ANNESSO TECNICO 6.

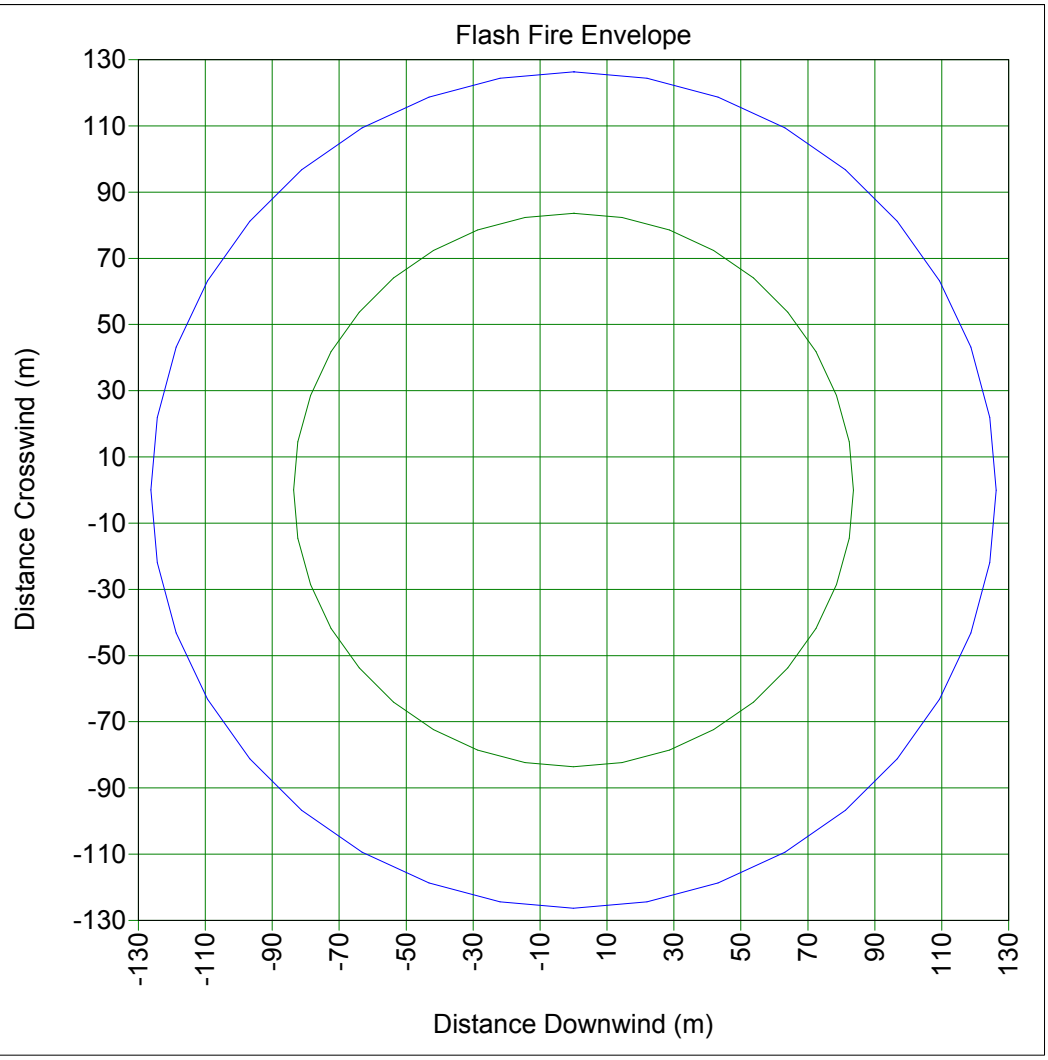
Elaborati di calcolo
Scenari incidentali ragionevolmente credibili

