

Table 1. Quantitative risk criteria for IR contours as provided by NFPA 59A (2016).

Criterion Annual Frequency (yr ⁻¹)	Remarks
Zone 1 IR > 10 ⁻⁵	<u>Not permitted:</u> Residential, office, and retail <u>Permitted:</u> Occasionally occupied developments (e.g., pump houses, transformer stations)
Zone 2 10 ⁻⁶ ≤ IR < 10 ⁻⁵	<u>Not permitted:</u> Shopping centers, large-scale retail outlets, restaurants, etc. <u>Permitted:</u> Work places, retail and ancillary services, residences in areas of 7,250 to 23,300 persons/mile ² density
Zone 3 3 × 10 ⁻⁷ ≤ IR < 10 ⁻⁶	<u>Not permitted:</u> Churches, schools, hospitals, major public assembly areas, and other sensitive establishments <u>Permitted:</u> All other structures and activities

1.1.3 Societal Risk Criteria

Based on a review of the literature and an understanding of the risk analysis framework, it is apparent that stationary facility SR criteria are not appropriate for transportation or shipping of hazardous materials. For the risk of a stationary facility, all consequences (e.g., toxic release, fires, and explosions) are limited to the region surrounding the facility, which may have a characteristic dimension on the order of 1 km with a fixed surrounding population. If the same consequences are applied to a tanker truck or rail car transportation route, then the geographic region where those consequences may be manifest can be much larger and the surrounding population may vary. Additionally, for stationary facilities there may be green space (i.e., no permanent population) around the site and/or a considerable amount of property under their control; however, concerning transport applications, this standoff distance is greatly reduced or may not exist.

The aggregate societal risk for a transportation route is directly proportional to the length of the route. For example, a 10 km route would have 10 times the risk of a stationary facility all else being equal, a 100 km route would have 100 times the risk, and so on. Using a quantitative risk criterion that is based on a stationary facility will inherently limit the consideration of routes to those that are similar in dimension to a stationary facility. In fact, to address this limitation, the international regulations and guidance documents employ a scaled approach where the SR criteria are evaluated on a per unit length of route (i.e., per route kilometer) basis. Authors and regulators have concluded that in order to directly compare the analysis of transportation or pipeline risk to stationary facilities, these scenarios should consider FN curves normalized per