

## **ANNESSO TECNICO 6.**

### **Elaborati di calcolo Scenari incidentali ragionevolmente credibili**

#### ***Ipotesi N. 17***

TRR S.r.l.

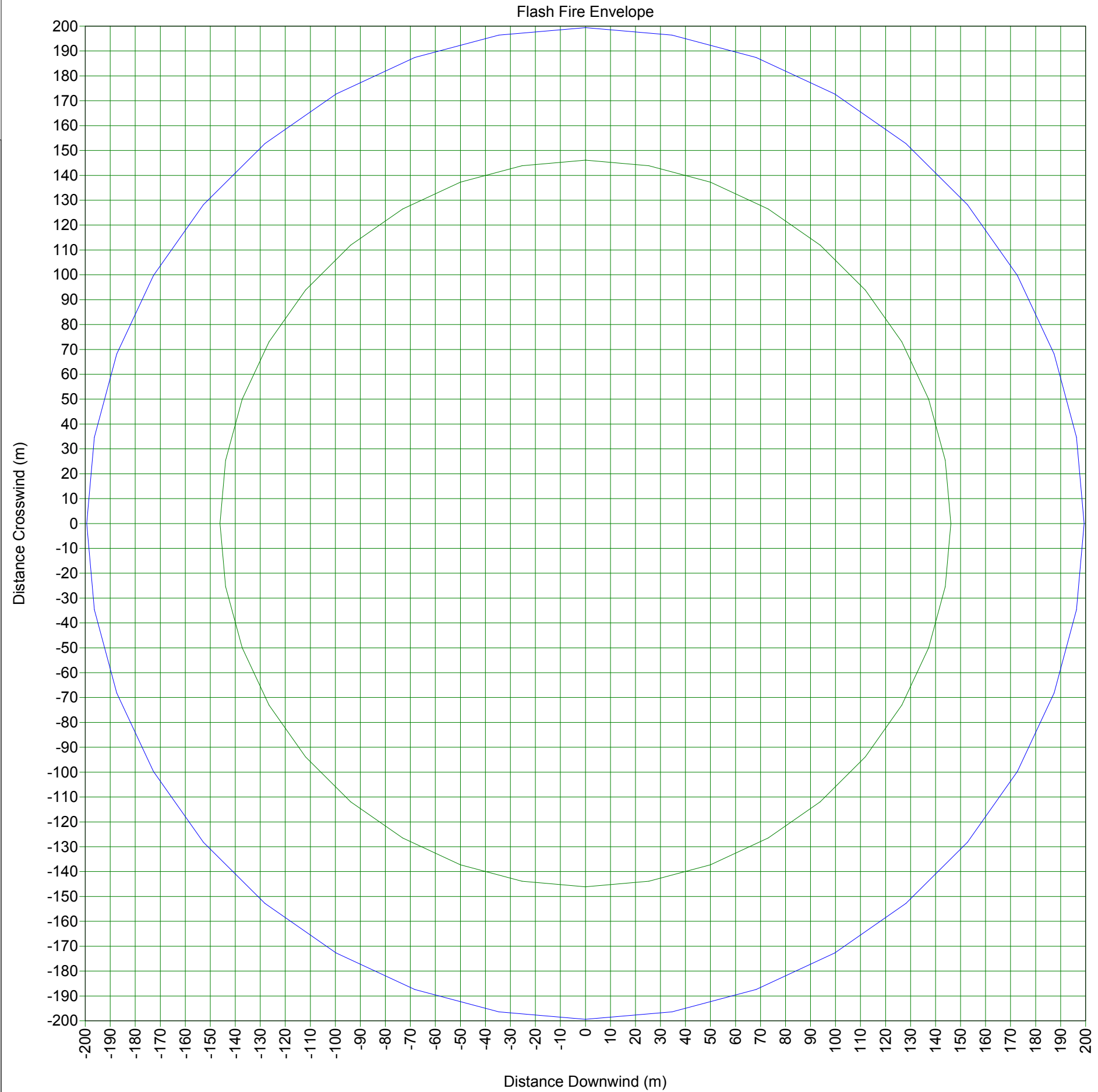
Il Direttore Generale

Ing. *Alfredo Romano*



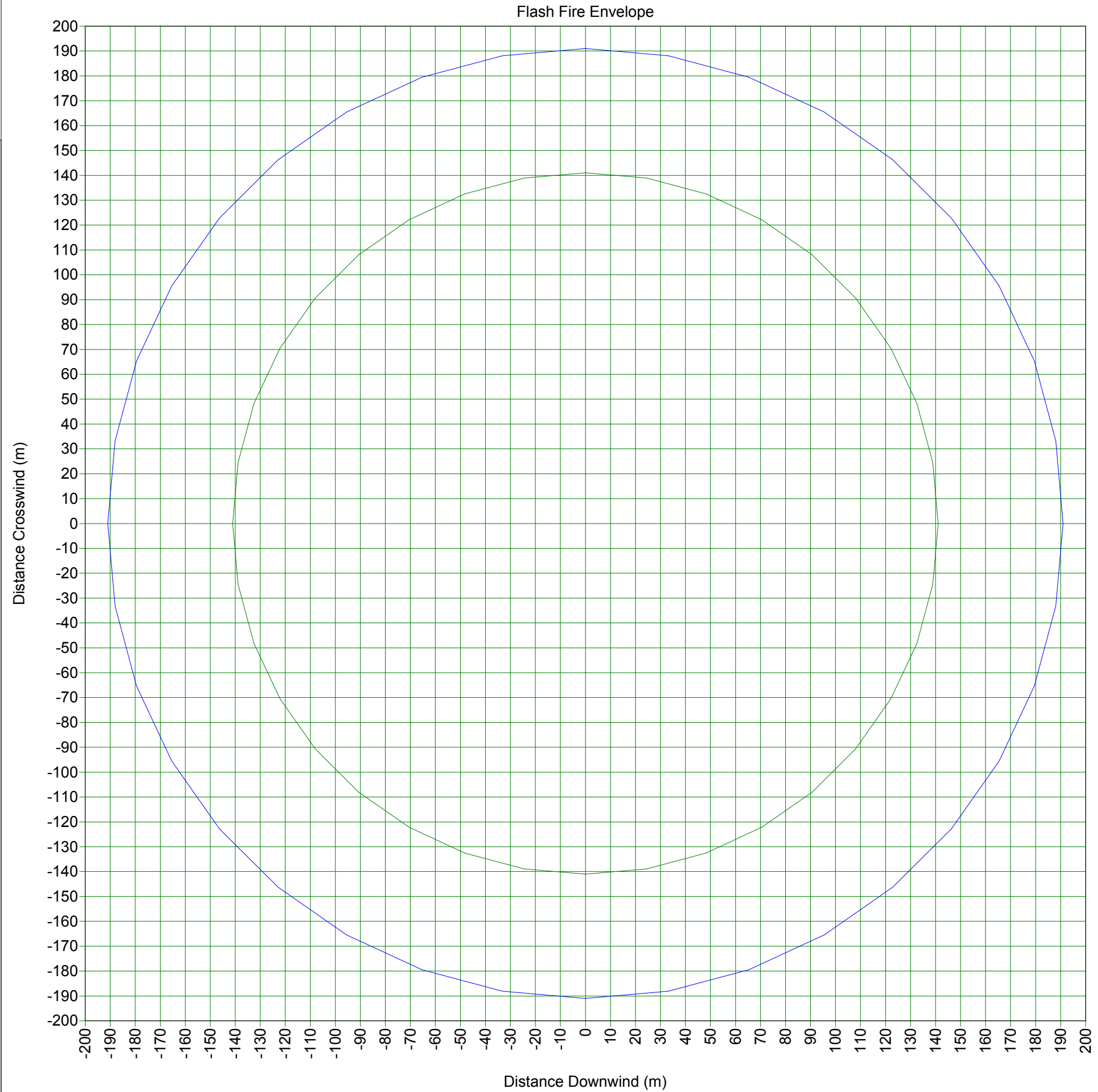
Study Folder: 70977-Fase  
2-lp17  
Audit No: 65928  
Model: 140mm  
Weather: Category 5/D  
Material: METHANE  
Concentration

— 2.2e+004 ppm  
— 4.4e+004 ppm



Study Folder: 70977-Fase  
2-lp17  
Audit No: 65928  
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Concentration

— 2.2e+004 ppm  
— 4.4e+004 ppm



# JET FIRE REPORT

Unique Audit Number: 66.280



Study Folder: 70977-Fase 2-Ip17

Phast 6.6



70977-Fase 2-Ip17



Collegamento Rete SNAM - Erogazione

140mm

Base Case

Data



Weather: Global Weathers\Category 2/F

Speed: 2,00

m/s

Stability: F

\\70977-Fase 2-Ip17\Collegamento Rete SNAM - Erogazione\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      | -1,03 degC    |
| Release Rate              | 152,60 kg/s   |

Input

Output

|                        |               |
|------------------------|---------------|
| Flame Emissive Power   | 138,34 kW/m2  |
| Fraction of Emissivity | 0,15 fraction |
| Expanded Radius        | 0,37 m        |
| Jet Velocity           | 500,00 m/s    |
| Flame Length           | 173,29 m      |
| Maximum Flame Radius   | 10,78 m       |

### Flame Co-ordinates

| X      | Z    | R     | Phi   |
|--------|------|-------|-------|
| m      | m    | m     | deg   |
| 0,00   | 1,00 | 0,37  | 90,00 |
| 19,25  | 1,00 | 4,14  | 90,00 |
| 38,51  | 1,00 | 6,85  | 90,00 |
| 57,76  | 1,00 | 8,78  | 90,00 |
| 77,02  | 1,00 | 10,06 | 90,00 |
| 96,27  | 1,00 | 10,70 | 90,00 |
| 115,53 | 1,00 | 10,67 | 90,00 |
| 134,78 | 1,00 | 9,80  | 90,00 |
| 154,04 | 1,00 | 7,67  | 90,00 |
| 173,29 | 1,00 | 0,00  | 90,00 |

# JET FIRE REPORT

Study Folder: 70977-Fase 2-Ip17

Unique Audit Number: 66.280



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

|                                  |             |                   |
|----------------------------------|-------------|-------------------|
