# Jet Fire

## Workspace: 72438-3InvioGN-10R

### Study: Invio GN a metanodotto

#### Equipment Item: 10R Linea di mandata gas

72438-3InvioGN-10R\Invio GN a metanodotto\10R Linea di mandata gas

| | | |
|---|---|---|
| Material | **GAS NATURALE** | |
| East | 0 | m |
| North | 0 | m |

### Scenario (Leak) : 81,3 mm

72438-3InvioGN-10R\Invio GN a metanodotto\10R Linea di mandata gas\81,3 mm

#### Weather: Category 2/F

| | |
|---|---|
| **Wind speed [m/s]** | **2** |
| **Pasquill stability** | **F stable - night with moderate clouds and light/moderate wind** |
| **Atmospheric temperature [degC]** | **25** |
| **Relative humidity [fraction]** | **0,75** |
| **Solar radiation flux [kW/m2]** | 0,5 |

#### Jet fire model results

**INPUT DATA**

**Scenario**

| | | |
|---|---|---|
| Elevation | **1** | m |
| Release angle from horizontal | **0** | deg |

**Jet Fire Parameters**

| | | |
|---|---|---|
| Jet fire method | Cone model | |
| Wind orientation about the z-axis (anti-clockwise from the East) | **0** | deg |
| Rotation about the z-axis (anti-clockwise from the east) | **0** | deg |
| Rate modification factor | 3 | |

## Calculated inputs

| | | |
|---|---|---|
| Mass flow rate | 67,986 | kg/s |
| Temperature after atmospheric expansion | -56,7906 | degC |
| Liquid fraction | 0 | fraction |
| Velocity after atmospheric expansion (input) | **300** | m/s |
| Rainout fraction time averaged | **0** | fraction |

## OUTPUT DATA

| | | |
|---|---|---|
| Flame emissive power | 282,1 | kW/m2 |
| Fraction of emissivity | 0,219523 | fraction |
| Jet velocity | 300 | m/s |
| Flame length | 70,5185 | m |
| Frustum length | 51,3465 | m |
| Frustum base width | 10,1074 | m |
| Frustum tip width | 18,0035 | m |
| Frustum lift-off distance | 21,8136 | m |
| Flame length in still air | 104,179 | m |
| Hole to flame angle | 33,8431 | deg |
| Expanded diameter | 0,530104 | m |
| Plane angular rotation | 0 | deg |

Flame on ground impingement with partial truncation

## Radiation Intensity Ellipse Results

## INPUT DATA

For ellipses 'observer direction' refers to whether inclination is 'fixed' or 'variable'. Orientation is always variable.

| | | |
|---|---|---|
| Observer direction | Variable | |
| Exposure duration | 5,22501 | s |
| Height of interest | **1,7** | m |

## OUTPUT DATA

## Radiation intensity

| Incident radiation [kW/m2] | Lethality [%] | View factor | Probit | Dose [(W/m2)^ProbitN.s] | Ellipse half-length [m] | Ellipse half-width [m] | Ellipse centre downwind distance [m] | Effect downwind distance [m] | Ellipse area [m2] |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 0 | 0,0106345 | -4,81943 | 226.013 | 103,601 | 118,517 | 51,9492 | 155,55 | 38573,8 |
| 5 | 0 | 0,0177242 | -3,07586 | 446.605 | 81,5372 | 92,5716 | 51,0327 | 132,57 | 23712,8 |
| 7 | 0 | 0,0248139 | -1,9274 | 699.449 | 69,6788 | 78,3537 | 50,1574 | 119,836 | 17151,8 |
| 12,5 | 3,74822E-05 | 0,0443105 | 0,0516672 | 1.515.294 | 53,1797 | 57,979 | 47,928 | 101,108 | 9686,48 |
| 37,5 | 11,5362 | 0,132931 | 3,8015 | 6.556.056 | 32,4745 | 28,8503 | 42,6541 | 75,1286 | 2943,35 |

## Radiation v Distance Results

### INPUT DATA

| | | |
|---|---|---|
| Maximum distance | 155,55 | m |
| Observer type radiation modelling flag | Planar | |
| Observer direction | Variable | |
| Height of interest | **1,7** | m |

