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May 31, 2017

The Honorable John Thune
Chairman
Committee on Commerce, Science, and Transportation
United States Senate

2015 Electronically Controlled Pneumatic Brake Rule: Comparison of DOT Forecasts for Selected Data Points for 2015 and 2016 to Preliminary Data for Those Years

Dear Mr. Chairman:

In recent years, freight rail shipments of crude oil—a flammable liquid—have increased in the United States. For example, according to the Energy Information Administration, the number of barrels of crude oil hauled by rail within the United States increased from 1.2 million in January 2010 to 11.1 million in January 2017.¹ If a train transporting such liquids derailed—which can happen due to a number of reasons, including a broken rail, broken train wheels, or train handling—the contents, if released from the tank cars, can catch fire.

In May 2015, the Department of Transportation (DOT) issued a final rule requiring, among other things, that freight railroads equip certain trains hauling flammable liquids, such as crude oil and ethanol, with electronically controlled pneumatic (ECP) brakes by 2021 and 2023, respectively.² ECP brakes send an electric brake signal instantly and simultaneously to each individual car in a train, potentially allowing for faster brake application than on trains with conventional air brakes. If a derailment occurs, this faster brake application can reduce the likelihood of cars on the train derailing and releasing their contents.

In October 2016, as required by the Fixing America’s Surface Transportation Act (FAST Act),³ we reported on DOT’s ECP brake rule and the analyses DOT conducted in support of that rule, including its analysis of the rule’s potential costs and benefits.⁴ According to DOT, some of the potential benefits from ECP brakes result from their ability to reduce the severity of derailments.⁵

¹While the general trend over this time period has been an increase in crude oil rail shipments, shipments decreased in calendar year 2016. According to the Energy Information Administration, the number of barrels of crude oil shipped by freight rail in the United States fell from 15.6 million barrels in January 2016 to 11.1 million in January 2017.

²Trains transporting crude oil must equip with ECP brakes by January 2021; trains transporting ethanol must equip with ECP brakes by May 2023. 80 Fed. Reg. 26644, 26748 (May 8, 2015) (codified at 49 C.F.R. § 174.310).

³Pub. L. No. 114-94, § 7311(a), 129 Stat. 1312, 1601 (2015).

⁴GAO, *Train Braking: DOT’s Rulemaking on Electronically Controlled Pneumatic Brakes Could Benefit from Additional Data and Transparency*, GAO-17-122 (Washington, D.C.: Oct. 12, 2016).

⁵DOT’s analysis also considered other benefits, including business benefits to railroads such as reduced fuel consumption.

As part of DOT's analysis of potential benefits, DOT forecasted annual freight rail shipments of crude oil and ethanol, as well as the number of derailments and the severity of those derailments (based on the amount of product released and the number of injuries and deaths) over a 20-year period. We found that in forecasting the potential costs and benefits of the ECP brake rule, DOT used single point estimates for some variables, such as for annual rail shipments of crude oil and ethanol, instead of including a range of scenarios.⁶ For example, for every year in the 20 year forecast period, DOT forecasted a single value for rail shipments of crude oil and ethanol instead of a range of possible shipments. Because DOT relied on single point estimates, it did not take into account the potential uncertainty inherent in such forecasts, which can affect the estimated costs and benefits of the rule. For example, if the actual number of shipments of crude oil and ethanol are lower or higher than forecasted point estimates for any given year, the calculated benefits realized for ECP brakes may be different than forecasted.⁷ Considering a range of scenarios instead of using point estimates, can help mitigate uncertainty in forecasts. As a result, we recommended, among other things, that DOT take into account, in an updated analysis of the potential costs and benefits of the ECP brake rule conducted in response to a statutory requirement,⁸ the potential uncertainty in key variables and assumptions, discuss this uncertainty, and present ranges of possible forecasts.⁹

