

SIMULAZIONI RILASCIO LIQUIDO INFIAMMABILE DA CONTAINER-CISTERNA

L'ipotesi riguarda il danneggiamento di un tank-container contenente liquido infiammabile durante la movimentazione all'interno del terminal oppure durante il trasporto su strada. L'incidente comporta la rottura della parete del tank con rilascio di liquido e successivo incendio della pozza.

Ipotesi simulazioni

Sostanza pericolosa: Isoprene
 Stato fisico: liquido
 Classificazione: Estremamente infiammabile

Tipo di contenitore: tank-container
 Volume: 24 m³

Tipo di rottura: rottura grave
 Dimensione foro: 51 mm

Condizioni meteo: 4D
 (maggiormente ricorrenti)

Risultati delle simulazioni

Scenario incidentale	Raggi di danno [m]					Durata effetti [min]
	37,5 kW/m ²	12,5 kW/m ²	7 kW/m ²	5 kW/m ²	3 kW/m ²	
Pool fire	12	18	23	25	29	> 20

Tabella 3

----- START OF SESSION 1(mYBNewLiquidRelease) -----

INPUT

Model..... : Liquid release (193)
Version..... : 5.08
Reference..... : Yellow Book, CPR-14E, 3rd edition
1997, Paragraph 2.5.4Yellow Book,
CPR-14E, 3rd edition 1997, Paragraph
2.5.4
Case description..... : Rilascio - IMO 3 - Isoprene
Chemical name..... : Isoprene
Use which representative step..... : First 20% average (flammable)
Type of release..... : Release through hole in vessel
Hole diameter..... : 51 mm
Hole rounding..... : Sharp edges
Discharge coefficient..... : 0.62 -
Vessel type..... : Horizontal cylinder
Vessel volume..... : 24 m3
Length cylinder..... : 6 m
Filling degree : 80 %
Overpressure above liquid (assuming closed system)..... : 0 bar
Height leak above tank bottom..... : 0 m
Initial temperature in vessel..... : 16 °C
Type of calculation..... : Calculate until device is empty

RESULTS

Initial mass in vessel..... : 13075 kg
Total mass released..... : 13075 kg
Time needed to empty vessel..... : 4194.3 s
Maximum mass flow rate..... : 4.9559 kg/s
Representative release rate..... : 4.8171 kg/s
Representative outflow duration..... : 1800 s
Representative pressure..... : 1.0151 bar

