ANNESSO TECNICO 6.

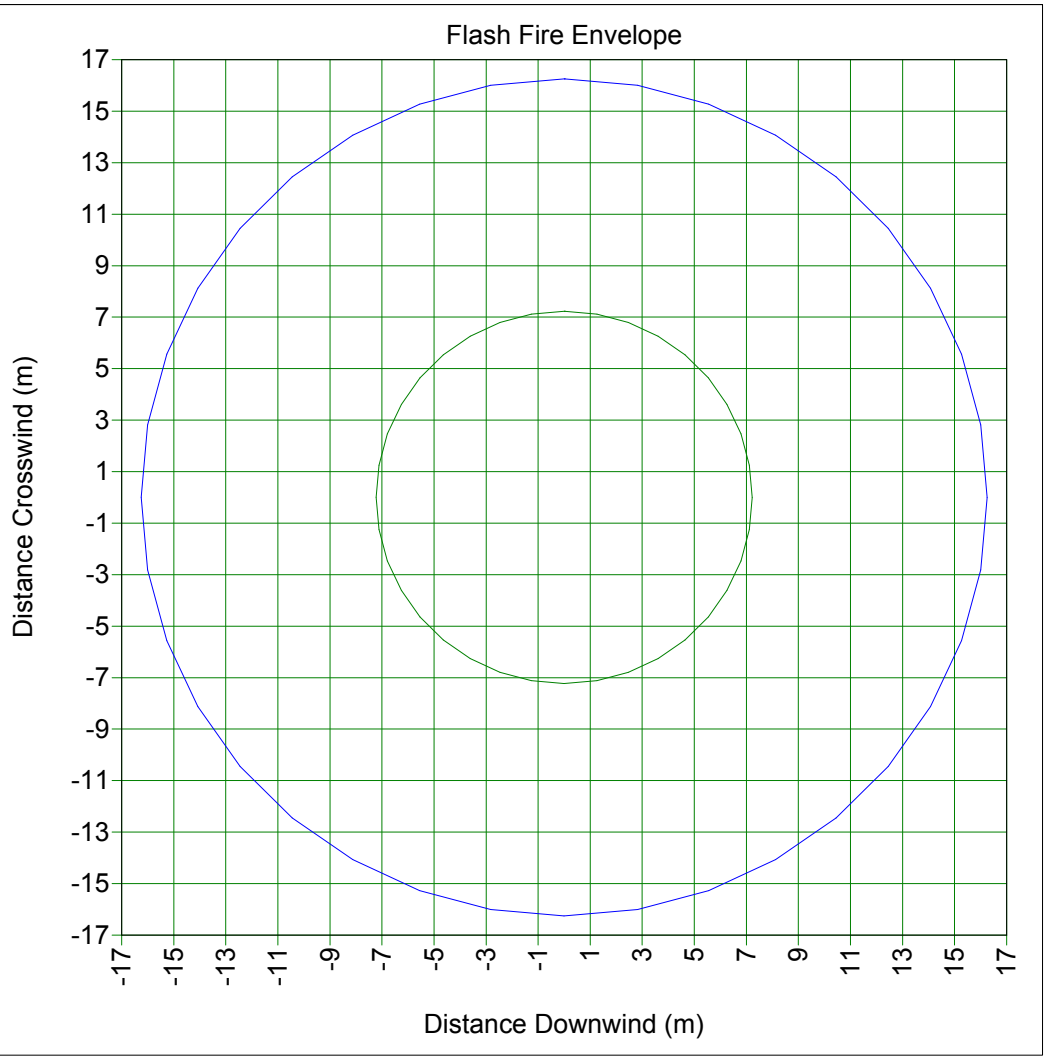
Elaborati di calcolo
Scenari incidentali ragionevolmente credibili

