

ANNESSO TECNICO 6.

Elaborati di calcolo Scenari incidentali ragionevolmente credibili

Ipotesi N. 1

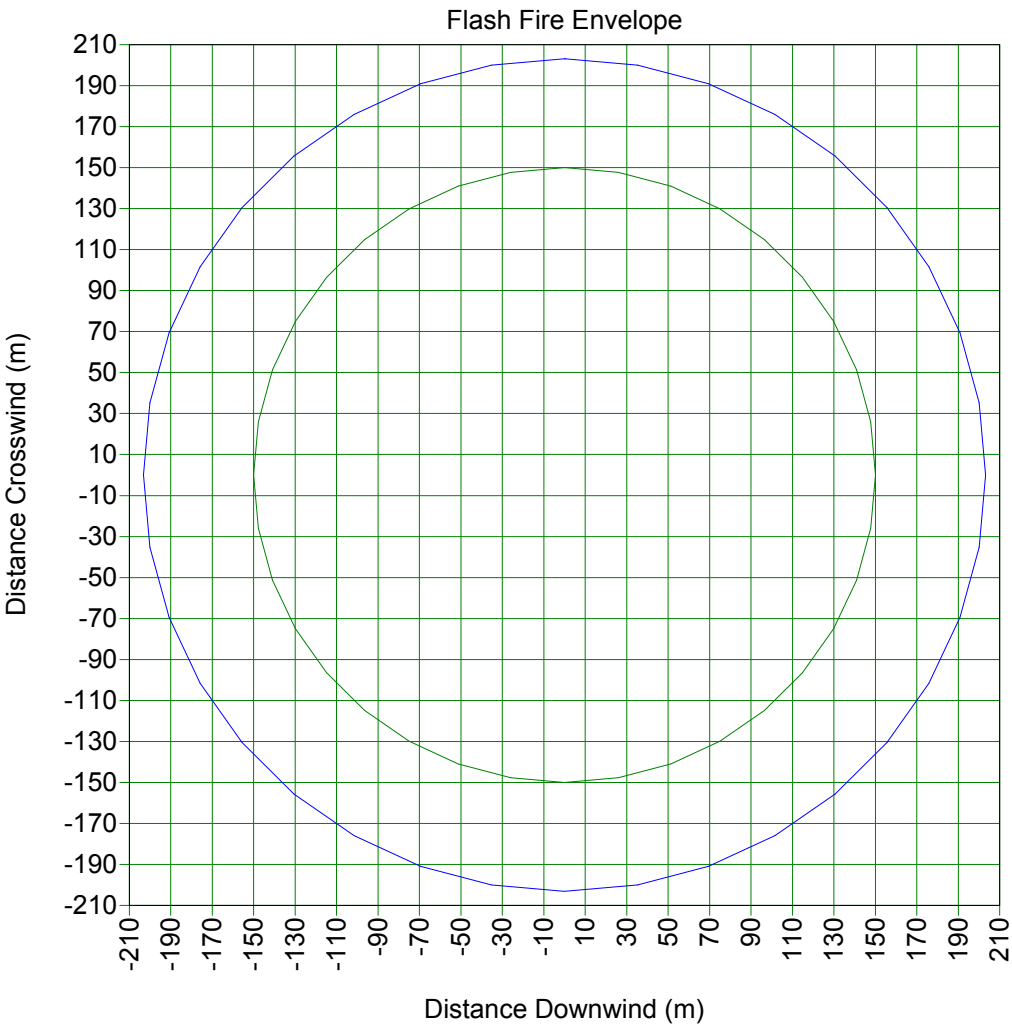
TRR S.r.l.

