ANNESSO TECNICO 6.

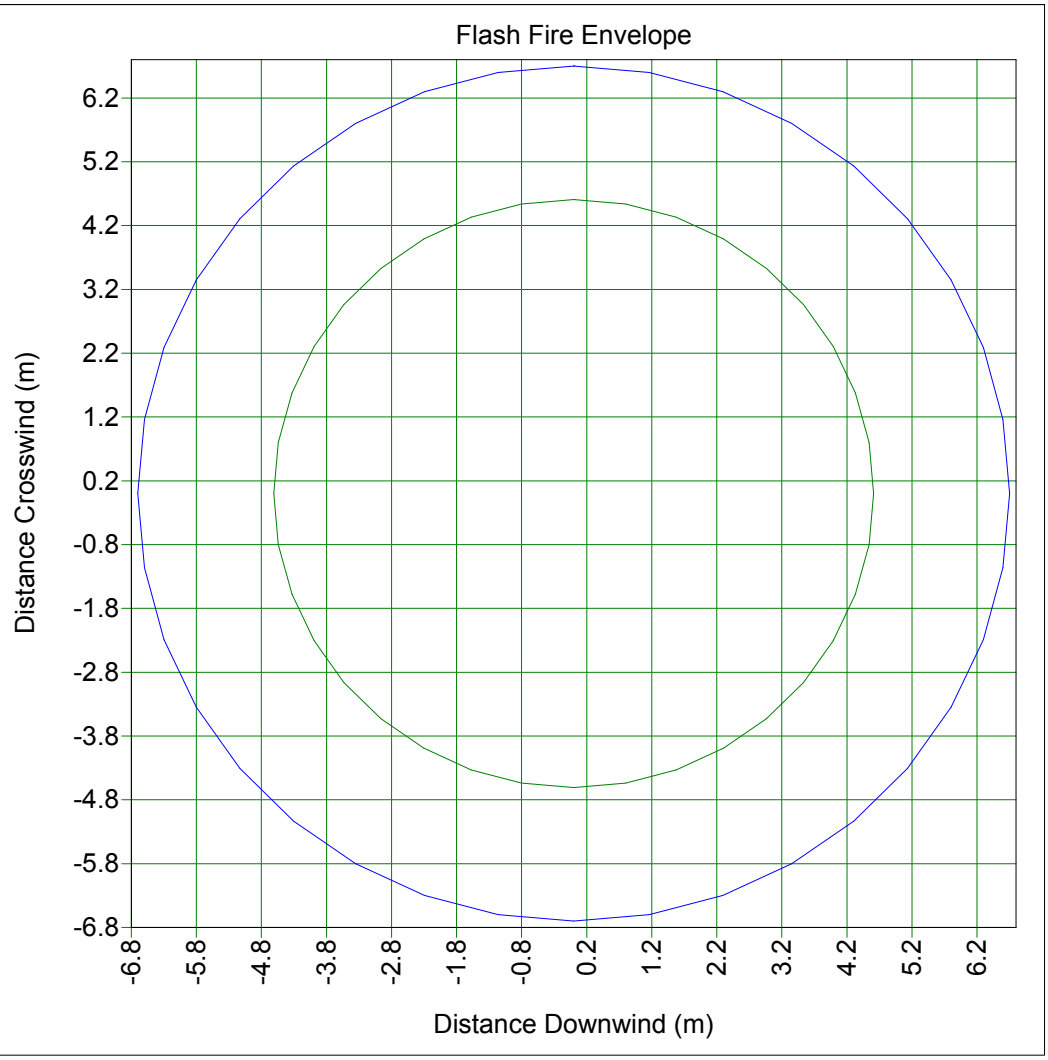
Elaborati di calcolo
Scenari incidentali ragionevolmente credibili

