

ANNESSO TECNICO 6.

Elaborati di calcolo Scenari incidentali ragionevolmente credibili

Ipotesi N. 27

TRR S.r.l.

Il Direttore Generale

Ing. *Alfredo Romano*



SUMMARY REPORT

Unique Audit Number: 182.294



Study Folder: 70977-Fase 1-Metanolo

Phast 6.6

70977-Fase 1-Metanolo

Manichetta

Vessel/Pipe Source

Base Case

CASE Name: Data

Path: \70977-Fase 1-Metanolo\Manichetta\Vessel/Pipe Source

User-Defined Data

Material

Material Identifier	METHANOL
Type of Vessel	Padded Liquid
Pressure Specification	Pressure specified
Storage Pressure - gauge	1 bar
Temperature	25 degC
Mass Inventory	20 kg

Scenario

Scenario Type	Catastrophic rupture
Phase to be Released	Liquid
Building Wake Effect	None

Location

[Elevation	1 m]
Use ERPG averaging time	ERPG not selected
Use IDLH averaging time	IDLH not selected
Use STEL averaging time	STEL not selected
Supply a user defined averaging time	Not supplied

Bund

Status of Bund	No bund present
[Type of Bund Surface	Concrete]
[Bund Height	0 m]
[Bund Failure Modeling	Bund cannot fail]

Indoor/Outdoor

Location of release	Open air release
---------------------	------------------

Flammable

Explosion Method	TNT
Jet Fire Method	API Model

Dispersion

Late Ignition Location	No ignition location
Mass Inventory of material to Disperse	20 kg
Use Burst Pressure	No - Use release pressure for fireball

Fireball Parameters

[Mass Modification Factor	3]
[Calculation method for fireball	DNV Recommended]
[TNO model flame temperature	1727 degC]

Toxic Parameters

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Study Folder: 70977-Fase 1-Metanolo

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[Indoor Calculations	Unselected]
[Wind Dependent Exchange Rate	Case Specified]
[Building Exchange Rate	4 /hr]
[Tail Time	1800 s]
[Set averaging time equal to exposure time	Use a fixed averaging time]
[Cut-off fraction of toxic load for exposure time calculation	0.05 fraction]
[Cut-off concentration for exposure time calculations	0 fraction]

Geometry

Shape	Point
Dimension	2D
System	Absolute
East(1)	0 m
North(1)	0 m

Path: \70977-Fase 1-Metanolo\Manichetta\Vessel/Pipe Source

Discharge Data

User-Defined Quantities

Material	METHANOL
Temperature	25,00 degC
Pressure	2,01 bar
Inventory	20,00 kg
Scenario	Catastrophic rupture
Fixed Duration	n/a s

Calculated Quantities

Weather: Global Weathers\Category 2/F

Mass Flow of Air (Vent from Vapor Space Only) n/a

Average Values for Segment Number 1

Liquid Fraction	1,00 fraction
Final Temperature	24,98 degC
Final Velocity	9,03 m/s
Droplet Diameter	477,64 um

Continuous Release Data:

Mass Flowrate	n/a kg/s
Release Duration	n/a s
Orifice Velocity	n/a m/s
Exit Pressure	n/a bar
Exit Temperature	n/a degC
Discharge Coefficient	n/a
Expanded Radius	n/a m

Weather: Global Weathers\Category 5/D

Mass Flow of Air (Vent from Vapor Space Only) n/a

Average Values for Segment Number 1

Liquid Fraction	1,00 fraction
Final Temperature	24,98 degC

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Final Velocity	9,03 m/s
Droplet Diameter	477,64 um
Continuous Release Data:	
Mass Flowrate	n/a kg/s
Release Duration	n/a s
Orifice Velocity	n/a m/s
Exit Pressure	n/a bar
Exit Temperature	n/a degC
Discharge Coefficient	n/a
Expanded Radius	n/a m

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Study Folder: 70977-Fase 1-Metanolo

