

ANNESSO TECNICO 6.

Elaborati di calcolo Scenari incidentali ragionevolmente credibili

Ipotesi N. 14

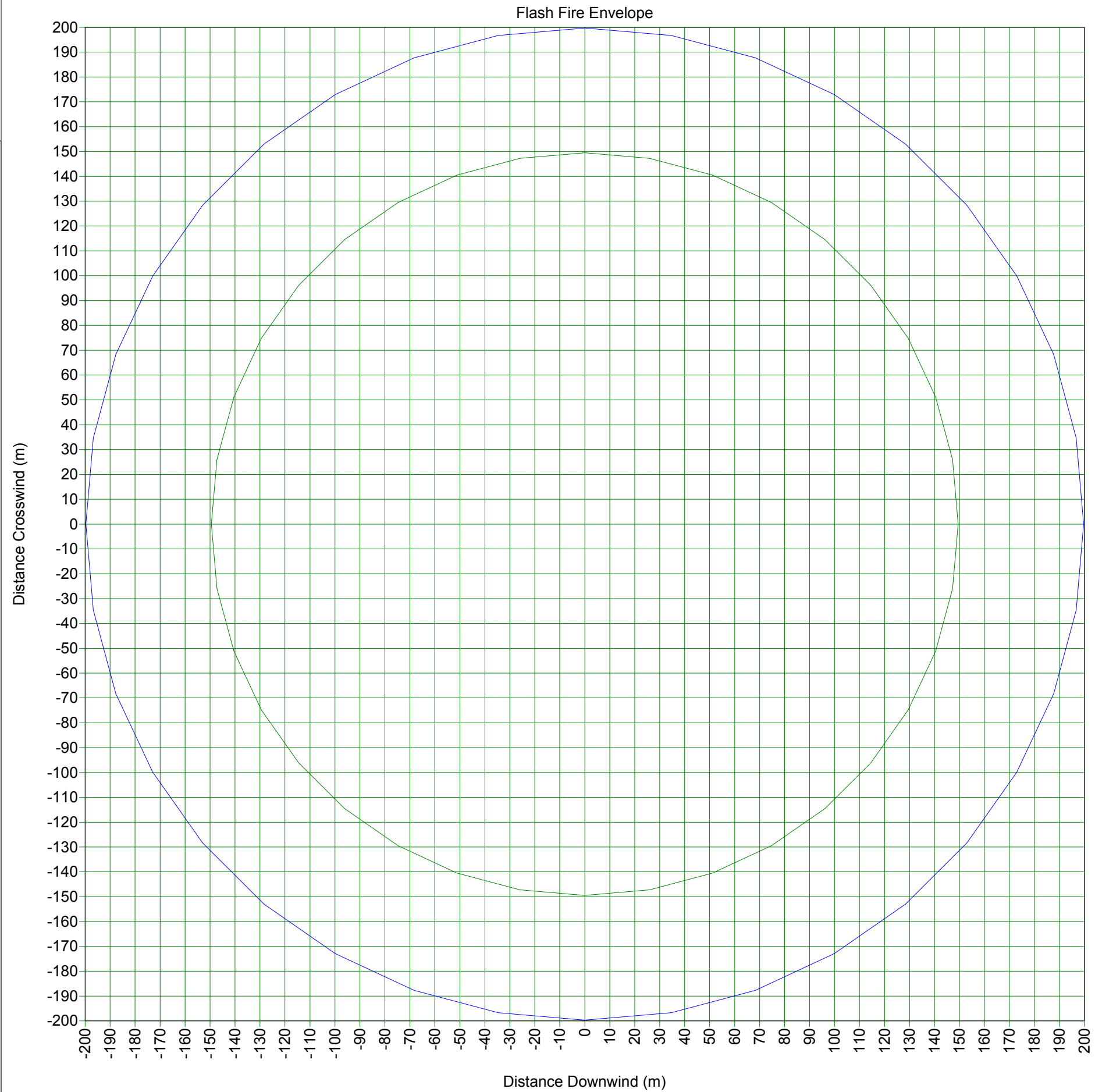
TRR S.r.l.

