Appendix 11.2.4

SAFETI Parameters of the Hazard Assessment for the Existing Ma Tau Kok Gas Works North Plant (MTKGWNP) and its Associated Facilities

MTKGW_20080728_gasProperties (Run

Parameters

Dispersion Parameters

Expansion zone length/source diameter ratio	0.01	
Near Field Passive Entrainment Parameter	1	
Jet Model	Morton et.al.	
Jet entrainment coefficient alpha1	0.17	
Jet entrainment coefficient alpha2	0.35	
Drag coefficient between plume and air	0	
Dense cloud parameter gamma (continuous)	0	
Dense cloud parameter gamma (instant)	0.3	
Dense cloud parameter k (continuous)	1.15	
Dense cloud parameter k (instantaneous)	1.15	
Modeling of instantaneous expansion	Standard Method	
Maximum Cloud/Ambient Velocity Difference	0.1	
Maximum Cloud/Ambient Density Difference	0.015	
Maximum Non-passive entrainment fraction	0.3	
Maximum Richardson number	15	
Distance multiple for full passive entrainment	2	
Core Averaging Time	18.75	s
Ratio instantaneous/continuous sigma-y	1	
Ratio instantaneous/continuous sigma-z	1	
Droplet evaporation thermodynamics model	Rainout, Non-equilibrium	
DropEqnSolnMethod	Synchronized	
Drop/expansion velocity for inst. release	0.8	
Expansion energy cutoff for droplet angle	0.69	kJ/kg
Coefficient of Initial Rainout	0	
Flag to reset rainout position	Do reset rainout position	
Richardson Number for passive transition above pool	0.015	
Pool Vaporization entrainment parameter	1.5	
Ground Drag Model	New (Recommended)	
Drag coefficient between plume and ground	1.5	
Richardson number criterion for cloud lift-off	-20	
Flag for Heat/Water vapor transfer	Heat and Water	
Surface over which the dispersion occurs	Land	
Minimum temperature allowed	-262.1	degC
Maximum temperature allowed	626.9	degC
Minimum release velocity for cont. release	0.1	m/s
Minimum Continuous Release Height	0	m
Maximum distance for dispersion	5E4	m
Maximum height for dispersion	1000	m
Minimum cloud depth	0.02	m
Flag for mixing height	Constrained	
Model In Use	Best Estimate	
Calculate Lee Length	Calculate	
Calculate Lee Half-Width	Calculate	
Calculate Lee Height	Calculate	
Calculate K-Factor	Calculate	
Calculate Switch Distance	Calculate	
Maximum Initial Step Size	10	m
Minimum Number of Steps per Zone	5.00	
Factor for Step Increase	1.2	

Maximum Number of Output Steps	1,000.00	
Flag for finite duration correction	QI without Duration Adjustment	
Quasi-instantaneous transition parameter	0.8	
Accuracy for integration of dispersion	0.001	
Accuracy for droplet integration	0.001	
Minimum integration step size (Instantaneous)	0.01	s
Minimum integration step size (Continuous)	0.01	m
Maximum integration step size (Instantaneous)	1000	s
Maximum integration step size (Continuous)	100	m
Criterion for halting dispersion model	Risk based	

Discharge Parameters

Continuous Critical Weber number	12.5	
Instantaneous Critical Weber number	12.5	
Venting equation constant	24.82	
Relief valve safety factor	1.2	
Minimum RV diameter ratio	1	
Critical pressure greater than flow phase	0.3447	bar
Maximum release velocity	500	m/s
Minimum drop diameter allowed	0.01	um
Maximum drop diameter allowed	1E4	um
Default Liquid Fraction	1	fraction
Continuous Drop Slip factor	1	
Instantaneous Drop Slip factor	1	
Pipe-Fluid Thermal Coupling	0	
Number of Time Steps	100.00	
Maximum Number of Data Points	1,000.00	
Droplet Method	1.00	
Input Flash Mechanism	Do not force correlation	
Tolerance	1E-6	
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	/m
Frequency of couplings in long pipes	0	/m
Frequency of junctions in long pipes	0	/m
Line length	50	m
Pipe roughness	0.0457	mm
Default volume changes	3	/hr
Elevation	1	m
Atmospheric Expansion Method	Closest to Initial Conditions	
Tank Roof Failure Model Effects	Instantaneous Effects	

