ANNESSO TECNICO 6.

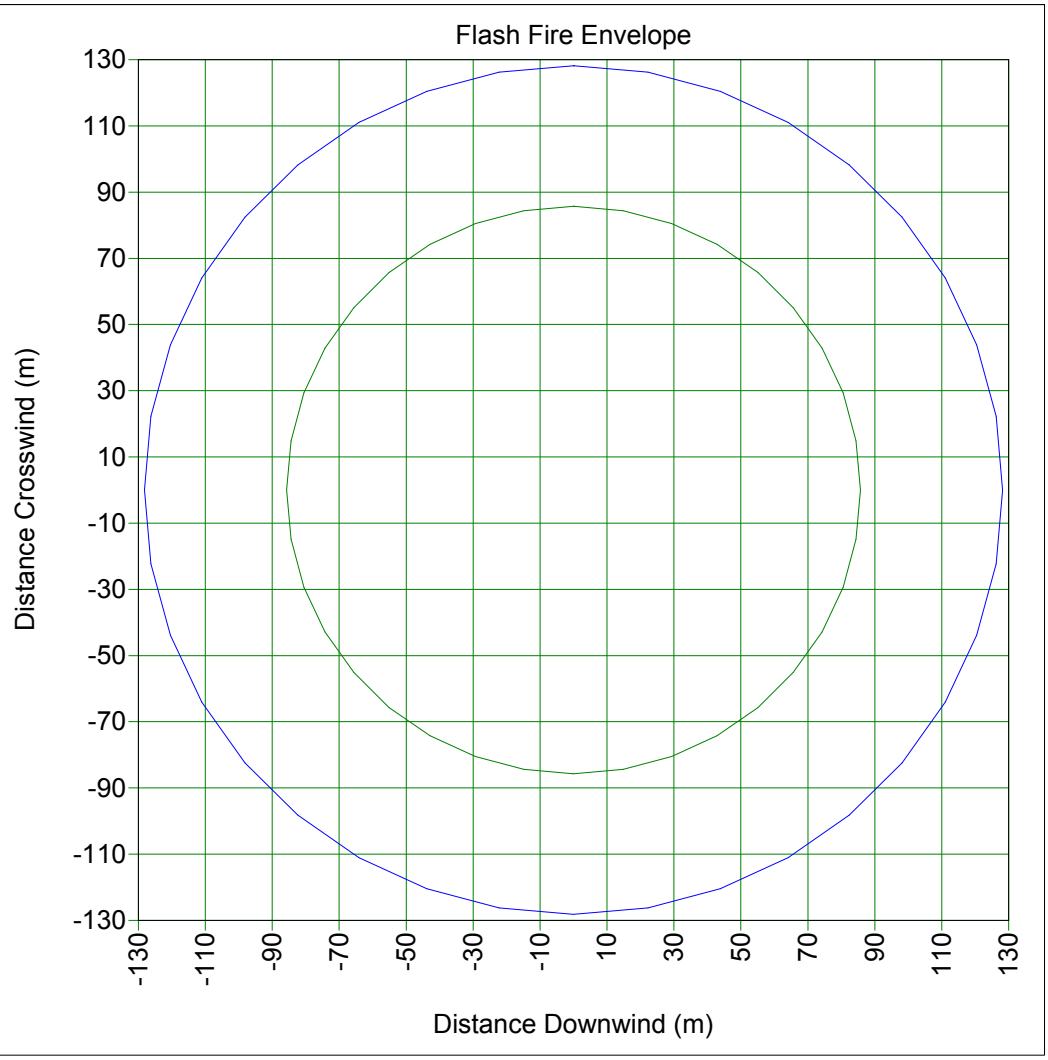
Elaborati di calcolo
Scenari incidentali ragionevolmente credibili

