

Hydrogen and Mines Summit Geirmund Vislie

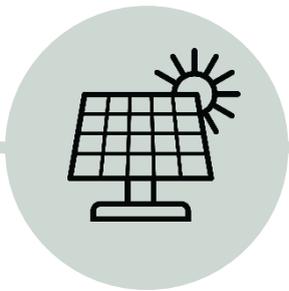
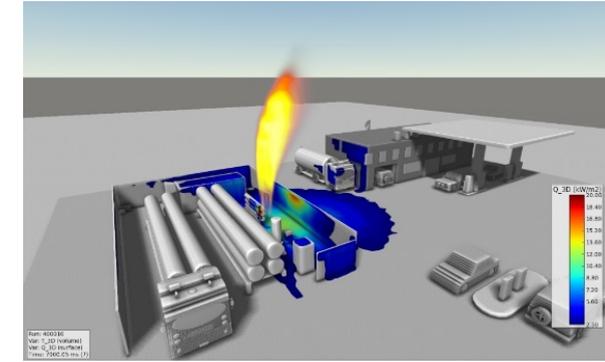


Dame Judith Hackett

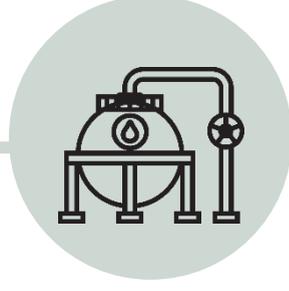
“There are no new accidents, just old accidents happening to new people.”

Expertise in Hydrogen safety

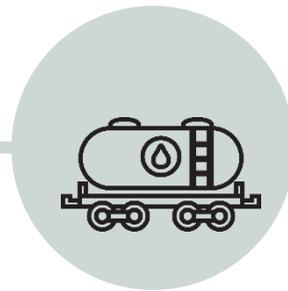
- Gexcon has a strong experience on various H₂ related projects
 - Process safety and safety reviews
 - Assistance for conceptual phase : safety distances, arrangement/layout optimization
 - Regulation and ATEX compliance
 - Optimization of ventilation and gas detection
 - Modeling of accidental events : dispersion, explosion and fire
 - Prevention and Mitigation measures
 - Design of structures and equipment to withstand accidental events



PRODUCTION



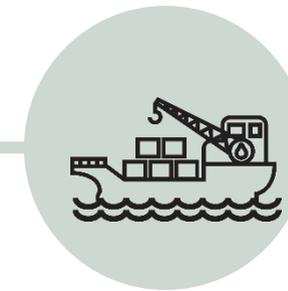
STORAGE



TRANSPORT



DISTRIBUTION



MOBILITY

Understanding Risk



Full scale test

Confined deflagration



Test no. 09

24 vol% H₂

No vent devices

Internal pressure approximately 1.1 bar

Full scale test

Vented deflagration



Test no. 24

21 vol% H₂

Plastic foil vent devices in ceiling

Very low overpressure

Significant learning:

Explosion pressures can be directed away from area of occupancy

Implemented in software

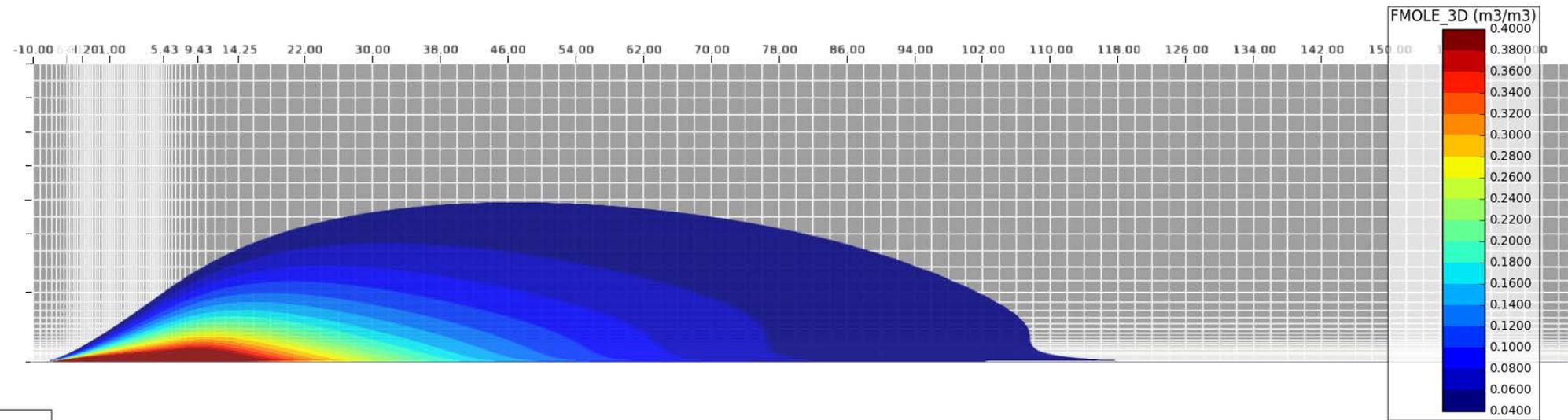
Only CFD Safety tool validated for Hydrogen

- Various dummy equipment configurations to mimic vehicle fueling compressor stations
- Framework in ceiling to accommodate explosion vent devices
- FLACS has been calibrated against large-scale explosion experiments at the Gexcon test site.

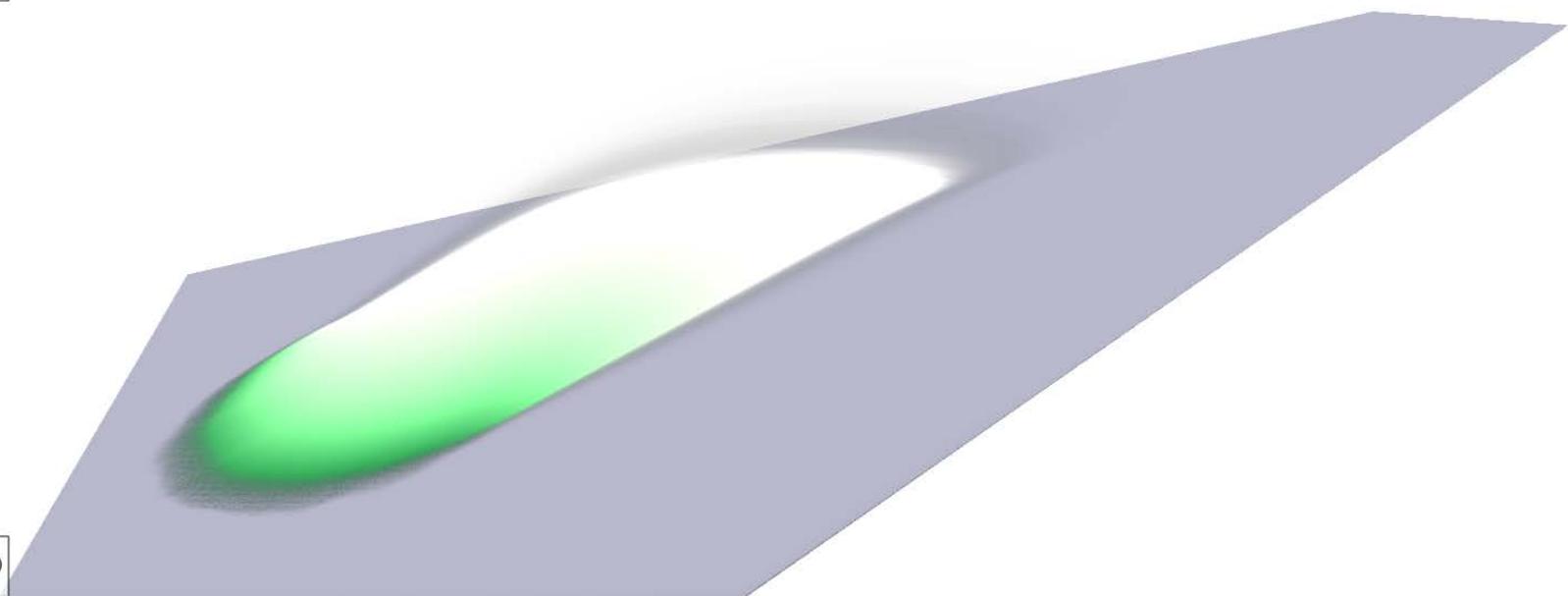
The experiment to the right is a 20ft container filled with 21% Hydrogen.