Ipotesi N. 2

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

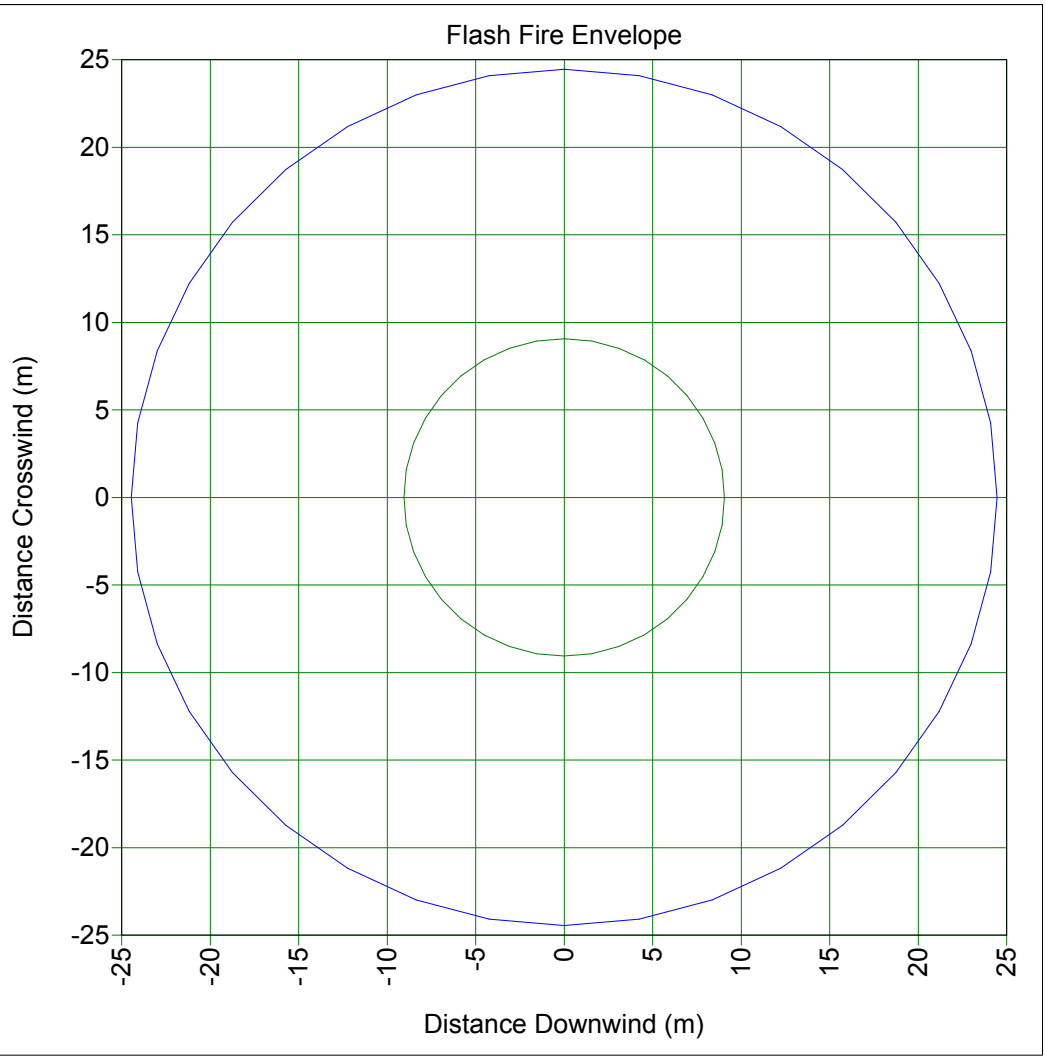
Study Folder: 70977-Fase 1-Ip2
Audit No: 54034
Model: 10mm
Weather: Category 5/D
Material: METHANE
Concentration

2.2e+004 ppm
4.4e+004 ppm



Study Folder: 70977-Fase 1-Ip2
Audit No: 54034
Model: 10mm
Weather: Category 2/F
Material: METHANE
Concentration

2.2e+004 ppm
4.4e+004 ppm



70977-Fase 1-Ip2

Separatore Testa Pozzo

10mm

Base Case

Data

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

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

\70977-Fase 1-Ip2\Separatore Testa Pozzo\10mm

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	-81,49	degC
Release Rate	1,31	kg/s

	Input	**Output**	
Flame Emissive Power		112,27	kW/m2
Fraction of Emissivity		0,15	fraction
Expanded Radius		0,03	m
Jet Velocity	500,00	500,00	m/s
Flame Length		17,81	m
Maximum Flame Radius		1,11	m

