure rate of 87 percent and illustrates the continued inability of DOT-111 tank cars to withstand the forces of accidents, even when the train is traveling at 36 mph, as was the case in this accident. Head breaches resulting in the release of denatured fuel ethanol occurred in 9 of the 15 tank cars in the pileup. Head failures in seven of the cars were apparently caused by coupler or draft sill strikes. Two of the tank heads were breached by other striking objects or tank car structures. Additionally, side shells of three of the tank cars were breached as a result of car-to-car impacts. Clearly, the heads and shells of DOT-111 tank cars, such as those that are used to transport denatured fuel ethanol in unit trains, can almost always be expected to breach in derailments that involve pileups or multiple car-to-car impacts. The inability of the DOT-111 tank car heads and shells to retain lading in this accident is comparable with previously mentioned ethanol unit train accidents that occurred in New Brighton, Pennsylvania, in which 12 heads or shells were breached of 23 derailed tank cars, and in Arcadia, Ohio, in which 28 heads and shells of 32 derailed tank cars were breached.

DOT-111 tank cars make up about 69 percent of the national tank car fleet, and denatured fuel ethanol is ranked as the largest-volume hazardous materials commodity shipped by rail. This accident demonstrates the need for extra protection such as head shields, tank jackets, more robust top fittings protection, and modification of bottom outlet valves on DOT-111 tank cars

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[2] NTSB/SS-91/01.

[3] *Derailment of Burlington Northern Freight Train No. 01-142-30 and Release of Hazardous Materials in the Town of Superior, Wisconsin, June 30, 1992*, Hazardous Materials Accident Report NTSB/HZM-94/01 (Washington, DC: National Transportation Safety Board, 1994) <www.ntsb.gov/>

[4] *Derailment of Canadian National Freight Train M33371 and Subsequent Release of Hazardous Materials in Tamaroa, Illinois, February 9, 2003*, Accident Report NTSB/RAR-05/01 (Washington, DC: National Transportation Safety Board, 2005). <www.ntsb.gov/>

[5] NTSB/RAR-08/02.

used to transport hazardous materials. The NTSB concluded that if enhanced tank head and shell puncture-resistance systems such as head shields, tank jackets, and increased shell thicknesses had been features of the DOT-111 tank cars involved in this accident, the release of hazardous materials likely would have been significantly reduced, mitigating the severity of the accident.

Although hazardous materials are better protected when transported in pressure tank cars, the majority of the fleet of pressure tank cars, which are currently used for other hazardous materials such as liquefied petroleum gas, chlorine, and anhydrous ammonia, would be required to supply the demand for ethanol transportation alone. The FRA estimates there are about 40,000 class DOT-111 general service tank cars currently in ethanol service, while the total fleet of pressure tank cars of all specifications consists of about 62,000 cars.[6] Since this accident, the Association of American Railroads (AAR) has opted to increase the crashworthiness of newly constructed class DOT-111 tank cars used in ethanol and crude oil service in Packing Groups[7] I and II. AAR requirements for new tank cars increase the minimum head and shell thickness to 1/2 inch for TC-128B nonjacketed cars and 7/16 inch for jacketed cars. Shells of nonjacketed tank cars constructed of A516-70 steel must now be 9/16 inch thick; shells of jacketed cars must be 1/2 inch thick. The AAR requirements also specify that both the heads and the shells must be constructed of normalized steel and that in all cases, a 1/2-inch-thick head shield must be provided.

The AAR requirements do not provide a retrofit solution for the existing fleet of about 40,000 tank cars that are dedicated to transporting denatured fuel ethanol. In its March 9, 2011, petition for rulemaking, the AAR specifically recommended that no provisions be adopted to require modifications or retrofitting of existing DOT-111 tank cars. In the petition, the AAR notes that it considered applying risk-reduction options both to the existing fleet and to new tank cars; however the Railway Supply Institute conservatively estimates the cost of retrofitting existing cars with head shield and jackets to be more than $1 billion over the life of a retrofit program, not including cleaning and out-of-service costs. The AAR argues, by contrast, that a member survey for information on the consequences of derailments involving Packing Groups I and II hazardous materials from 2004 to 2008 found 1 fatality, 11 injuries and the release of approximately 925,000 gallons of materials with associated cleanup costs of approximately $63 million.