Ipotesi N. 10

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

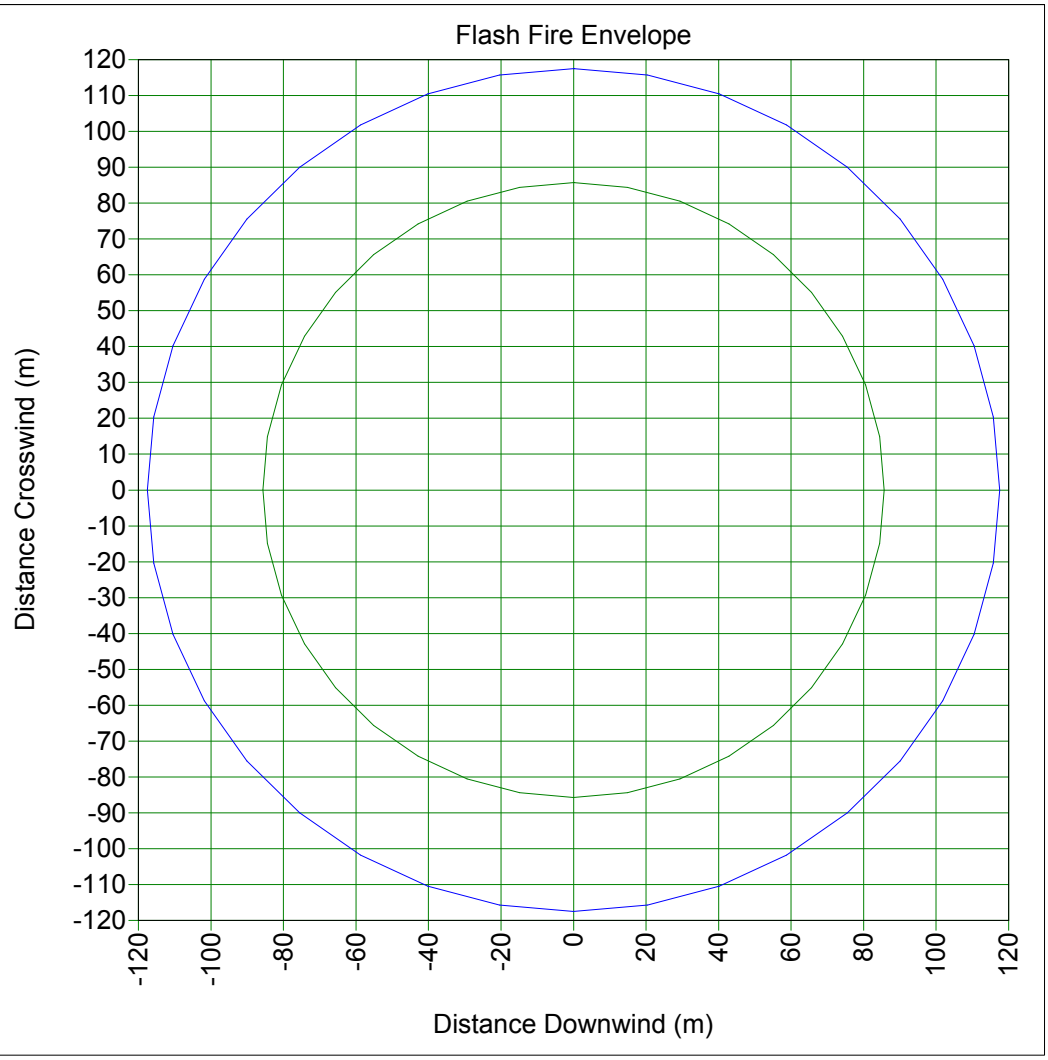
Study Folder: 70977-Fase 1-Ip10
Audit No: 65806
Model: 90mm
Weather: Category 5/D
Material: METHANE
Concentration

2.2e+004 ppm
4.4e+004 ppm



Study Folder: 70977-Fase 1-lp10
Audit No: 65806
Model: 90mm
Weather: Category 2/F
Material: METHANE
Concentration

- 2.2e+004 ppm
- 4.4e+004 ppm



70977-Fase 1-Ip10

Collettore Colonne Disidratazione

90mm

Base Case

Data

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

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

\70977-Fase 1-Ip10\Collettore Colonne Disidratazione\90mm

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	0,66	degC
Release Rate	42,14	kg/s

	Input	**Output**	
Flame Emissive Power		130,73	kW/m2
Fraction of Emissivity		0,15	fraction
Expanded Radius		0,19	m
Jet Velocity	500,00	500,00	m/s
Flame Length		93,68	m
Maximum Flame Radius		5,83	m