Ipotesi N. 15

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

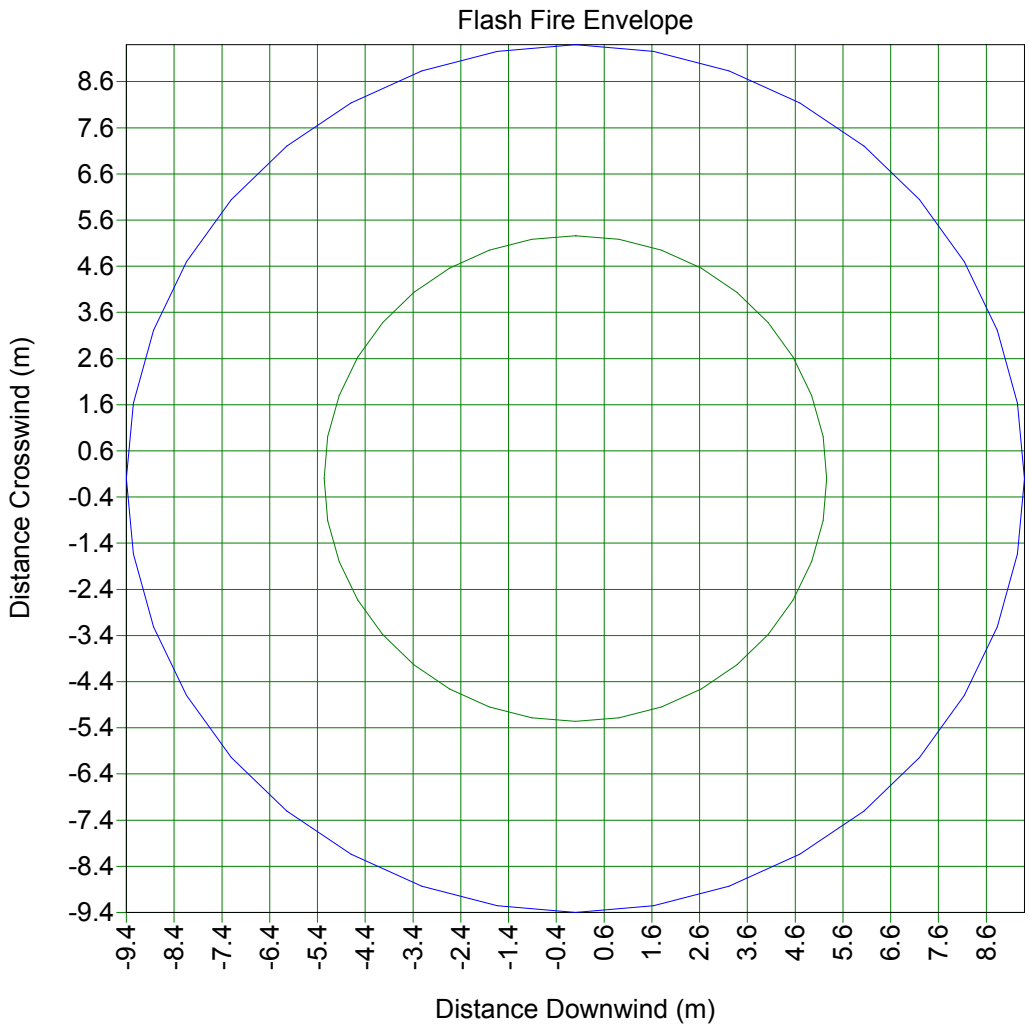
Study Folder: 70977-Fase 1-Ip15
Audit No: 65565
Model: 10mm
Weather: Category 5/D
Material: METHANE
Concentration

2.2e+004 ppm
4.4e+004 ppm



Study Folder: 70977-Fase 1-Ip15
Audit No: 65565
Model: 10mm
Weather: Category 2/F
Material: METHANE
Concentration

2.2e+004 ppm
4.4e+004 ppm



70977-Fase 1-Ip15

Filtro Aspirazione

10mm

Base Case

Data

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

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

\70977-Fase 1-Ip15\Filtro Aspirazione\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	-26,43	degC
Release Rate	0,42	kg/s

	Input	**Output**	
Flame Emissive Power		106,74	kW/m2
Fraction of Emissivity		0,15	fraction
Expanded Radius		0,02	m
Jet Velocity	500,00	500,00	m/s
Flame Length		10,31	m
Maximum Flame Radius		0,64	m