----- END OF SESSION 1 -----

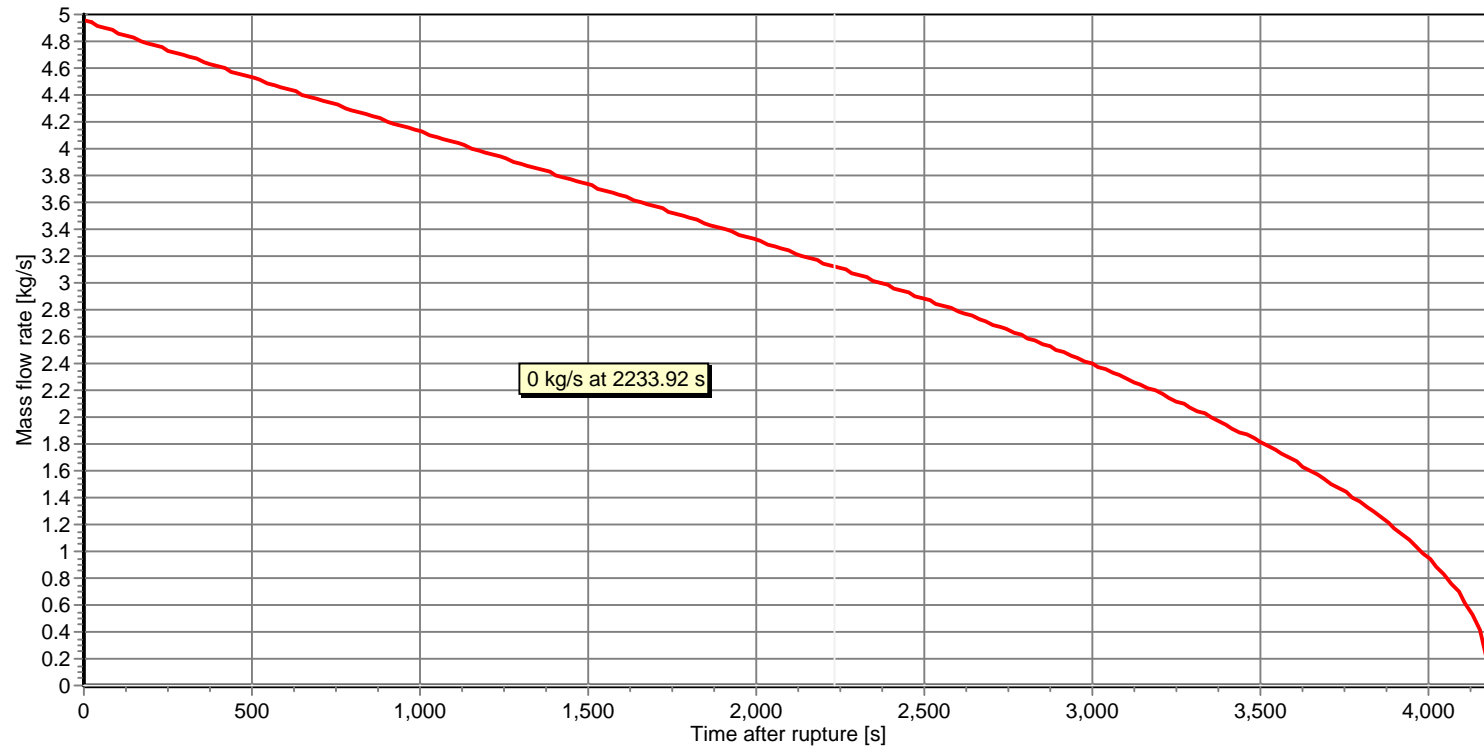
Administrative & version data:

Main program (production date) : Effects (24 Apr 2009 03:00:37)
Run mode (complexity level) : Expert
Model name : Liquid release (193)
Date of this calculation : 01 Oct 2013 19:10:25
License owner : rachele
Calculation performed by : rachele
Software library version : 7.6.4.3276
Model driver version(s) : 5.08
Model driver last modification : 10 July 2007
Model executable version(s) : N/A
Session nr. : 1
References : Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4Yellow Book,
CPR-14E, 3rd edition 1997, Paragraph 2.5.4
Project file name : "Rilascio - IMO 3 - Isoprene.alf"
Chemical database used : "Purple Book (1999).rdb" (30 ago 2013 15:58:00)
Environment database used : "Purple Book (1999).Env" (20 mag 2008 09:53:47)
System database used : "Purple Book (1999).SPF" (20 mag 2008 09:53:47)
Dispersion database used : "Purple Book (1999).dpp" (20 mag 2008 09:53:47)
Map background file used : "Rilascio - IMO 3 - Isoprene.gbf" (01 gen 0 00:00:00)
Project file directory : "C:\PC08_Rachele\RISP\RISP_2013\Simulazioni trasporti\IMO 3\Rilascio Isoprene 24m3"
Chemical database directory : "C:\Program Files (x86)\TNO\Effects 7.6\Shared data\Databases"
Environment database directory : "C:\Program Files (x86)\TNO\Effects 7.6\Shared data\Databases"
System database directory : "C:\Program Files (x86)\TNO\Effects 7.6\Shared data\Databases"
Dispersion database directory : "C:\Program Files (x86)\TNO\Effects 7.6\Shared data\Databases"
Map background directory : "C:\PC08_Rachele\RISP\RISP_2013\Simulazioni trasporti\IMO 3\Rilascio Isoprene 24m3"

