

Jet Fire

Workspace: 72438-2FSRURegas-14R

Study: FSRU in rigassificazione

Equipment Item: 14R Linee BOG da serbatoi

72438-2FSRURegas-14R\FSRU in rigassificazione\14R Linee BOG da serbatoi

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

Scenario (Leak) : 80mm

72438-2FSRURegas-14R\FSRU in rigassificazione\14R Linee BOG da serbatoi\80mm

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 | 12,5 | 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 | 4,64204 | kg/s |
| Temperature after atmospheric expansion | 20,43 | degC |
| Liquid fraction | 0 | fraction |
| Velocity after atmospheric expansion (input) | 300 | m/s |
| Rainout fraction time averaged | 0 | fraction |

OUTPUT DATA

| | | |
|---------------------------|----------|-------------------|
| Flame emissive power | 182,262 | kW/m ² |
| Fraction of emissivity | 0,192526 | fraction |
| Jet velocity | 300 | m/s |
| Flame length | 25,1301 | m |
| Frustum length | 19,7057 | m |
| Frustum base width | 1,78489 | m |
| Frustum tip width | 5,22609 | m |
| Frustum lift-off distance | 5,69996 | m |
| Flame length in still air | 32,6384 | m |
| Hole to flame angle | 20,2826 | deg |
| Expanded diameter | 0,161691 | m |
| Plane angular rotation | 0 | deg |

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 | 20 | s |
| Height of interest | 1,7 | m |

OUTPUT DATA

Radiation intensity

| Incident radiation [kW/m ²] | Lethality [%] | View factor | Probit | Dose [(W/m ²) ^{Probit} N.s] | Ellipse half-length [m] | Ellipse half-width [m] | Ellipse centre downwind distance [m] | Effect downwind distance [m] | Ellipse area [m ²] |
|---|---------------|-------------|----------|--|-------------------------|------------------------|--------------------------------------|------------------------------|--------------------------------|
| 3 | 0 | 0,0164599 | -1,38321 | 865.119 | 22,5392 | 27,7462 | 20,0904 | 42,6296 | 1964,68 |
| 5 | 0,000174704 | 0,0274331 | 0,360367 | 1.709.491 | 16,5212 | 19,4588 | 18,1666 | 34,6878 | 1009,97 |
| 7 | 0,02405 | 0,0384063 | 1,50883 | 2.677.313 | 12,1067 | 14,1699 | 17,1474 | 29,2541 | 538,944 |
| 12,5 | 6,52536 | 0,0685827 | 3,48789 | 5.800.162 | Not reached | Not reached | | 18,3275 | n/a |
| 37,5 | 98,7381 | 0,205748 | 7,23773 | 25.094.924 | Not reached | Not reached | | n/a | n/a |

Radiation v Distance Results

INPUT DATA

| | | |
|--|------------|---|
| Maximum distance | 48,3677 | 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/m ²] | Lethality level [fraction] |
|-----------------------|---|----------------------------|
| 0 | 4,10959 | 5,52244E-08 |
| 0,987095 | 4,63226 | 4,78933E-07 |
| 1,97419 | 5,18758 | 3,18495E-06 |
| 2,96129 | 5,78515 | 1,72402E-05 |
| 3,94838 | 6,37166 | 6,88952E-05 |
| 4,93548 | 6,9411 | 0,000215805 |



| | | |
|---------|---------|-------------|
| 5,92257 | 7,47205 | 0,000540802 |
| 6,90967 | 7,94569 | 0,00111178 |
| 7,89676 | 8,34857 | 0,00192736 |
| 8,88386 | 8,74894 | 0,00316734 |
| 9,87095 | 9,51139 | 0,00724792 |
| 10,858 | 10,2538 | 0,0143269 |
| 11,8451 | 10,8991 | 0,0238577 |
| 12,8322 | 11,5137 | 0,0365141 |
| 13,8193 | 11,8746 | 0,0457736 |
| 14,8064 | 12,2011 | 0,0553881 |
| 15,7935 | 12,4203 | 0,062521 |
| 16,7806 | 12,5331 | 0,0664109 |
| 17,7677 | 12,5413 | 0,066696 |
| 18,7548 | 12,4466 | 0,063416 |
| 19,7419 | 12,2522 | 0,0570009 |
| 20,729 | 11,9623 | 0,0482378 |
| 21,7161 | 11,5833 | 0,0381912 |
| 22,7032 | 11,1461 | 0,0284951 |
| 23,6903 | 10,5949 | 0,0189234 |
| 24,6774 | 10,0097 | 0,01159 |
| 25,6645 | 9,38296 | 0,00636672 |
| 26,6516 | 8,73043 | 0,00309857 |
| 27,6387 | 8,0676 | 0,00132068 |
| 28,6258 | 7,40894 | 0,000488023 |
| 29,6129 | 6,82507 | 0,000173453 |
| 30,6 | 6,34916 | 6,56062E-05 |
| 31,587 | 6,0055 | 2,98382E-05 |
| 32,5741 | 5,67796 | 1,30264E-05 |
| 33,5612 | 5,35625 | 5,30051E-06 |
| 34,5483 | 5,04352 | 2,01493E-06 |
| 35,5354 | 4,74222 | 7,17633E-07 |
| 36,5225 | 4,45411 | 2,40263E-07 |
| 37,5096 | 4,17631 | 7,45425E-08 |
| 38,4967 | 3,91846 | 2,23567E-08 |
| 39,4838 | 3,67569 | 0 |



| | | |
|---------|---------|---|
| 40,4709 | 3,44791 | 0 |
| 41,458 | 3,2348 | 0 |
| 42,4451 | 3,03587 | 0 |
| 43,4322 | 2,85048 | 0 |
| 44,4193 | 2,67793 | 0 |
| 45,4064 | 2,51749 | 0 |
| 46,3935 | 2,3684 | 0 |
| 47,3806 | 2,2299 | 0 |
| 48,3677 | 2,10123 | 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 | 12,5 | 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 | 4,64204 | kg/s |
| Temperature after atmospheric expansion | 20,43 | degC |
| Liquid fraction | 0 | fraction |
| Velocity after atmospheric expansion (input) | 300 | m/s |
| Rainout fraction time averaged | 0 | fraction |