Il Direttore Generale

Ing. *Alfredo Romano*

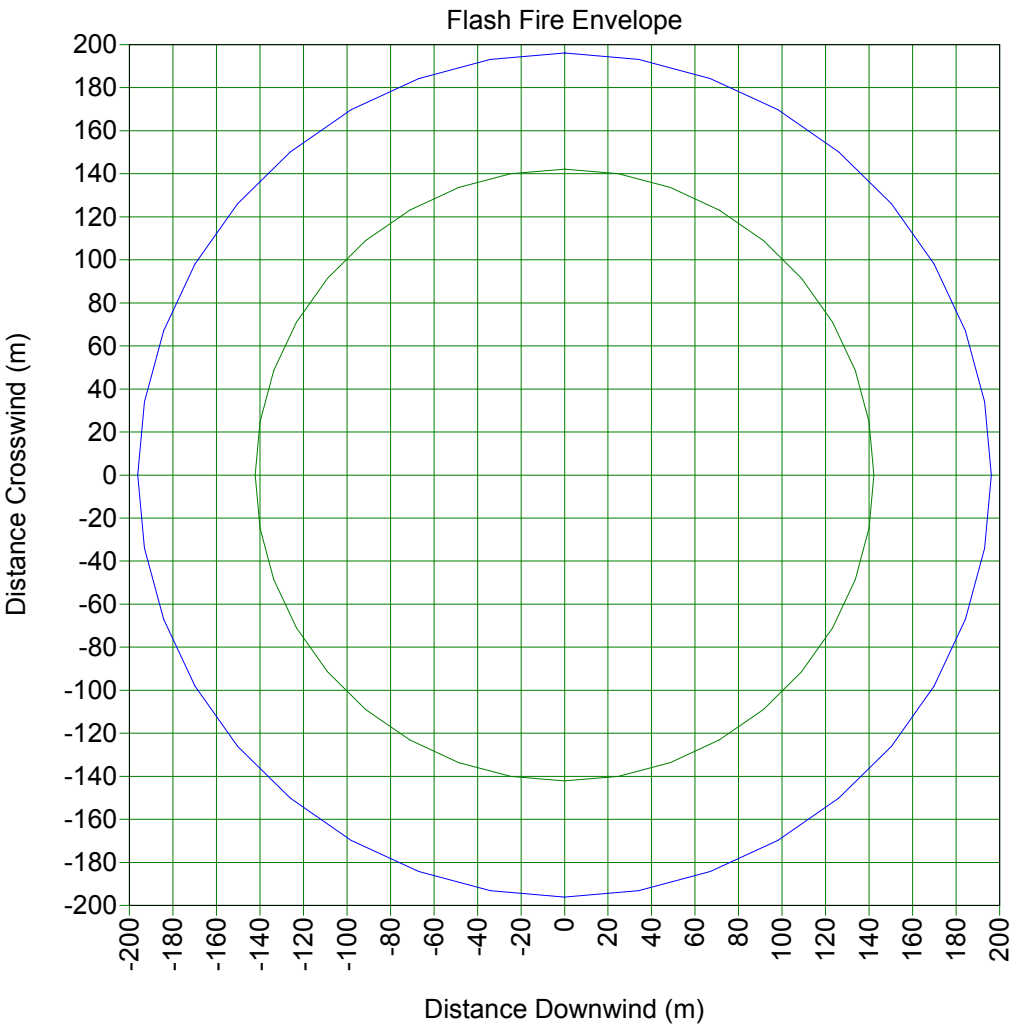
Study Folder: 70977-Fase
2-lp1
Audit No: 46833
Model: 200mm
Weather: Category 5/D
Material: METHANE
Concentration

2.2e+004 ppm
4.4e+004 ppm



Study Folder: 70977-Fase
2-lp1
Audit No: 46833
Model: 200mm
Weather: Category 2/F
Material: METHANE
Concentration

2.2e+004 ppm
4.4e+004 ppm



JET FIRE REPORT

Study Folder: 70977-Fase 2-Ip1

Unique Audit Number: 50.314



Phast 6.6



70977-Fase 2-Ip1



Testa Pozzo

200mm

Base Case

Data



Weather: Global Weathers\Category 2/F

Speed: 2,00 m/s

Stability: F

\\70977-Fase 2-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	-7,67 degC
Release Rate	151,83 kg/s

Input

Output

Flame Emissive Power	138,60 kW/m2
Fraction of Emissivity	0,15 fraction
Expanded Radius	0,36 m
Jet Velocity	497,66 m/s
Flame Length	172,87 m
Maximum Flame Radius	10,75 m

Flame Co-ordinates

X	Z	R	Phi
m	m	m	deg
0,00	1,00	0,36	90,00
19,21	1,00	4,13	90,00
38,42	1,00	6,83	90,00
57,62	1,00	8,76	90,00
76,83	1,00	10,03	90,00
96,04	1,00	10,68	90,00
115,25	1,00	10,64	90,00
134,46	1,00	9,77	90,00
153,67	1,00	7,65	90,00
172,87	1,00	0,00	90,00

