

## Research Note

### The Runaway Train

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*Abstract: The oil boom in America and the extensive use of tank-car trains to transport crude oil has ushered into an era when oil-train derailments and the resulting spills have skyrocketed 900% in just two years from 2010 to 2012. At the heart of the problem is the common tank cars used by freight train companies known as DOT-111, which has multiple design flaws and are ill equipped to protect crude oil in an accident. NTSB has made multiple recommendations over the years to the Pipeline and Hazardous Materials Safety Administration (PHMSA), which regulates the freight-train industry, and saw little action. So much so that the Association of American Railroads (AAR), in an effort to speed up the process, adopted its own CPC-1232 standards. Finally, PHMSA acted in May 2015 with the issuance of the new DOT-117 standard, which comes with multiple improvements over the DOT-111 as recommended by the NTSB. However, the risk to the community around the train tracks remains as train companies have three to 10 years to retrofit the existing fleets.*

### Introduction

It was a beautiful summer night in a population 6,000<sup>1</sup> town east of Montreal, Quebec called Lac-Mégantic. Christian Lafontaine and his wife Melanie - along with Christian's two brothers and a few friends - were having a good time at the Musi-Café located in the heart of the town. Although it was after midnight, the café was still buzzing with three dozen or so patrons enjoying their company eating and drinking complete with the smooth jazz music played in the background by the on-site band. Several miles to the west up on the hill in the town of Nantes, a series of events had caused a 74-car unmanned oil freight train with close to 2 million gallons of oil to roll downhill toward Lac-Mégantic at a speed of up to 62mph. At 1:14AM, as Christian and his wife

were getting ready to leave, they felt the earth shake and Christian turned and looked at his wife and asked, “Did you feel that? It felt like an earthquake” Before Melanie had a chance to respond, they felt another jolt, only much stronger this time. Then the restaurant turned pitch black, immediately followed by bright flashing orange lights reflected from the nearby tall buildings. Inside the bar, someone yelled “Fire!” and that was when Christian grabbed his wife’s hand and pulled her out through the front door. As they exited the front door and looked to their right, they could see a wall of fire and smoke 15 to 20 stories high hurling toward them at a high rate of speed. They turned and ran in the opposite direction with all the power and strength they could exert. They were among the last to get out of Musi-Café alive.<sup>2</sup>

Forty-seven people perished that early morning of July 6<sup>th</sup>, 2013, thirty of in the Musi-Café<sup>3</sup> as a result of the oil train derailment right behind the popular restaurant. The train had made a stop in Nantes a few hours before and the lone train engineer left the train for the night after leaving an engine running to operate the pneumatic or compressed-air operated brakes to keep the train stationary. As fate would have it, the running engine caught on fire somehow and firefighters were dispatched to the scene. In the course of putting out the fire, the firefighters shut off the engine to prevent the fire from reoccurring, probably not knowing that it was needed for the brakes to function. The brakes then slowly lost air pressure and the train started rolling downhill toward Lac-Mégantic. Musi-Café is located next to the train track where it starts to curve which caused the unmanned train to derail.

A total of 1.5 million gallons of oil out of nearly 2 million gallons aboard the ill-fated train were spilled or burned. The accident economically paralyzed the entire Lac-Mégantic with 115 companies destroyed and hundreds others at risk of bankruptcy due to the oil clean-up effort, combined with the shutdown of the major artery of transportation.<sup>4</sup> It cost \$195 million dollars for the cleanup alone.<sup>5</sup> The final environmental impact and the economic toll will probably not be known until years later. It took a year’s worth of cleanup before the areas were declared safe for residents to return;<sup>6</sup> both the namesake lake and the Chaudière River have been polluted by the spilled oil; the byproducts and residues of burned crude oil are toxic and could remain in the soil and waterways for years to come.<sup>7</sup>

## **Emerging Risk**

The incident in Lac-Mégantic ushered in a new era in which the increasing use of freight trains to transport crude oil introduced a safety and environmental risks for the communities near the train tracks. The advance in the development of hydraulic fracturing technique, also known as fracking, to extract oil and natural gas economically has turn North America, particularly the U.S., into the biggest oil producing country in the world.<sup>8</sup> Most of the oil extractions occurred in North Dakota<sup>9</sup> and surrounding states where few pipelines are available,<sup>10</sup> so oil-tank trains have become the transportation of choice for its flexibility and geographic reach. Trains also allow oil companies to ship the cargos to places that are far from oil pipelines and refineries where oil prices typically command higher premiums, which mean more profits for the producers.<sup>11</sup> As the

oil production grows, weekly rail deliveries of U.S. oil has jumped from 7,000 carloads in 2011 to 16,000 in 2014, an increase of a whopping 129 percent in just three years, according to the U.S. Energy Information Administration.<sup>12</sup> With the increase in delivery of oil by rails, accidents have skyrocketed from less than 10 cases in 2010 to almost 90 in 2012.<sup>13</sup>