The AAR cited other impediments to retrofitting DOT-111 tank cars with head shields or jackets. For example, the AAR contends that the extra weight of these safety features could overload tank cars designed to 263,000 pounds gross rail load even when the cars' draft sills are designed for 286,000 pounds. While increasing the thickness of existing tank car tank heads and shells would require replacement of the tank, retrofitting tank cars with head protection systems is not without precedent. When improved tank car construction specifications were adopted for certain tank cars used to transport flammable gasses, anhydrous ammonia, or ethylene oxide, the Research and Special Programs Administration (RSPA) took action to prohibit the use of tank cars built to older construction standards for these products. On January 27, 1984, RSPA issued a final rule that required after December 31, 1986, all DOT-105 tank cars constructed before

[6] Association of American Railroads, UMLER, February 2009.

[7] The *packing group* indicates the degree of danger presented by a hazardous material in transport. Packing Group I indicates great danger; Packing Group II, medium danger; and Packing Group III, minor danger.

March 1, 1981, as well as all DOT-111 tank cars used to transport these specifically identified hazardous materials to be equipped with the same tank head and thermal safety systems that are required on newly built DOT-105 tank cars and on all specification DOT-112 and DOT-114 tank cars used to transport those same hazardous materials.[8] The final rule noted that RSPA took this action to increase the safety of transportation by rail of hazardous materials.

The FRA reported that there are currently no plans to require phase-out or retrofitting of existing tank cars in the ethanol fleet.[9] The decision to not phase out or retrofit existing tank cars allows new DOT-111 tank cars with improved protection to be commingled in unit train service with the existing fleet of insufficiently protected tank cars. The decision thus ignores the safety risks posed by the current fleet of about 40,000 ethanol tank cars that are on average 8 years old with an estimated service life of 30 to 40 years. There will be increasing need for general service tank cars to meet transportation demands due to the mandated tripling of the amount of ethanol blended into the nation's fuel supply by 2022. Notwithstanding the anticipated growth in the volume of ethanol transported by railroad, existing DOT-111 tank cars will continue to make up a large percentage of the tank car fleet for many years.

In addition, the FRA reports recent orders for 10,000 new general service tank cars to provide for crude oil unit train transportation in the northwest United States and Canada due to the lack of pipeline infrastructure. Tank cars for crude oil service have the same specifications as cars used for ethanol, therefore design alternatives would easily apply to tank cars in both services. Over the past 3 years, rail shipments of crude oil from the Bakken region of North Dakota alone have increased from 500 carloads to more than 13,000 carloads, and volume is expected to grow to 70,000 carloads annually.[10] There would be significant benefit to developing improved design standards prior to construction of large numbers of additional tank cars, such as avoiding the need to later include these cars in a retrofit or phase-out program.

Improvements in tank car safety would most effectively be targeted to those hazardous materials commodities that are transported by unit train, such as denatured fuel ethanol and crude oils, and which pose the greatest risks when released, such as those commodities in Packing Groups I and II. The risks are greater in unit train operations because hazardous materials are transported in high density. For example, a unit train of 75 to 100 fully loaded 30,000-gallon tank cars typically transports between 2.1 million and 2.8 million gallons of hazardous materials per train.

Considering that 10 of the 13 cars that released product in this accident did so as a result of punctures and fractures of the tank heads and shells, the NTSB welcomes the AAR's actions requiring that new DOT-111 tanks cars built for Packing Groups I and II service have head shields and be constructed of thicker and higher quality steels. However, these actions do not address existing tank cars and would not ensure that all tank cars used to transport hazardous materials such as fuel ethanol will meet enhanced puncture resistance standards. Because of the impediments to retrofitting the existing tank car fleet with puncture-resistance systems, a phase-out of existing tank cars to other service may be the best option for the immediate future. The NTSB

[8] *Federal Register*, vol. 49, no. 19 (January 27, 1984), pp. 3468–3473.