JET FIRE REPORT

Study Folder: 70977-Fase 2-Ip1

Unique Audit Number: 50.314



Phast 6.6

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)	101,38	m
Crosswind semi-axis (B)	146,60	m
Offset Ratio (D)	0,95	
Effect Distance	198,27	m
Area	46.688,81	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)	95,33	m
Crosswind semi-axis (B)	111,29	m
Offset Ratio (D)	0,97	
Effect Distance	188,10	m
Area	33.328,64	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)	92,32	m
Crosswind semi-axis (B)	91,73	m
Offset Ratio (D)	0,98	
Effect Distance	182,87	m
Area	26.605,06	m2

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Study Folder: 70977-Fase 2-Ip1

Phast 6.6

Incident Radiation Level:	12,50	kW/m2
Lethality Level	6,53	%
View Factor	0,09	
Dose Level	5.800.161,90	(W/m2)^Probit N.s
Downwind semi-axis (A)	88,07	m
Crosswind semi-axis (B)	63,69	m
Offset Ratio (D)	0,99	
Effect Distance	175,17	m
Area	17.622,10	m2

JET FIRE REPORT

Study Folder: 70977-Fase 2-Ip1

Unique Audit Number: 50.314

Phast 6.6



Radiation Distance

User-Defined Quantities

Maximum Distance	345,75	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			36,51		
7,06			138,60		
14,11			138,60		
21,17			138,60		
28,22			138,60		
35,28			138,60		
42,34			138,60		
49,39			138,60		
56,45			138,60		
63,50			138,60		
70,56			138,60		
77,62			138,60		
84,67			138,60		
91,73			138,60		
98,79			138,60		
105,84			138,60		
112,90			138,60		
119,95			138,60		
127,01			138,60		
134,07			138,60		
141,12			138,60		
148,18			138,60		
155,23			138,60		
162,29			138,60		
169,35			138,60		
176,40			11,44		
183,46			6,72		
190,51			4,35		
197,57			3,03		
204,63			2,23		
211,68			1,70		
218,74			1,34		
225,79			1,10		
232,85			0,93		
239,91			0,80		
246,96			0,70		
254,02			0,61		

JET FIRE REPORT

Unique Audit Number: 50.314



Study Folder: 70977-Fase 2-Ip1

Phast 6.6

X Coordinates m	Y Coordinates m	Z Coordinates m	Incident Radiation kW/m2	Lethality Level %	View Factor
261,08			0,54		
268,13			0,48		
275,19			0,43		
282,24			0,39		
289,30			0,35		
296,36			0,32		
303,41			0,29		
310,47			0,27		
317,52			0,24		
324,58			0,23		
331,64			0,21		
338,69			0,19		
345,75			0,18		



Weather: Global Weathers\Category 5/D

Speed: 5,00 m/s

Stability: D

\70977-Fase 2-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	-7,67	degC
Release Rate	151,83	kg/s

Input		Output	
Flame Emissive Power		138,60	kW/m2
Fraction of Emissivity		0,15	fraction
Expanded Radius		0,36	m
Jet Velocity	497,66	497,66	m/s
Flame Length		172,87	m
Maximum Flame Radius		10,75	m

JET FIRE REPORT

Unique Audit Number: 50.314



Study Folder: 70977-Fase 2-Ip1

Phast 6.6

Flame Co-ordinates

X	Z	R	Phi
m	m	m	deg
0,00	1,00	0,36	90,00
19,21	1,00	4,13	90,00
38,42	1,00	6,83	90,00
57,62	1,00	8,76	90,00
76,83	1,00	10,03	90,00
96,04	1,00	10,68	90,00
115,25	1,00	10,64	90,00
134,46	1,00	9,77	90,00
153,67	1,00	7,65	90,00
172,87	1,00	0,00	90,00

JET FIRE REPORT

Study Folder: 70977-Fase 2-Ip1

Unique Audit Number: 50.314



Phast 6.6

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)	101,38	m
Crosswind semi-axis (B)	146,60	m
Offset Ratio (D)	0,95	
Effect Distance	198,27	m
Area	46.688,81	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)	95,33	m
Crosswind semi-axis (B)	111,29	m
Offset Ratio (D)	0,97	
Effect Distance	188,10	m
Area	33.328,64	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)	92,32	m
Crosswind semi-axis (B)	91,73	m
Offset Ratio (D)	0,98	
Effect Distance	182,87	m
Area	26.605,06	m2