Flame Co-ordinates

X	**Z**	**R**	**Phi**
m	m	m	deg
0,00	1,00	0,03	90,00
1,98	1,00	0,43	90,00
3,96	1,00	0,70	90,00
5,94	1,00	0,90	90,00
7,92	1,00	1,03	90,00
9,90	1,00	1,10	90,00
11,87	1,00	1,10	90,00
13,85	1,00	1,01	90,00
15,83	1,00	0,79	90,00
17,81	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	0,03	
Dose Level	865.118,83	(W/m2)^Probit N.s
Downwind semi-axis (A)	11,02	m
Crosswind semi-axis (B)	15,34	m
Offset Ratio (D)	0,86	
Effect Distance	20,49	m
Area	531,21	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)	10,11	m
Crosswind semi-axis (B)	11,55	m
Offset Ratio (D)	0,92	
Effect Distance	19,40	m
Area	366,69	m2
Incident Radiation Level:	**7,00**	kW/m2
Lethality Level	0,02	%
View Factor	0,06	
Dose Level	2.677.313,40	(W/m2)^Probit N.s
Downwind semi-axis (A)	9,59	m
Crosswind semi-axis (B)	9,45	m
Offset Ratio (D)	0,97	
Effect Distance	18,86	m
Area	284,68	m2

Incident Radiation Level:	**12,50**	kW/m2
Lethality Level	6,53	%
View Factor	0,11	
Dose Level	5.800.161,90	(W/m2)^Probit N.s
Downwind semi-axis (A)	8,95	m
Crosswind semi-axis (B)	6,47	m
Offset Ratio (D)	1,02	
Effect Distance	18,08	m
Area	181,74	m2

Radiation Distance

User-Defined Quantities

Maximum Distance	35,62	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			9,83		
0,73			22,07		
1,45			36,26		
2,18			49,61		
2,91			61,48		
3,64			72,92		
4,36			82,91		
5,09			91,55		
5,82			99,58		
6,54			105,80		
7,27			110,19		
8,00			112,27		
8,72			112,27		
9,45			112,27		
10,18			112,27		
10,91			112,27		
11,63			112,27		
12,36			112,27		
13,09			112,27		
13,81			112,27		
14,54			104,20		
15,27			93,36		
15,99			77,80		
16,72			52,34		
17,45			27,57		
18,18			11,07		
18,90			6,78		
19,63			4,40		
20,36			3,13		
21,08			2,40		
21,81			1,89		
22,54			1,52		
23,27			1,26		
23,99			1,05		
24,72			0,89		
25,45			0,77		
26,17			0,67		

X Coordinates m	Y Coordinates m	Z Coordinates m	Incident Radiation kW/m2	Lethality Level %	View Factor
26,90			0,59		
27,63			0,52		
28,35			0,46		
29,08			0,42		
29,81			0,38		
30,54			0,34		
31,26			0,31		
31,99			0,29		
32,72			0,27		
33,44			0,25		
34,17			0,23		
34,90			0,21		
35,62			0,20		

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

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

\70977-Fase 1-Ip2\Separatore Testa Pozzo\10mm

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		-81,49	degC
Release Rate		1,31	kg/s
	Input	**Output**	
Flame Emissive Power		112,27	kW/m2
Fraction of Emissivity		0,15	fraction
Expanded Radius		0,03	m
Jet Velocity	500,00	500,00	m/s
Flame Length		17,81	m
Maximum Flame Radius		1,11	m

Flame Co-ordinates

X	Z	R	Phi
m	m	m	deg
0,00	1,00	0,03	90,00
1,98	1,00	0,43	90,00
3,96	1,00	0,70	90,00
5,94	1,00	0,90	90,00
7,92	1,00	1,03	90,00
9,90	1,00	1,10	90,00
11,87	1,00	1,10	90,00
13,85	1,00	1,01	90,00
15,83	1,00	0,79	90,00
17,81	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	0,03	
Dose Level	865.118,83	(W/m2)^Probit N.s
Downwind semi-axis (A)	11,02	m
Crosswind semi-axis (B)	15,34	m
Offset Ratio (D)	0,86	
Effect Distance	20,49	m
Area	531,21	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)	10,11	m
Crosswind semi-axis (B)	11,55	m
Offset Ratio (D)	0,92	
Effect Distance	19,40	m
Area	366,69	m2
Incident Radiation Level:	**7,00**	kW/m2
Lethality Level	0,02	%
View Factor	0,06	
Dose Level	2.677.313,40	(W/m2)^Probit N.s
Downwind semi-axis (A)	9,59	m
Crosswind semi-axis (B)	9,45	m
Offset Ratio (D)	0,97	
Effect Distance	18,86	m
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Incident Radiation Level:	**12,50**	kW/m2
Lethality Level	6,53	%
View Factor	0,11	
Dose Level	5.800.161,90	(W/m2)^Probit N.s
Downwind semi-axis (A)	8,95	m
Crosswind semi-axis (B)	6,47	m
Offset Ratio (D)	1,02	
Effect Distance	18,08	m
Area	181,74	m2

