

Annex 8B

## Details of Risk Calculations

Table B1a: Site Specific Input Data, Tai Po Road WTW Base Case

Works/Phase	Tai Po Road
Storage capacity (full) (tonnes)	4.00E+00
Annual consumption (tonnes)	4.67E+01
Tonnes/delivery	1.30E+00
Deliveries/year	3.60E+01
Scrubber capacity (tonnes)	0.00E+00
Type of container (tonnes)	1.00E+00
Number of cylinders/year	0.00E+00
Average number of cylinders in store	0.00E+00
Average number of drums/year	4.67E+01
Number of drums in store	4.00E+00
Volume of store (m3)	1.00E+02
Frequency of aircrash (/yr)	4.94E-09
Ratio volume:mass (m3/kg)	1.00E-01
Pressure pulse (mbar)	4.50E+02
Probability of containment lost	1.00E+00
Frequency of subsidence (/yr)	1.00E-06
Likelihood of release from accident positioning to unload	1.00E-02
Time spent by loaded truck outside or with store doors open (hours)	7.50E-01
Truck crane lifts per delivery	1.30E+00
Average store crane lifts per delivery in open	0.00E+00
Average store crane lifts per year in store	4.67E+01
Length of road outside store (km)	8.00E-01
Speed limit on site (km/hr)	8.00E+00
Probability of other vehicles being in vicinity on site when chlorine truck is present	3.29E-03
Valve left open (per operation)	5.00E-05
Valve left closed (per operation)	5.00E-05
Failure to identify poor connection	5.00E-01
Likelihood of poor connection (per operation)	5.00E-05
Likelihood of fire causing release	1.00E-04
Length of Pipework (m)	2.00E+00
Standby container empty and not changed	1.00E+00
Fault on low pressure alarm switch	1.00E-04
Autochangeover left in manual	1.00E+00
Changeover factor	0.00E+00
Valves per container	2.00E+00

Table B1b: Site Specific Input Data for Shek Lei Pui

Works/Phase	Shek Lei Pui
Storage capacity (full) (tonnes)	9.00E+00
Annual consumption (tonnes)	1.11E+02
Average Tonnes/delivery	1.85E+00
Average Deliveries/year	6.00E+01
Scrubber capacity (tonnes)	0.00E+00
Type of container (tonnes)	1.00E+00
number of cylinders/year	0.00E+00
number of cylinders in store	0.00E+00
number of drums/year	1.11E+02
number of drums in store	9.00E+00
Volume of store (m3)	2.00E+02
Frequency of aircrash (/yr)	8.05E-09
Ratio volume:mass (m3/kg)	2.00E-01
Pressure pulse (mbar)	1.50E+02
Probability of containment lost	0.00E+00
Frequency of subsidence (/yr)	1.00E-06
Likelihood of release from accident positioning to unload	1.00E-02
Time spent by loaded truck outside or with store doors open (hours)	2.00E+00
Truck crane lifts per delivery	1.85E+00
Store crane lifts per delivery in open	0.00E+00
Store crane lifts per year in store	1.11E+02
Length of road outside store (km)	1.80E+00
Speed Limit on site (km/hr)	2.40E+01
Probability of other vehicles being in vicinity on site when chlorine truck is present	8.77E-03
Valve left open (per operation)	5.00E-05
Valve left closed (per operation)	5.00E-05
Failure to identify poor connection	5.00E-01
Likelihood of poor connection (per operation)	5.00E-05
Likelihood of fire causing release	1.00E-04
Length of Pipework	1.50E+01
Standby container empty and not changed	1.00E-04
Fault on low pressure alarm switch	1.00E-04
Autochangeover left in manual	1.00E-01
Changeover factor	1.00E+00
Valves per container	2.00E+00

Table B1c: 1tonne Release Case Input Data, Eastern WTW Base Case

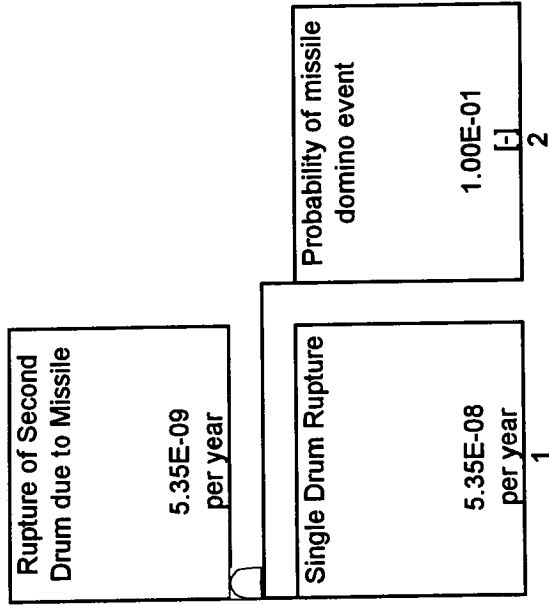
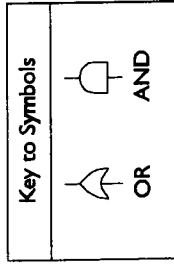
1 tonne drums Failures at Store	1 container			2nd container			All containers in store			All containers on truck			Likelihood	Units	Proportion of accidents	Leak probability given accident				
	Small	Large	Rupture	Small	Large	Rupture	Large	Large	Rupture	Large	Large	Checksum								
Aircrash	0	0	0	0	0	0	0	0	0	0	0	1	site specific							
Earthquake	0.4	0.39	0.1	0	0.1	0.01	0	0	0	0	0	1	1.00E-05 /yr							
Subsidence	0.5	0.5	0	0	0	0	0	0	0	0	0	1	site specific							
Driveway	0.9	0.09	0.01	0	0	0	0	0	0	0	0	1	2.00E-05 /operation							
Dropped drum	0.9899	0.01	0.0001	0	0	0	0	0	0	0	0	1	1.00E-06 /lift							
Spontaneous	0.54	0.42	0.04	0	0	0	0	0	0	0	0	1	6.50E-05 /yr							
Positioning to unload	0.69	0.30	0.01	0	0	0	0	0	0	0	0	1	2.00E-05 /operation							
Crushed at rear	1	0	0	0	0	0	0	0	0	0	0	1	1.12E-05 /truck km							
Crushed at side	0	0	0	0	0	0	0	0	0	0	0	1	1.12E-05 /truck km							
Spontaneous Truck Fire	0	0	0	0	0	0	0	0	0	0	0	1	1.12E-05 /truck km							
Missile domino event	0	0	0	0	0	0	0	0	0	0	0	1	4.00E-09 /truck km							
Tree Reference	E1SLL	E1TLL	E1TR	E1TD	E1TALL	E1TR	E1TAR	E1TALL	E1TALL	E1TALL	E1TALL	1	Total rupture freq.							
Failures on Road																				
Load shedding	0	0.9	0	0	0	0	0	0	0	0	0	1	1.12E-05 /truck km							
Roll over	0.69	0.30	0.01	0	0	0	0	0	0	0	0	1	1.12E-05 /truck km						c.f. ref [12] which used 0.13 and 0.59	
Vehicle fire	0	1	0	0	0	0	0	0	0	0	0	1	1.12E-05 /truck km							
Tanker fire	0	0	0	0	0	0	0	0	0	0	0	1	1.12E-05 /truck km						assume 20%	
Crushed at rear	1	0	0	0	0	0	0	0	0	0	0	1	1.12E-05 /truck km						site specific = proportion of onsite vehicles which are tankers = 0	
Crushed at side	1	0	0	0	0	0	0	0	0	0	0	1	1.12E-05 /truck km						same ratio 0.370968	
Spontaneous Truck Fire	0	0	0	0	0	0	0	0	0	0	0	1	1.12E-05 /truck km						same ratio 0.629032	
Spontaneous	0.54	0.42	0.04	0	0	0	0	0	0	0	0	1	4.00E-09 /truck km							
Missile domino event	0	0	0	0	0	0	0	0	0	0	0	1	6.50E-05 /yr							
Tree Reference	R1TSL	R1TLL	R1TR	R1TD	R1TALL	R1TR	R1TAR	R1TALL	R1TALL	R1TALL	R1TALL	1	Total rupture freq.							
Internal Failure Cases																				
	1 container			2nd container			All containers in store			All containers on truck			Likelihood	Units	Proportion of accidents	Leak probability given				
	Small	Large	Rupture	Small	Large	Rupture	Small	Large	Small	Large	Isolatable Gas	Isolatable Gas								
Container Spontaneous	0.54	0.42	0.04	0	0	0	0	0	0	0	0	0	6.50E-05 /yr							
Dropped drum	0.9899	0.01	0.0001	0	0	0	0	0	0	0	0	1	1.00E-06 /lift						Assume to include OA deviations (NC13, corrosion, overflow, water etc)	
Pipework Spontaneous	0	0	0	0	0	0	0	0	0	0	0	1	5.30E-05 per metre							
Pigtail Spontaneous	0	0	0	0	0	0	0	0	0	0	0	1	5.00E-05 per conn							
Failure to identify faulty connection	0	0	0	0	0	0	0	0	0	0	0	1	site specific							
Failure to tighten	0	0	0	0	0	0	0	0	0	0	0	1	site specific							
Isolation Error	0	0	0	0	0	0	0	0	0	0	0	1	site specific							
Failure to identify Faulty Valve	0	0	0	0	0	0	0	0	0	0	0	1	5.00E-05 per drum						use to calibrate	
Fire	0	0.9	0	0	0	0	0	0.1	0	0	0	1	6.00E-04						Site specific	
severe corrosion due to low pressure alarm fails	0	0	0	0	0	0	0	0	0	0	0	1	1.00E-04							
Domino Event	0	0	0	0	0	0	0	0	0	0	0	1								
	IU1TSL	IU1TLL	IU1TR	IU1TD	IU1TALL	IU1TR	IU1TAR	IU1TALL	IU1TALL	IU1TALL	IU1TALL	1								10% of rupture frequency