| <b>Incident Radiation Level:</b> | <b>3,00</b> | <b>kW/m2</b>      |
| Lethality Level                  | 0,00        | %                 |
| View Factor                      | 0,02        |                   |
| Dose Level                       | 865.118,83  | (W/m2)^Probit N.s |

|                         |           |    |
|-------------------------|-----------|----|
| Downwind semi-axis (A)  | 101,58    | m  |
| Crosswind semi-axis (B) | 146,78    | m  |
| Offset Ratio (D)        | 0,95      |    |
| Effect Distance         | 198,68    | m  |
| Area                    | 46.841,85 | m2 |

|                                  |              |                   |
|----------------------------------|--------------|-------------------|
| <b>Incident Radiation Level:</b> | <b>5,00</b>  | <b>kW/m2</b>      |
| Lethality Level                  | 0,00         | %                 |
| View Factor                      | 0,04         |                   |
| Dose Level                       | 1.709.490,54 | (W/m2)^Probit N.s |

|                         |           |    |
|-------------------------|-----------|----|
| Downwind semi-axis (A)  | 95,54     | m  |
| Crosswind semi-axis (B) | 111,42    | m  |
| Offset Ratio (D)        | 0,97      |    |
| Effect Distance         | 188,52    | m  |
| Area                    | 33.441,21 | m2 |

|                                  |              |                   |
|----------------------------------|--------------|-------------------|
| <b>Incident Radiation Level:</b> | <b>7,00</b>  | <b>kW/m2</b>      |
| Lethality Level                  | 0,02         | %                 |
| View Factor                      | 0,05         |                   |
| Dose Level                       | 2.677.313,40 | (W/m2)^Probit N.s |

|                         |           |    |
|-------------------------|-----------|----|
| Downwind semi-axis (A)  | 92,53     | m  |
| Crosswind semi-axis (B) | 91,83     | m  |
| Offset Ratio (D)        | 0,98      |    |
| Effect Distance         | 183,28    | m  |
| Area                    | 26.694,04 | m2 |