Dispersion – open field



Run: 100500
Var: FMOLE_3D (volume)
Time: 600.00 s (1200)



Run: 100500
Var: FMOLE_3D (volume)
Time: 600.00 s (1200)

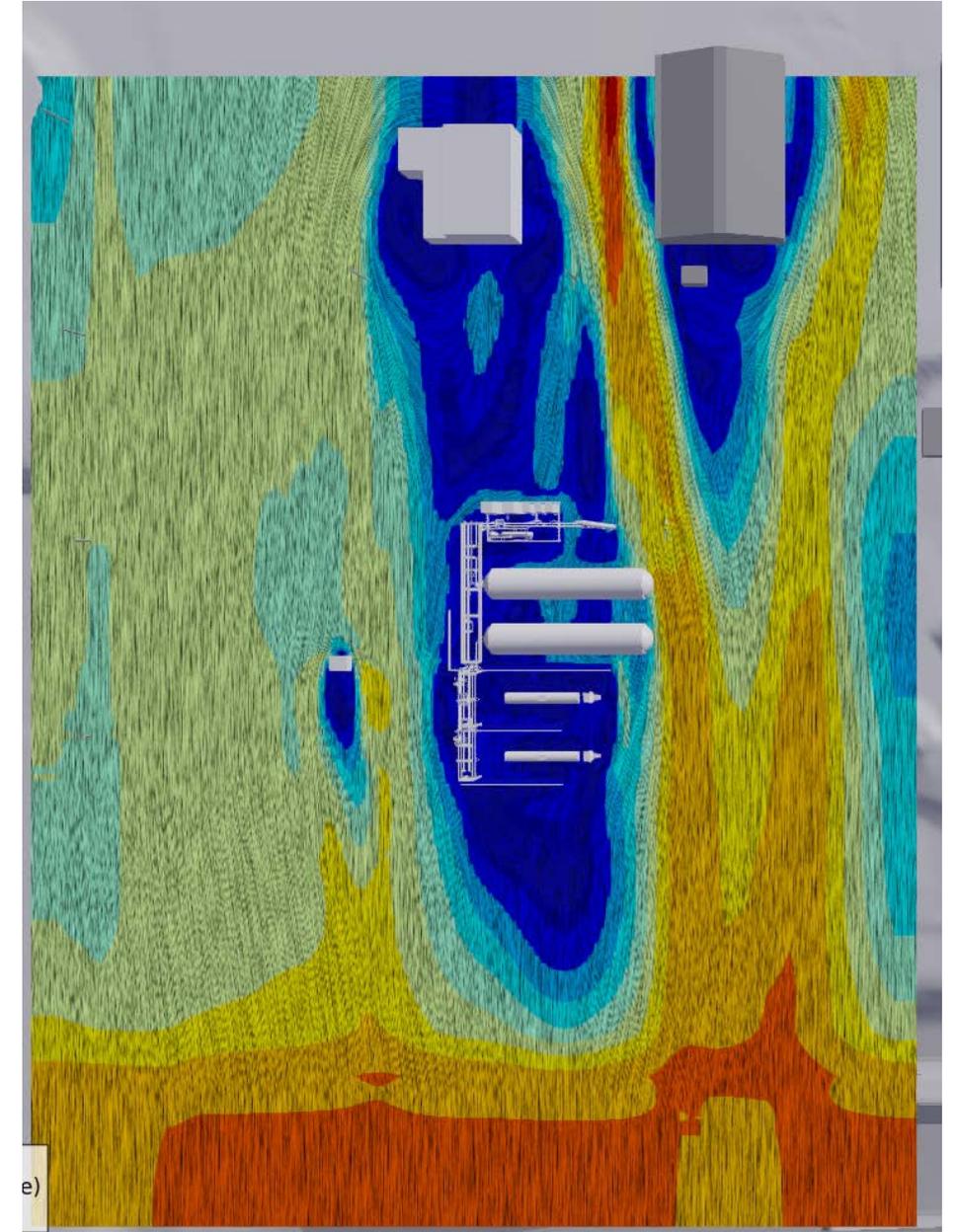
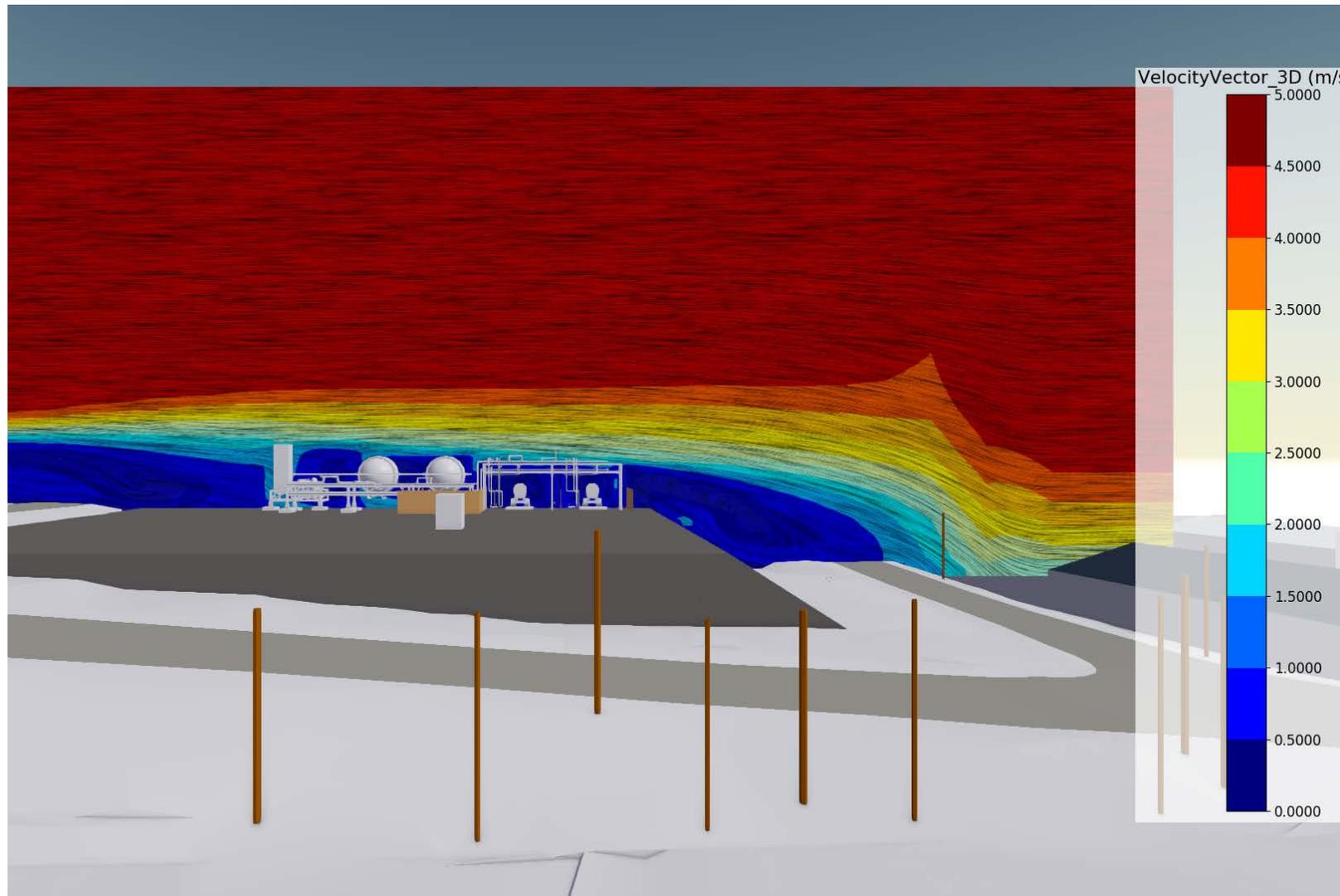


