Appendix 11.5.3

SAFETI Parameters of the Hazard Assessment for the Existing Petrol cum LPG Filling Stations and Dedicated LPG Filling Stations

Input Parameter of SAFETI (continuous release)

Default atmospheric temperature	293.15	K
Default atmospheric pressure	101325	N/m2
Relative humidity	70	%
Default surface roughness parameter	0.1	
Default surface temperature	293.15	K
Atmospheric molecular weight	28.966	
Atmospheric specific heat at constant pressure	1004	J/kg*K
Number of wind directions	12	
Angular Offset	15	degree
Pipe roughness	0.0457	mm
Excess Flow Valve velocity head losses	0	
Non-Return Valve velocity head losses	0	
Shut-Off Valve velocity head losses	0	
Frequency of bends in long pipes	0	1/m
Frequency of couplings in long pipes	0	1/m
Frequency of junctions in long pipes	0	1/m
Upper volume change limit/step	0.5	
Lower volume change limit/step	0.15	
Minimum RV diameter ratio	1	
Relief valve safety factor	1.2	
Critical pressure greater than flow phase	0.34474	bar
Default line length	10	m
Default Liquid Fraction	1	fraction
Default volume changes	2.999999	per h
Maximum release duration	3600	s
Minimum temperature allowed	9.99999	K
Maximum temperature allowed	900	K
Maximum pressure allowed	1000	bar
Maximum liquid head allowed	100	m
Maximum release velocity	500	m/s
Range of release angles	90.00021	degree
Minimum drop size allowed	1e-005	mm
Maximum drop size allowed	10	mm
BLEVE radiation level 1	4	kW/m2
BLEVE radiation level 2	12.5	kW/m2
BLEVE radiation level 3	37.5	kW/m2
Jet flame radiation level 1	4	kW/m2
Jet flame radiation level 2	12.5	kW/m2
Jet flame radiation level 3	37.5	kW/m2
Pool fire radiation level 1	4	kW/m2
Pool fire radiation level 2	12.5	kW/m2
Pool fire radiation level 3	37.5	kW/m2
LFL fraction to finish	1	fraction
BLEVE Mass correction factor	2	

Jet fire correction factor	3	
Cut-off time for immediate pool fire (cont)	10	s
Cut-off time for immediate pool fire (inst)	10	s
Maximum SEP for a BLEVE	400	kW/m2
Maximum SEP for a Jet flame	400	kW/m2
Explosion efficiency	0.1	
Explosion overpressure level 1	0.02068	bar
Explosion overpressure level 2	0.1379	bar
Explosion overpressure level 3	0.2068	bar
Minimum explosive mass	0	kg
Explosion location criterion	0	
Venting equation constant	24.82	N/m2
Immediate explosion correction factor	3	
Pool minimum thickness	5	mm
Surface thermal conductivity	2.21	W/m*K
Surface roughness factor	2.634	
Surface thermal diffusivity (per second)	9.48e-007	m2
Solar radiation flux	0.5	kW/m2
Continuous Critical Weber number	12.5	
Print level	132 Columns	
Flamm.: height for calculation of effects	0	m
Flamm.: result grid step in X-direction	1	m
Toxics: height for calculation of effects	0	m
Toxics: results grid step in X-direction	10	m
Toxics: result grid step in Y-direction	2.5	m
Atmospheric temp and pressure profile	3	
Wind speed profile	2	
Temperature reference height (m)	10	m
Wind speed reference height (m)	10	m
Cut-off height for wind speed profile (m)	1	m
Dispersing surface temperature	283	K
Default dispersing surface type	Land	
Default bund surface type	Concrete	
Minimum integration step size (distance)	0.1	m
Maximum integration step size (distance)	100	m
Minimum integration step size (time)	0.1	s
Maximum integration step size (time)	10	s
Maximum distance for dispersion	50000	m
Minimum release velocity for cont. release	0.1	m/s
Default minimum release height	1	m
Maximum height for dispersion	1000	m
Droplet evaporation thermodynamics model	2	
Flammable mass calculation method	2	
Treatment of top of mixing layer	1	
Quasi-instantaneous transition parameter	0.8	
Finite Duration Correction Flag	3	