# JET FIRE REPORT

Unique Audit Number: 66.280



Study Folder: 70977-Fase 2-Ip17

Phast 6.6

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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)    | 88,27        | m                 |
| Crosswind semi-axis (B)   | 63,76        | m                 |
| Offset Ratio (D)          | 0,99         |                   |
| Effect Distance           | 175,58       | m                 |
| Area                      | 17.679,83    | m2                |

# JET FIRE REPORT

Study Folder: 70977-Fase 2-Ip17

Unique Audit Number: 66.280

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<br>Coordinates<br>m | Y<br>Coordinates<br>m | Z<br>Coordinates<br>m | Incident<br>Radiation<br>kW/m2 | Lethality<br>Level<br>% | View<br>Factor |
|-----------------------|-----------------------|-----------------------|--------------------------------|-------------------------|----------------|
| 0,00                  |                       |                       | 36,76                          |                         |                |
| 10,20                 |                       |                       | 138,34                         |                         |                |
| 20,41                 |                       |                       | 138,34                         |                         |                |
| 30,61                 |                       |                       | 138,34                         |                         |                |
| 40,82                 |                       |                       | 138,34                         |                         |                |
| 51,02                 |                       |                       | 138,34                         |                         |                |
| 61,22                 |                       |                       | 138,34                         |                         |                |
| 71,43                 |                       |                       | 138,34                         |                         |                |
| 81,63                 |                       |                       | 138,34                         |                         |                |
| 91,84                 |                       |                       | 138,34                         |                         |                |
| 102,04                |                       |                       | 138,34                         |                         |                |
| 112,24                |                       |                       | 138,34                         |                         |                |
| 122,45                |                       |                       | 138,34                         |                         |                |
| 132,65                |                       |                       | 138,34                         |                         |                |
| 142,86                |                       |                       | 138,34                         |                         |                |
| 153,06                |                       |                       | 138,34                         |                         |                |
| 163,27                |                       |                       | 138,34                         |                         |                |
| 173,47                |                       |                       | 20,65                          |                         |                |
| 183,67                |                       |                       | 6,81                           |                         |                |
| 193,88                |                       |                       | 3,72                           |                         |                |
| 204,08                |                       |                       | 2,32                           |                         |                |
| 214,29                |                       |                       | 1,57                           |                         |                |
| 224,49                |                       |                       | 1,16                           |                         |                |
| 234,69                |                       |                       | 0,90                           |                         |                |
| 244,90                |                       |                       | 0,73                           |                         |                |
| 255,10                |                       |                       | 0,61                           |                         |                |
| 265,31                |                       |                       | 0,51                           |                         |                |
| 275,51                |                       |                       | 0,43                           |                         |                |
| 285,71                |                       |                       | 0,37                           |                         |                |
| 295,92                |                       |                       | 0,32                           |                         |                |
| 306,12                |                       |                       | 0,28                           |                         |                |
| 316,33                |                       |                       | 0,25                           |                         |                |
| 326,53                |                       |                       | 0,22                           |                         |                |
| 336,73                |                       |                       | 0,20                           |                         |                |
| 346,94                |                       |                       | 0,18                           |                         |                |
| 357,14                |                       |                       | 0,16                           |                         |                |
| 367,35                |                       |                       | 0,15                           |                         |                |

# JET FIRE REPORT

Unique Audit Number: 66.280



Study Folder: 70977-Fase 2-Ip17

Phast 6.6

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



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

**Speed:** 5,00

m/s

**Stability:** D

\70977-Fase 2-Ip17\Collegamento Rete SNAM - Erogazione\140mm

## Flame Data

### User-Defined Quantities

|                           |            |          |
|---------------------------|------------|----------|
| Model Correlation Type    | <b>API</b> |          |
| 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      | -1,03      | degC     |
| Release Rate              | 152,60     | kg/s     |

|                        | Input  | Output        |
|------------------------|--------|---------------|
| Flame Emissive Power   |        | 138,34 kW/m2  |
| Fraction of Emissivity |        | 0,15 fraction |
| Expanded Radius        |        | 0,37 m        |
| Jet Velocity           | 500,00 | 500,00 m/s    |
| Flame Length           |        | 173,29 m      |
| Maximum Flame Radius   |        | 10,78 m       |

# JET FIRE REPORT

Unique Audit Number: 66.280



Study Folder: 70977-Fase 2-Ip17

Phast 6.6

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## Flame Co-ordinates

| X      | Z    | R     | Phi   |
|--------|------|-------|-------|
| m      | m    | m     | deg   |
| 0,00   | 1,00 | 0,37  | 90,00 |
| 19,25  | 1,00 | 4,14  | 90,00 |
| 38,51  | 1,00 | 6,85  | 90,00 |
| 57,76  | 1,00 | 8,78  | 90,00 |
| 77,02  | 1,00 | 10,06 | 90,00 |
| 96,27  | 1,00 | 10,70 | 90,00 |
| 115,53 | 1,00 | 10,67 | 90,00 |
| 134,78 | 1,00 | 9,80  | 90,00 |
| 154,04 | 1,00 | 7,67  | 90,00 |
| 173,29 | 1,00 | 0,00  | 90,00 |

