

## Bepaling effectafstanden

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*betreft* Bepaling effectafstanden maatgevende scenario's brandweerrapportage  
*versie* 001  
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## Bepaling effectafstanden maatgevende scenario's brandweerrapportage

### 1. Inleiding en resultaten

Waalhaven Botlek Terminals (WBT) stelt in het kader van de vergunningaanvraag een bedrijfsbrandweerrapport op. In dit rapport zijn onder meer zeven ongevalsscenario's met geklasseerde stoffen uitgewerkt. Voor deze ongevalsscenario's moeten, afhankelijk van het scenario, effectafstanden voor toxische of brandbare stoffen worden bepaald met Safeti-NL.

Adviesbureau de Haan heeft voor vijf van deze ongevalsscenario's de effectafstanden bepaald met Safeti 8.21. De hoofdvraag van deze notitie luidt:

**Wat zijn de effecten van de scenario's uit het bedrijfsbrandweerrapport?**

Tabel 1 toont de scenario's en de berekende effectafstanden per weertype. In hoofdstuk 2 geven wij een toelichting op deze resultaten en in hoofdstuk 3 lichten wij de uitgangspunten van deze berekening toe.

**tabel 1: effectafstanden per scenario en weertype**

| Nr* | Stof            | Scenario                                            | Te bepalen effecten                                                                                              | Effectafstand weertype D5    | Effectafstand weertype F1,5  |
|-----|-----------------|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------|------------------------------|------------------------------|
| 2   | Propyleen oxide | Lek 20mm, plasbrand                                 | Stralingscontouren:<br>10 kW/m <sup>2</sup><br>3 kW/m <sup>2</sup><br>2 kW/m <sup>2</sup><br>1 kW/m <sup>2</sup> | 37 m<br>58 m<br>68 m<br>90 m | 34 m<br>57 m<br>67 m<br>92 m |
| 3   | 70% HF          | Lek IBC in boxcontainer – uitstroming in 10 minuten | LBW (59 ppm)<br>AGW (34 ppm)<br>1% letaliteit (toxisch, ca 125 ppm)                                              | 668 m<br>920 m<br>230 m      | 1482 m<br>2125 m<br>507      |
| 4   | Propaan         | Gat 10mm, Fakkelfbrand                              | Stralingscontouren:<br>10 kW/m <sup>2</sup><br>3 kW/m <sup>2</sup><br>2 kW/m <sup>2</sup><br>1 kW/m <sup>2</sup> | 20 m<br>27 m<br>31 m<br>39 m | 24 m<br>31 m<br>34 m<br>41 m |
| 5   | Acrylonitril    | Lek, 20mm,                                          | LBW (192 ppm)<br>AGW (105 ppm)<br>1% letaliteit (toxisch, ca 110 ppm)                                            | 84 m<br>120 m<br>96 m        | 176 m<br>292 m<br>194 m      |
| 7   | ADR klasse 4.3  | Ontstaan brandbare gassen in container              | LEL afstand waterstof (40.000 ppm)                                                                               | 8 m                          | 4 m                          |

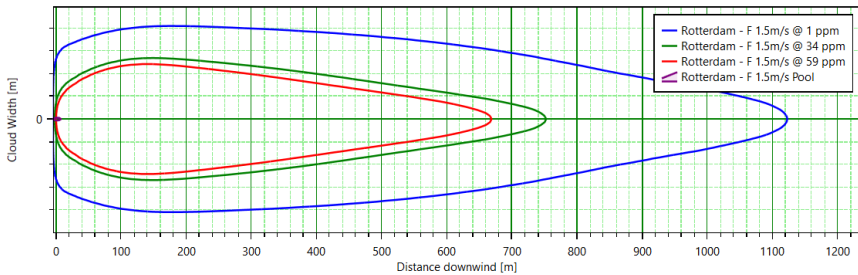
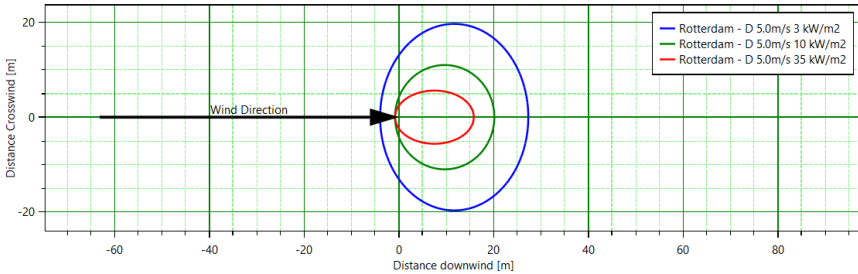
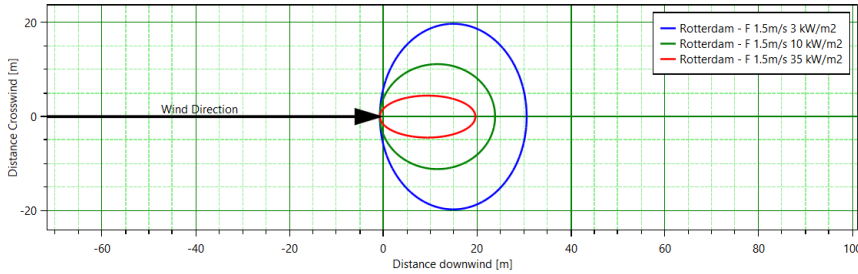
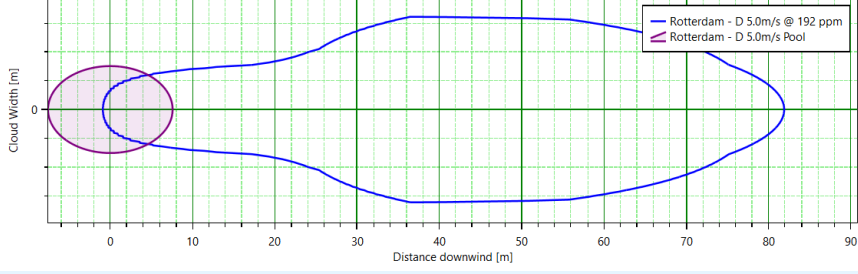
\* Scenario's 1 en 6 zijn niet geschikt voor Safeti en daarom niet uitgewerkt in deze notitie

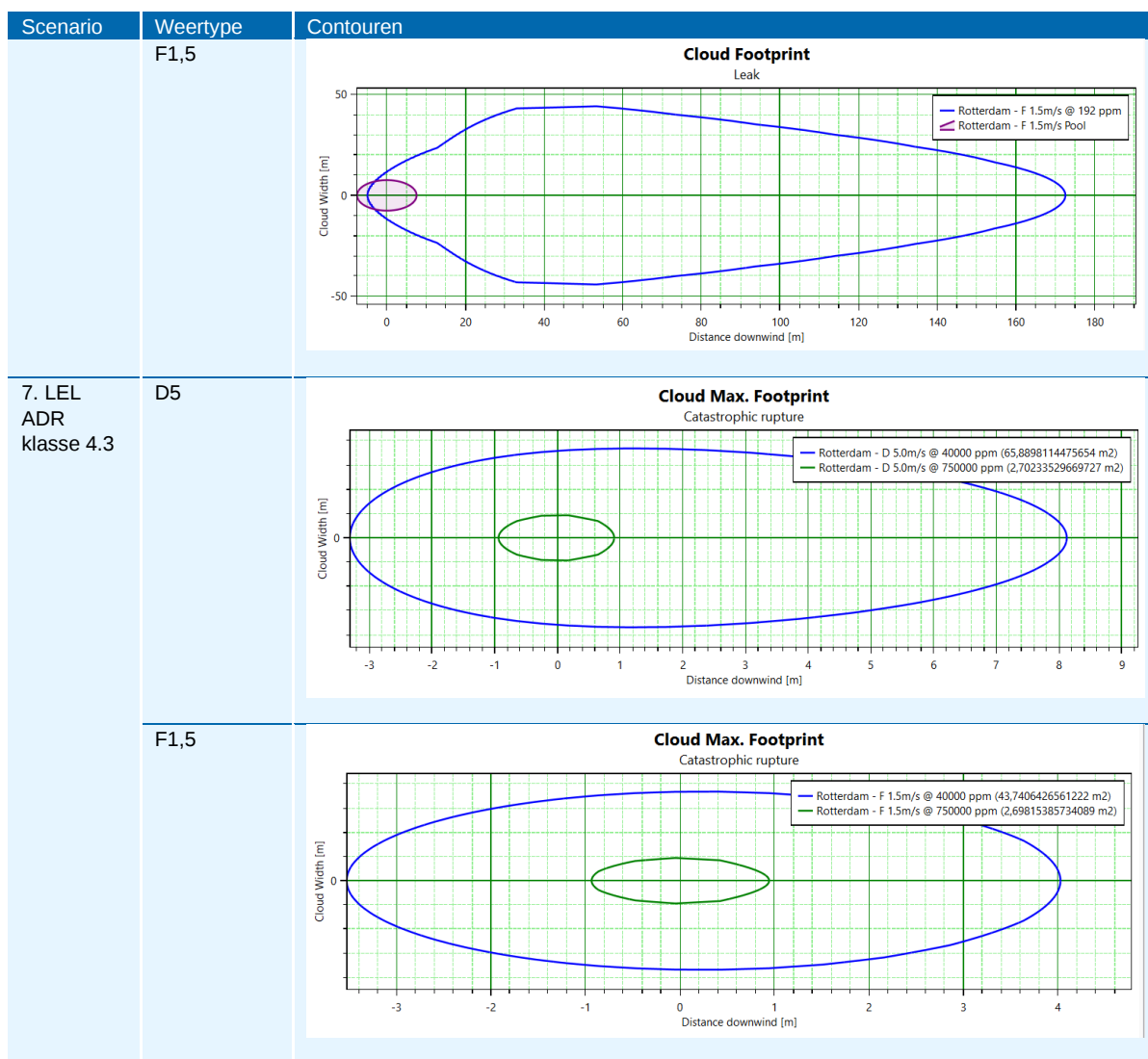
## 2. Toelichting afstanden

De in tabel 1 opgenomen waarden zijn zoals Safeti 8.21 deze genereert, afgerond op hele getallen. De afstanden zijn representatief in de windrichting en in de richting van de uitstroming. Voor andere richtingen gelden kleinere afstanden, die per scenario sterk verschillen. In tabel 2 zijn de afstanden per richting geïllustreerd. De effecten bij een plasbrand zijn in alle richtingen bijna hetzelfde, terwijl voor een toxische wolk de verschillen in afstand tussen weertype D5 en F1,5 het grootst zijn. De schaal verschilt per figuur, waardoor verschillen -zeker bij toxische wolken- minder opvallen. De afstanden in tabel 1 zijn de afstand van de oorsprong naar rechts (met wind mee).