Flame Co-ordinates

X	**Z**	**R**	**Phi**
m	m	m	deg
0,00	1,00	0,02	90,00
1,15	1,00	0,25	90,00
2,29	1,00	0,41	90,00
3,44	1,00	0,52	90,00
4,58	1,00	0,60	90,00
5,73	1,00	0,64	90,00
6,88	1,00	0,63	90,00
8,02	1,00	0,58	90,00
9,17	1,00	0,46	90,00
10,31	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)	6,59	m
Crosswind semi-axis (B)	8,81	m
Offset Ratio (D)	0,83	
Effect Distance	12,04	m
Area	182,58	m2
Incident Radiation Level:	**5,00**	kW/m2
Lethality Level	0,00	%
View Factor	0,05	
Dose Level	1.709.490,54	(W/m2)^Probit N.s
Downwind semi-axis (A)	5,93	m
Crosswind semi-axis (B)	6,60	m
Offset Ratio (D)	0,91	
Effect Distance	11,35	m
Area	122,96	m2
Incident Radiation Level:	**7,00**	kW/m2
Lethality Level	0,02	%
View Factor	0,07	
Dose Level	2.677.313,40	(W/m2)^Probit N.s
Downwind semi-axis (A)	5,53	m
Crosswind semi-axis (B)	5,38	m
Offset Ratio (D)	0,98	
Effect Distance	10,95	m
Area	93,45	m2

Incident Radiation Level:	**12,50**	kW/m2
Lethality Level	6,53	%
View Factor	0,12	
Dose Level	5.800.161,90	(W/m2)^Probit N.s
Downwind semi-axis (A)	5,05	m
Crosswind semi-axis (B)	3,62	m
Offset Ratio (D)	1,06	
Effect Distance	10,43	m
Area	57,51	m2

Radiation Distance

User-Defined Quantities

Maximum Distance	500,00	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			8,23		
10,20			17,00		
20,41			0,22		
30,61			0,06		
40,82			0,03		
51,02			0,02		
61,22			0,01		
71,43			0,01		
81,63			0,01		
91,84			0,00		
102,04			0,00		
112,24			0,00		
122,45			0,00		
132,65			0,00		
142,86			0,00		
153,06			0,00		
163,27			0,00		
173,47			0,00		
183,67			0,00		
193,88			0,00		
204,08			0,00		
214,29			0,00		
224,49			0,00		
234,69			0,00		
244,90			0,00		
255,10			0,00		
265,31			0,00		
275,51			0,00		
285,71			0,00		
295,92			0,00		
306,12			0,00		
316,33			0,00		
326,53			0,00		
336,73			0,00		
346,94			0,00		
357,14			0,00		
367,35			0,00		

X Coordinates m	Y Coordinates m	Z Coordinates m	Incident Radiation kW/m2	Lethality Level %	View Factor
377,55			0,00		
387,76			0,00		
397,96			0,00		
408,16			0,00		
418,37			0,00		
428,57			0,00		
438,78			0,00		
448,98			0,00		
459,18			0,00		
469,39			0,00		
479,59			0,00		
489,80			0,00		
500,00			0,00		

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

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

\70977-Fase 1-Ip15\Filtro Aspirazione\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		-26,43	degC
Release Rate		0,42	kg/s
	Input	**Output**	
Flame Emissive Power		106,74	kW/m2
Fraction of Emissivity		0,15	fraction
Expanded Radius		0,02	m
Jet Velocity	500,00	500,00	m/s
Flame Length		10,31	m
Maximum Flame Radius		0,64	m

Flame Co-ordinates

X	Z	R	Phi
m	m	m	deg
0,00	1,00	0,02	90,00
1,15	1,00	0,25	90,00
2,29	1,00	0,41	90,00
3,44	1,00	0,52	90,00
4,58	1,00	0,60	90,00
5,73	1,00	0,64	90,00
6,88	1,00	0,63	90,00
8,02	1,00	0,58	90,00
9,17	1,00	0,46	90,00
10,31	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)	6,59	m
Crosswind semi-axis (B)	8,81	m
Offset Ratio (D)	0,83	
Effect Distance	12,04	m
Area	182,58	m2
Incident Radiation Level:	**5,00**	kW/m2
Lethality Level	0,00	%
View Factor	0,05	
Dose Level	1.709.490,54	(W/m2)^Probit N.s
Downwind semi-axis (A)	5,93	m
Crosswind semi-axis (B)	6,60	m
Offset Ratio (D)	0,91	
Effect Distance	11,35	m
Area	122,96	m2
Incident Radiation Level:	**7,00**	kW/m2
Lethality Level	0,02	%
View Factor	0,07	
Dose Level	2.677.313,40	(W/m2)^Probit N.s
Downwind semi-axis (A)	5,53	m
Crosswind semi-axis (B)	5,38	m
Offset Ratio (D)	0,98	
Effect Distance	10,95	m
Area	93,45	m2

