Testimony of the Honorable Deborah A.P. Hersman
Member
National Transportation Safety Board
Before the
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Committee on Transportation and Infrastructure
Subcommittee on Railroads, Pipelines, and Hazardous Materials
Hearing on Safety Issues Involving the Transportation of Hazardous Materials
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Good morning, Chairwoman Brown, Ranking Member Shuster, and the Members of the Subcommittee. Thank you for the opportunity to appear before you today on behalf of the National Transportation Safety Board (NTSB) regarding the safe transportation of hazardous materials. Today, I would like to highlight some specific issues of concern to the NTSB, including the air transportation of lithium batteries, the hazards of wet lines on highway cargo tanks, and the loading and unloading of hazardous materials from railroad tank cars and highway cargo tanks. I will conclude with some brief remarks about improvements in railroad tank cars, the placement of tank cars transporting high-risk materials in trains, and the bulk transport of acetylene in cylinders on highway trailers and hydrogen in tube trailers.

Air Transportation of Lithium Batteries

Issues

Inadequate understanding of the cause of fires involving lithium batteries, and inadequate public awareness about safely carrying lithium batteries on aircraft.

Background

The first issue I wish to address is the air transportation of lithium batteries. There are two types of lithium batteries: primary and secondary. Primary lithium batteries are non-rechargeable and they are commonly used in items such as watches and pocket calculators. They contain metallic lithium that is sealed in a metal casing. The metallic lithium will burn when exposed to air if the metal casing is damaged, compromised, or exposed to sustained heating. Secondary lithium batteries, also known as lithium-ion batteries, are rechargeable and are commonly used in items such as cameras, cell phones, laptop computers, and hand power tools. The secondary lithium batteries contain electrically charged lithium atoms, or ions, in a flammable liquid electrolyte. Overheating of the battery can result in the ignition of the flammable electrolyte. Halon suppression systems (the only fire suppression systems certified for aviation) are not effective in extinguishing fires involving primary lithium batteries, but can be effective in extinguishing fires involving secondary lithium batteries.

The demand for primary and secondary lithium batteries has skyrocketed since the mid-1990s as the popularity and use of electronic equipment of all types has similarly grown. As the

use of lithium batteries has increased, the number of incidents involving fires or overheating of lithium batteries, particularly in aviation, has likewise grown. The NTSB has investigated three such accidents, which I would like to review for the committee.

Los Angeles International Airport, Los Angeles, California

On April 28, 1999, a fire destroyed two cargo pallets that included boxes of primary lithium batteries at Los Angeles International Airport, Los Angeles, California. The pallets had been taken off an inbound passenger-carrying flight from Japan. During the movement of one of the pallets by a forklift within the cargo facility, the pallet fell off the forklift and rolled onto its side against another pallet. The pallet of primary lithium batteries was moved a second time and placed next to a second pallet of primary lithium batteries. Three minutes later, smoke and a small fire were observed on the previously overturned pallet. The fire spread to the adjoining pallet of batteries, and both pallets erupted in flames. The fire department extinguished the fire in about 25 minutes only after separating the packages on the pallets and deluging them with water.

Interviews with the air carrier's employees revealed that it was not uncommon to overturn a pallet and that other loads of batteries had been damaged and sometimes resulted in spillage of the batteries.

The lithium batteries on the two pallets were neither identified nor shipped as hazardous materials. Instead, they had been shipped as ordinary freight under an exception to the *Hazardous Materials Regulations*. At the time of this incident, lithium batteries containing limited amounts of lithium and meeting certain packaging requirements were "excepted" (excluded) from all regulations. Lithium batteries not meeting the exception criteria had to be transported as a regulated hazardous material, be identified on the shipping documents, and have appropriately marked and labeled packaging. The batteries involved in this incident met the criteria for the exceptions.

The NTSB's investigation of this incident revealed that these batteries presented an unacceptable risk to aircraft and passengers. The NTSB recommended that the Pipeline and Hazardous Materials Safety Administration (PHMSA, then the Research and Special Programs Administration (RSPA)), with the Federal Aviation Administration (FAA), evaluate the fire hazards posed by lithium batteries in an aviation environment and require that appropriate safety measures be taken to protect the aircraft and occupants. (PHMSA was established in 2005 and assumed regulatory responsibility for the hazardous materials safety program. PHMSA will be used in all subsequent references.) The NTSB also recommended that packages containing lithium batteries be identified as hazardous materials, including appropriate marking and labeling of the packages and proper identification in shipping documents when transported on aircraft.