Flame Co-ordinates

X	**Z**	**R**	**Phi**
m	m	m	deg
0,00	1,00	0,19	90,00
10,41	1,00	2,24	90,00
20,82	1,00	3,70	90,00
31,23	1,00	4,75	90,00
41,64	1,00	5,44	90,00
52,04	1,00	5,79	90,00
62,45	1,00	5,77	90,00
72,86	1,00	5,30	90,00
83,27	1,00	4,14	90,00
93,68	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)	55,44	m
Crosswind semi-axis (B)	80,28	m
Offset Ratio (D)	0,93	
Effect Distance	107,51	m
Area	13.982,35	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)	51,96	m
Crosswind semi-axis (B)	60,81	m
Offset Ratio (D)	0,96	
Effect Distance	101,85	m
Area	9.926,13	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)	50,19	m
Crosswind semi-axis (B)	50,05	m
Offset Ratio (D)	0,97	
Effect Distance	98,95	m
Area	7.891,66	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)	47,84	m
Crosswind semi-axis (B)	34,65	m
Offset Ratio (D)	0,99	
Effect Distance	95,03	m
Area	5.208,57	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			22,94		
10,20			130,73		
20,41			130,73		
30,61			130,73		
40,82			130,73		
51,02			130,73		
61,22			130,73		
71,43			130,73		
81,63			130,73		
91,84			100,09		
102,04			4,90		
112,24			2,02		
122,45			1,12		
132,65			0,74		
142,86			0,53		
153,06			0,39		
163,27			0,31		
173,47			0,24		
183,67			0,20		
193,88			0,17		
204,08			0,14		
214,29			0,12		
224,49			0,10		
234,69			0,09		
244,90			0,08		
255,10			0,07		
265,31			0,06		
275,51			0,06		
285,71			0,05		
295,92			0,05		
306,12			0,04		
316,33			0,04		
326,53			0,04		
336,73			0,03		
346,94			0,03		
357,14			0,03		
367,35			0,03		

X Coordinates m	Y Coordinates m	Z Coordinates m	Incident Radiation kW/m2	Lethality Level %	View Factor
377,55			0,02		
387,76			0,02		
397,96			0,02		
408,16			0,02		
418,37			0,02		
428,57			0,02		
438,78			0,02		
448,98			0,02		
459,18			0,02		
469,39			0,01		
479,59			0,01		
489,80			0,01		
500,00			0,01		

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

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

\70977-Fase 1-Ip10\Collettore Colonne Disidratazione\90mm

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		0,66	degC
Release Rate		42,14	kg/s
	Input	**Output**	
Flame Emissive Power		130,73	kW/m2
Fraction of Emissivity		0,15	fraction
Expanded Radius		0,19	m
Jet Velocity	500,00	500,00	m/s
Flame Length		93,68	m
Maximum Flame Radius		5,83	m

Flame Co-ordinates

X	Z	R	Phi
m	m	m	deg
0,00	1,00	0,19	90,00
10,41	1,00	2,24	90,00
20,82	1,00	3,70	90,00
31,23	1,00	4,75	90,00
41,64	1,00	5,44	90,00
52,04	1,00	5,79	90,00
62,45	1,00	5,77	90,00
72,86	1,00	5,30	90,00
83,27	1,00	4,14	90,00
93,68	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)	55,44	m
Crosswind semi-axis (B)	80,28	m
Offset Ratio (D)	0,93	
Effect Distance	107,51	m
Area	13.982,35	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)	51,96	m
Crosswind semi-axis (B)	60,81	m
Offset Ratio (D)	0,96	
Effect Distance	101,85	m
Area	9.926,13	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)	50,19	m
Crosswind semi-axis (B)	50,05	m
Offset Ratio (D)	0,97	
Effect Distance	98,95	m
Area	7.891,66	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)	47,84	m
Crosswind semi-axis (B)	34,65	m
Offset Ratio (D)	0,99	
Effect Distance	95,03	m
Area	5.208,57	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