**Event: Rupture of Second Drum due to Missile External Release - On Road**

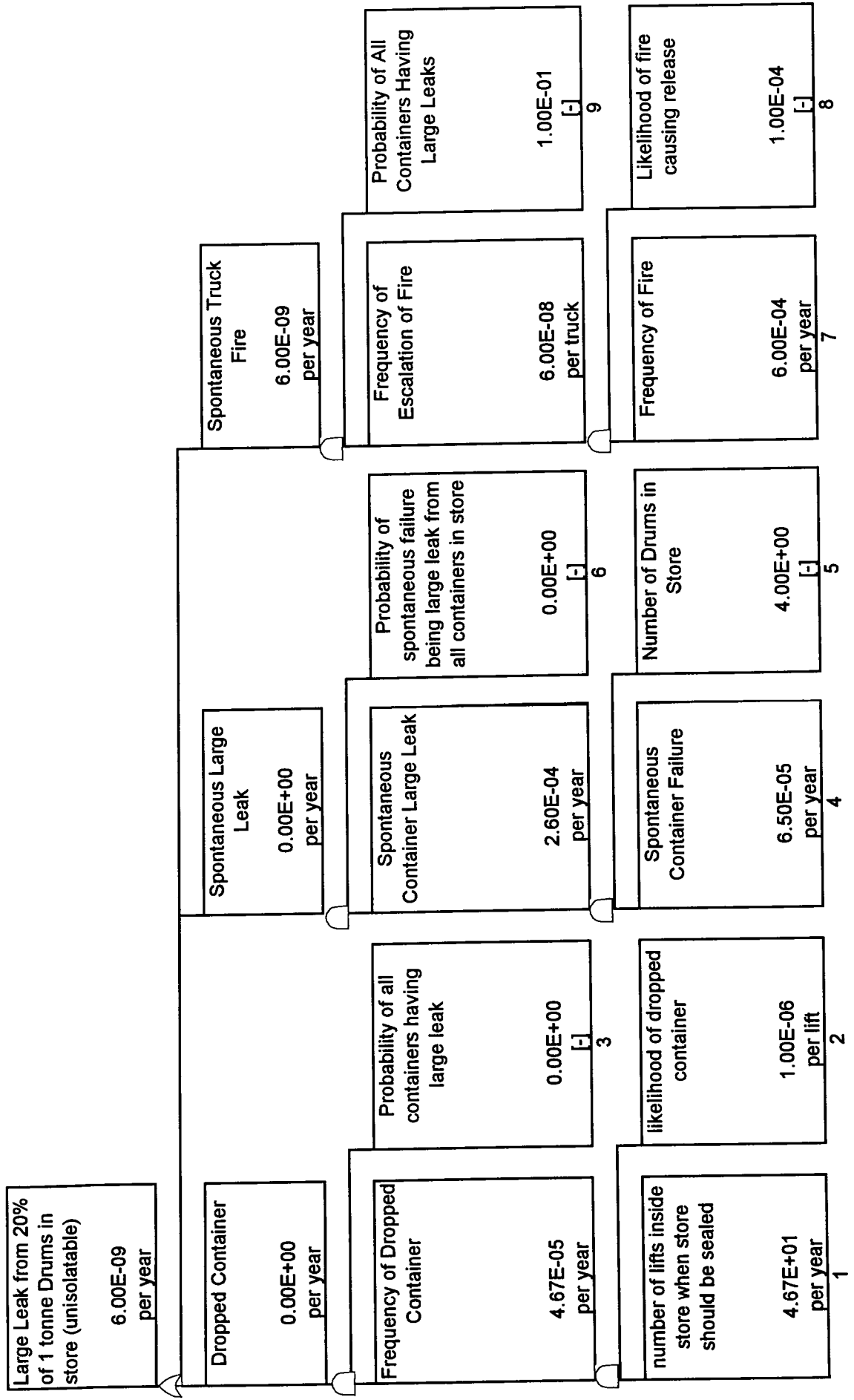




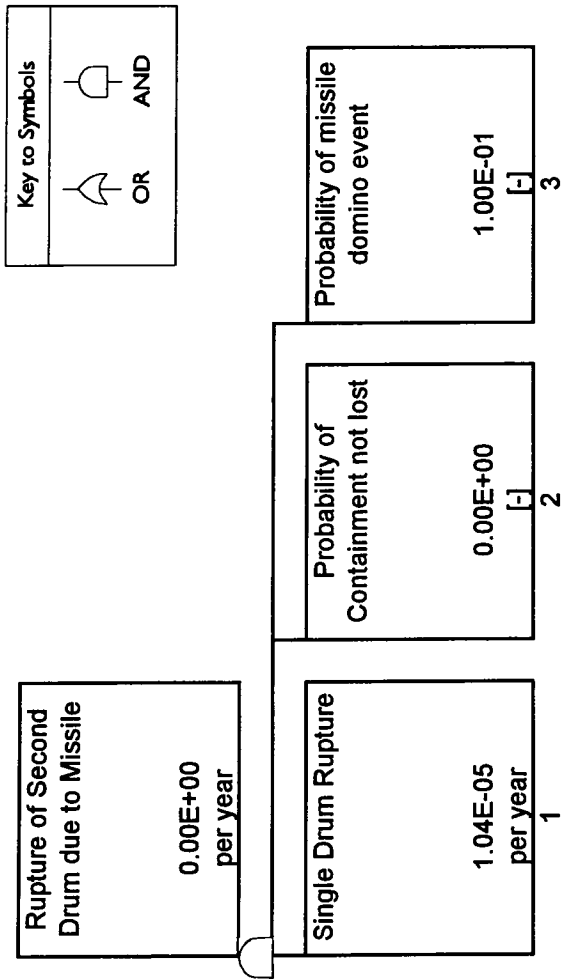




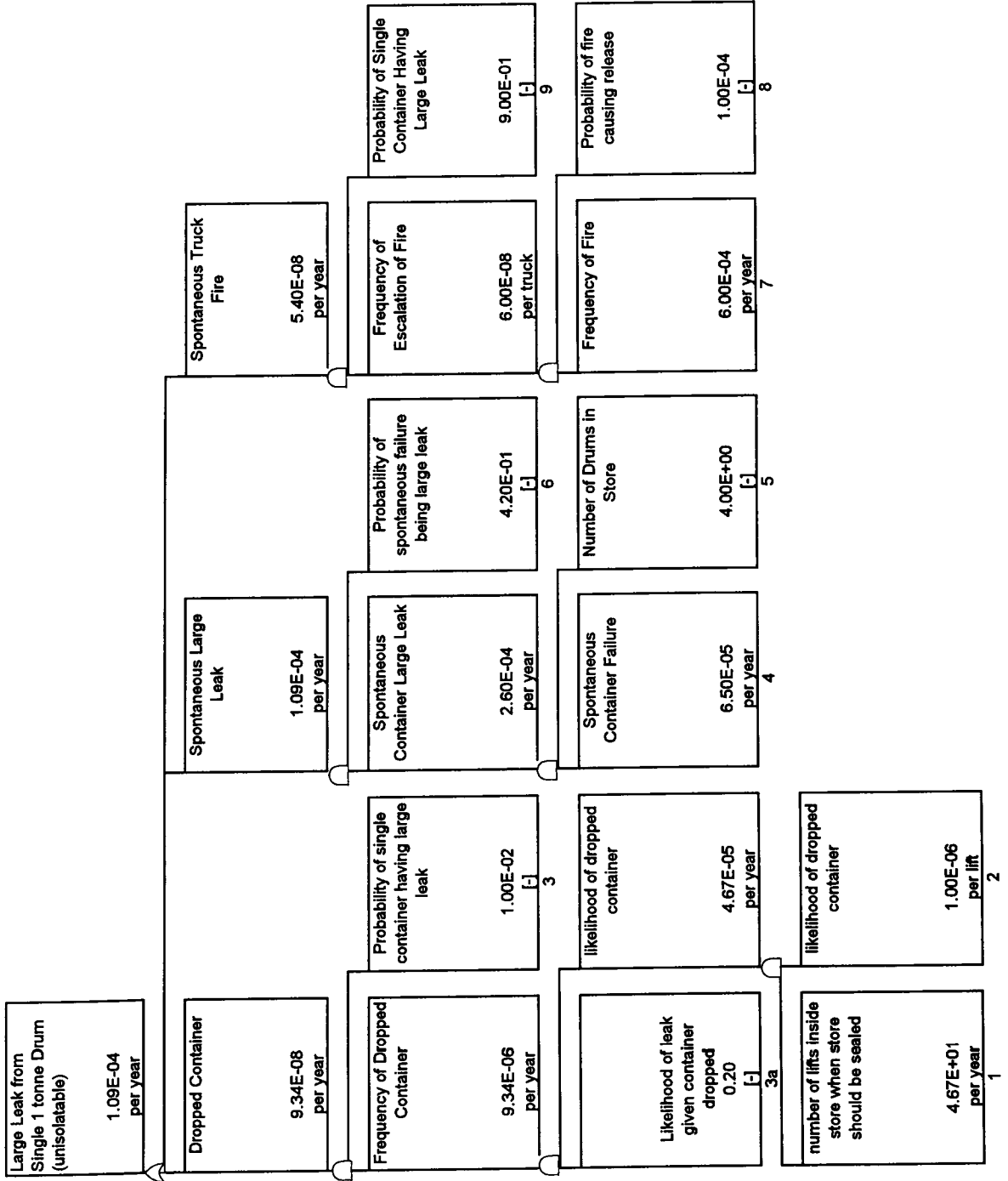
**Event:** Large Leak from 20% of 1 tonne Drums in store (unisolatable)  
Internal Release