The growing needs for crude-oil trains and the frequency of accidents have raised concerns for safety and put the industry under scrutiny. Many accidents have occurred since the Lac-Mégantic incident. A train carrying oil and gas derailed and burned in Gainford, Alberta, in October 2013; Oil continued to float on swamp waters near Aliceville, Alabama months after the November 2013 oil train crash; large explosions can be seen from miles away after an oil train derailed in Casselton, North Dakota, in December 2013. The list goes on.<sup>14</sup> Unfortunately, the rate of occurrences has not slowed down in recent months. In just a 30-day timeframe from mid-February to mid-March of 2015, four oil-tanker trains have crashed and burned in the United States and Canada.<sup>15</sup> States such as Montana and North Dakota where most of the oil productions take place have become ground zero for oil train safety and put many residents near the railways on edge.<sup>16</sup>

## **Tank Car Design and Regulations**

Why are oil trains prone to accidents and explosions? At the heart of the matter, according to National Transportation Safety Board (NTSB), is the popular tank cars used to transport oil and gas known as DOT-111 being unsafe to carry flammable liquids.<sup>17</sup> According to NTSB, DOT-111, a type of unpressurized tank cars, have multiple design flaws with respect to the tank heads, shells, and fittings that allow hazardous liquids to leak in an accident resulting in fires and explosions. With more than 170,000 DOT-111 cars<sup>18</sup> being used to transport hazardous materials, catastrophic accidents will all but certain to reoccur if history is any indication if improvements to the design are not made in time.

As early as 1991, NTSB had examined the safety performance of DOT-111 tank cars and concluded that the tank cars “have a high incidence of failure when involved in accidents”<sup>19</sup>. NTSB recommended the Pipeline and Hazardous Materials Safety Administration (PHMSA), which regulates the industry, to work with other public agencies and private organizations to identify a list of hazardous materials that “should be transported only in pressure tank cars with head shield protection and thermal protection if needed”, but stopped short of recommending improvements to the DOT-111 standards. It was not until after another fatal train derailment in 2009 in Cherry Valley, Illinois where rail cars loaded with thousands of gallons of ethanol ignited in flames after the derailment, before NTSB recommended PHMSA to require newly manufactured and existing tank cars for hazardous materials to “have enhanced tank head and shell puncture-resistance systems and top fittings protection that exceeds existing design requirements for DOT-111 tank cars”, as well as improvements to the bottom outlet valves and center sills.<sup>20</sup>

Over the ensuing years, PHMSA however did not act on the recommendations despite urging by

NTSB and industry associations such as the Association of American Railroads (AAR). In an effort to speed up the process, a new CPC-1232 standards, which call for thicker tank shell, rollover protection, and head shields, were issued by AAR and submitted to PHMSA for approval in 2012. No approval has been received thus far. As of early 2015, improving the legacy DOT-111 tank cars remains on NTSB's "Most Wanted" list.<sup>21</sup>

Meanwhile, some railway companies are hesitant to invest in the new CPC-1232 tank cars lest PHMSA deems the proposed standards inadequate resulting in additional investments to retrofit the already more-expensive tank cars. Yet other companies forged ahead and started buying CPC-1232 compliant tank cars for transporting hazardous materials.

In a twist of fate, new questions are being raised after a couple incidents in which CPC-1232 compliant tank cars derailed and caught on fire.<sup>22</sup> This prompted NTSB to call for even stronger tanker-car design recommending PHMSA in April 2015 to require tank cars be equipped with thermal protection systems that meet or exceed the requirements of Title 49 CFR 179.18(a),<sup>23</sup> which stipulates tank cars to withstand (1) a pool fire for 100 minutes and (2) a torch fire for 30 minutes. NTSB went on to recommend PHMSA to require pressure relief devices, an aggressive milestone schedule for retrofitting the existing tank cars and annual reporting. This time, PHMSA responded aggressively. On May 1<sup>st</sup>, 2015, PHMSA announced new rules for the enhanced tank car standards adopting most of NTSB's recommendations.<sup>24</sup> The new rules require high-hazard flammable unit trains to (1) install an electronically controlled pneumatic braking system, (2) adopt the new DOT-117 design for newly manufactured tank cars and retrofit legacy cars to meet the same specifications, (3) reduce operating speeds to no faster than 50 mph or 40 mph in high-threat urban areas, (4) have more accurate classification of unrefined petroleum-based products, (5) conduct risk assessment considering at a minimum 27 safety and security factors, and (6) notify State, local, and tribal officials to discuss routing decisions and provide appropriate contact information in the events information related to routing of hazardous materials through their jurisdictions.<sup>25</sup>