End of administrative & version data:

Effects 7.6.4.3276 Calculation: 01 Oct 2013 19:11:13
Model: Liquid release (193)
Graph: Mass flow rate vs Time (Liquid Release)

Rilascio - IMO 3 - Isoprene



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----- START OF SESSION 1(mYBPoolEvaporation) -----
INPUT
Model..... : Pool evaporation (194)
Version..... : 5.17
Reference..... : Yellow Book CPR14E 2rd Edition -
                Chapter 5: Evaporation
Case description..... : Rilascio - IMO 3 - Isoprene
Chemical name..... : Isoprene
Use which representative step..... : First 20% average (flammable)
Evaporation from land or water..... : Land
Type of release..... : Continuous
Total mass released..... : 13075 kg
Mass flow rate of the source..... : 4.8171 kg/s
Type of pool grow on land..... : Spreading
Temperature of the pool..... : 16 °C
Temperature of the subsoil..... : 13 °C
Wind speed at 10 m height..... : 4 m/s
Ambient temperature..... : 16 °C
Ambient relative humidity..... : 66 %
Solar radiation flux..... : Calculate value
Cloud cover..... : 50 %
Date: day number..... : 15
Date: month number..... : 4
Latitude of the location..... : 44 deg
Type of subsoil..... : Average subsoil
Subsoil roughness description..... : relatively flat sandy soil, gravel
Maximum evaluation time for evaporation..... : 5000 s

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RESULTS

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Heat flux from solar radiation..... : 1.2141 kW/m2
Outflow time of the continuous release..... : 2714.3 s
Representative release rate..... : 3.353 kg/s
Representative outflow duration..... : 3524.5 s
Representative temperature..... : -11.32 °C
Representative pool radius..... : 13.921 m
Total evaporated mass..... : 11818 kg
... duration evaporation time..... : 4999.5 s

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----- END OF SESSION 1 -----

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Administrative & version data:

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Main program (production date) : Effects (24 Apr 2009 03:00:37)
Run mode (complexity level) : Expert
Model name : Pool evaporation (194)
Date of this calculation : 01 Oct 2013 19:11:39
License owner : rachele
Calculation performed by : rachele
Software library version : 7.6.4.3276
Model driver version(s) : 5.17
Model driver last modification : 15 Oct 2008
Model executable version(s) : N/A
Session nr. : 1
References : Yellow Book CPR14E 2rd Edition - Chapter 5: Evaporation
Project file name : "Rilascio - IMO 3 - Isoprene.alf"
Chemical database used : "Purple Book (1999).rdb" (30 ago 2013 15:58:00)
Environment database used : "Purple Book (1999).Env" (20 mag 2008 09:53:47)
System database used : "Purple Book (1999).SPF" (20 mag 2008 09:53:47)
Dispersion database used : "Purple Book (1999).dppf" (20 mag 2008 09:53:47)
Map background file used : "Rilascio - IMO 3 - Isoprene.gbf" (01 gen 0 00:00:00)
Project file directory : "C:\PC08_Rachele\RISP\RISP_2013\Simulazioni trasporti\IMO 3\Rilascio Isoprene 24m3"
Chemical database directory : "C:\Program Files (x86)\TNO\Effects 7.6\Shared data\Databases"
Environment database directory : "C:\Program Files (x86)\TNO\Effects 7.6\Shared data\Databases"
System database directory : "C:\Program Files (x86)\TNO\Effects 7.6\Shared data\Databases"
Dispersion database directory : "C:\Program Files (x86)\TNO\Effects 7.6\Shared data\Databases"
Map background directory : "C:\PC08_Rachele\RISP\RISP_2013\Simulazioni trasporti\IMO 3\Rilascio Isoprene 24m3"

