

Date : 30-04-2019

Business Owner : Frederic Coppens – Project Manager

Department : ALBI-LI Industrial Direction

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Bepaling Invloed Noise Hood

Waterstof Booster Moerdijk (H2BM)

Context

Air Liquide wenst een waterstof compressor te bouwen om de capaciteit van haar waterstof pijpleijnnetwerk te verhogen tussen Antwerpen en Rotterdam. In het kader van het vergunningstraject wordt de QRA opgesteld. In deze QRA wordt het positief effect van de noise hood rond de compressor vermeld. Dit effect wordt in dit document berekend.

Uit de berekening van de QRA blijkt dat het grootste risico gevormd wordt door de warmtestraling van de waterstofvlam.

Opmerking

Op dit moment wordt het equipment voor het project nog ge-engineerd en is het aankoopproces lopende. Daarom wordt in dit document uitgegaan van overschattingen ('worst case') en van informatie van de meest waarschijnlijke leverancier van het betreffend equipment.

Noise Hood

De noise hood is de structuur rond de compressor die als primair doel heeft het geluid van de compressor te isoleren van de buitenwereld. Deze noise hood bestaat uit minerale wol ingepakt tussen 2 gegalvaniseerde stalen platen, waarvan de binnenste geperforeerd is.

Daar de invloed van de noise hood niet in het SAFETI-NL programma kan gemodelleerd worden, wordt dit in dit document gedaan.

De voorziene noise hood in dit project wordt geleverd door Acústica Integral, gebruikt makend van hun Acustimodul-80A. Dit systeem is reeds in gebruik op de Air Liquide site in Rotterdam. (Bijlage 1)

Deze panelen worden opgebouwd gebruik makend van de panelen van Knauf MCH-board-D7. (Datasheet Bijlage 2)

Deze constructie heeft daarenboven een goede brandweerstand (Euroclass A1) en warmte-isolatie.

Berekening Warmte-Isolatie

Lievense heeft, gebruik makend van het TKO pakket, berekeningen gemaakt van de warmteproductie berekend voor de meest bepalende scenario's uit het QRA rapport (Bijlage 3). Hieruit blijkt dat de maximale warmtestraling die aan de noise hood afgegeven wordt, 80kW/m² bedraagt, wanneer deze rechtstreeks door de vlam bestraald wordt.

De bepaling van de vlamtemperatuur is niet mogelijk, deze teveel afhankelijk is van omgevingsfactoren. Er is hier 1000°C aangenomen voor de binnenkant van de noise hood. Dit is de temperatuur die de noise hood zeker aan kan (zie datasheet). Waterstofvlammen kunnen in adiabatische omstandigheden hogere temperaturen bereiken, maar dit betekent dat er geen verlies is aan warmte naar de omgeving en dat alle geproduceerde warmte in de verbrandingsgassen blijven.

Wet van Fourier	$q/A = k \cdot 1/s \cdot dT$		
Thermische geleidbaarheid	k	0,035 W/m K	datasheet Knauf
Wanddikte	s	0,08 m	info Engineering
Temperatuur binnen	T _{in}	1000 °C	
Temperatuur buiten	T _{uit}	0 °C	
Temperatuursverschil over noise hood	dT	1000 °C	
Warmte straling buiten noise hood per m ²	q/A	437,5 W/m ²	

Besluit

De wand van de Noise hood heeft een warmtegeleiding van 437,5 W/m². Daar waar de warmte geproduceerd door de waterstofvlammen bij leidingbreuk 80kW/m² bedraagt.

De noise hood zal dus de omgeving beschermen voor falingen binnen de noise hood.

Indien de brand te lang duurt, bestaat de mogelijkheid dat de noise hood beschadigd wordt door de brand, maar dit is niet aannemelijk gezien de korte reactietijd van de veiligheden.

Indien deze veiligheden zouden falen, kan zal de centrale controlekamer of die van de fabrieken in Antwerpen en Rotterdam de toevoer van waterstof sluiten.

