consequence models, event tree-derived frequencies for each outcome, and industry-accepted population impact models to calculate the IR and SR for facilities and transportation operations.

The key parameters that must be evaluated to perform the QRA, from beginning (accident occurs) to end (a potential fatality is realized), include:

1. Accident—in order for the identified consequence to occur, a vessel containing LNG must first be involved in an accident. The likelihood of an accident involving the LNG ISO is estimated.
2. Loss of Containment—the hazards evaluated here concern the flammable nature of the LNG fuel vapors. In order for a fire or explosion to occur, there must be a loss of containment (LOC) event involving the LNG vessel. The LOC probabilities and leak size distributions are estimated.
3. Formation of flammable atmosphere—following an LOC, the LNG must vaporize and the flammable vapors must mix with air in the appropriate concentrations. The size and downwind distance of the flammable clouds are calculated in PHAST Risk.
4. Ignition of flammable atmosphere—the flammable atmosphere must be ignited in order for a fire or explosion to occur. The ignition probabilities, as a function of time, distance, and population as the flammable cloud is formed and dispersed, are calculated in PHAST Risk.
5. Exposure to a population—the populations that may be affected by an incident involving LNG are estimated using U.S. Census data, and the population data is input into PHAST Risk for calculation of the IR[18] and SR. The potential for a fatality, given a specific thermal event (i.e. flash fire, pool fire, jet fire, or explosion), is calculated in PHAST Risk.

Figure 21 provides a flow chart identifying each step of the risk assessment process. A further discussion of these key QRA parameters, as considered and evaluated for the proposed FECR shipping of (b) (4) ISO containers project, is provided in subsequent sections.

[18] Note that IR assumes continuous potential exposure of personnel or the public; thus, it is not directly related to population like SR. However, population density is an input to the probability of the ignition model employed in the software; hence, IR is a function of population.