# JET FIRE REPORT

Study Folder: 70977-Fase 2-Ip17

Unique Audit Number: 66.280



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

|                                  |             |                   |
|----------------------------------|-------------|-------------------|
| <b>Incident Radiation Level:</b> | <b>3,00</b> | <b>kW/m2</b>      |
| Lethality Level                  | 0,00        | %                 |
| View Factor                      | 0,02        |                   |
| Dose Level                       | 865.118,83  | (W/m2)^Probit N.s |

|                         |           |    |
|-------------------------|-----------|----|
| Downwind semi-axis (A)  | 101,58    | m  |
| Crosswind semi-axis (B) | 146,78    | m  |
| Offset Ratio (D)        | 0,95      |    |
| Effect Distance         | 198,68    | m  |
| Area                    | 46.841,85 | m2 |

|                                  |              |                   |
|----------------------------------|--------------|-------------------|
| <b>Incident Radiation Level:</b> | <b>5,00</b>  | <b>kW/m2</b>      |
| Lethality Level                  | 0,00         | %                 |
| View Factor                      | 0,04         |                   |
| Dose Level                       | 1.709.490,54 | (W/m2)^Probit N.s |

|                         |           |    |
|-------------------------|-----------|----|
| Downwind semi-axis (A)  | 95,54     | m  |
| Crosswind semi-axis (B) | 111,42    | m  |
| Offset Ratio (D)        | 0,97      |    |
| Effect Distance         | 188,52    | m  |
| Area                    | 33.441,21 | m2 |

|                                  |              |                   |
|----------------------------------|--------------|-------------------|
| <b>Incident Radiation Level:</b> | <b>7,00</b>  | <b>kW/m2</b>      |
| Lethality Level                  | 0,02         | %                 |
| View Factor                      | 0,05         |                   |
| Dose Level                       | 2.677.313,40 | (W/m2)^Probit N.s |

|                         |           |    |
|-------------------------|-----------|----|
| Downwind semi-axis (A)  | 92,53     | m  |
| Crosswind semi-axis (B) | 91,83     | m  |
| Offset Ratio (D)        | 0,98      |    |
| Effect Distance         | 183,28    | m  |
| Area                    | 26.694,04 | m2 |

# JET FIRE REPORT

Unique Audit Number: 66.280



Study Folder: 70977-Fase 2-Ip17

Phast 6.6

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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)    | 88,27        | m                 |
| Crosswind semi-axis (B)   | 63,76        | m                 |
| Offset Ratio (D)          | 0,99         |                   |
| Effect Distance           | 175,58       | m                 |
| Area                      | 17.679,83    | m2                |

# JET FIRE REPORT

Study Folder: 70977-Fase 2-Ip17

Unique Audit Number: 66.280

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<br>Coordinates<br>m | Y<br>Coordinates<br>m | Z<br>Coordinates<br>m | Incident<br>Radiation<br>kW/m2 | Lethality<br>Level<br>% | View<br>Factor |
|-----------------------|-----------------------|-----------------------|--------------------------------|-------------------------|----------------|
| 0,00                  |                       |                       | 36,76                          |                         |                |
| 10,20                 |                       |                       | 138,34                         |                         |                |
| 20,41                 |                       |                       | 138,34                         |                         |                |
| 30,61                 |                       |                       | 138,34                         |                         |                |
| 40,82                 |                       |                       | 138,34                         |                         |                |
| 51,02                 |                       |                       | 138,34                         |                         |                |
| 61,22                 |                       |                       | 138,34                         |                         |                |
| 71,43                 |                       |                       | 138,34                         |                         |                |
| 81,63                 |                       |                       | 138,34                         |                         |                |
| 91,84                 |                       |                       | 138,34                         |                         |                |
| 102,04                |                       |                       | 138,34                         |                         |                |
| 112,24                |                       |                       | 138,34                         |                         |                |
| 122,45                |                       |                       | 138,34                         |                         |                |
| 132,65                |                       |                       | 138,34                         |                         |                |
| 142,86                |                       |                       | 138,34                         |                         |                |
| 153,06                |                       |                       | 138,34                         |                         |                |
| 163,27                |                       |                       | 138,34                         |                         |                |
| 173,47                |                       |                       | 20,65                          |                         |                |
| 183,67                |                       |                       | 6,81                           |                         |                |
| 193,88                |                       |                       | 3,72                           |                         |                |
| 204,08                |                       |                       | 2,32                           |                         |                |
| 214,29                |                       |                       | 1,57                           |                         |                |
| 224,49                |                       |                       | 1,16                           |                         |                |
| 234,69                |                       |                       | 0,90                           |                         |                |
| 244,90                |                       |                       | 0,73                           |                         |                |
| 255,10                |                       |                       | 0,61                           |                         |                |
| 265,31                |                       |                       | 0,51                           |                         |                |
| 275,51                |                       |                       | 0,43                           |                         |                |
| 285,71                |                       |                       | 0,37                           |                         |                |
| 295,92                |                       |                       | 0,32                           |                         |                |
| 306,12                |                       |                       | 0,28                           |                         |                |
| 316,33                |                       |                       | 0,25                           |                         |                |
| 326,53                |                       |                       | 0,22                           |                         |                |
| 336,73                |                       |                       | 0,20                           |                         |                |
| 346,94                |                       |                       | 0,18                           |                         |                |
| 357,14                |                       |                       | 0,16                           |                         |                |
| 367,35                |                       |                       | 0,15                           |                         |                |

