

Annex 5C

Results of Frequency Analysis

Table 5C.1 Outcome Frequencies Summary for Natural Gas Facilities

Release Event	Leak Size (mm)	Release Scenario				
		Jet Fire	Fireball	Vapour Cloud Explosion	Flash Fire over Plant Area	Flash Fire Full Extent
FG_01	10	2.40E-07	-	4.32E-08	1.04E-06	1.20E-07
	25	2.40E-07	-	1.30E-07	9.50E-07	1.20E-07
	50	1.68E-07	-	9.07E-08	6.65E-07	8.40E-08
	100	1.68E-07	-	9.07E-08	6.65E-07	8.40E-08
	Full bore		7.73E-07	5.55E-07	1.30E-06	1.85E-07
FG_02	10	2.40E-07	-	4.32E-08	1.04E-06	1.20E-07
	25	2.40E-07	-	1.30E-07	9.50E-07	1.20E-07
	50	1.68E-07	-	9.07E-08	6.65E-07	8.40E-08
	100	1.68E-07	-	9.07E-08	6.65E-07	8.40E-08
	Full bore		7.73E-07	5.55E-07	1.30E-06	1.85E-07
FG_03	10	2.00E-08	-	3.60E-09	8.64E-08	1.00E-08
	25	2.00E-08	-	1.08E-08	7.92E-08	1.00E-08
	50	1.40E-08	-	7.56E-09	5.54E-08	7.00E-09
	100	1.40E-08	-	7.56E-09	5.54E-08	7.00E-09
	Full bore		1.68E-07	1.71E-07	3.98E-07	5.68E-08
FG_04	10	7.20E-07	-	1.30E-07	3.11E-06	3.60E-07
	25	7.20E-07	-	3.89E-07	2.85E-06	3.60E-07
	50	2.40E-07	-	1.30E-07	9.50E-07	1.20E-07
	100	2.40E-07	-	1.30E-07	9.50E-07	1.20E-07
	Full bore	6.46E-07	-	7.75E-07	1.81E-06	2.58E-07
FG_05	10	6.00E-07	-	1.08E-07	2.59E-06	3.00E-07
	25	6.00E-07	-	3.24E-07	2.38E-06	3.00E-07
	50	2.00E-07	-	1.08E-07	7.92E-07	1.00E-07
	100	2.00E-07	-	1.08E-07	7.92E-07	1.00E-07
	Full bore	5.27E-07	-	6.33E-07	1.48E-06	2.11E-07
FG_06	10	3.00E-08	-	5.40E-09	1.30E-07	1.50E-08
	25	3.00E-08	-	1.62E-08	1.19E-07	1.50E-08
	50	1.00E-08	-	5.40E-09	3.96E-08	5.00E-09
	100	1.00E-08	-	5.40E-09	3.96E-08	5.00E-09
	Full bore	1.55E-07	-	1.86E-07	4.34E-07	6.20E-08
FG_07	10	1.90E-07	-	3.42E-08	8.21E-07	9.50E-08
	25	1.90E-07	-	1.03E-07	7.52E-07	9.50E-08
	50	1.33E-07	-	7.18E-08	5.27E-07	6.65E-08
	100	1.33E-07	-	7.18E-08	5.27E-07	6.65E-08
	Full bore		3.83E-07	4.52E-07	1.05E-06	1.51E-07
FG_08	10	7.20E-07	-	1.30E-07	3.11E-06	3.60E-07
	25	7.20E-07	-	3.89E-07	2.85E-06	3.60E-07
	50	2.40E-07	-	1.30E-07	9.50E-07	1.20E-07
	100	2.40E-07	-	1.30E-07	9.50E-07	1.20E-07
	Full bore	6.22E-07	-	7.46E-07	1.74E-06	2.49E-07
FG_09	10	6.00E-07	-	1.08E-07	2.59E-06	3.00E-07
	25	6.00E-07	-	3.24E-07	2.38E-06	3.00E-07
	50	2.00E-07	-	1.08E-07	7.92E-07	1.00E-07
	100	2.00E-07	-	1.08E-07	7.92E-07	1.00E-07
	Full bore	5.26E-07	-	6.32E-07	1.47E-06	2.11E-07
FG_10	10	3.00E-08	-	5.40E-09	1.30E-07	1.50E-08
	25	3.00E-08	-	1.62E-08	1.19E-07	1.50E-08
	50	1.00E-08	-	5.40E-09	3.96E-08	5.00E-09
	100	1.00E-08	-	5.40E-09	3.96E-08	5.00E-09
	Full bore	1.58E-07	-	1.90E-07	4.43E-07	6.33E-08
GRS_01	10	3.20E-07	-	1.73E-07	1.27E-06	1.60E-07
	25	3.20E-07	-	1.73E-07	1.27E-06	1.60E-07

Release Event	Leak Size (mm)	Release Scenario				
		Jet Fire	Fireball	Vapour Cloud Explosion	Flash Fire over Plant Area	Flash Fire Full Extent
GRS_02	50	1.12E-06	-	1.34E-06	3.14E-06	4.48E-07
	100	1.12E-06	-	1.34E-06	3.14E-06	4.48E-07
	Full bore		5.37E-07	6.30E-07	1.47E-06	2.10E-07
	10	7.00E-08	-	3.78E-08	2.77E-07	3.50E-08
	25	7.00E-08	-	3.78E-08	2.77E-07	3.50E-08
GRS_03	50	2.45E-07	-	2.94E-07	6.86E-07	9.80E-08
	100	2.45E-07	-	2.94E-07	6.86E-07	9.80E-08
	Full bore		1.83E-07	2.19E-07	5.12E-07	7.31E-08
	10	8.00E-08	-	4.32E-08	3.17E-07	4.00E-08
	25	8.00E-08	-	4.32E-08	3.17E-07	4.00E-08
GRS_04	50	2.80E-07	-	3.36E-07	7.84E-07	1.12E-07
	100	2.80E-07	-	3.36E-07	7.84E-07	1.12E-07
	Full bore		2.13E-07	2.56E-07	5.97E-07	8.53E-08
	10	2.10E-07	-	1.13E-07	8.32E-07	1.05E-07
	25	2.10E-07	-	1.13E-07	8.32E-07	1.05E-07
GRS_05	50	7.35E-07	-	8.82E-07	2.06E-06	2.94E-07
	100	7.35E-07	-	8.82E-07	2.06E-06	2.94E-07
	Full bore		3.67E-07	4.40E-07	1.03E-06	1.47E-07
	10	1.90E-07	-	1.03E-07	7.52E-07	9.50E-08
	25	1.90E-07	-	1.03E-07	7.52E-07	9.50E-08
GRS_06	50	6.65E-07	-	7.98E-07	1.86E-06	2.66E-07
	100	6.65E-07	-	7.98E-07	1.86E-06	2.66E-07
	Full bore		3.54E-07	4.24E-07	9.90E-07	1.41E-07
	10	4.00E-08	-	2.16E-08	1.58E-07	2.00E-08
	25	4.00E-08	-	2.16E-08	1.58E-07	2.00E-08
GRS_07	50	1.40E-07	-	1.68E-07	3.92E-07	5.60E-08
	100	1.40E-07	-	1.68E-07	3.92E-07	5.60E-08
	Full bore		1.40E-07	1.68E-07	3.91E-07	5.59E-08
	10	9.00E-08	-	1.62E-08	3.89E-07	4.50E-08
	25	9.00E-08	-	4.86E-08	3.56E-07	4.50E-08
GRS_08	50	6.30E-08	-	3.40E-08	2.49E-07	3.15E-08
	100	6.30E-08	-	3.40E-08	2.49E-07	3.15E-08
	Full bore		3.63E-07	4.35E-07	1.02E-06	1.45E-07
	10	1.74E-08	-	9.41E-09	6.90E-08	8.71E-09
	25	1.74E-08	-	9.41E-09	6.90E-08	8.71E-09
GRS_11	50	6.10E-08	-	7.32E-08	1.71E-07	2.44E-08
	100	6.10E-08	-	7.32E-08	1.71E-07	2.44E-08
	Full bore		1.24E-07	1.49E-07	3.47E-07	4.95E-08
	10	1.40E-07	-	2.52E-08	6.05E-07	7.00E-08
	25	1.40E-07	-	7.56E-08	5.54E-07	7.00E-08
GRS_12	50	9.80E-08	-	5.29E-08	3.88E-07	4.90E-08
	100	4.90E-07	-	5.88E-07	1.37E-06	1.96E-07
	Full bore		3.10E-07	3.57E-07	8.33E-07	1.19E-07
	10	1.90E-07	-	3.42E-08	8.21E-07	9.50E-08
	25	1.90E-07	-	1.03E-07	7.52E-07	9.50E-08
GRS_13	50	1.33E-07	-	7.18E-08	5.27E-07	6.65E-08
	100	6.65E-07	-	7.98E-07	1.86E-06	2.66E-07
	Full bore		3.32E-07	3.99E-07	9.31E-07	1.33E-07
	10	9.00E-08	-	1.62E-08	3.89E-07	4.50E-08
	25	9.00E-08	-	4.86E-08	3.56E-07	4.50E-08
GRS_14	50	3.00E-08	-	1.62E-08	1.19E-07	1.50E-08
	100	1.50E-07	-	1.80E-07	4.20E-07	6.00E-08
	Full bore		1.93E-07	2.31E-07	5.40E-07	7.71E-08
	10	9.00E-08	-	1.62E-08	3.89E-07	4.50E-08
	25	9.00E-08	-	4.86E-08	3.56E-07	4.50E-08