**tabel 2: contouren per scenario**

| Scenario                           | Weertype | Contouren                                                 |
|------------------------------------|----------|-----------------------------------------------------------|
| 2. Plasbrand<br>Propyleen<br>oxide | D5       | <p><b>Intensity Radii for Late Pool Fire</b><br/>Leak</p> |
|                                    | F1,5     | <p><b>Intensity Radii for Late Pool Fire</b><br/>Leak</p> |
| 3. Lek IBC<br>HF                   | D5       | <p><b>Cloud Footprint</b><br/>Fixed duration release</p>  |

| Scenario               | Weertype | Contouren                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                        | F1,5     | <p><b>Cloud Footprint</b><br/>Fixed duration release</p>  <p>Cloud Width [m]</p> <p>Distance downwind [m]</p> <ul style="list-style-type: none"> <li>Rotterdam - F 1.5m/s @ 1 ppm</li> <li>Rotterdam - F 1.5m/s @ 34 ppm</li> <li>Rotterdam - F 1.5m/s @ 59 ppm</li> <li>Rotterdam - F 1.5m/s Pool</li> </ul>                         |
| 4. Fakkelt<br>Propaan  | D5       | <p><b>Intensity Radii for Jet Fire</b><br/>Leak</p>  <p>Distance Crosswind [m]</p> <p>Distance downwind [m]</p> <p>Wind Direction</p> <ul style="list-style-type: none"> <li>Rotterdam - D 5.0m/s 3 kW/m<sup>2</sup></li> <li>Rotterdam - D 5.0m/s 10 kW/m<sup>2</sup></li> <li>Rotterdam - D 5.0m/s 35 kW/m<sup>2</sup></li> </ul>  |
|                        | F1,5     | <p><b>Intensity Radii for Jet Fire</b><br/>Leak</p>  <p>Distance Crosswind [m]</p> <p>Distance downwind [m]</p> <p>Wind Direction</p> <ul style="list-style-type: none"> <li>Rotterdam - F 1.5m/s 3 kW/m<sup>2</sup></li> <li>Rotterdam - F 1.5m/s 10 kW/m<sup>2</sup></li> <li>Rotterdam - F 1.5m/s 35 kW/m<sup>2</sup></li> </ul> |
| 5. Lek<br>Acrylonitril | D5       | <p><b>Cloud Footprint</b><br/>Leak</p>  <p>Cloud Width [m]</p> <p>Distance downwind [m]</p> <ul style="list-style-type: none"> <li>Rotterdam - D 5.0m/s @ 192 ppm</li> <li>Rotterdam - D 5.0m/s Pool</li> </ul>                                                                                                                     |



De berekende scenario's hoeven niet per se de scenario's met de grootste effectafstanden te zijn. Letaliteitsafstanden kunnen groter of kleiner zijn wanneer een scenario op een andere (maar bijvoorbeeld minder waarschijnlijke) manier verloopt:

- Naast de AGW (alarmeringsgrenswaarde) en LBW (levensbedreigende waarde) van 30 minuten zijn ook concentraties vastgelegd voor een blootstelling van 10 minuten en van een uur. Dit zijn hogere respectievelijk lagere concentraties en daarbij horen kleinere respectievelijk grotere afstanden.
- De LEL (Lower Explosive Limit) geeft de minimale concentratie aan waarbij een wolk met een brandbaar gas kan ontsteken. Mocht een wolk ontsteken en een wolkbrand ontstaan, dan zijn de letale effecten enkele meters buiten deze wolkbrand en verder dan de aangegeven afstand.

### 3. Uitgangspunten

De berekeningen sluiten zoveel mogelijk aan op de QRA die Adviesbureau de Haan voor WBT heeft uitgevoerd. Daarnaast zijn een aantal uitgangspunten begrensd of voorgeselecteerd in Safeti-NL:

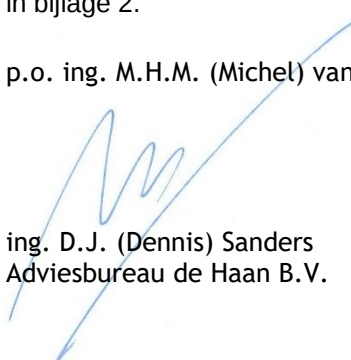
- We gaan net als in de QRA uit van de weersgegevens van Rotterdam en een ruwheid van 0,3 m.
- De berekeningen zijn uitgevoerd met de parameterset voor de nachtperiode.
- We hanteren zoveel mogelijk de gegevens zoals opgenomen in Safeti-NL versie 8.21. In Safeti zijn AGW en LBW opgenomen voor een halfuur blootstelling. Er zijn ook AGWs en LBWs voor 10 minuten en voor een uur.
- Resultaten zijn op 1 m hoogte.

Safeti-NL stopt met rekenen bij de 1% letaliteitsafstand van  $3 \text{ kW/m}^2$ . Door het model voor brandbare scenario's in te stellen op een vaste afstand van 100 meter, rekent het model door tot 100 meter van de risicobron. Op deze wijze genereert het model ook een afstand met  $2 \text{ kW/m}^2$  en  $1 \text{ kW/m}^2$ .

Voor zowel waterstoffluoride als acrylonitril hebben we gerekend met parameter rainout equilibrium. In een aantal verspreidingsberekeningen voor waterstoffluoride geeft Safeti-NL een foutmelding. De instelling 'parameter rainout equilibrium' onderdrukt deze foutmelding, maar is van invloed op de berekende concentraties. Berekende afstanden zijn met deze instelling circa 30% groter dan zonder deze instelling. Door deze instelling op alle scenario's met toxische stoffen toe te passen is deze benadering consistent.

De scenario specifieke uitgangspunten zijn vastgelegd in bijlage 1. Het gaat hierbij om uitstroombesonderheden de omvang daarvan en de plasgrootte. De volledige modelinvoer is opgenomen in bijlage 2.

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ing. D.J. (Dennis) Sanders  
Adviesbureau de Haan B.V.

## Bijlage 1

Titel

Uitgangspunten per scenario

|                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Scenario 2:</b>    | Plasbrand, berekening 10, 3, 2 en 1 kW/m <sup>2</sup> warmtestraling bij weertype D5 en F1,5                                                                                                                                                                                                                                                                                                                                                                      |
| Aangegeven informatie | Stof: propyleen oxide<br>Uitstroom: tankcontainer 20 ton, gat van 20 mm, continue uitstroming<br>Atmosferische omstandigheden<br>Uitstroom op verhard terrein zonder oppervlaktebeperking – maximaal oppervlak 180 m <sup>2</sup>                                                                                                                                                                                                                                 |
| Aanvullingen          | <ul style="list-style-type: none"> <li>We rekenen met de gegevens van 1,2 propyleen oxide zoals opgenomen in Safeti 8.21.</li> <li>Het oppervlak van de plas is beperkt tot 180 m<sup>2</sup></li> <li>Tank head: 2m – representatief voor een tankcontainer. Deze is van invloed op de hoeveelheid uitstromende vloeistof</li> <li>We gaan uit van de vertraagde ontsteking: in dit geval is de plas 180 m<sup>2</sup> wanneer de plasbrand optreedt.</li> </ul> |

|                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Scenario 3:</b>    | toxische plas (lekkage van 1 ICB waterstoffluoride 70%), berekening AGW en LBW bij weertype D5 en F1,5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Aangegeven informatie | Leegstromen in 10 minuten<br>Atmosferische omstandigheden<br>Uitstroom op verhard terrein zonder oppervlaktebeperking – maximaal oppervlak 180 m <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Aanvullingen          | <ul style="list-style-type: none"> <li>We rekenen met zuivere HF zoals opgenomen in Safeti 8.21. De AGW is 34 ppm, de LBW is 59 ppm. Dit komt overeen met de alarmeringsgrenswaarde en levensbedreigende waarde voor 30 minuten: 29 µg/m<sup>3</sup> en 51 µg/m<sup>3</sup></li> <li>We gaan uit van een IBC met een inhoud van 1 m<sup>3</sup></li> <li>Het oppervlak is beperkt tot 180m<sup>2</sup></li> <li>Tank head: 1 m – representatief voor een IBC. Bij uitstroming in 10 minuten is de invloed van de vloeistofkolom (tank head) marginaal</li> <li>We gaan uit van uitpandig vrijkomen.</li> <li>HF is zodanig vluchtig dat het standaard pakket van Safeti 8.21 een foutmelding geeft (UDM3 189). Omdat deze foutmelding inmiddels veelvuldig is ontstaan, heeft het RIVM een model met aangepaste instellingen (liquid rainout equilibrium) beschikbaar gesteld waarin enkele instellingen zijn aangepast en deze fout wordt onderdrukt. We rekenen met het model met de aangepaste instellingen.</li> </ul> |

|                       |                                                                                                                                                                                                                                                                                                                               |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Scenario 4:</b>    | lekkage tankcontainer propaan, berekening 10, 3, 2 en 1 kW/m <sup>2</sup> warmtestraling bij weertype D5 en F1,5                                                                                                                                                                                                              |
| Aangegeven informatie | gat van 10 mm, fakkelbrand                                                                                                                                                                                                                                                                                                    |
| Aanvullingen          | <ul style="list-style-type: none"> <li>We rekenen met de gegevens van propaan zoals opgenomen in Safeti 8.21.</li> <li>We gaan uit van een tot vloeistof verdicht gas (saturated liquid), 5,4 bar overdruk.</li> <li>Tank head: 2 m – representatief voor een tankcontainer. Deze is van invloed op de uitstroming</li> </ul> |

|                       |                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Scenario 5:</b>    | lekkage van tankcontainer acrylnitril (20 ton), berekening AGW en LBW bij weertype D5 en F1,5                                                                                                                                                                                                                                                                                                |
| Aangegeven informatie | gat van 20mm, continue uitstroming),<br>Atmosferische omstandigheden<br>Uitstroom op verhard terrein zonder oppervlaktebeperking – maximaal oppervlak 180m <sup>2</sup>                                                                                                                                                                                                                      |
| Aanvullingen          | <p>We rekenen met de gegevens van acrylnitril zoals opgenomen in Safeti 8.21: AGW = 105 ppm, LBW = 192 ppm. Dit komt overeen met de alarmeringsgrenswaarde en levensbedreigende waarde voor 30 minuten: 240 µg/m<sup>3</sup> en 440 µg/m<sup>3</sup></p> <p>We gaan uit van een tot vloeistofkolom van 2 m, representatief voor een tankcontainer. Deze is van invloed op de uitstroming</p> |

|                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Scenario 7:</b>    | ADR 4.3 – ontstaan van brandbare dampen, berekenen LEL afstand bij weertype D5 en F1,5                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Aangegeven informatie | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Aanvullingen          | <ul style="list-style-type: none"> <li>Een stof uit ADR klasse 4.3 reageert met water tot een brandbaar gas. Meestal ontleedt daarbij water en ontstaat waterstof. Bijvoorbeeld in geval van Kalium (VN 2257) dat reageert tot kaliumoxide en waterstof.</li> <li>We gaan bij deze berekening uit dat in een boxcontainer kalium nat is geworden en de gehele boxcontainer (1 TEU, 6 x 2 x 2 = 24 m<sup>3</sup>) vol met waterstof komt onder atmosferische druk. Waterstof heeft een LEL van 40.000 ppm.</li> </ul> |

**Bijlage 2**

Titel

Modelinvoer

# Input Report

## Workspace: Effectafstanden

### Study

Study

Effectafstanden

| Tab                        | Group                       | Field                                  | Value                   | Units |
|----------------------------|-----------------------------|----------------------------------------|-------------------------|-------|
| Bund, building and terrain | Terrain and bund definition | Type of terrain for dispersion         | Land                    |       |
|                            |                             | Type of pool substrate and bunds       | Concrete, no bund       |       |
| Toxic parameters           | Indoor toxic calculations   | Specify the downwind building type     | Unselected              |       |
|                            |                             | Building type (downwind building type) | Buildings\Building type |       |
| Dispersion                 | Distances of interest       | Distances of interest                  |                         | m     |