JET FIRE REPORT

Unique Audit Number: 50.314



Study Folder: 70977-Fase 2-Ip1

Phast 6.6

Incident Radiation Level:	12,50	kW/m2
Lethality Level	6,53	%
View Factor	0,09	
Dose Level	5.800.161,90	(W/m2)^Probit N.s
Downwind semi-axis (A)	88,07	m
Crosswind semi-axis (B)	63,69	m
Offset Ratio (D)	0,99	
Effect Distance	175,17	m
Area	17.622,10	m2

JET FIRE REPORT

Study Folder: 70977-Fase 2-Ip1

Unique Audit Number: 50.314

Phast 6.6



Radiation Distance

User-Defined Quantities

Maximum Distance	345,75	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			36,51		
7,06			138,60		
14,11			138,60		
21,17			138,60		
28,22			138,60		
35,28			138,60		
42,34			138,60		
49,39			138,60		
56,45			138,60		
63,50			138,60		
70,56			138,60		
77,62			138,60		
84,67			138,60		
91,73			138,60		
98,79			138,60		
105,84			138,60		
112,90			138,60		
119,95			138,60		
127,01			138,60		
134,07			138,60		
141,12			138,60		
148,18			138,60		
155,23			138,60		
162,29			138,60		
169,35			138,60		
176,40			11,44		
183,46			6,72		
190,51			4,35		
197,57			3,03		
204,63			2,23		
211,68			1,70		
218,74			1,34		
225,79			1,10		
232,85			0,93		
239,91			0,80		
246,96			0,70		
254,02			0,61		