You asked us to compare selected single point data forecasts for shipments of crude oil and ethanol, the number of crude oil and ethanol derailments and associated derailment rate, the amount of product lost in such derailments and the related costs of cleanup, and the number of injuries and deaths sustained in such derailments in DOT's ECP brake final rule to the actual values realized for those data points in 2015 and 2016. This report examines how DOT's forecasts for 2015 and 2016 compare to actual values realized during those years for the following selected data points:

- total annual rail shipments of crude oil and ethanol, as measured by carloads;
- the number of crude oil and ethanol freight train derailments and derailment rate;
- the amount of crude oil or ethanol released in such derailments and the related costs of such releases; and
- the number of injuries and deaths in such derailments.

⁶DOT solicited public input on a proposed ECP brake rule and used public comments to inform its final analysis and final rule. In addition, while DOT did not include a range of scenarios, DOT did acknowledge some uncertainties in some of the single point forecasts.

⁷In addition, the calculated costs may be lower than forecasted in such a scenario because with lower than forecasted traffic, railroads may need to equip fewer trains with ECP brakes.

⁸The FAST Act, enacted in December 2015, requires DOT to enter into an agreement with the National Academies of Sciences to test ECP brakes and, based on the results of this testing and our 2016 report, re-estimate the costs and benefits of the ECP brake requirement and update the regulatory impact analysis. Pub. L. No. 114-94, § 7311(b) and (c), 129 Stat. 1312, 1602. The Act requires the Secretary of DOT, by December 2017, either to determine the ECP brakes are justified based on the updated RIA or to repeal the ECP brakes requirement. Pub. L. No. 114-94, § 7311(c)(2), 129 Stat. 1312, 1603.

⁹We also recommended that DOT develop a plan to collect additional data from railroads on their experiences with ECP brakes (prior to 2015, some railroads had limited use of ECP brakes on certain routes) and publish additional information regarding computer-based modeling DOT used to support the 2015 ECP brake rule. DOT disagreed with our recommendations, stating that we did not have sufficient and appropriate evidence to justify our findings. We believe that the findings and recommendations in that report were well supported and justified, as discussed in that report. See GAO-17-122.

To make these comparisons, we reviewed relevant documentation from DOT's 2015 ECP brake rule, including the final rule and its supporting economic analysis to determine forecasts for 2015 and 2016 for the selected data points, and interviewed DOT officials regarding these data and how they collect them. We then compared those forecasts to preliminary or, when available, final data for 2015 and 2016. Forecasts by their nature involve uncertainty; therefore, it is expected that forecasts would not match actual data realized in these years. However, differences observed between forecasted and realized actual values may provide insight about the precision of the forecasted values.

For data on the number of carloads of crude oil and ethanol for 2015 rail shipments, we obtained data from DOT. To determine these shipments, DOT used 2015 Waybill Sample data from the Surface Transportation Board (STB).¹⁰ As of March 2017, STB had not completed its validation of the 2016 Waybill Sample data. As a result, DOT was unable to provide data on the number of carloads based on 2016 Waybill Sample data. In addition, given the potential for errors in data that have not been fully validated, we did not analyze and report on 2016 Waybill Sample data.

We also reviewed preliminary 2015 and 2016 data from DOT on the number of crude oil and ethanol derailments, the amount of crude oil or ethanol released in such derailments, the related costs of such releases, and the number of injuries and deaths in such derailments. Railroads are required to report data on derailments involving a release of hazardous materials to the Pipeline and Hazardous Materials Safety Administration (PHMSA) which tracks data on derailments in the Hazardous Materials Incident Database.¹¹ PHMSA's database tracks the type of incident, the type of hazardous material released, the amount of hazardous material released, among other things. Upon receiving an incident report from a railroad, DOT investigates it and may update information provided by railroads through the course of investigations. Railroads are also required to report information on certain train incidents such as derailments to the Federal Railroad Administration (FRA), which maintains these data in its Railroad Safety Information System.¹²