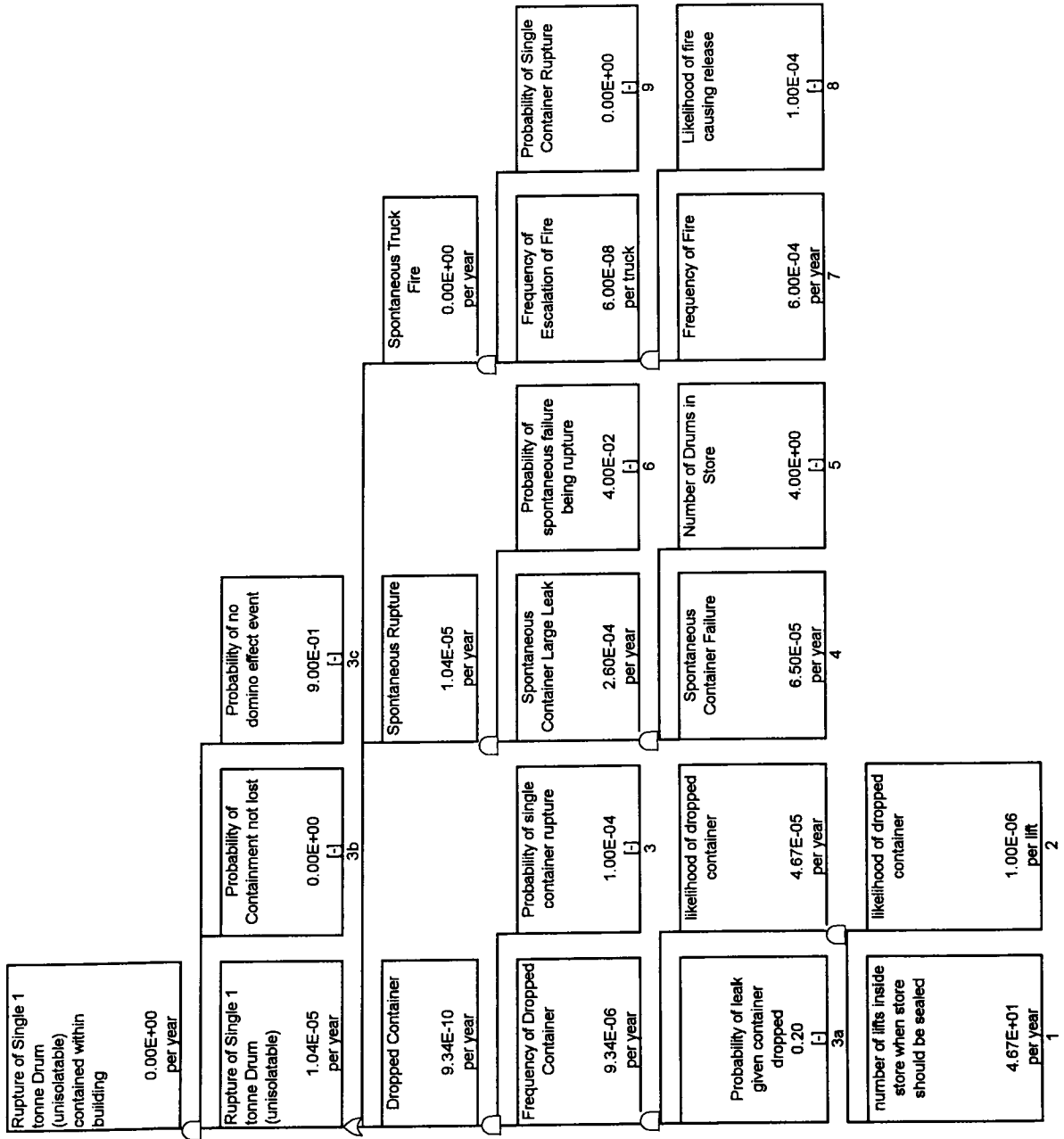
**Event: Rupture of Second Drum due to Missile Internal Release**



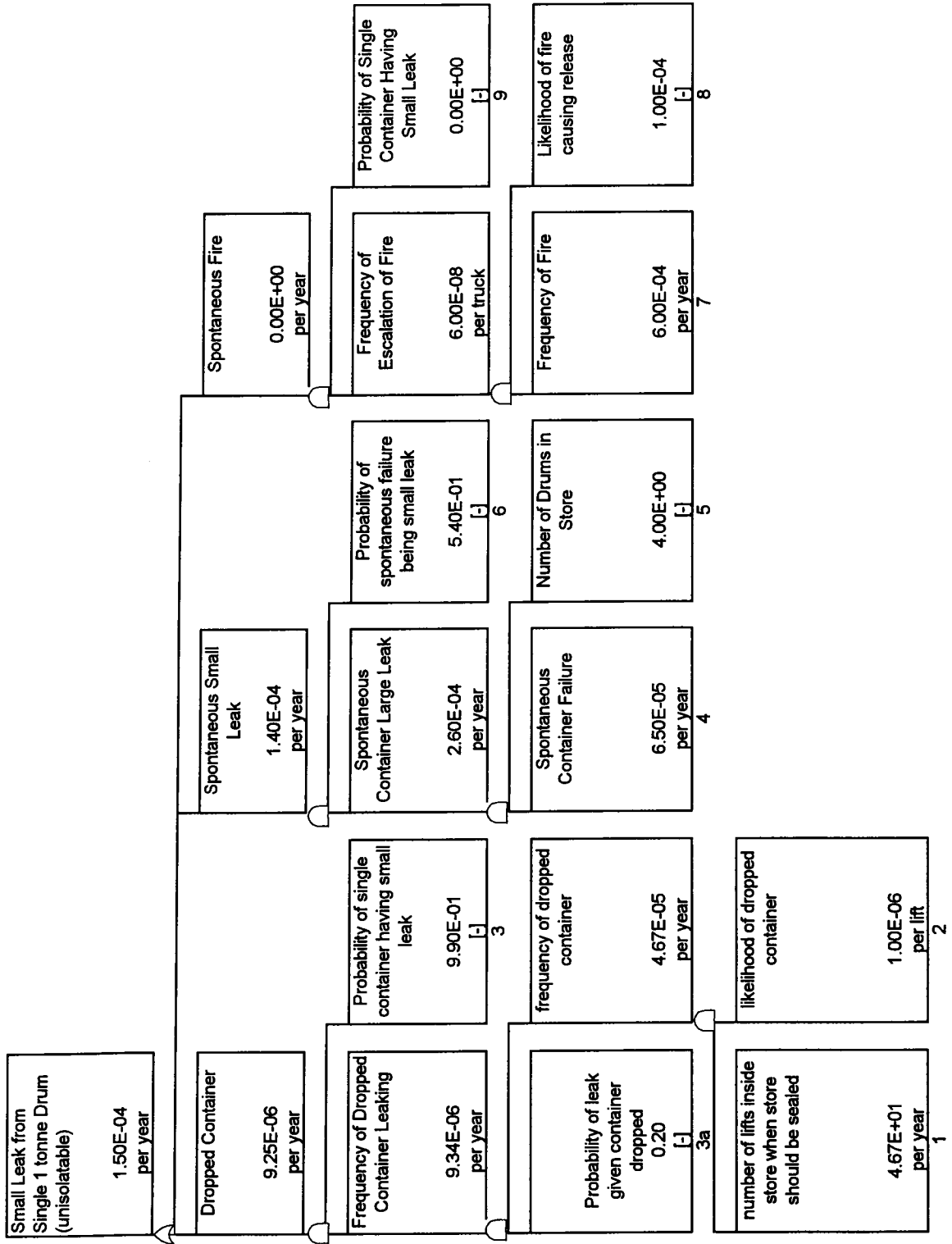
**Event: Large Leak from Single 1 tonne Drum (unisolatable)  
Internal Release**