Memphis, Tennessee

On August 4, 2004, fire destroyed freight in a unit load device (a cargo container configured for aircraft) that was being loaded on a cargo-only aircraft in Memphis, Tennessee. As the unit load device was about halfway onto the aircraft, loading personnel smelled smoke and lowered the device to the ground. When fire responders arrived and opened the unit load device, a fire flared inside it.

The fire originated in a cardboard box that held two secondary lithium battery modules that were components of a prototype battery pack for an electric car. The package also contained metal tools taped to a cardboard lining in the top of the box. The accident package was identified on shipping documents as "lithium batteries" and class 9 miscellaneous hazardous materials. The package was shipped under a U.S. Department of Transportation (DOT) "competent authority approval," a formal written authorization for the limited shipment and transportation of a specific hazardous material in specially designed containers or packaging. The DOT approval applied to the complete battery pack and not the individual battery modules. The DOT approval further stipulated that the battery pack was to be secured in an insulated fiberboard case. The fiberboard case was to be enclosed and secured in a wooden crate.

On the basis of this evidence, the NTSB determined that the fire was caused by the failure of unapproved packaging to adequately protect the secondary lithium batteries from short-circuiting during transportation.

In conjunction with its investigation of the Memphis incident, the NTSB requested accident data from PHMSA about other reported incidents involving lithium batteries. According to PHMSA, six other incidents involving lithium batteries in air transportation were reported from January 1989 through May 2005. In five of these incidents, the batteries caused fire or charring of the packaging. During the same period, six incidents involving lithium batteries in other modes were reported, but only one included a fire directly related to the transport of lithium batteries.

The NTSB did not issue any additional safety recommendations as part of its investigation of the Memphis incident. Because the safety recommendations to evaluate the fire hazards of lithium batteries issued following the 1999 incident in Los Angeles addressed lithium batteries in general, the NTSB felt these recommendations would also apply to secondary lithium batteries, and that PHMSA should evaluate the fire hazards of secondary lithium batteries.

Philadelphia, Pennsylvania

The most recent accident investigated by the NTSB occurred on February 7, 2006. After an in-flight cargo fire, a cargo aircraft made an emergency landing at its destination airport, Philadelphia International Airport, Philadelphia, Pennsylvania. The aircraft and most of the cargo were destroyed by fire after landing.

The NTSB examined the contents of the cargo containers where the fire most likely originated, and found that several electronic devices containing secondary lithium batteries were shipped in these containers. No batteries were found that exhibited any damage identifying a source of ignition, nor could any determination be made that secondary batteries found in the debris had been subject to recalls.

Although the cause of the in-flight fire ultimately could not be determined, the prevalence of electronic equipment in the main cargo compartment caused the NTSB to closely examine safety issues involving the transportation of secondary lithium batteries on commercial aircraft, including batteries in airline passengers' laptop computers and other personal electronic devices. The NTSB concluded from its investigation that testing and incident data indicated that both

primary and secondary lithium batteries pose a fire hazard, and that an in-depth analysis of the causes of primary and secondary lithium battery failures would improve the safe transportation of these batteries.

The NTSB issued safety recommendations to PHMSA in December 2007 to address growing concerns about the increasing frequency of rechargeable and non-rechargeable lithium batteries overheating and igniting when transported on aircraft, either as cargo or as items in passenger baggage or carry-on items. Because the causes of these battery failures in many cases remain unknown, the NTSB issued multiple safety recommendations urging PHMSA to address the problems with lithium batteries on a number of fronts, including reporting all incidents; retaining and analyzing failed batteries; researching the modes of failure; and eliminating regulatory provisions that permit limited quantities of these batteries to be transported without labeling, marking, or packaging them as hazardous materials. In January 2008, the NTSB issued additional recommendations to PHMSA and the FAA to address the NTSB's concerns about the lack of public awareness about issues involving the overheating and ignition of lithium batteries.

Action to Date

In December 2004, PHMSA published an interim final rule that addressed the safety recommendations issued following the 1999 incident in Los Angeles. This rule prohibited the transportation of most cargo shipments of primary lithium batteries on board passenger-carrying aircraft. Cargo shipments of equipment containing small- and medium-sized primary lithium batteries (containing less than 25 grams of lithium) were still permitted on passenger-carrying aircraft, as were shipments of secondary lithium batteries, including those in equipment and within specified weight restrictions.

