Moving Crude Oil Safely by Rail

ASSOCIATION OF AMERICAN RAILROADS JULY 2015

Summary

U.S. crude oil production has risen sharply in recent years, with much of the increased output moving by rail. In 2008, U.S. Class I railroads originated 9,500 carloads of crude oil. In 2014, they originated 493,146 carloads.

In light of these increased volumes, railroads have taken numerous steps to enhance crude oil safety. They've undertaken top-to-bottom reviews of their operations and voluntarily updated their operating practices, from the selection of routes, to train speeds, to track and equipment inspections. Railroads already provide training to more than 20,000 emergency responders each year, and they are increasing their efforts to train additional responders.

For years, railroads have been calling for tougher federal standards for tank cars used to transport crude oil, and they support many aspects of the new rules released by the U.S. Department of Transportation (DOT) on May 8, 2015, that mandate many of the enhanced standards railroads have long been advocating. However, railroads strongly object to a provision of the new rules that mandates the use of electronically controlled pneumatic (ECP) brakes. ECP brakes do not improve safety. Whatever small benefits they might yield would be dwarfed by the costs they would impose on the national rail system and its users. In addition, the thermal protection requirement for tank cars in the new DOT standards is inadequate to provide first responders adequate time to respond to an incident and should therefore be made more stringent.

Moving Crude Oil Safely

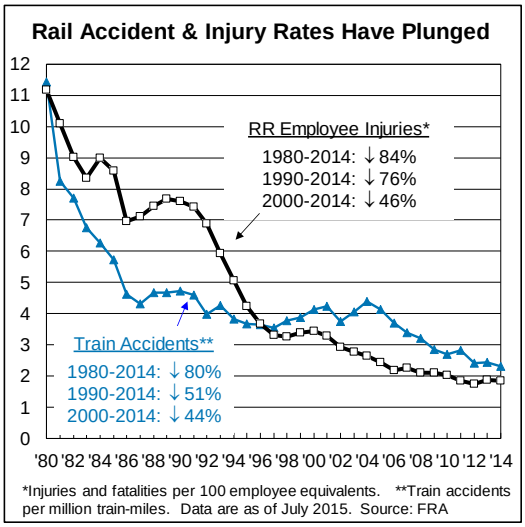
In recent years, as U.S. crude oil output has surged, so too have carloads of crude oil on U.S. railroads. Originated carloads of crude oil on U.S. Class I railroads (including the U.S. Class I subsidiaries of Canadian railroads) rose from 9,500 in 2008 to 493,146 in 2014. Terminated carloads of crude oil on U.S. Class I railroads rose from 9,344 in 2008 to 540,383 in 2014.

From 2000 through 2014, a period during which U.S. railroads terminated 1.405 million carloads of crude oil, more than 99.99 percent of those carloads arrived at their destination without a release caused by an accident. That said, several recent rail accidents involving crude oil have led some to question railroads' ability to operate safely. Railroads are committed to keeping the public's full confidence and demonstrating that nothing is more important to railroads than the safety of their employees, their customers, and the communities they serve.

Railroads devote enormous resources to enhancing the safety of moving crude oil by rail. Rail actions in this regard fall into three broad categories: accident **prevention**, accident **mitigation**, and **emergency response**.

Accident Prevention

Railroads' overall safety record, as measured by Federal Railroad Administration (FRA) data, has been improving for decades. In fact, based on the three most common rail safety measures, recent years have been the safest in rail history: the train accident rate in 2014 was down 80 percent from 1980 and down 44 percent from 2000; the employee injury rate was down 84 percent from 1980 and down 46 percent from 2000; and the grade crossing collision rate was down 80 percent from 1980 and down 38 percent from 2000.



Railroads are proud of these achievements, but they know that the pursuit of safety never ends. The rail industry's goal is zero accidents, which is why railroads are always looking for ways to prevent accidents, including through the following means:

- Reinvestments. One of the most important ways railroads have improved safety is through massive spending back into their networks. Despite a weak economy, railroads poured nearly $123 billion back into their infrastructure and equipment from 2010 to 2014, more than in any five-year period in history. One of the major aims of this spending is to make the rail network more robust, so that the industry's decades-long record of declining accident rates continues.

- Technological advancements. Railroads are constantly developing and implementing new technologies to improve rail safety, such as sophisticated detectors along tracks that identify defects on passing rail cars; specialized vehicles that identify defects in tracks and the ground underneath the tracks; and sophisticated systems that combine data from a variety of sources to produce "vehicle condition reports" on individual rail cars so that poorly performing cars can be identified before accidents occur.