**Event: Rupture of Single 1 tonne Drum (unisolatable)  
Internal Release**



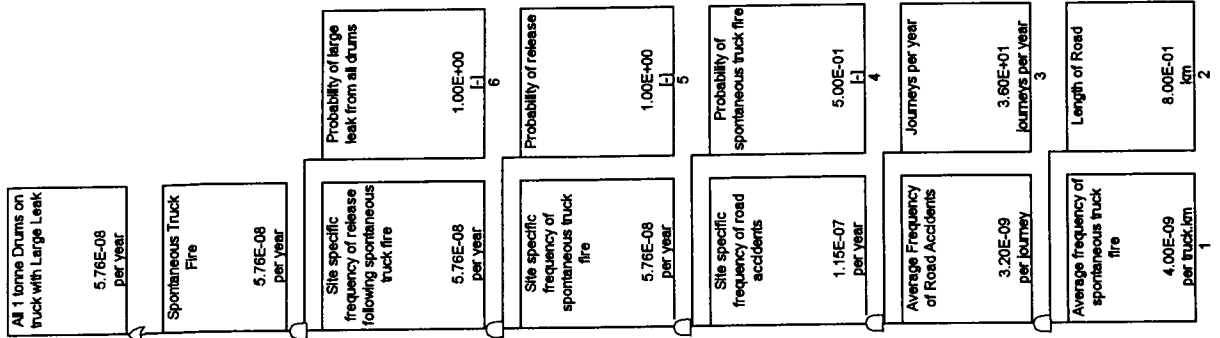
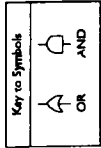
**Event: Small Leak from Single 1 tonne Drum (unisolatable)  
Internal Release**







**Event: All 1 tonne Drums on truck with Large Leak External Release - Stationary at store**



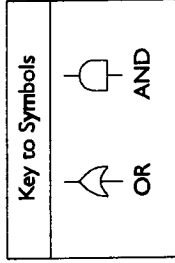


**Event: Rupture of Second Drum due to Missile External Release**

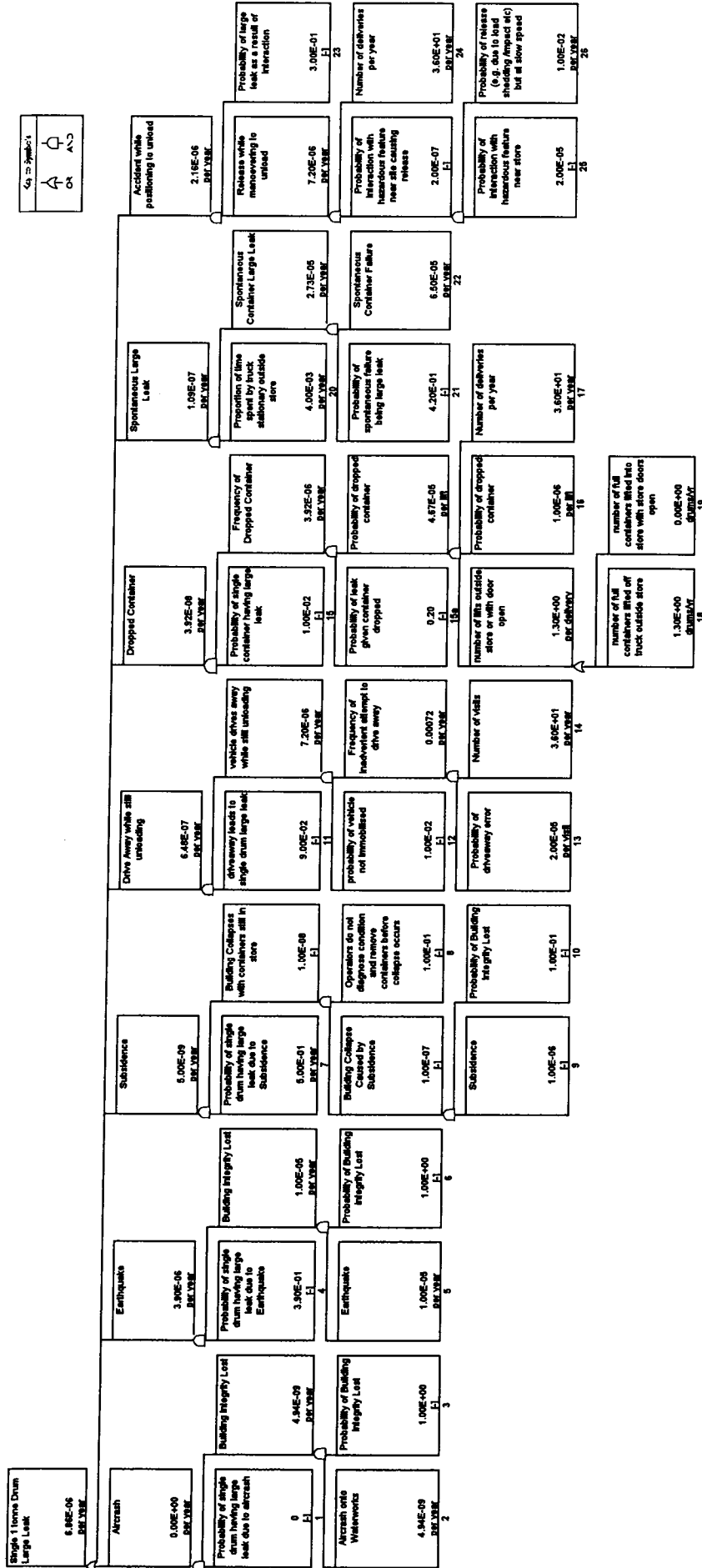
Rupture of Second Drum due to Missile  
 1.16E-06  
 per year

Single Drum Rupture  
 1.16E-05  
 per year  
 1

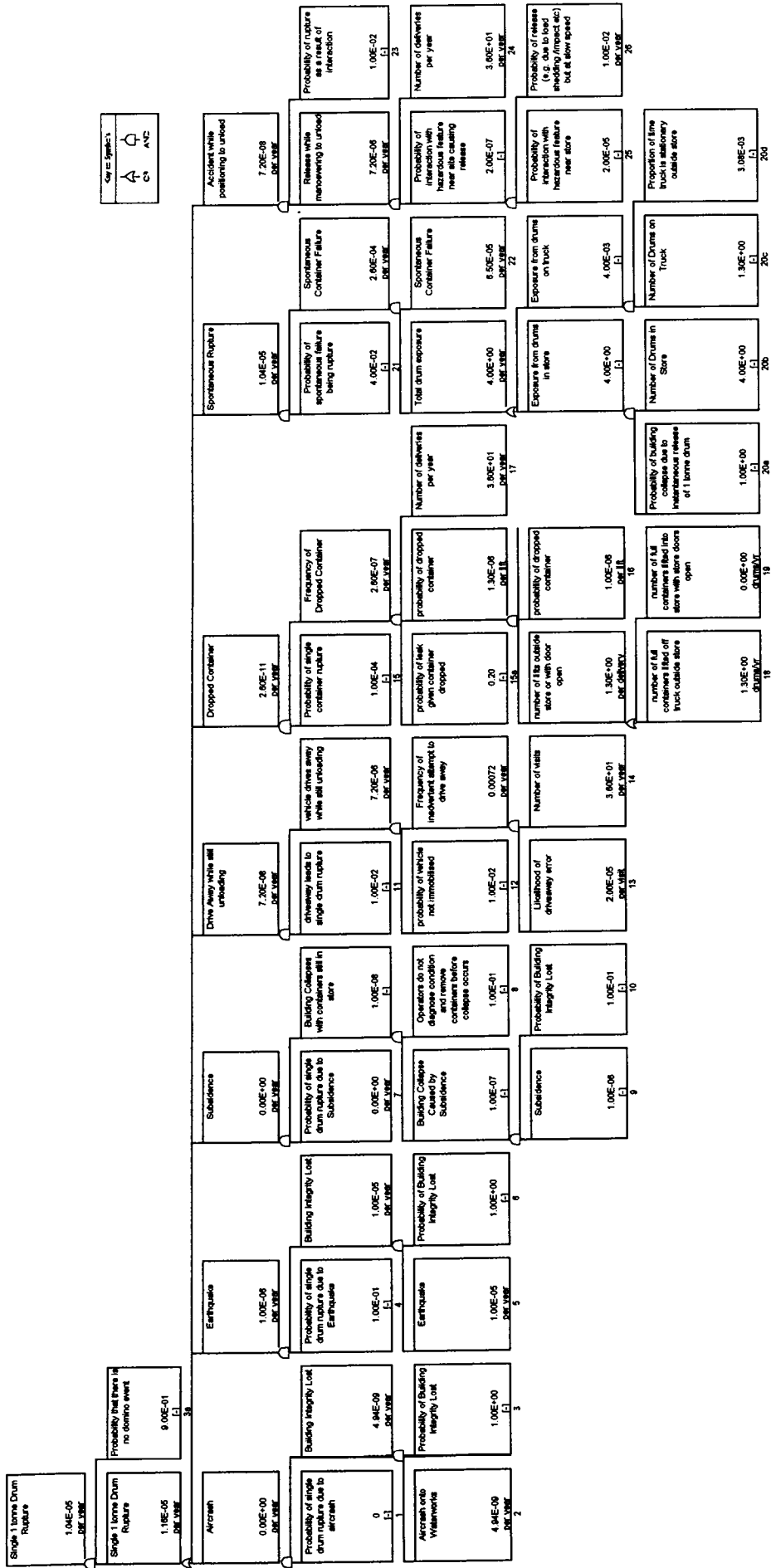
Probability of missile domino event  
 1.00E-01  
 [ ]  
 2