### scenario 2: tank propylenoxide

Atmospheric storage tank

Effectafstanden\Study

| Tab      | Group                         | Field                                      | Value                                | Units    |
|----------|-------------------------------|--------------------------------------------|--------------------------------------|----------|
| Material | Material                      | Material                                   | 1,2-PROPYLENE OXIDE                  |          |
|          |                               | Specify volume inventory?                  | No                                   |          |
|          |                               | Mass inventory                             | 20000                                | kg       |
|          |                               | Volume inventory                           | 23,7516                              | m3       |
|          |                               | Material to track                          | 1,2-PROPYLENE OXIDE                  |          |
|          |                               | Type of risk effects to model              | Flammable only                       |          |
|          | Phase                         | Specified condition                        | Temperature and atmospheric pressure |          |
|          |                               | Temperature                                | 10                                   | degC     |
|          |                               | Pressure (gauge)                           |                                      | bar      |
|          |                               | Fluid state                                | Liquid                               |          |
|          |                               | Liquid mole fraction                       | 1                                    | fraction |
| Risk     | Type of risk effects to model | Jet fire modelling for horizontal releases | Horizontal jet only                  |          |
|          |                               | Reduce risks for mounded / underground     | No                                   |          |



tanks

|                       |                                                   |                                        |                                      |          |
|-----------------------|---------------------------------------------------|----------------------------------------|--------------------------------------|----------|
|                       | Non-ignition probabilities                        | Specify probability of non-ignition    | Calculate non-ignition probability   |          |
|                       |                                                   | Non-ignition probability               |                                      | fraction |
|                       | Immediate ignition probabilities                  | Probability of immediate ignition      | Stationary - use material reactivity |          |
|                       |                                                   | Immediate ignition probability         |                                      | fraction |
| Scenario              | Pipe dimensions                                   | Pipe length                            |                                      | m        |
|                       | Release location                                  | Elevation                              | 1                                    | m        |
|                       |                                                   | Tank head                              | 2                                    | m        |
|                       | Direction                                         | Outdoor release direction              | Horizontal                           |          |
|                       |                                                   | Outdoor release angle                  | 0                                    | deg      |
| Short pipe            | Pipe characteristics                              | Pipe roughness                         | 0,045                                | mm       |
|                       | Frequencies                                       | Frequency of bends in pipe             | 0                                    | /m       |
|                       |                                                   | Frequency of couplings in pipe         | 0                                    | /m       |
|                       |                                                   | Frequency of junctions in pipe         | 0                                    | /m       |
|                       | Frequencies of valves                             | Frequency of excess flow valves        | 0                                    | /m       |
|                       |                                                   | Frequency of non-return valves         | 0                                    | /m       |
|                       |                                                   | Frequency of shut-off valves           | 0                                    | /m       |
|                       | Velocity head losses                              | Excess flow valve velocity head losses | 0                                    |          |
|                       |                                                   | Non-return valve velocity head losses  | 0                                    |          |
|                       |                                                   | Shut-off valve velocity head losses    | 0                                    |          |
| Time varying releases | Modelling of time-varying leaks and line ruptures | Vacuum relief valve                    | Operating                            |          |
|                       |                                                   | Vacuum relief valve set point          | 0                                    | bar      |
|                       | Inventory data for time-varying releases          | Tank volume                            | 23,7516                              | m3       |
|                       |                                                   | Tank vapour volume                     | 0                                    | m3       |
|                       |                                                   | Tank liquid volume                     | 23,7516                              | m3       |
|                       |                                                   | Tank liquid level                      | 0                                    | m        |
|                       |                                                   | Maximum vapour release height          |                                      | m        |
|                       |                                                   | Minimum mass inventory                 | 0,1                                  | kg       |
|                       |                                                   | Maximum mass inventory                 | 1E+09                                | kg       |
| Dispersion            | Dispersion scope                                  | Concentration of interest              |                                      | ppm      |

|                            |                             |                                              |             |     |
|----------------------------|-----------------------------|----------------------------------------------|-------------|-----|
|                            |                             | Averaging time for concentration of interest |             |     |
|                            |                             | Specify user-defined averaging time          | No          |     |
|                            |                             | User defined averaging time                  |             |     |
|                            | Distances of interest       | Distances of interest                        | 100         | m   |
|                            |                             | Averaging time for reports                   |             |     |
|                            |                             | NLIV [1 hr]                                  | No          |     |
|                            |                             | IDLH [30 mins]                               | No          |     |
|                            |                             | STEL [15 mins]                               |             |     |
|                            |                             |                                              | No          |     |
| Bund, building and terrain | Terrain and bund definition | Type of terrain for dispersion               | Land        |     |
|                            |                             | Type of pool substrate and bunds             | Beton 180m2 |     |
|                            | Building definition         | Release building                             |             |     |
|                            |                             | In-building release?                         |             |     |
|                            |                             |                                              | Outdoor     |     |
|                            |                             | Building wake effect                         | Roof/lee    |     |
|                            |                             | Wind or release angle from North             |             |     |
|                            |                             |                                              | 0           | deg |
|                            |                             | Handling of droplets                         | Trapped     |     |
|                            |                             | Indoor mass modification factor              |             |     |
|                            |                             |                                              | 3           |     |
| Geometry                   | Geometry                    | East                                         | 75950       | m   |
|                            |                             | North                                        | 432850      | m   |
|                            |                             | Apply location offset                        | No          |     |

## Leak

Leak

Effectafstanden\Study\scenario 2: tank propylenoxide

| Tab      | Group            | Field                                | Value      | Units    |
|----------|------------------|--------------------------------------|------------|----------|
| Scenario | Hole             | Orifice diameter                     | 20         | mm       |
|          |                  | Use specified discharge coefficient? | No         |          |
|          |                  | Discharge coefficient                |            |          |
|          |                  |                                      |            | fraction |
|          | Release location | Elevation                            | 1          | m        |
|          |                  | Tank head                            |            |          |
|          |                  |                                      | 2          | m        |
|          | Direction        | Outdoor release direction            | Horizontal |          |
|          |                  | Outdoor release angle                |            |          |
|          |                  |                                      | 0          | deg      |
| Risk     | Event frequency  | Event frequency                      | 1E-05      | / AvgeY  |



|            |                                  |                                              |                                      |          |
|------------|----------------------------------|----------------------------------------------|--------------------------------------|----------|
|            | Type of risk effects to model    | Reduce risks for mounded / underground tanks | No                                   | ear      |
|            | Non-ignition probabilities       | Specify probability of non-ignition          | Calculate non-ignition probability   |          |
|            |                                  | Non-ignition probability                     |                                      | fraction |
|            | Immediate ignition probabilities | Probability of immediate ignition            | Stationary - use material reactivity |          |
|            |                                  | Immediate ignition probability               |                                      | fraction |
| Material   | Material                         | Material characteristics                     | Toxic and flammable                  |          |
|            |                                  | Material to track                            | 1,2-PROPYLENE OXIDE                  |          |
|            |                                  | Type of risk effects to model                | Flammable only                       |          |
|            | Phase                            | Phase to be released                         | Liquid                               |          |
| Dispersion | Dispersion scope                 | Concentration of interest                    |                                      | ppm      |
|            |                                  | Averaging time for concentration of interest |                                      |          |
|            |                                  | Specify user-defined averaging time          | No                                   |          |
|            |                                  | User defined averaging time                  |                                      | s        |
|            | Distances of interest            | Distances of interest                        | 100                                  | m        |
|            | Averaging time for reports       | NLIV [1 hr]                                  | No                                   |          |
|            |                                  | IDLH [30 mins]                               | No                                   |          |
|            |                                  | STEL [15 mins]                               | No                                   |          |

## scenario 4: fakkelt propaan

Pressure vessel

Effectafstanden\Study

| Tab      | Group    | Field                         | Value                    | Units |
|----------|----------|-------------------------------|--------------------------|-------|
| Material | Material | Material                      | PROPANE                  |       |
|          |          | Specify volume inventory?     | Yes                      |       |
|          |          | Mass inventory                | 10281,4                  | kg    |
|          |          | Volume inventory              | 20                       | m3    |
|          |          | Material to track             | PROPANE                  |       |
|          |          | Type of risk effects to model | Flammable only           |       |
|          | Phase    | Specified condition           | Temperature/bubble point |       |



|                       |                                                   |                                              |                                      |          |
|-----------------------|---------------------------------------------------|----------------------------------------------|--------------------------------------|----------|
|                       |                                                   | Temperature                                  | 9,99999                              | degC     |
|                       |                                                   | Pressure (gauge)                             | 5,35777                              | bar      |
|                       |                                                   | Fluid state                                  | Liquid                               |          |
|                       |                                                   | Liquid mole fraction                         | 1                                    | fraction |
| Risk                  | Type of risk effects to model                     | Jet fire modelling for horizontal releases   | Horizontal jet only                  |          |
|                       |                                                   | Reduce risks for mounded / underground tanks | No                                   |          |
|                       | Non-ignition probabilities                        | Specify probability of non-ignition          | Calculate non-ignition probability   |          |
|                       |                                                   | Non-ignition probability                     |                                      | fraction |
|                       | Immediate ignition probabilities                  | Probability of immediate ignition            | Stationary - use material reactivity |          |
|                       |                                                   | Immediate ignition probability               |                                      | fraction |
| Scenario              | Pipe dimensions                                   | Pipe length                                  |                                      | m        |
|                       | Release location                                  | Elevation                                    | 1                                    | m        |
|                       |                                                   | Tank head                                    | 0                                    | m        |
|                       | Direction                                         | Outdoor release direction                    | Horizontal                           |          |
|                       |                                                   | Outdoor release angle                        | 0                                    | deg      |
| Short pipe            | Pipe characteristics                              | Pipe roughness                               | 0,045                                | mm       |
|                       | Frequencies                                       | Frequency of bends in pipe                   | 0                                    | /m       |
|                       |                                                   | Frequency of couplings in pipe               | 0                                    | /m       |
|                       |                                                   | Frequency of junctions in pipe               | 0                                    | /m       |
|                       | Frequencies of valves                             | Frequency of excess flow valves              | 0                                    | /m       |
|                       |                                                   | Frequency of non-return valves               | 0                                    | /m       |
|                       |                                                   | Frequency of shut-off valves                 | 0                                    | /m       |
|                       | Velocity head losses                              | Excess flow valve velocity head losses       | 0                                    |          |
|                       |                                                   | Non-return valve velocity head losses        | 0                                    |          |
|                       |                                                   | Shut-off valve velocity head losses          | 0                                    |          |
| Time varying releases | Modelling of time-varying leaks and line ruptures | Vacuum relief valve                          | Operating                            |          |
|                       |                                                   | Vacuum relief valve set point                | 0                                    | bar      |
|                       | Inventory data for time-varying releases          | Tank volume                                  | 20                                   | m3       |
|                       |                                                   | Tank vapour volume                           | 0                                    | m3       |

|                            |                                                   |                                                  |                   |                |
|----------------------------|---------------------------------------------------|--------------------------------------------------|-------------------|----------------|
|                            |                                                   | Tank liquid volume                               | 20                | m <sup>3</sup> |
|                            |                                                   | Tank liquid level                                | 0                 | m              |
|                            |                                                   | Maximum vapour release height                    |                   | m              |
|                            |                                                   | Minimum mass inventory                           | 0,1               | kg             |
|                            |                                                   | Maximum mass inventory                           | 1E+09             | kg             |
|                            | Safety system modelling for time-varying releases | Safety system modelling (isolation and blowdown) | No                |                |
| Dispersion                 | Dispersion scope                                  | Concentration of interest                        |                   | ppm            |
|                            |                                                   | Averaging time for concentration of interest     |                   |                |
|                            |                                                   | Specify user-defined averaging time              | No                |                |
|                            |                                                   | User defined averaging time                      |                   | s              |
|                            | Distances of interest                             | Distances of interest                            | 100               | m              |
|                            | Averaging time for reports                        | NLIV [1 hr]                                      | No                |                |
|                            |                                                   | IDLH [30 mins]                                   | No                |                |
|                            |                                                   | STEL [15 mins]                                   | No                |                |
| Bund, building and terrain | Terrain and bund definition                       | Type of terrain for dispersion                   | Land              |                |
|                            |                                                   | Type of pool substrate and bunds                 | Concrete, no bund |                |
|                            | Building definition                               | Release building                                 |                   |                |
|                            |                                                   | In-building release?                             | Outdoor           |                |
|                            |                                                   | Building wake effect                             | Roof/lee          |                |
|                            |                                                   | Wind or release angle from North                 | 0                 | deg            |
|                            |                                                   | Handling of droplets                             | Trapped           |                |
|                            |                                                   | Indoor mass modification factor                  | 3                 |                |
| Geometry                   | Geometry                                          | East                                             | 75950             | m              |
|                            |                                                   | North                                            | 432850            | m              |
|                            |                                                   | Apply location offset                            | No                |                |