On August 9, 2007, PHMSA issued a final rule on the transportation of lithium batteries that became effective on January 1, 2008. The 2007 rule permanently adopted the amendments contained in the December 2004 interim final rule. The 2007 rule also included the following new requirements:

- Testing of the packaging for small lithium batteries;
- Labeling, marking, and packaging for single packages containing 12 or more small lithium batteries;
- Shipments of medium-sized lithium batteries to be transported and identified as class 9 hazardous materials when transported by air (and vessel); and
- Permitting airline passengers and flight and cabin crew to carry spare lithium batteries on aircraft as carry-on items only.

On January 14, 2009, PHMSA published another final rule concerning the transportation of batteries and battery-powered devices on aircraft. This final rule addressed the harmonization of the U.S. *Hazardous Materials Regulations* with international standards for transporting hazardous materials, including lithium batteries, by air. This rule did not address the NTSB's 2007 and 2008 recommendations other than by enhancing the incident reporting requirements for battery failures.

Action Needed

Between December 2007 and November 2008, the Consumer Product Safety Commission issued 5 recalls of nearly 800,000 secondary lithium batteries because of overheating, melting, or creating a fire hazard.

PHMSA needs to expedite actions to implement the following safety recommendations:

Safety Recommendations

--to the Pipeline and Hazardous Materials Safety Administration:

> Require aircraft operators to implement measures to reduce the risk of primary lithium batteries becoming involved in fires on cargo-only aircraft, such as transporting such batteries in fire resistant containers and/or in restricted quantities at any single location on the aircraft. (A-07-104); Current classification: Open—Acceptable Response
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> Until fire suppression systems are required on cargo-only aircraft, as asked for in Safety Recommendation A-07-99, require that cargo shipments of secondary lithium batteries, including those contained in or packed with equipment, be transported in crew-accessible locations where portable fire suppression systems can be used. (A-07-105); Current classification: Open—Acceptable Response
>
> Require commercial cargo and passenger operators to report to the Pipeline and Hazardous Materials Safety Administration all incidents involving primary and secondary lithium batteries, including those contained in or packed with equipment, that occur either on board or during loading or unloading operations and retain the failed items for evaluation purposes. (A-07-107); Current classification: Open—Acceptable Response
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> Analyze the causes of all thermal failures and fires involving secondary and primary lithium batteries and, based on this analysis, take appropriate action to mitigate any risks determined to be posed by transporting secondary and primary lithium batteries, including those contained in or packed with equipment, on board cargo and passenger aircraft as cargo; checked baggage; or carry-on items. (A-07-108); Current classification: Open—Acceptable Response
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> Eliminate regulatory exemptions for the packaging, marking, and labeling of cargo shipments of small secondary lithium batteries (no more than 8 grams equivalent lithium content) until the analysis of the failures and the implementation of risk-based requirements asked for in Safety Recommendation A-07-108 are completed. (A-07-109); Current classification: Open—Acceptable Response

--to the Federal Aviation Administration and the Pipeline and Hazardous Materials Safety Administration:

> In collaboration with air carriers, manufacturers of lithium batteries and electronic devices, air travel associations, and other appropriate government and private organizations, establish a process to ensure wider, highly visible, and continuous dissemination of guidance and information to the air-traveling public, including flight

> crews, about the safe carriage of secondary (rechargeable) lithium batteries or electronic devices containing these batteries on board passenger aircraft. (A-08-1); Current classification: Open—Acceptable Response
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> In collaboration with air carriers, manufacturers of lithium batteries and electronic devices, air travel associations, and other appropriate government and private organizations, establish a process to periodically measure the effectiveness of your efforts to educate the air-traveling public, including flight crews, about the safe carriage of secondary (rechargeable) lithium batteries or electronic devices containing these batteries on board passenger aircraft. (A-08-2); Current classification: Open—Acceptable Response

Wet Lines on Highway Cargo Tanks

Issue

Gasoline and other hazardous materials can be transported in piping below cargo tanks that can be released onto vehicles in accidents.

Background

Presently, each external product pipe or wet line on a cargo tank semitrailer transporting flammable liquid may contain as much as 50 gallons of product directly underneath a fully loaded cargo tank. Because the wet lines are designed to break away in order to prevent damage to the tank shell, the wet lines could release a substantial amount of product on a striking passenger vehicle, which may be trapped beneath the cargo tank and engulfed in a fire. This issue predominately applies to tank trucks delivering gasoline to local gas stations.

