

LNG DOT-113s. A flow chart supplementing the following discussion is provided in Figure 5 at the end of this section.

The Pipeline and Hazardous Materials Safety Administration (PHMSA) maintains an online database that provides historical LOC data for rail tank cars, among other transportation vessels.²² The database complements the FRA database in that the PHMSA database records the inventory of HAZMAT cargo released for each accident; whereas, the FRA database only identifies that an LOC has occurred. The PHMSA database was analyzed in order to estimate the LOC probabilities for the LNG DOT-113 cars. The PHMSA database provided relatively scant accident data for DOT-113 rail cars (and did not contain catastrophic release scenarios), but it did list a significant number of pressure tank car LOC accidents. Although there are differences between the DOT-113 construction and, for example, a DOT-112 pressure tank car, the analysis is likely representative of DOT-113 rail cars. Thus, pressure tank cars were used as an analog to estimate the probability of an LOC if a car was derailed.

The PHMSA database listed accident data from 1971 to the present. All rail car data was queried from 1971 to 2017, for incidents including spillage, vapor (gas) dispersion, and no release. The resulting data was then filtered for pressure tank cars only, and incidents where no tank car specification was available were excluded from the analysis. The resulting 5,542 pressure tank car incidents²³ were then sorted by amount released (units are either cubic feet (ft³) or gallons).

The PHMSA data was grouped into four release volume ranges in order to estimate the probability of a certain leak size. The categories were no release (less than 100 gallons), small release (100 to 1,000 gallons), large release (1,000-30,000 gallons), and catastrophic release (30,000+ gallons).²⁴ These volumes were chosen as the PHMSA data appeared to reflect mostly 30,000+ gallon tank cars.

Representative hole sizes were chosen for each release category, in line with PHAST calculation results assuming storage at 90 psig. Small releases were modeled using a ½-inch hole while a 2-inch hole was used for large releases. A catastrophic release assumes that the tank shell has been ruptured, leading to an instantaneous spill of the entire tank contents. Catastrophic releases were thus assumed to represent the PHMSA database cases where 30,000 gallons or more of contents were spilled. The resulting release probabilities are provided in Table 10.

²² Accessible via hazmatonline.phmsa.dot.gov/IncidentReportsSearch/search.aspx.

²³ As of September 20, 2017.

²⁴ Section 3.3.3.3, Railways, page 3.13 in *Guideline for Quantitative Risk Assessment, Part Two: Transport* (Dutch Purple Book), Publication Series on Dangerous Substances, Ministerie van Verkeer en Waterstaat (2005).