## **Budget Shortfall**

A recent Amtrak derailment in Philadelphia on May 12<sup>th</sup>, 2015, in which eight people were killed and dozens hospitalized, has highlighted another risk of the train industry—budget shortfall that causes delay and neglect of upgrading and maintaining the U.S. ailing transportation infrastructure. While the Philadelphia accident does not involve freight trains or oil tank cars, passenger trains run on more than 22,000 miles of track that are also used by freight trains.<sup>26</sup> The "interdependency of freight and passenger rail infrastructure – including common bridges, tunnels, and tracks – also increases the likelihood that incidents affecting highly critical assets could affect the entire railroad system."<sup>27</sup> While the cause of the Philadelphia accident is under investigation, it has been widely reported that the train was traveling twice the 50 mph speed limit. If it is indeed the case, a technology called Positive Train Control (PTC) safety systems, which likely could have prevented the Philadelphia accident by overriding the control and

slowing down the train.<sup>28</sup> For no particular reason other than meeting a spending cap, the House of Representatives with Republicans as the majority voted to cut Amtrak's budget by \$251 million the day after the accident<sup>29</sup> while the investigations of the root cause are still ongoing. This move of Congress exemplifies the extreme polarity of ideology over reasoning on the part of GOP without regard to scientific data and analyses. According to American Enterprise Institute, a public policy research community, between 2004 and 2013, United States train safety records are far behind those of the European developing countries with one reported passenger injury per 75,000 passenger miles on average, comparable to the records of a country like Lithuania. Many European countries experienced one injury per 250,000 to 470,000 passenger miles, much lower than the United States<sup>30</sup>. Yet, railroad management agencies such as the Northeast Corridor Infrastructure and Operations Advisory Commission, which manages the Northeast Corridor multi-states passenger railways including the one on which the Amtrak train crashed in Philadelphia expected to receive only 68% of requested funding for fiscal year 2015 if federal funding remains consistent with that of fiscal year 2014.<sup>31</sup>

By the same token, America's overall infrastructure does not fare any better. In the 2013 Report Card for America's Infrastructure, the America's Society of Civil Engineers gave the U.S. infrastructure a D+ grade,<sup>32</sup> and the country will need \$3.6 trillion dollars to fix the problems as compared with only \$1.3 trillion had we approved the funding in 2001.<sup>33</sup> The transportation critical infrastructure is also known to have been targeted by foreign adversary such as Iran.<sup>34</sup> It is important for the U.S. government to act more than ever to protect this critical infrastructure. President Obama proposed an infrastructure spending back in 2012 in his State of the Union address, yet it has been delayed by Congress and even used as a bargaining chip in recent months by the Republican Chairman of the Committee on Transportation and Infrastructure, Bill Shuster (R-PA), in exchange for the President's approval of the Keystone XL pipeline project. Evidently, the White House did not budge.

## **Conclusion**

What can we do now that we have learned that the oil tank cars are not up to snuff; the regulations have not evolved quick enough with the rapid changes; the railroads and infrastructure are badly in need of cash infusion to upgrade and maintain for safety?

The Department of Transportation (DOT) Rule Summary issued on May 1<sup>st</sup>, 2015<sup>35</sup> stipulates new tank cars manufactured after October 1<sup>st</sup>, 2015 to meet the new requirements is a good start. It also issues the required timetables for existing DOT-111 and CPC-1232 to be retrofitted with the most vulnerable non-jacketed DOT-111 to be completed by May 1<sup>st</sup>, 2017 and others to be completed between March 2018 to May 2025. These will come at a cost to the freight train companies and it is unclear at this point what the reception of the new law by these companies would be. We can only hope that the transition would not be an issue for the industry judging from the aggressiveness exerted in the past to retrofit and improve the safety of the tank cars while waiting for PHMSA to come up with the new regulations.