## Leak

Leak

Effectafstanden\Study\scenario 4: fakkel propaan

| Tab      | Group | Field            | Value | Units |
|----------|-------|------------------|-------|-------|
| Scenario | Hole  | Orifice diameter | 10    | mm    |



|            |                                  |                                              |                                    |           |
|------------|----------------------------------|----------------------------------------------|------------------------------------|-----------|
|            |                                  | Use specified discharge coefficient?         | No                                 |           |
|            |                                  | Discharge coefficient                        |                                    | fraction  |
|            | Release location                 | Elevation                                    | 1                                  | m         |
|            |                                  | Tank head                                    | 2                                  | m         |
|            | Direction                        | Outdoor release direction                    | Horizontal                         |           |
|            |                                  | Outdoor release angle                        | 0                                  | deg       |
| Risk       | Event frequency                  | Event frequency                              | 1E-05                              | / AveYear |
|            | Type of risk effects to model    | Reduce risks for mounded / underground tanks | No                                 |           |
|            | Non-ignition probabilities       | Specify probability of non-ignition          | Calculate non-ignition probability |           |
|            |                                  | Non-ignition probability                     |                                    | fraction  |
|            | Immediate ignition probabilities | Probability of immediate ignition            | Transport - Road tanker            |           |
|            |                                  | Immediate ignition probability               |                                    | fraction  |
| Material   | Material                         | Material characteristics                     | Flammable only                     |           |
|            |                                  | Material to track                            | PROPANE                            |           |
|            |                                  | Type of risk effects to model                | Flammable only                     |           |
|            | Phase                            | Phase to be released                         | Liquid                             |           |
| Dispersion | Dispersion scope                 | Concentration of interest                    |                                    | ppm       |
|            |                                  | Averaging time for concentration of interest |                                    |           |
|            |                                  | Specify user-defined averaging time          | No                                 |           |
|            |                                  | User defined averaging time                  |                                    | s         |
|            | Distances of interest            | Distances of interest                        | 100                                | m         |
|            | Averaging time for reports       | NLIV [1 hr]                                  | No                                 |           |
|            |                                  | IDLH [30 mins]                               | No                                 |           |
|            |                                  | STEL [15 mins]                               | No                                 |           |

## scenario 7: ADR klasse 4.3

Pressure vessel

Effectafstanden\Study

| Tab | Group | Field | Value | Units |
|-----|-------|-------|-------|-------|
|-----|-------|-------|-------|-------|



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|            |                                  |                                              |                                      |          |
|------------|----------------------------------|----------------------------------------------|--------------------------------------|----------|
| Material   | Material                         | Material                                     | HYDROGEN                             |          |
|            |                                  | Specify volume inventory?                    | Yes                                  |          |
|            |                                  | Mass inventory                               | 2,10588                              | kg       |
|            |                                  | Volume inventory                             | 24                                   | m3       |
|            |                                  | Material to track                            | HYDROGEN                             |          |
|            |                                  | Type of risk effects to model                | Flammable only                       |          |
|            | Phase                            | Specified condition                          | Pressure/temperature                 |          |
|            |                                  | Temperature                                  | 10                                   | degC     |
|            |                                  | Pressure (gauge)                             | 0,01                                 | bar      |
|            |                                  | Fluid state                                  | Vapour                               |          |
|            |                                  | Liquid mole fraction                         | 0                                    | fraction |
| Risk       | Type of risk effects to model    | Jet fire modelling for horizontal releases   | Horizontal jet only                  |          |
|            |                                  | Reduce risks for mounded / underground tanks | No                                   |          |
|            | Non-ignition probabilities       | Specify probability of non-ignition          | Calculate non-ignition probability   |          |
|            |                                  | Non-ignition probability                     |                                      | fraction |
|            | Immediate ignition probabilities | Probability of immediate ignition            | Stationary - use material reactivity |          |
|            |                                  | Immediate ignition probability               |                                      | fraction |
| Scenario   | Pipe dimensions                  | Pipe length                                  |                                      | m        |
|            | Release location                 | Elevation                                    | 1                                    | m        |
|            |                                  | Tank head                                    | 0                                    | m        |
|            | Direction                        | Outdoor release direction                    | Horizontal                           |          |
|            |                                  | Outdoor release angle                        | 0                                    | deg      |
| Short pipe | Pipe characteristics             | Pipe roughness                               | 0,045                                | mm       |
|            | Frequencies                      | Frequency of bends in pipe                   | 0                                    | /m       |
|            |                                  | Frequency of couplings in pipe               | 0                                    | /m       |
|            |                                  | Frequency of junctions in pipe               | 0                                    | /m       |
|            | Frequencies of valves            | Frequency of excess flow valves              | 0                                    | /m       |
|            |                                  | Frequency of non-return valves               | 0                                    | /m       |
|            |                                  | Frequency of shut-off valves                 | 0                                    | /m       |
|            | Velocity head losses             | Excess flow valve velocity head losses       | 0                                    |          |

|                                  |                                                      |                                                     |                   |     |
|----------------------------------|------------------------------------------------------|-----------------------------------------------------|-------------------|-----|
|                                  |                                                      | Non-return valve velocity head losses               | 0                 |     |
|                                  |                                                      | Shut-off valve velocity head losses                 | 0                 |     |
| Time<br>varying<br>releases      | Modelling of time-varying<br>leaks and line ruptures | Vacuum relief valve                                 | Operating         |     |
|                                  |                                                      | Vacuum relief valve set point                       | 0                 | bar |
|                                  | Inventory data for time-<br>varying releases         | Tank volume                                         | 24                | m3  |
|                                  |                                                      | Tank vapour volume                                  | 24                | m3  |
|                                  |                                                      | Tank liquid volume                                  | 0                 | m3  |
|                                  |                                                      | Tank liquid level                                   | 0                 | m   |
|                                  |                                                      | Maximum vapour release height                       |                   | m   |
|                                  |                                                      | Minimum mass inventory                              | 0,1               | kg  |
|                                  |                                                      | Maximum mass inventory                              | 1E+09             | kg  |
|                                  | Safety system modelling<br>for time-varying releases | Safety system modelling (isolation and<br>blowdown) | No                |     |
| Dispersion                       | Dispersion scope                                     | Concentration of interest                           |                   | ppm |
|                                  |                                                      | Averaging time for concentration of<br>interest     |                   |     |
|                                  |                                                      | Specify user-defined averaging time                 | No                |     |
|                                  |                                                      | User defined averaging time                         |                   | s   |
|                                  | Distances of interest                                | Distances of interest                               |                   | m   |
|                                  | Averaging time for reports                           | NLIV [1 hr]                                         | No                |     |
|                                  |                                                      | IDLH [30 mins]                                      | No                |     |
|                                  |                                                      | STEL [15 mins]                                      | No                |     |
| Bund,<br>building and<br>terrain | Terrain and bund definition                          | Type of terrain for dispersion                      | Land              |     |
|                                  |                                                      | Type of pool substrate and bunds                    | Concrete, no bund |     |
|                                  | Building definition                                  | Release building                                    |                   |     |
|                                  |                                                      | In-building release?                                | Outdoor           |     |
|                                  |                                                      | Building wake effect                                | Roof/lee          |     |
|                                  |                                                      | Wind or release angle from North                    | 0                 | deg |
|                                  |                                                      | Handling of droplets                                | Trapped           |     |
|                                  |                                                      | Indoor mass modification factor                     | 3                 |     |
| Geometry                         | Geometry                                             | East                                                | 75950             | m   |
|                                  |                                                      | North                                               | 432850            | m   |

Apply location offset

No

## Catastrophic rupture

Catastrophic rupture

Effectafstanden\Study\scenario 7: ADR klasse 4.3

| Tab        | Group                            | Field                                        | Value                                        | Units       |
|------------|----------------------------------|----------------------------------------------|----------------------------------------------|-------------|
| Scenario   | Release location                 | Elevation                                    | 1                                            | m           |
|            |                                  | Tank head                                    | 0                                            | m           |
|            | Fireball emissive power          | Use vessel burst pressure                    | No                                           |             |
|            |                                  | Vessel burst pressure - gauge                |                                              | bar         |
| Risk       | Event frequency                  | Event frequency                              | 1E-05                                        | / AvgeY ear |
|            |                                  | Type of risk effects to model                | Reduce risks for mounded / underground tanks | No          |
|            | Non-ignition probabilities       | Specify probability of non-ignition          | Calculate non-ignition probability           |             |
|            |                                  | Non-ignition probability                     |                                              | fraction    |
|            | Immediate ignition probabilities | Probability of immediate ignition            | Stationary - use material reactivity         |             |
|            |                                  | Immediate ignition probability               |                                              | fraction    |
| Material   | Material                         | Material characteristics                     | Flammable only                               |             |
|            |                                  | Material to track                            | HYDROGEN                                     |             |
|            |                                  | Type of risk effects to model                | Flammable only                               |             |
| Dispersion | Dispersion scope                 | Concentration of interest                    |                                              | ppm         |
|            |                                  | Averaging time for concentration of interest |                                              |             |
|            |                                  | Specify user-defined averaging time          | No                                           |             |
|            |                                  | User defined averaging time                  |                                              | s           |
|            | Distances of interest            | Distances of interest                        |                                              | m           |
|            | Averaging time for reports       | NLIV [1 hr]                                  | No                                           |             |
|            |                                  | IDLH [30 mins]                               | No                                           |             |
|            |                                  | STEL [15 mins]                               | No                                           |             |

# Input Report

## Workspace: parameter\_liquid\_rainout\_equilibrium\_HF Study

Study

parameter\_liquid\_rainout\_equilibrium\_HF

| Tab                        | Group                       | Field                                  | Value                   | Units |
|----------------------------|-----------------------------|----------------------------------------|-------------------------|-------|
| Bund, building and terrain | Terrain and bund definition | Type of terrain for dispersion         | Land                    |       |
|                            |                             | Type of pool substrate and bunds       | Concrete, no bund       |       |
| Toxic parameters           | Indoor toxic calculations   | Specify the downwind building type     | Unselected              |       |
|                            |                             | Building type (downwind building type) | Buildings\Building type |       |
| Dispersion                 | Distances of interest       | Distances of interest                  |                         | m     |

