3.3.1 Probability of Immediate Ignition

The “stationary” immediate ignition probability is dependent on the specific release characteristics for the scenario including the leak rate for a continuous release, the storage volume for an instantaneous/catastrophic release, and the material released. Methane is defined as a low reactivity material in the software, and the probability of immediate ignition has fixed value depending upon the hole size. PHAST Risk also considers a catastrophic instantaneous release of the entire contents of the vessel and calls this an “instantaneous” release. The term “tank wagon” refers to rail tank cars and was used to represent ISOs during train movement here. The “tank wagon” immediate ignition probability only depends on whether the release is continuous or instantaneous; the rate of release is not considered. Table 28 lists the probability of immediate ignition for the scenarios identified in the QRA.

Table 28. Probability of immediate ignition for methane in PHAST Risk

Hole Size	Stationary	Rail Tank Car
0.5-inch	0.02	0.1
2-inch	0.04	0.1
Instantaneous	0.09	0.8

3.3.2 Probability of Delayed Ignition

The probability of delayed ignition is dependent upon many characteristics of the release scenario, including the growth of an un-ignited vapor cloud with time and the presence of potential ignition sources at some distance from the point of release. Thus, the probability of delayed ignition is not a fixed value; it is calculated as a function of space and time for “stationary” and “tank wagon.” The model domain space is split into grid cells, and the size of the cells is an integer value dependent on the size of the model domain. PHAST Risk performs calculations for each grid cell and sums the probability of ignition for all cells at a given time step. The domain is the maximum spatial extent of the consequence (e.g., maximum flammable cloud size), and PHAST Risk uses up to 40,000 grid cells for analyzing the domain.

The delayed ignition probability for a given grid cell is then calculated from the equation,

$$P_{x,y,t} = f_{x,y}(1 - e^{-\omega_{x,t} t})$$

where $P_{x,y,t}$ is the probability of delayed ignition in the grid cell located at (x,y). The variable $f_{x,y}$ is the proportion of time that the flammable cloud is present in the grid cell located at (x,y), $\omega_{x,y}$ is the ignition effectiveness factor for that grid cell, and t is the time step. No fixed location ignition sources were defined in the QRA analysis presented here (e.g., a stationary flare), thus