Multi-component toxic calculation method 1
Force cloud to rain out at source No
Disable 'Free Jet' routes? Yes
Accuracy for integration of dispersion 0.001
Accuracy for droplet integration 0.001
Turbulent Schmidt number 1
Jet entrainment coefficient alpha1 0.11
Jet entrainment coefficient alpha2 0.26
Dense cloud parameter alpha (continuous) 1.6
Dense cloud parameter beta (continuous) 0.015
Dense cloud parameter gamma (continuous) 0.05
Dense cloud parameter k (continuous) 0.15
Dense cloud parameter alpha (instant) 1
Dense cloud parameter beta (instant) 0.015
Dense cloud parameter gamma (instant) 0.3
Dense cloud parameter k (instantaneous) 1.2
Ratio instantaneous/continuous sigma-y 1
Ratio instantaneous/continuous sigma-z 1
Drag coefficient between plume and air 0.15
Drag coefficient between plume and ground 1.5
Impact parameter - plume/ground 0.8
Lift-off suppression parameter 2
Base averaging time 60 s
Expansion zone length/source diameter ratio 0.01
Toxics: cut-off rate for pool evaporation 0.001 kg/s
Height for concentration output 0 m
Flamm.: cut-off rate for pool evaporation 0.1 kg/s
Flamm.: accuracy of flammable mass calc 0.001
Minimum vap fract for convection from ground 0.0015 fraction
Drop/expansion velocity for inst. release 0.8 m/s
Minimum cloud depth 0.02 m
Default bund height 0 m
Duration for jet fire averaging 20 s
Cut-off time for short continuous releases 5 s
Expansion energy cutoff for droplet angle 690 J/kg
Flamm.: inclination Variable
Flamm.: angle of inclination 0 degree
Dense cloud parameter beta (pool vaporisation) 0.015
Pool vaporisation entrainment parameter 1.5
Distance multiple for full passive entrainment 2
Density tolerance for cloud buoyancy 0.005 kg/m3
Minimum case frequency considered 1e-012
Minimum event probability considered 1e-012
Fraction population outdoors, F-N 0.1
Fraction population outdoors, risk 1
Fraction out killed by explosion R1 0.3

Fraction in killed by explosion R1 1
Fraction out killed by explosion R1-2 0.1
Fraction in killed by explosion R1-2 0.3
Fraction out killed by flash fire 1
Fraction in killed by flash fire 0.1
Fraction out killed by BLEVE 0.7
Fraction in killed by BLEVE 0.2
Fraction out killed by jet flame 0.7
Fraction in killed by jet flame 0.1
Fraction out killed by pool fire 0.7
Fraction in killed by pool fire 0.1
Fraction out killed by toxics 0.9
Fraction in killed by toxics 0.1
Pop omega factor (per person) 1e-005
No sub-squares across ellipse in flamm. impct 10
Max times to subdivide a square in flamm. impct 5
Multiplying factor for toxic F-N spread 2
Probability of Immediate Ignition 0.05
Probability of Explosion given Ignition 0.01
Probability of Jet Fire rather than just pool 0.5
Probability Cloud ignites rather than just pool 0.5
Probability Inst. Cloud ignites with pool 0
Probability Horizontal Jet ignites with pool 0
Probability Vertical Jet ignites with pool 0
Probability split for short continuous releases 0
Probability of BLEVE rather than Flash Fire 0.99
1st Risk contour level 1 per yr
2nd Risk contour level 0.1 per yr
3rd Risk contour level 0.01 per yr
4th Risk contour level 0.001 per yr
5th Risk contour level 0.0001 per yr
6th Risk contour level 1e-005 per yr
7th Risk contour level 1e-006 per yr
8th Risk contour level 1e-007 per yr
9th Risk contour level 1e-008 per yr
10th Risk contour level 0 per yr
1st Risk contour Color Black
2nd Risk contour Color Black
3rd Risk contour Color Black
4th Risk contour Color Black
5th Risk contour Color Black
6th Risk contour Color Red
7th Risk contour Color Black
8th Risk contour Color Black
9th Risk contour Color Black
10th Risk contour Color Black

Line thickness for contours 2
Line type for contours (thickness =1 only) Solid
Minimum risk level 1e-008 per yr
Display risk criteria lines No
Maximum risk criteria line start N 1
Maximum risk criteria line start F 0.001 per yr
Maximum risk criteria line end N 10
Maximum risk criteria line end F 1e-005 per yr
Minimum risk criteria line start N 1
Minimum risk criteria line start F 1e-005 per yr
Minimum risk criteria line end N 10
Minimum risk criteria line end F 1e-007 per yr