JET FIRE REPORT

Unique Audit Number: 50.314



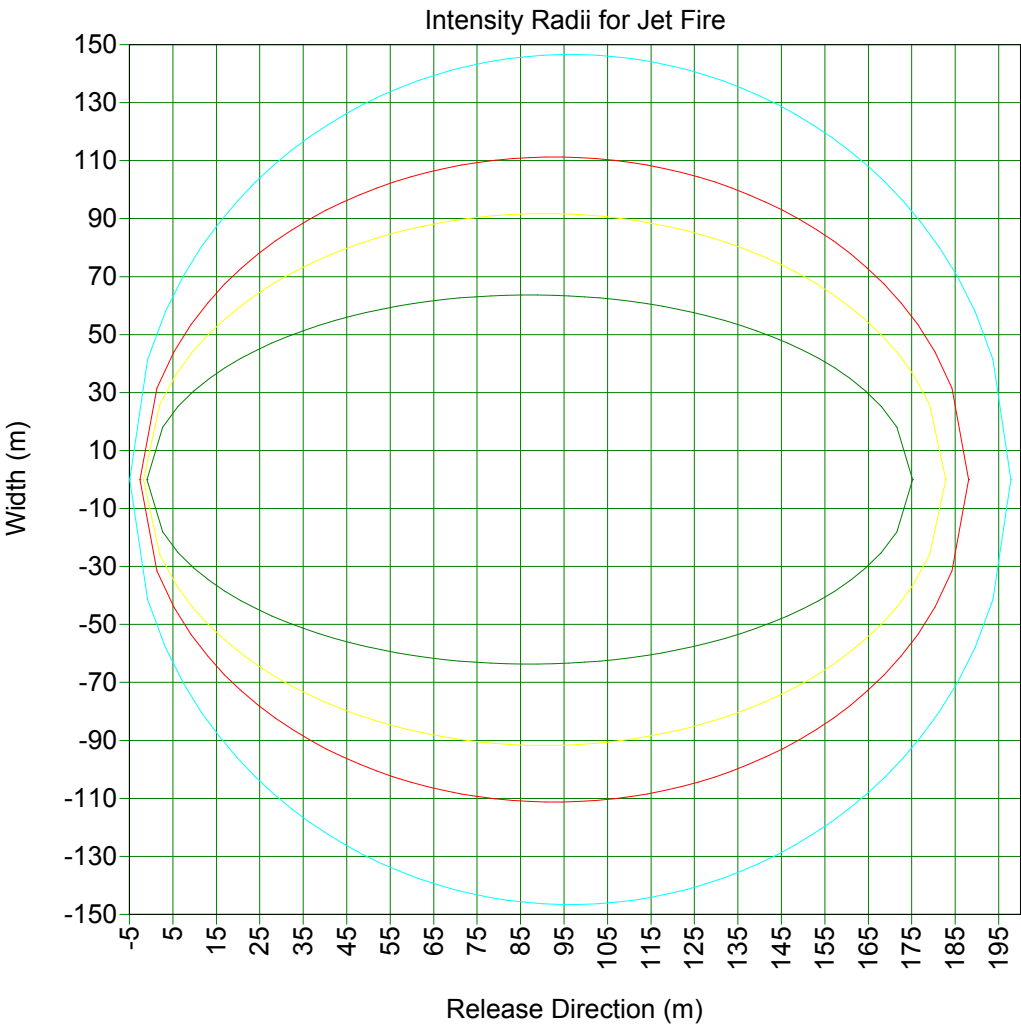
Study Folder: 70977-Fase 2-Ip1

Phast 6.6

X Coordinates m	Y Coordinates m	Z Coordinates m	Incident Radiation kW/m2	Lethality Level %	View Factor
261,08			0,54		
268,13			0,48		
275,19			0,43		
282,24			0,39		
289,30			0,35		
296,36			0,32		
303,41			0,29		
310,47			0,27		
317,52			0,24		
324,58			0,23		
331,64			0,21		
338,69			0,19		
345,75			0,18		

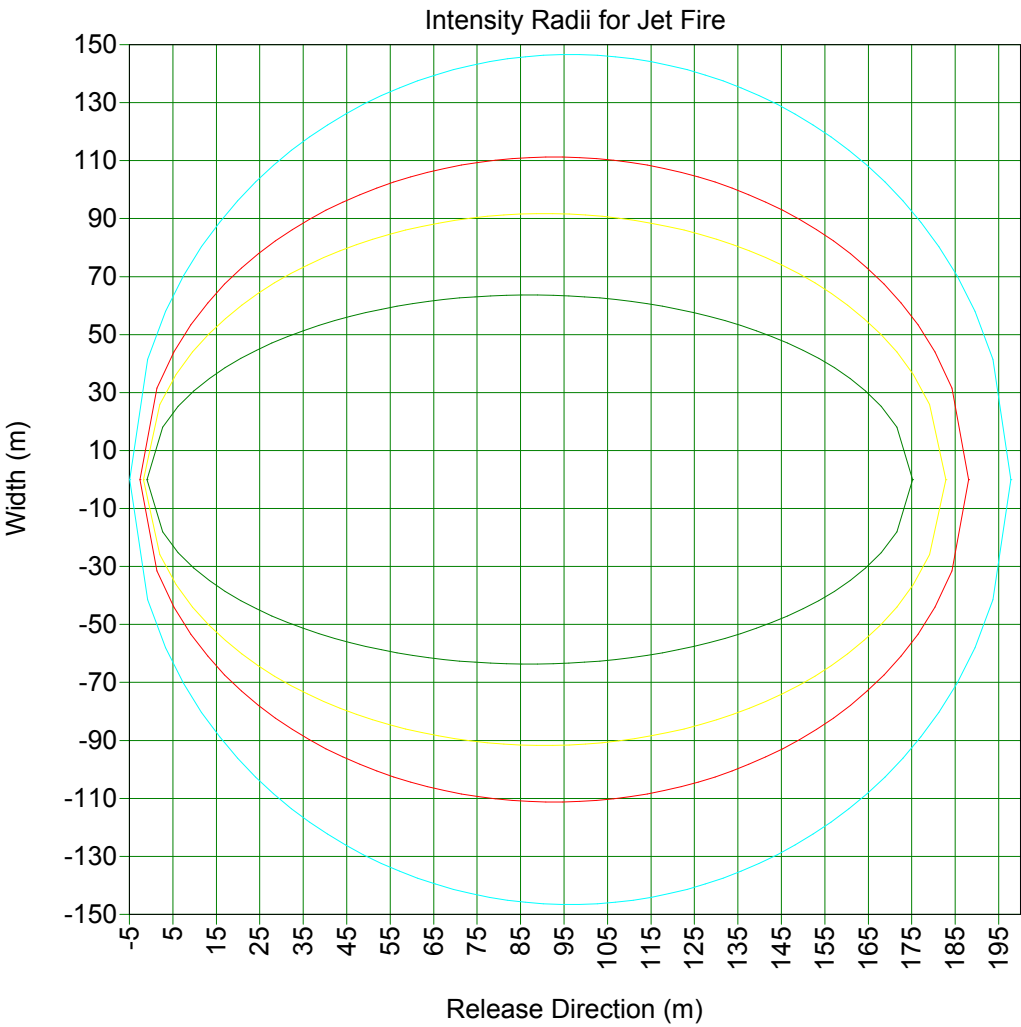
Study Folder: 70977-Fase
2-lp1
Audit No: 50314
Model: 200mm
Weather: Category 5/D
Material: METHANE