Ipotesi N. 1

TRR S.r.l.
Il Direttore Generale
Ing. Alfredo Romano

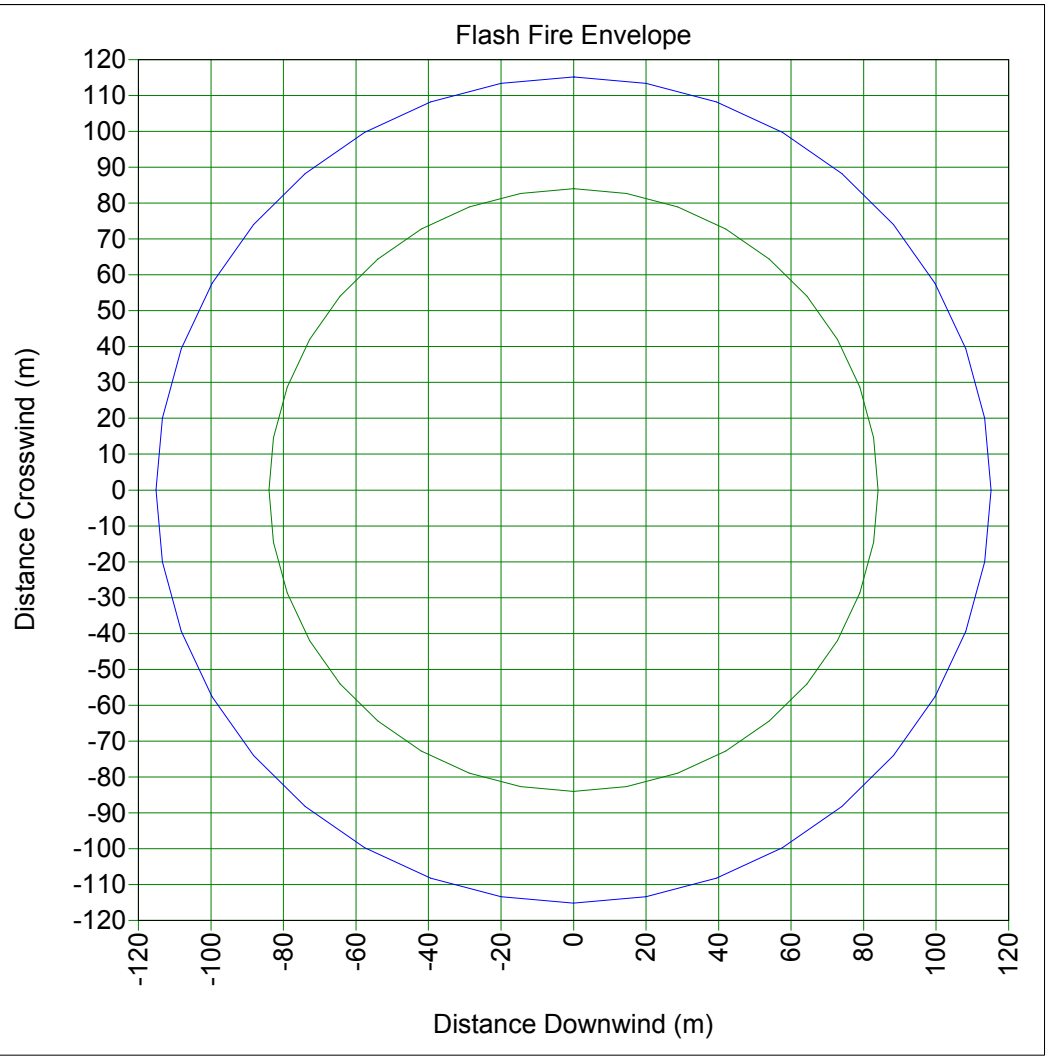
Study Folder: 70977-Fase 1-Ip1
Audit No: 58077
Model: 200mm
Weather: Category 5/D
Material: METHANE
Concentration

2.2e+004 ppm
4.4e+004 ppm



Study Folder: 70977-Fase 1-Ip1
Audit No: 58077
Model: 200mm
Weather: Category 2/F
Material: METHANE
Concentration

2.2e+004 ppm
4.4e+004 ppm



70977-Fase 1-Ip1

Testa Pozzo

200mm

Base Case

Data

Weather: **Global Weathers\Category 2/F**

Speed: 2,00 **m/s** **Stability: F**

\70977-Fase 1-Ip1\Testa Pozzo\200mm

Flame Data

User-Defined Quantities

Model Correlation Type	**API**	
Material	METHANE	
Ambient Temperature	25,00	degC
Ambient Relative Humidity	0,75	fraction
Ambient Wind Speed	2,00	m/s
Maximum Exposure Duration	20,00	s
Elevation	1,00	m
Expanded Temperature	0,73	degC
Release Rate	40,08	kg/s

	Input	**Output**	
Flame Emissive Power		130,46	kW/m2
Fraction of Emissivity		0,15	fraction
Expanded Radius		0,19	m
Jet Velocity	499,89	499,89	m/s
Flame Length		91,46	m
Maximum Flame Radius		5,69	m

Flame Co-ordinates

X	**Z**	**R**	**Phi**
m	m	m	deg
0,00	1,00	0,19	90,00
10,16	1,00	2,18	90,00
20,32	1,00	3,61	90,00
30,49	1,00	4,63	90,00
40,65	1,00	5,31	90,00
50,81	1,00	5,65	90,00
60,97	1,00	5,63	90,00
71,14	1,00	5,17	90,00
81,30	1,00	4,05	90,00
91,46	1,00	0,00	90,00

Radiation Intensity Ellipse

User-Defined Quantities

Observer Inclination	Variable	deg
Observer Orientation	Variable	deg
Exposure Duration	20,00	s
Effect Height	0,00	m