[9] E-mail communication with FRA Hazardous Materials Division staff, November 2, 2011.

[10] Association of American Railroads' *Insider Newsletter*, December 12, 2011.

concluded that the safety benefits of new specification tank cars will not be realized while the current fleet of DOT-111 tank cars remains in hazardous materials unit train service, unless the existing cars are retrofitted with appropriate tank head and shell puncture resistance systems.

Top fittings on tank cars generally project from the tank and are thus vulnerable to impact damage in derailments where the fittings may impact the ground or another object with the entire weight and momentum of the tank car behind it. Although housings used to protect the top fittings of DOT-111 tank cars involved in this accident were fabricated in accordance with Title 49 *Code of Federal Regulations* (CFR) 179.200-16, the postaccident inspection of the derailed tank cars revealed that the housings were not effective in preventing damage to the top fittings of two tank cars, resulting in subsequent loss of lading.[11] While the housing did protect the fittings in the case of one car, which came to rest lying upside down in soft mud, the top fittings were damaged in other instances where the housings contacted less compliant objects. In one case, the housing separated from the car, and both the liquid and vapor valves were sheared from their threaded pipes, thereby causing the car to lose about 26,357 gallons of product. The housing cover of another car was knocked askew in the derailment, breaking the vapor valve from its fitting and contributing to the release of product from that car. Clearly, unprotected top fittings are vulnerable to impact damage and release of hazardous materials even when tank cars are otherwise less severely damaged, as was the case with the tank cars described above. The NTSB concluded that requirements for protection of the top fittings of the DOT-111 tank cars involved in this accident are inadequate because the protective housings were not able to withstand the forces of the derailment.

In order to demonstrate the viability of possible solutions for top fittings protection for non-pressure tank cars, the FRA, in October 2009, published the preliminary results of a report following testing of three concepts: adding a roll bar assembly to the top of the tank; incorporating a fabricated deflective skid to the top of the tank; and recessing the fittings into the interior of the tank.[12] Under an FRA contract, researchers created computer models, designed the concepts, and conducted full-scale dynamic rollover tests as recently as August 2010 in order to validate the models. Each of the concepts proved effective in preventing rollover damage to the top fittings; however, the Pipeline and Hazardous Materials Safety Administration (PHMSA) has not initiated rulemaking to require enhanced top fittings protection for general service tank cars.

Notwithstanding PHMSA's inaction in mandating top fittings protection, the AAR, which by regulation is responsible for approving tank car designs, as of July 1, 2010, now requires that all new non-pressure tank cars used to transport Packing Groups I and II hazardous materials be equipped with discontinuity protection[13] housings for top fittings. The top fittings are subject to an impact performance standard incorporated into AAR's *Manual of Standards and Recommended Practices*. Essentially, top fittings may be grouped inside a more robust pressure-car-type protective housing or mounted on nozzles or flanges within rollover skid

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[11] One tank car released product from both a damaged top fitting and a bottom outlet valve.

[12] *Survivability of Railroad Tank Car Top Fittings in Rollover Scenario Derailments Phase 2 Final Report*, Federal Railroad Administration Report DOT/FRA/ORD-09-20 (Washington, DC: U.S. Department of Transportation, 2009).

[13] *Discontinuity protection* refers to a housing or skid-plate structure designed to protect fittings and valves from damage in a derailment.

protection. Although the top liquid and vapor valve fittings on the derailed tank cars were contained within a housing, this housing was not nearly as strong as a pressure-car-type protective housing that would be required by the new AAR standard.

The current AAR standard addresses new construction only and does not require retrofitting of the current tank car fleet with top fittings protection. With approximately 40,000 existing DOT-111 tank cars that the FRA estimates are transporting denatured fuel ethanol with an estimated service life of 30 to 40 years, this represents the potential for tank cars with inadequately protected top fittings to continue to release products in accidents.