### OUTPUT DATA

| Downwind distance [m] | Maximum incident radiation [kW/m2] | Lethality level [fraction] |
|---|---|---|
| 0 | 16,6579 | 3,62246E-05 |
| 3,17449 | 20,4972 | 0,000556569 |
| 6,34899 | 26,1482 | 0,00756657 |
| 9,52348 | 35,0274 | 0,0761702 |
| 12,698 | 50,1662 | 0,418692 |
| 15,8725 | 95,7482 | 0,977305 |

| | | |
|---|---|---|
| 19,047 | 213,141 | 0,999999 |
| 22,2215 | 282,1 | 1 |
| 25,396 | 282,1 | 1 |
| 28,5704 | 282,1 | 1 |
| 31,7449 | 282,1 | 1 |
| 34,9194 | 235,629 | 1 |
| 38,0939 | 182,433 | 0,999987 |
| 41,2684 | 151,17 | 0,999814 |
| 44,4429 | 129,978 | 0,998834 |
| 47,6174 | 114,451 | 0,995473 |
| 50,7919 | 102,359 | 0,987089 |
| 53,9664 | 92,3781 | 0,969858 |
| 57,1409 | 83,5763 | 0,937847 |
| 60,3154 | 75,3365 | 0,88153 |
| 63,4899 | 67,19 | 0,785836 |
| 66,6644 | 58,9178 | 0,634432 |
| 69,8389 | 50,5866 | 0,429851 |
| 73,0134 | 42,5582 | 0,221655 |
| 76,1879 | 35,0765 | 0,0768568 |
| 79,3624 | 28,6015 | 0,0168733 |
| 82,5369 | 23,8513 | 0,00304413 |
| 85,7113 | 21,3031 | 0,000878151 |
| 88,8858 | 19,1187 | 0,000234509 |
| 92,0603 | 17,1192 | 5,33428E-05 |
| 95,2348 | 15,3213 | 1,05213E-05 |
| 98,4093 | 13,6953 | 1,77259E-06 |
| 101,584 | 12,3021 | 2,82965E-07 |
| 104,758 | 11,0763 | 4,14563E-08 |
| 107,933 | 9,99991 | 0 |
| 111,107 | 9,05476 | 0 |
| 114,282 | 8,22385 | 0 |
| 117,456 | 7,49192 | 0 |
| 120,631 | 6,84558 | 0 |
| 123,805 | 6,27322 | 0 |
| 126,98 | 5,76478 | 0 |

| | | |
|---|---|---|
| 130,154 | 5,31194 | 0 |
| 133,329 | 4,9073 | 0 |
| 136,503 | 4,54464 | 0 |
| 139,678 | 4,21864 | 0 |
| 142,852 | 3,92477 | 0 |
| 146,027 | 3,65909 | 0 |
| 149,201 | 3,4183 | 0 |
| 152,376 | 3,19948 | 0 |
| 155,55 | 3,00013 | 0 |

## Weather: Category 5/D

| | |
|---|---|
| **Wind speed [m/s]** | **5** |
| **Pasquill stability** | **D neutral - little sun and high wind or overcast/windy night** |
| **Atmospheric temperature [degC]** | 25 |
| **Relative humidity [fraction]** | 0,75 |
| **Solar radiation flux [kW/m2]** | 0,5 |

## Jet fire model results

### INPUT DATA

### Scenario

| | | |
|---|---|---|
| Elevation | **1** | m |
| Release angle from horizontal | **0** | deg |

### Jet Fire Parameters

| | | |
|---|---|---|
| Jet fire method | Cone model | |
| Wind orientation about the z-axis (anti-clockwise from the East) | **0** | deg |
| Rotation about the z-axis (anti-clockwise from the east) | **0** | deg |
| Rate modification factor | 3 | |

### Calculated inputs

| | | |
|---|---|---|
| Mass flow rate | 67,986 | kg/s |
| Temperature after atmospheric expansion | -56,7906 | degC |
| Liquid fraction | 0 | fraction |
| Velocity after atmospheric expansion (input) | **300** | m/s |
| Rainout fraction time averaged | **0** | fraction |

### OUTPUT DATA

| | | |
|---|---|---|
| Flame emissive power | 335,768 | kW/m2 |
| Fraction of emissivity | 0,218471 | fraction |

| | | |
|---|---|---|
| Jet velocity | 300 | m/s |
| Flame length | 75,3249 | m |
| Frustum length | 54,2359 | m |
| Frustum base width | 10,1074 | m |
| Frustum tip width | 12,9909 | m |
| Frustum lift-off distance | 21,8136 | m |
| Flame length in still air | 104,179 | m |
| Hole to flame angle | 17,5137 | deg |
| Expanded diameter | 0,530104 | m |
| Plane angular rotation | 0 | deg |

Flame on ground impingement with partial truncation

## Radiation Intensity Ellipse Results

### INPUT DATA

For ellipses 'observer direction' refers to whether inclination is 'fixed' or 'variable'. Orientation is always variable.