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Consequence Results

Weather Conditions

Path: \70977-Fase 1-Metanolo\Manichetta\Vessel/Pipe Source

		Category 2/F	Category 5/D
Wind Speed	m/s	2	5
Pasquill Stability		F	D
Surface Roughness Length	mm	1000	1000
Surface Roughness Parameter		0.173718	0.173718
Atmospheric Temperature	degC	25	25
Surface Temperature	degC	25	25
Relative Humidity	fraction	0.75	0.75

DETAILED DISPERSION REPORT

Unique Audit Number: 184.384



Study Folder: 70977-Fase 1-Metanolo

Phast 6.6

70977-Fase 1-Metanolo

Manichetta

User Defined Source-F2/D5

Base Case

Data

Weather: Global Weathers\Category 2/F

Speed: 2,00 m/s Stability: F

\70977-Fase 1-Metanolo\Manichetta\User Defined Source-F2/D5

Material: METHANOL

Note: C/Line Concentration is calculated at an averaging time of: 18,75 s
 Plume Width and Height are calculated at an averaging time of: 600,00 s
 and a Concentration of Interest of: 6.700,00 ppm
 Concentration at Height calculated at a Height of: 0,00 m

For Instantaneous releases (and if present in this report) the Mass Flowrate is the Mass of Released Material in the cloud, and the C/Line Distance is the same as the Time.

Downwind Distance m	C/Line Height m	C/Line Conc ppm	Plume Half-width m	Plume Total Depth m	Vapor Temperature degC	Liquid Fraction fraction	Time s	Liquid Temperature degC	Centroid Velocity m/s	Cloud Density kg/m3
Segment Number: 1			Start Time: 0,00 s							
0,00	1,00	472.563,02	0,27	0,47	46,13	0,04	0,00	46,13	0,31	1,19
0,00	1,00	472.563,02	0,27	0,47	46,13	0,04	0,00	46,13	0,31	1,19
0,01	1,00	436.126,08	0,27	0,47	44,33	0,04	0,06	44,33	0,33	1,19
0,03	1,00	375.707,40	0,28	0,48	41,07	0,04	0,12	41,07	0,35	1,19
0,07	1,00	288.788,52	0,29	0,51	35,55	0,03	0,23	35,55	0,39	1,19
0,15	0,99	186.555,73	0,32	0,56	27,10	0,01	0,42	27,10	0,44	1,20
0,31	0,97	93.909,79	0,38	0,69	25,02	0,00	0,77		0,48	1,19
0,47	0,95	61.560,65	0,51	0,75	25,02	0,00	1,10		0,50	1,18
0,63	0,93	52.964,24	0,68	0,72	25,02	0,00	1,42		0,50	1,18
0,79	0,90	50.716,90	0,68	0,72	25,02	0,00	1,74		0,51	1,18

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Study Folder: 70977-Fase 1-Metanolo