Calculated Quantities

Incident Radiation Level:	**3,00**	kW/m2
Lethality Level	0,00	%
View Factor	0,02	
Dose Level	865.118,83	(W/m2)^Probit N.s
Downwind semi-axis (A)	54,15	m
Crosswind semi-axis (B)	78,41	m
Offset Ratio (D)	0,93	
Effect Distance	104,96	m
Area	13.338,22	m2
Incident Radiation Level:	**5,00**	kW/m2
Lethality Level	0,00	%
View Factor	0,04	
Dose Level	1.709.490,54	(W/m2)^Probit N.s
Downwind semi-axis (A)	50,74	m
Crosswind semi-axis (B)	59,39	m
Offset Ratio (D)	0,96	
Effect Distance	99,43	m
Area	9.466,31	m2
Incident Radiation Level:	**7,00**	kW/m2
Lethality Level	0,02	%
View Factor	0,05	
Dose Level	2.677.313,40	(W/m2)^Probit N.s
Downwind semi-axis (A)	49,01	m
Crosswind semi-axis (B)	48,87	m
Offset Ratio (D)	0,97	
Effect Distance	96,60	m
Area	7.524,85	m2

Incident Radiation Level:	**12,50**	kW/m2
Lethality Level	6,53	%
View Factor	0,10	
Dose Level	5.800.161,90	(W/m2)^Probit N.s
Downwind semi-axis (A)	46,72	m
Crosswind semi-axis (B)	33,84	m
Offset Ratio (D)	0,99	
Effect Distance	92,79	m
Area	4.965,95	m2

Radiation Distance

User-Defined Quantities

Maximum Distance	182,92	m
Angle from Wind Direction	0,00	deg
Height above Origin	0,00	m
Observer Inclination	Variable	deg
Observer Orientation	Variable	deg

Calculated Quantities

X Coordinates m	Y Coordinates m	Z Coordinates m	Incident Radiation kW/m2	Lethality Level %	View Factor
0,00			22,57		
3,73			87,55		
7,47			130,46		
11,20			130,46		
14,93			130,46		
18,67			130,46		
22,40			130,46		
26,13			130,46		
29,86			130,46		
33,60			130,46		
37,33			130,46		
41,06			130,46		
44,80			130,46		
48,53			130,46		
52,26			130,46		
56,00			130,46		
59,73			130,46		
63,46			130,46		
67,20			130,46		
70,93			130,46		
74,66			130,46		
78,39			130,46		
82,13			130,46		
85,86			130,46		
89,59			100,94		
93,33			11,04		
97,06			6,61		
100,79			4,32		
104,53			3,02		
108,26			2,23		
111,99			1,71		
115,73			1,37		
119,46			1,13		
123,19			0,95		
126,93			0,81		
130,66			0,71		
134,39			0,62		

X Coordinates m	Y Coordinates m	Z Coordinates m	Incident Radiation kW/m2	Lethality Level %	View Factor
138,12			0,55		
141,86			0,49		
145,59			0,44		
149,32			0,40		
153,06			0,36		
156,79			0,33		
160,52			0,30		
164,26			0,27		
167,99			0,25		
171,72			0,23		
175,46			0,21		
179,19			0,20		
182,92			0,19		

Weather: **Global Weathers\Category 5/D**

Speed: 5,00 **m/s** **Stability: D**

\70977-Fase 1-Ip1\Testa Pozzo\200mm

Flame Data

User-Defined Quantities

Model Correlation Type		**API**	
Material		METHANE	
Ambient Temperature		25,00	degC
Ambient Relative Humidity		0,75	fraction
Ambient Wind Speed		5,00	m/s
Maximum Exposure Duration		20,00	s
Elevation		1,00	m
Expanded Temperature		0,73	degC
Release Rate		40,08	kg/s
	Input	**Output**	
Flame Emissive Power		130,46	kW/m2
Fraction of Emissivity		0,15	fraction
Expanded Radius		0,19	m
Jet Velocity	499,89	499,89	m/s
Flame Length		91,46	m
Maximum Flame Radius		5,69	m

Flame Co-ordinates

X	Z	R	Phi
m	m	m	deg
0,00	1,00	0,19	90,00
10,16	1,00	2,18	90,00
20,32	1,00	3,61	90,00
30,49	1,00	4,63	90,00
40,65	1,00	5,31	90,00
50,81	1,00	5,65	90,00
60,97	1,00	5,63	90,00
71,14	1,00	5,17	90,00
81,30	1,00	4,05	90,00
91,46	1,00	0,00	90,00

Radiation Intensity Ellipse

User-Defined Quantities

Observer Inclination	Variable	deg
Observer Orientation	Variable	deg
Exposure Duration	20,00	s
Effect Height	0,00	m