Incident Radiation Level:	**12,50**	kW/m2
Lethality Level	6,53	%
View Factor	0,12	
Dose Level	5.800.161,90	(W/m2)^Probit N.s
Downwind semi-axis (A)	5,05	m
Crosswind semi-axis (B)	3,62	m
Offset Ratio (D)	1,06	
Effect Distance	10,43	m
Area	57,51	m2

Radiation Distance

User-Defined Quantities

Maximum Distance	500,00	m
Angle from Wind Direction	0,00	deg
Height above Origin	0,00	m
Observer Inclination	Variable	deg
Observer Orientation	Variable	deg

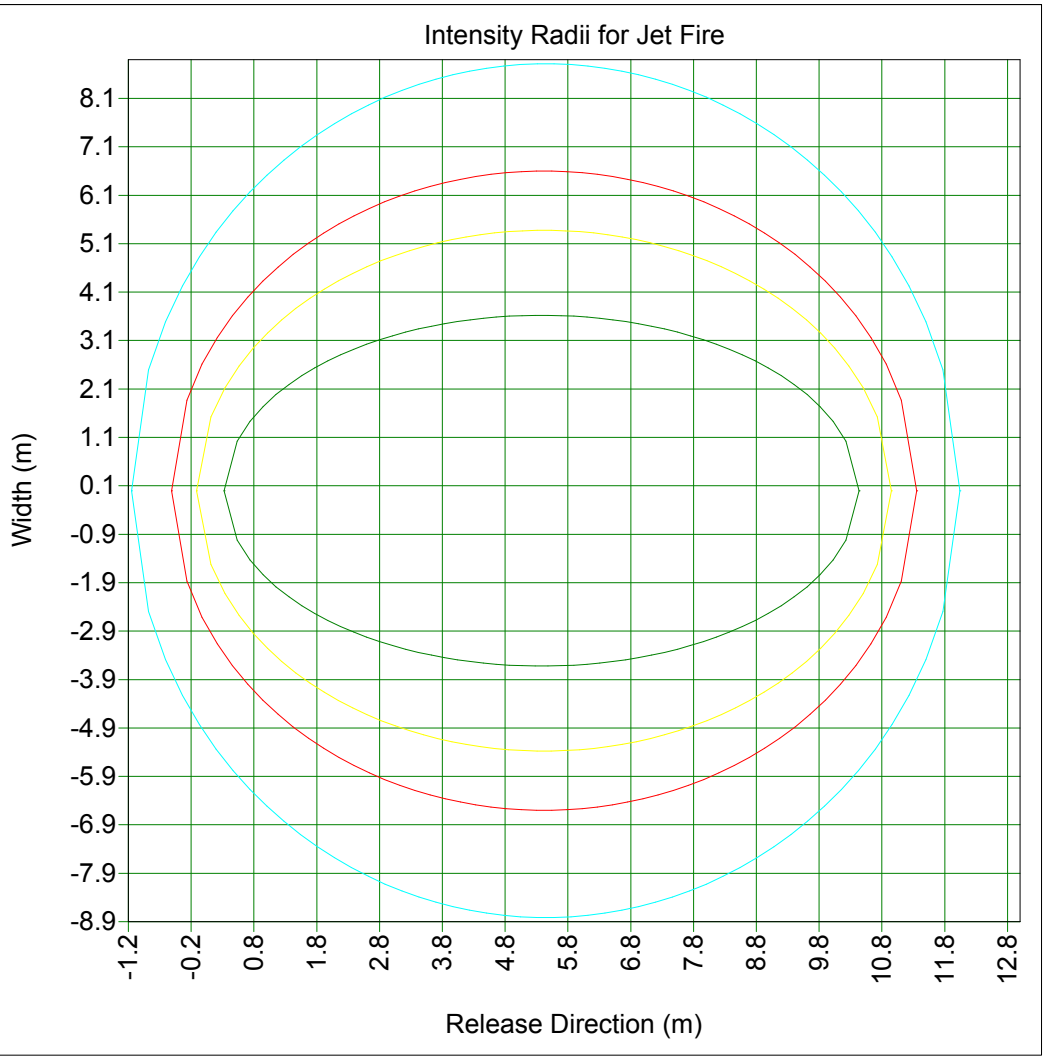
Calculated Quantities

X Coordinates m	Y Coordinates m	Z Coordinates m	Incident Radiation kW/m2	Lethality Level %	View Factor
0,00			8,23		
10,20			17,00		
20,41			0,22		
30,61			0,06		
40,82			0,03		
51,02			0,02		
61,22			0,01		
71,43			0,01		
81,63			0,01		
91,84			0,00		
102,04			0,00		
112,24			0,00		
122,45			0,00		
132,65			0,00		