### scenario 3: waterstof fluoride

Atmospheric storage tank

parameter\_liquid\_rainout\_equilibrium\_HF\Study

| Tab      | Group                         | Field                                      | Value                                | Units    |
|----------|-------------------------------|--------------------------------------------|--------------------------------------|----------|
| Material | Material                      | Material                                   | HYDROGEN FLUORIDE                    |          |
|          |                               | Specify volume inventory?                  | Yes                                  |          |
|          |                               | Mass inventory                             | 979,061                              | kg       |
|          |                               | Volume inventory                           | 1                                    | m3       |
|          | Phase                         | Material to track                          | HYDROGEN FLUORIDE                    |          |
|          |                               | Type of risk effects to model              | Toxic only                           |          |
|          |                               | Specified condition                        | Temperature and atmospheric pressure |          |
|          |                               | Temperature                                | 10                                   | degC     |
|          |                               | Pressure (gauge)                           |                                      | bar      |
|          |                               | Fluid state                                | Liquid                               |          |
|          |                               | Liquid mole fraction                       | 1                                    | fraction |
| Risk     | Type of risk effects to model | Jet fire modelling for horizontal releases | Horizontal jet only                  |          |
|          |                               | Reduce risks for mounded / underground     | No                                   |          |



tanks

|                       |                                                   |                                        |                                      |          |
|-----------------------|---------------------------------------------------|----------------------------------------|--------------------------------------|----------|
|                       | Non-ignition probabilities                        | Specify probability of non-ignition    | Calculate non-ignition probability   |          |
|                       |                                                   | Non-ignition probability               |                                      | fraction |
|                       | Immediate ignition probabilities                  | Probability of immediate ignition      | Stationary - use material reactivity |          |
|                       |                                                   | Immediate ignition probability         |                                      | fraction |
| Scenario              | Pipe dimensions                                   | Pipe length                            |                                      | m        |
|                       | Release location                                  | Elevation                              | 1                                    | m        |
|                       |                                                   | Tank head                              | 1                                    | m        |
|                       | Direction                                         | Outdoor release direction              | Horizontal                           |          |
|                       |                                                   | Outdoor release angle                  | 0                                    | deg      |
| Short pipe            | Pipe characteristics                              | Pipe roughness                         | 0,045                                | mm       |
|                       | Frequencies                                       | Frequency of bends in pipe             | 0                                    | /m       |
|                       |                                                   | Frequency of couplings in pipe         | 0                                    | /m       |
|                       |                                                   | Frequency of junctions in pipe         | 0                                    | /m       |
|                       | Frequencies of valves                             | Frequency of excess flow valves        | 0                                    | /m       |
|                       |                                                   | Frequency of non-return valves         | 0                                    | /m       |
|                       |                                                   | Frequency of shut-off valves           | 0                                    | /m       |
|                       | Velocity head losses                              | Excess flow valve velocity head losses | 0                                    |          |
|                       |                                                   | Non-return valve velocity head losses  | 0                                    |          |
|                       |                                                   | Shut-off valve velocity head losses    | 0                                    |          |
| Time varying releases | Modelling of time-varying leaks and line ruptures | Vacuum relief valve                    | Operating                            |          |
|                       |                                                   | Vacuum relief valve set point          | 0                                    | bar      |
|                       | Inventory data for time-varying releases          | Tank volume                            | 1                                    | m3       |
|                       |                                                   | Tank vapour volume                     | 0                                    | m3       |
|                       |                                                   | Tank liquid volume                     | 1                                    | m3       |
|                       |                                                   | Tank liquid level                      | 0                                    | m        |
|                       |                                                   | Maximum vapour release height          |                                      | m        |
|                       |                                                   | Minimum mass inventory                 | 0                                    | kg       |
|                       |                                                   | Maximum mass inventory                 | 1E+09                                | kg       |
| Dispersion            | Dispersion scope                                  | Concentration of interest              | 59                                   | ppm      |

|                            |                             |                                              |              |     |
|----------------------------|-----------------------------|----------------------------------------------|--------------|-----|
|                            |                             | Averaging time for concentration of interest | User-defined |     |
|                            |                             | Specify user-defined averaging time          | Yes          |     |
|                            |                             | User defined averaging time                  | 1800         | s   |
|                            | Distances of interest       | Distances of interest                        | 600          | m   |
|                            | Averaging time for reports  | NLIV [1 hr]                                  | No           |     |
|                            |                             | IDLH [30 mins]                               | No           |     |
|                            |                             | STEL [15 mins]                               | No           |     |
| Bund, building and terrain | Terrain and bund definition | Type of terrain for dispersion               | Land         |     |
|                            |                             | Type of pool substrate and bunds             | Beton 180m2  |     |
|                            | Building definition         | Release building                             |              |     |
|                            |                             | In-building release?                         | Outdoor      |     |
|                            |                             | Building wake effect                         | Roof/lee     |     |
|                            |                             | Wind or release angle from North             | 0            | deg |
|                            |                             | Handling of droplets                         | Trapped      |     |
|                            |                             | Indoor mass modification factor              | 3            |     |
| Geometry                   | Geometry                    | East                                         | 75950        | m   |
|                            |                             | North                                        | 432850       | m   |
|                            |                             | Apply location offset                        | No           |     |

## Fixed duration release

Fixed duration release

parameter\_liquid\_rainout\_equilibrium\_HF\Study\scenario 3: waterstof fluoride

| Tab      | Group            | Field                                | Value      | Units    |
|----------|------------------|--------------------------------------|------------|----------|
| Scenario | Scenario         | Duration for fixed duration release  | 600        | s        |
|          | Hole             | Orifice diameter                     |            | mm       |
|          |                  | Use specified discharge coefficient? | No         |          |
|          |                  | Discharge coefficient                |            | fraction |
|          | Release location | Elevation                            | 1          | m        |
|          |                  | Tank head                            | 1          | m        |
|          | Direction        | Outdoor release direction            | Horizontal |          |
|          |                  | Outdoor release angle                | 0          | deg      |



| Risk       | Event frequency                  | Event frequency                              | 1E-05 / AveY ear                     |          |
|------------|----------------------------------|----------------------------------------------|--------------------------------------|----------|
|            | Type of risk effects to model    | Reduce risks for mounded / underground tanks | No                                   |          |
|            | Non-ignition probabilities       | Specify probability of non-ignition          | Calculate non-ignition probability   |          |
|            |                                  | Non-ignition probability                     |                                      | fraction |
|            | Immediate ignition probabilities | Probability of immediate ignition            | Stationary - use material reactivity |          |
|            |                                  | Immediate ignition probability               |                                      | fraction |
| Material   | Material                         | Material characteristics                     | Toxic only                           |          |
|            |                                  | Material to track                            | HYDROGEN FLUORIDE                    |          |
|            |                                  | Type of risk effects to model                | Toxic only                           |          |
|            | Phase                            | Phase to be released                         | Liquid                               |          |
| Dispersion | Dispersion scope                 | Concentration of interest                    | 59 ppm                               |          |
|            |                                  | Averaging time for concentration of interest | User-defined                         |          |
|            |                                  | Specify user-defined averaging time          | Yes                                  |          |
|            |                                  | User defined averaging time                  | 1800 s                               |          |
|            | Distances of interest            | Distances of interest                        | 200 m                                |          |
|            | Averaging time for reports       | NLIV [1 hr]                                  | No                                   |          |
|            |                                  | IDLH [30 mins]                               | No                                   |          |
|            |                                  | STEL [15 mins]                               | No                                   |          |

## scenario 5: acrylnitril

Atmospheric storage tank

parameter\_liquid\_rainout\_equilibrium\_HF\Study

| Tab      | Group    | Field                         | Value               | Units |
|----------|----------|-------------------------------|---------------------|-------|
| Material | Material | Material                      | ACRYLONITRILE       |       |
|          |          | Specify volume inventory?     | No                  |       |
|          |          | Mass inventory                | 20000               | kg    |
|          |          | Volume inventory              | 24,4497             | m3    |
|          |          | Material to track             | ACRYLONITRILE       |       |
|          |          | Type of risk effects to model | Toxic and flammable |       |



| Phase                 |                                                   | Specified condition                          | Temperature and atmospheric pressure |          |
|-----------------------|---------------------------------------------------|----------------------------------------------|--------------------------------------|----------|
|                       |                                                   | Temperature                                  | 10                                   | degC     |
|                       |                                                   | Pressure (gauge)                             |                                      | bar      |
|                       |                                                   | Fluid state                                  | Liquid                               |          |
|                       |                                                   | Liquid mole fraction                         | 1                                    | fraction |
| Risk                  | Type of risk effects to model                     | Jet fire modelling for horizontal releases   | Horizontal jet only                  |          |
|                       |                                                   | Reduce risks for mounded / underground tanks | No                                   |          |
|                       | Non-ignition probabilities                        | Specify probability of non-ignition          | Calculate non-ignition probability   |          |
|                       |                                                   | Non-ignition probability                     |                                      | fraction |
|                       | Immediate ignition probabilities                  | Probability of immediate ignition            | Stationary - use material reactivity |          |
|                       |                                                   | Immediate ignition probability               |                                      | fraction |
| Scenario              | Pipe dimensions                                   | Pipe length                                  |                                      | m        |
|                       | Release location                                  | Elevation                                    | 1                                    | m        |
|                       |                                                   | Tank head                                    | 2                                    | m        |
|                       | Direction                                         | Outdoor release direction                    | Horizontal                           |          |
|                       |                                                   | Outdoor release angle                        | 0                                    | deg      |
| Short pipe            | Pipe characteristics                              | Pipe roughness                               | 0,045                                | mm       |
|                       | Frequencies                                       | Frequency of bends in pipe                   | 0                                    | /m       |
|                       |                                                   | Frequency of couplings in pipe               | 0                                    | /m       |
|                       |                                                   | Frequency of junctions in pipe               | 0                                    | /m       |
|                       | Frequencies of valves                             | Frequency of excess flow valves              | 0                                    | /m       |
|                       |                                                   | Frequency of non-return valves               | 0                                    | /m       |
|                       |                                                   | Frequency of shut-off valves                 | 0                                    | /m       |
|                       | Velocity head losses                              | Excess flow valve velocity head losses       | 0                                    |          |
|                       |                                                   | Non-return valve velocity head losses        | 0                                    |          |
|                       |                                                   | Shut-off valve velocity head losses          | 0                                    |          |
| Time varying releases | Modelling of time-varying leaks and line ruptures | Vacuum relief valve                          | Operating                            |          |
|                       |                                                   | Vacuum relief valve set point                | 0                                    | bar      |
|                       | Inventory data for time-                          | Tank volume                                  | 24,4497                              | m3       |

## varying releases

|                            |                             |                                              |              |     |
|----------------------------|-----------------------------|----------------------------------------------|--------------|-----|
|                            |                             | Tank vapour volume                           | 0            | m3  |
|                            |                             | Tank liquid volume                           | 24,4497      | m3  |
|                            |                             | Tank liquid level                            | 0            | m   |
|                            |                             | Maximum vapour release height                |              | m   |
|                            |                             | Minimum mass inventory                       | 0            | kg  |
|                            |                             | Maximum mass inventory                       | 1E+09        | kg  |
| Dispersion                 | Dispersion scope            | Concentration of interest                    | 192          | ppm |
|                            |                             | Averaging time for concentration of interest | User-defined |     |
|                            |                             | Specify user-defined averaging time          | Yes          |     |
|                            |                             | User defined averaging time                  | 1800         | s   |
|                            | Distances of interest       | Distances of interest                        | 600          | m   |
|                            | Averaging time for reports  | NLIV [1 hr]                                  | No           |     |
|                            |                             | IDLH [30 mins]                               | No           |     |
|                            |                             | STEL [15 mins]                               | No           |     |
| Bund, building and terrain | Terrain and bund definition | Type of terrain for dispersion               | Land         |     |
|                            |                             | Type of pool substrate and bunds             | Beton 180m2  |     |
|                            | Building definition         | Release building                             |              |     |
|                            |                             | In-building release?                         | Outdoor      |     |
|                            |                             | Building wake effect                         | Roof/lee     |     |
|                            |                             | Wind or release angle from North             | 0            | deg |
|                            |                             | Handling of droplets                         | Trapped      |     |
|                            |                             | Indoor mass modification factor              | 3            |     |
| Geometry                   | Geometry                    | East                                         | 75950        | m   |
|                            |                             | North                                        | 432850       | m   |
|                            |                             | Apply location offset                        | No           |     |