In 1978, the Office of Motor Carrier Safety within the Federal Highway Administration established a policy allowing gasoline to be carried in wet lines because of "economic and practicality considerations." In 1985, PHMSA published a notice of proposed rulemaking (NPRM) that increased the bottom accident damage protection for cargo tanks, including the wet lines. In 1988, in the process of developing the final rule, PHMSA staff prepared an issue outline memorandum that discussed the external piping issue. The memorandum noted:

> It is unreasonable and illogical to allow the piping to be considered as an acceptable container for the transport of gasoline. Therefore, the petroleum industry's decision to bottom load in compliance with the Clean Air Act and their unwillingness or inability to drain the cargo lines has resulted in widespread non-compliance with the intent and letter of the *Hazardous Materials Regulations* as interpreted by RSPA [PHMSA] for the transportation of gasoline.

When PHMSA published the final rule in 1989, PHMSA noted that wet lines were not appropriate packaging for hazardous materials:

> Bottom loading and unloading outlets on cargo tanks, although very useful, present the inherent risk that if damaged the entire contents of the tank may be released. Piping

attached to the outlet valve is provided with a sacrificial device that is designed to break under accident loads.

In addressing comments from the petroleum industry regarding data supporting the infrequency of accidents resulting in damage to the wet lines and the loss of lading, PHMSA responded that although such accidents were infrequent, the consequences of such accidents could be substantial. PHMSA encouraged the petroleum industry to consider and evaluate all possible ways to eliminate this risk in the most cost effective manner. The industry responded but not with a solution. The American Petroleum Institute (API) replied that the analysis of wet line accident statistics indicates that the probability is quite low that a fatality will be directly attributed to a wet line failure. Based on the results of its analysis, API cancelled a study to evaluate alternate means of loading cargo tanks that would result in dry loading lines. Consequently, PHMSA prohibited the transportation of poison B liquids, oxidizer liquids, liquid organic peroxides, and liquid corrosives in wet lines, but allowed gasoline and petroleum products in external unprotected wet lines. PHMSA justified the exception for gasoline by the lack of sufficient accident data and the inadequacy of information concerning possible alternative procedures and/or equipment.

Subsequent to this rulemaking activity, the NTSB investigated two accidents in which wet lines were damaged, and gasoline in the wet lines was released and ignited. On October 9, 1997, a tractor/cargo tank semitrailer transporting 8,800 gallons of gasoline was struck by a car in Yonkers, New York. The car hit the right side of the cargo tank in the area of the tank's external wet lines, releasing the gasoline in them. The ensuing fire destroyed both vehicles, and the driver of the car was killed. Five months after this accident, the NTSB investigated a similar accident that happened on February 15, 1998, in Wilmington, Delaware. A tractor/cargo tank semitrailer transporting 8,900 gallons of gasoline struck the left rear of a car parked on the right shoulder of a bridge. The truck pushed the car into a concrete barrier bordering the bridge. A fire ensued, destroyed the car, and moderately damaged the truck. The NTSB determined that three of the four wet lines on the cargo tank fractured during the collision, releasing about 12 gallons of gasoline. As a result of these investigations, the NTSB recommended that PHMSA prohibit the carrying of hazardous materials in external piping of cargo tanks, such as wet lines, which may be vulnerable to failure in an accident (Safety Recommendation H-98-27).

In another accident in Mustang, Oklahoma, in July 1998, local authorities attributed the severity of the accident to the failure of wet lines after an automobile hit a cargo tank and broke the wet lines. The gasoline in the wet lines was released and ignited, engulfing the automobile and cargo tank in fire.

Action to Date

In December 2004, PHMSA published an NPRM addressing the transportation of flammable liquids in external wet lines. PHMSA noted in the NPRM that 190 accidents involving wet lines were reported in the 12-year period from January 1, 1990, through December 31, 2001, and included at least 7 fatal accidents in which unprotected wet lines were damaged and gasoline was released. PHMSA also acknowledged that there was a degree of underreporting of hazardous materials transportation accidents of all types.

To improve the safety of wet lines, PHMSA proposed to prohibit flammable liquids, including gasoline, in external product piping (that is, wet lines) unless the piping was protected from impact. Two options that would meet this performance standard would be the use of purging systems for existing external piping, or replacing the existing external piping with shortened or recessed piping. In the NPRM, PHMSA estimated the costs of installing a manual purging system or switching to shortened/recessed loading lines to be about $2,250 and $1,540, respectively, per trailer. PHMSA also estimated that 15,000 cargo tank trailers would be affected. A vendor of purging systems estimated the cost of a manual purging system to be between $2,100 and $2,300 per trailer, and for an automatic purging system between $3,000 and $4,000 per trailer.