142,86			0,00		
153,06			0,00		
163,27			0,00		
173,47			0,00		
183,67			0,00		
193,88			0,00		
204,08			0,00		
214,29			0,00		
224,49			0,00		
234,69			0,00		
244,90			0,00		
255,10			0,00		
265,31			0,00		
275,51			0,00		
285,71			0,00		
295,92			0,00		
306,12			0,00		
316,33			0,00		
326,53			0,00		
336,73			0,00		
346,94			0,00		
357,14			0,00		
367,35			0,00		

X Coordinates m	Y Coordinates m	Z Coordinates m	Incident Radiation kW/m2	Lethality Level %	View Factor
377,55			0,00		
387,76			0,00		
397,96			0,00		
408,16			0,00		
418,37			0,00		
428,57			0,00		
438,78			0,00		
448,98			0,00		
459,18			0,00		
469,39			0,00		
479,59			0,00		
489,80			0,00		
500,00			0,00		

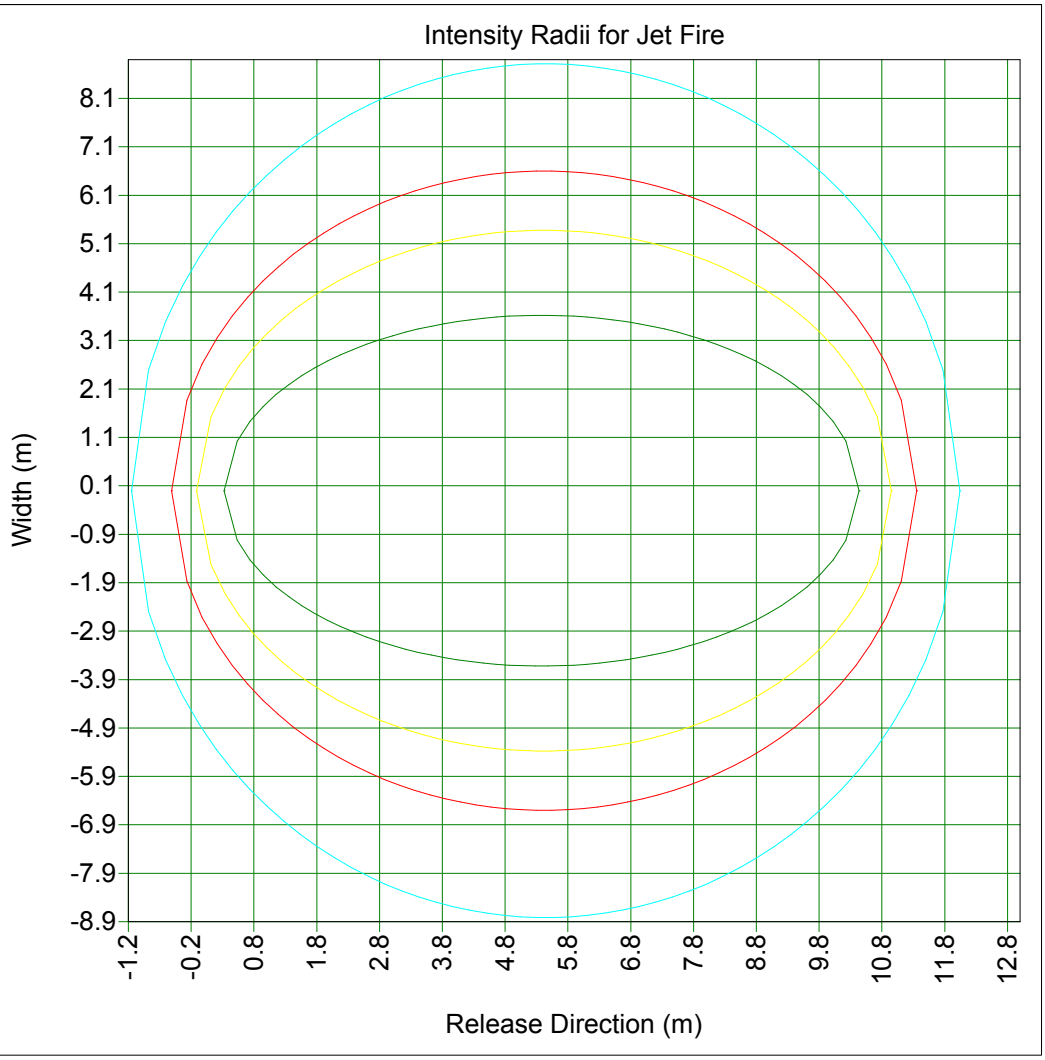
Study Folder: 70977-Fase 1-Ip15
Audit No: 65565
Model: 10mm
Weather: Category 5/D
Material: METHANE