Release Event	Leak Size (mm)	Release Scenario				
		Jet Fire	Fireball	Vapour Cloud Explosion	Flash Fire over Plant Area	Flash Fire Full Extent
GRS_15	50	6.30E-08	-	3.40E-08	2.49E-07	3.15E-08
	100	3.15E-07	-	3.78E-07	8.82E-07	1.26E-07
	Full bore		2.18E-07	2.62E-07	6.11E-07	8.73E-08
	10	1.60E-07	-	2.88E-08	6.91E-07	8.00E-08
	25	1.60E-07	-	8.64E-08	6.34E-07	8.00E-08
GRS_16	50	1.12E-07	-	6.05E-08	4.44E-07	5.60E-08
	100	5.60E-07	-	6.72E-07	1.57E-06	2.24E-07
	Full bore		3.18E-07	3.81E-07	8.90E-07	1.27E-07
	10	2.40E-07	-	4.32E-08	1.04E-06	1.20E-07
	25	2.40E-07	-	1.30E-07	9.50E-07	1.20E-07
GRS_17	50	8.00E-08	-	4.32E-08	3.17E-07	4.00E-08
	100	4.00E-07	-	4.80E-07	1.12E-06	1.60E-07
	Full bore		3.19E-07	3.83E-07	8.93E-07	1.28E-07
	10	7.00E-08	-	1.26E-08	3.02E-07	3.50E-08
	25	7.00E-08	-	3.78E-08	2.77E-07	3.50E-08
GRS_18	50	4.90E-08	-	2.65E-08	1.94E-07	2.45E-08
	100	2.45E-07	-	2.94E-07	6.86E-07	9.80E-08
	Full bore		2.14E-07	2.57E-07	5.99E-07	8.56E-08
	10	5.30E-07	-	9.54E-08	2.29E-06	2.65E-07
	25	5.30E-07	-	2.86E-07	2.10E-06	2.65E-07
GRS_19	50	3.71E-07	-	2.00E-07	1.47E-06	1.86E-07
	100	3.71E-07	-	2.00E-07	1.47E-06	1.86E-07
	Full bore		8.98E-07	1.08E-06	2.51E-06	3.59E-07
	10	1.74E-08	-	3.14E-09	7.53E-08	8.71E-09
	25	1.74E-08	-	9.41E-09	6.90E-08	8.71E-09
FG_101	50	1.22E-08	-	6.58E-09	4.83E-08	6.10E-09
	100	6.10E-08	-	7.32E-08	1.71E-07	2.44E-08
	Full bore		1.09E-07	1.31E-07	3.05E-07	4.36E-08
	10	4.00E-07	-	7.20E-08	1.73E-06	2.00E-07
	25	4.00E-07	-	2.16E-07	1.58E-06	2.00E-07
FG_102	50	2.80E-07	-	1.51E-07	1.11E-06	1.40E-07
	100	2.80E-07	-	1.51E-07	1.11E-06	1.40E-07
	Full bore		7.33E-07	8.64E-07	2.02E-06	2.88E-07
	10	4.00E-07	-	7.20E-08	1.73E-06	2.00E-07
	25	4.00E-07	-	2.16E-07	1.58E-06	2.00E-07
FG_103	50	2.80E-07	-	1.51E-07	1.11E-06	1.40E-07
	100	2.80E-07	-	1.51E-07	1.11E-06	1.40E-07
	Full bore		7.33E-07	8.64E-07	2.02E-06	2.88E-07
	10	6.00E-07	-	1.08E-07	2.59E-06	3.00E-07
	25	6.00E-07	-	3.24E-07	2.38E-06	3.00E-07
FG_104	50	2.00E-07	-	1.08E-07	7.92E-07	1.00E-07
	100	2.00E-07	-	1.08E-07	7.92E-07	1.00E-07
	Full bore		-	6.71E-07	1.57E-06	2.24E-07
	10	3.60E-07	-	6.48E-08	1.56E-06	1.80E-07
	25	3.60E-07	-	1.94E-07	1.43E-06	1.80E-07
FG_105	50	1.20E-07	-	6.48E-08	4.75E-07	6.00E-08
	100	1.20E-07	-	6.48E-08	4.75E-07	6.00E-08
	Full bore		-	4.25E-07	9.92E-07	1.42E-07
	10	3.00E-08	-	5.40E-09	1.30E-07	1.50E-08
	25	3.00E-08	-	1.62E-08	1.19E-07	1.50E-08
FG_106	50	1.00E-08	-	5.40E-09	3.96E-08	5.00E-09
	100	1.00E-08	-	5.40E-09	3.96E-08	5.00E-09
	Full bore		-	6.13E-08	1.43E-07	2.04E-08
	10	6.00E-07	-	1.08E-07	2.59E-06	3.00E-07
	25	6.00E-07	-	3.24E-07	2.38E-06	3.00E-07

Release Event	Leak Size (mm)	Release Scenario				
		Jet Fire	Fireball	Vapour Cloud Explosion	Flash Fire over Plant Area	Flash Fire Full Extent
FG_107	50	2.00E-07	-	1.08E-07	7.92E-07	1.00E-07
	100	2.00E-07	-	1.08E-07	7.92E-07	1.00E-07
	Full bore	5.73E-07	-	6.87E-07	1.60E-06	2.29E-07
	10	3.60E-07	-	6.48E-08	1.56E-06	1.80E-07
	25	3.60E-07	-	1.94E-07	1.43E-06	1.80E-07
	50	1.20E-07	-	6.48E-08	4.75E-07	6.00E-08
FG_108	100	1.20E-07	-	6.48E-08	4.75E-07	6.00E-08
	Full bore	3.62E-07	-	4.35E-07	1.01E-06	1.45E-07
FG_109	10	3.00E-08	-	5.40E-09	1.30E-07	1.50E-08
	25	3.00E-08	-	1.62E-08	1.19E-07	1.50E-08
	50	1.00E-08	-	5.40E-09	3.96E-08	5.00E-09
	100	1.00E-08	-	5.40E-09	3.96E-08	5.00E-09
	Full bore	5.60E-08	-	6.72E-08	1.57E-07	2.24E-08
FG_110	10	6.00E-07	-	1.08E-07	2.59E-06	3.00E-07
	25	6.00E-07	-	3.24E-07	2.38E-06	3.00E-07
	50	2.00E-07	-	1.08E-07	7.92E-07	1.00E-07
	100	2.00E-07	-	1.08E-07	7.92E-07	1.00E-07
	Full bore	5.68E-07	-	6.81E-07	1.59E-06	2.27E-07
FG_111	10	4.20E-07	-	7.56E-08	1.81E-06	2.10E-07
	25	4.20E-07	-	2.27E-07	1.66E-06	2.10E-07
	50	1.40E-07	-	7.56E-08	5.54E-07	7.00E-08
	100	1.40E-07	-	7.56E-08	5.54E-07	7.00E-08
	Full bore	4.04E-07	-	4.85E-07	1.13E-06	1.62E-07
FG_112	10	3.00E-08	-	5.40E-09	1.30E-07	1.50E-08
	25	3.00E-08	-	1.62E-08	1.19E-07	1.50E-08
	50	1.00E-08	-	5.40E-09	3.96E-08	5.00E-09
	100	1.00E-08	-	5.40E-09	3.96E-08	5.00E-09
	Full bore	5.65E-08	-	6.78E-08	1.58E-07	2.26E-08
FG_113	10	6.00E-07	-	1.08E-07	2.59E-06	3.00E-07
	25	6.00E-07	-	3.24E-07	2.38E-06	3.00E-07
	50	2.00E-07	-	1.08E-07	7.92E-07	1.00E-07
	100	2.00E-07	-	1.08E-07	7.92E-07	1.00E-07
	Full bore	5.90E-07	-	7.07E-07	1.65E-06	2.36E-07
FG_114	10	4.20E-07	-	7.56E-08	1.81E-06	2.10E-07
	25	4.20E-07	-	2.27E-07	1.66E-06	2.10E-07
	50	1.40E-07	-	7.56E-08	5.54E-07	7.00E-08
	100	1.40E-07	-	7.56E-08	5.54E-07	7.00E-08
	Full bore	3.84E-07	-	4.60E-07	1.07E-06	1.53E-07
FG_115	10	3.00E-08	-	5.40E-09	1.30E-07	1.50E-08
	25	3.00E-08	-	1.62E-08	1.19E-07	1.50E-08
	50	1.00E-08	-	5.40E-09	3.96E-08	5.00E-09
	100	1.00E-08	-	5.40E-09	3.96E-08	5.00E-09
	Full bore	4.97E-08	-	5.96E-08	1.39E-07	1.99E-08
FG_116	10	6.00E-07	-	1.08E-07	2.59E-06	3.00E-07
	25	6.00E-07	-	3.24E-07	2.38E-06	3.00E-07
	50	2.00E-07	-	1.08E-07	7.92E-07	1.00E-07
	100	2.00E-07	-	1.08E-07	7.92E-07	1.00E-07
	Full bore	5.50E-07	-	6.60E-07	1.54E-06	2.20E-07
FG_117	10	3.60E-07	-	6.48E-08	1.56E-06	1.80E-07
	25	3.60E-07	-	1.94E-07	1.43E-06	1.80E-07
	50	1.20E-07	-	6.48E-08	4.75E-07	6.00E-08
	100	1.20E-07	-	6.48E-08	4.75E-07	6.00E-08
	Full bore	3.46E-07	-	4.16E-07	9.70E-07	1.39E-07
FG_117	10	3.00E-08	-	5.40E-09	1.30E-07	1.50E-08
	25	3.00E-08	-	1.62E-08	1.19E-07	1.50E-08