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



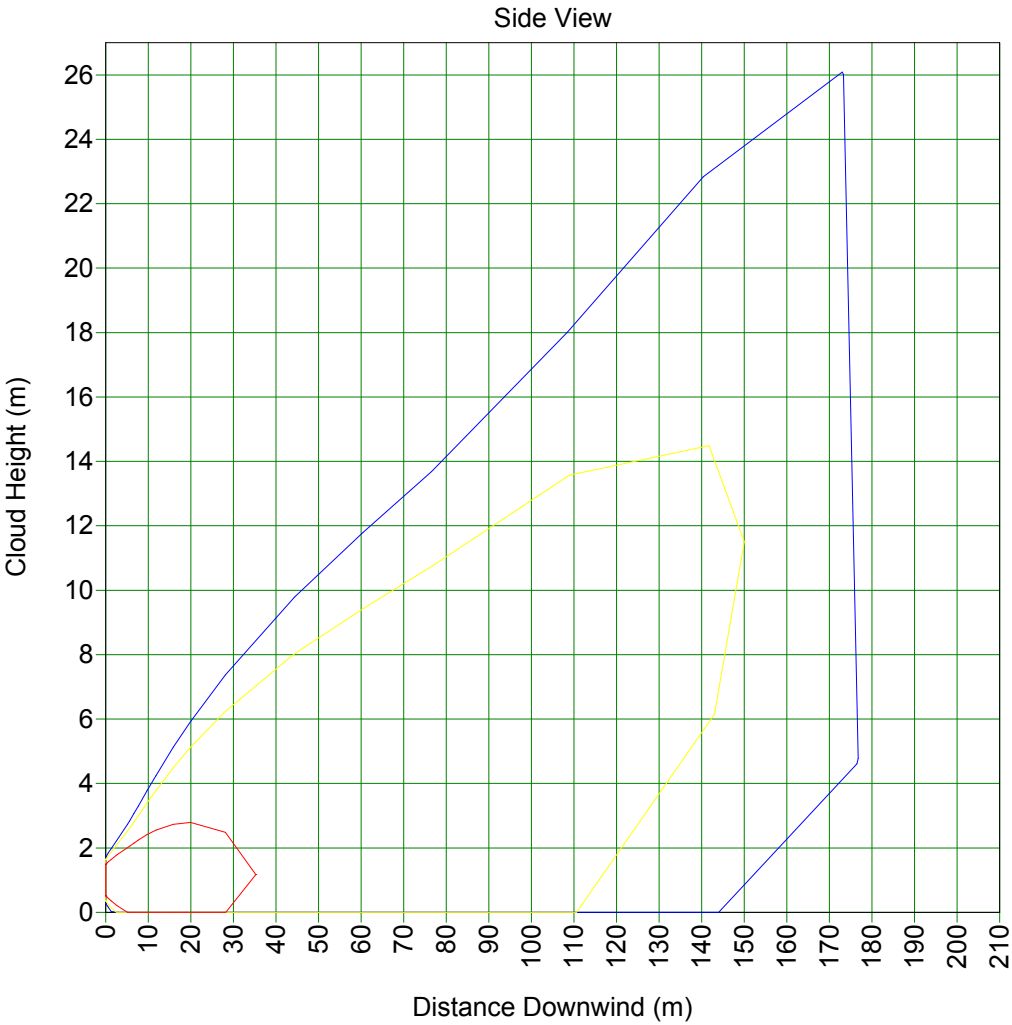
Study Folder: 70977-Fase
2-lp1
Audit No: 50314
Model: 200mm
Weather: Category 2/F
Material: METHANE