Phast 6.6

Downwind Distance m	C/Line Height m	C/Line Conc ppm	Plume Half-width m	Plume Total Depth m	Vapor Temperature degC	Liquid Fraction fraction	Time s	Liquid Temperature degC	Centroid Velocity m/s	Cloud Density kg/m3
1,10	0,82	46.656,94	0,68	0,73	25,02	0,00	2,36		0,52	1,18
1,71	0,63	39.951,78	0,67	0,73	25,01	0,00	3,58		0,53	1,18
2,30	0,39	34.699,93	0,67	0,77	25,01	0,00	4,77		0,55	1,18
2,42	0,34	33.809,17	0,67	0,77	25,01	0,00	5,00		0,55	1,18
2,54	0,29	32.982,16	0,66	0,74	25,01	0,00	5,23		0,56	1,18
2,78	0,21	31.517,97	0,66	0,71	25,01	0,00	5,69		0,56	1,18
3,03	0,15	30.250,21	0,66	0,71	25,00	0,00	6,15		0,56	1,18
3,53	0,07	28.078,47	0,66	0,72	25,00	0,00	7,06		0,56	1,18
4,55	0,00	24.569,56	0,64	0,72	25,00	0,00	8,93		0,54	1,18
5,58	0,00	21.678,21	0,62	0,70	25,00	0,00	10,84		0,53	1,18
7,62	0,00	17.221,80	0,51	0,60	25,00	0,00	14,74		0,52	1,18
11,72	0,00	11.635,57	0,00	0,00	25,00	0,00	22,60		0,52	1,18
15,82	0,00	8.402,85	0,00	0,00	25,00	0,00	30,49		0,52	1,17
24,01	0,00	4.988,87	0,00	0,00	25,00	0,00	46,25		0,52	1,17
40,39	0,00	2.355,83	0,00	0,00	25,00	0,00	77,66		0,52	1,17
56,78	0,00	1.303,00	0,00	0,00	25,00	0,00	105,68		0,65	1,17
89,54	0,00	560,60	0,00	0,00	25,00	0,00	154,69		0,69	1,17
97,74	0,00	465,76	0,00	0,00	25,00	0,00	165,19		0,87	1,17
99,78	0,00	447,02	0,00	0,00	25,00	0,00	167,62		0,81	1,17
101,83	0,00	431,54	0,00	0,00	25,00	0,00	170,07		0,86	1,17
103,88	0,00	417,14	0,00	0,00	25,00	0,00	172,48		0,84	1,17
107,98	0,00	390,31	0,00	0,00	25,00	0,00	177,30		0,86	1,17
116,17	0,00	344,15	0,00	0,00	25,00	0,00	186,80		0,87	1,17
132,55	0,00	273,65	0,00	0,00	25,00	0,00	205,44		0,89	1,17
165,32	0,00	185,63	0,00	0,00	25,00	0,00	241,23		0,94	1,17
230,86	0,00	102,23	0,00	0,00	25,00	0,00	308,16		1,02	1,17
330,86	0,00	52,97	0,00	0,00	25,00	0,00	399,95		1,16	1,17
430,86	0,00	32,42	0,00	0,00	25,00	0,00	480,99		1,31	1,17
530,86	0,00	21,98	0,00	0,00	25,00	0,00	554,39		1,42	1,17

DETAILED DISPERSION REPORT

Unique Audit Number: 184.384



Study Folder: 70977-Fase 1-Metanolo

Phast 6.6



Weather: Global Weathers/Category 5/D

Speed: 5,00 m/s

Stability: D

\70977-Fase 1-Metanolo\Manichetta\User Defined Source-F2/D5

Material: METHANOL

Note: C/Line Concentration is calculated at an averaging time of: 18,75 s
 Plume Width and Height are calculated at an averaging time of: 600,00 s
 and a Concentration of Interest of: 6.700,00 ppm
 Concentration at Height calculated at a Height of: 0,00 m

For Instantaneous releases (and if present in this report) the Mass Flowrate is the Mass of Released Material in the cloud, and the C/Line Distance is the same as the Time.

Downwind Distance m	C/Line Height m	C/Line Conc ppm	Plume Half-width m	Plume Total Depth m	Vapor Temperature degC	Liquid Fraction fraction	Time s	Liquid Temperature degC	Centroid Velocity m/s	Cloud Density kg/m3
Segment Number:	1		Start Time:	0,00	s					
0,00	1,00	472.566,86	0,13	0,26	46,13	0,04	0,00	46,13	1,34	1,19
0,00	1,00	472.566,86	0,13	0,26	46,13	0,04	0,00	46,13	1,34	1,19
0,01	1,00	428.709,92	0,13	0,26	43,95	0,04	0,01	43,95	1,45	1,19
0,03	1,00	361.225,43	0,13	0,26	40,22	0,04	0,03	40,22	1,62	1,19
0,07	1,00	272.050,38	0,13	0,27	34,35	0,03	0,05	34,35	1,85	1,19
0,15	1,00	174.916,56	0,15	0,29	25,93	0,00	0,09	25,93	2,11	1,20
0,31	1,00	90.678,62	0,17	0,35	24,99	0,00	0,16		2,33	1,19
0,63	1,00	44.156,29	0,31	0,34	24,99	0,00	0,30		2,46	1,18
0,95	0,99	30.677,02	0,29	0,36	24,99	0,00	0,42		2,50	1,18
1,59	0,99	17.470,95	0,20	0,29	24,99	0,00	0,68		2,53	1,18
2,87	0,98	7.970,13	0,00	0,00	24,99	0,00	1,18		2,56	1,17
4,15	0,98	4.572,42	0,00	0,00	24,99	0,00	1,68		2,57	1,17
6,71	0,97	2.108,38	0,00	0,00	24,99	0,00	2,68		2,58	1,17
9,27	0,96	1.228,54	0,00	0,00	24,99	0,00	3,66		2,64	1,17
11,83	0,96	809,13	0,00	0,00	24,99	0,00	4,61		2,76	1,17
16,95	0,96	433,45	0,00	0,00	24,99	0,00	6,43		2,87	1,17