Release Event	Leak Size (mm)	Release Scenario				
		Jet Fire	Fireball	Vapour Cloud Explosion	Flash Fire over Plant Area	Flash Fire Full Extent
FG_118	50	1.00E-08	-	5.40E-09	3.96E-08	5.00E-09
	100	1.00E-08	-	5.40E-09	3.96E-08	5.00E-09
	Full bore	5.13E-08	-	6.16E-08	1.44E-07	2.05E-08
	10	6.00E-07	-	1.08E-07	2.59E-06	3.00E-07
	25	6.00E-07	-	3.24E-07	2.38E-06	3.00E-07
	50	2.00E-07	-	1.08E-07	7.92E-07	1.00E-07
FG_119	100	2.00E-07	-	1.08E-07	7.92E-07	1.00E-07
	Full bore	5.80E-07	-	6.96E-07	1.63E-06	2.32E-07
FG_120	10	3.60E-07	-	6.48E-08	1.56E-06	1.80E-07
	25	3.60E-07	-	1.94E-07	1.43E-06	1.80E-07
	50	1.20E-07	-	6.48E-08	4.75E-07	6.00E-08
	100	1.20E-07	-	6.48E-08	4.75E-07	6.00E-08
	Full bore	3.60E-07	-	4.32E-07	1.01E-06	1.44E-07
FG_121	10	3.00E-08	-	5.40E-09	1.30E-07	1.50E-08
	25	3.00E-08	-	1.62E-08	1.19E-07	1.50E-08
	50	1.00E-08	-	5.40E-09	3.96E-08	5.00E-09
	100	1.00E-08	-	5.40E-09	3.96E-08	5.00E-09
	Full bore	5.64E-08	-	6.77E-08	1.58E-07	2.26E-08
FG_122	10	6.00E-07	-	1.08E-07	2.59E-06	3.00E-07
	25	6.00E-07	-	3.24E-07	2.38E-06	3.00E-07
	50	2.00E-07	-	1.08E-07	7.92E-07	1.00E-07
	100	2.00E-07	-	1.08E-07	7.92E-07	1.00E-07
	Full bore	5.60E-07	-	6.72E-07	1.57E-06	2.24E-07
FG_123	10	3.60E-07	-	6.48E-08	1.56E-06	1.80E-07
	25	3.60E-07	-	1.94E-07	1.43E-06	1.80E-07
	50	1.20E-07	-	6.48E-08	4.75E-07	6.00E-08
	100	1.20E-07	-	6.48E-08	4.75E-07	6.00E-08
	Full bore	3.44E-07	-	4.13E-07	9.65E-07	1.38E-07
FG_124	10	3.00E-08	-	5.40E-09	1.30E-07	1.50E-08
	25	3.00E-08	-	1.62E-08	1.19E-07	1.50E-08
	50	1.00E-08	-	5.40E-09	3.96E-08	5.00E-09
	100	1.00E-08	-	5.40E-09	3.96E-08	5.00E-09
	Full bore	4.89E-08	-	5.87E-08	1.37E-07	1.96E-08
FG_125	10	6.00E-07	-	1.08E-07	2.59E-06	3.00E-07
	25	6.00E-07	-	3.24E-07	2.38E-06	3.00E-07
	50	2.00E-07	-	1.08E-07	7.92E-07	1.00E-07
	100	2.00E-07	-	1.08E-07	7.92E-07	1.00E-07
	Full bore	5.56E-07	-	6.67E-07	1.56E-06	2.22E-07
FG_126	10	3.60E-07	-	6.48E-08	1.56E-06	1.80E-07
	25	3.60E-07	-	1.94E-07	1.43E-06	1.80E-07
	50	1.20E-07	-	6.48E-08	4.75E-07	6.00E-08
	100	1.20E-07	-	6.48E-08	4.75E-07	6.00E-08
	Full bore	3.33E-07	-	3.99E-07	9.32E-07	1.33E-07
FG_127	10	3.00E-08	-	5.40E-09	1.30E-07	1.50E-08
	25	3.00E-08	-	1.62E-08	1.19E-07	1.50E-08
	50	1.00E-08	-	5.40E-09	3.96E-08	5.00E-09
	100	1.00E-08	-	5.40E-09	3.96E-08	5.00E-09
	Full bore	4.61E-08	-	5.53E-08	1.29E-07	1.84E-08
FG_128	10	1.96E-06	-	3.52E-07	8.46E-06	9.79E-07
	25	1.96E-06	-	1.06E-06	7.75E-06	9.79E-07
	50	1.37E-06	-	7.40E-07	5.43E-06	6.85E-07
	100	1.37E-06	-	7.40E-07	5.43E-06	6.85E-07
	Full bore		2.97E-06	3.57E-06	8.32E-06	1.19E-06

Table 5C.2 Outcome Frequencies Summary for Hydrogen Gas Facilities

Release Event	Leak Size (mm)	Release Scenario			
		Jet Fire	Fireball	Vapour Cloud Explosion	Flash Fire
HY_01	10	3.87E-07	-	7.74E-09	1.86E-07
	25	3.68E-08	-	4.42E-10	3.24E-09
	Catastrophic Rupture	-	3.72E-08	1.12E-09	2.60E-09
HY_02	10	2.66E-04	-	5.31E-06	1.27E-04
	Full bore	5.46E-04	-	1.09E-05	2.62E-04
HY_03	10	5.18E-05	-	1.04E-06	2.48E-05
	Full bore	1.06E-04	-	2.13E-06	5.11E-05
HY_04	10	3.87E-07	-	7.74E-09	1.86E-07
	25	3.68E-08	-	4.42E-10	3.24E-09
	Catastrophic Rupture	-	3.72E-08	1.12E-09	2.60E-09
HY_05	10	8.55E-05	-	1.71E-06	4.10E-05
	Full bore	1.76E-04	-	3.52E-06	8.44E-05
HY_06	10	5.18E-05	-	1.04E-06	2.48E-05
	Full bore	1.06E-04	-	2.13E-06	5.11E-05
HY_11	10	1.93E-06	-	3.87E-08	9.29E-07
	25	1.84E-07	-	2.21E-09	1.62E-08
	Catastrophic Rupture	-	1.86E-07	5.58E-09	1.30E-08
HY_12	10	8.32E-05	-	1.66E-06	3.99E-05
	25	1.50E-04	-	1.80E-06	1.32E-05
	Catastrophic Rupture	-	1.15E-04	3.46E-06	8.06E-06
HY_13	10	9.00E-06	-	1.80E-07	4.32E-06
	Full bore	3.33E-05	-	4.00E-07	2.93E-06
HY_14	10	9.00E-06	-	1.80E-07	4.32E-06
	Full bore	1.85E-05	-	3.70E-07	8.88E-06
HY_15	10	2.23E-04	-	4.46E-06	1.07E-04
	Full bore	4.59E-04	-	9.18E-06	2.20E-04
HY_16	10	1.44E-05	-	2.88E-07	6.91E-06
	Full bore	2.96E-05	-	5.92E-07	1.42E-05
HY_17	10	1.40E-05	-	2.79E-07	6.70E-06
	Full bore	2.87E-05	-	5.74E-07	1.38E-05
HY_18	10	1.94E-05	-	3.87E-07	9.29E-06
	Full bore	3.98E-05	-	7.96E-07	1.91E-05
HY_19	10	1.58E-05	-	3.15E-07	7.56E-06
	Full bore	3.24E-05	-	6.48E-07	1.55E-05
HY_20	10	1.62E-05	-	3.24E-07	7.78E-06
	Full bore	3.33E-05	-	6.66E-07	1.60E-05
HY_21	10	1.62E-05	-	3.24E-07	7.78E-06
	Full bore	3.33E-05	-	6.66E-07	1.60E-05
HY_22	10	1.98E-05	-	3.96E-07	9.50E-06
	Full bore	4.07E-05	-	8.14E-07	1.95E-05
HY_23	10	1.62E-05	-	3.24E-07	7.78E-06
	Full bore	3.33E-05	-	6.66E-07	1.60E-05

Table 5C.3 Outcome Frequencies Summary for Distillate Oil Facilities

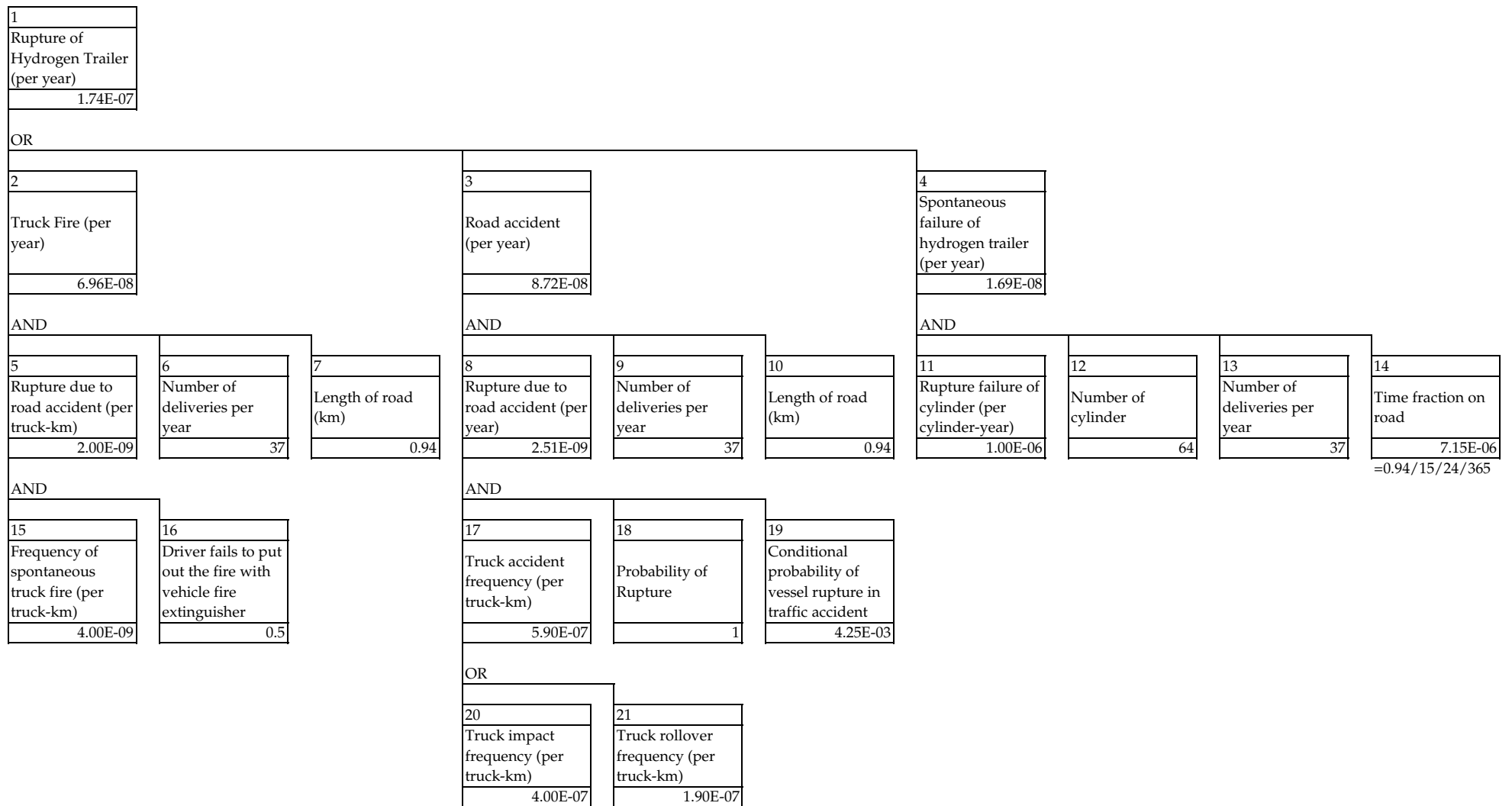
Release Event	Leak Size (mm)	Release Scenario	
		Pool Fire	Flash Fire
DO_01	10	1.35E-07	5.40E-07
	25	1.35E-07	5.40E-07
	50	4.50E-08	1.80E-07
	100	9.00E-08	5.40E-07
	Full bore	4.50E-08	2.70E-07
DO_02	10	3.75E-07	1.50E-06
	25	3.75E-07	1.50E-06
	50	1.25E-07	5.00E-07
	100	2.50E-07	1.50E-06
	Full bore	1.55E-07	2.50E-07
DO_03	10	2.85E-07	1.14E-06
	25	2.85E-07	1.14E-06
	50	9.50E-08	3.80E-07
	100	1.90E-07	1.14E-06
	Full bore	9.81E-08	5.70E-07
DO_04	10	3.75E-07	1.50E-06
	25	3.75E-07	1.50E-06
	50	1.25E-07	5.00E-07
	100	2.50E-07	1.50E-06
	Full bore	6.48E-08	2.50E-07
DO_11	10	1.00E-06	4.00E-06
	Catastrophic Rupture	1.00E-07	6.00E-07
DO_12	10	1.00E-06	4.00E-06
	Catastrophic Rupture	1.94E-07	6.00E-07
DO_13	10	1.00E-06	4.00E-06
	Catastrophic Rupture	1.94E-07	6.00E-07
DO_14	10	8.11E-06	3.24E-05
	25	1.05E-07	4.20E-07
	50	3.50E-08	1.40E-07
	100	7.00E-08	4.20E-07
	Full bore	1.68E-06	9.81E-06
DO_15	10	9.00E-08	3.60E-07
	25	9.00E-08	3.60E-07
	50	3.00E-08	1.20E-07
	100	6.00E-08	3.60E-07
	Full bore	7.99E-08	1.80E-07
DO_16	10	7.50E-08	3.00E-07
	25	7.50E-08	3.00E-07
	50	2.50E-08	1.00E-07
	100	5.00E-08	3.00E-07
	Full bore	5.73E-08	1.50E-07
DO_17	10	1.31E-06	5.22E-06
	25	1.31E-06	5.22E-06
	50	4.35E-07	1.74E-06
	100	8.70E-07	5.22E-06
	Full bore	8.37E-07	2.61E-06
DO_18	10	2.25E-07	9.00E-07
	25	2.25E-07	9.00E-07
	50	7.50E-08	3.00E-07
	100	7.50E-08	3.00E-07
	Full bore	9.29E-08	1.50E-07
DO_19	10	2.25E-07	9.00E-07
	25	2.25E-07	9.00E-07
	50	7.50E-08	3.00E-07
	100	7.50E-08	3.00E-07