Il Direttore Generale

Ing. Alfredo Romano

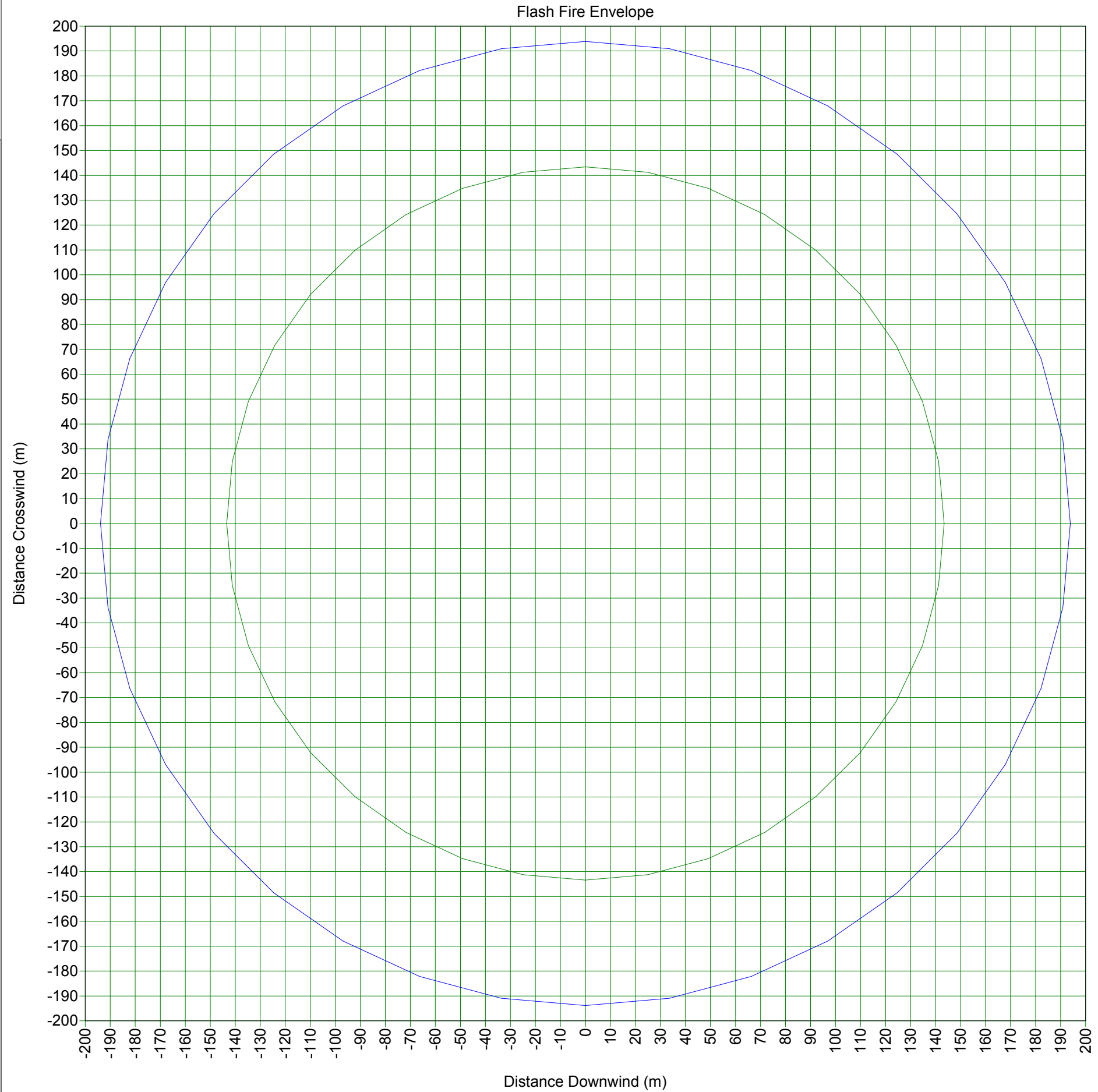

Study Folder: 70977-Fase
2-lp14
Audit No: 65748
Model: 140mm
Weather: Category 5/D
Material: METHANE
Concentration

— 2.2e+004 ppm
— 4.4e+004 ppm



Study Folder: 70977-Fase
2-lp14
Audit No: 65748
Model: 140mm
Weather: Category 2/F
Material: METHANE
Concentration

— 2.2e+004 ppm
— 4.4e+004 ppm



JET FIRE REPORT

Unique Audit Number: 65.748



Study Folder: 70977-Fase 2-Ip14

Phast 6.6



70977-Fase 2-Ip14



Collettore Colonne Disidratazione

140mm

Base Case

Data



Weather: Global Weathers\Category 2/F

Speed: 2,00

m/s

Stability: F

\\70977-Fase 2-Ip14\Collettore Colonne Disidratazione\140mm

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	-0,84 degC
Release Rate	158,73 kg/s

Input

Output

Flame Emissive Power	138,58 kW/m2
Fraction of Emissivity	0,15 fraction
Expanded Radius	0,37 m
Jet Velocity	500,00 m/s
Flame Length	176,59 m
Maximum Flame Radius	10,98 m

Flame Co-ordinates

X	Z	R	Phi
m	m	m	deg
0,00	1,00	0,37	90,00
19,62	1,00	4,22	90,00
39,24	1,00	6,98	90,00
58,86	1,00	8,95	90,00
78,48	1,00	10,25	90,00
98,10	1,00	10,91	90,00
117,72	1,00	10,87	90,00
137,34	1,00	9,98	90,00
156,97	1,00	7,81	90,00
176,59	1,00	0,00	90,00