Calculated Quantities

Incident Radiation Level:	**3,00**	kW/m2
Lethality Level	0,00	%
View Factor	0,02	
Dose Level	865.118,83	(W/m2)^Probit N.s
Downwind semi-axis (A)	54,15	m
Crosswind semi-axis (B)	78,41	m
Offset Ratio (D)	0,93	
Effect Distance	104,96	m
Area	13.338,22	m2
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Lethality Level	0,00	%
View Factor	0,04	
Dose Level	1.709.490,54	(W/m2)^Probit N.s
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Lethality Level	0,02	%
View Factor	0,05	
Dose Level	2.677.313,40	(W/m2)^Probit N.s
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Incident Radiation Level:	**12,50**	kW/m2
Lethality Level	6,53	%
View Factor	0,10	
Dose Level	5.800.161,90	(W/m2)^Probit N.s
Downwind semi-axis (A)	46,72	m
Crosswind semi-axis (B)	33,84	m
Offset Ratio (D)	0,99	
Effect Distance	92,79	m
Area	4.965,95	m2

Radiation Distance

User-Defined Quantities

Maximum Distance	182,92	m
Angle from Wind Direction	0,00	deg
Height above Origin	0,00	m
Observer Inclination	Variable	deg
Observer Orientation	Variable	deg

Calculated Quantities

X Coordinates m	Y Coordinates m	Z Coordinates m	Incident Radiation kW/m2	Lethality Level %	View Factor
0,00			22,57		
3,73			87,55		
7,47			130,46		
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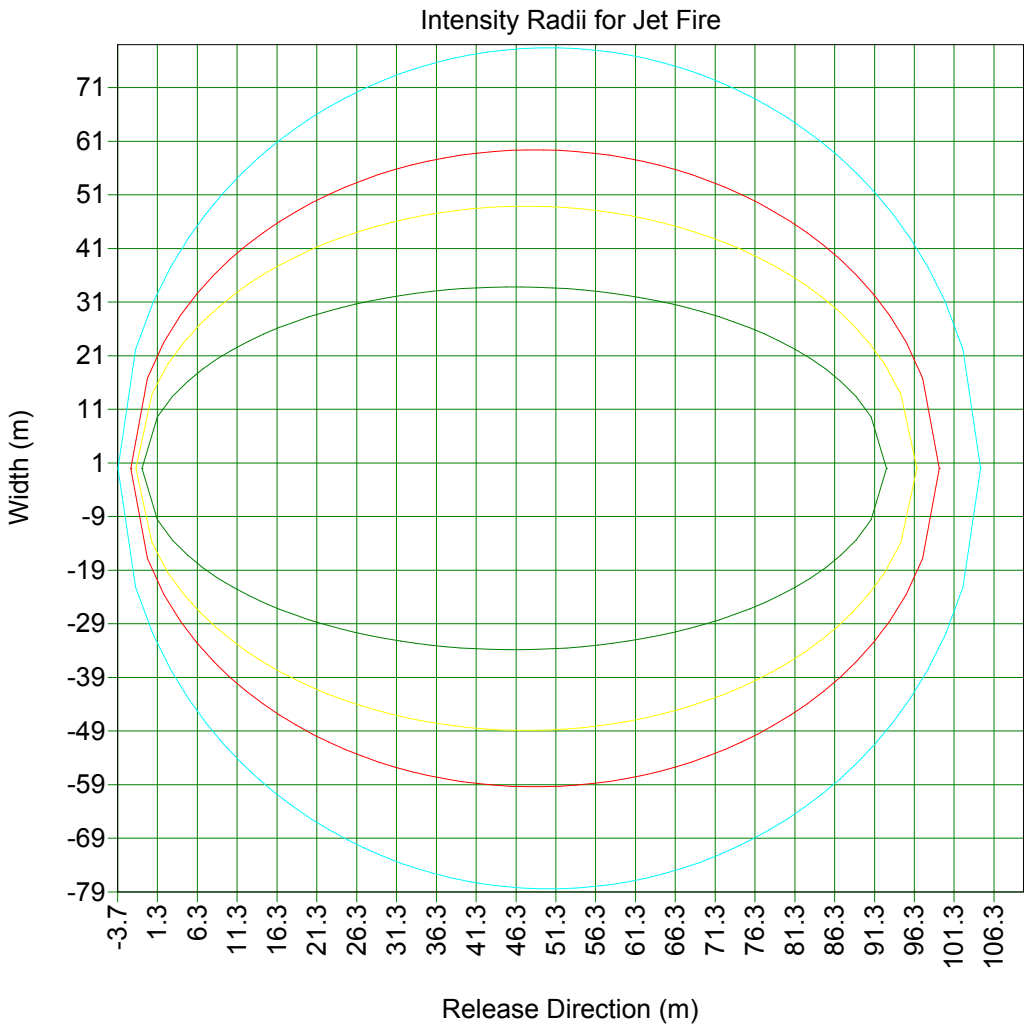
22,40			130,46		
26,13			130,46		
29,86			130,46		
33,60			130,46		
37,33			130,46		
41,06			130,46		
44,80			130,46		
48,53			130,46		
52,26			130,46		
56,00			130,46		
59,73			130,46		
63,46			130,46		
67,20			130,46		
70,93			130,46		
74,66			130,46		
78,39			130,46		
82,13			130,46		
85,86			130,46		
89,59			100,94		
93,33			11,04		
97,06			6,61		
100,79			4,32		
104,53			3,02		
108,26			2,23		
111,99			1,71		
115,73			1,37		
119,46			1,13		
123,19			0,95		
126,93			0,81		
130,66			0,71		
134,39			0,62		