Release Event	Leak Size (mm)	Release Scenario	
		Pool Fire	Flash Fire
DO_20	Full bore	3.75E-08	1.50E-07
	10	2.25E-07	9.00E-07
	25	2.25E-07	9.00E-07
	50	7.50E-08	3.00E-07
	100	7.50E-08	3.00E-07
	Full bore	3.75E-08	1.50E-07
DO_21	10	2.25E-07	9.00E-07
	25	2.25E-07	9.00E-07
	50	7.50E-08	3.00E-07
	100	7.50E-08	3.00E-07
	Full bore	3.75E-08	1.50E-07
DO_22	10	2.25E-07	9.00E-07
	25	2.25E-07	9.00E-07
	50	7.50E-08	3.00E-07
	100	7.50E-08	3.00E-07
	Full bore	3.75E-08	1.50E-07
DO_23	10	2.25E-07	9.00E-07
	25	2.25E-07	9.00E-07
	50	7.50E-08	3.00E-07
	100	7.50E-08	3.00E-07
	Full bore	3.75E-08	1.50E-07
DO_24	10	2.25E-07	9.00E-07
	25	2.25E-07	9.00E-07
	50	7.50E-08	3.00E-07
	100	7.50E-08	3.00E-07
	Full bore	3.75E-08	1.50E-07
DO_25	10	2.25E-07	9.00E-07
	25	2.25E-07	9.00E-07
	50	7.50E-08	3.00E-07
	100	7.50E-08	3.00E-07
	Full bore	3.75E-08	1.50E-07
DO_26	10	1.16E-09	4.62E-09
	25	1.16E-09	4.62E-09
	50	1.16E-09	4.62E-09
	100	1.16E-09	4.62E-09
	Full bore	4.62E-11	1.85E-10
DO_27	10	3.42E-11	1.37E-10
	25	3.42E-11	1.37E-10
	50	1.14E-11	4.57E-11
	100	2.28E-11	1.37E-10
	Full bore	1.14E-11	6.85E-11

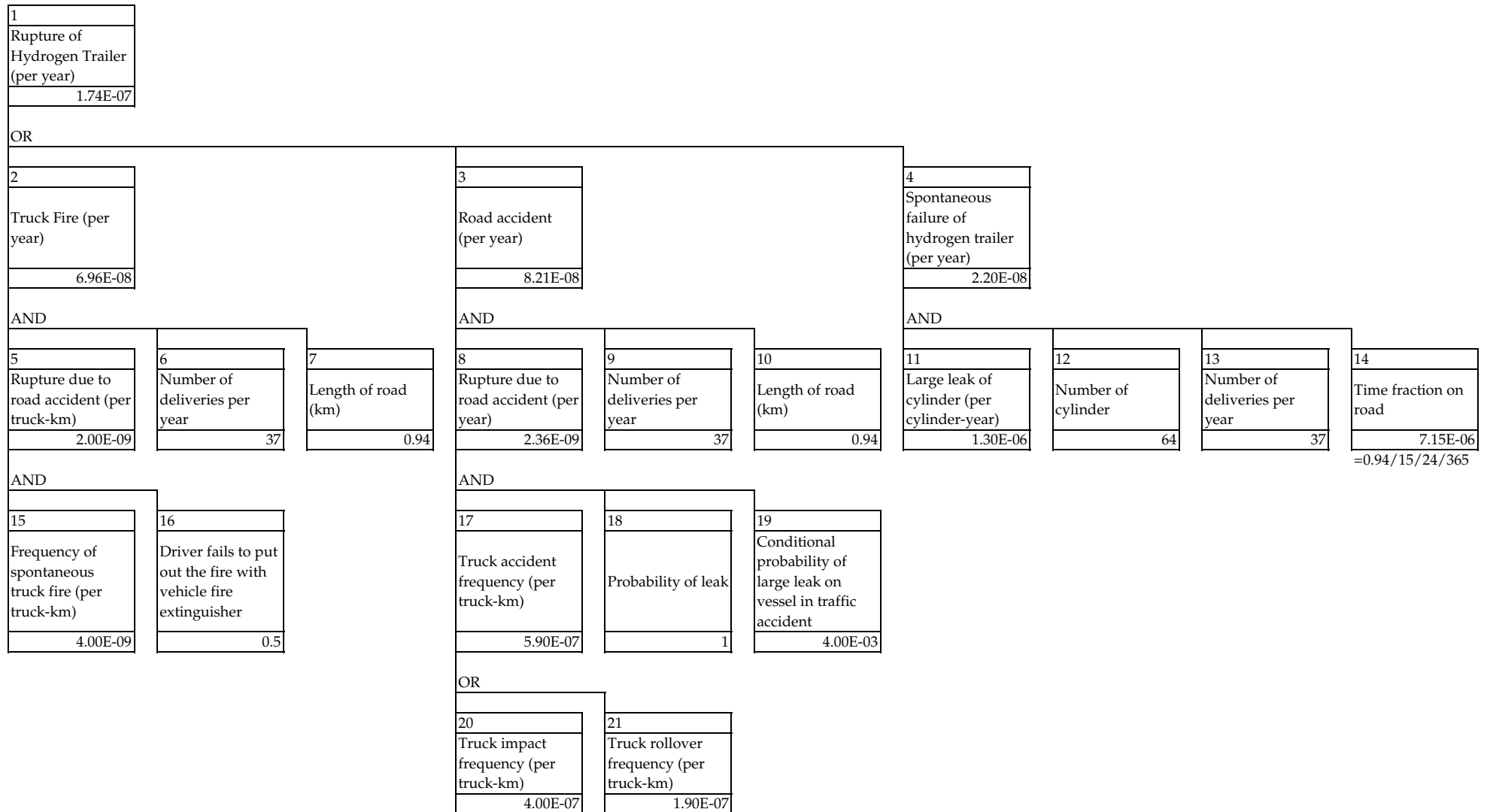
Table 5C.4 Outcome Frequencies Summary for Carbon Dioxide Facilities

Release Event	Leak Size (mm)	Release Scenario	
		Toxicity	Overpressure
CD_01	25	1.63E-08	-
	Catastrophic Rupture	1.69E-08	1.69E-08
CD_02	10	2.70E-04	-
	Full bore	5.55E-04	-
CD_03	10	1.13E-04	-
	Full bore	2.31E-04	-
CD_04	25	1.63E-08	-
	Catastrophic Rupture	1.69E-08	1.69E-08
CD_05	10	8.55E-05	-
	Full bore	1.76E-04	-
CD_06	10	1.13E-04	-
	Full bore	2.31E-04	-
CD_11	25	8.16E-08	-
	Catastrophic Rupture	8.43E-08	8.43E-08
CD_12	10	6.25E-09	-
	25	6.25E-09	-
	Catastrophic Rupture	1.25E-08	1.25E-08
CD_13	10	1.80E-05	-
	Full bore	3.70E-05	-
CD_14	10	2.48E-04	-
	Full bore	5.09E-04	-
CD_15	10	2.70E-05	-
	Full bore	5.55E-05	-
CD_16	10	2.70E-05	-
	Full bore	5.55E-05	-
CD_17	10	4.05E-05	-
	Full bore	8.33E-05	-
CD_18	10	3.15E-05	-
	Full bore	6.48E-05	-
CD_19	10	3.15E-05	-
	Full bore	6.48E-05	-
CD_20	10	3.15E-05	-
	Full bore	6.48E-05	-
CD_21	10	4.05E-05	-
	Full bore	8.33E-05	-
CD_22	10	3.15E-05	-
	Full bore	6.48E-05	-