Jet Fire Parameters

Maximum SEP for a Jet Fire	400	kW/m2
Jet Fire Averaging Time	20	s
Jet fire radiation intensity level 1	4	kW/m2
Jet fire radiation intensity level 2	12.5	kW/m2
Jet fire radiation intensity level 3	37.5	kW/m2
Rate Modification Factor	3	
Jet Fire Maximum Exposure Duration	20	s
Jet fire radiation dose level 1	1.27E6	
Jet fire radiation dose level 2	5.8E6	
Jet fire radiation dose level 3	2.51E7	
Jet fire radiation probit level 1	2.73	

Jet fire radiation probit level 2	3.72	
Jet fire radiation probit level 3	7.5	
Jet fire radiation lethality level 1	0.01	fraction
Jet fire radiation lethality level 2	0.1	fraction
Jet fire radiation lethality level 3	1	fraction
Calculate Dose	Unselected	
Calculate Probit	Unselected	
Calculate Lethality	Unselected	
CrosswindAngle	0	deg
Shell Calculation Method	DNV Recommended	
Use Johnson Method If Horizontal	Use Johnson	

Pool Fire Parameters

Min. pool duration for pool fire risk(Inst. releases)	10	s
Min. pool duration for pool fire risk(Cont. releases)	10	s
Pool fire radiation intensity level 1	4	kW/m2
Pool fire radiation intensity level 2	12.5	kW/m2
Pool fire radiation intensity level 3	37.5	kW/m2
Pool Fire Maximum Exposure Duration	20	s
Pool fire radiation dose level 1	1.27E6	
Pool fire radiation dose level 2	5.8E6	
Pool fire radiation dose level 3	2.51E7	
Pool fire radiation probit level 1	2.73	
Pool fire radiation probit level 2	3.72	
Pool fire radiation probit level 3	7.5	
Pool fire radiation lethality level 1	0.01	fraction
Pool fire radiation lethality level 2	0.1	fraction
Pool fire radiation lethality level 3	1	fraction
Calculate Dose	Unselected	
Calculate Probit	Unselected	
Calculate Lethality	Unselected	

Fireball and BLEVE Blast Parameters

Maximum SEP for a BLEVE	400	kW/m2
Radiation Dose for BLEVE risk calculations	1.15E7	
Fireball radiation intensity level 1	4	kW/m2
Fireball radiation intensity level 2	12.5	kW/m2
Fireball radiation intensity level 3	37.5	kW/m2
Mass Modification Factor	3	
Fireball Maximum Exposure Duration	20	s
Fireball radiation dose level 1	1.27E6	
Fireball radiation dose level 2	5.8E6	
Fireball radiation dose level 3	2.51E7	
Fireball radiation probit level 1	2.73	
Fireball radiation probit level 2	3.72	
Fireball radiation probit level 3	7.5	
Fireball radiation lethality level 1	0.01	fraction
Fireball radiation lethality level 2	0.1	fraction
Fireball radiation lethality level 3	1	fraction
Calculate Dose	Unselected	
Calculate Probit	Unselected	
Calculate Lethality	Unselected	
Temperature of fireball	1727	degC
Calculation method for fireball	DNV Recommended	
Ground Reflection	Ground Burst	

Ideal Gas Modeling	Model as real gas	
Ground Reflection	Ground Burst	
Ideal Gas Modeling	Model as real gas	
Ground Reflection	Ground Burst	
Ideal Gas Modeling	Model as real gas	

Flammable Parameters

Height for calculation of flammable effects	0	m
Flammable result grid step in X-direction	10	m
LFL fraction to finish	1	
Flammable angle of inclination	0	deg
Flammable inclination	Variable	
Flammable mass calculation method	Mass above LFL	
Flammable Base averaging time	18.75	s
Radiation level for Jet/Pool Fire Risk	35	kW/m2
Cut Off Fraction	0.001	fraction
UFL Multiple	1	
Cut Off Time for Short Continuous Releases	20	s
Observer type radiation modelling flag	Planar	
Probit A Value	-36.38	
Probit B Value	2.56	
Probit N Value	1.333	
Height for reports	Centreline Height	
Angle of orientation	0	deg
Relative tolerance for radiation calculations	0.01	fraction
Number of Lethality Ellipses	5.00	
Radiation Ellipse Interpolation	Probit	
Minimum Probability Of Death	0.01	fraction