# JET FIRE REPORT

Unique Audit Number: 66.280



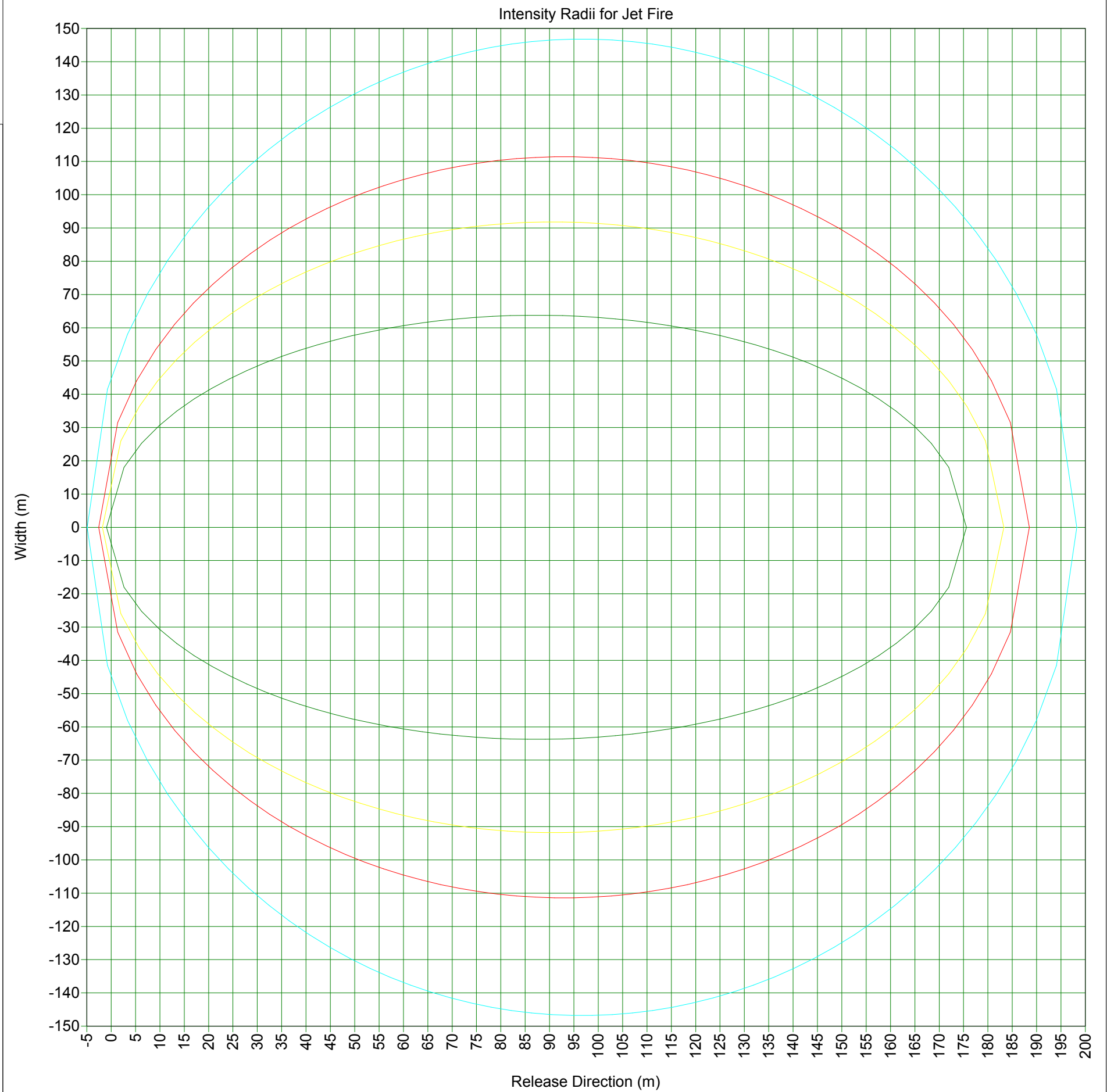
Study Folder: 70977-Fase 2-Ip17

Phast 6.6

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

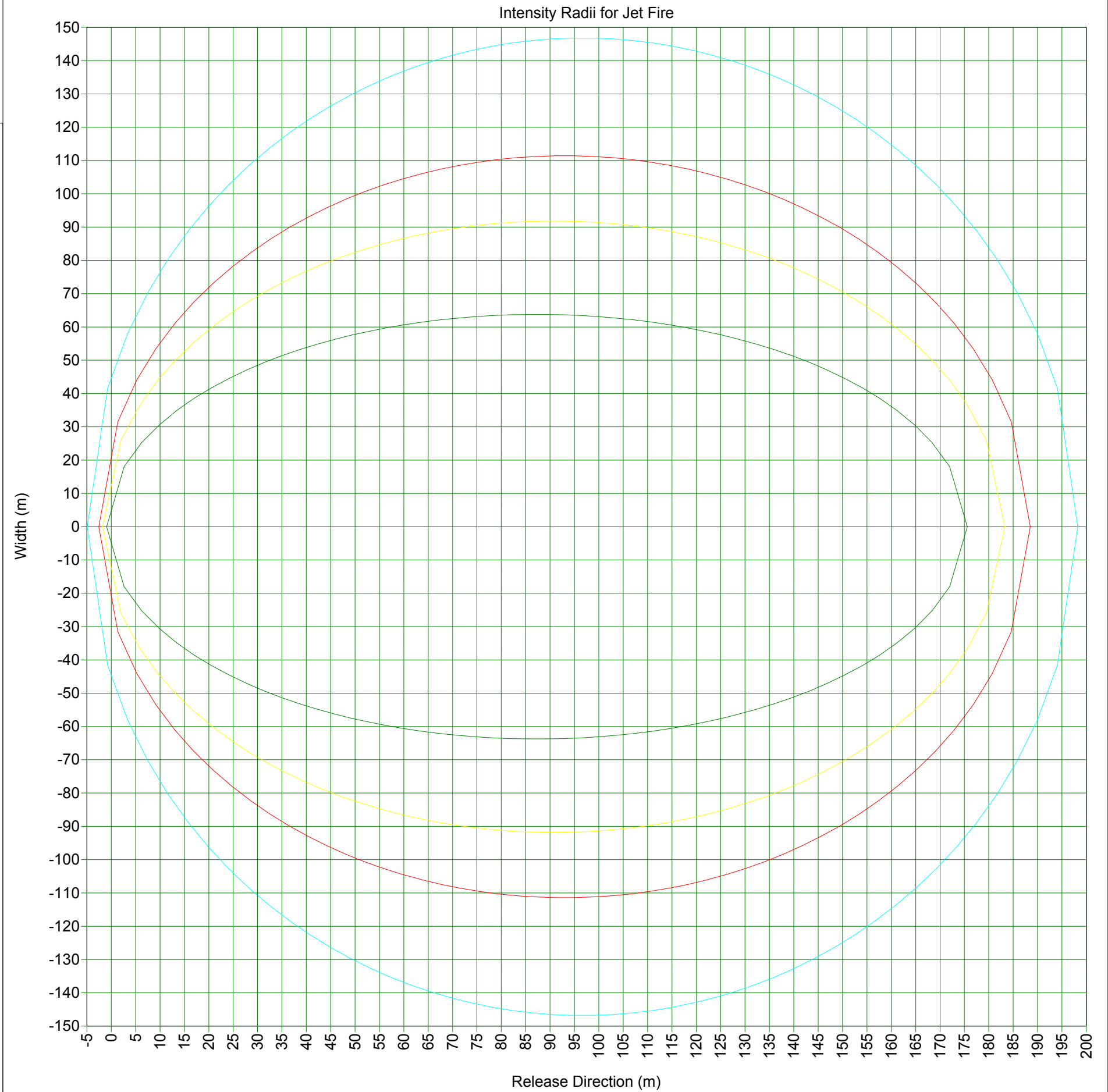
Study Folder: 70977-Fase  
2-lp17  
Audit No: 65928  
Model: 140mm  
Weather: Category 5/D  
Material: METHANE