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



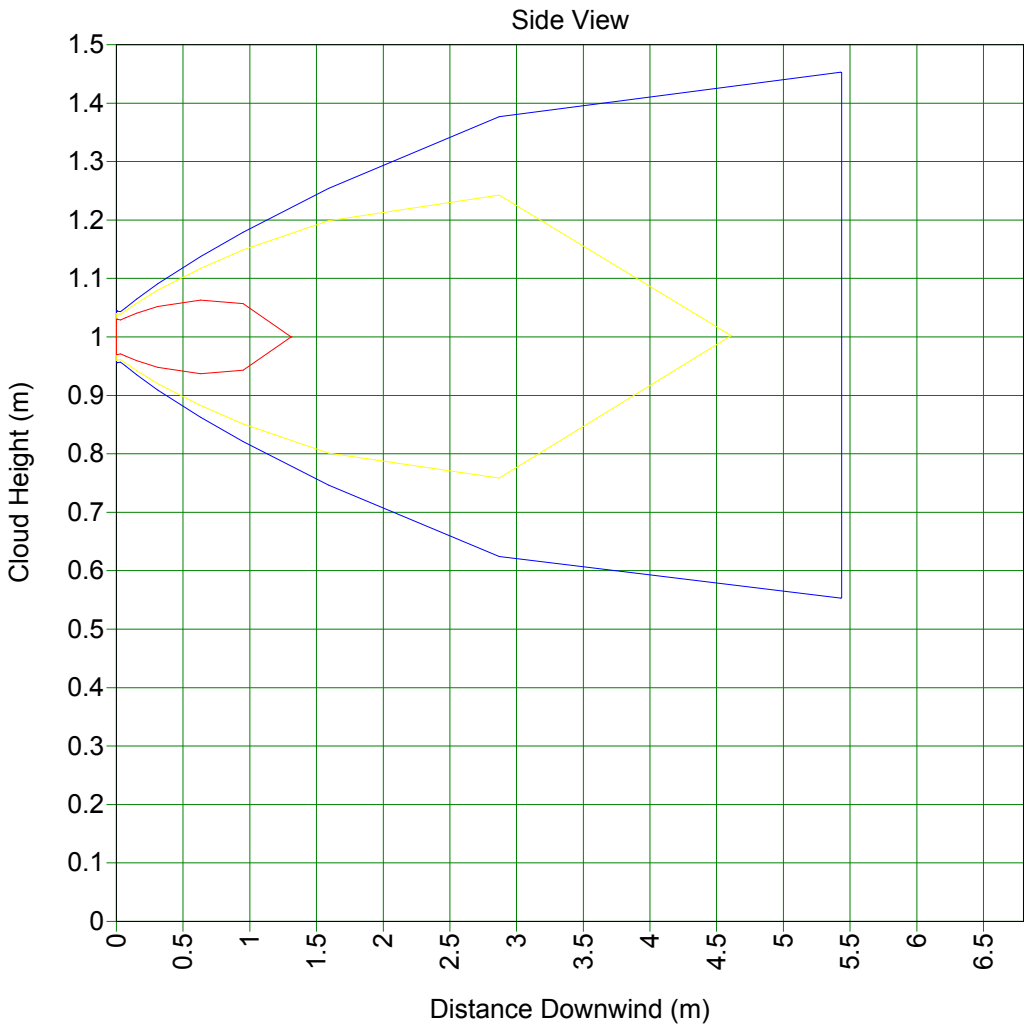
Study Folder: 70977-Fase 1-Ip15
Audit No: 65565
Model: 10mm
Weather: Category 2/F
Material: METHANE