Explosion Parameters

Over Pressure Level 1	0.02068	bar
Over Pressure Level 2	0.1379	bar
Over Pressure Level 3	0.2068	bar
Explosion Location Criterion	Cloud Front (LFL Fraction)	
Minimum explosive mass	0	kg
Minimum Explosion Energy	5E6	kJ
Explosion Efficiency	0.1	fraction
MPACT explosion higher damage zone coefficient	0.03	
MPACT explosion lower damage zone coefficient	0.06	
Explosion efficiency	10	%
Air or Ground burst	Air burst	
Early Explosion Mass Modification Factor	3	
Critical Separation Ratio	0.5	
Cloud Shape of Area Integration	Elliptical	
Flammable Mass Calculation Type	Area Weighted Mass Integral	
Explosion Type Calculation Method	Polynomial Curve-Fit Equations	
Number of Blast Curve Discretization Points	30,000.00	

General Parameters

Maximum release duration	3600	s
Height for concentration output	0	m
Rotation	0	deg
Minimum Z	0	m
Maximum Z	1	m

Pool Vaporization Parameters

Toxics Cut-off rate for pool evaporation	0.001	kg/s
Flammable Cut-off rate for pool evaporation	0.1	kg/s
Concentration Power	1	
Maximum No. Pool Evaporation Rates	10.00	
Pool minimum thickness	5	mm
Surface thermal conductivity	0.00221	kJ/m.s.deg
Surface roughness factor	2.634	
Surface thermal diffusivity (per second)	9.48E-7	m2/s
Type of Bund Surface	Concrete	
Bund Height	3	m
Bund Failure Modeling	Bund cannot fail	

Toxic Parameters

Toxics: minimum probability of death	0.001	
Toxics: height for calculation of effects	0	m
Toxics: results grid step in Y-direction	2.5	m
Toxics: results grid step in X-direction	25	m
Multi-comp. toxic calc. method	Mixture Probit	
Toxic Averaging Time (New Parameter)	600	s
Probit Calculation Method	Use Probit	
Building Exchange Rate	4	/hr
Tail Time	1800	s
Indoor Calculations	Unselected	
Wind Dependent Exchange Rate	Case Specified	

Weather Parameters

Atmospheric pressure	1.013	bar
Atmospheric molecular weight	28.97	
Atmospheric specific heat at constant pressure	1.004	kJ/kg.deg
Wind speed reference height (m)	10	m
Temperature reference height (m)	0	m
Cut-off height for wind speed profile (m)	1	m
Wind speed profile	Power Law	
Atmospheric Temperature and Pressure Profile	Temp.Logarithmic; Pres.Linear	
Atmospheric temperature	25	degC
Relative humidity	0.8	fraction
Surface Roughness Parameter	0.1	
Surface Roughness Length	183.2	mm
Roughness or Parameter	Parameter	
Dispersing surface temperature	25	degC
Default surface temperature of bund	25	degC
Solar radiation flux	0.5	kW/m2
Building Exchange Rate	4	/hr
Tail Time	1800	s
Surface Type	City centre with high and low rise buildings (3m)	
Mixing layer height for Pasquil Stability A	1300	m
Mixing layer height for Pasquil Stability A/B	1080	m
Mixing layer height for Pasquil Stability B	920	m
Mixing layer height for Pasquil Stability B/C	880	m
Mixing layer height for Pasquil Stability C	840	m
Mixing layer height for Pasquil Stability C/D	820	m
Mixing layer height for Pasquil Stability D	800	m
Mixing layer height for Pasquil Stability E	400	m
Mixing layer height for Pasquil Stability F	100	m
Mixing layer height for Pasquil Stability G	100	m