X Coordinates m	Y Coordinates m	Z Coordinates m	Incident Radiation kW/m2	Lethality Level %	View Factor
138,12			0,55		
141,86			0,49		
145,59			0,44		
149,32			0,40		
153,06			0,36		
156,79			0,33		
160,52			0,30		
164,26			0,27		
167,99			0,25		
171,72			0,23		
175,46			0,21		
179,19			0,20		
182,92			0,19		

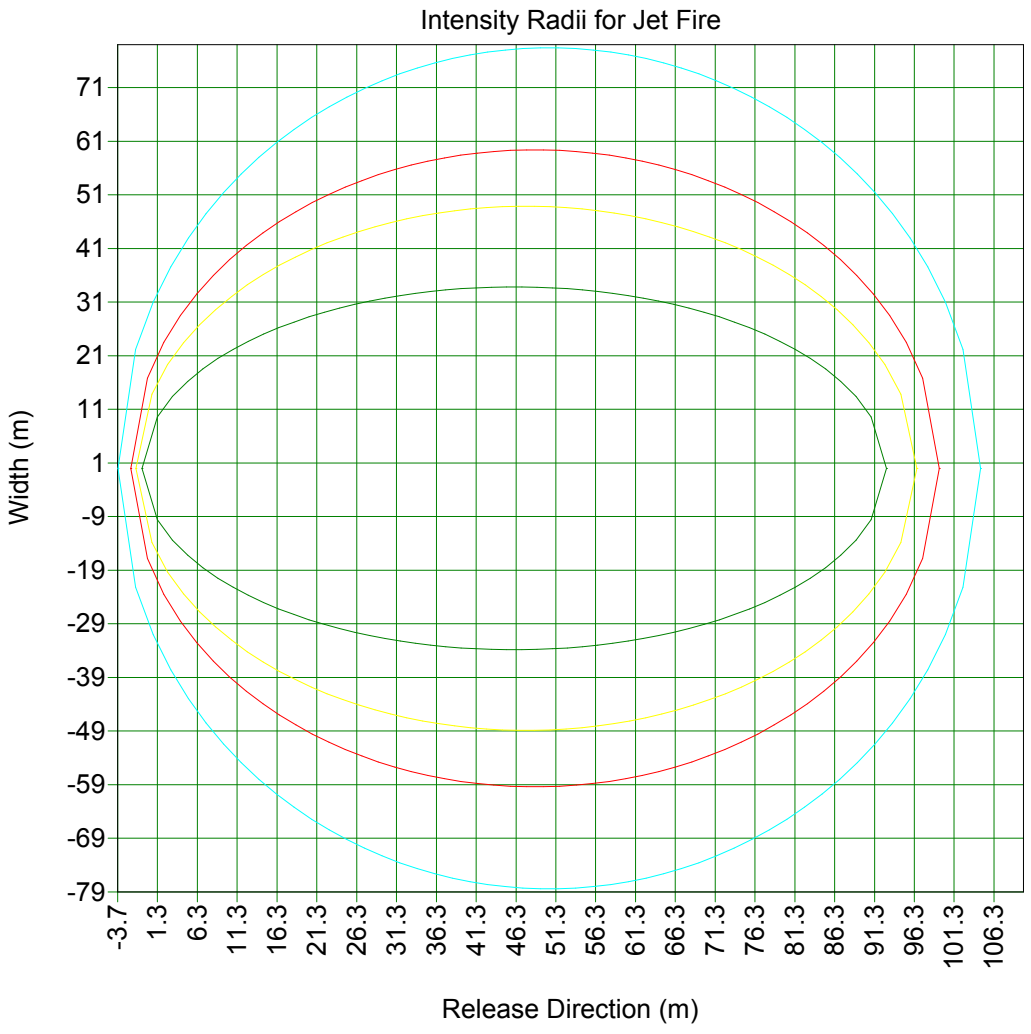
Study Folder: 70977-Fase 1-Ip1
Audit No: 58077
Model: 200mm
Weather: Category 5/D
Material: METHANE