FLACS geometry model

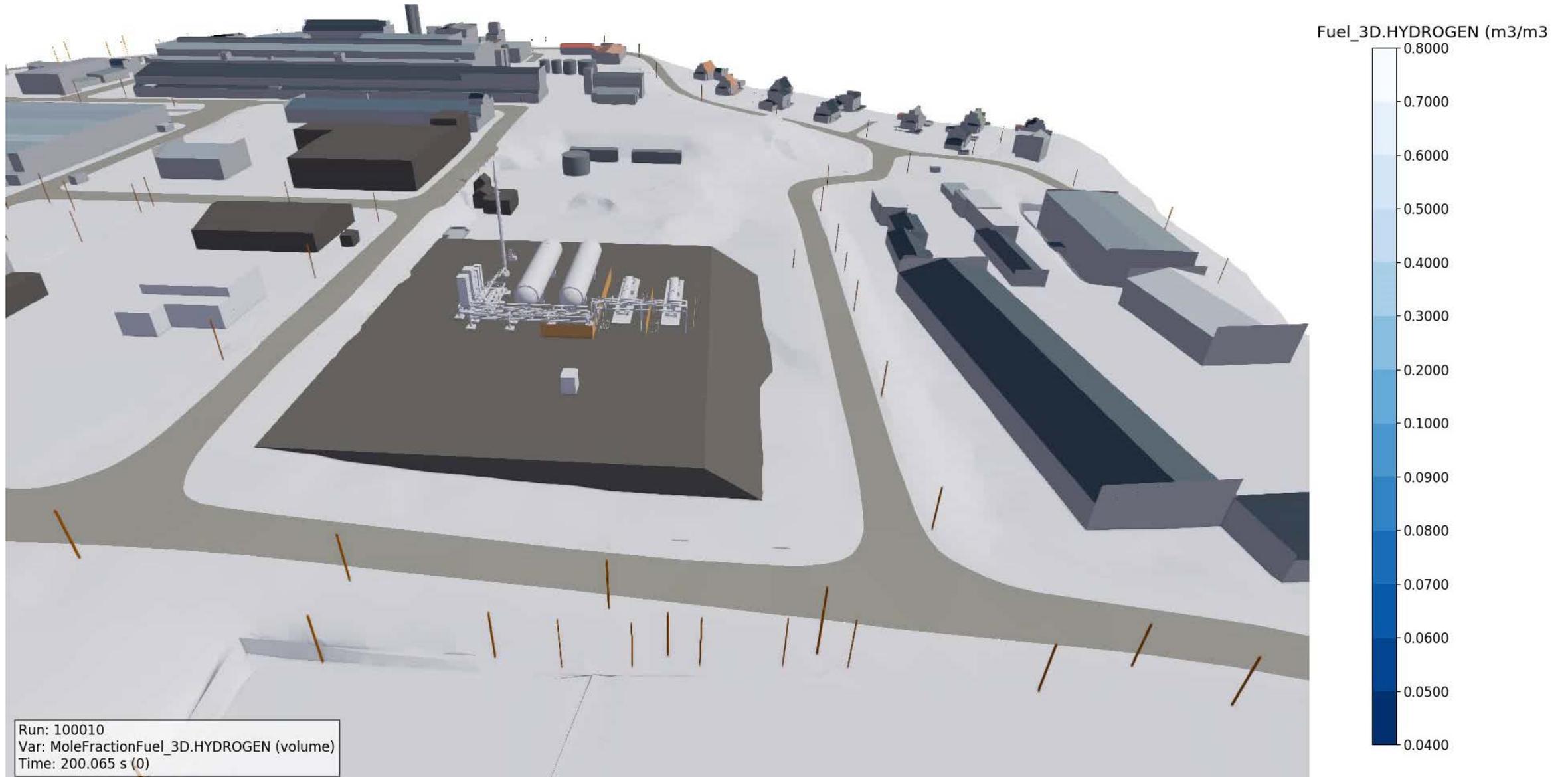
- 3D FLACS model generated by Gexcon, landscape and buildings included