The petroleum industry strongly opposed the NPRM and resisted any initiatives to require purging of the wet lines or incorporating design enhancements to better protect the exposed piping. Industry also contested PHMSA's cost estimates and the number of cargo tank trailers that would be affected. The API and the National Tank Truck Carriers estimated the installation and retrofit costs to be far higher—as much as $5,000 per trailer. Both also estimated that 26,000 trailers would be affected.

Sunoco, Inc., on the other hand, was very proactive and made a decision to equip all of its fleet of 120 cargo tanks with purging systems. Sunoco advised that its vehicles have been equipped for several years and that the systems have worked well. Sunoco identified two accidents in the Philadelphia area where it believes purged lines may have prevented the destruction of its trailers. Sunoco stated that the cost of a fully automated purging system is $3,800. The cost of installing the system on a new cargo tank when it is being manufactured is nominal; however, the cost to install the purging system on a used cargo tank is estimated to be about $4,400. Sunoco estimates the cost of an 8,000-gallon cargo tank to be $110,000 and a 12,500-gallon cargo tank to be $135,000. A power unit (tractor) costs about $95,000.

In its March 5, 2005, comment letter to PHMSA on the NPRM, the NTSB stated (1) that it did not believe that reliance upon impact damage protection devices for wet lines would provide the greatest level of safety and (2) that the hazards from wet lines full of a hazardous cargo can be more effectively eliminated if the wet lines are purged of the cargo.

On June 7, 2006, PHMSA published a notice withdrawing the NPRM. PHMSA stated in the withdrawal notice that it had concluded that "further regulation would not produce the level of benefits … originally expected and that the quantifiable benefits of proposed regulatory approaches would not justify the corresponding costs."

On July 31, 2007, PHMSA advised the NTSB that while it would not eliminate wet lines, it developed an outreach program focused on best practices for fueling operations, maintenance procedures, and other safeguards. PHMSA also advised that it was working with industry to refine data on the wet line issue. While recognizing these increased activities, the NTSB advised PHMSA on September 4, 2008, that these actions still do not address the need to eliminate wet lines and that they did not satisfy the NTSB's 1998 recommendation.

On April 1, 2009, PHMSA advised the NTSB that prohibiting the transport of hazardous materials in wet lines was not justified because of cost factors and a decrease in reported

incidents. Instead, it stated that it has developed a strategy focusing on avoiding incidents and voluntary actions to limit safety risks.

Action Needed

The risk of wet lines has been recognized for 30 years. Because the risk is primarily from cargo tank vehicles making gasoline deliveries at neighborhood service stations and convenience stores, the exposure of the public is not acceptable. For this reason, PHMSA needs to prohibit the carrying of hazardous materials in external piping of cargo tanks, such as wet lines, that may be vulnerable to failure in an accident. Further, PHMSA alluded to the underreporting of accident data in its NPRM, and the NTSB believes that PHMSA could take action to improve the accuracy and completeness of the data.

Safety Recommendation

--to the U.S. Department of Transportation:

> Prohibit the carrying of hazardous materials in external piping of cargo tanks, such as loading lines, that may be vulnerable to failure in an accident. (H-98-27); Current classification: Open—Acceptable Response

Loading and Unloading of Hazardous Materials from Railroad Tank Cars and Highway Cargo Tanks

Issues

The lack of adequate safety requirements and oversight for loading and unloading of hazardous materials from railroad tank cars and highway cargo tanks.

Background

The NTSB investigated eight accidents involving the loading or unloading of highway cargo tanks or railroad tank cars between June 1998 and August 2003.

On November 19, 1998, at an industrial facility in Louisville, Kentucky, a cargo tank truck containing a corrosive liquid mixture was offloaded into a storage tank containing an incompatible chemical, causing a chemical reaction that resulted in 7 worker injuries and the evacuation of 2,400 persons. A plant employee inadvertently attached the transfer hose to the wrong pipe fitting at a manifold on which confusing labeling was affixed. Less than 7 months later, a similar accident occurred on June 4, 1999, at a tannery in Whitehall, Michigan. When a cargo tank truck containing sodium hydrosulfide solution arrived at the facility, the tannery's shift supervisor failed to verify the chemical that was to be delivered. The supervisor directed the truck driver to offload his cargo into a tank that contained an incompatible hazardous material. The resulting chemical reaction generated hydrogen sulfide, a poisonous gas that killed the truck driver. The NTSB cited as contributing causes to both accidents the failure of the DOT to establish, and oversee compliance with, adequate safety requirements for unloading hazardous materials from highway cargo tanks.