- Ellipse @12.5 kW/m2
- Ellipse @7 kW/m2
- Ellipse @5 kW/m2
- Ellipse @3 kW/m2



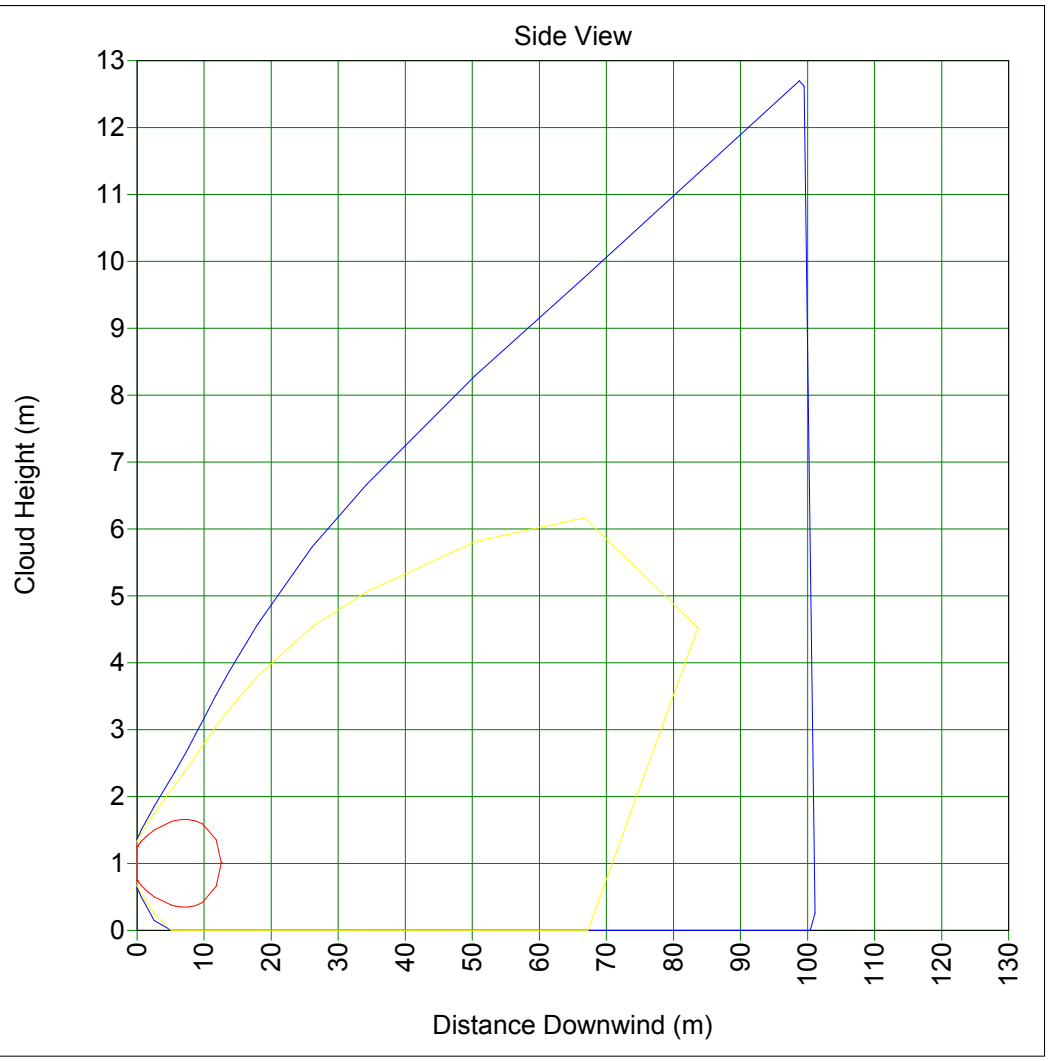
Study Folder: 70977-Fase 1-Ip1
Audit No: 58077
Model: 200mm
Weather: Category 2/F
Material: METHANE