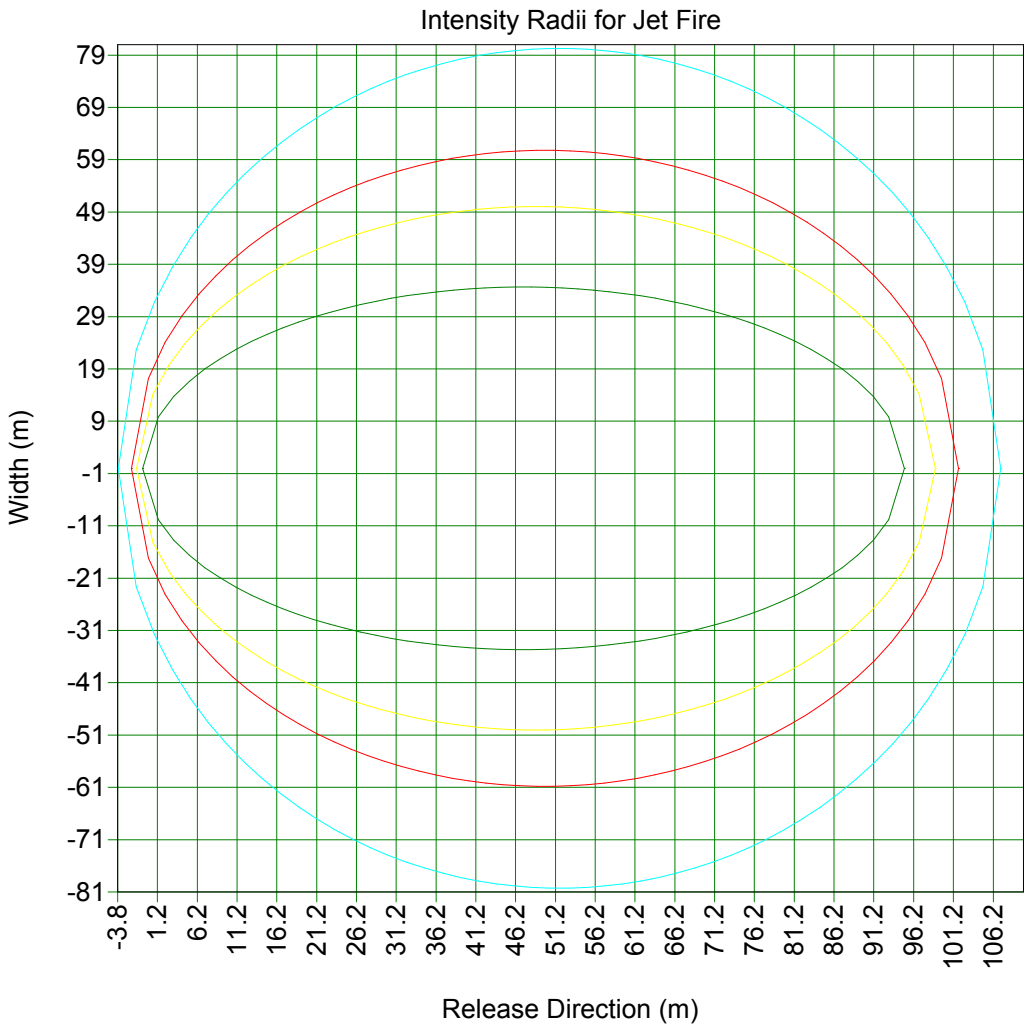
Calculated Quantities

X Coordinates m	Y Coordinates m	Z Coordinates m	Incident Radiation kW/m2	Lethality Level %	View Factor
0,00			22,94		
10,20			130,73		
20,41			130,73		
30,61			130,73		
40,82			130,73		
51,02			130,73		
61,22			130,73		
71,43			130,73		
81,63			130,73		
91,84			100,09		
102,04			4,90		
112,24			2,02		
122,45			1,12		
132,65			0,74		
142,86			0,53		
153,06			0,39		
163,27			0,31		
173,47			0,24		
183,67			0,20		
193,88			0,17		
204,08			0,14		
214,29			0,12		
224,49			0,10		
234,69			0,09		
244,90			0,08		
255,10			0,07		
265,31			0,06		
275,51			0,06		
285,71			0,05		
295,92			0,05		
306,12			0,04		
316,33			0,04		
326,53			0,04		
336,73			0,03		
346,94			0,03		
357,14			0,03		
367,35			0,03		

X Coordinates m	Y Coordinates m	Z Coordinates m	Incident Radiation kW/m2	Lethality Level %	View Factor
377,55			0,02		
387,76			0,02		
397,96			0,02		
408,16			0,02		
418,37			0,02		
428,57			0,02		
438,78			0,02		
448,98			0,02		
459,18			0,02		
469,39			0,01		
479,59			0,01		
489,80			0,01		
500,00			0,01		

