Chapter 24


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ABSTRACT

This paper analyzes 21 years of data related to unintentional hazardous materials (hazmat) releases on air, marine, and rail transportation modes reported in the United States (U.S.) -- although their origins and destinations may be outside the U.S. The authors' analysis reveals thousands of cases have occurred and their impacts vary by mode. These impacts include material losses, carrier damages, property damages, response costs, and remediation and clean-up costs. There appears to be some reduction in the frequency of incidents and accidents as regulations have been promulgated, although the authors cannot attribute causation. They review suggests that enhanced regulations and attentiveness have probably led to better reporting of hazmat occurrences. Moreover, developing and maintaining safer processes and designing safer products, containers, and systems can play an important role in minimizing hazmat releases.

1. INTRODUCTION

The transportation of hazardous materials (Hazmat) represents a necessary requirement for virtually all industrial processes in modern economic systems. Recent statistics for U.S. suggest that the large majority of hazmat is carried through pipelines and road haulage. However, other transport modes (air, sea and rail) also have relevant shares of this business and may contribute to an increased multimodal evolu-
tion of transportation activities in this sector. These alternative transport modes require stringent safety procedures with respect to both terminal operations and to transportation legs in order to minimize risk and to provide seamless transportation. Some decades ago, very few regulations regarding the transport of hazardous materials had been adopted. Since then, layers of local, national, and international regulatory frameworks pertaining to hazmat have been constructed. In this respect, the U.S. laws have tried to regulate this segment of transportation and to harmonize with the international framework. Such legal evolution has also been partly due to the improved relevance of this business and to the peculiar characteristics of hazardous materials. Regulations are a preventative measure, but preparation for responding to hazmat spills is critical too.

Rising oil prices made the exploration of unconventional and/or otherwise inaccessible sources of hydrocarbons for use in petroleum based products feasible. Bitumen from Alberta’s “Tar Sands” and oil from the Bakken formation in central North America (northwestern North Dakota, northeastern Montana, southern Saskatchewan and southwestern Manitoba) are sources of such hydrocarbons. The increase in demand for petroleum products from this region has outstripped the pipeline capacity to carry it resulting in shippers turning to rail and marine modes of transport. Production from the region is expected to triple by 2030 (Crosby, et al 2013).

Bitumen from these regions tends to be viscous and must be diluted to transport it effectively. Natural gas condensate or synthetic oil can be mixed with the mined product to make it flow better. This process can make the transported product more volatile. Meanwhile, oil from the North Dakota shale formation is low viscosity, high volatility, high flammability and similar benzene, toluene, ethyl benzene, xylene (BTEX) levels more like gasoline. Texas shale oil has similar physical properties and hazards, with the additional hazard of ignition potential through static discharge.

The possible collateral effects of hazmat transport accidents have attracted the attention of researchers that have proposed several studies surveying hazmat transport safety related episodes (see, among others, Romer et al., 1995, Oggero et al., 2006 and Yang et al., 2010) that have been mainly related to road transport or to one single alternative transport mode (normally rail or marine transport). A comparative analysis of the accidents that have involved several alternative transport modes seems not to have been proposed in the scientific literature. The present paper aims at filling this gap and it relies on a large-scale database that considers all documented incidents and accidents that have involved air, marine and rail transport between 1990 and 2010 in the U.S. but whose origin and/or destination may or may not be in the U.S.

The paper first proposes a review of the evolution of the U.S. hazmat transport related regulations and plans in order to assess its main trends and its efforts to harmonize with the international framework. We review the incidence response framework in the U.S. and the transboundary efforts to plan and train for pollution incidents. The subsequent section analyzes the main safety-related issues in these alternative transport modes proposed by recent literature in order to pinpoint the most remarkable similarities and heterogeneities. Moreover, a statistical description of accidents partitioned by mode and by cost component is further provided in section four, in order to elicit possible patterns of accident characteristics. The last section concludes and discusses the policy implications of the results.