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



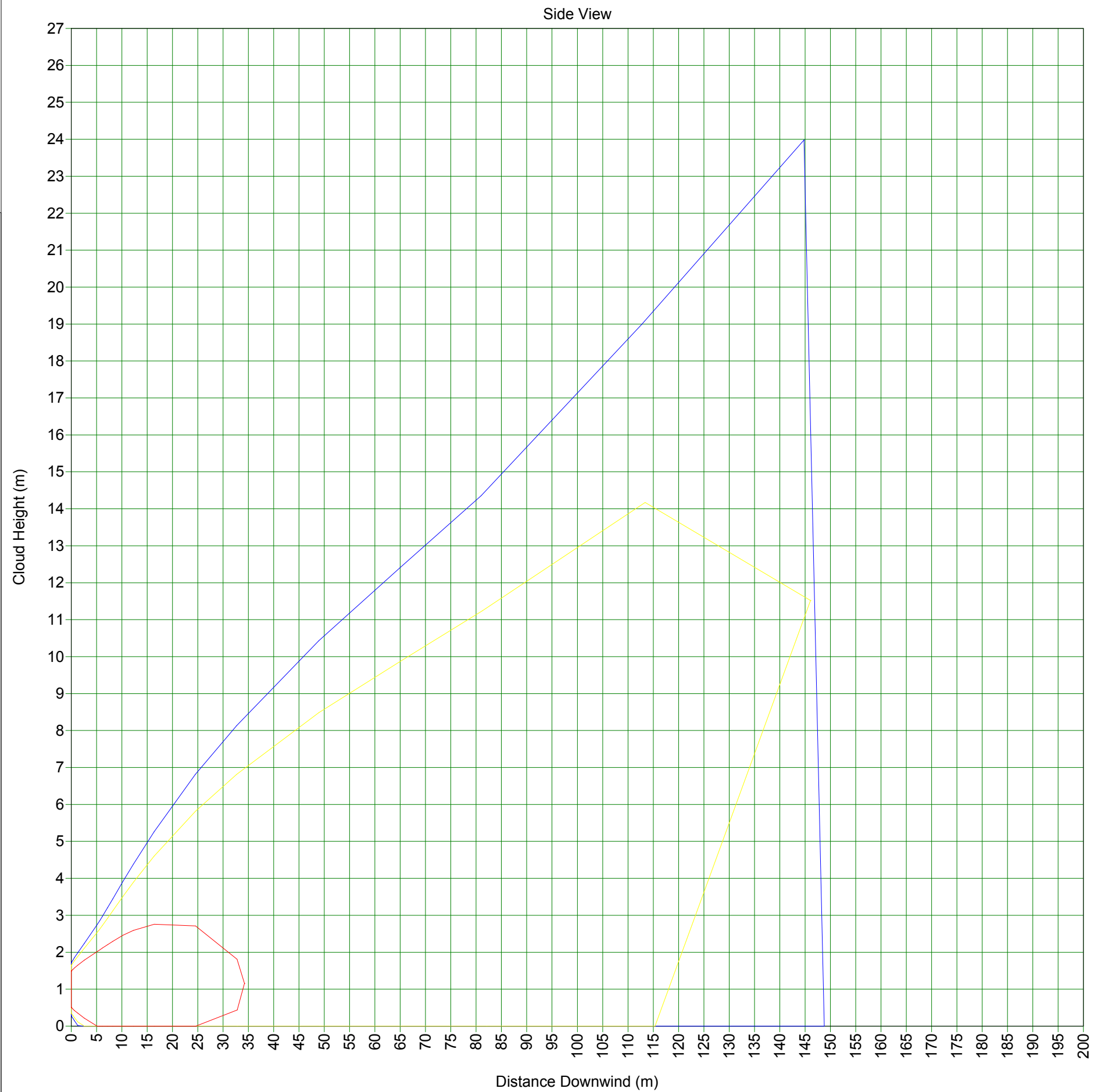
Study Folder: 70977-Fase  
2-lp17  
Audit No: 65928  
Model: 140mm  
Weather: Category 2/F  
Material: METHANE