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



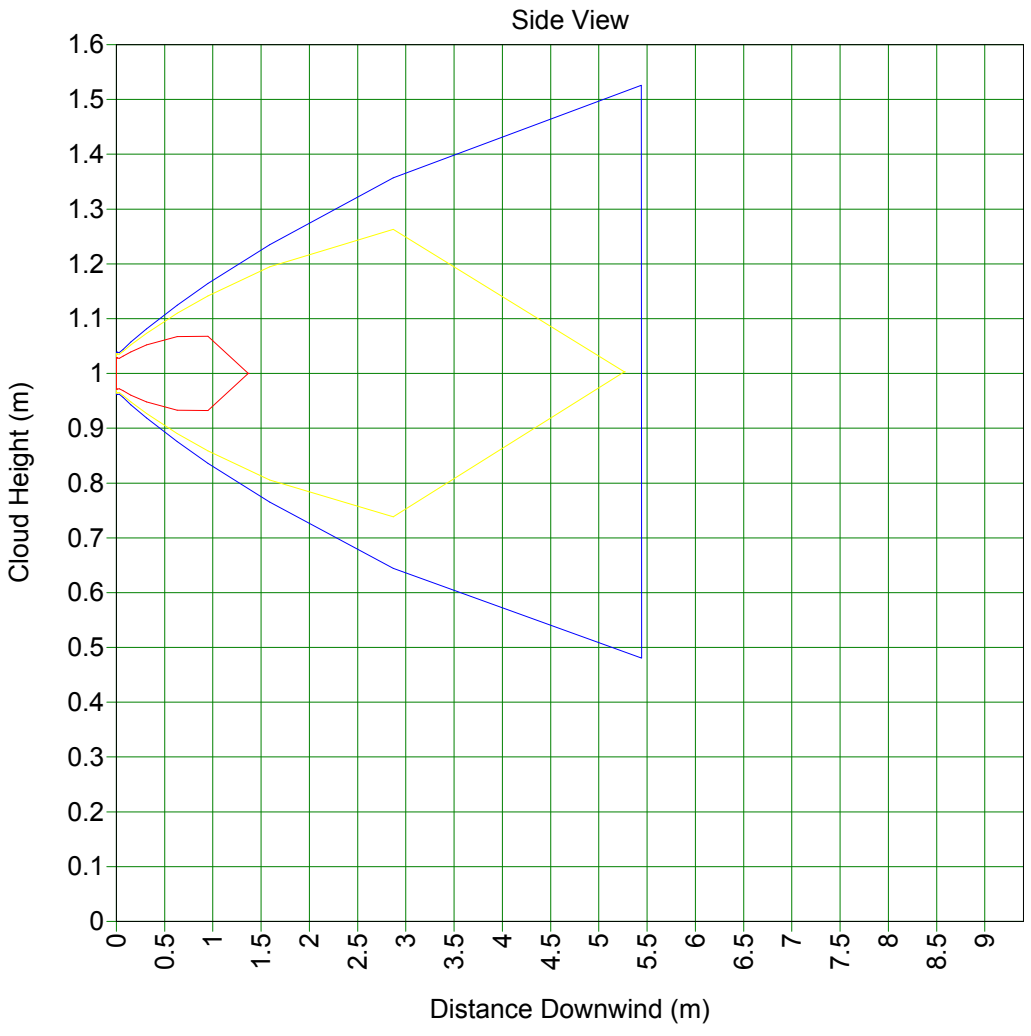
Study Folder: 70977-Fase 1-Ip15
Audit No: 65565
Model: 10mm
Weather: Category 5/D
Material: METHANE
Averaging Time: Flammable(18.75 s)
C/L Offset: 0 m
Concentration
Time: 0.2085 s

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



Study Folder: 70977-Fase 1-Ip15
Audit No: 65565
Model: 10mm
Weather: Category 2/F
Material: METHANE
Averaging Time: Flammable(18.75 s)
C/L Offset: 0 m
Concentration
Time: 0.2007 s

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



70977-Fase 1-Ip15

Filtro Aspirazione

10mm

Base Case

CASE Name: **Data**

Path: \70977-Fase 1-Ip15\Filtro Aspirazione\10mm

User-Defined Data

Material

Material Identifier	METHANE	
Type of Vessel	Pressurized Gas	
Pressure Specification	Pressure specified	
Storage Pressure - gauge	35	bar
Temperature	45	degC
Mass Inventory	100	kg