| | | |
|---|---|---|
| Observer direction | Variable | |
| Exposure duration | 5,22501 | s |
| Height of interest | **1,7** | m |

### OUTPUT DATA

**Radiation intensity**

| Incident radiation [kW/m2] | Lethality [%] | View factor | Probit | Dose [(W/m2)^ProbitN.s] | Ellipse half-length [m] | Ellipse half-width [m] | Ellipse centre downwind distance [m] | Effect downwind distance [m] | Ellipse area [m2] |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 0 | 0,0089347 4 | -4,81943 | 226.013 | 90,3189 | 119,959 | 55,3314 | 146,488 | 34037,9 |
| 5 | 0 | 0,0148912 | -3,07586 | 446.605 | 73,7455 | 93,774 | 54,23 | 127,976 | 21725,4 |
| 7 | 0 | 0,0208477 | -1,9274 | 699.449 | 65,0151 | 79,4795 | 53,3659 | 118,381 | 16233,8 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 12,5 | 3,74822E-05 | 0,0372281 | 0,0516672 | 1.515.294 | 53,1284 | 59,1515 | 51,6612 | 104,79 | 9872,86 |
| 37,5 | 11,5362 | 0,111684 | 3,8015 | 6.556.056 | 37,8091 | 31,0156 | 47,5318 | 85,3408 | 3684,06 |

## Radiation v Distance Results

### INPUT DATA

| | | |
|---|---|---|
| Maximum distance | 147,071 | m |
| Observer type radiation modelling flag | Planar | |
| Observer direction | Variable | |
| Height of interest | **1,7** | m |

### OUTPUT DATA

| Downwind distance [m] | Maximum incident radiation [kW/m2] | Lethality level [fraction] |
|---|---|---|
| 0 | 13,8795 | 2,20773E-06 |
| 3,00144 | 17,6172 | 7,93603E-05 |
| 6,00289 | 23,3464 | 0,00243108 |
| 9,00433 | 33,7201 | 0,0592454 |
| 12,0058 | 54,4232 | 0,529003 |
| 15,0072 | 97,6715 | 0,980722 |
| 18,0087 | 191,526 | 0,999994 |
| 21,0101 | 317,441 | 1 |
| 24,0115 | 335,768 | 1 |
| 27,013 | 335,768 | 1 |
| 30,0144 | 335,768 | 1 |
| 33,0159 | 335,768 | 1 |
| 36,0173 | 335,768 | 1 |
| 39,0188 | 335,768 | 1 |
| 42,0202 | 335,768 | 1 |
| 45,0216 | 285,233 | 1 |
| 48,0231 | 244,41 | 1 |
| 51,0245 | 214,938 | 0,999999 |
| 54,026 | 192,269 | 0,999994 |

| | | |
|---|---|---|
| 57,0274 | 174,213 | 0,999974 |
| 60,0289 | 159,152 | 0,999906 |
| 63,0303 | 145,879 | 0,999707 |
| 66,0317 | 133,06 | 0,999109 |
| 69,0332 | 118,831 | 0,996911 |
| 72,0346 | 100,791 | 0,985231 |
| 75,0361 | 77,9842 | 0,903296 |
| 78,0375 | 54,1925 | 0,523232 |
| 81,039 | 47,3981 | 0,344956 |
| 84,0404 | 40,4799 | 0,174249 |
| 87,0419 | 33,8173 | 0,0604125 |
| 90,0433 | 28,1191 | 0,0145866 |
| 93,0447 | 23,4682 | 0,00256896 |
| 96,0462 | 19,729 | 0,000348669 |
| 99,0476 | 16,7272 | 3,84391E-05 |
| 102,049 | 14,3115 | 3,62498E-06 |
| 105,051 | 12,3444 | 3,0066E-07 |
| 108,052 | 10,7336 | 2,27662E-08 |
| 111,053 | 9,40287 | 0 |
| 114,055 | 8,29458 | 0 |
| 117,056 | 7,36365 | 0 |
| 120,058 | 6,57553 | 0 |
| 123,059 | 5,90347 | 0 |
| 126,061 | 5,32636 | 0 |
| 129,062 | 4,82759 | 0 |
| 132,063 | 4,39393 | 0 |
| 135,065 | 4,01475 | 0 |
| 138,066 | 3,68147 | 0 |
| 141,068 | 3,38711 | 0 |
| 144,069 | 3,12593 | 0 |
| 147,071 | 2,8932 | 0 |