JET FIRE REPORT

Study Folder: 70977-Fase 2-Ip14

Unique Audit Number: 65.748



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)	103,48	m
Crosswind semi-axis (B)	149,51	m
Offset Ratio (D)	0,95	
Effect Distance	202,45	m
Area	48.603,54	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)	97,33	m
Crosswind semi-axis (B)	113,49	m
Offset Ratio (D)	0,97	
Effect Distance	192,10	m
Area	34.703,96	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)	94,27	m
Crosswind semi-axis (B)	93,55	m
Offset Ratio (D)	0,98	
Effect Distance	186,77	m
Area	27.705,65	m2

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Study Folder: 70977-Fase 2-Ip14

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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)	89,94	m
Crosswind semi-axis (B)	64,95	m
Offset Ratio (D)	0,99	
Effect Distance	178,92	m
Area	18.352,61	m2

JET FIRE REPORT

Study Folder: 70977-Fase 2-Ip14

Unique Audit Number: 65.748

Phast 6.6



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			37,36		
10,20			138,58		
20,41			138,58		
30,61			138,58		
40,82			138,58		
51,02			138,58		
61,22			138,58		
71,43			138,58		
81,63			138,58		
91,84			138,58		
102,04			138,58		
112,24			138,58		
122,45			138,58		
132,65			138,58		
142,86			138,58		
153,06			138,58		
163,27			138,58		
173,47			138,58		
183,67			8,73		
193,88			4,52		
204,08			2,73		
214,29			1,82		
224,49			1,30		
234,69			1,00		
244,90			0,80		
255,10			0,66		
265,31			0,55		
275,51			0,47		
285,71			0,40		
295,92			0,35		
306,12			0,30		
316,33			0,27		
326,53			0,24		
336,73			0,21		
346,94			0,19		
357,14			0,17		
367,35			0,16		

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Unique Audit Number: 65.748



Study Folder: 70977-Fase 2-Ip14

Phast 6.6

X Coordinates m	Y Coordinates m	Z Coordinates m	Incident Radiation kW/m2	Lethality Level %	View Factor
377,55			0,14		
387,76			0,13		
397,96			0,12		
408,16			0,11		
418,37			0,10		
428,57			0,10		
438,78			0,09		
448,98			0,08		
459,18			0,08		
469,39			0,07		
479,59			0,07		
489,80			0,07		
500,00			0,06		



Weather: Global Weathers\Category 5/D

Speed: 5,00

m/s

Stability: D

\70977-Fase 2-Ip14\Collettore Colonne Disidratazione\140mm

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	-0,84	degC
Release Rate	158,73	kg/s

	Input	Output
Flame Emissive Power		138,58 kW/m2
Fraction of Emissivity		0,15 fraction
Expanded Radius		0,37 m
Jet Velocity	500,00	500,00 m/s
Flame Length		176,59 m
Maximum Flame Radius		10,98 m

JET FIRE REPORT

Study Folder: 70977-Fase 2-Ip14

Unique Audit Number: 65.748

Phast 6.6



Flame Co-ordinates

X	Z	R	Phi
m	m	m	deg
0,00	1,00	0,37	90,00
19,62	1,00	4,22	90,00
39,24	1,00	6,98	90,00
58,86	1,00	8,95	90,00
78,48	1,00	10,25	90,00
98,10	1,00	10,91	90,00
117,72	1,00	10,87	90,00
137,34	1,00	9,98	90,00
156,97	1,00	7,81	90,00
176,59	1,00	0,00	90,00

JET FIRE REPORT

Study Folder: 70977-Fase 2-Ip14

Unique Audit Number: 65.748



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)	103,48	m
Crosswind semi-axis (B)	149,51	m
Offset Ratio (D)	0,95	
Effect Distance	202,45	m
Area	48.603,54	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)	97,33	m
Crosswind semi-axis (B)	113,49	m
Offset Ratio (D)	0,97	
Effect Distance	192,10	m
Area	34.703,96	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)	94,27	m
Crosswind semi-axis (B)	93,55	m
Offset Ratio (D)	0,98	
Effect Distance	186,77	m
Area	27.705,65	m2

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Study Folder: 70977-Fase 2-Ip14

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)	89,94	m
Crosswind semi-axis (B)	64,95	m
Offset Ratio (D)	0,99	
Effect Distance	178,92	m
Area	18.352,61	m2