- Ellipse @12.5 kW/m2
- Ellipse @7 kW/m2
- Ellipse @5 kW/m2
- Ellipse @3 kW/m2



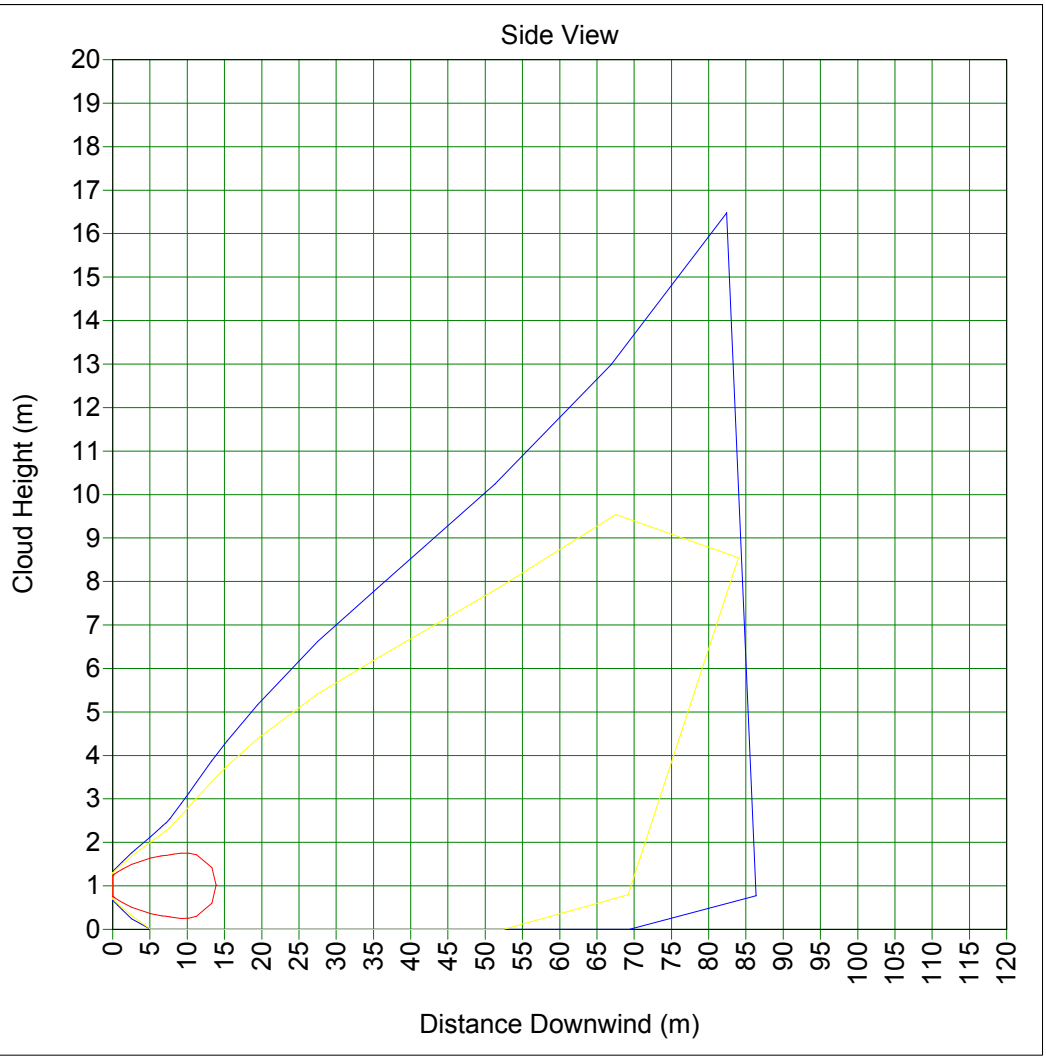
Study Folder: 70977-Fase 1-Ip1
Audit No: 58077
Model: 200mm
Weather: Category 5/D
Material: METHANE
Averaging Time: Flammable(18.75 s)
C/L Offset: 0 m
Concentration
Time: 7.938 s

- 2.2e+004 ppm
- 4.4e+004 ppm
- 1.65e+005 ppm



Study Folder: 70977-Fase 1-Ip1
Audit No: 58077
Model: 200mm
Weather: Category 2/F
Material: METHANE
Averaging Time: Flammable(18.75 s)
C/L Offset: 0 m
Concentration
Time: 8.544 s

- 2.2e+004 ppm
- 4.4e+004 ppm
- 1.65e+005 ppm



70977-Fase 1-Ip1

Testa Pozzo

200mm

Base Case

CASE Name: **Data**

Path: \70977-Fase 1-Ip1\Testa Pozzo\200mm

User-Defined Data

Material			
	Material Identifier	METHANE	
	Type of Vessel	Pressurized Gas	
	Pressure Specification	Pressure specified	
	Storage Pressure - gauge	100	bar
	Temperature	25	degC
Scenario			
	Scenario Type	Long Pipeline	
	Phase to be Released	Vapor	
	Building Wake Effect	None	
Pipe			
	Internal Diameter	200	mm
	Line length	10	m
	Distance To Break	1	m
	Relative Aperture	1	fraction
	Pumped Inflow	40	kg/s
	Use Ambient Temperature	Use ambient temperature	
Vessel/Tank			
	Duration of Interest	300	s
	Method Used for Time Varying Releases	Average Rates	
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	
	Outdoor Release Direction	Horizontal	
Flammable			
	Explosion Method	TNT	

