

### 3.4.1 Flammable Effects Event Trees

The flammable effects resulting from a release of LNG include pool fires, jet fires, flash fires, and BLEVE. 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 fraction of LNG that flashes immediately upon release with the remainder raining out on the ground, forming a pool, subsequently vaporizing, and/or leaving a persistent pool. The event tree used in PHAST to represent the probabilistic outcomes for these continuous releases with rainout is provided in Figure 29.

Similar event trees exist for a continuous release with no rainout and an instantaneous release with rainout, all scenarios examined in this study. The structure of the event trees is consistent with guidance in the Dutch Purple Book.<sup>43</sup> 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.<sup>44</sup> For the example event tree provided in Figure 29, the delayed ignition branch has a 60% probability of resulting in a flash fire and a 40% probability of resulting in an explosion (there is zero probability for no effect); the residual pool fire has a probability of 15% and “no effect” is 85% for that branch.

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<sup>43</sup> *Guideline for Quantitative Risk Assessment* (Dutch Purple Book), Publication Series on Dangerous Substances, Ministerie van Verkeer en Waterstaat (2005).

<sup>44</sup> PHAST Risk Technical Documentation, “MPACT Theory,” DNV Software, page 128 (2010).