The NTSB also investigated a number of accidents in which it addressed the inadequacy of Federal oversight of loading and unloading safety procedures for railroad tank cars. On July 14, 2001, at a chemical plant in Riverview, Michigan, a pipe that was attached to a fitting on the unloading line attached to a railroad tank car fractured and separated, which caused the release of methyl mercaptan, a poisonous and flammable gas. The methyl mercaptan ignited, and the fire damaged cargo transfer hoses on an adjacent tank car that resulted in the release of chlorine, a poisonous gas. Three plant employees were killed, and several others were injured. About 2,000 residents were also evacuated from their homes. The NTSB determined that this accident resulted from inadequate inspection and maintenance of cargo transfer equipment and inadequate Federal oversight of unloading operations involving hazardous materials.

On September 13, 2002, a 24,000-gallon railroad tank car containing a hazardous waste mixture catastrophically ruptured at a chemical facility in Freeport, Texas. The tank rupture occurred while the car was being steam-heated to permit transfer of the contents. As a result, 28 people were injured. The NTSB determined that the tank car was over pressurized by excessive heating, which caused a runaway chemical reaction; the NTSB also cited unloading procedures as a safety issue.

Action to Date

In an NPRM issued on June 14, 2001, PHMSA stated that loading and unloading bulk liquid containers such as tank cars and highway cargo tanks generally were not transportation activities and, therefore, were not subject to the *Hazardous Materials Regulations*. The NPRM was strongly opposed by many carriers and shippers of hazardous materials who were concerned that the NPRM, if implemented, would replace a national system of uniform and consistent regulations with differing regional standards established by local jurisdictions, the U.S. Environmental Protection Agency, and the Occupational Safety and Health Administration (OSHA).

The NTSB also opposed the NPRM. In its October 29, 2001, comments to the NPRM, the NTSB stated its belief that the DOT had both the statutory mandate and the authority to regulate loading and unloading operations. The NTSB also stated that the proposed rules "may result in the elimination of effective Federal oversight" of these operations and that "DOT should strengthen its oversight rather than ignore these issues." In the fall of 2002, OSHA notified the NTSB of its willingness to work with the DOT to review the adequacy of current requirements and to identify any gaps or inconsistencies that may exist and endanger the safety of workers. PHMSA published the final rules on October 30, 2003, with virtually no changes from the NPRM.

In the fall of 2006, the then current PHMSA administrator reexamined the issue and directed PHMSA staff to establish a working group of government and industry representatives to develop recommended practices for loading and unloading of these bulk liquid tanks. On January 4, 2008, PHMSA published a notice requesting comments on the "proposed recommended practices" that had been developed. PHMSA stated in the notice that between 2004 and 2006, bulk loading and unloading operations accounted for 27 percent of all serious unintentional release accidents.

Although the 2008 proposed practices are comprehensive, the NTSB is still concerned that the practices would not be enforceable because they are not required. No further action has been taken since the publication of recommended practices in January 2008.

Action Needed

PHMSA needs to complete rulemaking that either incorporates its recommended practices directly into the *Hazardous Materials Regulations* or incorporates them by reference into the regulations. By codifying the recommended practices, PHMSA would have regulatory and enforcement authority over the loading and unloading operations as a function of transportation, while OSHA could continue to address personal protection requirements, emergency shutdown measures, and other actions needed to protect workers.

Safety Recommendations

--to the Pipeline and Hazardous Materials Safety Administration:

> In cooperation with the Occupational Safety and Health Administration and the Environmental Protection Agency, develop regulations that require safe operating procedures to be established before hazardous materials are heated in a railroad tank car for unloading; at a minimum, the procedures should include the monitoring of internal tank pressure and cargo temperature. (R-04-10); Current classification: Open—Unacceptable Response

--to the U.S. Department of Transportation:

> Develop, with the assistance of the Environmental Protection Agency and Occupational Safety and Health Administration, safety requirements that apply to the loading and unloading of railroad tank cars, highway cargo tanks, and other bulk containers that address the inspection and maintenance of cargo transfer equipment, emergency shutdown measures, and personal protection requirements. (I-02-1); Current classification: Open—Unacceptable Response
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> Implement, after the adoption of safety requirements developed in response to Safety Recommendation I-02-1, an oversight program to ensure compliance with these requirements. (I-02-02); Current classification: Open—Unacceptable Response