Scenario

Scenario Type	Leak	
Phase to be Released	Vapor	
Hole Diameter	10	mm
Building Wake Effect	None	

Location

[Elevation	1	m]
Concentration of Interest	2.2E4	ppm
Averaging time associated with Concentration	Flammable	
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

Late Ignition Location	No ignition location	
Mass Inventory of material to Disperse	100	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-Ip15\Filtro Aspirazione\10mm

Discharge Data

User-Defined Quantities

Material	METHANE	
Temperature	45,00	degC
Pressure	36,01	bar
Inventory	100,00	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	-26,43	degC
Final Velocity	500,00	m/s
Droplet Diameter	0,00	um
Continuous Release Data:		
Mass Flowrate	4.16953E-001	kg/s
Release Duration	239,84	s
Orifice Velocity	424,23	m/s
Exit Pressure	19,46	bar
Exit Temperature	0,26	degC
Discharge Coefficient	0,87	
Expanded Radius	0,02	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	-26,43	degC
Final Velocity	500,00	m/s
Droplet Diameter	0,00	um
Continuous Release Data:		
Mass Flowrate	4.16953E-001	kg/s
Release Duration	239,84	s
Orifice Velocity	424,23	m/s
Exit Pressure	19,46	bar
Exit Temperature	0,26	degC
Discharge Coefficient	0,87	
Expanded Radius	0,02	m

Consequence Results

Distance to Concentration Results

Path: \70977-Fase 1-Ip15\Filtro Aspirazione\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
User Conc (22000)	18.75	s	No Hazard	No Hazard
UFL (165000)	18.75	s	1.3664	1.30891
LFL (44000)	18.75	s	5.26255	4.60949
LFL Frac (22000)	18.75	s	9.39856	6.70106

Concentration(ppm)	Averaging Time		Heights (m) for above distances Category 2/F	Category 5/D
User Conc (22000)	18.75	s	0	0
UFL (165000)	18.75	s	1.00009	1.00008
LFL (44000)	18.75	s	1.00317	1.0022
LFL Frac (22000)	18.75	s	1.0169	1.00526

Concentration At Distance Results

Path: \70977-Fase 1-Ip15\Filtro Aspirazione\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

Distance		Conc.(ppm) at Flammable Avg.Time of 18.75 s	
		Category 2/F	Category 5/D
50	m	4370.25	3317.74
250	m	610.301	205.342
500	m	240.093	57.9835

Distance		Heights (m) for above concentrations	
		Category 2/F	Category 5/D
50	m	4.48487	1.64584
250	m	18.6003	3.60606
500	m	28.6865	4.36473

Distance		Conc.(ppm) at Core Avg.Time of 18.75 s	
		Category 2/F	Category 5/D
50	m	4370.25	3317.74
250	m	610.301	205.342
500	m	240.093	57.9835

Distance		Heights (m) for above concentrations	
		Category 2/F	Category 5/D
50	m	4.48487	1.64584
250	m	18.6003	3.60606
500	m	28.6865	4.36473

Jet Fire Hazard

Path: \70977-Fase 1-Ip15\Filtro Aspirazione\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-Ip15\Filtro Aspirazione\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	10.4344	10.4344
Radiation Level	7	kW/m2	10.9531	10.9531
Radiation Level	5	kW/m2	11.353	11.353
Radiation Level	3	kW/m2	12.0397	12.0397

Radiation Effects: Jet Fire Distance

Path: \70977-Fase 1-Ip15\Filtro Aspirazione\10mm

		Radiation Level (kW/m2)	
		Category 2/F	Category 5/D
Distance Of Interest 50	m	0.0170681	0.0170681
Distance Of Interest 250	m	0.000427425	0.000427425
Distance Of Interest 500	m	9.20259e-005	9.20259e-005

Flash Fire Envelope

Path: \70977-Fase 1-Ip15\Filtro Aspirazione\10mm

All flammable results are reported at the cloud centreline height

			Distance (m)	
			Category 2/F	Category 5/D
Furthest Extent	22000	ppm	9.39856	6.70106
Furthest Extent	44000	ppm	5.26255	4.60949

			Heights (m) for above distances	
			Category 2/F	Category 5/D
Furthest Extent	22000	ppm	1.0169	1.00526
Furthest Extent	44000	ppm	1.00317	1.0022

Weather Conditions

Path: \70977-Fase 1-Ip15\Filtro Aspirazione\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