## Leak

Leak

parameter\_liquid\_rainout\_equilibrium\_HF\Study\scenario 5: acrylnitril

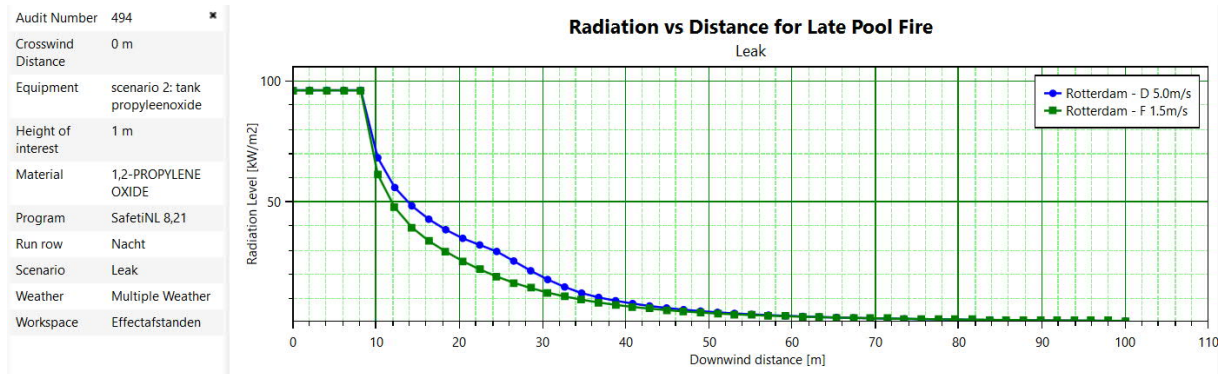
| Tab      | Group | Field            | Value | Units |
|----------|-------|------------------|-------|-------|
| Scenario | Hole  | Orifice diameter | 20    | mm    |



|            |                                  |                                              |                                      |            |
|------------|----------------------------------|----------------------------------------------|--------------------------------------|------------|
|            |                                  | Use specified discharge coefficient?         | No                                   |            |
|            |                                  | Discharge coefficient                        |                                      | fraction   |
|            | Release location                 | Elevation                                    | 1                                    | m          |
|            |                                  | Tank head                                    | 2                                    | m          |
|            | Direction                        | Outdoor release direction                    | Horizontal                           |            |
|            |                                  | Outdoor release angle                        | 0                                    | deg        |
| Risk       | Event frequency                  | Event frequency                              | 1E-05                                | / AveY ear |
|            | Type of risk effects to model    | Reduce risks for mounded / underground tanks | No                                   |            |
|            | Non-ignition probabilities       | Specify probability of non-ignition          | Calculate non-ignition probability   |            |
|            |                                  | Non-ignition probability                     |                                      | fraction   |
|            | Immediate ignition probabilities | Probability of immediate ignition            | Stationary - use material reactivity |            |
|            |                                  | Immediate ignition probability               |                                      | fraction   |
| Material   | Material                         | Material characteristics                     | Toxic and flammable                  |            |
|            |                                  | Material to track                            | ACRYLONITRILE                        |            |
|            |                                  | Type of risk effects to model                | Toxic and flammable                  |            |
|            | Phase                            | Phase to be released                         | Liquid                               |            |
| Dispersion | Dispersion scope                 | Concentration of interest                    | 192                                  | ppm        |
|            |                                  | Averaging time for concentration of interest | User-defined                         |            |
|            |                                  | Specify user-defined averaging time          | Yes                                  |            |
|            |                                  | User defined averaging time                  | 1800                                 | s          |
|            | Distances of interest            | Distances of interest                        | 600                                  | m          |
|            | Averaging time for reports       | NLIV [1 hr]                                  | No                                   |            |
|            |                                  | IDLH [30 mins]                               | No                                   |            |
|            |                                  | STEL [15 mins]                               | No                                   |            |

## Resultaten

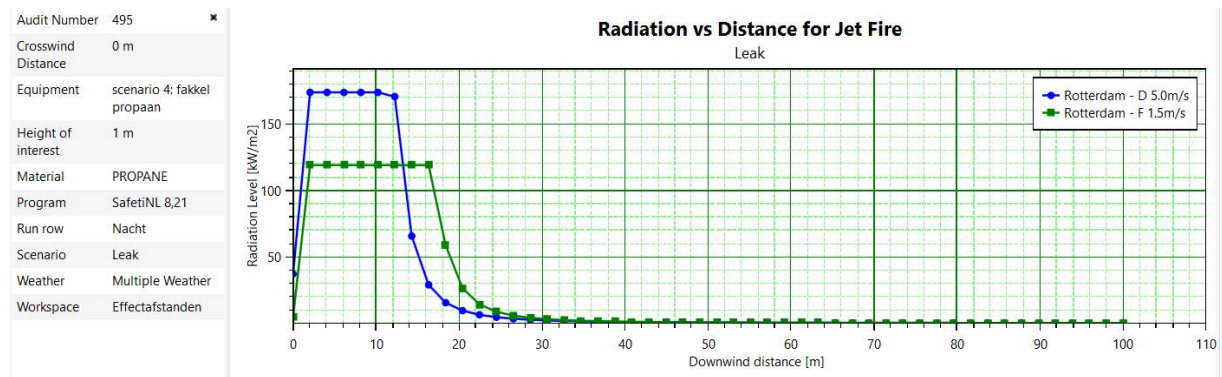
### Scenario 2: plasbrand propyleenoxide



| DownwindDistance<br>(m) | RadiationLevel<br>(kW/m²) D5 | RadiationLevel<br>(kW/m²) F1,5 |
|-------------------------|------------------------------|--------------------------------|
| 0,000                   | 96,200                       | 96,191                         |
| 2,041                   | 96,200                       | 96,191                         |
| 4,082                   | 96,200                       | 96,191                         |
| 6,122                   | 96,200                       | 96,191                         |
| 8,163                   | 96,200                       | 96,191                         |
| 10,204                  | 68,301                       | 61,301                         |
| 12,245                  | 55,989                       | 47,710                         |
| 14,286                  | 48,401                       | 39,531                         |
| 16,327                  | 42,869                       | 33,880                         |
| 18,367                  | 38,529                       | 29,469                         |
| 20,408                  | 34,951                       | 25,528                         |
| 22,449                  | 32,216                       | 22,103                         |
| 24,490                  | 29,518                       | 19,138                         |
| 26,531                  | 25,577                       | 16,582                         |
| 28,571                  | 21,549                       | 14,389                         |
| 30,612                  | 17,919                       | 12,515                         |
| 32,653                  | 14,835                       | 10,920                         |
| 34,694                  | 12,298                       | 9,564                          |
| 36,735                  | 10,514                       | 8,412                          |
| 38,776                  | 9,138                        | 7,431                          |
| 40,816                  | 7,969                        | 6,594                          |
| 42,857                  | 6,981                        | 5,877                          |
| 44,898                  | 6,147                        | 5,262                          |
| 46,939                  | 5,441                        | 4,731                          |
| 48,980                  | 4,842                        | 4,270                          |
| 51,020                  | 4,330                        | 3,870                          |
| 53,061                  | 3,891                        | 3,520                          |
| 55,102                  | 3,513                        | 3,219                          |

|         |       |       |
|---------|-------|-------|
| 57,143  | 3,185 | 2,963 |
| 59,184  | 2,899 | 2,734 |
| 61,224  | 2,648 | 2,530 |
| 63,265  | 2,428 | 2,346 |
| 65,306  | 2,234 | 2,181 |
| 67,347  | 2,061 | 2,032 |
| 69,388  | 1,907 | 1,897 |
| 71,429  | 1,769 | 1,775 |
| 73,469  | 1,645 | 1,664 |
| 75,510  | 1,534 | 1,562 |
| 77,551  | 1,433 | 1,469 |
| 79,592  | 1,342 | 1,384 |
| 81,633  | 1,259 | 1,306 |
| 83,673  | 1,183 | 1,234 |
| 85,714  | 1,114 | 1,168 |
| 87,755  | 1,050 | 1,106 |
| 89,796  | 0,992 | 1,050 |
| 91,837  | 0,938 | 0,997 |
| 93,878  | 0,889 | 0,948 |
| 95,918  | 0,843 | 0,903 |
| 97,959  | 0,800 | 0,860 |
| 100,000 | 0,761 | 0,821 |

## Scenario 4: Fakkelpropaan



tabel 1

| DownwindDistance<br>(m) | RadiationLevel<br>(kW/m <sup>2</sup> ) - D5 | RadiationLevel<br>(kW/m <sup>2</sup> ) - F1,5 |
|-------------------------|---------------------------------------------|-----------------------------------------------|
| 0,000                   | 37,077                                      | 4,744                                         |
| 2,041                   | 173,882                                     | 119,065                                       |
| 4,082                   | 173,882                                     | 119,065                                       |
| 6,122                   | 173,882                                     | 119,065                                       |
| 8,163                   | 173,882                                     | 119,065                                       |
| 10,204                  | 173,882                                     | 119,065                                       |
| 12,245                  | 170,723                                     | 119,065                                       |
| 14,286                  | 65,589                                      | 119,065                                       |
| 16,327                  | 28,818                                      | 119,065                                       |
| 18,367                  | 15,419                                      | 58,927                                        |
| 20,408                  | 9,395                                       | 26,300                                        |
| 22,449                  | 6,264                                       | 14,113                                        |
| 24,490                  | 4,456                                       | 8,567                                         |
| 26,531                  | 3,317                                       | 5,675                                         |
| 28,571                  | 2,558                                       | 4,011                                         |
| 30,612                  | 2,029                                       | 2,974                                         |
| 32,653                  | 1,646                                       | 2,285                                         |
| 34,694                  | 1,360                                       | 1,806                                         |
| 36,735                  | 1,142                                       | 1,461                                         |
| 38,776                  | 0,971                                       | 1,204                                         |
| 40,816                  | 0,836                                       | 1,009                                         |
| 42,857                  | 0,726                                       | 0,857                                         |
| 44,898                  | 0,637                                       | 0,736                                         |
| 46,939                  | 0,563                                       | 0,639                                         |
| 48,980                  | 0,501                                       | 0,559                                         |
| 51,020                  | 0,448                                       | 0,493                                         |
| 53,061                  | 0,403                                       | 0,438                                         |
| 55,102                  | 0,365                                       | 0,392                                         |
| 57,143                  | 0,331                                       | 0,352                                         |
| 59,184                  | 0,302                                       | 0,318                                         |

|         |       |       |
|---------|-------|-------|
| 61,224  | 0,277 | 0,289 |
| 63,265  | 0,254 | 0,264 |
| 65,306  | 0,235 | 0,241 |
| 67,347  | 0,217 | 0,222 |
| 69,388  | 0,201 | 0,204 |
| 71,429  | 0,187 | 0,189 |
| 73,469  | 0,174 | 0,175 |
| 75,510  | 0,163 | 0,163 |
| 77,551  | 0,153 | 0,152 |
| 79,592  | 0,143 | 0,141 |
| 81,633  | 0,134 | 0,132 |
| 83,673  | 0,127 | 0,124 |
| 85,714  | 0,119 | 0,117 |
| 87,755  | 0,113 | 0,110 |
| 89,796  | 0,107 | 0,103 |
| 91,837  | 0,101 | 0,098 |
| 93,878  | 0,096 | 0,092 |
| 95,918  | 0,091 | 0,087 |
| 97,959  | 0,087 | 0,083 |
| 100,000 | 0,082 | 0,079 |

# Consequence Summary Report

Workspace: parameter\_liquid\_rainout\_equilibrium\_HF

Study: Study

## Summary Basis

These tables will only report global values set in the parameters. Values that are modified in the study tree will not be reported.

The report is context sensitive, and filters up to the study level. You will need to generate multiple summary reports if you have multiple studies in your workspace.