  Many railroad-related technological advancements are developed at the Transportation Technology Center, Inc. (TTCI) in Pueblo, Colorado. TTCI is a subsidiary of the Association of American Railroads and is widely considered to be the finest rail research facility in the world.

- "Hot box" detectors. As of July 2014, specialized track side "hot box" detectors have been installed at least every 40 miles along routes with trains carrying 20 or more cars containing crude oil. These detectors help prevent accidents by measuring if wheel bearings are generating excessive heat and therefore are in the process of failing.

- Routing model. Several years ago, the rail industry and several federal agencies jointly developed the Rail Corridor Risk Management System (RCRMS), a sophisticated statistical routing model designed to help railroads analyze and identify the overall safest and most secure routes for transporting highly hazardous materials. The model uses a minimum of 27 risk factors — including hazmat volume, trip length, population density along the route, and emergency response capability — to assess the overall safety and security of rail routes. Major U.S. railroads are now using the RCRMS for trains carrying at least 20 carloads of crude oil.

- Inspections. FRA regulations dictate the types and frequencies of inspections railroads must perform. The FRA-mandated inspection regime is comprehensive and thorough. New FRA regulations regarding inspections for internal rail defects became effective on March 25th, 2015. Railroad inspections often go beyond what the FRA requires. For example, for main line tracks on which trains carrying at least 20 carloads of crude oil travel, railroads have agreed to perform at least one more internal rail inspection each calendar year than the new FRA regulations require. In addition, railroads will conduct at least two automated comprehensive track geometry inspections each year on main line routes over which trains with 20 or more loaded cars of crude oil are moving, something FRA regulations do not currently require.

- Speed restrictions. In August 2013, railroads self-imposed a 50-mph speed limit for trains carrying 20 or more carloads of crude oil. As of July 2014, trains carrying at least 20 cars of crude oil with at least one of those cars an older "DOT-111" car, that train will travel no faster than 40 mph when travelling within one of the 46 nationwide "high threat urban areas" designated by the Department of Homeland Security.

- Train braking. As of April 1, 2014, trains operating on main line tracks carrying at least 20 carloads of crude oil have been equipped either with distributed power (locomotives placed in locations other than the front of the train) or with end-of-train (EOT) devices equipped with a two-way radio link that connects the rear of the train with the head locomotive. Distributed power and EOTs allow brakes to be applied from the head of the train and locations farther back in the train in order to stop the train faster.

Accident Mitigation

In addition to their efforts to prevent accidents from occurring, railroads have been taking numerous steps to mitigate the consequences of accidents should they occur.

Many of these mitigation efforts focus on increased federal tank car safety and design standards. The total North American tank car fleet consists of around 340,000 cars. Railroads themselves own fewer than 1 percent of tank cars; nearly all are owned by rail customers and leasing companies. The dozens of distinct types of tank cars are differentiated by characteristics (pressure or general service, insulated or non-insulated, how much they can carry, and so on) that make them suitable for carrying specific commodities.

U.S. federal regulations pertaining to tank cars are set by the Pipeline and Hazardous Materials Safety Administration (PHMSA), an agency within the U.S. Department of Transportation (DOT). Transport Canada, the Canadian equivalent of DOT, performs a similar role in Canada. In addition, the AAR Tank Car Committee (TCC) sets rail industry standards regarding how tank cars used in North America are designed and constructed.[1]

The rail industry has long called for more stringent PHMSA standards for tank cars carrying crude oil. For example, in March 2011, the AAR formally petitioned PHMSA to adopt more stringent requirements for new tank cars used to transport certain types of hazardous materials, including crude oil. In July 2011, after it had become clear that PHMSA adoption of the AAR's proposal was not imminent, the TCC adopted what the AAR had proposed to

[1] The AAR Tank Car Committee is comprised of railroads, rail car owners, rail car manufacturers, and rail hazmat customers, with active participation from the U.S. DOT, Transport Canada, and the National Transportation Safety Board (NTSB).

PHMSA as the basis for new industry standards for tank cars used to carry ethanol and crude oil. The new standards, referred to as "CPC-1232," were applicable to new tank cars ordered after October 1, 2011. In November 2013, the rail industry called on PHMSA to adopt standards even more stringent than CPC-1232 for new tank cars used to transport crude oil and ethanol.