Bijlagen

1. Email 19/3/2019 van Acústica Integral
2. Datasheet Knauf MCH-board D7
3. Warmtestraling langs een horizontale fakel.docx



COPPENS, Frederic <frederic.coppens@airliquide.com>

RE: H2BM - urgent - valeur d'isolation thermique Acustimodul-80A

1 message

David Le Goff - Acústica Integral <dlegoff@acusticaintegral.com>

18 mars 2019 à 16:17

À : "COPPENS, Frederic" <frederic.coppens@airliquide.com>

Bonjour Monsieur Coppens,

Veuillez trouver en pièces jointes les fiches techniques de la laine de roche que nous utilisons pour la fabrication de nos panneaux ACUSTIMODUL-80A (référence MCH D7 GVB).

Pour information, nous avons réalisé une cabine acoustique il y a maintenant 4 ans pour le site de AIR LIQUIDE ROZENBURG.

Je reste à votre entière disposition pour tout renseignement complémentaire que vous jugeriez utile.

Cordialement,

David Le Goff

Export Manager

dlegoff@acusticaintegral.com

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De: COPPENS, Frederic [mailto:frederic.coppens@airliquide.com]
Enviado el: lunes, 18 de marzo de 2019 11:14
Para: David Le Goff - Acústica Integral <dlegoff@acusticaintegral.com>
Asunto: H2BM - urgent - valeur d'isolation thermique Acustimodul-80A

Monsieur Le Goff,

Pour un projet au Pays-Bas, nous considérons utiliser les Acustimodul-80A pour faire un caisson anti-son autour d'une machine.

Mais je dois démontrer qu'en cas d'incendie, le caisson donnera une isolation thermique aussi. Pour ce calcul, j'ai besoin de la valeur d'isolation thermique de vos panneaux. Si vous ne l'avez pas, Rockwool a besoin de savoir quel type exact de produit Rockwool que vous utiliser, pour me donner cette valeur.

Merci à vous,

Frederic Coppens
Project Manager



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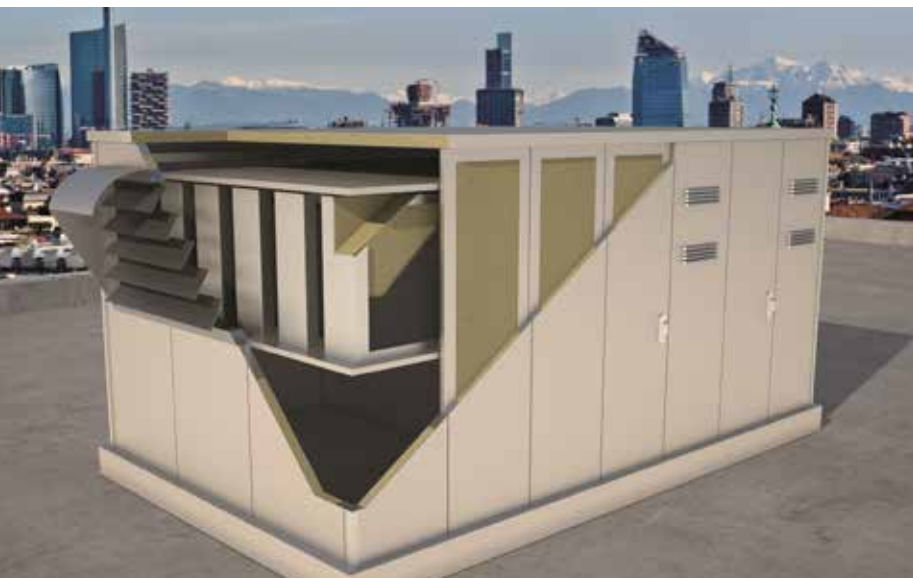


Le lun. 18 mars 2019 à 11:06, David Le Goff - Acústica Integral <dlegoff@acusticaintegral.com> a écrit :

MCH BOARD D7/GVB/GVN

February 2018

Boards for multipurpose insulation in industrial applications



DESCRIPTION

Knauf Insulation MCH BOARD D7 (MCH B D7) is a board made of rock mineral wool. Due to its thermal and acoustic properties it is built into a wide range of machinery. With its excellent thermal characteristics Knauf Insulation MCH B is used to boost the device efficiency and at the same time reduce noise associated with machine operation. It can be used at continuous operating temperatures of up to 250°C.

In addition, board can be **faced with black glass fleece (MCH B GVB)** on one or both sides. The black colour of glass fleece makes it visually neutral in perforated metal sheeting. Neutral glass fleece facing **(MCH B GVN)** on one or both sides is also available on request.