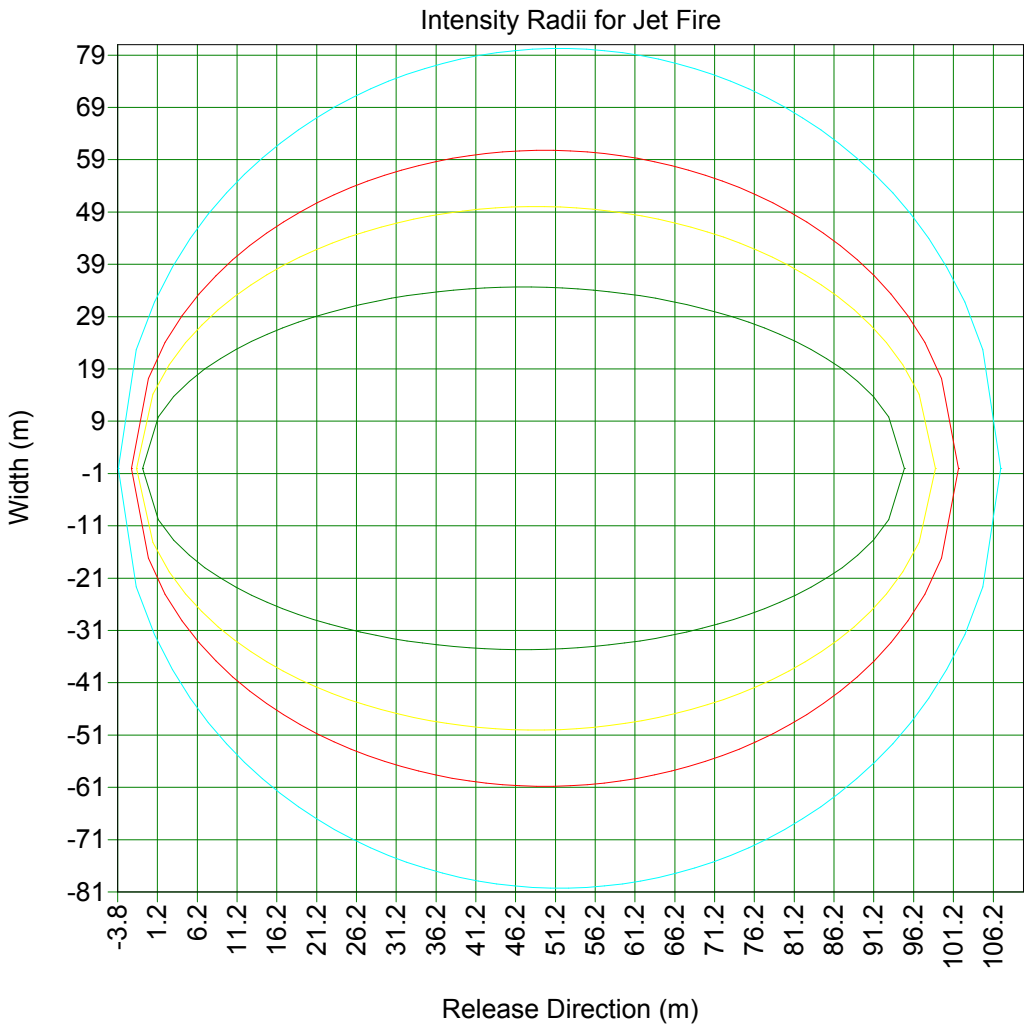
Study Folder: 70977-Fase 1-Ip10
Audit No: 65806
Model: 90mm
Weather: Category 5/D
Material: METHANE