## Discharge Results (after atmospheric expansion)

| Path                                 | Scenario               | Weather              | Peak Flowrate [kg/s] | Temperature [degC] | Liquid mass fraction in material [fraction] | Droplet diameter [um] | Expanded diameter [m] | Velocity [m/s] | End time of release [s] |
|--------------------------------------|------------------------|----------------------|----------------------|--------------------|---------------------------------------------|-----------------------|-----------------------|----------------|-------------------------|
| Study\scenario 3: waterstof fluoride | Fixed duration release | Rotterdam - D 5.0m/s | 1,63177              | 9,99715            | 1                                           | 4825,02               | 0,0218797             | 4,43273        | 600                     |
|                                      |                        | Rotterdam - F 1.5m/s | 1,63177              | 9,99715            | 1                                           | 4825,02               | 0,0218797             | 4,43273        | 600                     |

## Dispersion Results

### Input dispersion parameters

|                          |       |   |
|--------------------------|-------|---|
| Core averaging time      | 18,75 | s |
| Flammable averaging time | 18,75 | s |
| Toxic averaging time     | 600   | s |
| Height of interest       | 1     | m |

### Distance downwind to defined concentrations

The reported concentration of interest is defined at the scenario

| Path                                 | Scenario               | Weather              | Material                 | Material to track | Concentration of interest [ppm] | Averaging time selected | Distance downwind to concentration of interest [m] |
|--------------------------------------|------------------------|----------------------|--------------------------|-------------------|---------------------------------|-------------------------|----------------------------------------------------|
| Study\scenario 3: waterstof fluoride | Fixed duration release | Rotterdam - D 5.0m/s | <b>HYDROGEN FLUORIDE</b> | HYDROGEN FLUORIDE | 34                              | User-defined            | 920,184                                            |
|                                      |                        | Rotterdam - F 1.5m/s | <b>HYDROGEN FLUORIDE</b> | HYDROGEN FLUORIDE | 34                              | User-defined            | 2125,08                                            |

## Outdoor Toxic Results

### Distance downwind to defined concentrations

The reported concentrations are defined in the respective material properties

| Path                                 | Scenario               | Weather              | Distance downwind to VRW (3600 s) [m] | Distance downwind to AGW (3600 s) [m] | Distance downwind to LBW (3600 s) [m] | Distance downwind to STEL (900 s) [m] | Distance downwind to IDLH (1800 s) [m] |
|--------------------------------------|------------------------|----------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|----------------------------------------|
| Study\scenario 3: waterstof fluoride | Fixed duration release | Rotterdam - D 5.0m/s | n/a                                   | n/a                                   | n/a                                   | n/a                                   | n/a                                    |
|                                      |                        | Rotterdam - F 1.5m/s | n/a                                   | n/a                                   | n/a                                   | n/a                                   | n/a                                    |

### Distance downwind to defined dangerous doses

The reported dangerous doses are defined in the respective material properties

### Exposure duration at defined dangerous doses

The reported dangerous doses are defined in the respective material properties



# Consequence Summary Report

Workspace: parameter\_liquid\_rainout\_equilibrium\_HF

Study: Study

## Summary Basis

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## Discharge Results (after atmospheric expansion)

| Path                                 | Scenario               | Weather              | Peak Flowrate [kg/s] | Temperature [degC] | Liquid mass fraction in material [fraction] | Droplet diameter [um] | Expanded diameter [m] | Velocity [m/s] | End time of release [s] |
|--------------------------------------|------------------------|----------------------|----------------------|--------------------|---------------------------------------------|-----------------------|-----------------------|----------------|-------------------------|
| Study\scenario 3: waterstof fluoride | Fixed duration release | Rotterdam - D 5.0m/s | 1,63177              | 9,99715            | 1                                           | 4825,02               | 0,0218797             | 4,43273        | 600                     |
|                                      |                        | Rotterdam - F 1.5m/s | 1,63177              | 9,99715            | 1                                           | 4825,02               | 0,0218797             | 4,43273        | 600                     |

## Dispersion Results

### Input dispersion parameters

|                          |       |   |
|--------------------------|-------|---|
| Core averaging time      | 18,75 | s |
| Flammable averaging time | 18,75 | s |
| Toxic averaging time     | 600   | s |
| Height of interest       | 1     | m |

### Distance downwind to defined concentrations

The reported concentration of interest is defined at the scenario

| Path                                 | Scenario               | Weather              | Material                 | Material to track | Concentration of interest [ppm] | Averaging time selected | Distance downwind to concentration of interest [m] |
|--------------------------------------|------------------------|----------------------|--------------------------|-------------------|---------------------------------|-------------------------|----------------------------------------------------|
| Study\scenario 3: waterstof fluoride | Fixed duration release | Rotterdam - D 5.0m/s | <b>HYDROGEN FLUORIDE</b> | HYDROGEN FLUORIDE | 59                              | User-defined            | 667,91                                             |
|                                      |                        | Rotterdam - F 1.5m/s | <b>HYDROGEN FLUORIDE</b> | HYDROGEN FLUORIDE | 59                              | User-defined            | 1482,21                                            |

## Outdoor Toxic Results

### Distance downwind to defined concentrations

The reported concentrations are defined in the respective material properties

| Path                                 | Scenario               | Weather              | Distance downwind to VRW (3600 s) [m] | Distance downwind to AGW (3600 s) [m] | Distance downwind to LBW (3600 s) [m] | Distance downwind to STEL (900 s) [m] | Distance downwind to IDLH (1800 s) [m] |
|--------------------------------------|------------------------|----------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|----------------------------------------|
| Study\scenario 3: waterstof fluoride | Fixed duration release | Rotterdam - D 5.0m/s | n/a                                   | n/a                                   | n/a                                   | n/a                                   | n/a                                    |
|                                      |                        | Rotterdam - F 1.5m/s | n/a                                   | n/a                                   | n/a                                   | n/a                                   | n/a                                    |

### Distance downwind to defined dangerous doses

The reported dangerous doses are defined in the respective material properties

### Exposure duration at defined dangerous doses

The reported dangerous doses are defined in the respective material properties



# Consequence Summary Report

Workspace: parameter\_liquid\_rainout\_equilibrium\_HF

Study: Study

## Summary Basis

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The report is context sensitive, and filters up to the study level. You will need to generate multiple summary reports if you have multiple studies in your workspace.

## Discharge Results (after atmospheric expansion)

| Path                          | Scenario | Weather              | Peak Flowrate [kg/s] | Temperature [degC] | Liquid mass fraction in material [fraction] | Droplet diameter [um] | Expanded diameter [m] | Velocity [m/s] | End time of release [s] |
|-------------------------------|----------|----------------------|----------------------|--------------------|---------------------------------------------|-----------------------|-----------------------|----------------|-------------------------|
| Study\scenario 5: acrylnitril | Leak     | Rotterdam - D 5.0m/s | 1,20123              | 9,99587            | 1                                           | 4684,93               | 0,0154919             | 7,79055        | 1800                    |
|                               |          | Rotterdam - F 1.5m/s | 1,20123              | 9,99587            | 1                                           | 4684,93               | 0,0154919             | 7,79055        | 1800                    |

## Dispersion Results

### Input dispersion parameters

|                          |       |   |
|--------------------------|-------|---|
| Core averaging time      | 18,75 | s |
| Flammable averaging time | 18,75 | s |
| Toxic averaging time     | 600   | s |
| Height of interest       | 1     | m |

### Distance downwind to defined concentrations

The reported concentration of interest is defined at the scenario

| Path                          | Scenario | Weather              | Material             | Material to track | Concentration of interest [ppm] | Averaging time selected | Distance downwind to concentration of interest [m] |
|-------------------------------|----------|----------------------|----------------------|-------------------|---------------------------------|-------------------------|----------------------------------------------------|
| Study\scenario 5: acrylnitril | Leak     | Rotterdam - D 5.0m/s | <b>ACRYLONITRILE</b> | ACRYLONITRILE     | 105                             | User-defined            | 119,613                                            |
|                               |          | Rotterdam - F 1.5m/s | <b>ACRYLONITRILE</b> | ACRYLONITRILE     | 105                             | User-defined            | 292,432                                            |

| Path                          | Scenario | Weather              | Distance to UFL [m] | Distance to LFL [m] | Distance to LFL fraction [m] |
|-------------------------------|----------|----------------------|---------------------|---------------------|------------------------------|
| Study\scenario 5: acrylnitril | Leak     | Rotterdam - D 5.0m/s | 1,47118             | 2,76128             | 2,76128                      |
|                               |          | Rotterdam - F 1.5m/s | 1,03758             | 1,62608             | 1,62608                      |

## Outdoor Toxic Results

### Distance downwind to defined concentrations

The reported concentrations are defined in the respective material properties

| Path                          | Scenario | Weather              | Distance downwind to VRW (3600 s) [m] | Distance downwind to AGW (3600 s) [m] | Distance downwind to LBW (3600 s) [m] | Distance downwind to STEL (900 s) [m] | Distance downwind to IDLH (1800 s) [m] |
|-------------------------------|----------|----------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|----------------------------------------|
| Study\scenario 5: acrylnitril | Leak     | Rotterdam - D 5.0m/s | n/a                                   | n/a                                   | n/a                                   | n/a                                   | n/a                                    |
|                               |          | Rotterdam - F 1.5m/s | n/a                                   | n/a                                   | n/a                                   | n/a                                   | n/a                                    |

### Distance downwind to defined dangerous doses

The reported dangerous doses are defined in the respective material properties

### Exposure duration at defined dangerous doses

The reported dangerous doses are defined in the respective material properties

## Jet Fire Results

### Distance downwind to defined radiation levels

The reported radiations are defined in the parameters

| Path                          | Scenario | Weather              | Flame length [m] | Distance downwind to intensity level 1 (3 kW/m <sup>2</sup> ) [m] | Distance downwind to intensity level 2 (10 kW/m <sup>2</sup> ) [m] | Distance downwind to intensity level 3 (35 kW/m <sup>2</sup> ) [m] |
|-------------------------------|----------|----------------------|------------------|-------------------------------------------------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------|
| Study\scenario 5: acrylnitril | Leak     | Rotterdam - D 5.0m/s | 12,6527          | 22,2058                                                           | 17,3507                                                            | 14,2225                                                            |
|                               |          | Rotterdam - F 1.5m/s | 12,3895          | 18,3463                                                           | 14,6391                                                            | n/a                                                                |

## Early Pool Fire Results

### Distance downwind to defined radiation levels

The reported radiations are defined in the parameters

| Path                          | Scenario | Weather              | Pool diameter [m] | Distance downwind to intensity level 1 (3 kW/m <sup>2</sup> ) [m] | Distance downwind to intensity level 2 (10 kW/m <sup>2</sup> ) [m] | Distance downwind to intensity level 3 (35 kW/m <sup>2</sup> ) [m] |
|-------------------------------|----------|----------------------|-------------------|-------------------------------------------------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------|
| Study\scenario 5: acrylnitril | Leak     | Rotterdam - D 5.0m/s | 5,67683           | 22,8299                                                           | 16,1344                                                            | 9,28821                                                            |
|                               |          | Rotterdam - F 1.5m/s | 5,91643           | 23,1663                                                           | 15,3175                                                            | 8,48874                                                            |

## Late Pool Fire Results

### Distance downwind to defined radiation levels

The reported radiations are defined in the parameters

| Path                          | Scenario | Weather              | Pool diameter [m] | Distance downwind to intensity level 1 (3 kW/m <sup>2</sup> ) [m] | Distance downwind to intensity level 2 (10 kW/m <sup>2</sup> ) [m] | Distance downwind to intensity level 3 (35 kW/m <sup>2</sup> ) [m] |
|-------------------------------|----------|----------------------|-------------------|-------------------------------------------------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------|
| Study\scenario 5: acrylnitril | Leak     | Rotterdam - D 5.0m/s | 15,1395           | 48,7144                                                           | 31,4757                                                            | 17,2912                                                            |
|                               |          | Rotterdam - F 1.5m/s | 15,1425           | 47,7995                                                           | 28,9377                                                            | 13,941                                                             |

## Flash Fire Results

### Distance downwind to defined concentrations

The reported LFL and LFL fraction are defined in the respective material property

| Path                          | Scenario | Weather                 | Distance downwind to LFL [m] | Distance downwind to LFL Fraction [m] |
|-------------------------------|----------|-------------------------|------------------------------|---------------------------------------|
| Study\scenario 5: acrylnitril | Leak     | Rotterdam - D<br>5.0m/s | 2,76128                      | 2,76128                               |
|                               |          | Rotterdam - F<br>1.5m/s | 1,62608                      | 1,62608                               |

### Maximum distance to LFL fraction at any height

| Path                          | Scenario | Weather                 | Max flash fire distance [m] | Height of the max flash fire distance [m] | Time [s] |
|-------------------------------|----------|-------------------------|-----------------------------|-------------------------------------------|----------|
| Study\scenario 5: acrylnitril | Leak     | Rotterdam - D<br>5.0m/s | 3,58481                     | 0,505405                                  | 3,53307  |
|                               |          | Rotterdam - F<br>1.5m/s | 6,04118                     | 0,0428808                                 | 901,231  |

## Explosion Results

Explosion scenarios for worst-case maximum downwind distance to defined overpressures. The worst-case explosion will be modelled in the risk calculations if ignition conditions are present at the time for the scenario.