The dimensions of each board can be customized according to the requirements of specific applications.

PERFORMANCE

Thermal insulation

Optimal thermal conductivity $\lambda_d = 0,035 \text{ W/mK}$

Fire performance

Classified as non-combustible Euroclass A1

Sound performance

Excellent sound absorption and sound insulation properties

BENEFITS

- ✓ Non-combustibility (Euroclass A1)
- ✓ Excellent sound absorption
- ✓ Excellent sound insulation
- ✓ Optimal thermal conductivity
- ✓ Mechanical stability throughout its lifetime
- ✓ Hydrophobic properties help resist external influences (condensation)
- ✓ Our production technology enables custommade sizes and dimensions.

APPLICATION

Multipurpose insulation element used as an integral part of a device to **boost efficiency and reduce noise**.

STANDARDS

Technical properties of Knauf Insulation MCH BOARD D7 (GVB) are declared in accordance with EN 13162.

Knauf Insulation MCH BOARD D7 (GVB) is manufactured in accordance with ISO 9001 Quality Management Systems, ISO 14001 Environmental Management Systems, ISO 50001 Energy Management Systems and OHSAS 18001 Occupational Health and Safety Management Systems as certified by Bureau Veritas.

CERTIFICATES

**DOP code: 04309LPCPR**www.dopki.com

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MCH BOARD D7

February 2018

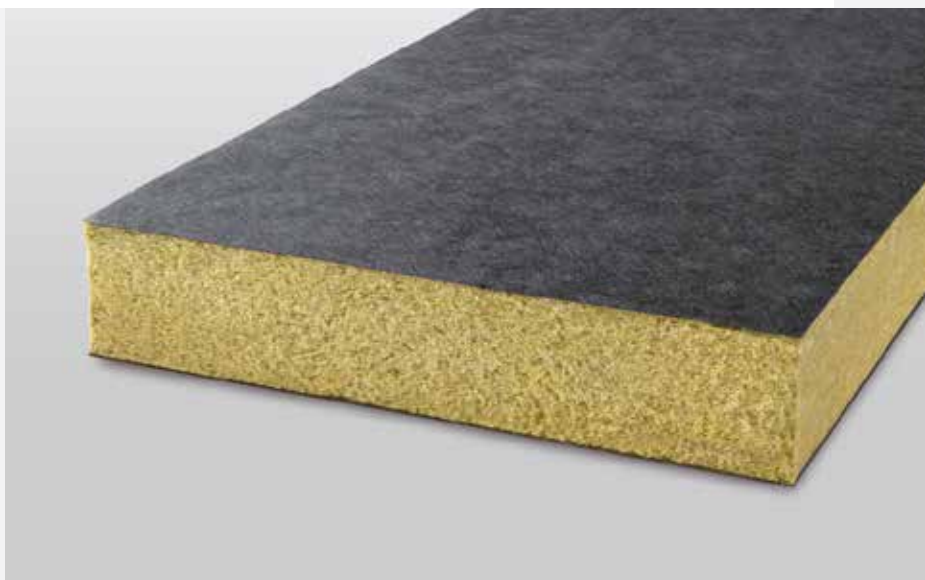
TECHNICAL PROPERTIES

Characteristics	Symbol	Value							Unit	Standard
Density	-	70							kg/m ³	-
Reaction to fire	-	Euroclass A1							-	EN 13501-1
Melting point	-	> 1000							°C	DIN 4102/T17
Water vapour diffusion resistance factor	μ	1							-	EN ISO 10456
Specific heat capacity	c_p	1030							J/kgK	-
Short - term water absorption	W_p	< 1							kg/m ²	EN 1609
Long - term water absorption	W_p	< 3							kg/m ²	EN 12087
Air flow resistance	AF_r	> 23							kPa-s/m ²	EN 29053
Water soluble chloride ions (on request)	-	≤10							mg/kg	EN 13468
Thermal conductivity - declared (10 °C)	λ_d	0.035							W/mK	EN 12667
Sound absorption coefficient	α_s	Frequency	125	250	500	1000	2000	4000	Hz	EN 20354
		50 mm	0.25	0.70	1.00	1.00	1.00	1.00	-	
		100 mm	0.52	0.95	0.99	1.01	1.01	1.01	-	
Sound reduction	$R'_w(C; C_w)$	13 (50 mm) (0; -2)							dB	SIST EN ISO 717-1