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



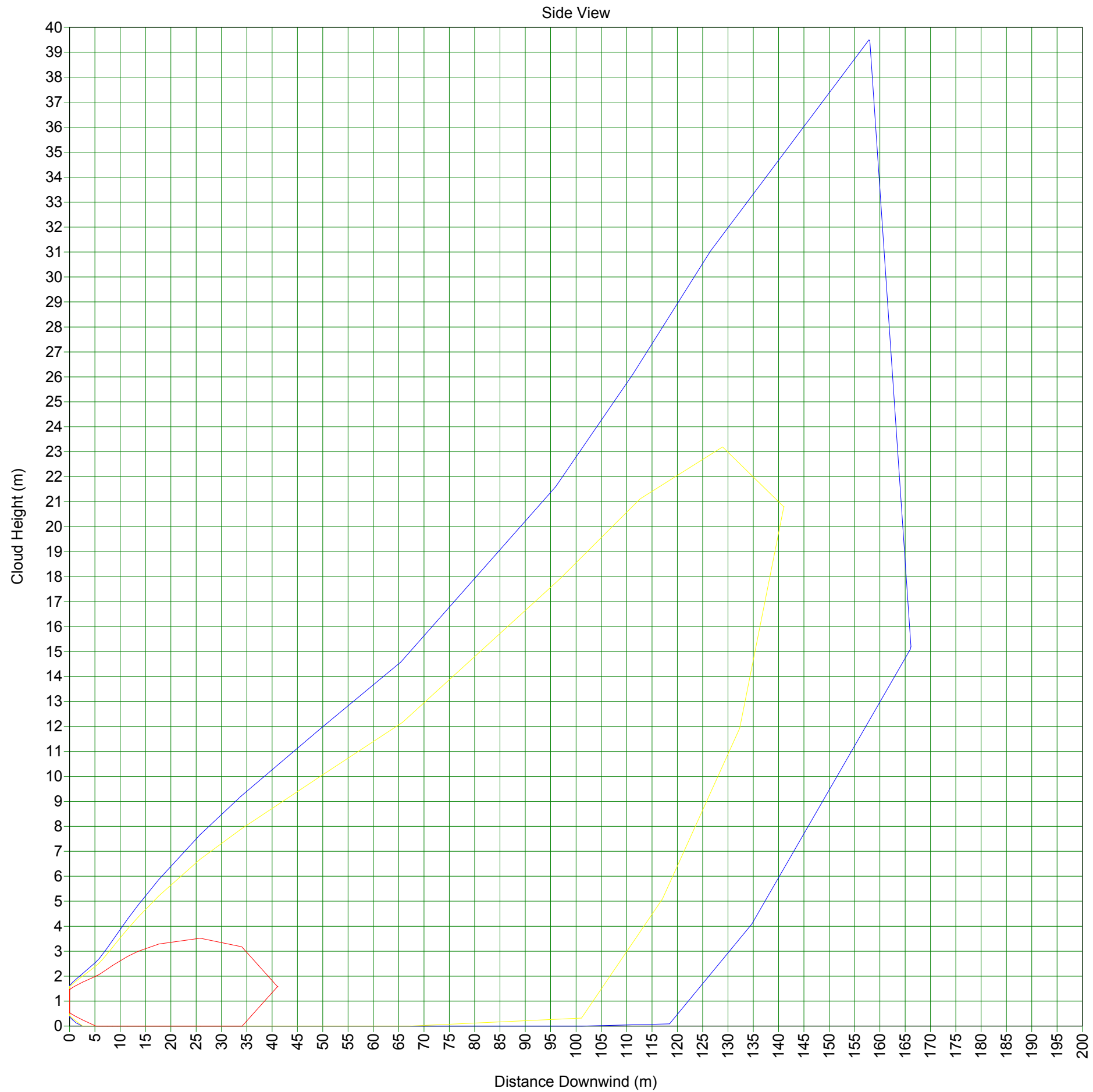
Study Folder: 70977-Fase  
2-lp17  
Audit No: 65928  
Model: 140mm  
Weather: Category 5/D  
Material: METHANE  
Averaging Time:  
Flammable(18.75 s)  
C/L Offset: 0 m  
Concentration  
Time: 9.618 s

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



Study Folder: 70977-Fase  
2-lp17  
Audit No: 65928  
Model: 140mm  
Weather: Category 2/F  
Material: METHANE  
Averaging Time:  
Flammable(18.75 s)  
C/L Offset: 0 m  
Concentration  
Time: 16.6 s

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



# SUMMARY REPORT

Unique Audit Number: 66.280



Study Folder: 70977-Fase 2-IP17

Phast 6.6



70977-Fase 2-IP17



Collegamento Rete SNAM - Erogazione

140mm

Base Case

CASE Name: Data

Path: \70977-Fase 2-IP17\Collegamento Rete SNAM - Erogazione\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             | 35 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

# SUMMARY REPORT

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|                                                               |                             |
|---------------------------------------------------------------|-----------------------------|
| Location of release                                           | Open air release            |
| Outdoor Release Direction                                     | Horizontal                  |
| <b>Flammable</b>                                              |                             |
| Explosion Method                                              | TNT                         |
| Jet Fire Method                                               | API Model                   |
| <b>Dispersion</b>                                             |                             |
| Late Ignition Location                                        | No ignition location        |
| <b>Fireball Parameters</b>                                    |                             |
| [Mass Modification Factor                                     | 3]                          |
| [Calculation method for fireball                              | DNV Recommended]            |
| [TNO model flame temperature                                  | 1727 degC]                  |
| <b>Toxic Parameters</b>                                       |                             |
| [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]                 |
| <b>Geometry</b>                                               |                             |
| Shape                                                         | Point                       |
| Dimension                                                     | 2D                          |
| System                                                        | Absolute                    |
| East(1)                                                       | 0 m                         |
| North(1)                                                      | 0 m                         |

Path: \70977-Fase 2-Ip17\Collegamento Rete SNAM - Erogazione\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 | -1,03 degC    |
| Final Velocity    | 500,00 m/s    |
| Droplet Diameter  | 0,00 um       |

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## Continuous Release Data:

|                       |                   |
|-----------------------|-------------------|
| Mass Flowrate         | 1.52597E+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 | -1,03 degC    |
| Final Velocity   | 500,00 m/s    |
| Droplet Diameter | 0,00 um       |

## Continuous Release Data:

|                       |                   |
|-----------------------|-------------------|
| Mass Flowrate         | 1.52597E+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