SAFETI Input Parameter (Instantaneous Release)

Default atmospheric temperature	293.15	K
Default atmospheric pressure	101325	N/m2
Relative humidity	70	%
Default surface roughness parameter	0.1	
Default surface temperature	293.15	K
Atmospheric molecular weight	28.966	
Atmospheric specific heat at constant pressure	1004	J/kg*K
Number of wind directions	12	
Angular Offset	15	degree
Pipe roughness	0.0457	mm
Excess Flow Valve velocity head losses	0	
Non-Return Valve velocity head losses	0	
Shut-Off Valve velocity head losses	0	
Frequency of bends in long pipes	0	1/m
Frequency of couplings in long pipes	0	1/m
Frequency of junctions in long pipes	0	1/m
Upper volume change limit/step	0.5	
Lower volume change limit/step	0.15	
Minimum RV diameter ratio	1	
Relief valve safety factor	1.2	
Critical pressure greater than flow phase	0.34474	bar
Default line length	10	m
Default Liquid Fraction	1	fraction
Default volume changes	2.999999	per h
Maximum release duration	3600	s
Minimum temperature allowed	9.99999	K
Maximum temperature allowed	900	K
Maximum pressure allowed	1000	bar
Maximum liquid head allowed	100	m
Maximum release velocity	500	m/s
Range of release angles	90.00021	degree
Minimum drop size allowed	1e-005	mm
Maximum drop size allowed	10	mm
BLEVE radiation level 1	4	kW/m2
BLEVE radiation level 2	12.5	kW/m2
BLEVE radiation level 3	37.5	kW/m2
Jet flame radiation level 1	4	kW/m2
Jet flame radiation level 2	12.5	kW/m2
Jet flame radiation level 3	37.5	kW/m2
Pool fire radiation level 1	4	kW/m2
Pool fire radiation level 2	12.5	kW/m2
Pool fire radiation level 3	37.5	kW/m2
LFL fraction to finish	1	fraction
BLEVE Mass correction factor	2	

Jet fire correction factor 3
Cut-off time for immediate pool fire (cont) 10 s
Cut-off time for immediate pool fire (inst) 10 s
Maximum SEP for a BLEVE 400 kW/m2
Maximum SEP for a Jet flame 400 kW/m2
Explosion efficiency 0.1
Explosion overpressure level 1 0.02068 bar
Explosion overpressure level 2 0.1379 bar
Explosion overpressure level 3 0.2068 bar
Minimum explosive mass 0 kg
Explosion location criterion 0
Venting equation constant 24.82 N/m2
Immediate explosion correction factor 3
Pool minimum thickness 5 mm
Surface thermal conductivity 2.21 W/m*K
Surface roughness factor 2.634
Surface thermal diffusivity (per second) 9.48e-007 m2
Solar radiation flux 0.5 kW/m2
Continuous Critical Weber number 12.5
Print level 132 Columns
Flamm.: height for calculation of effects 0 m
Flamm.: result grid step in X-direction 1 m
Toxics: height for calculation of effects 0 m
Toxics: results grid step in X-direction 10 m
Toxics: result grid step in Y-direction 2.5 m
Atmospheric temp and pressure profile 3
Wind speed profile 2
Temperature reference height (m) 10 m
Wind speed reference height (m) 10 m
Cut-off height for wind speed profile (m) 1 m
Dispersing surface temperature 283 K
Default dispersing surface type Land
Default bund surface type Concrete
Minimum integration step size (distance) 0.1 m
Maximum integration step size (distance) 100 m
Minimum integration step size (time) 0.1 s
Maximum integration step size (time) 10 s
Maximum distance for dispersion 50000 m
Minimum release velocity for cont. release 0.1 m/s
Default minimum release height 1 m
Maximum height for dispersion 1000 m
Droplet evaporation thermodynamics model 2
Flammable mass calculation method 2
Treatment of top of mixing layer 1
Quasi-instantaneous transition parameter 0.8
Finite Duration Correction Flag 3