HANDLING & STORAGE

Knauf Insulation MCH BOARD D7 (GVB) is packed on a wooden pallet. Slabs are covered with a PE thermo shrink hood or wrapped twice with stretch foil, which is designed for shortterm protection only. For longer-term protection on site, we recommend storing the product either indoors, or under a cover and off the ground, for a maximum of up to 12 months. If covered storage is not available, products can be stored outside (open-air-storage), for a maximum of up to one month. Outdoor storage is not recommended during particularly humid months with large fluctuations in temperature. If the material becomes damp on location, ensure the moisture evaporates before placing such slabs into a manufacturing process, as water content can affect the performance of the final product.

The performance of MCH BOARD D7 (GVB) depends on the customer's manufacturing process. Individual customers must establish, optimize and control their manufacturing process to ensure the material meets the requirements of their manufacturing process and their final product.



Knauf Insulation, d.o.o.

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Fax: +386 (0)4 5114 319

 E-mail: oem@knaufinsulation.com

For more info visit:

www.oem.knaufinsulation.com

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 challenge.
 create.
 care.

Gas Jet Fire (Chamberlain model)

- watestofleiding breuk 80bar
- watestofleiding lek 80bar
- watestofleiding breuk 33bar
- watestofleiding lek 33bar

Model: Gas Jet Fire (Chamberlain model) (5.12)