DETAILED DISPERSION REPORT

Unique Audit Number: 184.384



Study Folder: 70977-Fase 1-Metanolo

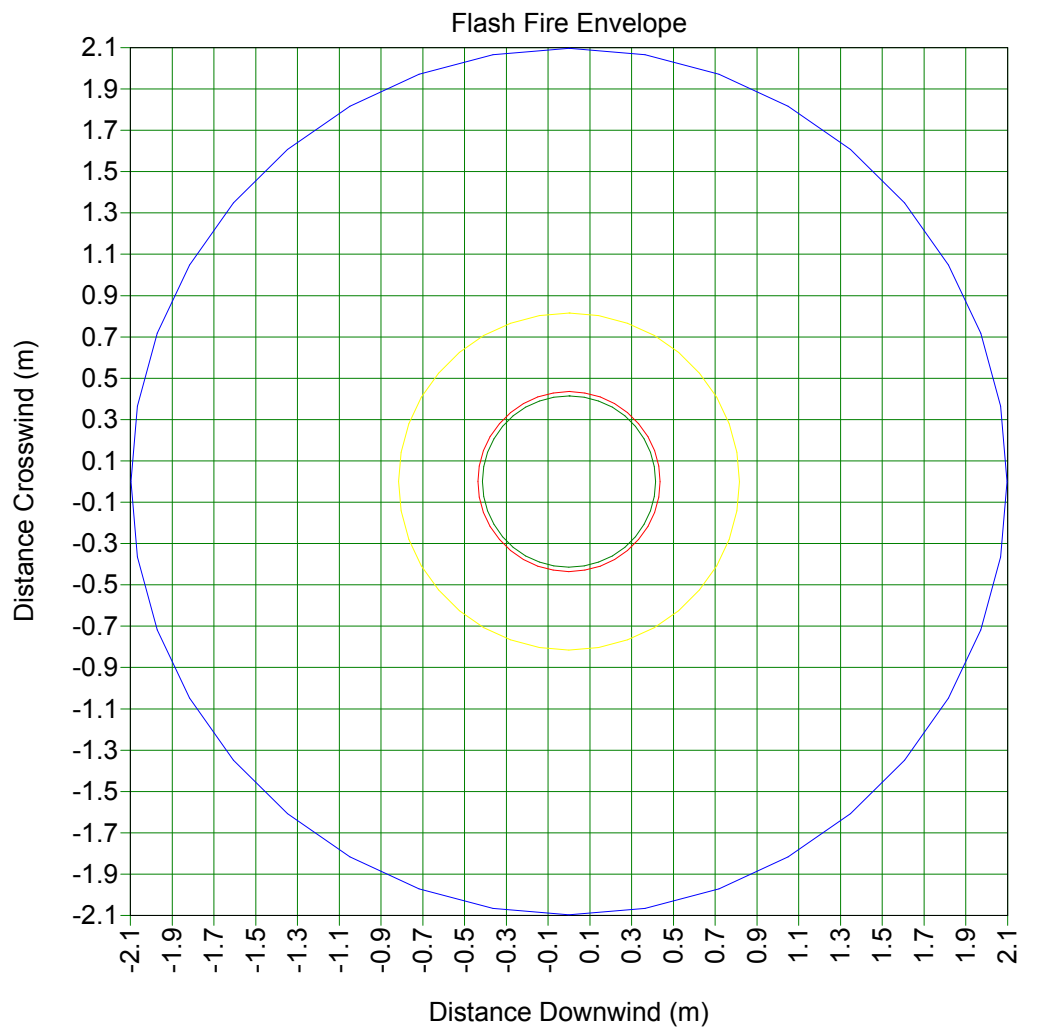
Phast 6.6



Downwind Distance m	C/Line Height m	C/Line Conc ppm	Plume Half-width m	Plume Total Depth m	Vapor Temperature degC	Liquid Fraction fraction	Time s	Liquid Temperature degC	Centroid Velocity m/s	Cloud Density kg/m3
27,19	0,96	186,28	0,00	0,00	24,99	0,00	9,87		3,09	1,17
37,43	0,96	102,53	0,00	0,00	24,99	0,00	13,02		3,41	1,17
57,91	0,96	44,85	0,00	0,00	24,99	0,00	18,84		3,63	1,17
78,39	0,96	24,68	0,00	0,00	24,99	0,00	24,18		4,04	1,17
98,87	0,96	15,51	0,00	0,00	24,99	0,00	29,09		4,29	1,17
103,99	0,96	14,12	0,00	0,00	24,99	0,00	30,25		4,53	1,17