JET FIRE REPORT

Study Folder: 70977-Fase 2-Ip14

Unique Audit Number: 65.748

Phast 6.6



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			37,36		
10,20			138,58		
20,41			138,58		
30,61			138,58		
40,82			138,58		
51,02			138,58		
61,22			138,58		
71,43			138,58		
81,63			138,58		
91,84			138,58		
102,04			138,58		
112,24			138,58		
122,45			138,58		
132,65			138,58		
142,86			138,58		
153,06			138,58		
163,27			138,58		
173,47			138,58		
183,67			8,73		
193,88			4,52		
204,08			2,73		
214,29			1,82		
224,49			1,30		
234,69			1,00		
244,90			0,80		
255,10			0,66		
265,31			0,55		
275,51			0,47		
285,71			0,40		
295,92			0,35		
306,12			0,30		
316,33			0,27		
326,53			0,24		
336,73			0,21		
346,94			0,19		
357,14			0,17		
367,35			0,16		

JET FIRE REPORT

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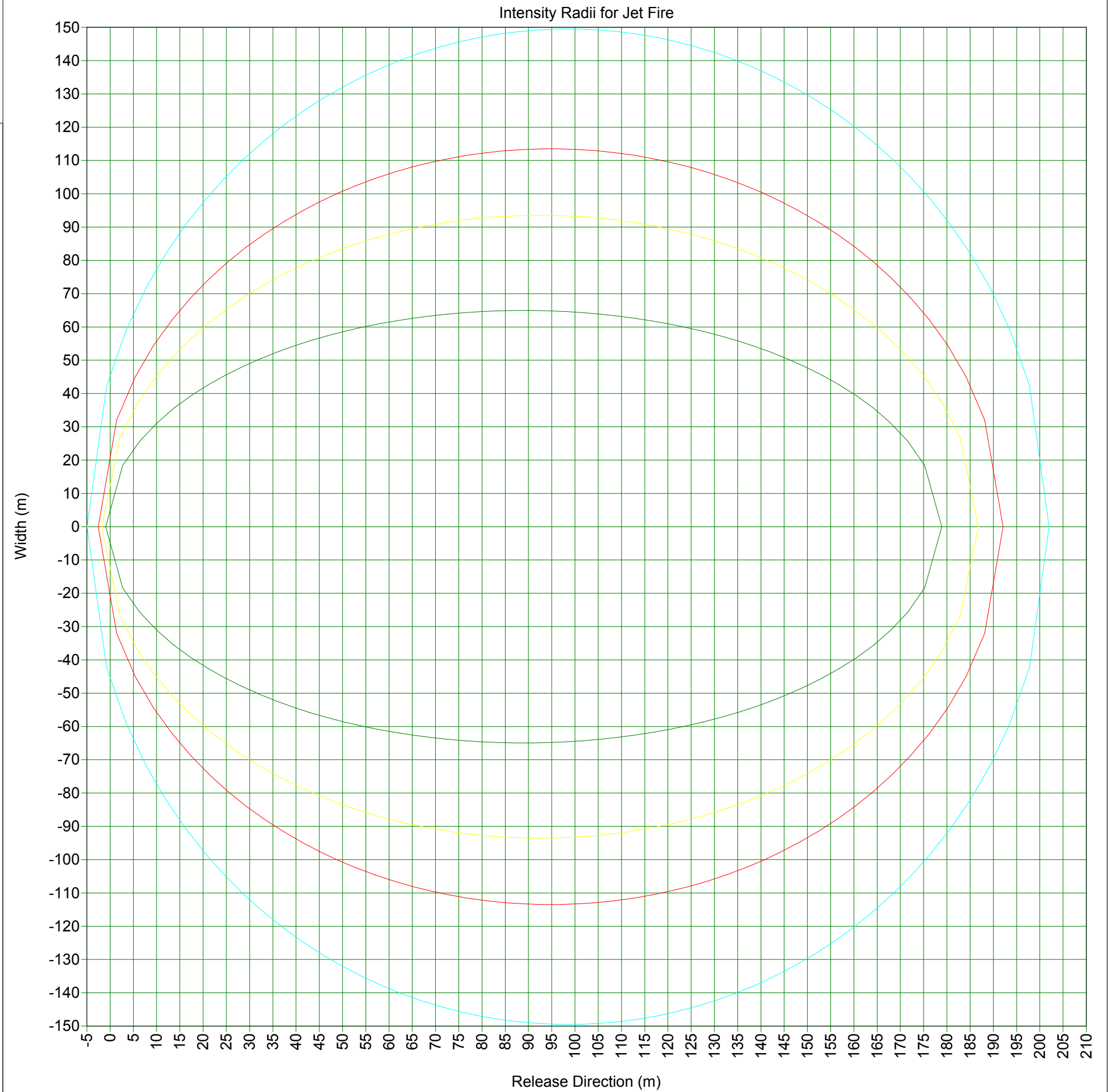
Study Folder: 70977-Fase 2-Ip14

