



RAILROAD TANK CARS

Safely Transporting Hazardous Materials

A Publication of the
Railroad Tank Car Safety Research & Test Project

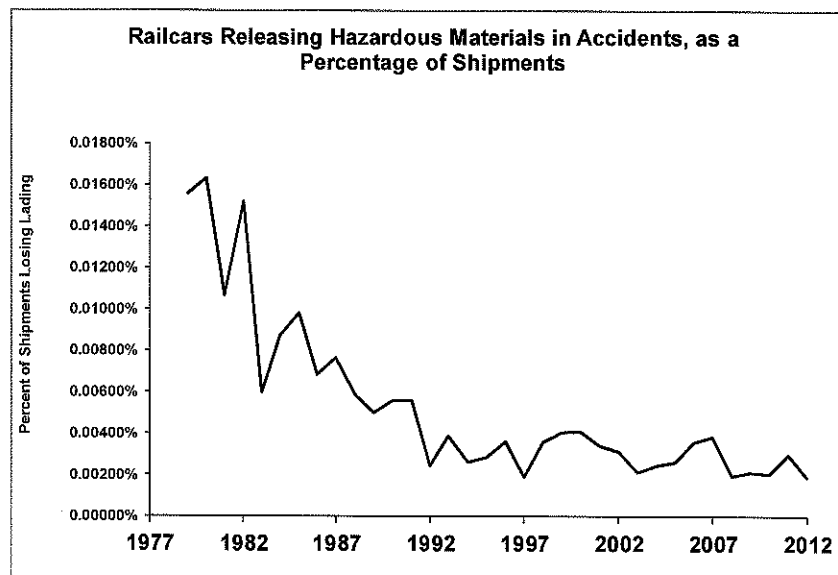
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Every year, tank cars carry nearly 2 million shipments including over 150 million tons of hazardous materials on the North American rail system. Despite the magnitude of this operation, railroads have an outstanding track record in safely delivering hazardous materials – many of which are chemicals that are essential in our daily lives. In fact, **more than 99.997** percent of hazardous materials arrive at their destination without a release caused by an accident.

This performance is a result of dedication to continual improvements in the design and use of tank cars through the collective efforts of tank car manufacturers, tank car owners, railroads, shippers, regulators and other partners. Railroads factor in safety and security when selecting routes used for the transportation of hazardous materials depending upon the risk.

Figure 1



STATISTICS PROVE TANK CAR SAFETY

Statistics show that railroads provide the safest, most efficient and most practical way to transport hazardous materials. In 2012, North American railroads safely delivered over 2.44 million carloads of hazardous chemicals and fuels. Only 46 railcars leaked in train accidents in 2012, a decrease of 80% since 1978's peak of 232. The extent of the improvement is understated, considering that during the same time frame hazardous materials rail shipments increased by 130 percent. Figure 1 above shows the percentage of the railroads' hazardous materials traffic these incidents represent – about one release per 53,100 shipments in 2012.

While any loss of lading (freight car cargo) is undesirable, it also should be understood that many of these incidents involve losses of small amounts.

Non-accident tank car releases also have decreased by 54 percent since 1996, when a program to prevent these incidents was initiated across the North American rail system. This reduction can be credited to a focused effort and improvements in securement, inspection and maintenance practices.

Additionally, between 1990 and 2012, there were 21 hazardous material-related deaths as a result of rail transportation incidents. Note that, in the same period, trucks hauling hazardous materials were involved in incidents that claimed 316 lives (Figure 2 on the next page).

Note: The counts of incidents and casualties presented in this brochure do not encompass 2013, and in particular, do not account for the July crude oil accident in Lac-Mégantic, Quebec. At the time of the brochure's publication, industry and regulatory organizations are assessing the implications of what can be learned from this accident.

Despite the serious nature of this incident, two facts remain true. The industry is tenacious and proactive about improving the safety performance of tank cars, as exemplified by the adoption of a package of safety improvements for new cars carrying crude oil and other flammable liquids in 2010 and 2011, thus reducing the chance of punctures and fires in accidents. Also, the rate of hazardous materials releases continues to decline, and DOT/TC-111-class tank cars survive a large majority of accidents with no release of lading, as do all tank cars.