Case description: watestofleiding breuk 80bar

Chemical name (YAWS): Hydrogen

Type of release: Release from vessel through (a hole in) pipe

Pipeline length: 20000 m

Pipeline diameter: 140 mm

Hole diameter: 140 mm

Initial temperature in vessel: 20 °C

Initial (absolute) pressure in vessel: 80 bar

Outflow angle in XZ plane (0°=horizontal; 90°=vertical): 0 deg

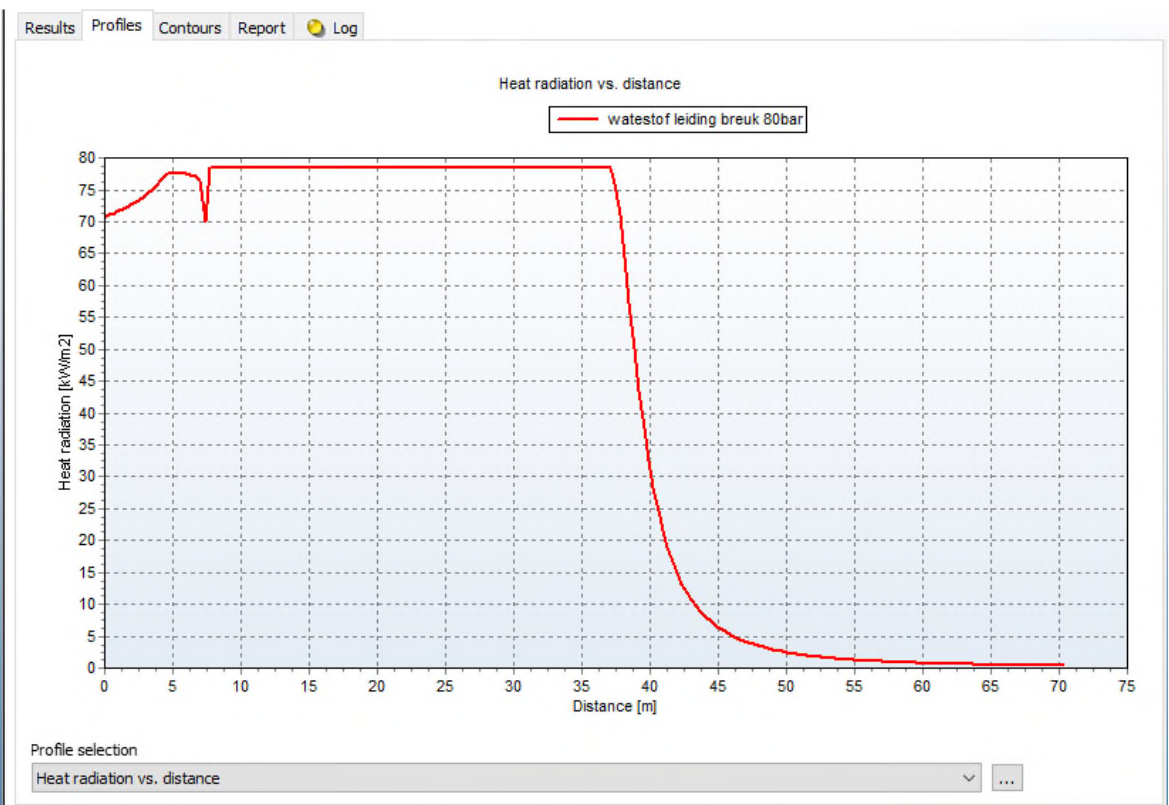
Release height (Stack height): 0 m

Wind speed at 10 m height: 0 m/s

Percentage of the flame covered by soot: 0 %

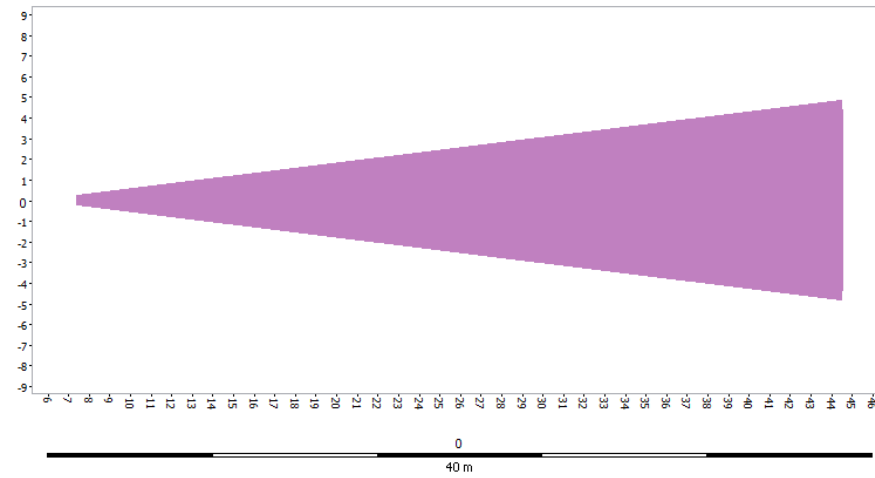
Distance from release (Xd): 70 m

Clear Defaults Calculate

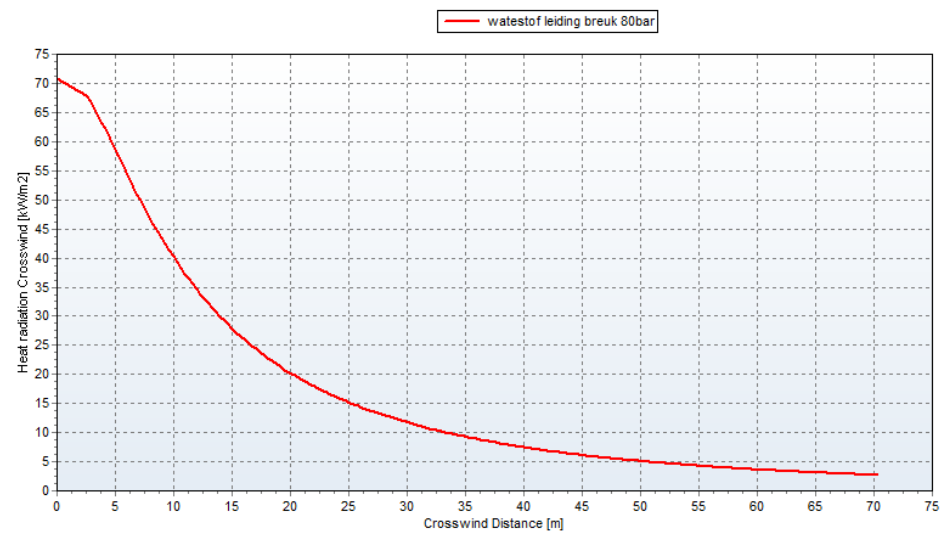


Warmtestraling langs een horizontale fabel.