That happened on May 8, 2015, when DOT released a final rule setting forth new, tougher tank car standards. The new DOT rule generally applies to "high hazard flammable trains" (HHTF), which the rule defines as trains with either a continuous block of 20 or more tank cars loaded with a flammable liquid or at least 35 tank cars loaded with a flammable liquid dispersed throughout the train.

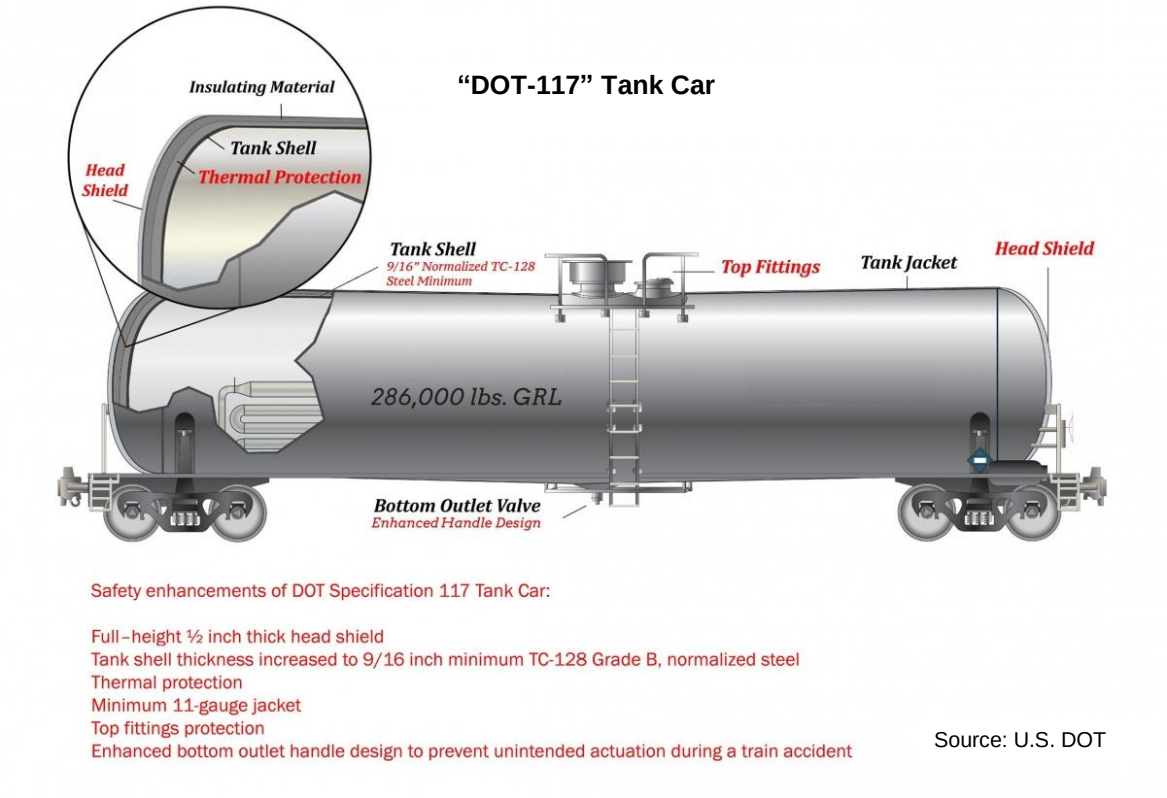
According to the final DOT rule, rail tank cars built after October 1, 2015 used to transport flammable liquids, including crude oil and ethanol, in HHTFs must have:

- A steel tank cylinder, or **shell**, that's at least **9/16"** thick. Most existing non-pressurized tank cars are made of 7/16" steel. In the event of an accident, a 9/16" shell is significantly less likely to breach than a 7/16" shell.
- **Thermal protection** to help prevent a tank car from overheating. Thermal protection reduces the chance that, if there is an accident, heat transfer from a resulting fire will lead to "thermal tears" of tank cars that survived the initial accident intact. Railroads do not think the thermal protection requirement in the final rule is stringent enough.
- A "**jacket**" made of 11-gauge or stronger steel that wraps around the shell. A jacket offers additional puncture resistance and shields the thermal protection layer.
- A "**head shield**" at both ends of the car, at least 1/2" thick and extending to the full height of the shell, to protect against punctures caused by couplers on other rail cars, broken rails, or other objects. In essence, a head shield is an additional layer of steel at the ends of cars. It can be a separate attachment or incorporated into a tank's jacket.
- Improved **pressure-relief valves**. If the internal pressure in a tank car gets too high (say, because the liquid inside gets too hot), the pressure could cause a tank car to rupture. Pressure relief valves are designed to open when pressure reaches a certain level, thereby emitting product in a controlled fashion and lowering the internal pressure.
- Better protection to prevent **bottom outlet valves** from opening in an accident. These valves, which are used to load or unload product, and their handles are susceptible to damage in accidents, leading to a release of the product. The new rule calls for improvements in the way the handles are protected.