109,11	0,96	12,94	0,00	0,00	24,99	0,00	31,39		4,52	1,17
119,35	0,96	10,99	0,00	0,00	24,99	0,00	33,63		4,58	1,17
139,83	0,96	8,23	0,00	0,00	24,99	0,00	38,06		4,67	1,17
180,79	0,96	5,15	0,00	0,00	24,99	0,00	46,67		4,84	1,17
221,75	0,96	3,54	0,00	0,00	24,99	0,00	54,89		5,12	1,17
262,71	0,96	2,59	0,00	0,00	24,99	0,00	62,74		5,31	1,17
344,63	0,96	1,58	0,00	0,00	24,99	0,00	77,90		5,50	1,17
426,55	0,96	1,06	0,00	0,00	24,99	0,00	92,34		5,84	1,17
508,47	0,96	0,77	0,00	0,00	24,99	0,00	106,09		6,07	1,17

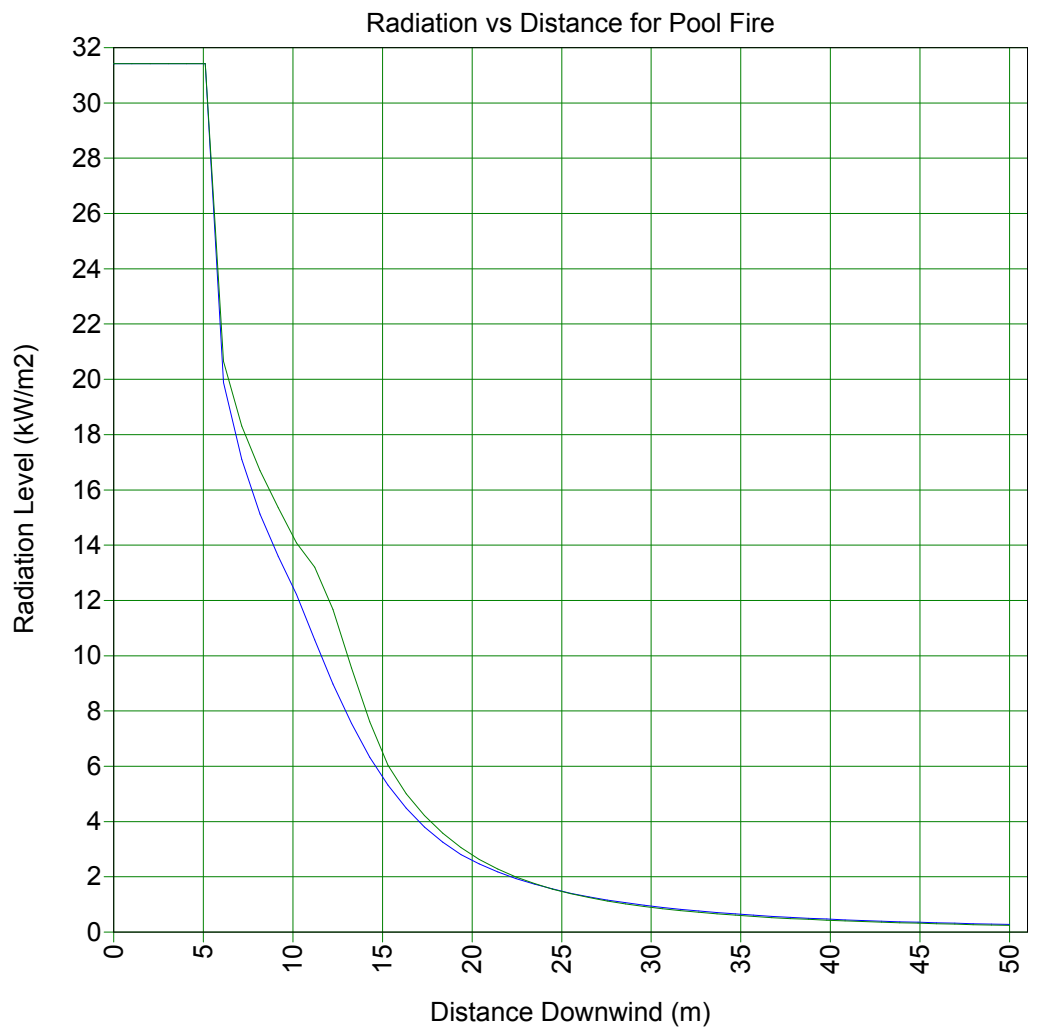
Study Folder: 70977-Fase
1-Metanolo
Audit No: 182297
Model: User Defined
Source-F2/D5
Material: METHANOL
Weathers