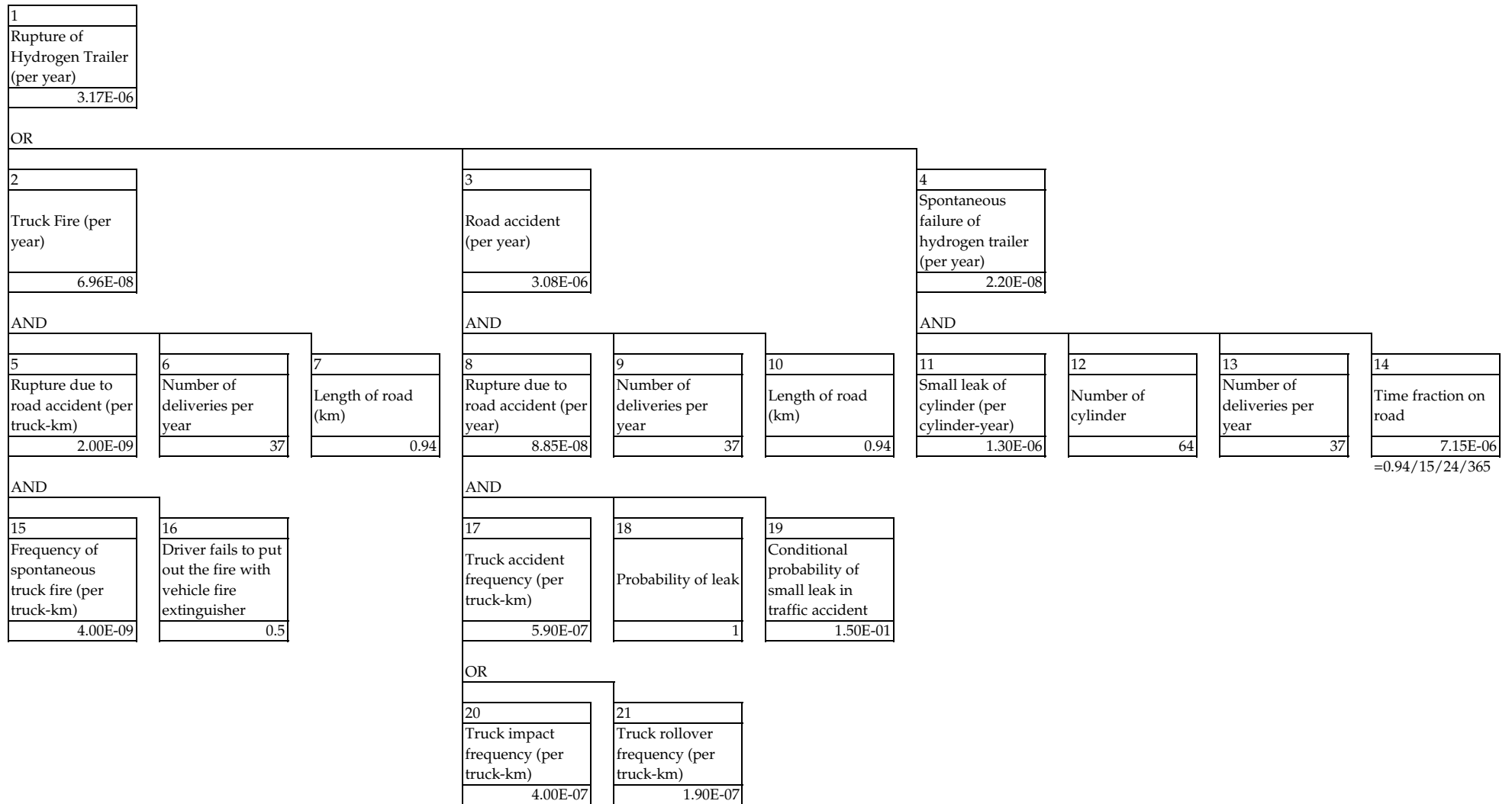
Fault Tree for Hydrogen Trailer Rupture Failure (onsite)



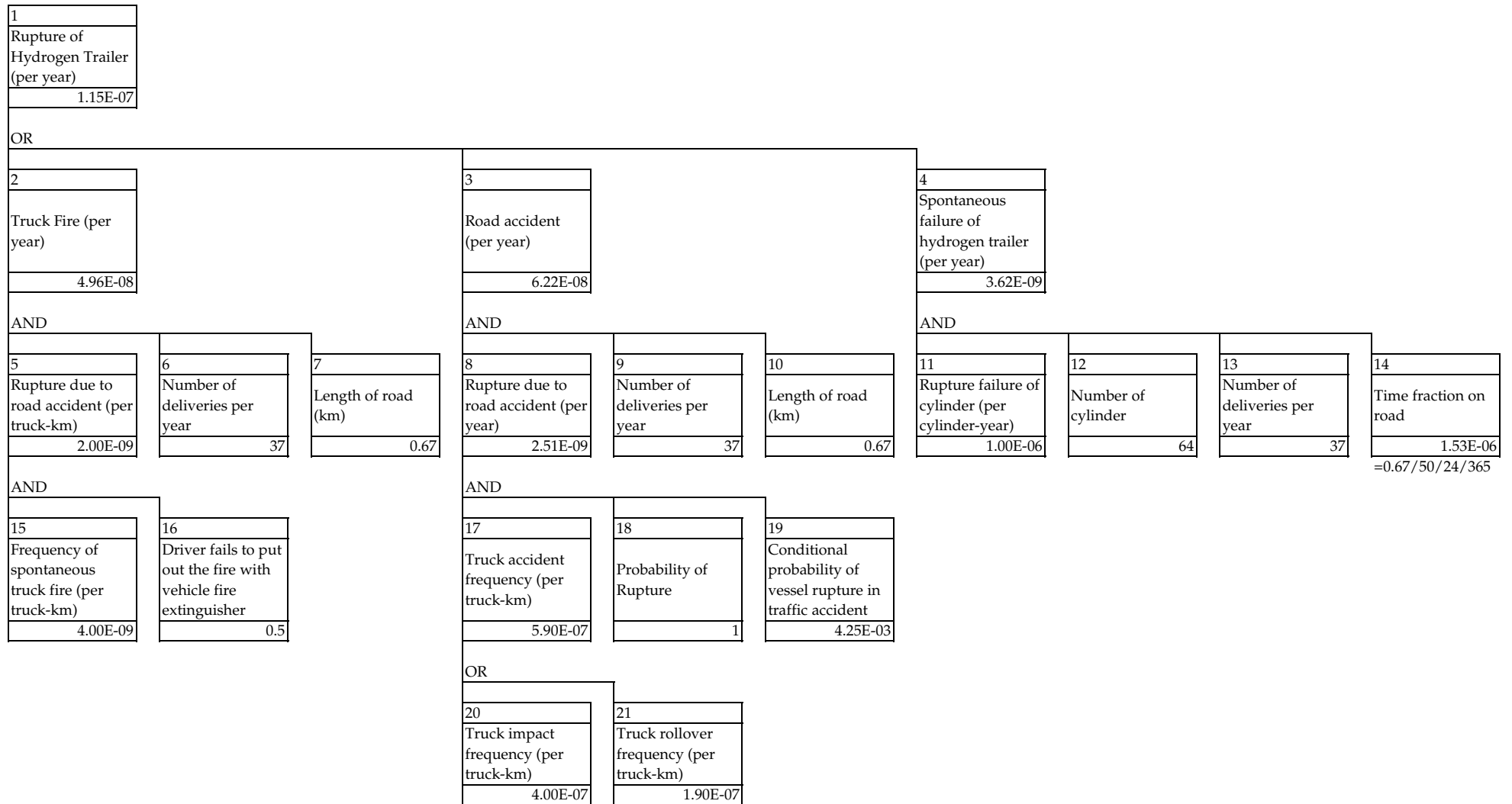
Fault Tree for Hydrogen Trailer Large Leak (onsite)



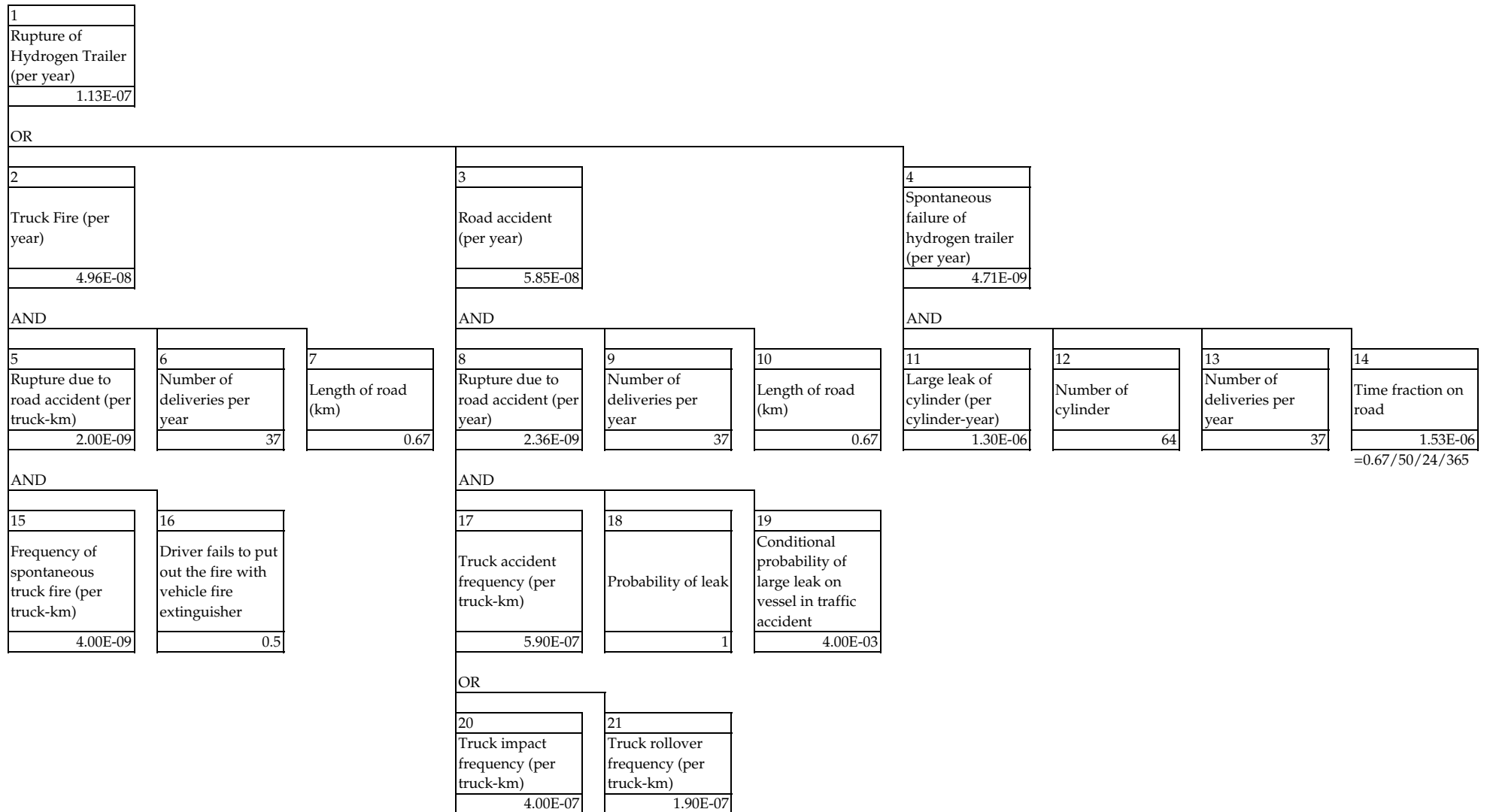
Fault Tree for Hydrogen Trailer Small Leak (onsite)