The May 8, 2015 final rule also requires that existing tank cars that are used to carry flammable liquids but do not meet the new standards must be retrofitted to higher standards if they are to continue to carry flammable liquids. Depending on the flammable liquid involved, so-called "legacy DOT-111" cars — a type of older tank car that typically lacks many of the features discussed above — must be retrofitted in as few as three years, and CPC-1232 cars that do not

meet the new standards must be retrofitted in as few as five years. Legacy DOT-111s once carried the bulk of crude oil by rail in the United States, but they no longer do. In the first quarter of 2015, around 36,000 distinct rail cars were used to transport crude oil at least once. Of those, 28,500 (80 percent) were CPC-1232 cars. Nearly 110,000 (84 percent) of the 131,000 crude oil loads in the first quarter in the United States were in CPC-1232 cars.[2]

Railroads believe the thermal protection requirements should be more stringent, but otherwise they strongly support the new tank car design standards and retrofit requirements described above, which the DOT calls a "DOT-117" car and is summarized below:



In addition to the tank car standards discussed above, the recent PHMSA rule requires HHFTs to have a functioning two-way end-of-train device or a distributed power braking system. A subset of HHFTs — high-hazard flammable unit trains (HHFUT), defined as trains of 70 or more loaded cars — must be equipped with "electronically controlled pneumatic brakes" (ECP brakes) by the beginning of 2021. If not so equipped, these unit trains would be limited to a maximum of 30 miles per hour.

Railroads are always searching for technologies and new procedures that enhance the safety of rail operations. Unfortunately, ECP brakes are not the way to go:

- **ECP brakes would not provide a meaningful safety benefit**. DOT speculates that ECP brakes would reduce the severity of accidents by reducing their kinetic energy. AAR's Transportation Technology Center, Inc. has analyzed this claim. TTCI found

[2] The 131,000 carloads referred to in this paragraph is from a different data source than the source used to quantify crude oil originations and terminations mentioned earlier.

that, on 100-car unit trains, ECP brakes would result, on average, in 1.2 to 1.6 fewer cars derailing. Put another way, if a 100-car train derailed, 20 cars might be expected to derail in the absence of ECP brakes, and 19 if ECP brakes were used. From a safety standpoint, this is not a meaningful benefit. ECP brakes would add little to the improved stopping capability associated with alternative braking systems (distributive power, EOTs, and dynamic braking) that railroads already use.

- **Implementing ECP brakes would present unnecessary operational challenges and are likely to substantially impair the fluidity of the rail network.** Almost all tank cars are owned by rail customers and leasing companies, not by railroads. This means that adherence to the ECP mandate and the other elements of the final rule is almost completely dependent on the actions of rail customers and other tank car owners. In the case of ECP brakes, tank car owners could simply choose not to install the technology and thereby force railroads to operate their trains at no more than 30 miles per hour. These slow-moving trains would back up the entire national rail system, sharply reducing rail capacity for all rail customers. It would also add substantial complexity to rail operations, including fleet maintenance, inspection, repair, and switching.

- **ECP would entail very large costs for its very small benefits.** Railroads would have to equip approximately 20,000 locomotives with ECP technology at a cost of approximately $89,000 per locomotive, and approximately 100,000 railroad tank cars would potentially have to be equipped at a cost of approximately $7,500 per car. But this would only be part of the costs. If they had to transport crude oil trains at 30 miles per hour, railroads could face huge additional expenses for added infrastructure to make up for the capacity lost to the slow crude oil trains. Railroad engineers, conductors, and maintenance personnel would have to be trained in the use and maintenance of ECP brakes. Inspection, repair, and maintenance costs would rise sharply. These and other costly expenses would be required in exchange for negligible safety benefits.

- **The Federal Railroad Administration (FRA) has previously found that ECP brakes can't be justified.** In a 2007-2008 rulemaking, the FRA found that the benefits of ECP brakes were far less than their costs, and so the FRA did not mandate their use. Nothing has changed since then: ECP brakes still fail all reasonable cost-benefit analyses.