☒ Flame area in XY plane (top view)



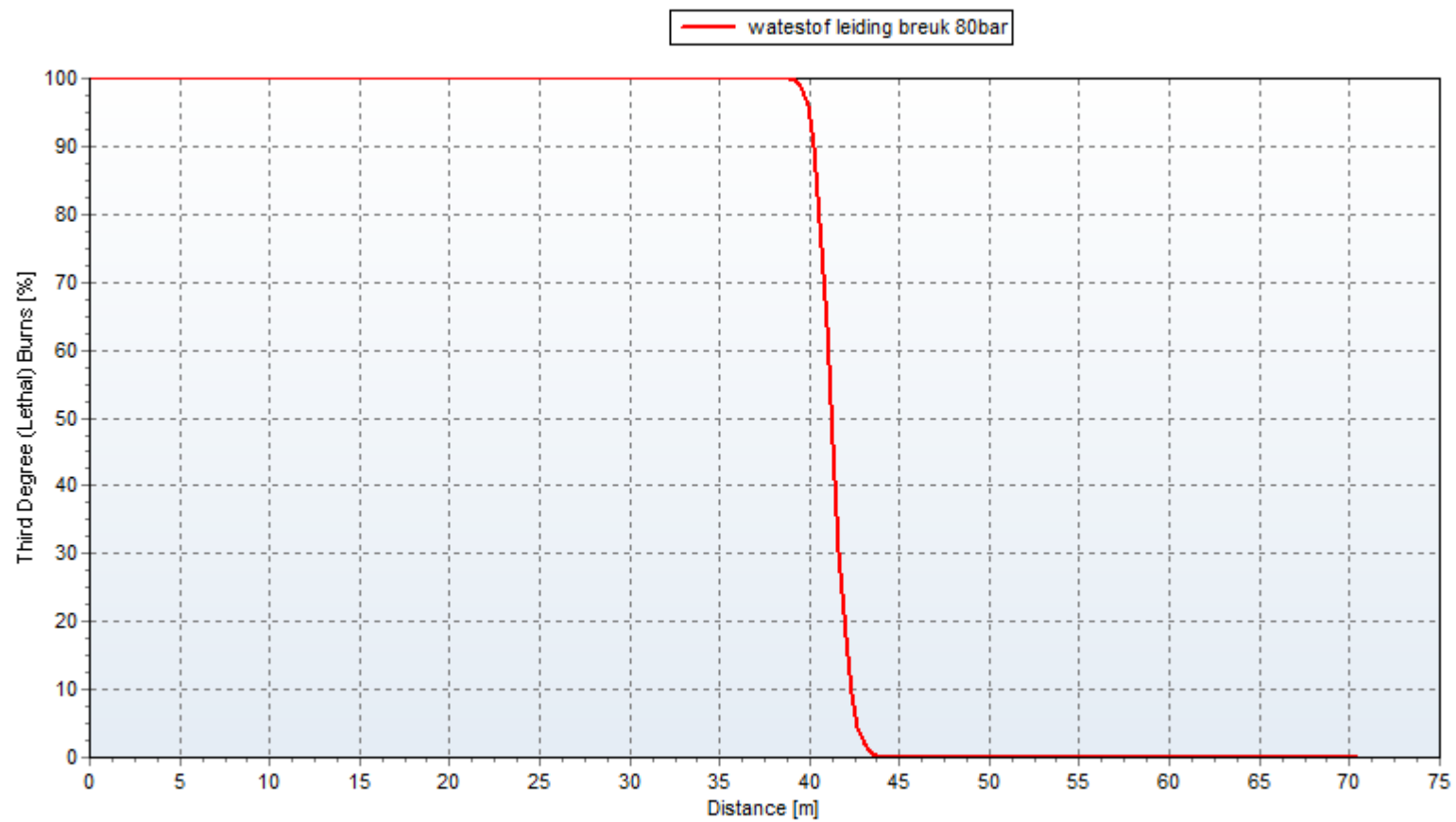
Heat radiation vs. crosswind distance



Profile selection