Due to limitations in DOT's collection of data on derailments in these two databases and DOT's validation of such data, 2015 and 2016 data on derailments and their effects are preliminary and subject to change. PHMSA's database generally does not contain information on derailments when there is not a release of hazardous materials such as crude oil or ethanol. FRA's database generally does not contain data on the hazardous material involved in a derailment if there is no release. As a result, it is possible that some derailments of trains carrying crude oil or ethanol are not included in these databases. DOT, in order to address this limitation, cross references the two databases to validate the data contained in both. DOT also takes other steps to validate the data. For example, DOT searches media reports for any derailments not reported to either database. DOT has not yet completed cross referencing these databases for 2015 and 2016 derailments.¹³ Furthermore, data on 2016 derailments may still be updated through the

¹⁰The Surface Transportation Board (STB) requires railroads to compile a random sample of their waybills (a document that accompanies a shipment and describes the freight being transported) and submit them to STB. The sample is statistically weighted to be nationally representative of all rail freight movements that occur in the United States each year. 49 C.F.R. § 1244.2.

¹¹49 C.F.R. § 171.16.

¹²49 C.F.R. §§ 225.9 and 225.11.

¹³According to DOT, it should complete this process for 2015 data by June 2017 and it is now trying to reconcile differing data on the number of gallons released in two derailments that occurred in 2015. In one instance, PHMSA's

course of DOT investigations into derailments as well as updates from railroads, which have up to one year after a derailment occurs to report updated information to DOT.¹⁴

To review the reliability of the data provided by DOT, we reviewed documentation detailing data validation procedures, reviewed our recent reports using these data sources, and interviewed officials at DOT. We determined that these data are sufficiently reliable for the purposes of this report. However, because some 2015 and 2016 data are preliminary, it is difficult to be conclusive about the precision of DOT's forecasts of the number (and rate) of derailments, the amount of crude oil or ethanol released in such derailments, and the number of injuries and deaths in such derailments.

We conducted this performance audit from February 2017 to May 2017 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Comparison of Rule's 2015 and 2016 Forecasts for Selected Variables to Preliminary Data for Those Years

The 2015 and 2016 data we reviewed indicate that for those 2 years, DOT's forecasted values for selected variables included in our review may be higher than values realized in those years based on preliminary data. Specifically, DOT's 2015 forecast for the number of tank cars shipping crude oil and ethanol was higher than DOT's estimated value for that year based on Waybill Sample data.¹⁵ In addition, preliminary data suggest that for each of the derailment-related forecasts we reviewed for 2015 and 2016, DOT's forecasts appear to be higher than the railroads' actual derailment experience. The forecasted number of crude oil and ethanol derailments (and derailment rate), the average amount of hazardous material lost in those derailments, and the number of injuries and deaths sustained were also higher than realized for both years.¹⁶ However, forecasts by their nature involve uncertainty; therefore, it is expected these forecasts would not be found to exactly match actual data realized in these years. In addition, as DOT forecasted cost and benefits of the rule over 20 years, in other years some actual data realized may be higher or lower than DOT forecasted.

Freight Rail Shipments of Crude Oil and Ethanol

In the 2015 analysis supporting the ECP brake rule, DOT forecasted freight shipments for crude oil and ethanol from 2015 to 2034 using forecasted traffic data provided by the Railway Supply

database reports that 362,349 gallons were released while FRA's database reports 379,549 gallons were released. In the other instance, PHMSA's database reports that 1,000 gallons were released while FRA's reports that 500 were released.

¹⁴49 C.F.R. § 171.16

¹⁵The 2015 value is estimated from a sample that is weighted to be nationally representative of all rail freight movements that occur in the United States each year.

¹⁶Because these data are preliminary, it is difficult to be conclusive about the precision of DOT's forecasts of the number (and rate) of derailments, the amount of crude oil or ethanol lost in such derailments, and the number of injuries and deaths in such derailments.