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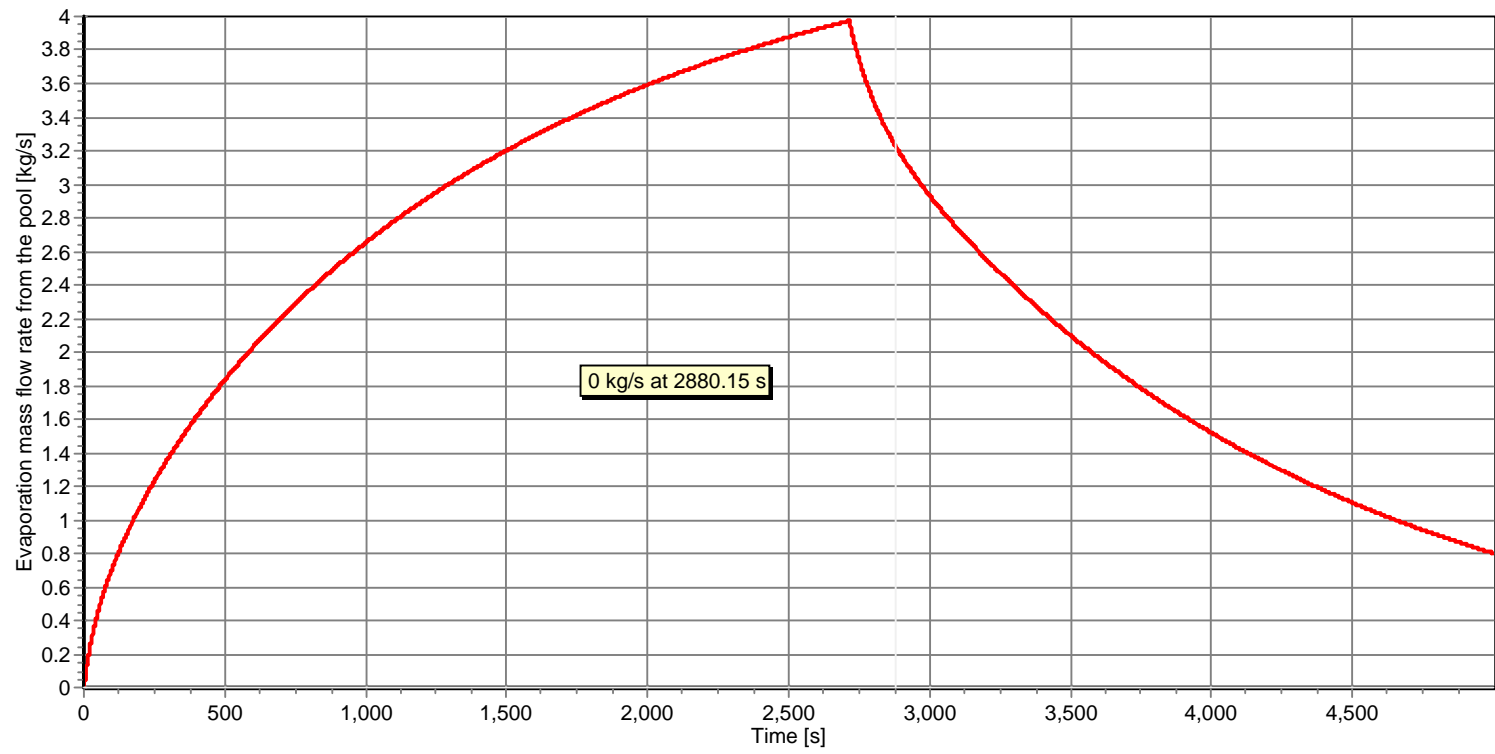
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End of administrative & version data:
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Effects 7.6.4.3276 Calculation: 01 Oct 2013 19:12:08
Model: Pool evaporation (194)
Graph: Evaporation mass flow rate vs. Time (Pool Evaporation)