Event: Single 1 tonne Drum Large Leak  
External Release - On Truck or Storage with building damage



Event: Single 1 tonne Drum Rupture  
External Release - On Truck or Storage with building damage



Event: Large Leaks from all 1 tonne Drums in store  
External Release - On Truck or Storage with building damage

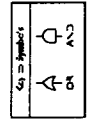
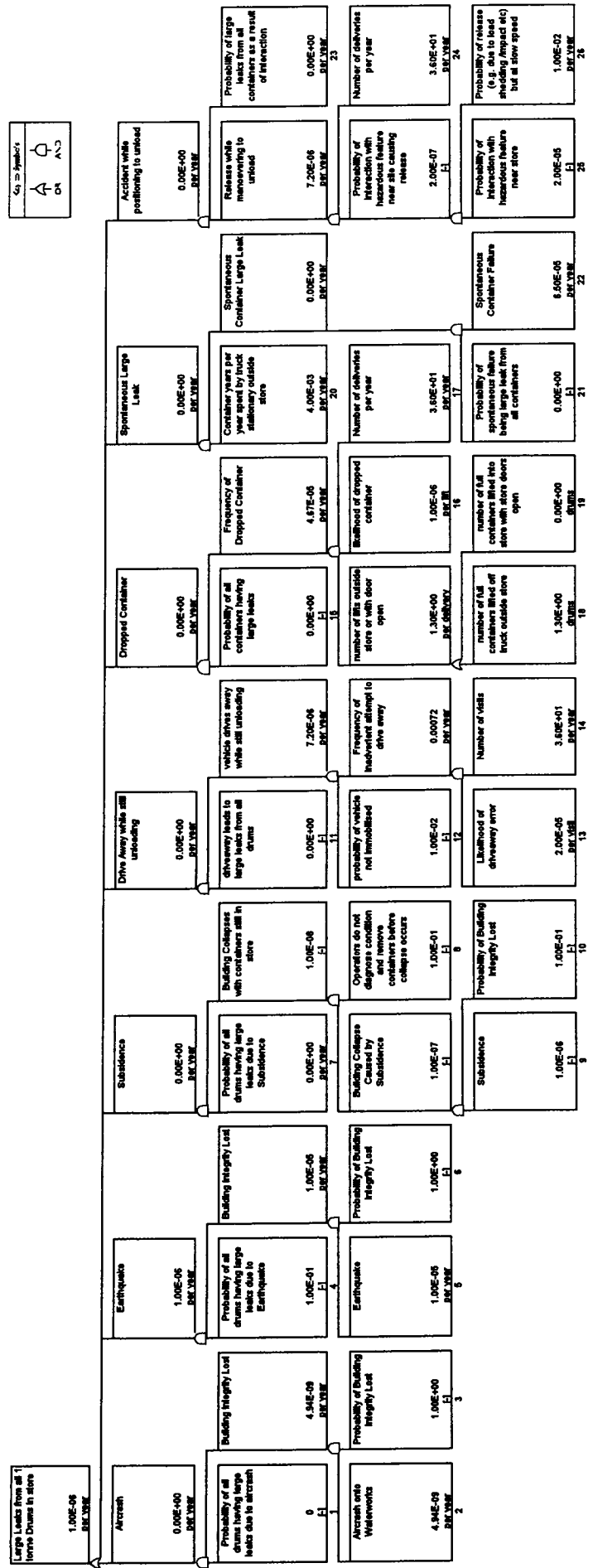