Therefore, the NTSB recommends that PHMSA require that all newly manufactured and existing general service tank cars authorized for transportation of denatured fuel ethanol and crude oil in Packing Groups I and II have enhanced tank head and shell puncture resistance systems and top fittings protection that exceeds existing design requirements for DOT-111 tank cars.

Damage to Bottom Outlet Valves

During the derailment, three bottom outlet valves opened as a result of valve operating levers being bent and pulled away from their retaining brackets. The bottom outlet nozzles were also sheared-off outward of discontinuity protection during the derailment, thus exposing the open outlet valves. The open bottom outlet valves resulted in the release of most, if not all, of the product from the respective cars.

Bottom outlet discontinuity protection of the type that existed on the accident tank cars has been shown to be of limited effectiveness in preventing product releases from bottom outlets during accidents. Cited in the Transportation Research Board report on *Ensuring Tank Car Safety*, the AAR and the Railway Progress Institute reviewed the accident data for lading releases from bottom outlet valve damage and found that tank cars with damaged bottom outlets had a 30-percent failure rate when protected, compared with a 66-percent failure when non-protected. The rate of release for even the protected bottom outlet valves thus remains at such frequency that it is likely that some DOT-111 tank cars will release product during derailments involving a substantial number of these cars.

One of the derailed cars with an open bottom outlet valve was a CIT Rail-owned car with a bottom outlet valve and handle configuration that had been modified from the original design. The bottom outlet valve handle on the car was constructed with a breakaway point that was designed to allow the handle to break free in an accident without causing the valve to open. But the valve operating handle was too robust and failed to break away when the handle struck the ground or another object. Instead, the retaining bracket broke, and the intact handle, though bent, opened the valve and allowed lading to be released.

The AAR *Manual of Standards and Recommended Practices Specifications for Tank Cars* specifies that: “bottom outlet valve handles … must be designed to either bend or break free on impact, or the handle in the closed position must be located above the bottom surface of the skid.” In the modified valve arrangement, although the handle was designed to bend or break free on impact, the end of the handle protruded outward such that it could become caught by other objects, debris, or soil, and the break point feature was ineffective.

The other two cars with bottom outlet valves that opened during the derailment were GE Equipment- and Trinity-owned cars that used a bottom valve handle arrangement in which the valve handle extended out from the center of the tank and then upward and was secured to the right side of the tank. Moving the handle longitudinally from the A end toward the B end of the car opened the valve. This design does not have a breakaway feature for the valve handle, instead relying on the fact that the handle extends above the bottom surface of the skid protection plate in satisfaction of the AAR standard. Postaccident inspection of the two cars revealed that bottom outlet valve handles were bent and pulled away from their retaining brackets and that the exposed ball valves were open, thus allowing release of lading through the sheared nozzles.

The risks of releases from bottom outlet valves on general service tank cars has been recognized for many years, as illustrated by the Chemical Manufacturers' Association's June 7, 1994, correspondence with the NTSB concerning the status of Safety Recommendation R-91-11 in which it reported that some of its members had made voluntary equipment modifications to enhance the performance of their DOT-111 tank cars and that these modifications included eliminating bottom outlets where feasible.

The AAR Tank Car Committee task force that considered several DOT-111 protective systems or changes in operations discussed removal of bottom outlets from new and existing DOT-111 tank cars in ethanol and crude oil service. The task force concluded that although bottom outlet removal would be a significant improvement to tank car release performance and could be easily accomplished, removing the bottom fittings would have major impact on existing loading and unloading infrastructure. Therefore, AAR Circular letter CPC 1230 that includes new requirements for tank cars ordered after October 1, 2011, failed to address removal or further protection of bottom fittings.