- **U.S. railroads have already tried ECP brakes — and found them wanting**. Several U.S. railroads have experimented with using ECP brakes in recent years, but none of them has been able to justify regular use. ECP brakes are used in a few places around the world in locations where locomotives and cars are used in dedicated "closed loop" service (e.g., on iron ore trains in Australia), but those situations are very different than what the ECP mandate would involve in the United States.

Emergency Response

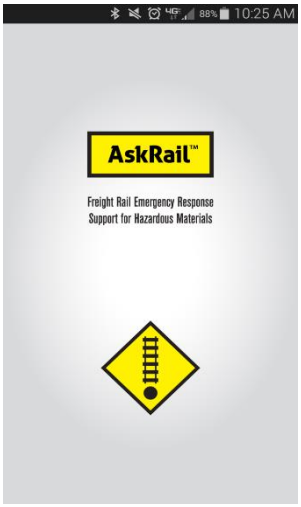
Railroads have extensive emergency response capabilities. Railroad personnel work in cooperation with federal, state and local governments, to assist communities in the event of an incident involving crude oil or other hazardous materials:

- Railroads' emergency response efforts begin internally:
  - ✓ All the major railroads have teams of full-time personnel whose primary focus is hazmat safety and emergency response. Teams of environmental, industrial

hygiene, and medical professionals are available at all times to provide assistance during hazmat incidents.

- ✓ Railroads also maintain networks of hazmat response contractors and environmental consultants, strategically located throughout their service areas, who can handle virtually any air, water, waste or public health issue. These contractors, who are on call at all times, have multiple offices and equipment storage locations and a vast array of monitoring equipment, containment booms, industrial pumps, and other spill response tools and equipment.
- ✓ Railroads have "standard of care" protocols to ensure that community impacts, such as evacuations, are addressed promptly and professionally.

- Railroads recently introduced a web-based application, called AskRail, covering all the major freight railroads, that allows emergency responders to input the identification number of a particular rail car and immediately determine whether the car is loaded or empty, if loaded the commodity contained in the car, its hazard class, the handling railroad, the handling railroad's emergency contact phone number, and emergency response information associated with the commodity.



- Each year, railroads actively train well over 20,000 emergency responders throughout the country. This training ranges from general awareness training to much more in-depth offerings. The precise parameters of these emergency response training programs vary from railroad to railroad, but in general they consist of a combination of some or all of the following aspects:
  - ✓ Safety trains. Several railroads utilize "hazmat safety trains" and other training equipment that travel from community to community to allow for hands-on training for local first responders.
  - ✓ Training centers. Several railroads operate centralized hazmat training sites where they train employees, first responders, customers, and other railroad industry personnel in all aspects of dealing with hazmat incidents.
  - ✓ Local firehouse visits. In aggregate, railroads visit hundreds of local firehouses each year to provide classroom and face-to-face hazmat training.
  - ✓ Table top drills. Railroads regularly partner with local emergency responders to conduct simulations of emergency situations in which general problems and procedures in the context of an emergency scenario are discussed. The focus is on training and familiarization with roles, procedures, and responsibilities.
  - ✓ Self-study training courses. Railroads make available self-study programs for emergency responders that allow students to learn proper procedures at their own pace. Some railroads also provide related web-based training on hazmat and general rail safety issues.
- Railroads also support our nation's emergency response capability through the Security and Emergency Response Training Center (SERTC), a world-class facility in Pueblo,

Colorado, that is operated by TTCI. Since its inception in 1985, SERTC has provided in-depth, realistic, hands-on hazmat emergency response training to more than 50,000 local, state, and tribal emergency responders and railroad, chemical, and petroleum industry employees from all over the country. Most of the training at SERTC is advanced training that builds on basic training responders receive elsewhere.

- Many railroads regularly provide funding to emergency responders in their service areas to attend SERTC. In addition, railroads funded the development of a curriculum at TTCI specifically devoted to crude oil emergency response.
- Railroads have long provided appropriate local authorities, upon request, with a list of the hazardous materials, including crude oil, transported through their communities.
- Railroads have developed an inventory of emergency response resources along their networks. This inventory includes locations for the staging of emergency response equipment and contact information.
- Emergency responders have control of railroad accidents in which hazardous materials are spilled, but railroads provide the resources for mitigating accidents. Railroads also reimburse local emergency agencies for the costs of materials the agencies expend.