Radiation Distance

User-Defined Quantities

Maximum Distance	35,62	m
Angle from Wind Direction	0,00	deg
Height above Origin	0,00	m
Observer Inclination	Variable	deg
Observer Orientation	Variable	deg

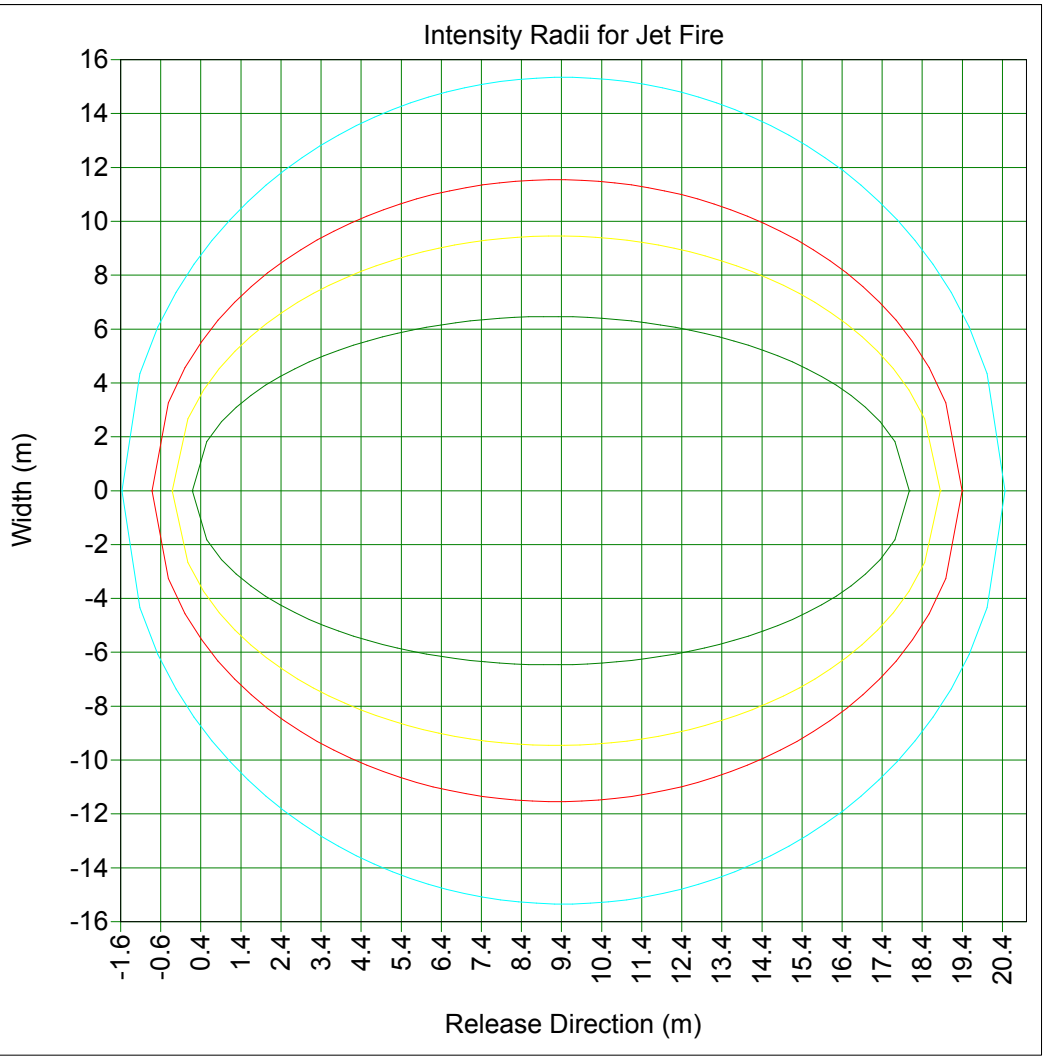
Calculated Quantities

X Coordinates m	Y Coordinates m	Z Coordinates m	Incident Radiation kW/m2	Lethality Level %	View Factor
0,00			9,83		
0,73			22,07		
1,45			36,26		
2,18			49,61		
2,91			61,48		
3,64			72,92		
4,36			82,91		
5,09			91,55		
5,82			99,58		
6,54			105,80		
7,27			110,19		
8,00			112,27		
8,72			112,27		
9,45			112,27		
10,18			112,27		
10,91			112,27		
11,63			112,27		
12,36			112,27		
13,09			112,27		
13,81			112,27		
14,54			104,20		
15,27			93,36		
15,99			77,80		
16,72			52,34		
17,45			27,57		
18,18			11,07		
18,90			6,78		
19,63			4,40		
20,36			3,13		
21,08			2,40		
21,81			1,89		
22,54			1,52		
23,27			1,26		
23,99			1,05		
24,72			0,89		
25,45			0,77		
26,17			0,67		