The Hazardous Materials Regulations at 49 CFR 179.200-17(a)(4) and 173.31(d)(2) require that outlet nozzle construction ensure against the unseating of the valve and that closures on tank cars be designed and closed such that there will be no release of a hazardous material under conditions normally incident to transportation, including the effects of temperature and vibration, but the regulations are silent on the performance of bottom outlet valve operating mechanisms under accident conditions. All bottom outlet nozzles are provided with a score section around the piping or bolts that allow the nozzle to break away when struck in an accident, thus preventing the bottom outlet valve from being damaged. When the bottom outlet nozzle is stripped away by the forces of an accident, it is essential that the valve remain closed, otherwise product will be free to drain from the tank.

To prevent unintended opening of bottom outlet valves during derailments, the valve operating handles should be weak enough to readily break free before forces acting on the handle become sufficient to break the retaining pin and rotate the bottom valve to its open position. Alternatively, operating handles could be made of a detachable design such that no protruding mechanism is present that could inadvertently open the bottom outlet valve during an accident. The NTSB therefore concluded that the existing standards and regulations for the protection of bottom outlet valves on tank cars do not address the valves' operating mechanisms and therefore are insufficient to ensure that the valves remain closed during accidents. The NTSB therefore recommends that PHMSA require that all bottom outlet valves used on newly manufactured and existing non-pressure tank cars are designed to remain closed during accidents in which the valve and operating handle are subjected to impact forces.

Design Requirements for Hazardous Materials Tank Cars

One of the derailed tank cars in this accident had a large breach that occurred as the draft sill was loaded downward relative to the tank. The draft sill is attached to pads that are attached to the tank car. The pads should help protect the tank from fracture caused by loads applied to the draft sill. The strength of the welds attaching the draft sill to the pad should be no more than 85 percent of the strength of the welds attaching the pad to the tank. Thus, it is expected that the draft sill should separate from the pad before the pad separates from the tank. However, in the case of this particular tank car, the front sill pad fractured from the tank and remained attached to the draft sill.

The fracture of the front sill pad occurred at its edges within the fillet welds where it was attached to the tank. Overall deformation and fracture patterns indicated fracture initiated at the front edge of the front sill pad due to downward loading of the head brace relative to the tank. Fractures at the edges of the front sill pad all showed ductile overstress features with no evidence of preexisting damage such as weld defects or fatigue cracks.

As the draft sill deformed further downward during the accident sequence, the front sill pad separated completely from the tank, but the body bolster pad remained attached to the tank, and the draft sill remained attached to the body bolster pad. As a result, the downward deformation of the draft sill led to a circumferential rupture of the tank shell adjacent to the front edge of the body bolster pad.

AAR standards require that the pads extend at least 1 inch transversely on either side of the draft sill attachment and must extend some distance from the head brace in the longitudinal direction as defined by a formula. However, there is no other requirement for distance that the pads extend in the longitudinal direction. In the tank cars involved in this accident, transverse portions of the draft sill attachment above the center plate were welded to the body bolster pad adjacent to the edge of the bolster pad where the pad was welded to the tank. This area also corresponded to the tank circumferential fracture location. While separation of the front sill pad made tank failure more likely, the proximity of the attachment welds for the pads and the draft sill in this area provided a location where draft sill loads could be transferred directly to the tank wall rather than going first through the pads.

According to AAR standards for other substantial attachments such as brackets (AAR MSRP C-III Appendix E 15.2.4), the distance between a bracket and the edge of the pad shall not be less than three times the thickness of the pad in any direction. However, there is no similar requirement for draft sills in the longitudinal direction except between the head brace and the front edge of the front sill pad. The NTSB concluded that tank car design standards for the attachments of draft sills to sill pads and of sill pads to the tanks are insufficient to protect the integrity of the tanks in accidents in which the draft sills are subjected to significant downward deformation. The NTSB believes that the requirements for draft sills should be reviewed to ensure that appropriate distances are maintained between the draft sill/pad attachment welds and the pad/tank welds in all directions throughout the entire length of the draft sill attachment. The NTSB has issued the following safety recommendation to the AAR:

> Review the design requirements in the Association of American Railroads *Manual of Standards and Recommended Practices* C-III, “Specifications for Tank Cars for Attaching Center Sills or Draft Sills,” and revise those requirements as needed to ensure that appropriate distances between the welds attaching the draft sill to the reinforcement pads and the welds attaching the reinforcement pads to the tank are maintained in all directions in accidents, including the longitudinal direction. (R-12-9)

The revised AAR standard would address tank cars constructed after the changes are published and would not be expected to require retrofitting of the tank car fleet existing at the time the changes are published. Given the estimated tank car service life of 30 to 40 years, this represents the potential for tank cars with susceptibility to tank failure from loads applied to the draft sill to exist long after changes are made to the design standards.