Rilascio - IMO 3 - Isoprene



----- START OF SESSION 1(mYBPoolFire) -----

INPUT

Model..... : Pool fire (137)
 Version..... : 5.11
 Reference..... : Yellow Book (CPR-14E), 3rd edition
 1997, Paragraph 6.5.4
 Case description..... : Rilascio - IMO 3 - Isoprene
 Chemical name..... : Isoprene
 Type of confinement..... : Unconfined
 Total mass released..... : 13075 kg
 Fixed pool surface..... : 54.077 m2
 Height of the observer position above ground level..... : 1.7 m
 Hole diameter..... : 51 mm
 Discharge coefficient..... : 0.62 -
 Initial height of the liquid above release point..... : 2.26 m
 Cross-sectional area of the tank..... : 4 m2
 Pool thickness..... : 10 mm
 Temperature of the pool..... : 16 °C
 Pool burning rate..... : Calculate/Default
 Fraction combustion heat radiated..... : 13 %
 Soot Fraction..... : Calculate/Default
 Wind speed at 10 m height..... : 4 m/s
 Ambient temperature..... : 16 °C
 Ambient relative humidity..... : 66 %
 Amount of CO2 in atmosphere..... : 0.03 %
 Distance from the edge of the pool..... : 50 m
 Exposure duration to heat radiation..... : 20 s
 Take protective effects of clothing into account..... : No
 X-coordinate of release..... : 0 m
 Y-coordinate of release..... : 0 m
 Predefined wind direction..... : User defined
 Wind comes from (West = 180 degrees)..... : 180 deg
 Calculate all contours for..... : Physical effects
 Heat radiation level (lowest) for first contour plot..... : 3 kW/m2
 Heat radiation level for second contour plot..... : 5 kW/m2
 Heat radiation level (highest) for third contour plot..... : 12.5 kW/m2

RESULTS

Heat radiation at X..... : 0.37976 kW/m2
 Heat radiation first contour at..... : 25.351 m
 Heat radiation second contour at..... : 21.448 m
 Heat radiation third contour at..... : 13.949 m
 Combustion rate..... : 5.7413 kg/s
 Duration of the pool fire..... : 2277.3 s
 Heat emission from fire surface..... : 28.873 kW/m2
 Flame tilt..... : 52.684 deg
 View factor..... : 1.9138 %
 Atmospheric transmissivity..... : 68.725 %
 Flame temperature..... : 574.47 °C
 Height of the Flame..... : 17.427 m
 Weight ratio of HCL/chemical..... : 0 %
 Weight ratio of NO2/chemical..... : 0 %
 Weight ratio of SO2/chemical..... : 0 %
 Weight ratio of CO2/chemical..... : 323.16 %
 Weight ratio of H2O/chemical..... : 105.85 %

----- END OF SESSION 1 -----

Administrative & version data:

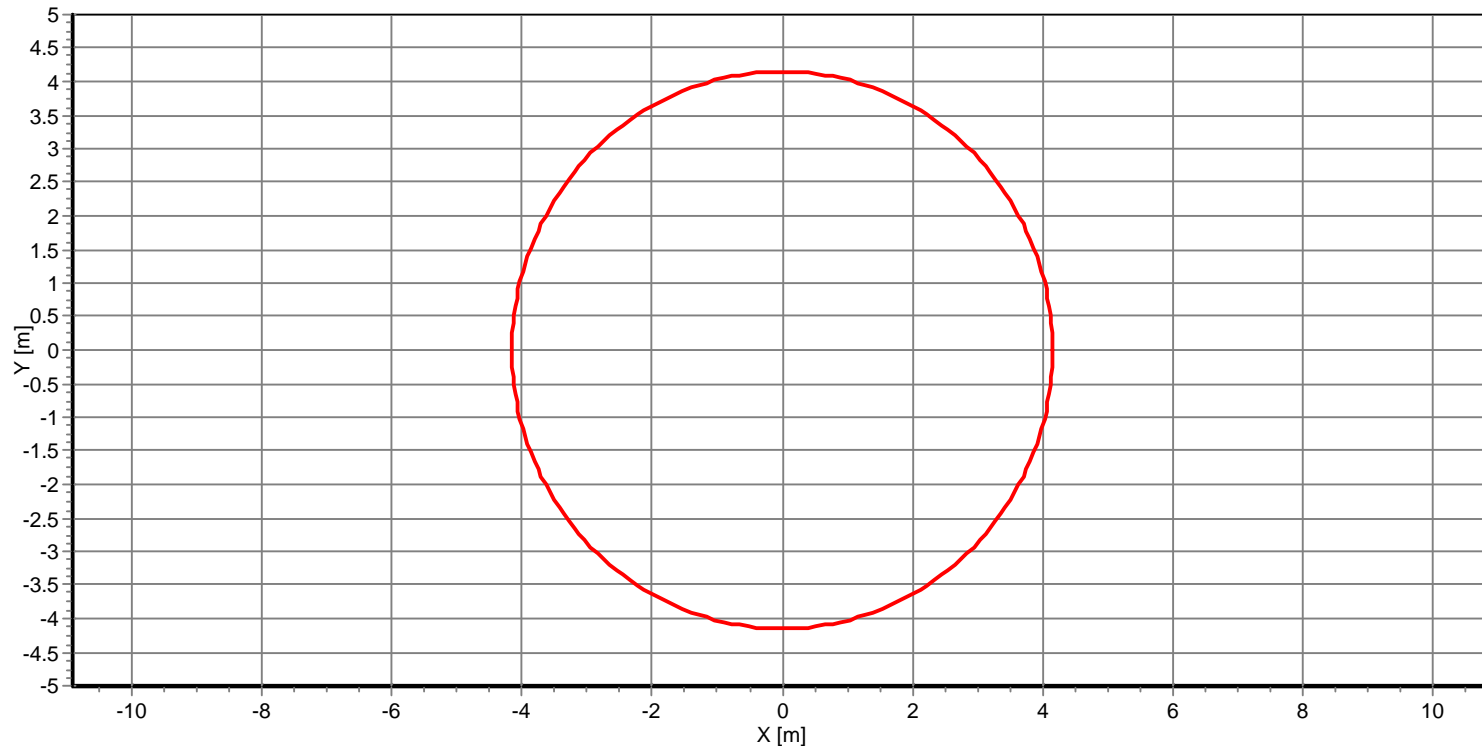
 Main program (production date) : Effects (24 Apr 2009 03:00:37)
 Run mode (complexity level) : Expert
 Model name : Pool fire (137)
 Date of this calculation : 01 Oct 2013 19:21:29
 License owner : rachele
 Calculation performed by : rachele
 Software library version : 7.6.4.3276
 Model driver version(s) : 5.11
 Model driver last modification : 30 Nov 2007
 Model executable version(s) : N/A
 Session nr. : 1
 References : Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4
 Project file name : "Rilascio - IMO 3 - Isoprene.alf"
 Chemical database used : "Purple Book (1999).rdb" (30 ago 2013 15:58:00)
 Environment database used : "Purple Book (1999).Env" (20 mag 2008 09:53:47)
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 Dispersion database used : "Purple Book (1999).dpf" (20 mag 2008 09:53:47)
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 System database directory : "C:\Program Files (x86)\TNO\Effects 7.6\Shared data\Databases"
 Dispersion database directory : "C:\Program Files (x86)\TNO\Effects 7.6\Shared data\Databases"
 Map background directory : "C:\PC08_Rachele\RISP\RISP_2013\Simulazioni trasporti\IMO 3\Rilascio Isoprene 24m3"

End of administrative & version data:

Effects 7.6.4.3276 Calculation: 01 Oct 2013 19:26:17
Model: Pool fire (137)
Graph: Pool contour (Pool Fire)

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Rilascio - IMO 3 - Isoprene



Effects 7.6.4.3276 Calculation: 01 Oct 2013 19:19:24
Model: Pool fire (137)
Graph: Heat radiation vs. distance (Pool Fire)

Rilascio - IMO 3 - Isoprene