Institute, an industry association representing builders of tank cars and other entities.¹⁷ DOT's forecast for 2015 was higher than the 2015 value calculated by DOT using Waybill Sample data (see table 1).¹⁸ For the reasons stated previously, we are unable to compare 2016 preliminary Waybill Sample data with DOT's forecast. However, the Energy Information Administration creates estimates of freight rail shipments of crude oil and ethanol shipments (in terms of barrels and not the number of cars) based on Waybill Sample data it receives from the Surface Transportation Board which STB has not fully validated. According to the Energy Information Administration, in 2016 there were 373.1 million barrels of crude oil and ethanol shipped by freight rail in the U.S., down from 490.5 million in 2015.

Table 1: Comparison of Department of Transportation's (DOT) Forecast of Crude Oil and Ethanol Shipments for 2015 and 2016 with Final Data When Available

	DOT Forecast for 2015	2015 Final	DOT Forecast for 2016	2016 Final
Shipments of crude oil and ethanol as measured by number of tank cars (in thousands)	1,119	1,014 ^a	1,124	Not available ^b

Source: GAO analysis of Department of Transportation data. | GAO-17-567R

^aAs the Waybill Sample data are collected through a sample that is weighted to be nationally representative of all rail freight movements that occur in the United States each year, there should be a sampling error associated with this data point. However, according to DOT it did not calculate a sampling error but has confirmed that the Waybill Sample value has been appropriately weighted to estimate actual carloads shipped.

^bAs of March 2017, the Surface Transportation Board has not completed its validation of 2016 Waybill Sample data; as a result, DOT is not able to calculate data on 2016 shipments of crude oil and ethanol and given the potential for data errors in not fully validated data, we are unable to report on 2016 Waybill Sample data.

DOT's Derailment-Related Forecasts

In the analysis supporting the 2015 ECP brake rule, DOT forecasted the number and rate of crude oil and ethanol rail derailments, the amount of crude oil and ethanol released in such derailments, the costs (e.g., cleanup and environmental) associated with those derailments, and the injuries and deaths sustained in such derailments, using historical data from a variety of sources:

- To forecast the number of derailments,¹⁹ DOT reviewed historic data from PHMSA's Hazardous Materials Incident Report database and FRA's Railroad Safety Information System on crude oil and ethanol freight derailments from 2009 through 2013. Based on

¹⁷Because data from the Railroad Supply Institute included data on traffic of crude oil and ethanol in Canada as well as the United States and DOT's rule only requires ECP brakes on trains in the United States, DOT adjusted the estimate to eliminate shipments in Canada.

¹⁸According to DOT, its forecast was based on data from the Energy Information Administration and the Railway Supply Institute and was not adjusted for a decline in oil prices that likely led to a reduction in shipments of crude oil and a related number of derailments in 2015 and 2016. Furthermore, according to DOT officials, the overall quality of tank cars used in service since 2015 has improved more than expected as old tank cars have been taken out of service. This improvement in fleet-wide tank car quality may have resulted in a lower quantity of crude oil spilled in derailments.

¹⁹DOT's analysis did not include derailments that occur within rail yards where trains are only traveling at low speeds. According to DOT such derailments occur at low speeds, and the ECP brake requirement would do little to mitigate such derailments. Such derailments are not included in this analysis either.

the historic data, DOT calculated a derailment rate based on the number of rail shipments and applied that rate to its forecast for annual freight shipments of crude oil and ethanol.

- To forecast the amount of crude oil or ethanol released in such derailments, DOT reviewed historical data from 2006 to 2013 in PHMSA’s Hazardous Materials Incident Report database and FRA’s Railroad Safety Information System to determine an average amount of crude oil or ethanol released per derailment.
- To forecast the cost associated with those crude oil and ethanol releases, DOT assumed a cost per gallon of \$200 based on a review of literature and data from recent PHMSA incident reports. That cost took into account cleanup costs as well as certain environmental and other societal costs.
- To forecast the number of injuries and deaths sustained in crude oil and ethanol derailments, DOT reviewed data for 2006 through 2014 and determined an injury rate. DOT applied that rate to its forecast for annual crude oil and ethanol shipments from 2015 to 2034.