Therefore, the NTSB recommends that PHMSA require that all newly manufactured and existing tank cars authorized for transportation of hazardous materials have center sill or draft sill attachment designs that conform to the revised Association of American Railroads’ design requirements adopted as a result of Safety Recommendation R-12-9.

Pipeline Damage

At the site of the derailment was a 12-inch-diameter underground natural gas transmission pipeline operated by Nicor Gas. The pipeline exceeded Federal standards for protective ground cover by a factor of 3. It was also five times as deep as the industry-recommended protection requirement for depth of cover that was in effect at the time the pipeline was constructed. Yet, as the wreckage was removed from above the pipeline, Nicor’s crews discovered that a railcar wheel and axle assembly had impinged on the pipeline. Although the pipeline was buried about 11 feet deep and protected within a 16-inch-diameter casing, the rail car wheels impacted and severely dented the pipeline. The impact caused a severe flattening of the pipe casing with sharp angular bends at two locations where it was contacted by the rail car wheel assembly. This degree of deformation to the 16-inch casing pipe likely caused similar damage to the 12-inch carrier pipe. The NTSB concluded that had the gas pipeline been installed at the railroad crossing with the minimum level of ground cover permitted by the current Federal and industry pipeline construction standards, it likely would have failed as a result of being struck by derailed equipment in this accident.

Although the pipeline did not leak as a result of this accident, even minor dents and nicks are capable of causing pipeline failures. Pipeline damage caused by an accident may result in a catastrophic pipeline failure that occurs some period of time after the damage was inflicted, as was the case following the derailment of a Southern Pacific Transportation Company freight train on May 12, 1989, in San Bernardino, California.[14] Thirteen days after the derailment in San Bernardino, a 14-inch pipeline at the derailment site ruptured, released gasoline, and ignited. The San Bernardino pipeline failure and subsequent fire resulted in 2 fatalities and 19 injuries and

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[14] *Derailment of Southern Pacific Transportation Company Freight Train on May 12, 1989 and Subsequent Rupture of Calnev Petroleum Pipeline on May 25, 1989, San Bernardino, California*, Railroad Accident Report NTSB/RAR-90/02 (Washington, DC: National Transportation Safety Board, 1990). <http://:www.ntsb.gov>

illustrates the potential outcome had a release occurred at the Cherry Valley, Illinois, derailment site.

PHMSA research found only five reportable incidents[15] since 1984 in which a train derailment caused damage to pipelines crossing under the tracks. Although PHMSA does not collect data that would reflect the number of incidents in which pipelines are damaged by train derailments at locations in railroad rights-of-way other than crossings, the aforementioned San Bernardino pipeline failure illustrates that buried pipelines can be damaged when present near railroad accident scenes. Despite the infrequency of such incidents, the NTSB believes that pipeline operators and railroad companies should be informed about the potential risk of damages to pipelines whenever a train derails. Given the prevalence both of underground pipelines and aboveground railroad tracks, the two must, of necessity, cross at numerous locations. Responsible pipeline operators may wish to consider protection methods that offer a higher level of safety when installing pipelines at these critical locations. The NTSB therefore recommends that PHMSA inform pipeline operators about the circumstances of the accident and advise them of the need to inspect pipeline facilities after notification of accidents occurring in railroad rights-of-way.