Multi-component toxic calculation method 1
Force cloud to rain out at source No
Disable 'Free Jet' routes? Yes
Accuracy for integration of dispersion 0.001
Accuracy for droplet integration 0.001
Turbulent Schmidt number 1
Jet entrainment coefficient alpha1 0.11
Jet entrainment coefficient alpha2 0.26
Dense cloud parameter alpha (continuous) 1.6
Dense cloud parameter beta (continuous) 0.015
Dense cloud parameter gamma (continuous) 0.05
Dense cloud parameter k (continuous) 0.15
Dense cloud parameter alpha (instant) 1
Dense cloud parameter beta (instant) 0.015
Dense cloud parameter gamma (instant) 0.3
Dense cloud parameter k (instantaneous) 1.2
Ratio instantaneous/continuous sigma-y 1
Ratio instantaneous/continuous sigma-z 1
Drag coefficient between plume and air 0.15
Drag coefficient between plume and ground 1.5
Impact parameter - plume/ground 0.8
Lift-off suppression parameter 2
Base averaging time 60 s
Expansion zone length/source diameter ratio 0.01
Toxics: cut-off rate for pool evaporation 0.001 kg/s
Height for concentration output 0 m
Flamm.: cut-off rate for pool evaporation 0.1 kg/s
Flamm.: accuracy of flammable mass calc 0.001
Minimum vap fract for convection from ground 0.0015 fraction
Drop/expansion velocity for inst. release 0.8 m/s
Minimum cloud depth 0.02 m
Default bund height 0 m
Duration for jet fire averaging 20 s
Cut-off time for short continuous releases 5 s
Expansion energy cutoff for droplet angle 690 J/kg
Flamm.: inclination Variable
Flamm.: angle of inclination 0 degree
Dense cloud parameter beta (pool vaporisation) 0.015
Pool vaporisation entrainment parameter 1.5
Distance multiple for full passive entrainment 2
Density tolerance for cloud buoyancy 0.005 kg/m3
Minimum case frequency considered 1e-012
Minimum event probability considered 1e-012
Fraction population outdoors, F-N 0.1
Fraction population outdoors, risk 1
Fraction out killed by explosion R1 0.3

Fraction in killed by explosion R1 1
Fraction out killed by explosion R1-2 0.1
Fraction in killed by explosion R1-2 0.3
Fraction out killed by flash fire 1
Fraction in killed by flash fire 0.1
Fraction out killed by BLEVE 0.7
Fraction in killed by BLEVE 0.2
Fraction out killed by jet flame 0.7
Fraction in killed by jet flame 0.1
Fraction out killed by pool fire 0.7
Fraction in killed by pool fire 0.1
Fraction out killed by toxics 0.9
Fraction in killed by toxics 0.1
Pop omega factor (per person) 1e-005
No sub-squares across ellipse in flamm. impct 10
Max times to subdivide a square in flamm. impct 5
Multiplying factor for toxic F-N spread 2
Probability of Immediate Ignition 0.9
Probability of Explosion given Ignition 0.01
Probability of Jet Fire rather than just pool 0.5
Probability Cloud ignites rather than just pool 0.5
Probability Inst. Cloud ignites with pool 0
Probability Horizontal Jet ignites with pool 0
Probability Vertical Jet ignites with pool 0
Probability split for short continuous releases 0
Probability of BLEVE rather than Flash Fire 0.99
1st Risk contour level 1 per yr
2nd Risk contour level 0.1 per yr
3rd Risk contour level 0.01 per yr
4th Risk contour level 0.001 per yr
5th Risk contour level 0.0001 per yr
6th Risk contour level 1e-005 per yr
7th Risk contour level 1e-006 per yr
8th Risk contour level 1e-007 per yr
9th Risk contour level 1e-008 per yr
10th Risk contour level 0 per yr
1st Risk contour Color Black
2nd Risk contour Color Black
3rd Risk contour Color Black
4th Risk contour Color Black
5th Risk contour Color Black
6th Risk contour Color Red
7th Risk contour Color Black
8th Risk contour Color Black
9th Risk contour Color Black
10th Risk contour Color Black

Line thickness for contours_____2
Line type for contours (thickness =1 only)_____Solid
Minimum risk level_____1e-008 per yr
Display risk criteria lines_____No
Maximum risk criteria line start N_____1
Maximum risk criteria line start F_____0.001 per yr
Maximum risk criteria line end N_____10
Maximum risk criteria line end F_____1e-005 per yr
Minimum risk criteria line start N_____1
Minimum risk criteria line start F_____1e-005 per yr
Minimum risk criteria line end N_____10
Minimum risk criteria line end F_____1e-007 per yr