X Coordinates m	Y Coordinates m	Z Coordinates m	Incident Radiation kW/m2	Lethality Level %	View Factor
26,90			0,59		
27,63			0,52		
28,35			0,46		
29,08			0,42		
29,81			0,38		
30,54			0,34		
31,26			0,31		
31,99			0,29		
32,72			0,27		
33,44			0,25		
34,17			0,23		
34,90			0,21		
35,62			0,20		

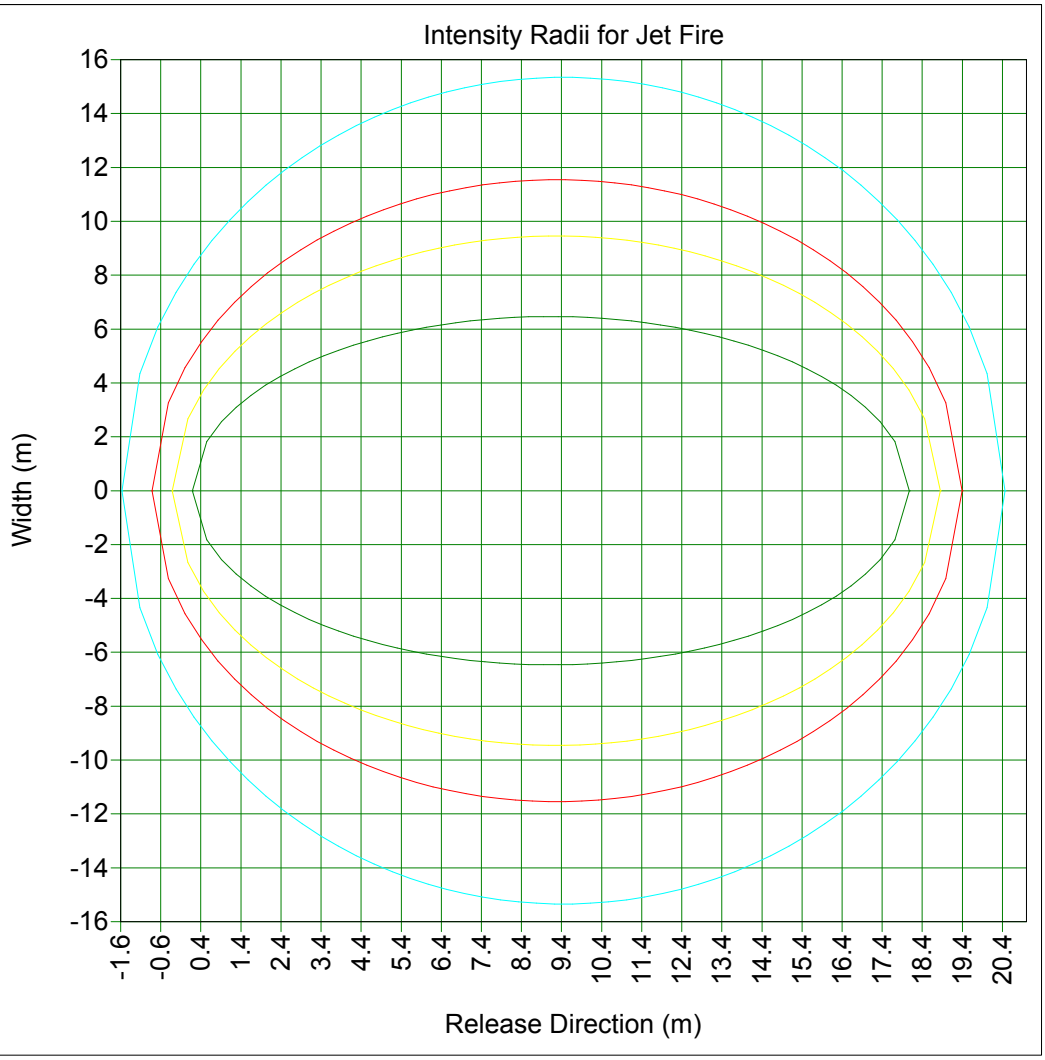
Study Folder: 70977-Fase 1-Ip2
Audit No: 54034
Model: 10mm
Weather: Category 5/D
Material: METHANE