Accuracy of Train Consist Information

The original consist for the accident train had only 3 of the 76 cars in their proper positions on the train. This was not the first instance in which the CN failed to comply with 49 CFR 174.26, "Notice to Train Crews," which requires that a train crew have a train consist that accurately reflects the current position of each rail car containing hazardous material in a train. In a July 10, 2005, accident in Anding, Mississippi,[16] in which one of the train consists was destroyed in the collision of two freight trains, the CN subsequently delivered an inaccurate consist that caused confusion during the emergency response. During the FRA's 2006 national hazardous materials audit focusing on the level of compliance with hazardous materials communications, it also found that 22.3 percent of the CN trains audited had improper hazardous materials car documentation, consist errors, train crews failing to update the train consist to reflect actual car placement, or trains dispatched with erroneous consist information.

In this accident, because the tank cars of the accident train made up a unit train consisting of a single commodity, no confusion occurred as a result of the train crew's failure to update the train consist. If different hazardous commodities had been commingled in the train, emergency responders would have been unable to locate them based upon the train consist. The NTSB therefore concluded that the inaccurate train consist carried by the crew did not affect the emergency response to this accident; however, had a mixture of hazardous commodities been involved, the inaccurate consist information could have hampered the response effort or put the safety of emergency responders and others at risk.

Electronic transmission of shipping paper information did occur in this accident, albeit about 3 hours after the train crew provided emergency responders with an inaccurate paper document, and about 4 hours after the dispatcher orally conveyed hazardous materials

[15] Damage to the pipeline that does not involve the release of gas is not necessarily reported.

[16] *Collision of Two CN Freight Trains Anding, Mississippi July 10, 2005*, Railroad Accident Report NTSB/RAR-07/01 (Washington, DC: National Transportation Safety Board, 2007). <www.ntsb.gov>

information to the fire department. When first contacted about the accident about 9:15 p.m. on the day of the accident, the CN could have at that time faxed or e-mailed the correctly ordered train car consist directly to incident command. Since this accident, the CN has provided its emergency responders with the capability, through e-mail, to receive the train consist, hazardous materials waybills, and material safety data sheets. Accuracy of the train consist information would be ensured through automatic equipment identification readers that relay train consist data to the CN's central computer. With this increased use of technology, remote access to the CN's database should ensure that updated train car consist and hazardous materials information is available to emergency response personnel at accident scenes in a more timely manner.

As a result of its investigation of the Anding, Mississippi, train collision, the NTSB recommended that the FRA (Safety Recommendation R-07-2) and PHMSA (Safety Recommendation R-07-4) work together to develop PHMSA regulations requiring that railroads immediately provide to emergency responders accurate, real-time information about the identity and location of all hazardous materials on a train.

PHMSA, in a January 22, 2008, response to Safety Recommendation R-07-4, indicated to the NTSB that it was examining (1) ways to improve the availability of accurate and immediate information for emergency responders on the scene of an accident, and (2) strategies for enhancing emergency response planning and training efforts. Additionally, PHMSA indicated that it was evaluating the emergency response issues raised in the safety recommendation and the Federal, state, and local government, and industry programs intended to address those issues. Based on this response, the NTSB classified Safety Recommendation R-07-4 "Open—Acceptable Response."

In an October 10, 2007, response to Safety Recommendation R-07-2, the FRA noted the ongoing efforts of the AAR, CHEMTREC,[17] and the American Short Line and Regional Railroad Association to enhance the availability of hazardous materials information during an accident. But the FRA maintained that the current practice of requiring the physical hand-off of train consists and other hazardous materials information "remains the most accurate method of transferring this information when an accident occurs." The FRA stated that it had no reason to believe that regulatory revisions are necessary to address this issue.

In an April 12, 2011, follow-up response to the safety recommendation, the FRA noted that its regulations require that information on the identity and location of hazardous materials shipments on a train be maintained by a member of the train crew for the benefit of emergency responders. Further, with the FRA's encouragement, the AAR issued a circular offering to provide hazardous materials information on the top 25 commodities to local emergency response organizations to assist in training and preparing for emergencies. Finally, with the FRA's encouragement, CSX Transportation, Inc., and CHEMTREC established a real-time information process that provides car content and train consist information on a "one-call" basis. The FRA indicated that it continues to evaluate this process to determine if additional regulations are necessary.