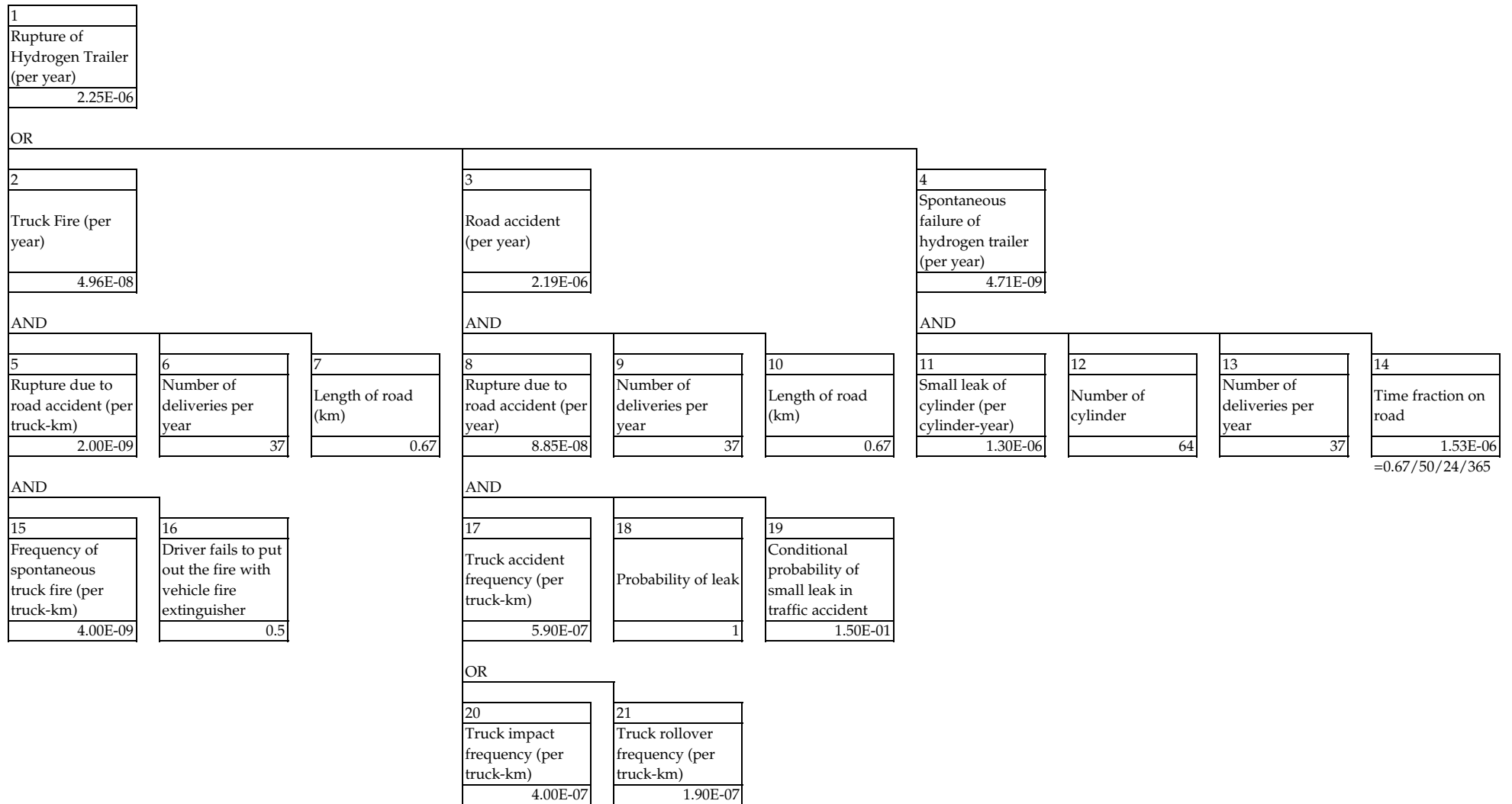
Fault Tree for Hydrogen Trailer Rupture Failure (offsite)



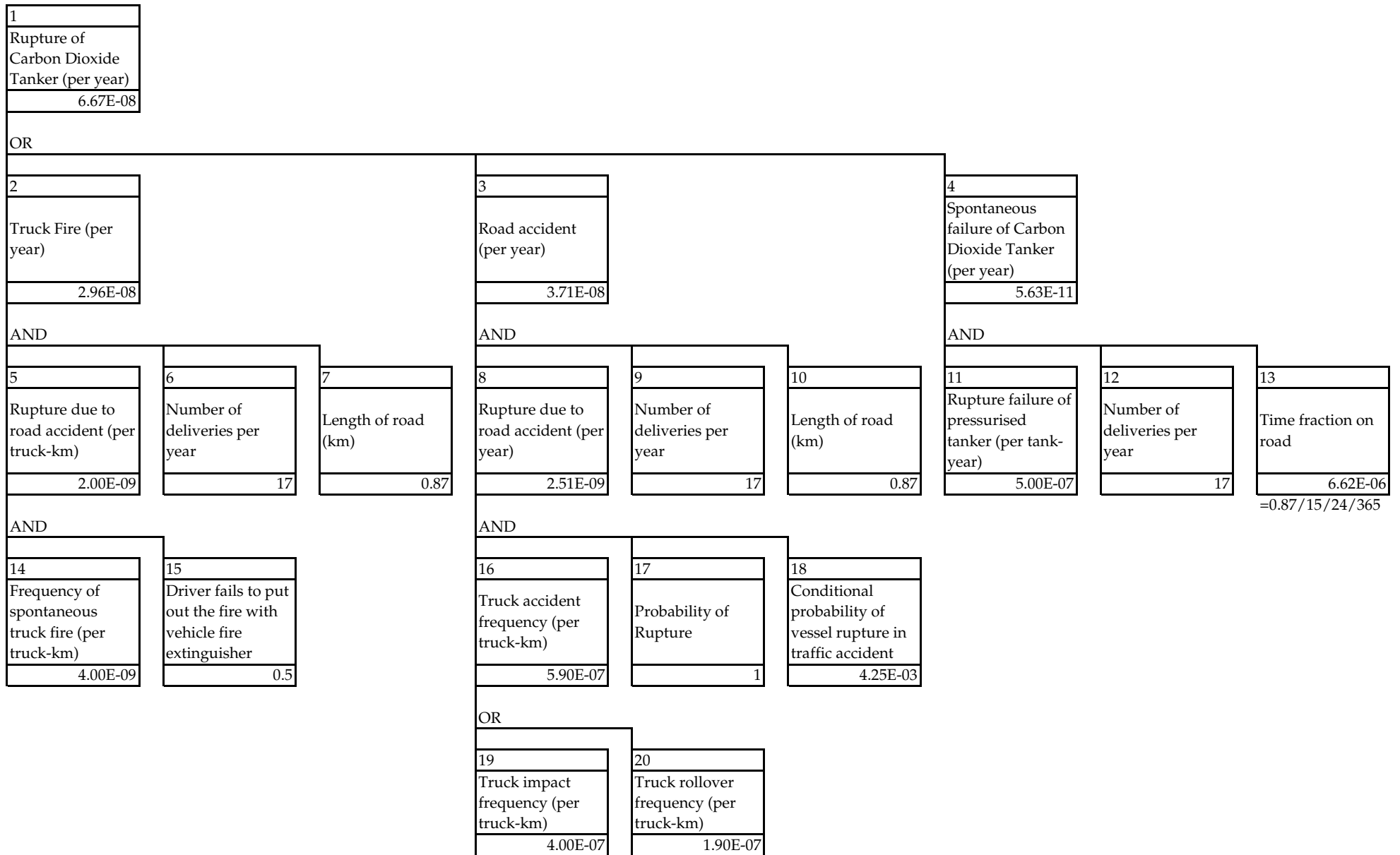
Fault Tree for Hydrogen Trailer Large Leak (offsite)