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



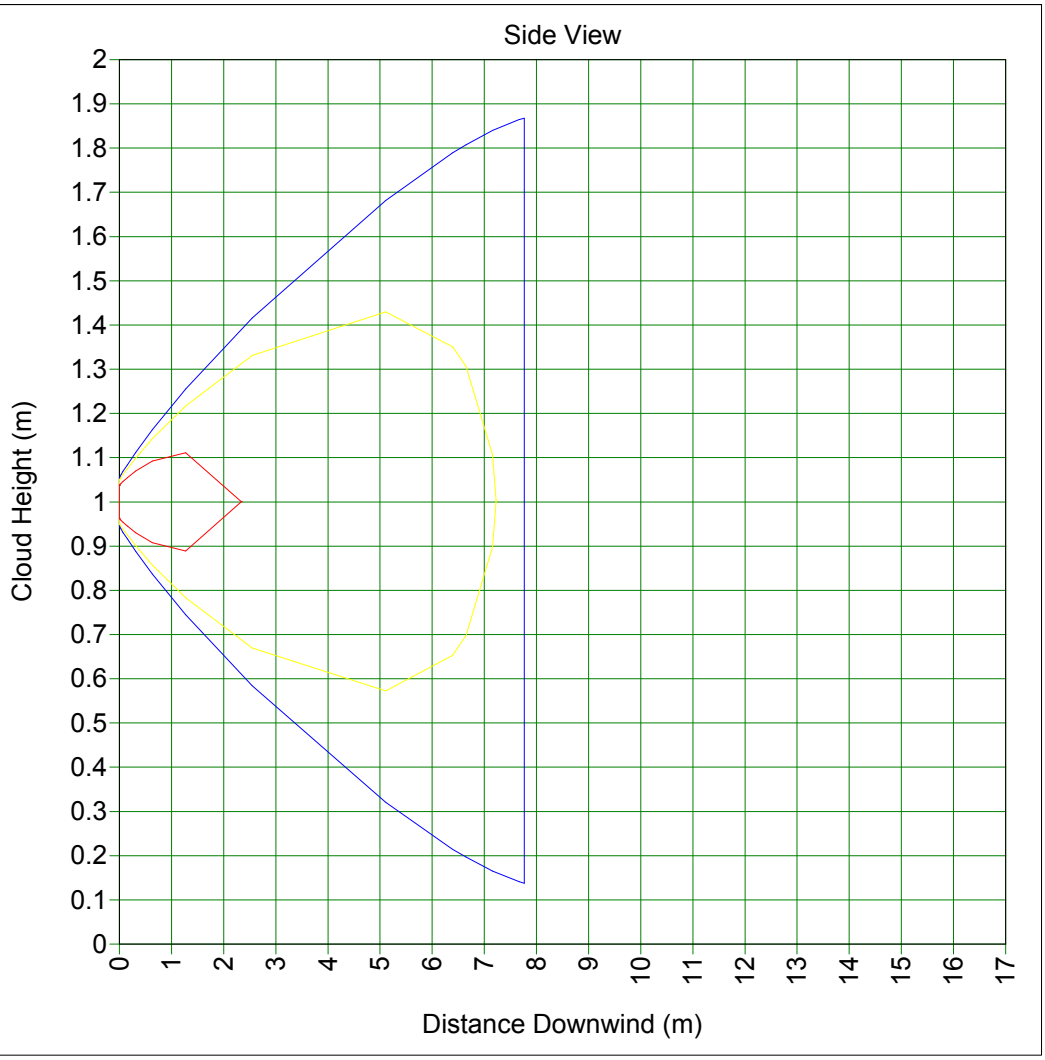
Study Folder: 70977-Fase 1-Ip2
Audit No: 54034
Model: 10mm
Weather: Category 2/F
Material: METHANE