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



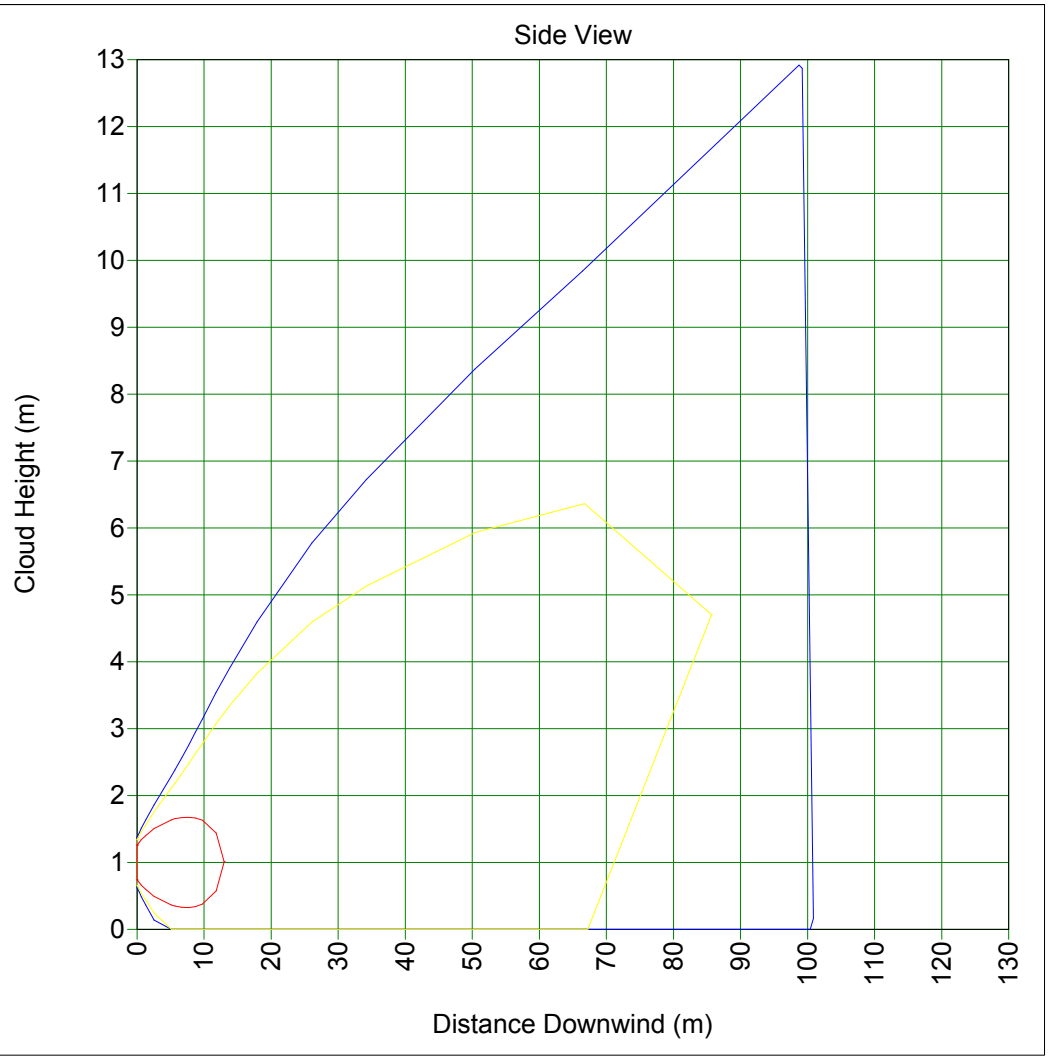
Study Folder: 70977-Fase 1-Ip10
Audit No: 65806
Model: 90mm
Weather: Category 2/F
Material: METHANE