Figure 2

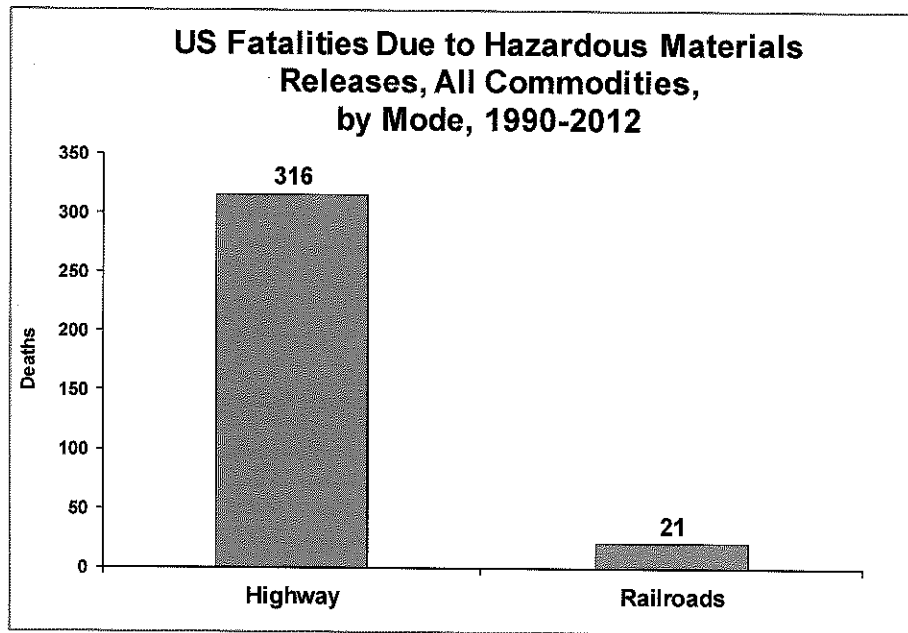
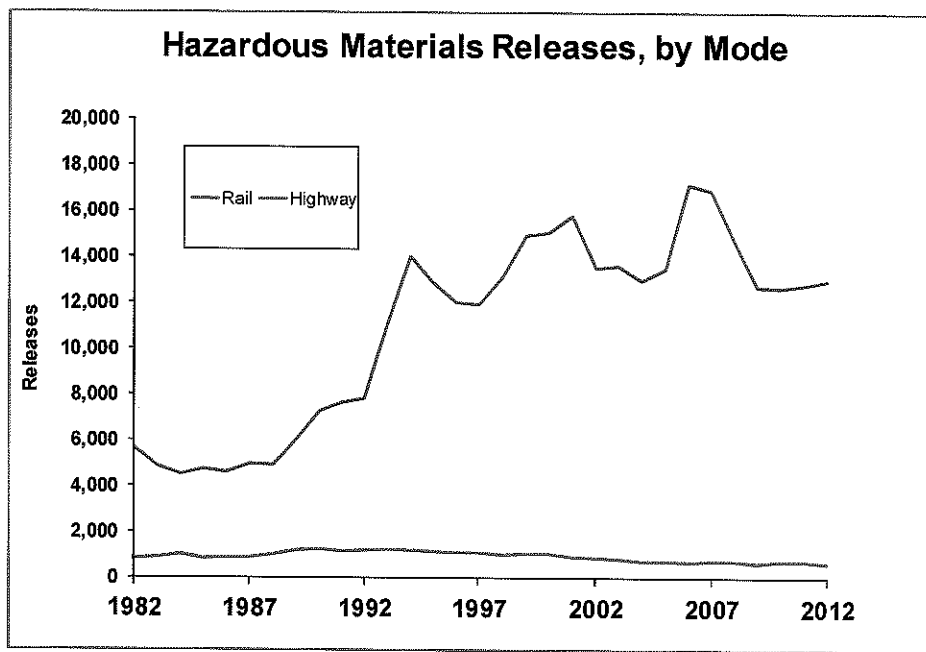


Figure 3 shows the trend in hazmat incidents over time for highway versus rail.