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



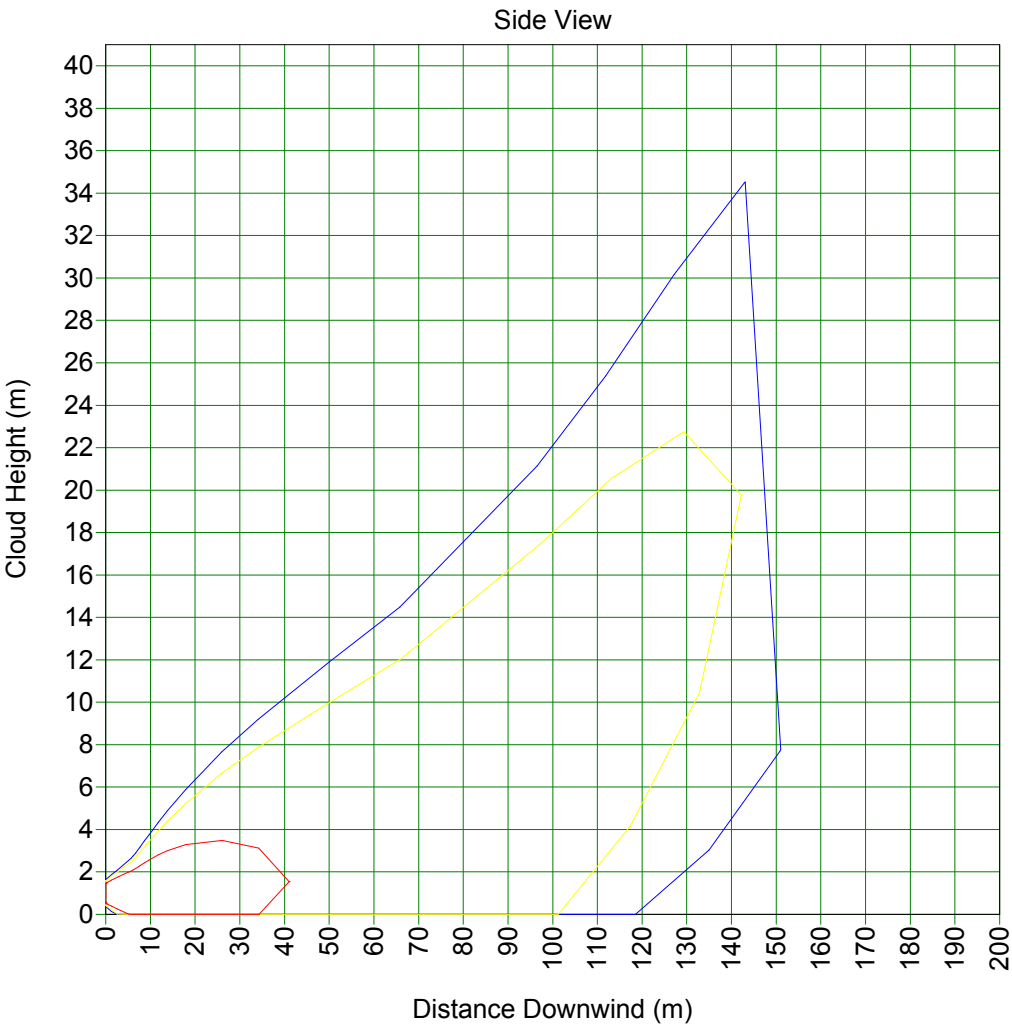
Study Folder: 70977-Fase
2-lp1
Audit No: 50314
Model: 200mm
Weather: Category 5/D
Material: METHANE
Averaging Time:
Flammable(18.75 s)
C/L Offset: 0 m
Concentration
Time: 13.07 s

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



Study Folder: 70977-Fase
2-lp1
Audit No: 50314
Model: 200mm
Weather: Category 2/F
Material: METHANE
Averaging Time:
Flammable(18.75 s)
C/L Offset: 0 m
Concentration
Time: 13.75 s

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



SUMMARY REPORT

Unique Audit Number: 50.314



Study Folder: 70977-Fase 2-Ip1

Phast 6.6



70977-Fase 2-Ip1



Testa Pozzo

200mm

Base Case

CASE Name: Data

Path: \70977-Fase 2-Ip1\Testa Pozzo\200mm

User-Defined Data

Material

Material Identifier	METHANE
Type of Vessel	Pressurized Gas
Pressure Specification	Pressure specified
Storage Pressure - gauge	154 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	150 kg/s
Use Ambient Temperature	Do not use ambient temperature

Vessel/Tank

Duration of Interest	3600 s
Method Used for Time Varying Releases	Average between 2 times
1st Time for Time-Varying Release	0 s
2nd Time for Time-Varying Release	20 s