--to the Occupational Safety and Health Administration:

> Assist the U.S. Department of Transportation in developing safety requirements that apply to the loading and unloading of railroad tank cars, highway cargo tanks, and other bulk containers that address personal protection requirements, emergency shutdown measures, and the inspection and maintenance of cargo transfer equipment. (I-02-3); Current classification: Open—Acceptable Response

Other Issues

Improvements in Railroad Tank Cars Transporting Hazardous Materials

Issues

An inadequate understanding of forces acting on tank cars during accident conditions and inadequate tank car design and material standards for tank car construction.

Discussion

Four safety recommendations (R-04-4 through -7) issued to the Federal Railroad Administration (FRA) as a result of the investigation of a 2002 train derailment in Minot, North Dakota, focused on the poor performance of the steels used for the construction of tank cars involved in the accident, the need to validate the modeling of the effect of accident forces on tank cars, and the development of improved standards for steels used in the construction of tank cars transporting these hazardous materials. The safety recommendations addressed needed crashworthiness improvements in all pressure tank cars authorized for the transportation of liquefied gases, such as liquefied petroleum gas as well as poisonous-by-inhalation (PIH) materials. On August 10, 2005, Congress passed the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users, which enacted as statutory mandates the NTSB's four tank car-related safety recommendations from the Minot investigation.

On April 1, 2008, PHMSA published an NPRM that included enhanced puncture resistance standards for tank heads, new puncture standards for tank shells, and speed restrictions for trains transporting PIH materials in non-signaled territory or in tank cars not meeting the enhanced puncture resistance standards. Although the NTSB expressed its support of the overall intent of the NPRM, it noted several areas in the NPRM that could be improved. For example, the proposed standard that a tank car must be puncture resistant up to a speed of 25 mph does not represent a standard for ensuring safety in 50-mph derailments. The proposed rule defines a puncture-resistance standard for tank cars, but it does not address the spectrum of loads from a variety of impacts that have occurred in derailments, such as crushing. The NTSB believes that more technically rigorous models should be developed to identify forces acting on tank cars during derailments and validated to address these concerns. Lastly, the NPRM did not include a standard for the fracture toughness of steels as recommended.

PHMSA published a final rule on January 13, 2009, that did not accept any of the NTSB's suggestions to improve the NPRM. Further, according to PHMSA, an overwhelming number of industry commenters expressed the view that the tank car industry lacks the technological and engineering ability to manufacture tank cars meeting the proposed standards. Based on these comments, the FRA and PHMSA adopted interim standards for tank cars used to transport PIH materials. Under the interim standards, heavier and thicker tank cars having higher design pressures will be required for PIH materials, such as chlorine and anhydrous ammonia.

Action Needed

PHMSA and the FRA need to develop improved performance standards for all pressure tank cars and not only for those used in the transportation of PIH materials. The performance

standards need to be based on more advanced modeling of the variety of forces acting on a tank car during accidents. A coordinated and cooperative effort among the FRA, PHMSA, railroads, tank car manufacturers and owners, and hazardous materials manufacturers and shippers is also needed to develop and implement performance standards for pressure tank cars.

Placement of Tank Cars Transporting High-Risk Materials in Trains

Issue

Reduction of the vulnerability of tank cars transporting PIH materials to accident damage through operational measures, such as positioning tank cars toward the rear of trains and reducing speeds.

Discussion

The collision and derailment of two freight trains in Macdona, Texas, in June 2004, resulted in the puncture of a tank car transporting chlorine, a poisonous gas. Three persons died from inhalation of the chlorine gas. Another tank car transporting chlorine was also punctured in a second railroad accident in Graniteville, South Carolina, in January 2005, causing nine fatalities. Recognizing that it would take several years before pressure tank cars with improved steels and designs would constitute a significant percentage of tank cars in service, NTSB believes the most expedient and effective means to protect the public from the release of highly poisonous gases in train accidents is for railroads to implement operational measures that will minimize the vulnerability of tank cars transporting these products. The NTSB recommended that the FRA:

> Require railroads to implement operating measures, such as positioning tank cars toward the rear of trains and reducing speeds through populated areas, to minimize impact forces from accidents and reduce the vulnerability of tank cars transporting chlorine, anhydrous ammonia, and other liquefied gases designated as poisonous by inhalation. (R-05-16); Current classification: Open—Unacceptable Response

The FRA has strongly objected to both tank car placement and speed reduction measures to reduce the vulnerability of tank cars transporting PIH materials. The FRA has not offered any other operational measures to reduce the vulnerability of these tank cars.