Figure 3



HAZMATS: ESSENTIAL TO OUR DAILY LIVES

Our society depends on chemicals in nearly every facet of daily life. Some 2,500 commodities that the U.S. Department of Transportation (DOT) defines as “hazardous” must be transported from one place to another, often in large quantities. These include fuels, fertilizers, disinfectants and cleansers, along with chemicals for foods, glass, life-saving medicines and the weapons and munitions required by the military. For example, freight trains carry the chlorine used to purify more than half of the nation’s water supplies and in the manufacturing of 85 percent of all pharmaceuticals. Tank cars also carry non-hazardous economic staples such as corn syrup, food products and clay slurry used in manufacturing paper.

THE RAILROAD TANK CAR SAFETY RESEARCH AND TEST PROJECT

In 1970, the Railway Progress Institute, the predecessor to the Railway Supply Institute, teamed up with the Association of American Railroads (AAR) to create the Railroad Tank Car Safety Research and Test Project (Tank Car Safety Project). Since then, the founding partners have invested more than \$20 million in the Tank Car Safety Project, while also investing significantly in safety improvements to the tank car fleet. These investments have yielded vast improvements in safety research, modifications to existing tank cars, construction of new tank cars to meet improved specifications, and reductions in derailment rates.

The Tank Car Safety Project created, maintains and continually adds to a set of data describing damage to tank cars in train accidents. This information is available to industry researchers to support studies of potential enhancements to tank car construction, designs and materials. These data allow the performance of various features to be quantified and improvement initiatives to be prioritized.

The Tank Car Safety Project also conducts tests and other studies to provide the industry with the information it needs to continue improving upon an already excellent safety record in the transportation of hazardous materials. Recommendations from the Tank Car Safety Project have provided the U.S. Department of Transportation, Transport Canada and the AAR Tank Car Committee with the quantitative information needed to adopt effective new regulations and standards. The most recent examples are in the development of new standards for tank cars carrying Toxic Inhalation Hazard (TIH) materials, ethanol products and crude oil.

A TRACK RECORD OF SAFETY IMPROVEMENTS

A potential danger of transporting hazardous materials was highlighted in the 1960s and early 1970s, when a number of rail incidents resulted in chain reaction explosions of large pressurized tank cars carrying liquefied petroleum gas (LPG) that were exposed to fires at accident scenes. The Tank Car Safety Project teamed up with the AAR and the Federal Railroad Administration (FRA) to analyze these accidents and make changes to ensure tank car safety. All LPG cars were outfitted with the following safety devices, which include:

- ◆ **Shelf couplers** to prevent car couplers from overriding one another and puncturing the ends, or heads, of tank car tanks in a derailment or sudden stop
- ◆ **Head shields** fashioned of half-inch steel and applied to the heads of tank car tanks to protect against head punctures
- ◆ **Thermal protection**, a fire-resistant insulation that helps keep the tank's lading cool enough to delay or prevent tank failures in fires

Today, tank cars carrying the most hazardous loadings are equipped with these safety devices. A rail industry study found that in the first six years after retrofitting LPG cars, there was a 94-percent reduction in punctures to tank heads, a 93-percent improvement in preventing fire-induced ruptures of tanks, and a 67-percent decrease in shell punctures. Other safety improvements and upgrades include:

- ◆ **Substantially stronger tank cars for carrying Toxic Inhalation Hazard (TIH) commodities**
- ◆ **Substantially stronger new tank cars for carrying various liquid commodities**, including ethanol and crude oil, incorporating thicker, stronger tank shells and head shields, and top fittings protection to protect these fittings when the car rolls over in a derailment.
- ◆ **Substantially stronger tank cars for transporting chemicals with environmental hazards**, with similar improvements for protection in derailments
- ◆ **Bottom-fittings protection**, which helps keep the fittings on the bottoms of tank cars from leaking during an accident
- ◆ **Steel with improved low-temperature properties** for tougher tanks
- ◆ **Appropriate speeds** for trains of high concern and enhanced track maintenance on routes of high concern
- ◆ **Track side equipment defect detectors** installed at a higher-than-usual density on certain routes
- ◆ **Best practices for loading and unloading** tank cars
- ◆ **Inspections of tank car stub sills** — the components that attach the coupling and cushioning systems to the tank — at regular intervals
- ◆ **Surge suppression devices** on all new tank cars with pressure relief devices