While the new DOT rule for now resolves the design flaws of the legacy tank cars, it does not address other aspects of oil train accidents. Recently, several Democratic Senators including Maria Cantwell (D-WA), Patty Murray (D-WA), Tammy Baldwin (D-WI), and Dianne Feinstein (D-CA) have introduced the Crude-By-Rail Safety Act of 2015 that, if passed, will require PHMSA to enact new regulations to address among others, (1) resources for first responders on training programs, emergency response plan, and notification procedures, (2) requirements for rail carriers on emergency response plans and (3) sharing information with State Response Commissions and Local Emergency Planning Committees along the rail routes on crude-by-rail shipments.<sup>36</sup>

Congress and the President must work together to provide the badly needed upgrades to the transportation infrastructure from roads to bridges to tunnels with high assurance of safety. Humans make mistakes and will continue to make mistakes. This is where technology can be deployed to compensate for the human shortcomings such as the mentioned Positive Train Control Safety System that automatically slows down trains if found to be speeding.

Carrying millions of gallons of flammable materials that endanger human and wildlife lives and environments can never be a good solution. Transporting oil using pipelines will reduce the risk since pipelines themselves do not move and can be built to avoid populous areas, but they are expensive and take years to build assuming all the local, tribal, state and federal authorities, as well as environmentalists can come to an agreement. As an example, the proposed Keystone XL pipeline that would have duplicated the phase I route from Hardisty, Canada to Steele City, Nebraska except with a shorter and direct route started in 2008 and took years of negotiations and political wrangling, only to be rejected twice by the Executive Branch, once in 2012 and another in 2014. Currently, the plan has been on-hold indefinitely citing ongoing litigation.<sup>37</sup>

The stalling of the Keystone XL pipeline proposal also reflects the attitudes of Americans including those of President Obama toward reducing the greenhouse effect, which experts believe has contributed to the current climate change and extreme weather. In 2012 alone, natural disasters have cost the United States \$110 billion dollars making it the second costliest in history.<sup>38</sup> However, a balance needs to be struck between oil independence before a viable alternative energy source can be found and reducing greenhouse gas by moving away from fossil fuels. As such, investing in expensive pipelines would be counterproductive to the environmental policy established by the hard work of many. Given the pro-environment policy that is the White House, it is unlikely that large expansion of pipeline projects would be approved as long as Democrats have a say in the decision making process. One can find the hints in Obama's plan to combat climate change announced in June 2013 that singles out "heavy-duty vehicles (commercial trucks, vans, and buses) are currently the second largest source of greenhouse gas pollution within the transportation sector."<sup>39</sup> The same plan also calls for a reduction in greenhouse gas emission.

The best strategy to reduce the risk associated with oil trains has to involve replacing fossil fuels

with clean energy to knock out both problems at once – reducing the risk of train accidents and cutting down greenhouse gas to help the environments. Building more pipelines, while possibly helping reducing oil train accidents, cannot be a long-term and sustainable solution. The last thing we want is to make oil so inexpensive that makes it much more difficult to move away from and adopt clean energy. We know that progress toward clean energy conversion is difficult and expensive to make (think buying an electric car, which is more expensive than a traditional gas-engine one, or using solar panels instead of grid power), so we cannot allow the momentum toward green energy to go the opposite direction by adding “incentives” to fossil fuels. The short term could be painful, but the long-term returns will be worth it.

In the meantime, oil trains are here to stay and the risk to the communities around the train tracks remain. As for the railroad industry, it now has an additional risk on its hand in addition to the risk brought about by train accidents—compliance to the PHMSA’s new DOT-117 standards. The events that led to the industry where it is today highlight the important roles of risk management and its oversights in the boardroom. Board members should raise the bar by asking the executives the right questions; look across the industry, such as the lessons learned from the Lac-Mégantic incident to see how risk can be mitigated to protect the interest of the shareholders; and finally consider the “black swan” or outliers in the risk management strategy.<sup>40</sup> Train accidents should not be a foreign concept to railroad executives, and the fact of the matter is that using corn-syrup grade tank cars to haul flammable liquids is simply “pushing the envelope” and exposes the company to grave risks. MMA, the operator of the train derailed in Lac-Mégantic, filed for bankruptcy<sup>41</sup> shortly after the incident after facing multiple lawsuits and may end up footing part of the proposed \$200 million settlement.<sup>42</sup>

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