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



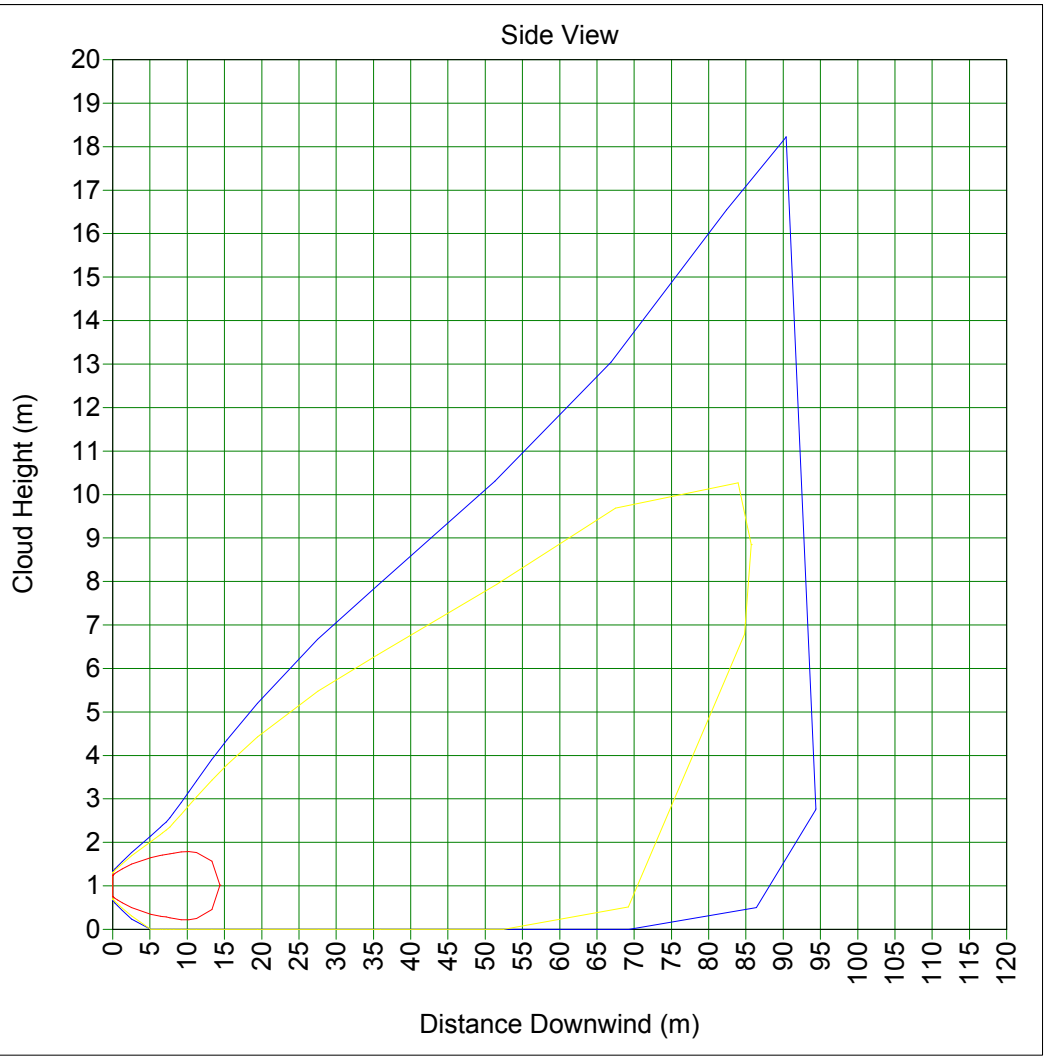
Study Folder: 70977-Fase 1-Ip10
Audit No: 65806
Model: 90mm
Weather: Category 5/D
Material: METHANE
Averaging Time: Flammable(18.75 s)
C/L Offset: 0 m
Concentration
Time: 7.756 s

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



Study Folder: 70977-Fase 1-Ip10
Audit No: 65806
Model: 90mm
Weather: Category 2/F
Material: METHANE
Averaging Time: Flammable(18.75 s)
C/L Offset: 0 m
Concentration
Time: 9.938 s

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



70977-Fase 1-Ip10

Collettore Colonne Disidratazione

90mm

Base Case

CASE Name: **Data**

Path: \70977-Fase 1-Ip10\Collettore Colonne Disidratazione\90mm

User-Defined Data

Material

Material Identifier	METHANE	
Type of Vessel	Pressurized Gas	
Pressure Specification	Pressure specified	
Storage Pressure - gauge	70	bar
Temperature	50	degC

Scenario

Scenario Type	Long Pipeline	
Phase to be Released	Vapor	
Building Wake Effect	None	

Pipe

Internal Diameter	450	mm
Line length	70	m
Distance To Break	1	m
Relative Aperture	0.2	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]
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	

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-Ip10\Collettore Colonne Disidratazione\90mm

Discharge Data

User-Defined Quantities

Material	METHANE	
Temperature	25,00	degC
Pressure	71,01	bar
Inventory	14.000,00	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	0,66	degC
Final Velocity	500,00	m/s
Droplet Diameter	0,00	um

Continuous Release Data:		
Mass Flowrate	4.21401E+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	0,66	degC
Final Velocity	500,00	m/s
Droplet Diameter	0,00	um
Continuous Release Data:		
Mass Flowrate	4.21401E+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-Ip10\Collettore Colonne Disidratazione\90mm