- Category 2/F 3.65e+004
- Category 2/F 7.3e+004 p
- Category 5/D 3.65e+004
- Category 5/D 7.3e+004 p



Study Folder: 70977-Fase
1-Metanolo
Audit No: 182295
Model: Pool Fire
Material: METHANOL
Weathers

— Category 2/F
— Category 5/D



POOL VAPORIZATION REPORT

Unique Audit Number: 182.296



Study Folder: 70977-Fase 1-Metanolo

Phast 6.6




 70977-Fase 1-Metanolo

 Manichetta

Pool Vaporization

Base Case

Data

 Weather: Global Weathers\Category 2/F
Speed: 2,00 m/s Stability: F

\\70977-Fase 1-Metanolo\Manichetta\Pool Vaporization

User-Defined Quantities

Material	METHANOL
Type of Spill	Instantaneous
Surface Type	Concrete
Bund Diameter	11,00 m
Ambient Temperature	25,00 degC
Bund Surface Temperature	25,00 degC
Ambient Wind Speed	2,00 m/s
Solar Flux	1,20 kW/m2

Calculated Quantities

Status of Bund: The Bund was not hit
Maximum Pool Radius 1,27 m

Averages for Release Segment: 1

Number of Cloud Segments	1
Rainout Fraction	1,00 fraction
Spill Rate	20.000,00 kg/s
Spill Duration	0,00 s
Spill Mass	20,00 kg
Spill Temperature	25,00 degC
Mass Remaining	17,27 kg

Cloud Segments for this Release Segment

Cloud Segment	Rate	Duration	Temperature	Total Mass	Radius	Mass Air Entrained
	kg/s	s	degC	kg	m	kg/s
1	0,01	300,00	19,55	2,73	1,21	0,06

POOL VAPORIZATION REPORT

Unique Audit Number: 182.296



Study Folder: 70977-Fase 1-Metanolo

Phast 6.6



Weather: Global Weathers\Category 5/D

Speed: 5,00 m/s

Stability: D

\70977-Fase 1-Metanolo\Manichetta\Pool Vaporization

User-Defined Quantities

Material	METHANOL
Type of Spill	Instantaneous
Surface Type	Concrete
Bund Diameter	11,00 m
Ambient Temperature	25,00 degC
Bund Surface Temperature	25,00 degC
Ambient Wind Speed	5,00 m/s
Solar Flux	1,20 kW/m2