Heat radiation vs. crosswind distance

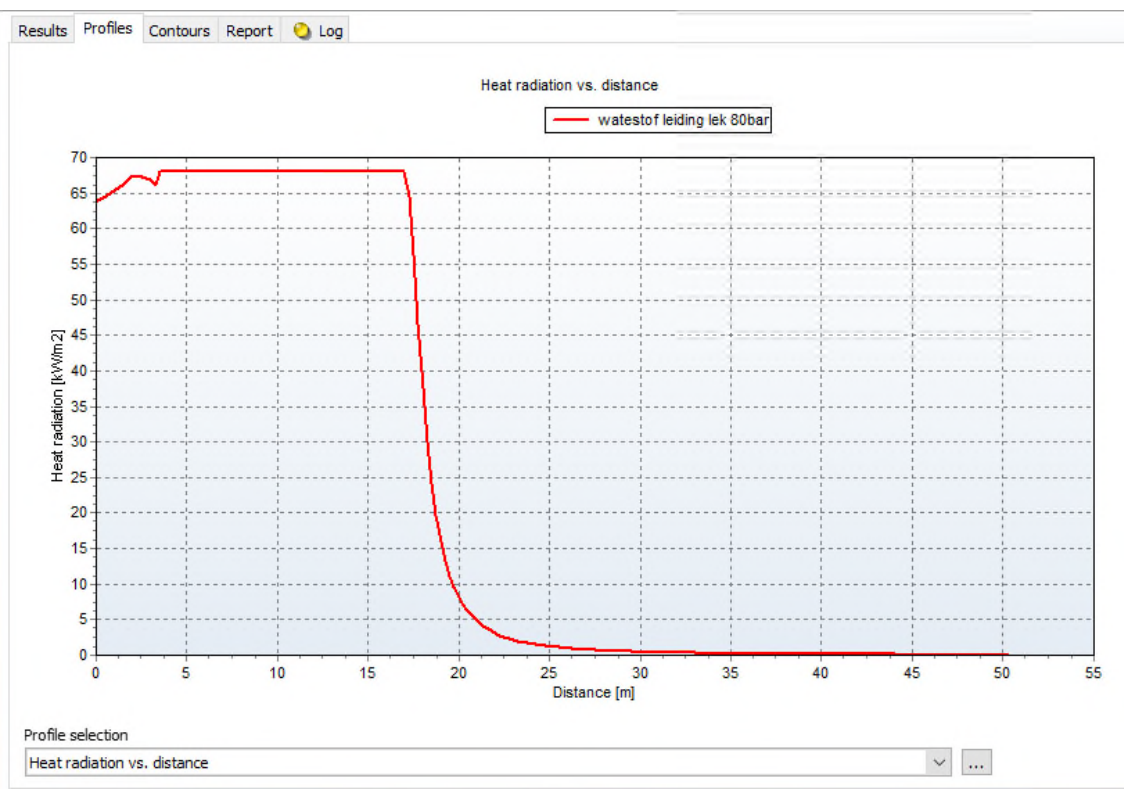
Lethal Burns (Third Degree) vs. Distance