Where available, preliminary 2015 and 2016 data suggest that DOT’s forecasts were higher than the number of derailments and their resulting effects for those 2 years. (See table 2.) As previously noted, the 2015 and 2016 data we reviewed are preliminary and subject to change.

Table 2: The Department of Transportation’s (DOT) Forecast of Crude Oil and Ethanol Mainline Derailments for 2015 and 2016 Compared To Actual Derailments Based on Preliminary Data

	DOT Forecast for 2015	2015 (Preliminary) ^a	DOT Forecast for 2016	2016 (Preliminary) ^a
Derailments ^b	11.9	9	11.95	4
Derailment rate (per thousand crude oil or ethanol tank cars)	.01064	.00888 ^c	0.0164	Not available ^d
Average gallons of crude oil or ethanol released per derailment	83,602	80,280	83,602	11,351
Range of gallons of crude oil or ethanol released in all derailments	N/A ^e	0- 362,349	N/A ^e	20-42,448
Total cost per gallon released in derailment	\$200	Not available ^f	\$200	Not available ^f
Injuries sustained in derailments	3.61	1	3.63	0
Deaths sustained in derailments	0.26	0	0.26	0

Source: GAO analysis of Department of Transportation data. | GAO-17-567R

^aBecause DOT has not completed validation of these data, they are preliminary at this time and subject to change. In addition, 2016 data are also subject to change because railroads have up to one year after derailments to submit updated information (49 C.F.R. § 171.16(c)) and DOT may also update information through the course of derailment investigations.

^bThis only includes mainline derailments and not those that happened on rail yards for example because, according to DOT, such incidents occur at low speeds and the electronically controlled pneumatic brake rule would do little to mitigate them.

^cDOT calculated the derailment rate using the preliminary 2015 data on derailments and the 2015 value of shipments from the Waybill Sample. As the Waybill Sample data are collected through a sample that is weighted to be nationally representative of all rail freight movements that occur in the United States each year, there should be a sampling error associated with this data point. However, according to DOT it did not calculate a sampling error but has confirmed that the Waybill Sample value has been appropriately weighted to estimate actual carloads shipped.

^dBecause 2016 Waybill Sample data is not yet finalized, DOT is unable to calculate the derailment rate.

^eDOT did not forecast a range of crude oil or ethanol released per derailment in the supporting analysis and only forecasted an average.

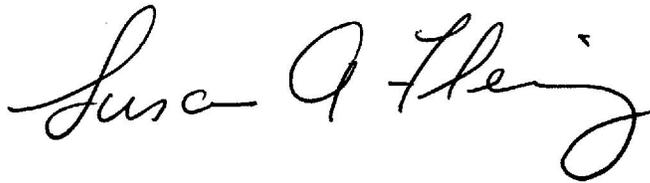
¹According to DOT, derailment incident reports often do not reflect all costs—such as property damage or environmental damage. As a result, according to DOT, final data on the complete cost per gallon released in derailments are not available.

Agency Comments

We provided a draft of this report to the Department of Transportation and Surface Transportation Board for comment. DOT and the Surface Transportation Board provided technical comments that we incorporated as appropriated as appropriate.

We will send copies of this report to appropriate congressional committees, the Secretary of Transportation, and the Chair of the Surface Transportation Board. In addition, the report will be available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff have any questions concerning this report, please contact me at (202) 512-2834 or flemings@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Key contributors to this report were Sharon Silas (Assistant Director), Matt Rosenberg (Analyst in Charge), Namita Bhatia-Sabharwal, Dave Hooper, Christopher Jones, Delwen Jones, and SaraAnn Moessbauer. Sincerely yours,



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