Event Tree Probabilities

Probability of a BLEVE	1	fraction
Probability of a Pool Fire	1	fraction
Toxic Probability	1	fraction
Continuous no Rainout Immediate Ignition	0.3	fraction
Continuous no Rainout Long Duration Horizontal Fraction	0.6	fraction
Continuous no Rainout Long Duration Horizontal Jet Fire	1	fraction
Continuous no Rainout Long Duration Vertical Jet Fire	1	fraction
Continuous no Rainout Short Duration Fraction	1	fraction
Continuous no Rainout Short Duration BLEVE	1	fraction
Continuous no Rainout Short Duration Flash Fire	0	fraction
Continuous no Rainout Short Duration Explosion	0	fraction
Continuous no Rainout Delayed Ignition Flash Fire	0.6	fraction
Continuous no Rainout Delayed Ignition Explosion	0.4	fraction
Continuous with Rainout Immediate Ignition	0.3	fraction
Continuous with Rainout Long Duration Horizontal Fraction	0.6	fraction
Continuous with Rainout Long Duration Horizontal Jet Fire	0	fraction
Continuous with Rainout Long Duration Horizontal Pool Fire	0	fraction
Continuous with Rainout Long Duration Horizontal Jet Fire with Pool Fi	1	fraction
Continuous with Rainout Long Duration Vertical Pool Fire	0	fraction
Continuous with Rainout Long Duration Vertical Jet Fire	0	fraction
Continuous with Rainout Short Duration Fraction	1	fraction
Continuous with Rainout Long Duration Vertical Jet Fire with Pool Fire	1	fraction
Continuous with Rainout Short Duration BLEVE with Pool Fire	1	fraction
Continuous with Rainout Short Duration BLEVE alone	0	fraction
Continuous with Rainout Short Duration Flash Fire with Pool Fire	0	fraction
Continuous with Rainout Short Duration Flash Fire Alone	0	fraction
Continuous with Rainout Short Duration Explosion with Pool Fire	0	fraction
Continuous with Rainout Short Duration Explosion Alone	0	fraction
Continuous with Rainout Short Duration Pool Fire	0	fraction
Continuous with Rainout Residual Pool Fire	0.15	fraction
Continuous with Rainout Delayed Ignition Flash Fire	0.6	fraction
Continuous with Rainout Delayed Ignition Explosion	0.4	fraction
Instantaneous no Rainout Immediate Ignition	0.3	fraction
Instantaneous no Rainout BLEVE	1	fraction
Instantaneous no Rainout Immediate Flash Fire	0	fraction
Instantaneous no Rainout Immediate Explosion	0	fraction
Instantaneous no Rainout Delayed Ignition Flash Fire	0.6	fraction
Instantaneous no Rainout Delayed Ignition Explosion	0.4	fraction
Instantaneous with Rainout Immediate Ignition	0.3	fraction
Instantaneous with Rainout BLEVE with Pool Fire	1	fraction
Instantaneous with Rainout BLEVE Alone	0	fraction
Instantaneous with Rainout Immediate Flash Fire with Pool Fire	0	fraction
Instantaneous with Rainout Immediate Flash Fire Alone	0	fraction
Instantaneous with Rainout Immediate Explosion with Pool Fire	0	fraction
Instantaneous with Rainout Immediate Explosion Alone	0	fraction
Instantaneous with Rainout Immediate Pool Fire Alone	0	fraction
Instantaneous with Rainout Residual Pool Fire	0.15	fraction
Instantaneous with Rainout Delayed Ignition Flash Fire	0.6	fraction
Instantaneous with Rainout Delayed Ignition Explosion	0.4	fraction
Immediate Ignition	0.1	fraction
Explosion Given Ignition	0.5	fraction
Long Duration Jet Fire	0.5	fraction
Short Duration Any Ignition of Cloud	0.5	fraction
Short Duration Ignition of Cloud with Pool Fire	0	fraction

Long Duration Horizontal Jet Fire with Pool	0	fraction
Long Duration Vertical Jet Fire with Pool	0	fraction
Short Duration Fraction for Effects	0	fraction
Short Duration BLEVE not Flash Fire	0.5	fraction