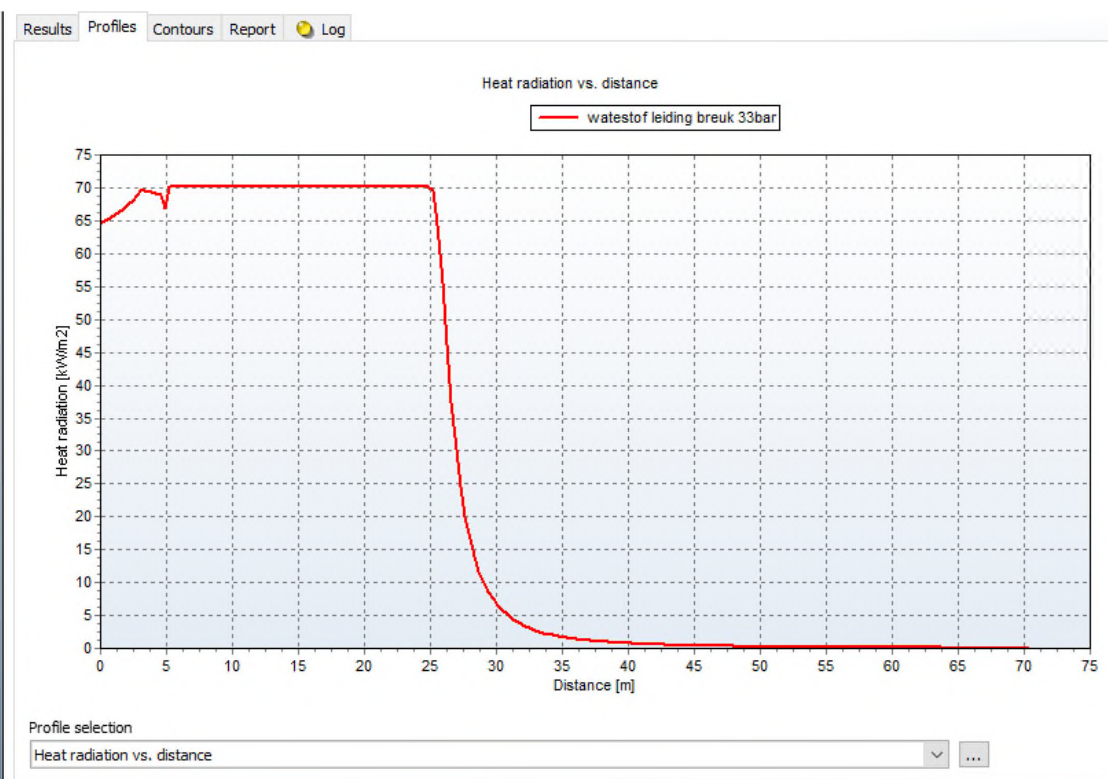


Profile selection

Lethal Burns (Third Degree) vs. Distance







🔥 Gas Jet Fire (Chamberlain model)
watestof leiding breuk 80bar
watestof leiding lek 80bar
watestof leiding breuk 33bar
watestof leiding lek 33bar

Model: Gas Jet Fire (Chamberlain model) (5.12)

Case description	watestof leiding lek 33bar	
Chemical name (YAWS)	Hydrogen	...
Type of release	Release from vessel through (a hole in) pipe	
Pipeline length	20000	m
Pipeline diameter	140	mm
Hole diameter	14	mm
Initial temperature in vessel	20	°C
Initial (absolute) pressure in vessel	33	bar
Outflow angle in XZ plane (0°=horizontal; 90°=vertical)	0	deg
Release height (Stack height)	0	m
Wind speed at 10 m height	0	m/s
Percentage of the flame covered by soot	0	%
Distance from release (Xd)	50	m



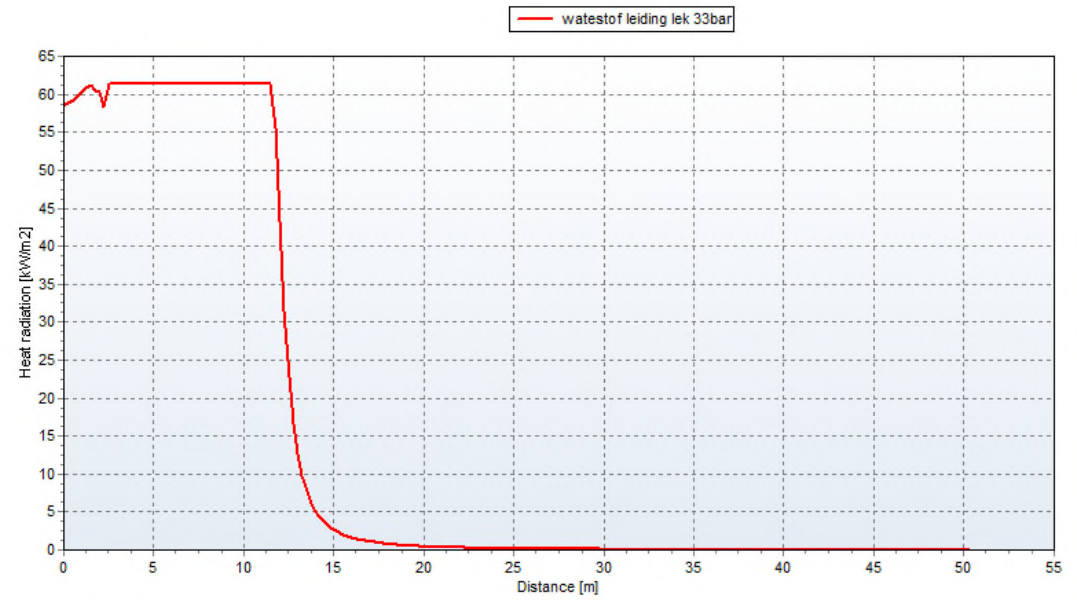
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Results Profiles Contours Report Log

Heat radiation vs. distance



Profile selection

Heat radiation vs. distance