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



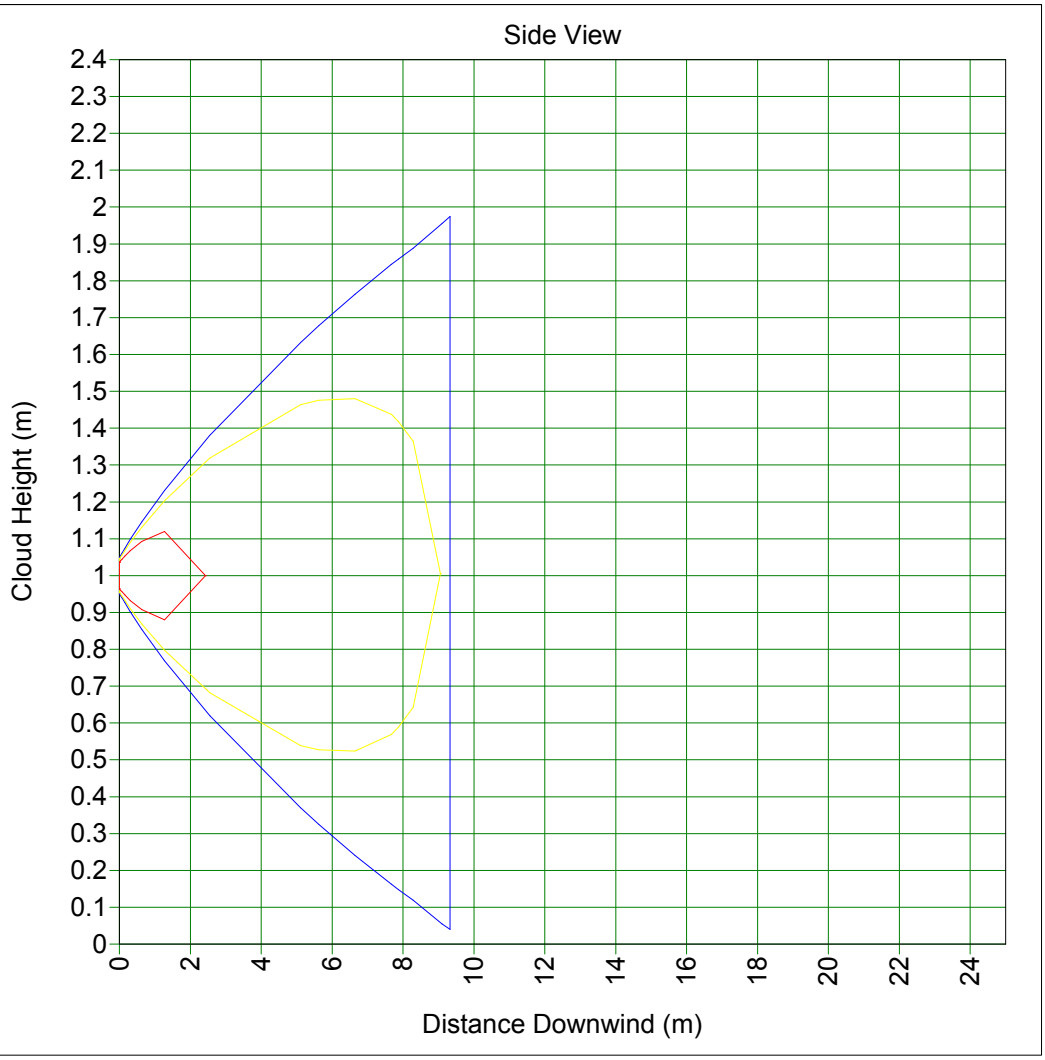
Study Folder: 70977-Fase 1-Ip2
Audit No: 54034
Model: 10mm
Weather: Category 5/D
Material: METHANE
Averaging Time: Flammable(18.75 s)
C/L Offset: 0 m
Concentration
Time: 0.2558 s

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



Study Folder: 70977-Fase 1-Ip2
Audit No: 54034
Model: 10mm
Weather: Category 2/F
Material: METHANE
Averaging Time: Flammable(18.75 s)
C/L Offset: 0 m
Concentration
Time: 0.3557 s

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



70977-Fase 1-Ip2

Separatore Testa Pozzo

10mm

Base Case

CASE Name: **Data**

Path: \70977-Fase 1-Ip2\Separatore Testa Pozzo\10mm

User-Defined Data

Material

Material Identifier	METHANE	
Type of Vessel	Pressurized Gas	
Pressure Specification	Pressure specified	
Storage Pressure - gauge	100	bar
Temperature	25	degC
Mass Inventory	300	kg

Scenario

Scenario Type	Leak	
Phase to be Released	Vapor	
Hole Diameter	10	mm
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	
Outdoor Release Direction	Horizontal	