Phast 6.6

X Coordinates m	Y Coordinates m	Z Coordinates m	Incident Radiation kW/m2	Lethality Level %	View Factor
377,55			0,14		
387,76			0,13		
397,96			0,12		
408,16			0,11		
418,37			0,10		
428,57			0,10		
438,78			0,09		
448,98			0,08		
459,18			0,08		
469,39			0,07		
479,59			0,07		
489,80			0,07		
500,00			0,06		

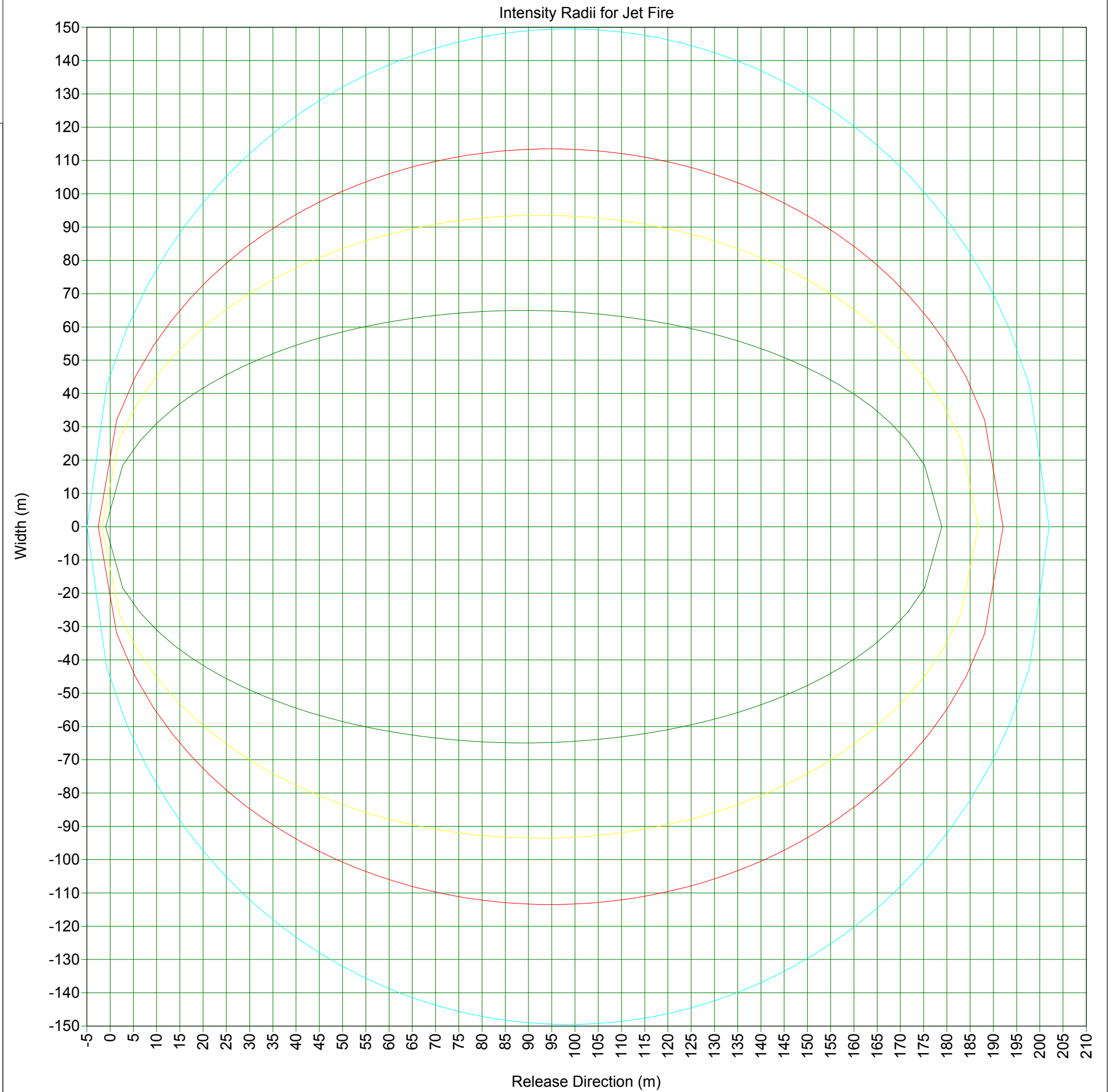
Study Folder: 70977-Fase
2-lp14
Audit No: 65748
Model: 140mm
Weather: Category 5/D
Material: METHANE