Jet Fire Method	API Model	

Dispersion

Late Ignition Location	No ignition location	

Fireball Parameters

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

Toxic Parameters

[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-Ip1\Testa Pozzo\200mm

Discharge Data

User-Defined Quantities

Material	METHANE	
Temperature	25,00	degC
Pressure	101,01	bar
Inventory	1.250.000,00	kg
Scenario	Long Pipeline	
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	0,00	fraction
FinalTemperature	0,73	degC
Final Velocity	499,89	m/s
Droplet Diameter	0,00	um
Continuous Release Data:		
Mass Flowrate	4.00782E+001	kg/s
Release Duration	300,00	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	0,00	fraction
FinalTemperature	0,73	degC
Final Velocity	499,89	m/s
Droplet Diameter	0,00	um
Continuous Release Data:		
Mass Flowrate	4.00782E+001	kg/s
Release Duration	300,00	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

Consequence Results

Distance to Concentration Results

Path: \70977-Fase 1-Ip1\Testa Pozzo\200mm

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
UFL (165000)	18.75	s	13.8569	12.5503
LFL (44000)	18.75	s	84.006	83.6224
LFL Frac (22000)	18.75	s	115.149	126.306

Concentration(ppm)	Averaging Time		Heights (m) for above distances	
			Category 2/F	Category 5/D
UFL (165000)	18.75	s	1.0142	1.0088
LFL (44000)	18.75	s	8.54603	4.52059
LFL Frac (22000)	18.75	s	16.537	9.61696

Jet Fire Hazard

Path: \70977-Fase 1-Ip1\Testa Pozzo\200mm

Jet fire method used: API

	Category 2/F	Category 5/D
Jet Fire Status	Hazard	Hazard
Flame Direction	Horizontal	Horizontal

Radiation Effects: Jet Fire Ellipse

Path: \70977-Fase 1-Ip1\Testa Pozzo\200mm

This table gives the distances to the specified radiation levels
for each jet fire listed in the above hazard table

			Distance (m)	
			Category 2/F	Category 5/D
Radiation Level	12.5	kW/m2	92.7892	92.7892
Radiation Level	7	kW/m2	96.6014	96.6014
Radiation Level	5	kW/m2	99.4288	99.4288
Radiation Level	3	kW/m2	104.964	104.964

Radiation Effects: Jet Fire Distance

Path: \70977-Fase 1-Ip1\Testa Pozzo\200mm

	Radiation Level (kW/m2)	
	Category 2/F	Category 5/D

Flash Fire Envelope

Path: \70977-Fase 1-Ip1\Testa Pozzo\200mm

All flammable results are reported at the cloud centreline height

			Distance (m)	
			Category 2/F	Category 5/D
Furthest Extent	22000	ppm	115.149	126.306
Furthest Extent	44000	ppm	84.006	83.6224

			Heights (m) for above distances	
			Category 2/F	Category 5/D
Furthest Extent	22000	ppm	16.537	9.61696
Furthest Extent	44000	ppm	8.54603	4.52059

Explosion Effects: Late Ignition

Path: \70977-Fase 1-Ip1\Testa Pozzo\200mm

Explosion Model Used : TNT
Explosion Location Criterion: Cloud Front (LFL Fraction)
All distances are measured from the Source
All flammable results are reported at the cloud centreline height

			Maximum Distance (m) at Overpressure Level	
			Category 2/F	Category 5/D
Overpressure	0.02068	bar	284.816	273.755
Overpressure	0.1379	bar	155.264	159.811
Overpressure	0.2068	bar	145.024	150.805

		Supplementary Data at 0.02068 bar	
		Category 2/F	Category 5/D
Supplied Flammable Mass	kg	137.091	93.2731
Used Flammable Mass	kg	137.091	93.2731
Overpressure Radius	m	174.816	153.755
Distance to:			
- Ignition Source	m	110	120
- Cloud Front/Centre	m	110	120
- Explosion Centre	m	110	120

		Supplementary Data at 0.1379 bar	
		Category 2/F	Category 5/D
Supplied Flammable Mass	kg	137.091	93.2731
Used Flammable Mass	kg	137.091	93.2731
Overpressure Radius	m	45.2641	39.811
Distance to:			
- Ignition Source	m	110	120
- Cloud Front/Centre	m	110	120
- Explosion Centre	m	110	120

		Supplementary Data at 0.2068 bar	
		Category 2/F	Category 5/D
Supplied Flammable Mass	kg	137.091	93.2731
Used Flammable Mass	kg	137.091	93.2731
Overpressure Radius	m	35.0244	30.8048
Distance to:			
- Ignition Source	m	110	120
- Cloud Front/Centre	m	110	120
- Explosion Centre	m	110	120

Weather Conditions

Path: \70977-Fase 1-Ip1\Testa Pozzo\200mm

		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