hazard outcome probabilities are not considered. These consequences are unlikely to occur in the event of a release, and these hazard distances should not be construed as potential risk zones, but rather maximum potential events irrespective of likelihood.

3.4.2 Flammable Effects Event Trees

The flammable effects resulting from a release of LNG include pool fires, jet fires, flash fires, and fireball. The likelihood of each effect and the consequence outcome are affected by many parameters in the model. The probability of any of these outcomes occurring (or no ignition at all) is complex and is dealt with in PHAST by use of event trees. The probabilities of an individual consequence for a given release depends on whether the release is instantaneous (e.g., catastrophic scenarios) or continuous (e.g., the other scenarios considered), the presence of liquid rainout, subsequent pool vaporization, the presence of a persistent liquid pool, and the dispersion behavior of the flammable vapors.

A majority of the LNG releases considered here are continuous and will have some significant fraction of LNG that flashes immediately upon release. The event tree used in PHAST to represent the probabilistic outcomes for these continuous releases without liquid rainout is provided in Figure 7. The event tree used in PHAST for the catastrophic rupture events is provided in Figure 8.

Similar event trees exist for a continuous release with no rainout, an instantaneous release with no rainout, and an instantaneous release with rainout. The structure of the event trees is consistent with guidance in the Dutch Purple Book.[33] Each branch of these event trees corresponds to a probability of occurrence for that branch, and the sum of all branches for a given step (i.e., branches aligned vertically) sums to unity. The probabilities used in PHAST Risk are consistent with the values provided in the Dutch Purple Book.[34] For the 'No-immediate ignition' branch of the example event tree provided in Figure 7, the probability of delayed ignition ($P_{x,y,t}$) is calculated for each time step for each cell in the model domain (see Section 3.3.2). The outcomes in the delayed ignition branch have a 60% probability of resulting in a flash fire and a 40% probability of resulting in an explosion.

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[33] *Guideline for Quantitative Risk Assessment* (Dutch Purple Book), Publication Series on Dangerous Substances, Ministerie van Verkeer en Waterstaat (2005).

[34] PHAST Risk Technical Documentation, "MPACT Theory," DNV Software, page 128 (2010).