Table B2a: Failure Case Frequencies

Scenario No	Consequence No	Consequence	Failure Case	Initiating Event Frequency (per year)	Releasing Inventory	Hole Size (mm)	Phase	Isolation (mins)	Isolation Branching Probability	Drum Level	Half Full/ Full Branching Probability	Probability of event occurring before or after delivery of drums/ cylinders	Contain & Absorb	Factor	Cumulative Factor	Modified Event Frequency (million years)
1	4	IUTSL TPR 3.5e-10kgs 2610s	Internal 1to Small	1.50E-04	1 drum	6	Liquid	none	1	100%	100%	1	Forced ventilation by fan	2.99E-04	2.99E-04	0.0447
5	6	IUTLL TPR 1.3e0kgs 611s	Internal 1to Large	1.09E-04	1 drum	20	Liquid	none	1	100%	100%	1	Forced ventilation by fan	2.99E-04	2.99E-04	0.0327
9	12	IUTR TPR 1.3e0kgs 193s	Internal 1to Rupture	0.00E+00	1 drum	Rupture	Rupture	none	1	100%	100%	1	Forced ventilation by fan	2.99E-04	2.99E-04	0.0000
13	16	IHTSL TPR 2.6e-2kgs 372s	Internal 1to Small	1.04E-02	1 drum isolatable	6	Gas	3	0.74	100%	33%	1	Forced ventilation by fan	2.99E-04	7.29E-05	0.7588
17	20	IHTSL TPR 5.2e-2kgs 792s	Internal 1to Small	1.04E-02	1 drum isolatable	6	Gas	10	0.25	100%	33%	1	Forced ventilation by fan	2.99E-04	2.48E-05	0.2584
21	24	IHTSL TPR 7.3e-2kgs 3600s	Internal 1to Small	1.04E-02	1 drum isolatable	6	Gas	none	0.01	100%	33%	1	Forced ventilation by fan	2.99E-04	9.86E-07	0.1003
25	28	IHTSL TPR 2.8e-2kgs 372s	Internal 1to Small	1.04E-02	1 drum isolatable	6	Gas	3	0.74	25%	67%	1	Forced ventilation by fan	2.99E-04	1.48E-04	1.5407
29	32	IHTSL TPR 5.2e-2kgs 792s	Internal 1to Small	1.04E-02	1 drum isolatable	6	Gas	10	0.25	25%	67%	1	Forced ventilation by fan	2.99E-04	5.00E-05	0.5205
33	36	IHTSL TPR 7.2e-2kgs 3430s	Internal 1to Small	1.04E-02	1 drum isolatable	6	Gas	none	0.01	25%	67%	1	Forced ventilation by fan	2.99E-04	2.00E-06	0.2028
38	40	IUTALL TPR 1.3e0kgs 611s	Internal 1to All Large	6.00E-08	20% of drums in store	20	Liquid	none	1	100%	100%	0.5	Forced ventilation by fan	2.99E-04	1.49E-04	0.0000
41	43	IUTALL TPR 1.3e0kgs 611s	Internal 1to All Large	6.00E-08	20% of drums in store	20	Liquid	none	1	100%	100%	0.5	Forced ventilation by fan	2.99E-04	1.49E-04	0.0000
47	50	IUTD TPR 1.3e0kgs 193s	Internal 1to Rupture Domino	0.00E+00	2 drums	Rupture	Rupture	none	1	100%	100%	1	Forced ventilation by fan	2.99E-04	2.99E-04	0.0000
51	54	IUTSL TPR 2.7e-1kgs 3289s	Internal 1to Small	1.50E-04	1 drum	6	Liquid	none	1	100%	100%	1	Forced ventilation by fan	2.99E-04	4.34E-03	0.4746
55	58	IUTLL TPR 1.3e0kgs 611s	Internal 1to Large	1.09E-04	1 drum	20	Liquid	none	1	100%	100%	1	Forced ventilation by fan	2.99E-04	4.34E-03	0.4746
59	62	IUTR TPR 1.3e0kgs 193s	Internal 1to Rupture	0.00E+00	1 drum	Rupture	Rupture	none	1	100%	100%	1	Forced ventilation by fan	2.99E-04	4.34E-03	0.4746
63	66	IHTSL TPR 2.2e-3kgs 3403s	Internal 1to Small	1.04E-02	1 drum isolatable	6	Gas	3	0.74	100%	33%	1	No containment, driven by release expansion	4.34E-03	4.34E-03	0.4746
67	70	IHTSL TPR 6.8e-3kgs 3600s	Internal 1to Small	1.04E-02	1 drum isolatable	6	Gas	10	0.25	100%	33%	1	No containment, driven by release expansion	4.34E-03	4.34E-03	0.4746
71	74	IHTSL TPR 2.6e-2kgs 3600s	Internal 1to Small	1.04E-02	1 drum isolatable	6	Gas	none	0.01	100%	33%	1	No containment, driven by release expansion	4.34E-03	4.34E-03	0.4746
75	78	IHTSL TPR 2.7e-2kgs 3403s	Internal 1to Small	1.04E-02	1 drum isolatable	6	Gas	3	0.74	25%	67%	1	No containment, driven by release expansion	4.34E-03	4.34E-03	0.4746
79	82	IHTSL TPR 6.8e-3kgs 3600s	Internal 1to Small	1.04E-02	1 drum isolatable	6	Gas	10	0.25	25%	67%	1	No containment, driven by release expansion	4.34E-03	4.34E-03	0.4746
83	86	IHTSL TPR 2.8e-2kgs 3600s	Internal 1to Small	1.04E-02	1 drum isolatable	6	Gas	none	0.01	100%	33%	1	No containment, driven by release expansion	4.34E-03	4.34E-03	0.4746
88	91	IUTALL TPR 1.3e0kgs 611s	Internal 1to All Large	6.00E-08	20% of drums in store	20	Liquid	none	1	100%	100%	0.5	No containment, driven by release expansion	4.34E-03	2.17E-03	0.0000
90	93	IUTALL TPR 1.3e0kgs 611s	Internal 1to All Large	6.00E-08	20% of drums in store	20	Liquid	none	1	100%	100%	0.5	No containment, driven by release expansion	4.34E-03	2.17E-03	0.0000
97	100	IUTD TPR 1.3e0kgs 193s	Internal 1to Rupture Domino	0.00E+00	2 drums	Rupture	Rupture	none	1	100%	100%	1	No containment, driven by release expansion	4.34E-03	4.34E-03	0.0000
100	101	EITLL AnyPlant 3.8e-1kgs 2818s	External 1to Small	2.48E-05	1 drum	6	Liquid	none	1	100%	100%	1	No containment, driven by release expansion	1.00E+00	1.00E+00	24.8450
101	102	EITLL AnyPlant 2.4e0kgs 419s	External 1to Large	6.98E-06	1 drum	20	Liquid	none	1	100%	100%	1	No containment, driven by release expansion	1.00E+00	1.00E+00	6.8614
102	103	EITR AnyPlant 100kkg's 1s	External 1to Rupture	1.04E-05	1 drum	Rupture	Rupture	none	1	100%	100%	1	No containment, driven by release expansion	1.00E+00	1.00E+00	10.3990
107	108	EITALL TPR 9.8e0kgs 419s	External 1to All Large	1.00E-06	All drums in store	20	Liquid	none	1	100%	100%	0.5	No containment, driven by release expansion	1.00E+00	5.00E-01	0.5000
109	110	EITALL TPR 7.2e0kgs 419s	External 1to All Large	1.00E-06	All drums in store	20	Liquid	none	1	100%	100%	0.5	No containment, driven by release expansion	1.00E+00	5.00E-01	0.5000
117	118	EITAR TPR 400kkg's 1s	External 1to All Rupture	1.05E-07	All drums in store	Rupture	Rupture	none	1	100%	100%	0.5	No containment, driven by release expansion	1.00E+00	5.00E-01	0.0525
119	120	EITALL TPR 300kkg's 1s	External 1to All Rupture	1.05E-07	All drums in store	Rupture	Rupture	none	1	100%	100%	0.5	No containment, driven by release expansion	1.00E+00	5.00E-01	0.0525
123	124	EITALL AnyPlant 7.2e0kgs 419s	External 1to All Truck Large	5.76E-08	Half of drums on truck	20	Liquid	none	1	100%	100%	1	No containment, driven by release expansion	1.00E+00	1.00E+00	0.0576
124	125	EITD AnyPlant 200kkg's 1s	External 1to All Truck Large	1.16E-06	Half of drums on truck	20	Liquid	none	1	100%	100%	1	No containment, driven by release expansion	1.00E+00	1.00E+00	1.1554
127	128	RITALL Truck 7.2e0kgs 419s	External 1to Domino	8.74E-07	2 drums	Rupture	Rupture	none	1	100%	100%	1	No containment, driven by release expansion	1.00E+00	1.00E+00	0.8771
128	129	RITL Truck 3.8e-1kgs 2818s	Road 1to 1 cyl Small	9.43E-06	1 drum	6	Liquid	none	1	100%	100%	1	No containment, driven by release expansion	1.00E+00	1.00E+00	0.9433
129	130	RITL Truck 2.4e0kgs 419s	Road 1to 1 cyl Large	9.43E-06	1 drum	20	Liquid	none	1	100%	100%	1	No containment, driven by release expansion	1.00E+00	1.00E+00	0.9433
130	131	RITR Truck 100kkg's 1s	Road 1to 1 cyl Rupture	5.35E-08	1 drum	Rupture	Rupture	none	1	100%	100%	1	No containment, driven by release expansion	1.00E+00	1.00E+00	0.0535
131	130	RITD Truck 200kkg's 1s	Road 1to 1 cyl Domino	5.35E-08	2 drums	Rupture	Rupture	none	1	100%	100%	1	No containment, driven by release expansion	1.00E+00	1.00E+00	0.0584





**Table B3a : Contain and Absorb Failures**

Containment	Detection	Ventilation Fan Remains on	Damper Position	Scrubber Available	Scrubber Capacity	Scrubber Throughput	Outcome	
Release contained in building 9.96E-01	Leak Detected 0.9999	Ventilation Fan Shuts Down Normally 0.9999	Dampers set to contain and recycle 0.9999	Scrubber available	Released mass doesn't exceed scrubber capacity 0.9999	Concentration exceeds scrubber capacity 0.0001	Release contained, no hazard 9.95E-01	
			Dampers fail in exhaust to atmosphere position 0.0001	Scrubber available 0	Released mass exceeds scrubber capacity 0.0001	Concentration doesn't exceed scrubber capacity 0.9999	Scrubber overloaded by concentration, dampers open to outside and fan on - forced ventilation to outside plant 0.00E+00	neglect
Release not contained 4.34E-03	Leak not Detected 0.0001	Ventilation Fan Remains on 0.0001	Dampers set to contain and recycle 0.9999	Scrubber Unavailable 1.00E+00	(from absorb fault tree)	Release completely scrubbed, no hazard 0.00E+00	neglect	
			Dampers fail in exhaust to atmosphere position 0.0001	Scrubber Unavailable 1.00E+00	(from absorb fault tree)	Scrubber overloaded by mass, dampers open to outside and fan on - forced ventilation to outside plant (after delay) 0.00E+00	neglect	
							Scrubber fails completely, dampers open to outside and fan on - forced ventilation to outside plant 0.00E+00	neglect
							9.95E-05	rc
							Ventilation Remains on but also scrubber comes on - forced ventilation, unscrubbed release 9.96E-05	Lump together model as forced ventilation release through ventilation fan 2.99E-04
							Ventilation Remains on - forced ventilation, unscrubbed release 9.96E-05	rc
							Unscrubbed release to atmosphere driven by release expansion 4.34E-03	evaluate

**Table B3b : Failure of Containment System**

Event: System Failure  
 Instantaneous release  
 separate trees  
 separate trees