Flammable

Explosion Method	TNT	
Jet Fire Method	API Model	

Dispersion

Late Ignition Location	No ignition location	
Mass Inventory of material to Disperse	300	kg

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-Ip2\Separatore Testa Pozzo\10mm

Discharge Data

User-Defined Quantities

Material	METHANE	
Temperature	25,00	degC
Pressure	101,01	bar
Inventory	300,00	kg
Scenario	Leak	
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	-81,49	degC
Final Velocity	500,00	m/s
Droplet Diameter	0,00	um
Continuous Release Data:		
Mass Flowrate	1.30762E+000	kg/s
Release Duration	229,42	s
Orifice Velocity	393,67	m/s
Exit Pressure	53,08	bar
Exit Temperature	-21,64	degC
Discharge Coefficient	0,87	
Expanded Radius	0,03	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	-81,49	degC
Final Velocity	500,00	m/s
Droplet Diameter	0,00	um
Continuous Release Data:		
Mass Flowrate	1.30762E+000	kg/s
Release Duration	229,42	s
Orifice Velocity	393,67	m/s
Exit Pressure	53,08	bar
Exit Temperature	-21,64	degC
Discharge Coefficient	0,87	
Expanded Radius	0,03	m

Consequence Results

Distance to Concentration Results

Path: \70977-Fase 1-Ip2\Separatore Testa Pozzo\10mm

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	2.4301	2.33862
LFL (44000)	18.75	s	9.05949	7.22618
LFL Frac (22000)	18.75	s	24.4588	16.2493

Concentration(ppm)	Averaging Time		Heights (m) for above distances	
			Category 2/F	Category 5/D
UFL (165000)	18.75	s	1.00015	1.00013
LFL (44000)	18.75	s	1.00462	1.00236
LFL Frac (22000)	18.75	s	1.05215	1.01104

Jet Fire Hazard

Path: \70977-Fase 1-Ip2\Separatore Testa Pozzo\10mm

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-Ip2\Separatore Testa Pozzo\10mm

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	18.0806	18.0806
Radiation Level	7	kW/m2	18.855	18.855
Radiation Level	5	kW/m2	19.3986	19.3986
Radiation Level	3	kW/m2	20.4899	20.4899

Radiation Effects: Jet Fire Distance

Path: \70977-Fase 1-Ip2\Separatore Testa Pozzo\10mm

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

Flash Fire Envelope

Path: \70977-Fase 1-Ip2\Separatore Testa Pozzo\10mm

All flammable results are reported at the cloud centreline height

				Distance (m)
			Category 2/F	Category 5/D
Furthest Extent	22000	ppm	24.4588	16.2493
Furthest Extent	44000	ppm	9.05949	7.22618

				Heights (m) for above distances
			Category 2/F	Category 5/D
Furthest Extent	22000	ppm	1.05215	1.01104
Furthest Extent	44000	ppm	1.00462	1.00236

Explosion Effects: Late Ignition

Path: \70977-Fase 1-Ip2\Separatore Testa Pozzo\10mm

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	38.0925	25.6628
Overpressure	0.1379	bar	24.6846	14.0555
Overpressure	0.2068	bar	23.6248	13.138

		Supplementary Data at 0.02068 bar	
		Category 2/F	Category 5/D
Supplied Flammable Mass	kg	0.151972	0.0985991
Used Flammable Mass	kg	0.151972	0.0985991
Overpressure Radius	m	18.0925	15.6628
Distance to:			
- Ignition Source	m	20	10
- Cloud Front/Centre	m	20	10
- Explosion Centre	m	20	10

		Supplementary Data at 0.1379 bar	
		Category 2/F	Category 5/D
Supplied Flammable Mass	kg	0.151972	0.0985991
Used Flammable Mass	kg	0.151972	0.0985991
Overpressure Radius	m	4.68459	4.05548
Distance to:			
- Ignition Source	m	20	10
- Cloud Front/Centre	m	20	10
- Explosion Centre	m	20	10

		Supplementary Data at 0.2068 bar	
		Category 2/F	Category 5/D
Supplied Flammable Mass	kg	0.151972	0.0985991
Used Flammable Mass	kg	0.151972	0.0985991
Overpressure Radius	m	3.62483	3.13804
Distance to:			
- Ignition Source	m	20	10
- Cloud Front/Centre	m	20	10
- Explosion Centre	m	20	10

Weather Conditions

Path: \70977-Fase 1-Ip2\Separatore Testa Pozzo\10mm

		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