Calculated Quantities

Status of Bund: The Bund was not hit
Maximum Pool Radius 1,27 m

Averages for Release Segment: 1

Number of Cloud Segments	1
Rainout Fraction	1,00 fraction
Spill Rate	20.000,00 kg/s
Spill Duration	0,00 s
Spill Mass	20,00 kg
Spill Temperature	25,00 degC
Mass Remaining	16,77 kg

Cloud Segments for this Release Segment

Cloud Segment	Rate kg/s	Duration s	Temperature degC	Total Mass kg	Radius m	Mass Air Entrained kg/s
1	0,01	300,00	15,94	3,23	1,20	0,09

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Unique Audit Number: 185.110



Study Folder: 70977-Fase 1-Metanolo

Phast 6.6

70977-Fase 1-Metanolo

Manichetta

User Defined Source-F2/D5

Base Case

CASE Name: Data

Path: \70977-Fase 1-Metanolo\Manichetta\User Defined Source-F2/D5

User-Defined Data

Material

Material Identifier METHANOL

Scenario

Building Wake Effect None

Vessel/Tank

Release Type Pool Source (Radius given)

Location

[Elevation 1 m]
Concentration of Interest 6700 ppm
Averaging time associated with Concentration Toxic
Distances for Radiation Modeling and Dispersion Scope(1) 50 m
Distances for Radiation Modeling and Dispersion Scope(2) 250 m
Distances for Radiation Modeling and Dispersion Scope(3) 500 m
Use ERPG averaging time ERPG not selected
Use IDLH averaging time IDLH not selected
Use STEL averaging time STEL not selected
Supply a user defined averaging time Not supplied

Bund

Status of Bund No bund present
[Type of Bund Surface Concrete]
[Bund Height 0 m]
[Bund Failure Modeling Bund cannot fail]

Indoor/Outdoor

Location of release Open air release
Outdoor Release Direction Horizontal

Flammable

Explosion Method TNT
Jet Fire Method API Model

Dispersion

Number of Release Segments 1
Fluid Phase(1) Vapor
Duration of Discharge(1) 2000 s
Final Temperature(1) 25 degC
Release Rate(1) 0.01 kg/s
Pool Radii(1) 11 m
Pre-Dilution Air Rates(1) 0.01 kg/s

SUMMARY REPORT

Unique Audit Number: 185.110



Study Folder: 70977-Fase 1-Metanolo

Phast 6.6

Consequence Results

Distance to Concentration Results

Path: \70977-Fase 1-Metanolo\Manichetta\User Defined Source-F2/D5

The height for user defined concentrations is the user defined height 0 m
All toxic results are reported at the toxic effect height 0 m
All flammable results are reported at the cloud centreline height

Concentration(ppm) Averaging Time				Distance (m)	
				Category 2/F	Category 5/D
User Conc (6700)	600	s		10.427	No Hazard
UFL (360000)	18.75	s		0.0413158	0.0346489
LFL (73000)	18.75	s		0.415173	0.435695
LFL Frac (36500)	18.75	s		2.09739	0.815849

Concentration(ppm) Averaging Time				Heights (m) for above distances	
				Category 2/F	Category 5/D
User Conc (6700)	600	s		0	0
UFL (360000)	18.75	s		0.999188	0.999974
LFL (73000)	18.75	s		0.95913	0.99811
LFL Frac (36500)	18.75	s		0.471141	0.995842

SUMMARY REPORT

Study Folder: 70977-Fase 1-Metanolo

Unique Audit Number: 185.110

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Concentration At Distance Results

Path: \70977-Fase 1-Metanolo\Manichetta\User Defined Source-F2/D5

The height for user defined concentrations is the user defined height 0 m

All toxic results are reported at the toxic effect height 0 m

All flammable results are reported at the cloud centreline height

Distance		Conc.(ppm) at Flammable Avg.Time of 18.75 s	
		Category 2/F	Category 5/D
50	m	1738.48	67.1371
250	m	92.8034	2.8871
500	m	25.2025	0.801076