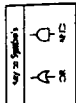
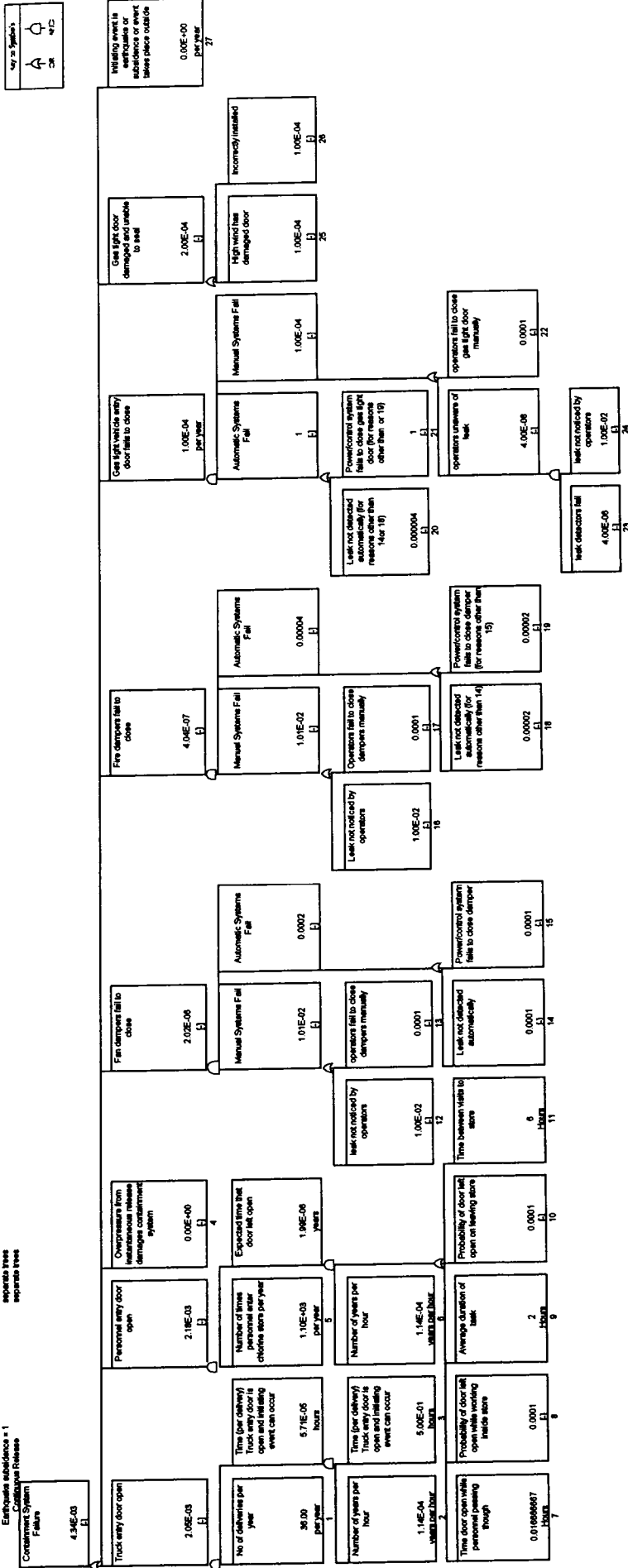




Table B4b: Consequence Data with Britter and McQuaid Model

Unique Consequence Name	50%		1D		50%		2.5B		50%		3.5D		50%		7D		50%		3E		50%		1F		
	d (m)	c (m)	s (m)	m (m)	Cloud height, m	d (m)	c (m)	s (m)	m (m)	Cloud height, m	d (m)	c (m)	s (m)	m (m)	Cloud height, m	d (m)	c (m)	s (m)	m (m)	Cloud height, m	d (m)	c (m)	s (m)	m (m)	Cloud height, m
<b>Internal Failure Cases</b>																									
UITSL_TPR_3.5e-1kg/s_2810s	135	28	-1	90	1	84	8	0	56	1	79	5	0	53	1	40	2	0	27	2	112	8	0	75	1
UITLL_TPR_1.3e0kg/s_611s	228	62	-4	152	1	170	19	0	113	1	168	13	0	112	1	86	4	0	57	2	234	19	0	156	1
UITR_TPR_1.3e0kg/s_193s	166	52	-4	110	1	125	15	0	83	1	124	11	0	82	1	64	4	0	43	2	171	16	0	114	1
UITSL_TPR_2.8e-2kg/s_372s	83	13	-1	55	0	32	2	0	21	1	32	2	0	22	1	23	1	0	15	1	43	3	0	29	1
UITSL_TPR_5.2e-2kg/s_722s	136	22	-1	91	1	55	5	0	37	1	50	3	0	33	1	35	1	0	23	2	71	5	0	47	1
UITSL_TPR_7.3e-2kg/s_3600s	158	27	-1	105	1	70	6	0	47	1	62	4	0	42	1	42	2	0	28	2	89	6	0	60	1
UITSL_TPR_5.2e-2kg/s_792s	83	13	-1	55	0	32	2	0	21	1	32	2	0	22	1	23	1	0	15	1	43	3	0	29	1
UITSL_TPR_7.2e-1kg/s_3269s	136	22	-1	91	1	55	5	0	37	1	50	3	0	33	1	35	1	0	23	2	71	5	0	47	1
UITSL_TPR_7.2e-2kg/s_3430s	157	27	-1	104	1	69	6	0	46	1	62	4	0	41	1	41	2	0	28	2	89	6	0	59	1
UITALL_TPR_1.3e0kg/s_611s	228	62	-4	152	1	170	19	0	113	1	168	13	0	112	1	86	4	0	57	2	234	19	0	156	1
UITALL_TPR_1.3e0kg/s_193s	166	52	-4	110	1	125	15	0	83	1	124	11	0	82	1	64	4	0	43	2	171	16	0	114	1
UITD_TPR_2.7e-1kg/s_3269s	123	22	-1	82	1	79	6	0	53	1	76	4	0	50	1	35	1	0	24	2	105	6	0	70	1
UITLL_TPR_1.3e0kg/s_611s	228	62	-4	152	1	170	19	0	113	1	168	13	0	112	1	86	4	0	57	2	234	19	0	156	1
UITR_TPR_1.3e0kg/s_193s	166	52	-4	110	1	125	15	0	83	1	124	11	0	82	1	64	4	0	43	2	171	16	0	114	1
UITSL_TPR_2.2e-3kg/s_3403s	24	2	0	16	0	10	1	0	7	0	12	1	0	7	0	7	0	0	5	0	14	1	0	8	0
UITSL_TPR_6.8e-3kg/s_3600s	50	6	0	33	0	18	1	0	12	1	13	0	0	8	1	13	0	0	8	1	24	1	0	16	1
UITSL_TPR_2.6e-2kg/s_3600s	99	14	0	66	1	49	3	0	33	1	42	2	0	28	1	25	1	0	17	1	62	3	0	41	1
UITSL_TPR_2.2e-3kg/s_3403s	24	2	0	16	0	10	1	0	7	0	12	1	0	7	0	7	0	0	5	0	14	1	0	8	0
UITSL_TPR_6.8e-3kg/s_3600s	50	6	0	33	0	18	1	0	12	1	13	0	0	8	1	13	0	0	8	1	24	1	0	16	1
UITSL_TPR_2.6e-2kg/s_3600s	98	14	0	66	1	49	3	0	32	1	42	2	0	28	1	25	1	0	17	1	61	3	0	41	1
UITALL_TPR_1.3e0kg/s_611s	228	62	-4	152	1	170	19	0	113	1	168	13	0	112	1	86	4	0	57	2	234	19	0	156	1
UITALL_TPR_1.3e0kg/s_193s	166	52	-4	110	1	125	15	0	83	1	124	11	0	82	1	64	4	0	43	2	171	16	0	114	1
UITD_TPR_1.3e0kg/s_193s	166	52	-4	110	1	125	15	0	83	1	124	11	0	82	1	64	4	0	43	2	171	16	0	114	1
<b>External Failure Cases at the Store</b>																									
EITSL_AnyPlant_3.8e-1kg/s_2618s	140	29	-1	94	1	80	8	0	60	1	86	6	0	57	1	42	2	0	28	2	120	8	0	80	1
EITLL_AnyPlant_2.4e0kg/s_419s	262	87	-7	175	1	203	26	-1	135	2	213	19	0	142	2	114	6	0	76	2	295	28	0	197	1
EITR_AnyPlant_1000kg/s_1s	367	222	-10	144	4	508	204	-10	304	4	481	174	-10	307	4	261	92	-10	170	8	503	189	-10	314	4
EITALL_TPR_9.6e0kg/s_419s	454	220	-25	303	2	376	64	-2	251	3	428	48	-1	285	2	267	18	0	178	3	551	67	-1	367	2
EITALL_TPR_7.2e0kg/s_419s	405	181	-19	270	2	332	53	-2	221	2	376	40	-1	250	2	224	14	0	149	3	484	56	-1	323	2
EITAR_TPR_4000kg/s_1s	533	352	-16	181	6	753	337	-16	415	6	854	323	-15	532	7	572	193	-16	379	10	806	330	-16	476	6
EITAR_TPR_3000kg/s_1s	493	320	-15	173	5	697	305	-15	392	6	782	285	-15	477	6	486	165	-15	321	10	746	298	-15	448	6
EITALL_TPR_2.2e0kg/s_419s	405	181	-19	270	2	332	53	-2	221	2	376	40	-1	250	2	224	14	0	149	3	484	56	-1	323	2
EITD_AnyPlant_2000kg/s_1s	442	280	-13	162	4	624	264	-13	360	5	645	238	-13	407	5	387	133	-13	254	9	660	256	-13	404	5
<b>External Failure Cases on the Road</b>																									
RITALL_Truck_7.2e0kg/s_419s	405	181	-19	270	2	332	53	-2	221	2	376	40	-1	250	2	224	14	0	149	3	484	56	-1	323	2
RITSL_Truck_3.8e-1kg/s_2618s	140	29	-1	94	1	80	8	0	60	1	86	6	0	57	1	42	2	0	28	2	120	8	0	80	1
RITLL_Truck_2.4e0kg/s_419s	262	87	-7	175	1	203	26	-1	135	2	213	19	0	142	2	114	6	0	76	2	295	28	0	197	1
RITR_Truck_1000kg/s_1s	367	222	-10	144	4	508	204	-10	304	4	481	174	-10	307	4	261	92	-10	170	8	503	189	-10	314	4
RITD_Truck_2000kg/s_1s	442	280	-13	162	4	624	264	-13	360	5	645	238	-13	407	5	387	133	-13	254	9	660	256	-13	404	5