The reported overpressures are defined in the explosion parameters

| Path                          | Scenario | Weather                 | Overpressure level [bar] | Maximum distance [m] | Diameter [m] |
|-------------------------------|----------|-------------------------|--------------------------|----------------------|--------------|
| Study\scenario 5: acrylnitril | Leak     | Rotterdam - D<br>5.0m/s | 0,02                     | 18,5737              | 32,8136      |
|                               |          |                         | 0,1                      | 6,13572              | 7,93767      |
|                               |          |                         | 0,3                      | 3,9937               | 3,65362      |
|                               |          | Rotterdam - F<br>1.5m/s | 0,02                     | 21,7848              | 39,4236      |
|                               |          |                         | 0,1                      | 6,84131              | 9,53663      |
|                               |          |                         | 0,3                      | 4,2678               | 4,3896       |

## Supplementary data for worst-case explosion scenarios

| Path                          | Scenario | Weather                 | Overpressure level [bar] | Explosion flammable mass [kg] | Ignition time [s] | Ignition source [m] | Cloud centre [m] | Explosion centre [m] |
|-------------------------------|----------|-------------------------|--------------------------|-------------------------------|-------------------|---------------------|------------------|----------------------|
| Study\scenario 5: acrylnitril | Leak     | Rotterdam - D<br>5.0m/s | 0,02                     | 0,069657                      | 1,1291            | 1                   | 2,16689          | 2,16689              |
|                               |          |                         | 0,1                      | 5                             | 1,1291            | 1                   | 2,16689          | 2,16689              |
|                               |          |                         | 0,3                      | 0,069657                      | 1,1291            | 1                   | 2,16689          | 2,16689              |
|                               |          | Rotterdam - F<br>1.5m/s | 0,02                     | 0,120802                      | 842,201           | 6                   | 2,073            | 2,073                |
|                               |          |                         | 0,1                      | 0,120802                      | 842,201           | 6                   | 2,073            | 2,073                |
|                               |          |                         | 0,3                      | 0,120802                      | 842,201           | 6                   | 2,073            | 2,073                |



# Consequence Summary Report

Workspace: parameter\_liquid\_rainout\_equilibrium\_HF

Study: Study

## Summary Basis

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The report is context sensitive, and filters up to the study level. You will need to generate multiple summary reports if you have multiple studies in your workspace.

## Discharge Results (after atmospheric expansion)

| Path                          | Scenario | Weather              | Peak Flowrate [kg/s] | Temperature [degC] | Liquid mass fraction in material [fraction] | Droplet diameter [um] | Expanded diameter [m] | Velocity [m/s] | End time of release [s] |
|-------------------------------|----------|----------------------|----------------------|--------------------|---------------------------------------------|-----------------------|-----------------------|----------------|-------------------------|
| Study\scenario 5: acrylnitril | Leak     | Rotterdam - D 5.0m/s | 1,20123              | 9,99587            | 1                                           | 4684,93               | 0,0154919             | 7,79055        | 1800                    |
|                               |          | Rotterdam - F 1.5m/s | 1,20123              | 9,99587            | 1                                           | 4684,93               | 0,0154919             | 7,79055        | 1800                    |

## Dispersion Results

### Input dispersion parameters

|                          |       |   |
|--------------------------|-------|---|
| Core averaging time      | 18,75 | s |
| Flammable averaging time | 18,75 | s |
| Toxic averaging time     | 600   | s |
| Height of interest       | 1     | m |

### Distance downwind to defined concentrations

The reported concentration of interest is defined at the scenario

| Path                          | Scenario | Weather              | Material             | Material to track | Concentration of interest [ppm] | Averaging time selected | Distance downwind to concentration of interest [m] |
|-------------------------------|----------|----------------------|----------------------|-------------------|---------------------------------|-------------------------|----------------------------------------------------|
| Study\scenario 5: acrylnitril | Leak     | Rotterdam - D 5.0m/s | <b>ACRYLONITRILE</b> | ACRYLONITRILE     | 192                             | User-defined            | 83,6221                                            |
|                               |          | Rotterdam - F 1.5m/s | <b>ACRYLONITRILE</b> | ACRYLONITRILE     | 192                             | User-defined            | 175,79                                             |

| Path                          | Scenario | Weather              | Distance to UFL [m] | Distance to LFL [m] | Distance to LFL fraction [m] |
|-------------------------------|----------|----------------------|---------------------|---------------------|------------------------------|
| Study\scenario 5: acrylnitril | Leak     | Rotterdam - D 5.0m/s | 1,47127             | 2,76125             | 2,76125                      |
|                               |          | Rotterdam - F 1.5m/s | 1,0378              | 1,62608             | 1,62608                      |

# Consequence Summary Report

## Workspace: Effectafstanden

### Study: Study

#### Summary Basis

These tables will only report global values set in the parameters. Values that are modified in the study tree will not be reported.

The report is context sensitive, and filters up to the study level. You will need to generate multiple summary reports if you have multiple studies in your workspace.

#### Discharge Results (after atmospheric expansion)

| Path                             | Scenario             | Weather              | Temperature [degC] | Liquid mass fraction in material [fraction] | Droplet diameter [um] | Velocity [m/s] |
|----------------------------------|----------------------|----------------------|--------------------|---------------------------------------------|-----------------------|----------------|
| Study\scenario 7: ADR klasse 4.3 | Catastrophic rupture | Rotterdam - D 5.0m/s | 9,19656            | 0                                           | 0                     | 30,2474        |
|                                  |                      | Rotterdam - F 1.5m/s | 9,19656            | 0                                           | 0                     | 30,2474        |

## Dispersion Results

### Input dispersion parameters

|                          |       |   |
|--------------------------|-------|---|
| Core averaging time      | 18,75 | s |
| Flammable averaging time | 18,75 | s |
| Toxic averaging time     | 600   | s |
| Height of interest       | 1     | m |

### Distance downwind to defined concentrations

The reported concentration of interest is defined at the scenario

| Path                             | Scenario             | Weather              | Distance to UFL [m] | Distance to LFL [m] | Distance to LFL fraction [m] |
|----------------------------------|----------------------|----------------------|---------------------|---------------------|------------------------------|
| Study\scenario 7: ADR klasse 4.3 | Catastrophic rupture | Rotterdam - D 5.0m/s | 0,946965            | 8,10733             | 8,10733                      |
|                                  |                      | Rotterdam - F 1.5m/s | 0,943511            | 4,04441             | 4,04441                      |

## Outdoor Toxic Results

### Distance downwind to defined concentrations

The reported concentrations are defined in the respective material properties

### Distance downwind to defined dangerous doses

The reported dangerous doses are defined in the respective material properties

### Exposure duration at defined dangerous doses

The reported dangerous doses are defined in the respective material properties

## Fireball Results

### Distance downwind to defined radiation levels

The reported radiations are defined in the parameters

| Path                             | Scenario             | Weather              | Fireball diameter [m] | Distance downwind to intensity level 1 (3 kW/m <sup>2</sup> ) [m] | Distance downwind to intensity level 2 (10 kW/m <sup>2</sup> ) [m] | Distance downwind to intensity level 3 (35 kW/m <sup>2</sup> ) [m] |
|----------------------------------|----------------------|----------------------|-----------------------|-------------------------------------------------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------|
| Study\scenario 7: ADR klasse 4.3 | Catastrophic rupture | Rotterdam - D 5.0m/s | 7,43429               | 27,0859                                                           | 15,0342                                                            | 7,95743                                                            |
|                                  |                      | Rotterdam - F 1.5m/s | 7,43429               | 27,0859                                                           | 15,0342                                                            | 7,95743                                                            |

## Flash Fire Results

### Distance downwind to defined concentrations

The reported LFL and LFL fraction are defined in the respective material property

| Path                             | Scenario             | Weather              | Distance downwind to LFL [m] | Distance downwind to LFL Fraction [m] |
|----------------------------------|----------------------|----------------------|------------------------------|---------------------------------------|
| Study\scenario 7: ADR klasse 4.3 | Catastrophic rupture | Rotterdam - D 5.0m/s | 8,10733                      | 8,10733                               |
|                                  |                      | Rotterdam - F 1.5m/s | 4,04441                      | 4,04441                               |

### Maximum distance to LFL fraction at any height

| Path                             | Scenario             | Weather              | Max flash fire distance [m] | Height of the max flash fire distance [m] | Time [s] |
|----------------------------------|----------------------|----------------------|-----------------------------|-------------------------------------------|----------|
| Study\scenario 7: ADR klasse 4.3 | Catastrophic rupture | Rotterdam - D 5.0m/s | 11,8652                     | 5,00823                                   | 2,44026  |
|                                  |                      | Rotterdam - F 1.5m/s | 6,61268                     | 9,98299                                   | 4,11484  |

## Explosion Results

Explosion scenarios for worst-case maximum downwind distance to defined overpressures. The worst-case explosion will be modelled in the risk calculations if ignition conditions are present at the time for the scenario.

The reported overpressures are defined in the explosion parameters

| Path                             | Scenario             | Weather                 | Overpressure level [bar] | Maximum distance [m] | Diameter [m] |
|----------------------------------|----------------------|-------------------------|--------------------------|----------------------|--------------|
| Study\scenario 7: ADR klasse 4.3 | Catastrophic rupture | Rotterdam - D<br>5.0m/s | 0,02                     | 76,9853              | 153,971      |
|                                  |                      |                         | 0,1                      | 20,4569              | 29,9283      |
|                                  |                      |                         | 0,3                      | 13,5192              | 11,0626      |
|                                  |                      | Rotterdam - F<br>1.5m/s | 0,02                     | 77,1255              | 154,251      |
|                                  |                      |                         | 0,1                      | 18,6568              | 37,3136      |
|                                  |                      |                         | 0,3                      | 8,65658              | 11,3721      |

## Supplementary data for worst-case explosion scenarios

| Path                             | Scenario             | Weather                 | Overpressure level [bar] | Explosion flammable mass [kg] | Ignition time [s] | Ignition source [m] | Cloud centre [m] | Explosion centre [m] |
|----------------------------------|----------------------|-------------------------|--------------------------|-------------------------------|-------------------|---------------------|------------------|----------------------|
| Study\scenario 7: ADR klasse 4.3 | Catastrophic rupture | Rotterdam - D<br>5.0m/s | 0,02                     | 1,91065                       | 1E-08             | 1                   | 0                | 0                    |
|                                  |                      |                         | 0,1                      | 0,991281                      | 1,51637           | 9                   | 5,4928           | 5,4928               |
|                                  |                      |                         | 0,3                      | 0,513369                      | 2,11091           | 11                  | 7,98794          | 7,98794              |
|                                  |                      | Rotterdam - F<br>1.5m/s | 0,02                     | 1,92111                       | 1E-08             | 1                   | 0                | 0                    |
|                                  |                      |                         | 0,1                      | 1,92111                       | 1E-08             | 1                   | 0                | 0                    |
|                                  |                      |                         | 0,3                      | 0,557674                      | 3,21375           | 6                   | 2,97054          | 2,97054              |