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



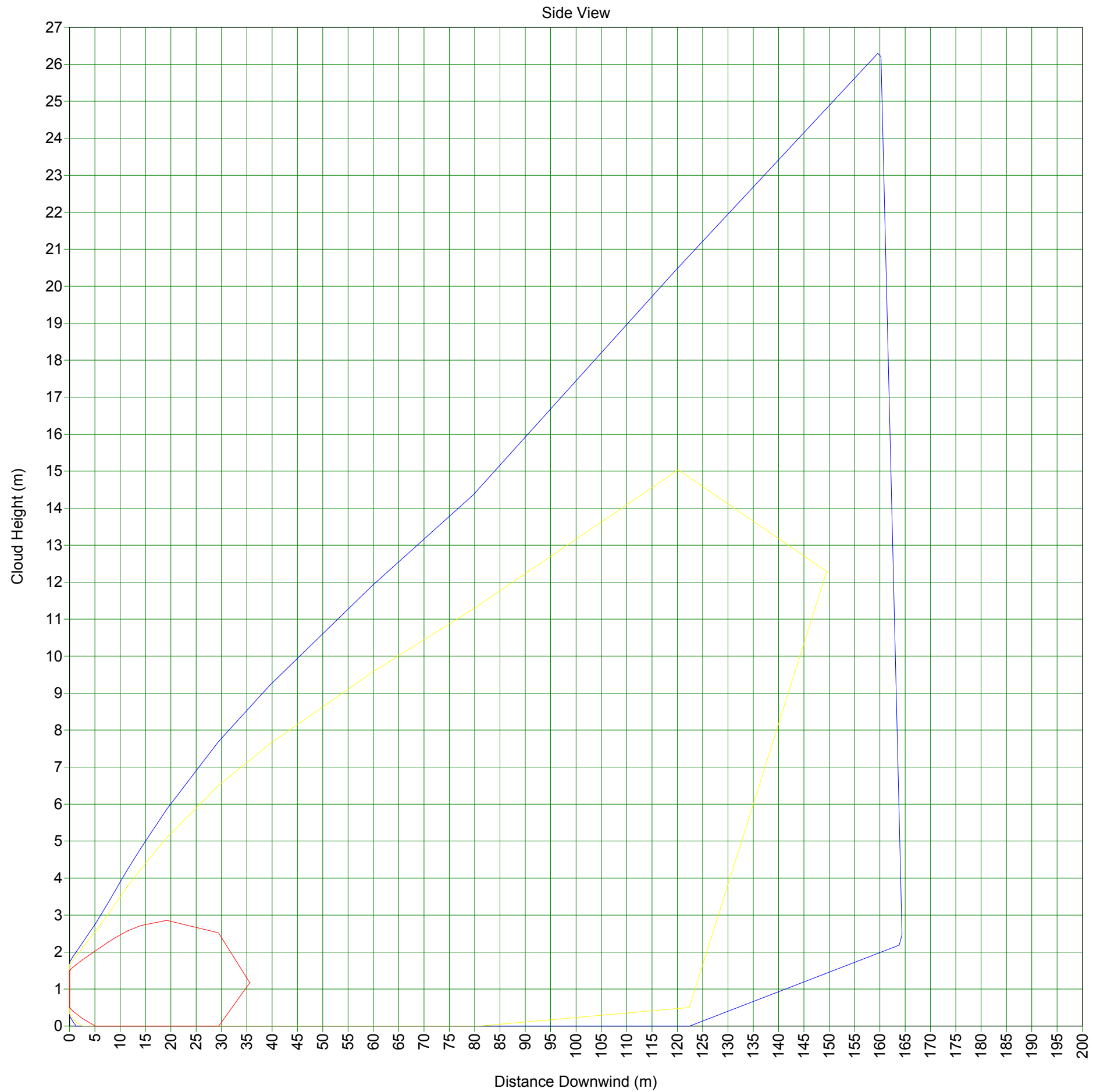
Study Folder: 70977-Fase
2-lp14
Audit No: 65748
Model: 140mm
Weather: Category 2/F
Material: METHANE