Table B4c: Consequence Data with Britter and McQuaid Model

Unique Consequence Name	90%		2.5 B		90%		3.5 D		90%		7 D		90%		3 E		90%		1 F						
	d (m)	c (m)	s (m)	m (m)	Cloud height, m	d (m)	c (m)	s (m)	m (m)	Cloud height, m	d (m)	c (m)	s (m)	m (m)	Cloud height, m	d (m)	c (m)	s (m)	m (m)	Cloud height, m					
Internal Failure Cases																									
IUTLL_TPR_3.5e-1kg/s_2810s	69	19	-1	46	0	29	0	28	0	22	1	0	15	1	58	5	0	39	0	103	24	-1	68	0	
IUTLL_TPR_1.3e0kg/s_611s	115	42	-4	77	0	58	1	58	1	46	3	0	31	1	121	12	0	80	1	172	53	-4	115	0	
IUTR_TPR_1.3e0kg/s_193s	84	35	-4	56	0	43	0	43	0	64	7	0	23	1	89	10	0	59	0	125	44	-4	84	0	
IITSL_TPR_2.8e-2kg/s_372s	43	8	-1	29	0	12	0	12	0	18	1	0	8	0	24	2	0	25	0	84	11	-1	43	0	
IITSL_TPR_5.2e-2kg/s_792s	70	14	-1	47	0	20	1	19	1	19	1	0	13	1	38	3	0	25	0	105	18	-1	70	0	
IITSL_TPR_7.9e-2kg/s_3600s	81	18	-1	54	0	25	1	34	3	34	3	0	15	1	48	4	0	32	0	121	23	-1	81	0	
IITSL_TPRh_2.8e-2kg/s_372s	43	8	-1	29	0	12	0	12	0	18	1	0	8	0	24	2	0	25	0	84	11	-1	43	0	
IITSL_TPRh_5.2e-2kg/s_792s	70	14	-1	47	0	20	1	19	1	19	1	0	13	1	38	3	0	25	0	105	18	-1	70	0	
IITSL_TPRh_7.9e-2kg/s_3430s	81	18	-1	54	0	24	1	33	3	23	1	0	15	1	47	4	0	32	0	120	23	-1	80	0	
IUTALL_TPR_1.3e0kg/s_611s	115	42	-4	77	0	58	1	58	1	46	3	0	31	1	121	12	0	80	1	172	53	-4	115	0	
IUTALL_TPR_1.3e0kg/s_193s	84	35	-4	56	0	43	0	43	0	64	7	0	23	1	89	10	0	59	0	125	44	-4	84	0	
IUTSL_TPR_2.7e-1kg/s_3269s	63	15	-1	42	0	27	0	26	0	39	3	0	13	1	55	4	0	36	0	94	19	-1	62	0	
IUTLL_TPR_1.3e0kg/s_611s	115	42	-4	77	0	58	1	58	1	46	3	0	31	1	121	12	0	80	1	172	53	-4	115	0	
IUTR_TPR_1.3e0kg/s_193s	84	35	-4	56	0	43	0	43	0	64	7	0	23	1	89	10	0	59	0	125	44	-4	84	0	
IITSL_TPR_2.2e-3kg/s_3403s	12	2	0	8	0	4	0	4	0	6	0	0	4	0	7	0	0	5	0	19	2	0	12	0	
IITSL_TPR_6.8e-3kg/s_3600s	26	4	0	17	0	7	0	7	0	23	1	0	9	1	41	0	0	9	0	39	5	0	26	0	
IITSL_TPR_2.8e-2kg/s_3600s	51	9	0	34	0	26	2	26	2	14	1	0	9	1	33	2	0	22	0	76	12	0	51	0	
IITSL_TPRh_2.2e-3kg/s_3403s	12	2	0	8	0	4	0	4	0	6	0	0	4	0	7	0	0	5	0	19	2	0	12	0	
IITSL_TPRh_6.8e-3kg/s_3600s	26	4	0	17	0	7	0	7	0	23	1	0	9	1	41	0	0	9	0	39	5	0	26	0	
IITSL_TPRh_2.8e-2kg/s_3600s	51	9	0	34	0	25	2	25	2	14	1	0	9	1	32	2	0	21	0	75	12	0	50	0	
IUTALL_TPR_1.3e0kg/s_611s	115	42	-4	77	0	58	1	58	1	46	3	0	31	1	121	12	0	80	1	172	53	-4	115	0	
IUTALL_TPR_1.3e0kg/s_611s	115	42	-4	77	0	58	1	58	1	46	3	0	31	1	121	12	0	80	1	172	53	-4	115	0	
IUTD_TPR_1.3e0kg/s_193s	84	35	-4	56	0	43	0	43	0	64	7	0	23	1	89	10	0	59	0	125	44	-4	84	0	
External Failure Cases at the Store																									
EITSL_AnyPlant_3.8e-1kg/s_2618s	72	19	-1	48	0	31	0	30	0	44	4	0	15	1	62	5	0	41	0	107	24	-1	71	0	
EITLL_AnyPlant_2.4e0kg/s_419s	133	60	-7	88	1	104	17	-10	12	110	12	0	41	1	152	18	0	102	1	198	74	-7	132	0	
EITR_AnyPlant_1000kg/s_1s	198	141	-10	57	3	240	125	-10	114	3	214	104	-10	71	5	228	114	-10	113	3	198	141	-10	57	3
EITALL_TPR_9.6e0kg/s_419s	228	158	-25	152	1	193	42	-2	129	1	220	32	-1	147	1	138	11	0	93	2	283	44	-1	189	1
EITALL_TPR_7.2e0kg/s_419s	204	128	-19	136	1	170	35	-2	113	1	194	26	-1	129	1	117	9	0	78	1	249	36	-1	166	1
EITAR_TPR_4000kg/s_1s	291	220	-16	71	4	396	220	-16	176	4	402	200	-16	127	4	266	120	-16	148	6	410	213	-16	197	4
EITAR_TPR_3000kg/s_1s	269	201	-15	68	4	365	199	-15	168	4	352	174	-15	178	4	365	188	-15	178	4	268	201	-15	68	4
EITALL_TPR_7.2e0kg/s_419s	204	128	-19	136	1	170	35	-2	113	1	194	26	-1	129	1	117	9	0	78	1	249	36	-1	166	1
EITD_TPR_2000kg/s_1s	240	176	-13	64	3	317	169	-13	147	3	293	144	-13	149	4	188	85	-13	103	5	310	157	-13	152	3
External Failure Cases on the Road																									
RITALL_Truck_7.2e0kg/s_419s	204	128	-19	136	1	170	35	-2	113	1	194	26	-1	129	1	117	9	0	78	1	249	36	-1	166	1
RITSL_Truck_3.8e-1kg/s_2618s	72	19	-1	48	0	31	0	30	0	44	4	0	15	1	62	5	0	41	0	107	24	-1	71	0	
RITLL_Truck_2.4e0kg/s_419s	133	60	-7	88	1	104	17	-10	12	110	12	0	41	1	152	18	0	102	1	198	74	-7	132	0	
RITR_Truck_1000kg/s_1s	198	141	-10	57	3	240	125	-10	114	3	214	104	-10	71	5	228	114	-10	113	3	198	141	-10	57	3
RITD_Truck_2000kg/s_1s	240	176	-13	64	3	317	169	-13	147	3	293	144	-13	149	4	188	85	-13	103	5	310	157	-13	152	3