[17] CHEMTREC (the Chemical Transportation Emergency Center), is an around-the-clock service available to firefighters, law enforcement officials, and other emergency responders who need immediate response information for emergency incidents involving chemicals, hazardous materials, and dangerous goods.

While acknowledging the activities and contributions of the AAR, CHEMTREC, and industry stakeholders to facilitate the rapid communication of hazardous materials information, in a January 10, 2011, letter, the NTSB reminded the FRA that the intent of Safety Recommendation R-07-2 was to require railroads to provide to emergency responders information about the identity and location of hazardous materials on a train at the time of an accident and that the FRA had not identified any initiatives it had taken to move this recommendation forward. Therefore, the NTSB continues to classify Safety Recommendation R-07-2 “Open—Unacceptable Response.”

The NTSB also supports the HM-ACCESS initiative of PHMSA, which will allow the electronic communication of shipping paper information and improve the availability and accuracy of hazard communications to emergency responders. If implemented as envisioned, railroads will be able to quickly transmit electronically updated and accurate train consist data to emergency responders when accidents occur.

However, PHMSA began its HM-ACCESS initiative with public meetings on October 13–14, 2009, to discuss an upcoming proof-of-concept study on the use of electronic documents for hazardous materials shipments, no rulemaking has been initiated by PHMSA or the FRA to require railroads to immediately provide accurate consist information to emergency responders. Therefore, the NTSB reiterates Safety Recommendations R-07-2 and R-07-4 to the FRA and PHMSA, respectively.

The National Transportation Safety Board makes the following safety recommendations to the Pipeline and Hazardous Materials Safety Administration:

> Require that all newly manufactured and existing general service tank cars authorized for transportation of denatured fuel ethanol and crude oil in Packing Groups I and II have enhanced tank head and shell puncture resistance systems and top fittings protection that exceeds existing design requirements for DOT-111 tank cars. (R-12-5)

> Require that all bottom outlet valves used on newly manufactured and existing non-pressure tank cars are designed to remain closed during accidents in which the valve and operating handle are subjected to impact forces. (R-12-6)

> Require that all newly manufactured and existing tank cars authorized for transportation of hazardous materials have center sill or draft sill attachment designs that conform to the revised Association of American Railroads’ design requirements adopted as a result of Safety Recommendation R-12-9. (R-12-7)

> Inform pipeline operators about the circumstances of the accident and advise them of the need to inspect pipeline facilities after notification of accidents occurring in railroad rights-of-way. (R-12-8)

Based on its findings in this accident investigation, the National Transportation Safety Board reiterates the following previously issued safety recommendation to the Pipeline and Hazardous Materials Safety Administration:

> With the assistance of the Federal Railroad Administration, require that railroads immediately provide to emergency responders accurate, real-time information regarding the identity and location of all hazardous materials on a train. (R-07-4)

The NTSB also issued safety recommendations to the U.S. Department of Transportation, the Federal Railroad Administration, to the Association of American Railroads, to the American Association of State Highway and Transportation Officials, to the National Association of County Engineers, to the American Public Works Association, to the Institute of Transportation Engineers, to the National League of Cities, to the National Association of Counties, to the Association of State Dam Safety Officials, to the National Association of Towns and Townships, to the U.S. Conference of Mayors, and to the Canadian National Railway Company. The NTSB also reiterated a previously issued safety recommendation to the Federal Railroad Administration.

In response to the recommendations in this letter, please refer to Safety Recommendations R-12-5 through -8 and R-07-4. We encourage you to submit updates electronically at the following e-mail address: correspondence@ntsb.gov. If a response includes attachments that exceed 5 megabytes, please e-mail us at the same address for instructions. To avoid confusion, please do not submit both an electronic copy and a hard copy of the same response.

Chairman HERSMAN, Vice Chairman HART, and Members SUMWALT, ROSEKIND, and WEENER concurred in these recommendations.

[Original Signed]

By: Deborah A.P. Hersman
Chairman