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



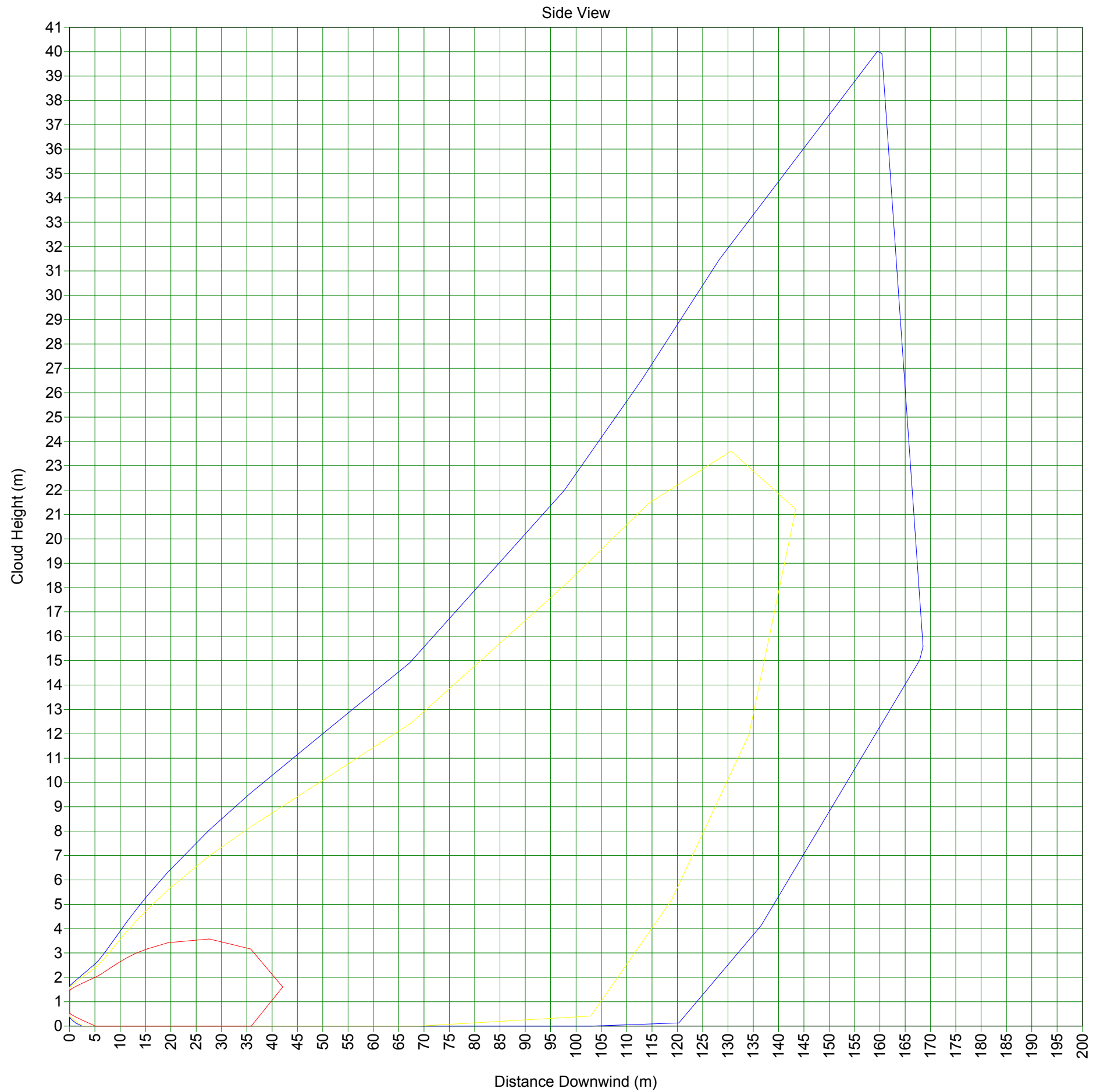
Study Folder: 70977-Fase
2-lp14
Audit No: 65748
Model: 140mm
Weather: Category 5/D
Material: METHANE
Averaging Time:
Flammable(18.75 s)
C/L Offset: 0 m
Concentration
Time: 11.4 s

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



Study Folder: 70977-Fase
2-lp14
Audit No: 65748
Model: 140mm
Weather: Category 2/F
Material: METHANE
Averaging Time:
Flammable(18.75 s)
C/L Offset: 0 m
Concentration
Time: 16.68 s

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



SUMMARY REPORT

Unique Audit Number: 65.748



Study Folder: 70977-Fase 2-Ip14

Phast 6.6



70977-Fase 2-Ip14



Collettore Colonne Disidratazione

140mm

Base Case

CASE Name: Data

Path: \70977-Fase 2-Ip14\Collettore Colonne Disidratazione\140mm

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	700 mm
Line length	90 m
Distance To Break	1 m
Relative Aperture	0.2 fraction
Pumped Inflow	150 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

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Study Folder: 70977-Fase 2-Ip14

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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 2-Ip14\Collettore Colonne Disidratazione\140mm

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
Final Temperature	-0,84 degC
Final Velocity	500,00 m/s
Droplet Diameter	0,00 um

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Continuous Release Data:

Mass Flowrate	1.58727E+002 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	-0,84 degC
Final Velocity	500,00 m/s
Droplet Diameter	0,00 um

Continuous Release Data:

Mass Flowrate	1.58727E+002 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

SUMMARY REPORT

Study Folder: 70977-Fase 2-IP14

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Consequence Results

Distance to Concentration Results

Path: \70977-Fase 2-IP14\Collettore Colonne Disidratazione\140mm

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		119.904	157.295
UFL (165000)	18.75	s		42.0977	35.5758
LFL (44000)	18.75	s		143.409	149.499
LFL Frac (22000)	18.75	s		193.885	199.731
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		1.60806	1.1743
LFL (44000)	18.75	s		21.2135	12.2885
LFL Frac (22000)	18.75	s		36.4761	20.2729