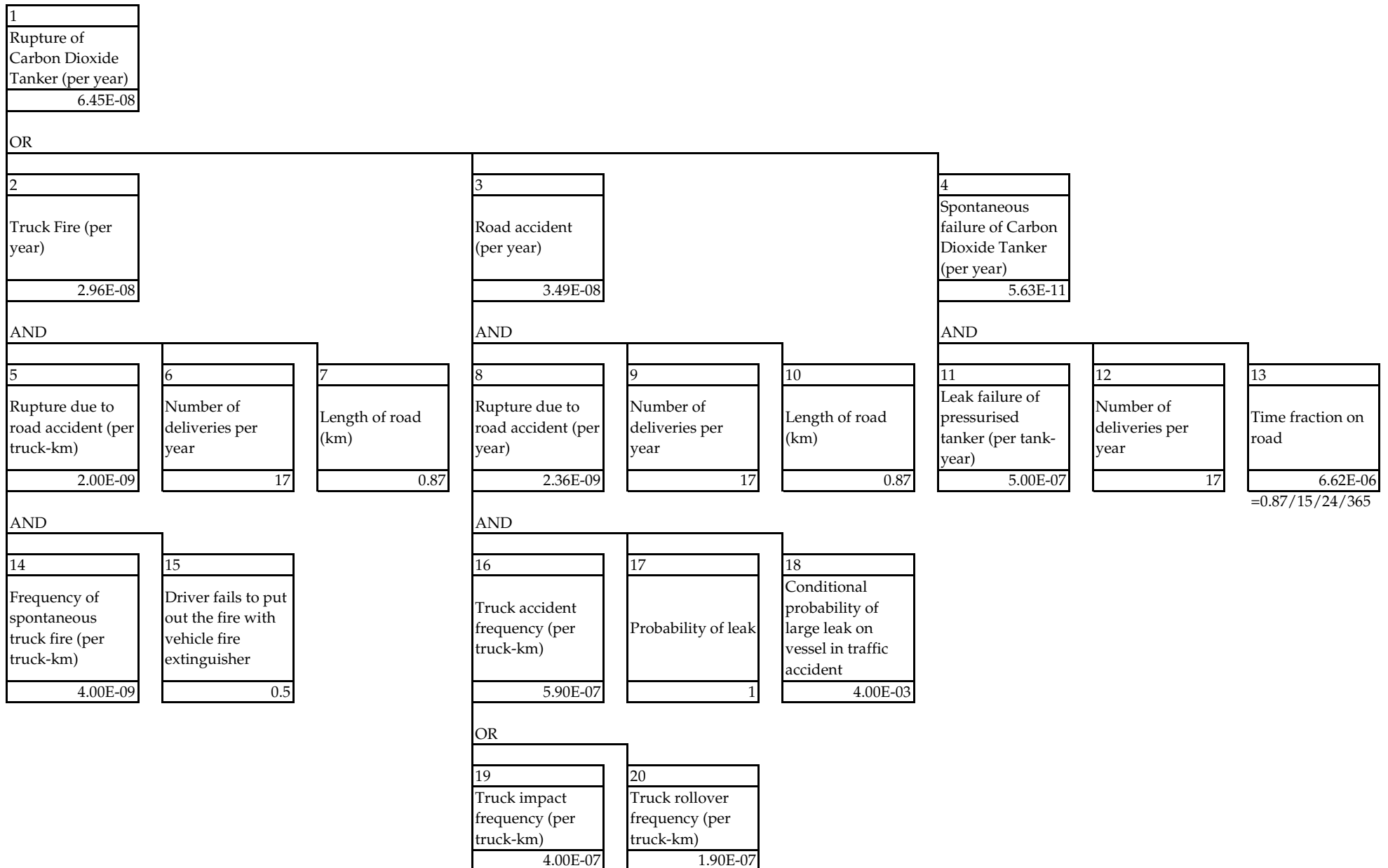
Fault Tree for Hydrogen Trailer Small Leak (offsite)



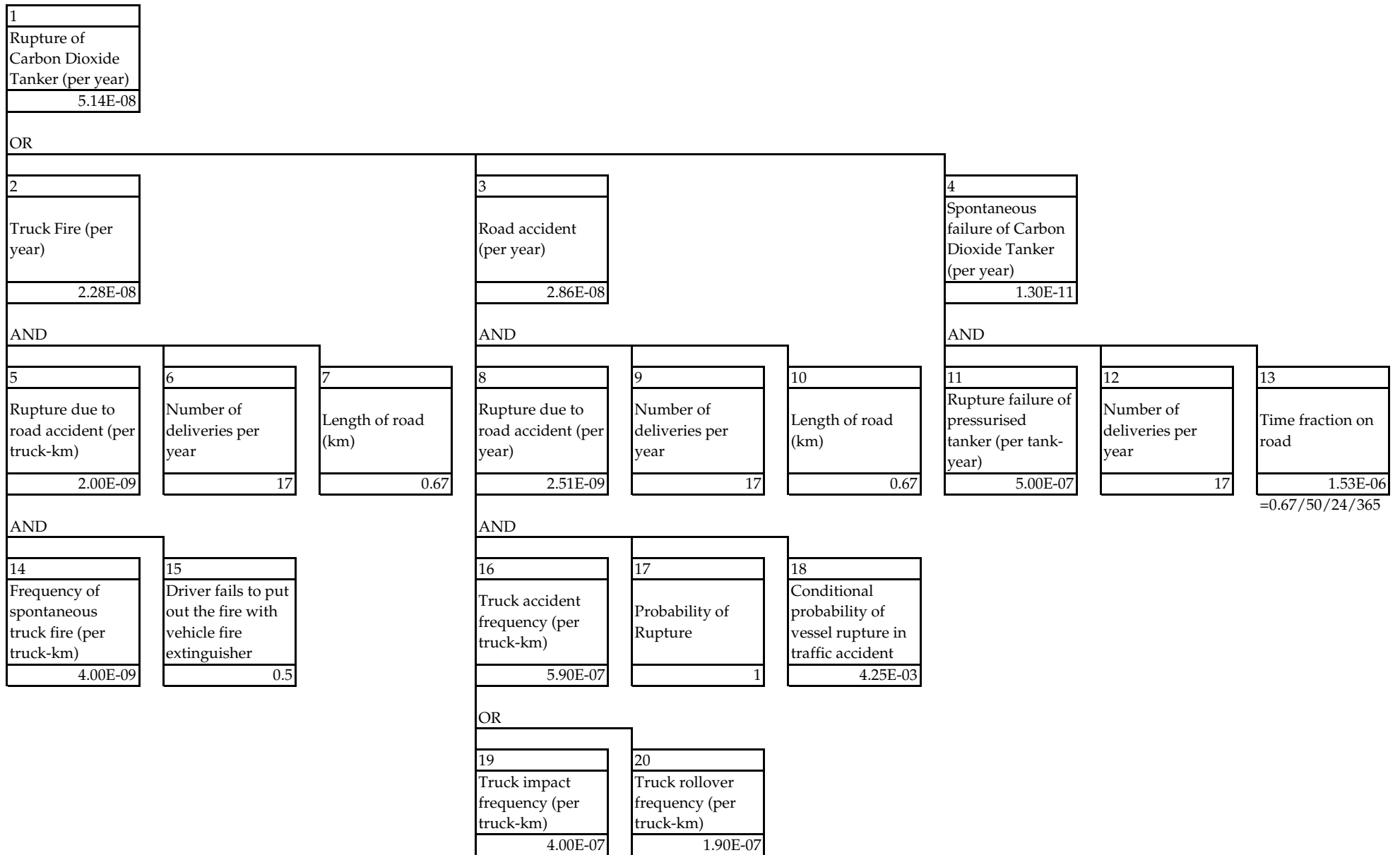
Fault Tree for Carbon Dioxide Tanker Rupture Failure (onsite)



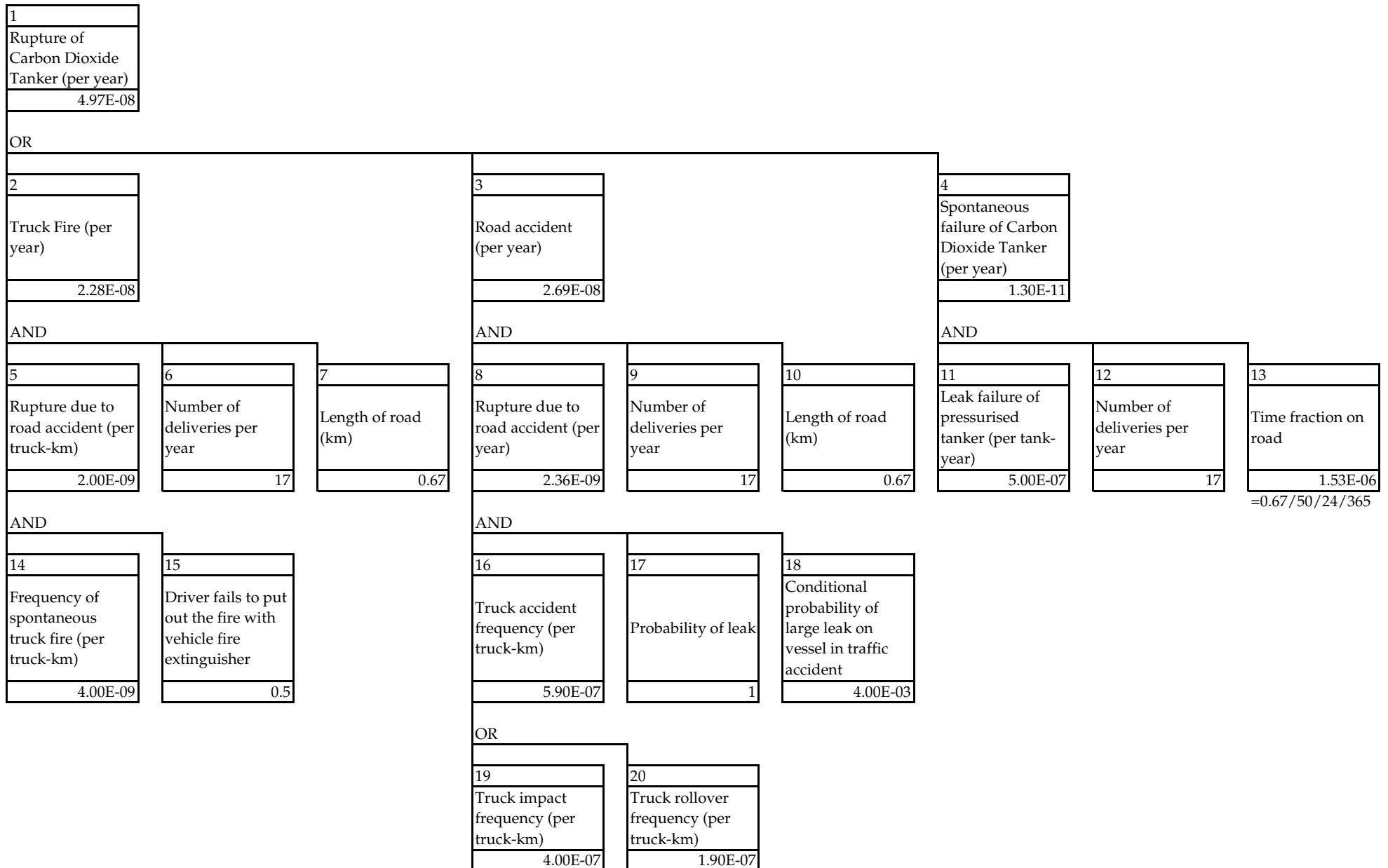
Fault Tree for Carbon Dioxide Tanker Leak (onsite)