OUTPUT DATA

| | | |
|------------------------|----------|----------|
| Flame emissive power | 174,295 | kW/m2 |
| Fraction of emissivity | 0,184571 | fraction |

| | | |
|---------------------------|----------|-----|
| Jet velocity | 300 | m/s |
| Flame length | 27,905 | m |
| Frustum length | 22,2864 | m |
| Frustum base width | 1,78489 | m |
| Frustum tip width | 4,5839 | m |
| Frustum lift-off distance | 5,69996 | m |
| Flame length in still air | 32,6384 | m |
| Hole to flame angle | 10,8557 | deg |
| Expanded diameter | 0,161691 | m |
| Plane angular rotation | 0 | deg |

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 | 20 | s |
| Height of interest | 1,7 | m |

OUTPUT DATA

Radiation intensity

| Incident radiation [kW/m ²] | Lethality [%] | View factor | Probit | Dose [(W/m ²) ^{Probit} N.s] | Ellipse half-length [m] | Ellipse half-width [m] | Ellipse centre downwind distance [m] | Effect downwind distance [m] | Ellipse area [m ²] |
|---|---------------|-------------|----------|--|-------------------------|------------------------|--------------------------------------|------------------------------|--------------------------------|
| 3 | 0 | 0,0172122 | -1,38321 | 865.119 | 23,3698 | 27,9006 | 20,409 | 43,7788 | 2048,42 |
| 5 | 0,000174704 | 0,0286869 | 0,360367 | 1.709.491 | 17,8248 | 19,7929 | 19,3224 | 37,1472 | 1108,36 |
| 7 | 0,02405 | 0,0401617 | 1,50883 | 2.677.313 | 13,5672 | 14,8218 | 18,7585 | 32,3257 | 631,744 |
| 12,5 | 6,52536 | 0,0717174 | 3,48789 | 5.800.162 | 5,79534 | 5,06254 | 18,3092 | 24,1046 | 92,1717 |

37,5 98,7381 0,2151 7,237 25.094.924 Not Not n/a n/a
52 73 reach reach
ed ed

Radiation v Distance Results

INPUT DATA

| | | |
|--|------------|---|
| Maximum distance | 55,175 | 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/m ²] | Lethality level [fraction] |
|-----------------------|---|----------------------------|
| 0 | 4,24735 | 1,01744E-07 |
| 1,12602 | 4,80771 | 9,06448E-07 |
| 2,25204 | 5,43081 | 6,58213E-06 |
| 3,37806 | 6,0471 | 3,29632E-05 |
| 4,50408 | 6,65242 | 0,0001237 |
| 5,63011 | 7,21002 | 0,000349171 |
| 6,75613 | 7,69771 | 0,00077052 |
| 7,88215 | 8,49146 | 0,00231369 |
| 9,00817 | 9,50724 | 0,00721804 |
| 10,1342 | 10,4374 | 0,0166834 |
| 11,2602 | 11,2729 | 0,0311055 |
| 12,3862 | 11,9984 | 0,0492782 |
| 13,5123 | 12,6104 | 0,069157 |
| 14,6383 | 13,1096 | 0,0885741 |
| 15,7643 | 13,4954 | 0,105543 |
| 16,8903 | 13,7678 | 0,118528 |
| 18,0163 | 13,9229 | 0,126282 |
| 19,1424 | 13,9552 | 0,12793 |
| 20,2684 | 13,8601 | 0,123115 |
| 21,3944 | 13,6297 | 0,111842 |



| | | |
|---------|---------|-------------|
| 22,5204 | 13,259 | 0,0949435 |
| 23,6464 | 12,7475 | 0,0742035 |
| 24,7725 | 12,101 | 0,0523114 |
| 25,8985 | 11,3328 | 0,0323962 |
| 27,0245 | 10,4656 | 0,0170695 |
| 28,1505 | 9,52989 | 0,0073823 |
| 29,2765 | 8,56166 | 0,00252531 |
| 30,4026 | 7,7973 | 0,000895178 |
| 31,5286 | 7,33277 | 0,000430172 |
| 32,6546 | 6,85986 | 0,00018533 |
| 33,7806 | 6,37972 | 7,01079E-05 |
| 34,9067 | 5,88239 | 2,20604E-05 |
| 36,0327 | 5,42901 | 6,54825E-06 |
| 37,1587 | 4,99565 | 1,72211E-06 |
| 38,2847 | 4,58712 | 4,03805E-07 |
| 39,4107 | 4,20891 | 8,60716E-08 |
| 40,5368 | 3,85547 | 1,63391E-08 |
| 41,6628 | 3,53176 | 0 |
| 42,7888 | 3,23668 | 0 |
| 43,9148 | 2,9686 | 0 |
| 45,0408 | 2,72562 | 0 |
| 46,1669 | 2,5057 | 0 |
| 47,2929 | 2,30678 | 0 |
| 48,4189 | 2,12688 | 0 |
| 49,5449 | 1,96413 | 0 |
| 50,6709 | 1,81681 | 0 |
| 51,797 | 1,68332 | 0 |
| 52,923 | 1,56224 | 0 |
| 54,049 | 1,45226 | 0 |
| 55,175 | 1,35224 | 0 |