General Risk Parameters

Use Free Field Modelling	No	
Distance to Site Boundary	0	m
Include Effects of Late Pool Fire	No	
Minimum Case Frequency	1e-012	
Minimum Event Probability	1e-012	
Fraction of Population Outdoors for Societal Risk	0.05	fraction
Fraction of Population Outdoors for Individual Risk	1	fraction
Population Omega Factor	0.000168	
Maximum Number of Subsquares across Ellipse	10.00	
Maximum Number of Subdivisions per Square	5.00	
Factor for Toxic F-N Spread	2	
Set Calculation Grid Size	No	
Grid Bounds Minimum X (input)	-1000	m
Grid Bounds Maximum X (input)	1000	m
Grid Bounds Minimum Y (input)	-1000	m
Grid Bounds Maximum Y (input)	1000	m
Grid Calculation Method	Number of cells	
MPACT cell size	10	m
Maximum number of MPACT cells	40,000.00	
Aversion Index	1.2	
Indoor Population Omega Factor	0.02	
Number of wind subdivisions per sector	1.00	
Method for handling Indoor/Outdoor risk	Indoor and outdoor risk calculations	
Inter-ellipse interpolation method	Weighted	
Heavy Explosion Damage (Outdoors)	1	fraction
Heavy Explosion Damage (Indoors)	1	fraction
Light Explosion Damage (Outdoors)	0	fraction
Light Explosion Damage (Indoors)	0.025	fraction
Flash Fire (Outdoors)	1	fraction
Flash Fire (Indoors)	1	fraction
Fireball Societal Radiation Criteria Zone (Outdoors)	1	fraction
Fireball Societal Radiation Criteria Zone (Indoors)	1	fraction
Fireball Individual Radiation Criteria Zone (Outdoors)	1	fraction
Fireball Individual Radiation Criteria Zone (Indoors)	1	fraction
Fireball Societal Flammable Probit Zone (Outdoors)	0.14	fraction
Fireball Societal Flammable Probit Zone (Indoors)	0	fraction
Fireball Individual Flammable Probit Zone (Outdoors)	1	fraction
Fireball Individual Flammable Probit Zone (Indoors)	0	fraction
Jet Fire Societal Radiation Criteria Zone (Outdoors)	1	fraction
Jet Fire Societal Radiation Criteria Zone (Indoors)	1	fraction
Jet Fire Individual Radiation Criteria Zone (Outdoors)	1	fraction
Jet Fire Individual Radiation Criteria Zone (Indoors)	1	fraction
Jet Fire Societal Flammable Probit Zone (Outdoors)	0.14	fraction
Jet Fire Societal Flammable Probit Zone (Indoors)	0	fraction
Jet Fire Individual Flammable Probit Zone (Outdoors)	1	fraction
Jet Fire Individual Flammable Probit Zone (Indoors)	0	fraction
Pool Fire Societal Radiation Criteria Zone (Outdoors)	1	fraction
Pool Fire Societal Radiation Criteria Zone (Indoors)	1	fraction
Pool Fire Individual Radiation Criteria Zone (Outdoors)	1	fraction

Pool Fire Individual Radiation Criteria Zone (Indoors)	1	fraction
Pool Fire Societal Flammable Probit Zone (Outdoors)	0.14	fraction
Pool Fire Societal Flammable Probit Zone (Indoors)	0	fraction
Pool Fire Individual Flammable Probit Zone (Outdoors)	1	fraction
Pool Fire Individual Flammable Probit Zone (Indoors)	0	fraction
Toxics (Outdoors)	1	fraction
Toxics (Indoors)	1	fraction

Plant parameters

Length of In-Unit Pipes	10	m
Path Factor for Inter-Unit Pipes	1.414	
Maximum Spacing Between Failures	50	m
Maximum Pipe Inventory as a Fraction of Upstream Inventory	0.25	fraction
Size for Leak Cases (as fraction of Pipe Diameter)	0.1	fraction
Minimum Detection Time	3600	s
Normal Gas Flow Velocity	20	m/s
Normal Liquid Flow Velocity	1	m/s
Probability of Non-Ignition	0.5	fraction
Minimum Volume Changes per Step	0.15	
Maximum Volume Changes per Step	0.5	
Bend Frequency for In Unit Pipes	0.2	/m
Coupling Frequency for In Unit Pipes	0.5	/m
Junction Frequency for In Unit Pipes	0.1	/m
Probability First Valve Fails to Close on Demand	0.01	
Minimum Event Frequency for Generated Models	6.5E-7	/AvgeYear
Smallest Leak Detectable as Fraction of Normal Flowrate	0.1	fraction
Time to Shut Non-Return Valves	5	s
Time to Shut Excess Flow Valves	5	s
Calculate Rupture Cases	Yes	
Divide Base Failure Rate Equally Along Length of Pipe	Yes	
Prevent Flashing in Pipes	Yes	