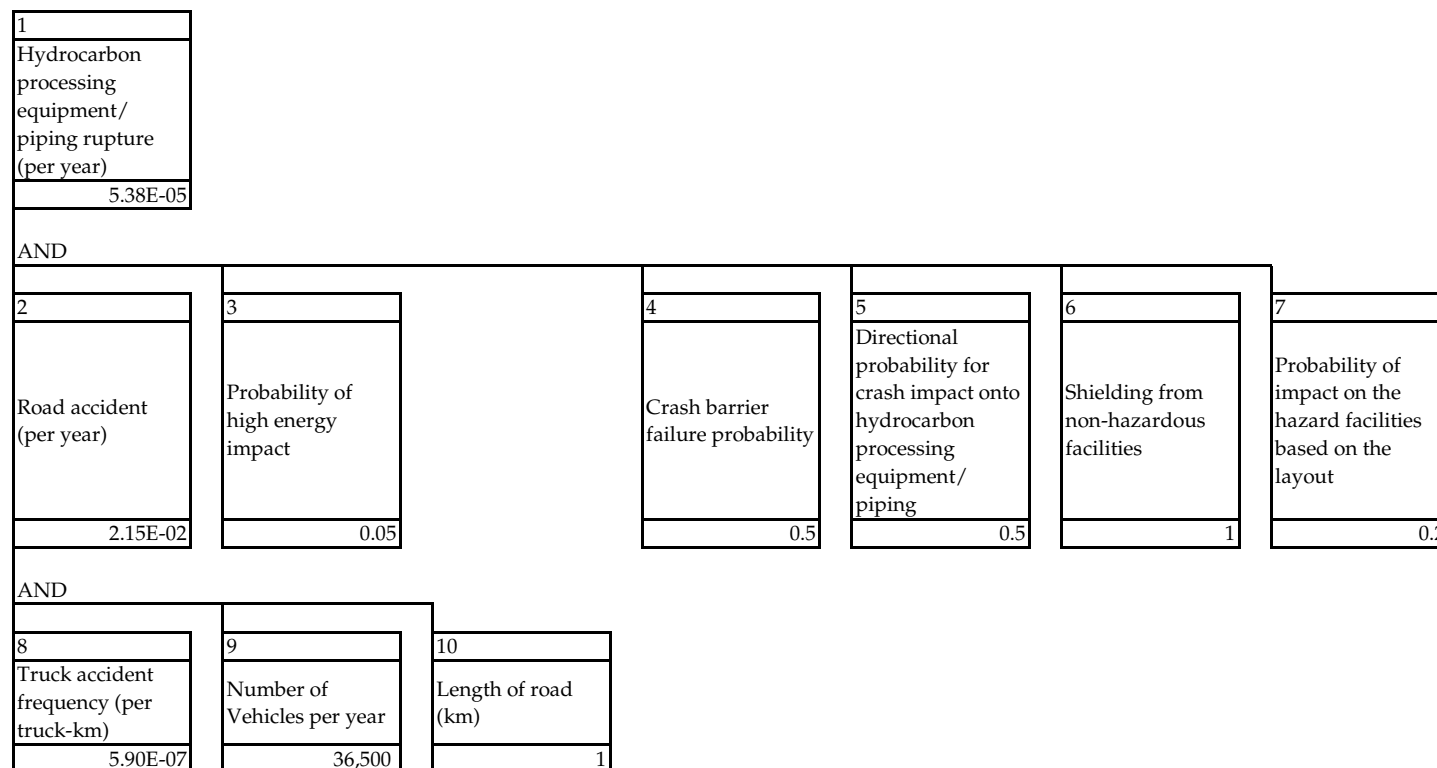
Fault Tree for Carbon Dioxide Tanker Rupture Failure (offsite)



Fault Tree for Carbon Dioxide Tanker Leak (offsite)



Fault Tree for Construction Vehicles Impact on Hazardous Facilities for Construction of 1st CCGT Unit



Note:

Item 1: Construction vehicles impact frequency has been added to those potentially impacted hazardous sections in the vicinity of the Project Site during the construction phase.

Item 3: Probability of high energy impact is 5% based on the UK (P A Davies & F P Lees, The assessment of major hazards: The road transport environment for conveyance of hazardous materials in Great Britain, Journal of Hazardous Materials, 32 (1992) 41-79) which assess the ratio of fatal incidents to non fatal accidents. The range was roughly estimated at 2%-5% for roads with speed limits lower than 40 mph. As a conservative approach, a 5% probability of high energy impact is adopted in this QRA study.

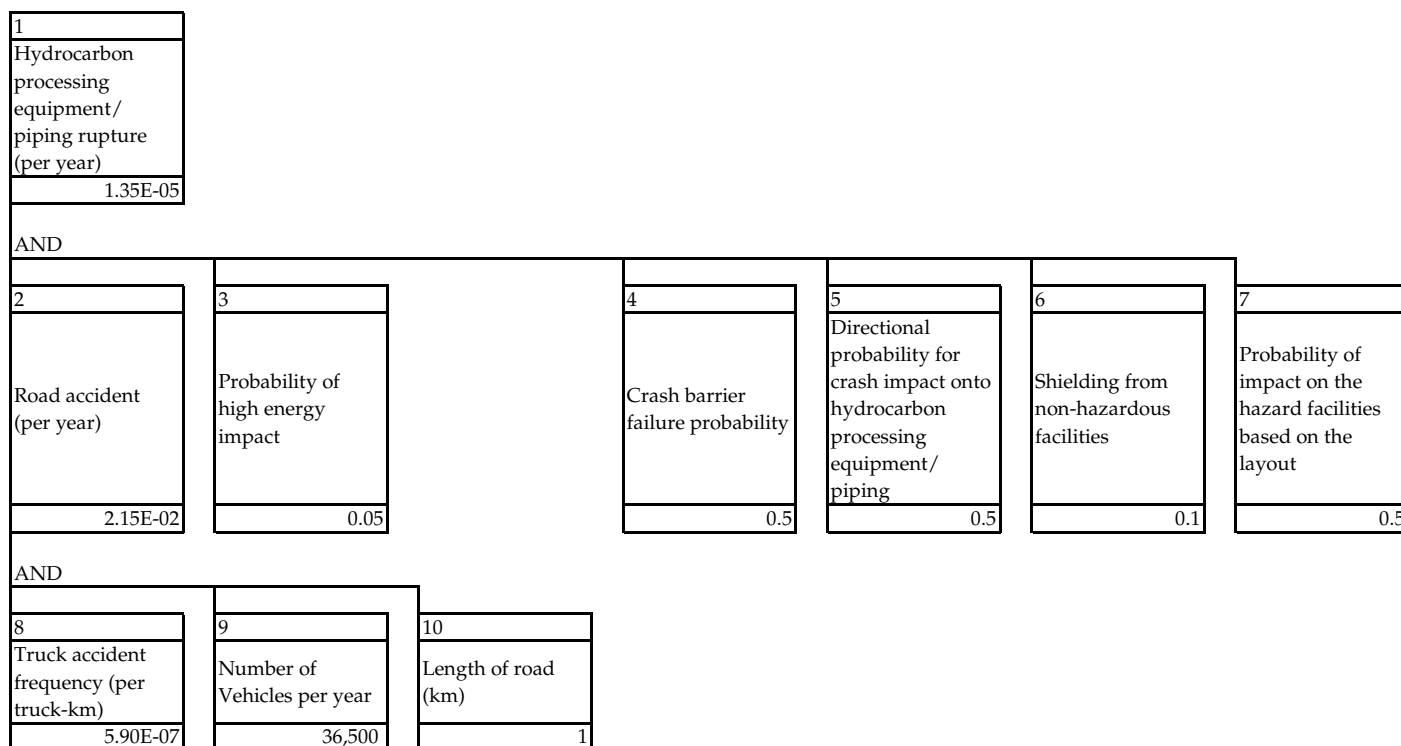
Item 4: Crash barrier between the construction site and the distillate oil facilities during 1st CCGT unit construction phase gives protection on the impact. 50% failure probability is conservatively taken to account for dependencies with Item 3 in this QRA study.

Item 5: Directional probability for crash impact onto hydrocarbon processing equipment/ piping is taken at 0.5 as the truck accident could occur when the truck moves away from the hazardous facilities. Assumed route for construction vehicles is to enter Project Site via Western Road.

Item 6: Shielding effect from non-hazardous facilities factor is conservatively taken as 1 even though there are some obstacles in front of the distillate oil pumping house during the construction of the 1st CCGT unit.

Item 7: Probability of impact on the hazard facilities based on the layout is 0.2 as the accident interaction distance is about one fifth of the access road length for construction vehicles.

Fault Tree for Construction Vehicles Impact on Hazardous Facilities for Construction of 2nd CCGT Unit



Note:

Item 1: Construction vehicles impact frequency has been added to those potentially impacted hazardous sections in the vicinity of the Project Site during the construction phase.

Item 3: Probability of high energy impact is 5% based on the UK (P A Davies & F P Lees, The assessment of major hazards: The road transport environment for conveyance of hazardous materials in Great Britain, Journal of Hazardous Materials, 32 (1992) 41-79) which assess the ratio of fatal incidents to non fatal accidents. The range was roughly estimated at 2%-5% for roads with speed limits lower than 40 mph. As a conservative approach, a 5% probability of high energy impact is adopted in this QRA study.

Item 4: Crash barrier between the construction site and the operating 1st CCGT unit facilities during 2nd CCGT unit construction phase gives protection on the vehicle crash impact. A 50% failure probability is conservatively taken to account for dependencies with Item 3 in this QRA study.

Item 5: Directional probability for crash impact onto the operating hazardous facilities of the 1st CCGT unit is taken at 0.5 as the truck accident could occur when the truck moves away from the hazardous facilities. Assumed route for construction vehicles is to enter Project Site via Western Road.

Item 6: During the construction of the 2nd CCGT unit, the operating hazardous facilities of the 1st CCGT unit are separated from the construction activities by non-hazardous facilities such as steam turbine building, air intake structure, etc. Therefore, shielding effect from non-hazardous facilities factor is conservatively taken as 0.1 to account that the hazardous process equipment/ piping is shielded by non-hazardous building and structure.

Item 7: Probability impact on the hazard facilities based on the layout is 0.5 as the accident interaction distance is about half of the access road length for construction vehicles.