



Safely Transporting Hazardous Liquids and Gases in a Changing U.S. Energy Landscape

A National Academies of Sciences, Engineering, and Medicine report expresses concerns about the safety of rail to transport energy liquids and gases. Pipelines and maritime transportation have more comprehensive safety systems in place.

With the sharp and largely unexpected increase in the long-distance movement of domestically produced crude oil, ethanol, and natural gas since 2005, a number of concerns have arisen about the safe transportation of these hazardous energy liquids and gases. To examine these concerns, the National Academies of Sciences, Engineering, and Medicine, through the auspices of the Transportation Research Board, sponsored a study of the relative safety of transporting these commodities by pipeline, barge, and rail. The report, authored by an expert committee, recommends policies that can help reduce the likelihood of future safety incidents and ensure an effective emergency response when incidents do occur.



The report explains that direct comparisons of the safety performance of the individual modes are hindered by inconsistencies in safety and traffic volume data. Such comparisons can also be irrelevant to decision making when the modes are not viable alternatives to another.

The report gives credit to transportation service providers and regulators for the overall performance of the modes in transporting the vast majority of this new hazardous traffic transported without incident, enabling the country to capitalize on its new energy resources.

Findings

The committee found that pipelines and waterways have accommodated major portions of the growth in domestic energy liquids and gases, and they have done so without creating major new safety problems and within the basic framework of their longstanding regulatory and safety assurance systems.

Railroads have an opportunity to create a more robust safety assurance system for moving crude oil and ethanol, one that resembles those of the maritime and pipeline carriers according to the committee. Prior to 2005, railroads had little experience carrying ethanol and crude oil in large quantities. The surge in domestic production of oil and ethanol resulted in a glut of energy resources in parts of the country that lacked sufficient barge and pipeline takeaway capacity. Therefore, railroads began to transport hazardous energy liquids in tank cars that had not previously carried these flammable materials in bulk and with shippers that lacked experience transporting them.

Preventing the derailment of these older railroad tank cars is imperative, the report concludes. In addition to car design, post-incident investigations of severe flammable liquids train derailments indicate track wear and defects are common causal factors. Questions remain about the technical basis for the track inspection standards, which set an allowable failure rate, and whether these allowable rates and repair priorities should be adjusted for routes that continue to be used by tank car unit trains.

In addition, the committee found that emergency response preparedness has improved but with geographic variability, and opportunities for improvement remain. Many communities lack familiarity with responding to large-scale incidents involving trainloads of flammable liquids. Industry and government authorities face a continuing challenge in ensuring that these response procedures are widely known and that existing training opportunities are exploited.

Between 2010 and 2016, oil transmission pipeline mileage grew by more than 40 percent. The committee said that incident rates have been generally stable, with year-to-year fluctuations stemming from periodic high-consequence events that are sufficiently rare as to limit judgments about their underlying risk. Although the committee found no new safety problems have emerged from the increased use of pipelines transporting larger volumes of domestic oil and gas, substantially more pipeline mileage and higher traffic volumes may result in more pipeline releases over time, simply because of the increase in exposure.

When the committee examined the safety record of energy liquids movement by waterways, it found no reports of ethanol or natural gas liquids releases over the past 10 years and only rare reports of crude oil releases. A series of incidents 30 years ago led to statutory and regulatory safety reforms producing a robust and anticipatory safety culture that can serve as a model for other energy transport modes.

Recommendations

The committee recommended that the Pipeline and Hazardous Materials Safety Administration (PHMSA) undertake a comprehensive review of the successes and failures in responding to transportation safety challenges since 2005, in order to inform the development of more anticipatory and robust safety assurance systems. PHMSA should take the lead organizing federal emergency preparedness grants and review training opportunities to respond to the needs of communities. Moreover, PHMSA and other safety regulators should encourage pipeline, barge, and rail carriers to make greater use of quantitative risk analysis tools, for instance, to inform decisions about priorities for maintenance and integrity management of the equipment and infrastructure and about the routing of energy liquids by rail.

The committee also said the Federal Railroad Administration (FRA) should enable and incentivize more frequent and comprehensive inspections of rail routes with regular energy liquids traffic as well as enable the use of new capabilities in sensor, high-resolution imaging, and autonomous systems technologies.

PHMSA and FRA should take advantage of the increased experience with tank car unit train movements, including accident experience, to systematically model the full array of factors that can give rise to and affect the severity of flammable liquids train crashes, including the propagation of internal rail defects and the kinetics that arise from multi-car derailments.

COMMITTEE FOR A STUDY OF DOMESTIC TRANSPORTATION OF PETROLEUM, NATURAL GAS, AND ETHANOL

VADM Paul G. Gaffney II (NAE), Monmouth University, New Jersey (Chair); Monica M. H. Blaney, Transport Canada, Ottawa; Guy F. Caruso, Center for Strategic and International Studies, Washington, D.C.; Edward R. Chapman, Crystal Lake, Illinois; Robert J. Chipkevich, Chipkevich Safety Consulting Group, Brentwood, Tennessee; Joseph W. Martinelli, PiPRO, Shorewood, Wisconsin; Ali Mosleh (NAE), University of California, Los Angeles; Tonya Ngotel, Center for Preparedness Education, Omaha, Nebraska; Gregory G. Noll, South Central Task Force, Lancaster, Pennsylvania; Craig E. Philip (NAE), Vanderbilt Center for Transportation Research, Nashville, Tennessee; Ian P. Savage, Northwestern University, Evanston, Illinois; Katherine F. Turnbull, Texas A&M Transportation Institute, College Station; Micah D. Himmel, Study Director.

For More Information . . . This summary was prepared by the Transportation Research Board, part of the National Academies of Sciences, Engineering, and Medicine, based on *Safely Transporting Hazardous Liquids and Gases in a Changing U.S. Energy Landscape* (2017). Copies of the report are available from the National Academies Press at www.nap.edu.

TRANSPORTATION RESEARCH BOARD

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

The nation turns to the National Academies of Sciences, Engineering, and Medicine for independent, objective advice on issues that affect people's lives worldwide.

www.national-academies.org