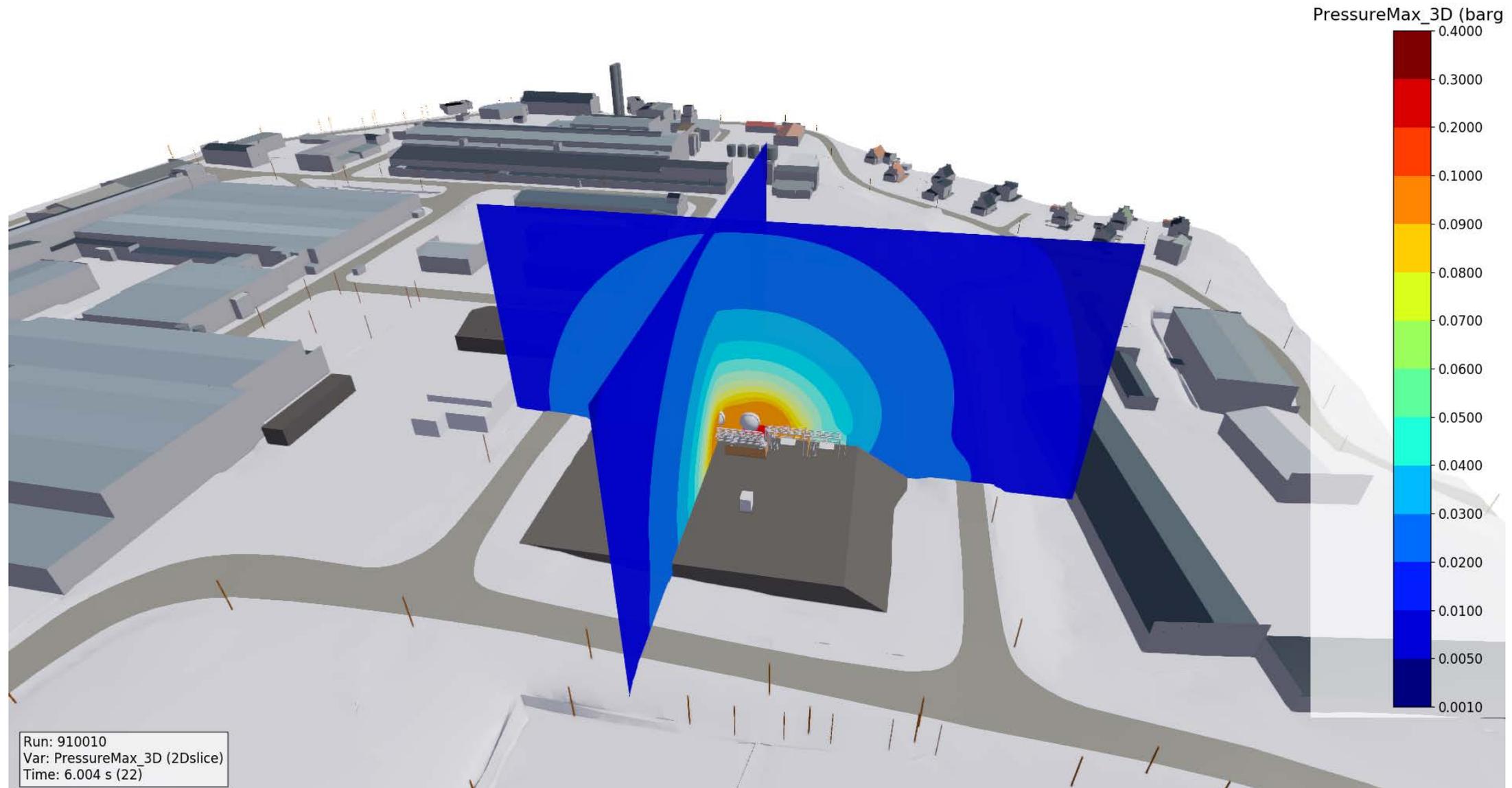
Ventilation Simulations