Action Needed

The FRA needs to address Safety Recommendation R-05-16 by offering some positive alternatives if it believes that tank car placement and speed reductions are not viable options to reduce the vulnerability of tank cars transporting PIH materials.

Bulk Transport of Acetylene in Cylinders on Highway Trailers and Hydrogen in Tube Trailers

Issues

Adequacy of the DOT *Hazardous Materials Regulations* for the protection of cylinders, valves, piping, and fittings mounted on cargo trailers, and the effectiveness of procedures for unloading acetylene from manifolded cylinders mounted on highway trailers.

Discussion

On May 1, 2001, in Ramona, Oklahoma, a tractor, in combination with a semitrailer that had horizontally-mounted, high-pressure cylinders filled with compressed hydrogen overturned, left the roadway, and traveled about 300 feet before stopping. Semitrailers with the horizontally-mounted cylinders are commonly referred to as "tube trailers." During the accident, the cylinders, valves, piping, and fittings at the rear of the semitrailer were damaged. One cylinder also fractured and was ejected from the trailer. Hydrogen was released and ignited, resulting in the evacuation of nearby residents and closure of the highway for 12 hours. The NTSB concluded that the *Hazardous Materials Regulations* did not provide sufficient and clear requirements for protecting the hydrogen cylinders, valves, piping, and other fittings.

The NTSB most recently investigated three accidents that occurred between July 25 and October 20, 2007, and involved highway trailers transporting bulk quantities of acetylene gas. Each trailer carried up to 225 cylinders that were connected by a manifold system and filled with acetylene gas. The NTSB also reviewed reports of a fourth accident that occurred on June 9, 2008.

Two of the accidents occurred as acetylene was being prepared for offloading from the cylinders mounted on the trailer. In the two remaining accidents, the trailers overturned, and acetylene cylinders were ejected from the trailers and damaged. In all four accidents, acetylene was released and ignited. The failures of the cylinders and release and ignition of acetylene raised concerns about the accident protection provided by configuration of the cylinders on the trailers and the safety standards and procedures applicable to the unloading of the manifolded cylinders.

In its reports of the Ramona, Oklahoma, accident and of the four accidents involving the acetylene cylinder trailers, the NTSB issued three safety recommendations (H-02-23 and -24 and H-09-01) to PHMSA to require that the cylinders on tube trailers and the manifolded acetylene cylinders are protected from roadway impact and are securely mounted to the trailer and that valves, fittings, and piping to the cylinders on both types of trailers are also protected from impact damage. In its report of the accidents involving the acetylene cylinder trailers, the NTSB also issued a safety recommendation (H-09-2) to PHMSA to require fail-safe equipment on these trailers that ensures that operators can perform unloading procedures only when done correctly and in proper sequence.

PHMSA worked with the Compressed Gas Association (CGA) to develop standards that address the 2002 recommendations that were issued following the Ramona accident, and that would be incorporated by reference into the *Hazardous Materials Regulations*. In April 2007, PHMSA published an NPRM that proposed to incorporate the requirements of a newly

completed CGA technical bulletin regarding design considerations for tube trailers. In its June 7, 2007, comments on the NPRM, the NTSB stated that although the CGA technical bulletin addressed Safety Recommendation H-02-23 regarding the protection of valves, fittings, and piping on tube trailers, it did not satisfy Safety Recommendation H-02-24 regarding the protection of the cylinders from impact. PHMSA published a final rule on April 9, 2009, that incorporated the CGA technical bulletin by referencing it in the *Hazardous Materials Regulations*. There was no change in the technical bulletin to address protection of the cylinders nor did PHMSA add a stand-alone amendment to regulations requiring impact protection of cylinders.

The recommendations involving the acetylene cylinder trailers were issued on March 5, 2009. The NTSB expects to receive a response from PHMSA in the coming weeks.

Action Needed

PHMSA should undertake regulatory action to develop and implement adequate standards to protect cylinders on tube trailers and the bulk transport of acetylene cylinders. PHMSA also should develop procedures applicable to the unloading of the manifolded cylinders.

Madam Chairwoman, this concludes my prepared testimony, and I would be happy to answer questions at the appropriate time.