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	84.7802	105.24
UFL (165000)	18.75	s	14.3979	12.9872
LFL (44000)	18.75	s	85.7035	85.7038
LFL Frac (22000)	18.75	s	117.54	128.194

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	1.01617	1.00959
LFL (44000)	18.75	s	8.84873	4.70347
LFL Frac (22000)	18.75	s	17.0746	9.84824

Concentration At Distance Results

Path: \70977-Fase 1-Ip10\Collettore Colonne Disidratazione\90mm

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	78499.5	70447.1
250	m	4392.19	5163.41
500	m	1337.91	1941.3

Distance		Heights (m) for above concentrations	
		Category 2/F	Category 5/D
50	m	2.57052	1.73642
250	m	43.0939	21.7846
500	m	66.2686	37.6012

Distance		Conc.(ppm) at Core Avg.Time of 18.75 s	
		Category 2/F	Category 5/D
50	m	78499.5	70447.1
250	m	4392.19	5163.41
500	m	1337.91	1941.3

Distance		Heights (m) for above concentrations	
		Category 2/F	Category 5/D
50	m	2.57052	1.73642
250	m	43.0939	21.7846
500	m	66.2686	37.6012

Jet Fire Hazard

Path: \70977-Fase 1-Ip10\Collettore Colonne Disidratazione\90mm

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-Ip10\Collettore Colonne Disidratazione\90mm

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	95.034	95.034
Radiation Level	7	kW/m2	98.9538	98.9538
Radiation Level	5	kW/m2	101.847	101.847
Radiation Level	3	kW/m2	107.509	107.509

Radiation Effects: Jet Fire Distance

Path: \70977-Fase 1-Ip10\Collettore Colonne Disidratazione\90mm

			Radiation Level (kW/m2)	
			Category 2/F	Category 5/D
Distance Of Interest 50		m	Engulfed	Engulfed
Distance Of Interest 250		m	0.0763249	0.0763249
Distance Of Interest 500		m	0.0121184	0.0121184

Flash Fire Envelope

Path: \70977-Fase 1-Ip10\Collettore Colonne Disidratazione\90mm

All flammable results are reported at the cloud centreline height

			Distance (m)	
			Category 2/F	Category 5/D
Furthest Extent	22000	ppm	117.54	128.194
Furthest Extent	44000	ppm	85.7035	85.7038

			Heights (m) for above distances	
			Category 2/F	Category 5/D
Furthest Extent	22000	ppm	17.0746	9.84824
Furthest Extent	44000	ppm	8.84873	4.70347

Explosion Effects: Late Ignition

Path: \70977-Fase 1-Ip10\Collettore Colonne Disidratazione\90mm

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	289.751	277.531
Overpressure	0.1379	bar	156.542	160.789
Overpressure	0.2068	bar	146.013	151.561

		Supplementary Data at 0.02068 bar Category 2/F	Category 5/D
Supplied Flammable Mass	kg	149.034	100.316
Used Flammable Mass	kg	149.034	100.316
Overpressure Radius	m	179.751	157.531
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	149.034	100.316
Used Flammable Mass	kg	149.034	100.316
Overpressure Radius	m	46.5421	40.7888
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	149.034	100.316
Used Flammable Mass	kg	149.034	100.316
Overpressure Radius	m	36.0132	31.5614
Distance to:			
- Ignition Source	m	110	120
- Cloud Front/Centre	m	110	120
- Explosion Centre	m	110	120

			Overpressures (bar gauge) at Distances Category 2/F	Category 5/D
Distance	50	m	1	1
Distance	250	m	0.0284402	0.0263779
Distance	500	m	0.00832905	0.00743324

		Supplementary Data at 50 m Category 2/F	Category 5/D
Supplied Flammable Mass	kg	53.535	52.1379

Used Flammable Mass	kg	53.535	52.1379
		Supplementary Data at 250 m	
		Category 2/F	Category 5/D
Supplied Flammable Mass	kg	149.034	100.316
Used Flammable Mass	kg	149.034	100.316
		Supplementary Data at 500 m	
		Category 2/F	Category 5/D
Supplied Flammable Mass	kg	149.034	100.316
Used Flammable Mass	kg	149.034	100.316

Weather Conditions

Path: \70977-Fase 1-Ip10\Collettore Colonne Disidratazione\90mm

		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