Bulk Transportation of Hazardous Materials by Rail: Lessons Learned from Non-Collision Accidents

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ABSTRACT

According to the most recently published U.S. Department of Transportation statistics, approximately 380,000 tons of hazardous materials (hazmat) are shipped by rail per year. Recently released data show that the number of rail hazmat incidents has generally decreased over the last ten years. Although the causes of these incidents are varied, non-collision / non-impact causes are often complex and thus more difficult to investigate. Frequently, relevant causal factors include rail car specification, history of use (or non-use) or unanticipated commodity behavior. Some of these factors are not explicitly addressed in the U.S. Department of Transportation hazmat shipping regulations.

In this paper, we take a look at three accidents that we have investigated. The first involves the catastrophic rupture of two covered hopper rail cars in division 5.1 solid oxidizer service. Central to this investigation was the type of rail car that was used for these shipments. Our second case study involves a tank car that exploded after routine steaming. The tank car had been used as a stationary chemical storage vessel for a number of years before it had been placed in transit. The tank car exploded at the receiving customer’s plant prior to unloading. The third case study involves the apparent inhalation of a toxic vapor from a tank car at the initiation of venting prior to steaming. That the toxic vapor was present in the headspace in such significant concentrations was unanticipated by the unloading personnel who had previously unloaded many identically classified tank cars without incident.

The common element to all three of these accidents is that the U.S. Department of Transportation hazmat shipping regulations did not address certain major factors relevant to accident causation. Hence, simple regulatory compliance would be insufficient to prevent a recurrence. One of the lessons learned here is that the use of good chemical process safety practices must be extended to loading and unloading operations of hazardous materials.