SUMMARY REPORT

Study Folder: 70977-Fase 2-IP14

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Concentration At Distance Results

Path: \70977-Fase 2-IP14\Collettore Colonne Disidratazione\140mm

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	147868	135899
250	m	13315.2	12829.7
500	m	3554.56	3888

Distance		Heights (m) for above concentrations	
		Category 2/F	Category 5/D
50	m	1.98716	1.55467
250	m	50.4364	27.0873
500	m	90.4806	50.6911

Distance		Conc.(ppm) at Core Avg. Time of 18.75 s	
		Category 2/F	Category 5/D
50	m	147868	135899
250	m	13315.2	12829.7
500	m	3554.56	3888

Distance		Heights (m) for above concentrations	
		Category 2/F	Category 5/D
50	m	1.98716	1.55467
250	m	50.4364	27.0873
500	m	90.4806	50.6911

Jet Fire Hazard

Path: \70977-Fase 2-IP14\Collettore Colonne Disidratazione\140mm

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-IP14\Collettore Colonne Disidratazione\140mm

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	178.916	178.916
Radiation Level	7	kW/m2	186.765	186.765
Radiation Level	5	kW/m2	192.104	192.104
Radiation Level	3	kW/m2	202.446	202.446

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Radiation Effects: Jet Fire Distance

Path: \70977-Fase 2-Ip14\Collettore Colonne Disidratazione\140mm

			Radiation Level (kW/m2)	
			Category 2/F	Category 5/D
Distance Of Interest 50	m		Engulfed	Engulfed
Distance Of Interest 250	m		0.72683	0.72683
Distance Of Interest 500	m		0.0618489	0.0618489

Flash Fire Envelope

Path: \70977-Fase 2-Ip14\Collettore Colonne Disidratazione\140mm

All flammable results are reported at the cloud centreline height

			Distance (m)	
			Category 2/F	Category 5/D
Furthest Extent	22000	ppm	193.885	199.731
Furthest Extent	44000	ppm	143.409	149.499
			Heights (m) for above distances	
			Category 2/F	Category 5/D
Furthest Extent	22000	ppm	36.4761	20.2729
Furthest Extent	44000	ppm	21.2135	12.2885

SUMMARY REPORT

Study Folder: 70977-Fase 2-IP14

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Phast 6.6



Explosion Effects: Late Ignition

Path: \70977-Fase 2-IP14\Collettore Colonne Disidratazione\140mm

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	526.213	494.538
Overpressure	0.1379	bar	277.054	268.852
Overpressure	0.2068	bar	257.36	251.014

			Supplementary Data at 0.02068 bar	
			Category 2/F	Category 5/D
Supplied Flammable Mass	kg		975.243	724.759
Used Flammable Mass	kg		975.243	724.759
Overpressure Radius	m		336.213	304.538
Distance to:				
- Ignition Source	m		190	190
- Cloud Front/Centre	m		190	190
- Explosion Centre	m		190	190

			Supplementary Data at 0.1379 bar	
			Category 2/F	Category 5/D
Supplied Flammable Mass	kg		975.243	724.759
Used Flammable Mass	kg		975.243	724.759
Overpressure Radius	m		87.054	78.8525
Distance to:				
- Ignition Source	m		190	190
- Cloud Front/Centre	m		190	190
- Explosion Centre	m		190	190

			Supplementary Data at 0.2068 bar	
			Category 2/F	Category 5/D
Supplied Flammable Mass	kg		975.243	724.759
Used Flammable Mass	kg		975.243	724.759
Overpressure Radius	m		67.3604	61.0143
Distance to:				
- Ignition Source	m		190	190
- Cloud Front/Centre	m		190	190
- Explosion Centre	m		190	190

			Overpressures (bar gauge) at Distances	
			Category 2/F	Category 5/D
Distance	50	m	1	1
Distance	250	m	0.248516	0.211699
Distance	500	m	0.0228494	0.0201679

			Supplementary Data at 50 m	
			Category 2/F	Category 5/D
Supplied Flammable Mass	kg		98.0893	76.4582

SUMMARY REPORT

Study Folder: 70977-Fase 2-Ip14

Unique Audit Number: 65.748

Phast 6.6



Used Flammable Mass	kg	98.0893	76.4582
Supplementary Data at 250 m			
		Category 2/F	Category 5/D
Supplied Flammable Mass	kg	975.243	724.759
Used Flammable Mass	kg	975.243	724.759
Supplementary Data at 500 m			
		Category 2/F	Category 5/D
Supplied Flammable Mass	kg	975.243	724.759
Used Flammable Mass	kg	975.243	724.759

Weather Conditions

Path: \70977-Fase 2-Ip14\Collettore Colonne Disidratazione\140mm

		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