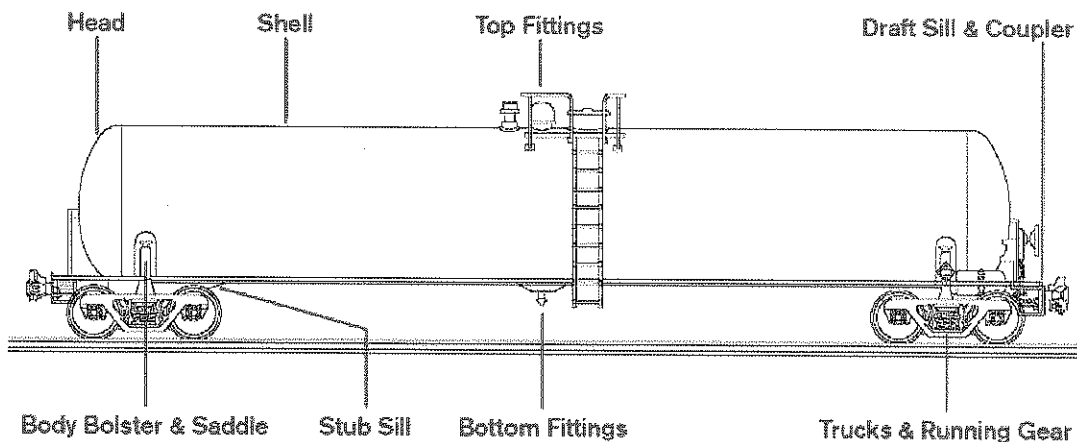
- ◆ **More robust rupture discs** for pressure relief devices on tank cars
- ◆ **More safety features for heavier tank cars**, designed to carry more lading

To address losses of hazardous lading that are not the result of accidents, the AAR spearheaded the launch of the North American Non-accident Release Prevention Task Force in 1995. Non-accident Releases (NARs) are usually less than 10 gallons and have caused no fatalities since the 1960s. Nevertheless, they are releases of hazardous materials and the industry works diligently to prevent them. Since the inception of the North American program to heighten awareness of rules and best practices, NARs have declined by 54 percent.

But while the industry is proud of its accomplishments, it does not consider the job done. Safety improvements, including evolving standards and designs and continuing research, will be advanced vigorously as long as tank cars are carrying hazardous materials on North American rails.

Figure 8 identifies the main components of a tank car, to illustrate where features such as head shields and top fittings protection are installed, for better damage resistance.

Figure 8



THE ASSOCIATION PARTNERS

The Railway Supply Institute (RSI) and the RSI Committee on Tank Cars

The Railway Supply Institute Committee on Tank Cars (CTC) works closely with its members, federal agencies in the U.S. and Canada, and the railroad industry promoting safe design and operation of railway tank cars in North America. The CTC includes the principal owners, builders and lessors of tank cars in North America. They regularly review tank car requirements through participation on the AAR Tank Car Committee and other groups. The CTC is at the forefront of the latest research to improve tank car safety and represents tank car manufacturers in federal, legislative and regulatory matters regarding tank car safety, security and operations.

The Association of American Railroads (AAR)

Founded in 1934, the Association of American Railroads (AAR) represents the major freight railroads of the United States, Canada and Mexico, as well as Amtrak and several short line, regional and commuter railroads. AAR member companies operate more than 140,000 miles of track, including over 82 percent of track mileage in the United States, employ over 95 percent of the workers, and generate over 97 percent of the freight revenue in the U.S. The AAR works to make the rails safer, more efficient and more productive by advancing sound public policy, establishing standards for equipment and operations, and promoting a seamless exchange of information among railroads, customers and suppliers.