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

Date: 19/06/2013

1 of 7

Time: 08.57.32

SUMMARY REPORT

Unique Audit Number: 50.314



Study Folder: 70977-Fase 2-Ip1

Phast 6.6

Explosion Method
Jet Fire Method

TNT
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 2-Ip1\Testa Pozzo\200mm

Discharge Data

User-Defined Quantities

Material METHANE
Temperature 25,00 degC
Pressure 155,01 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
Final Temperature -7,67 degC
Final Velocity 497,66 m/s
Droplet Diameter 0,00 um
Continuous Release Data:
Mass Flowrate 1.51827E+002 kg/s
Release Duration 3.556,92 s
Orifice Velocity n/a m/s

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Study Folder: 70977-Fase 2-Ip1

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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
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Average Values for Segment Number 1

Liquid Fraction	0,00 fraction
FinalTemperature	-7,67 degC
Final Velocity	497,66 m/s
Droplet Diameter	0,00 um

Continuous Release Data:

Mass Flowrate	1.51827E+002 kg/s
Release Duration	3.556,92 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

SUMMARY REPORT

Study Folder: 70977-Fase 2-IP1

Unique Audit Number: 50.314

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Consequence Results

Distance to Concentration Results

Path: \70977-Fase 2-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	41.0259	35.272
LFL	(44000)	18.75	s	142.202	150.003
LFL Frac	(22000)	18.75	s	196.113	203.138

Concentration(ppm) Averaging Time				Heights (m) for above distances	
				Category 2/F	Category 5/D
UFL	(165000)	18.75	s	1.53224	1.17681
LFL	(44000)	18.75	s	19.7659	11.5089
LFL Frac	(22000)	18.75	s	35.1828	19.5499

Jet Fire Hazard

Path: \70977-Fase 2-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 2-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		175.17	175.17
Radiation Level	7	kW/m2		182.866	182.866
Radiation Level	5	kW/m2		188.101	188.101
Radiation Level	3	kW/m2		198.268	198.268

Radiation Effects: Jet Fire Distance

Path: \70977-Fase 2-IP1\Testa Pozzo\200mm

		Radiation Level (kW/m2)
		Category 2/F

SUMMARY REPORT

Study Folder: 70977-Fase 2-Ip1

Unique Audit Number: 50.314

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Flash Fire Envelope

Path: \70977-Fase 2-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		196.113	203.138
Furthest Extent	44000	ppm		142.202	150.003
				Heights (m) for above distances	
				Category 2/F	Category 5/D
Furthest Extent	22000	ppm		35.1828	19.5499
Furthest Extent	44000	ppm		19.7659	11.5089

SUMMARY REPORT

Study Folder: 70977-Fase 2-Ip1

Unique Audit Number: 50.314

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Explosion Effects: Late Ignition

Path: \70977-Fase 2-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	520.014	498.138
Overpressure	0.1379	bar	275.449	277.195
Overpressure	0.2068	bar	256.118	259.732

			Supplementary Data at 0.02068 bar	
			Category 2/F	Category 5/D
Supplied Flammable Mass	kg		922.281	680.016
Used Flammable Mass	kg		922.281	680.016
Overpressure Radius	m		330.014	298.138
Distance to:				
- Ignition Source	m		190	200
- Cloud Front/Centre	m		190	200
- Explosion Centre	m		190	200

			Supplementary Data at 0.1379 bar	
			Category 2/F	Category 5/D
Supplied Flammable Mass	kg		922.281	680.016
Used Flammable Mass	kg		922.281	680.016
Overpressure Radius	m		85.4487	77.1953
Distance to:				
- Ignition Source	m		190	200
- Cloud Front/Centre	m		190	200
- Explosion Centre	m		190	200

			Supplementary Data at 0.2068 bar	
			Category 2/F	Category 5/D
Supplied Flammable Mass	kg		922.281	680.016
Used Flammable Mass	kg		922.281	680.016
Overpressure Radius	m		66.1183	59.732
Distance to:				
- Ignition Source	m		190	200
- Cloud Front/Centre	m		190	200
- Explosion Centre	m		190	200

SUMMARY REPORT

Unique Audit Number: 50.314



Study Folder: 70977-Fase 2-Ip1

Phast 6.6

Weather Conditions

Path: \70977-Fase 2-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