Unique Audit Number: 66.280



Study Folder: 70977-Fase 2-Ip17

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## Consequence Results

### Distance to Concentration Results

**Path:** \70977-Fase 2-Ip17\Collegamento Rete SNAM - Erogazione\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 |  | 118.204                         | 154.203      |
| UFL (165000)                      | 18.75 | s |  | 41.0527                         | 34.2392      |
| LFL (44000)                       | 18.75 | s |  | 141.044                         | 146.084      |
| LFL Frac (22000)                  | 18.75 | s |  | 191.003                         | 199.412      |
| 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 |  | 1.57763                         | 1.15522      |
| LFL (44000)                       | 18.75 | s |  | 20.7972                         | 11.519       |
| LFL Frac (22000)                  | 18.75 | s |  | 35.8821                         | 19.8572      |

# SUMMARY REPORT

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## Concentration At Distance Results

Path: \70977-Fase 2-Ip17\Collegamento Rete SNAM - Erogazione\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 | 144842                                       | 131081       |
| 250      | m | 12883.8                                      | 12572.7      |
| 500      | m | 3455.08                                      | 3563.12      |

| Distance |   | Heights (m) for above concentrations |              |
|----------|---|--------------------------------------|--------------|
|          |   | Category 2/F                         | Category 5/D |
| 50       | m | 1.97955                              | 1.49691      |
| 250      | m | 50.4592                              | 26.6625      |
| 500      | m | 89.8156                              | 49.243       |

| Distance |   | Conc.(ppm) at Core Avg. Time of 18.75 s |              |
|----------|---|-----------------------------------------|--------------|
|          |   | Category 2/F                            | Category 5/D |
| 50       | m | 144842                                  | 131081       |
| 250      | m | 12883.8                                 | 12572.7      |
| 500      | m | 3455.08                                 | 3563.12      |

| Distance |   | Heights (m) for above concentrations |              |
|----------|---|--------------------------------------|--------------|
|          |   | Category 2/F                         | Category 5/D |
| 50       | m | 1.97955                              | 1.49691      |
| 250      | m | 50.4592                              | 26.6625      |
| 500      | m | 89.8156                              | 49.243       |

## Jet Fire Hazard

Path: \70977-Fase 2-Ip17\Collegamento Rete SNAM - Erogazione\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-Ip17\Collegamento Rete SNAM - Erogazione\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 | 175.575      | 175.575      |
| Radiation Level | 7    | kW/m2 | 183.279      | 183.279      |
| Radiation Level | 5    | kW/m2 | 188.52       | 188.52       |
| Radiation Level | 3    | kW/m2 | 198.681      | 198.681      |

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## Radiation Effects: Jet Fire Distance

Path: \70977-Fase 2-IP17\Collegamento Rete SNAM - Erogazione\140mm

|                          |   |  | Radiation Level (kW/m2) |              |
|--------------------------|---|--|-------------------------|--------------|
|                          |   |  | Category 2/F            | Category 5/D |
| Distance Of Interest 50  | m |  | Engulfed                | Engulfed     |
| Distance Of Interest 250 | m |  | 0.665412                | 0.665412     |
| Distance Of Interest 500 | m |  | 0.0586975               | 0.0586975    |

## Flash Fire Envelope

Path: \70977-Fase 2-IP17\Collegamento Rete SNAM - Erogazione\140mm

All flammable results are reported at the cloud centreline height

|                 |       |     | Distance (m)                    |              |
|-----------------|-------|-----|---------------------------------|--------------|
|                 |       |     | Category 2/F                    | Category 5/D |
| Furthest Extent | 22000 | ppm | 191.003                         | 199.412      |
| Furthest Extent | 44000 | ppm | 141.044                         | 146.084      |
|                 |       |     | Heights (m) for above distances |              |
|                 |       |     | Category 2/F                    | Category 5/D |
| Furthest Extent | 22000 | ppm | 35.8821                         | 19.8572      |
| Furthest Extent | 44000 | ppm | 20.7972                         | 11.519       |

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## Explosion Effects: Late Ignition

Path: \70977-Fase 2-IP17\Collegamento Rete SNAM - Erogazione\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 | 520.872                                    | 483.365      |
| Overpressure | 0.1379  | bar | 275.671                                    | 265.959      |
| Overpressure | 0.2068  | bar | 256.29                                     | 248.776      |

|                         |    |  | Supplementary Data at 0.02068 bar |              |
|-------------------------|----|--|-----------------------------------|--------------|
|                         |    |  | Category 2/F                      | Category 5/D |
| Supplied Flammable Mass | kg |  | 929.495                           | 647.878      |
| Used Flammable Mass     | kg |  | 929.495                           | 647.878      |
| Overpressure Radius     | m  |  | 330.872                           | 293.365      |
| 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 |  | 929.495                          | 647.878      |
| Used Flammable Mass     | kg |  | 929.495                          | 647.878      |
| Overpressure Radius     | m  |  | 85.6709                          | 75.9595      |
| 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 |  | 929.495                          | 647.878      |
| Used Flammable Mass     | kg |  | 929.495                          | 647.878      |
| Overpressure Radius     | m  |  | 66.2902                          | 58.7757      |
| 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 | 0.242114                               | 0.199369     |
| Distance | 500 | m | 0.0223892                              | 0.0192496    |

|                         |    |  | Supplementary Data at 50 m |              |
|-------------------------|----|--|----------------------------|--------------|
|                         |    |  | Category 2/F               | Category 5/D |
| Supplied Flammable Mass | kg |  | 98.4704                    | 79.3877      |

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|                             |    |              |              |
|-----------------------------|----|--------------|--------------|
| Used Flammable Mass         | kg | 98.4704      | 79.3877      |
| Supplementary Data at 250 m |    |              |              |
|                             |    | Category 2/F | Category 5/D |
| Supplied Flammable Mass     | kg | 929.495      | 647.878      |
| Used Flammable Mass         | kg | 929.495      | 647.878      |
| Supplementary Data at 500 m |    |              |              |
|                             |    | Category 2/F | Category 5/D |
| Supplied Flammable Mass     | kg | 929.495      | 647.878      |
| Used Flammable Mass         | kg | 929.495      | 647.878      |

## Weather Conditions

**Path:** \70977-Fase 2-Ip17\Collegamento Rete SNAM - Erogazione\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         |