Distance		Heights (m) for above concentrations	
		Category 2/F	Category 5/D
50	m	0	0.958595
250	m	0	0.956879
500	m	0	0.956517

Distance		Conc.(ppm) at Toxic Avg.Time of 600 s	
		Category 2/F	Category 5/D
50	m	869.239	32.8976
250	m	46.4017	1.44109
500	m	12.6012	0.400288

Distance		Heights (m) for above concentrations	
		Category 2/F	Category 5/D
50	m	0	0
250	m	0	0
500	m	0	0

Distance		Conc.(ppm) at Core Avg.Time of 18.75 s	
		Category 2/F	Category 5/D
50	m	1738.48	65.7952
250	m	92.8034	2.88217
500	m	25.2025	0.800575

Distance		Heights (m) for above concentrations	
		Category 2/F	Category 5/D
50	m	0	0
250	m	0	0
500	m	0	0

Distance to Equivalent Toxic Dose

Path: \70977-Fase 1-Metanolo\Manichetta\User Defined Source-F2/D5

Toxic Calculation Method = Mixture Probit

Concentration(ppm)	Reference Time		Distance (m)	
			Category 2/F	Category 5/D
User Conc (6700)	600	s	30.0375	No Hazard

SUMMARY REPORT

Unique Audit Number: 185.110



Study Folder: 70977-Fase 1-Metanolo

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Time to Equivalent Toxic Dose

Path: \70977-Fase 1-Metanolo\Manichetta\User Defined Source-F2/D5

Toxic Calculation Method = Mixture Probit

At 50 m

Concentration(ppm)	Reference Time		Category 2/F	Time (s)	Category 5/D
User Conc (6700)	600	s	No Hazard		No Hazard

At 250 m

Concentration(ppm)	Reference Time		Category 2/F	Time (s)	Category 5/D
User Conc (6700)	600	s	No Hazard		No Hazard

At 500 m

Concentration(ppm)	Reference Time		Category 2/F	Time (s)	Category 5/D
User Conc (6700)	600	s	No Hazard		No Hazard

Late Pool Fire Hazard

Path: \70977-Fase 1-Metanolo\Manichetta\User Defined Source-F2/D5

Late Pool Fire Status	Category 2/F	Category 5/D
	Hazard	Hazard

Radiation Effects: Late Pool Fire Ellipse

Path: \70977-Fase 1-Metanolo\Manichetta\User Defined Source-F2/D5

Radiation Level			Category 2/F	Distance (m)	Category 5/D
4	kW/m2		31.9226	32.8968	
12.5	kW/m2		19.8206	22.512	
37.5	kW/m2		Not Reached	Not Reached	

Radiation Effects: Late Pool Fire Distance

Path: \70977-Fase 1-Metanolo\Manichetta\User Defined Source-F2/D5

Distance Of Interest			Category 2/F	Radiation Level (kW/m2)	Category 5/D
50	m		1.25595	1.22453	
250	m		0.0297453	0.0259814	
500	m		0.00635365	0.00550813	

SUMMARY REPORT

Unique Audit Number: 185.110



Study Folder: 70977-Fase 1-Metanolo

Phast 6.6

Flash Fire Envelope

Path: \70977-Fase 1-Metanolo\Manichetta\User Defined Source-F2/D5

All flammable results are reported at the cloud centreline height

				Distance (m)	
				Category 2/F	Category 5/D
Furthest Extent	36500	ppm		2.09739	0.815849
Furthest Extent	73000	ppm		0.415173	0.435695
				Heights (m) for above distances	
				Category 2/F	Category 5/D
Furthest Extent	36500	ppm		0.471141	0.995842
Furthest Extent	73000	ppm		0.95913	0.99811

Weather Conditions

Path: \70977-Fase 1-Metanolo\Manichetta\User Defined Source-F2/D5

				Category 2/F	Category 5/D
Wind Speed		m/s		2	5
Pasquill Stability				F	D
Surface Roughness Length		mm		1000	1000
Surface Roughness Parameter				0.173718	0.173718
Atmospheric Temperature		degC		25	25
Surface Temperature		degC		25	25
Relative Humidity		fraction		0.75	0.75