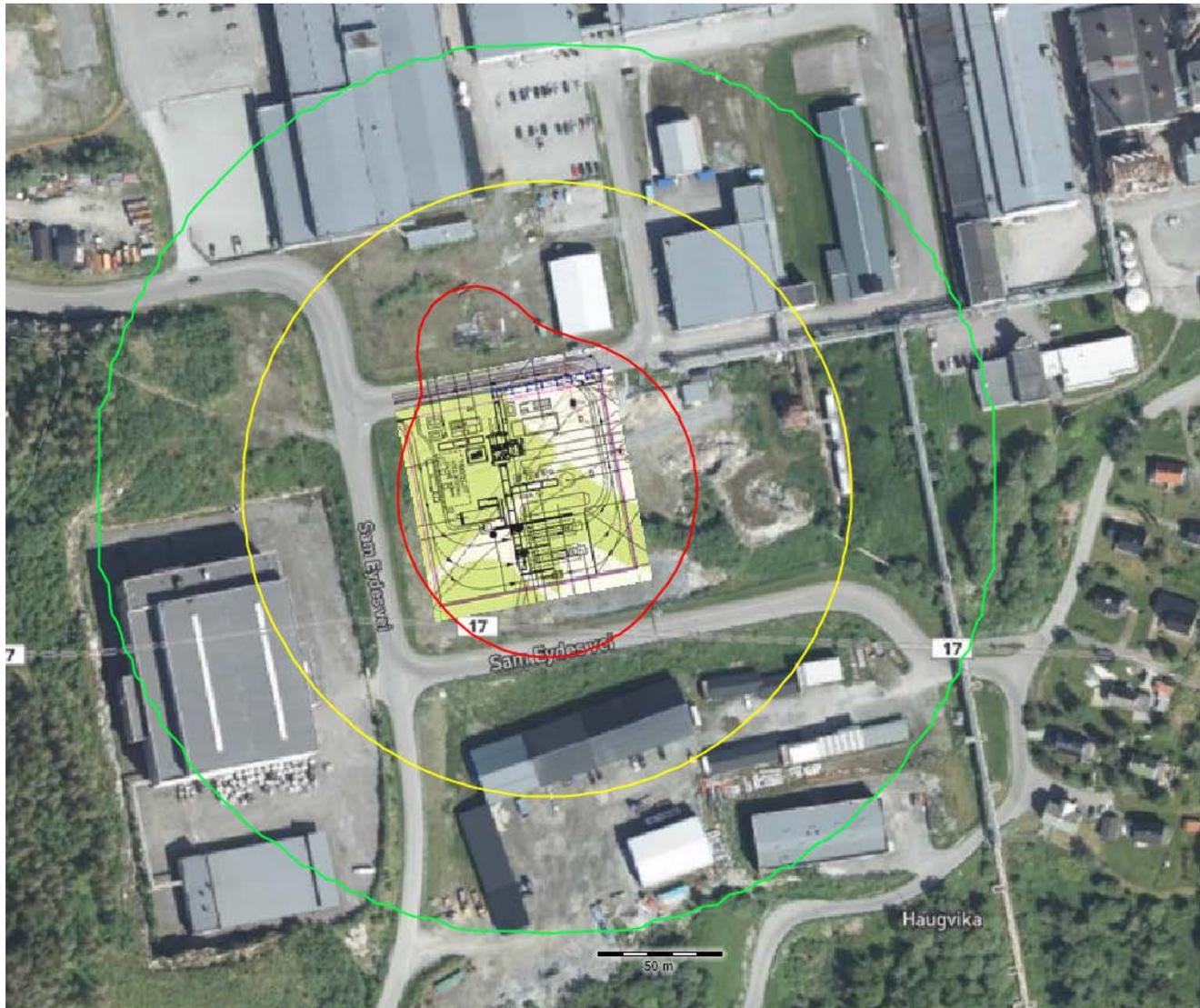
Liquid H2 Dispersion



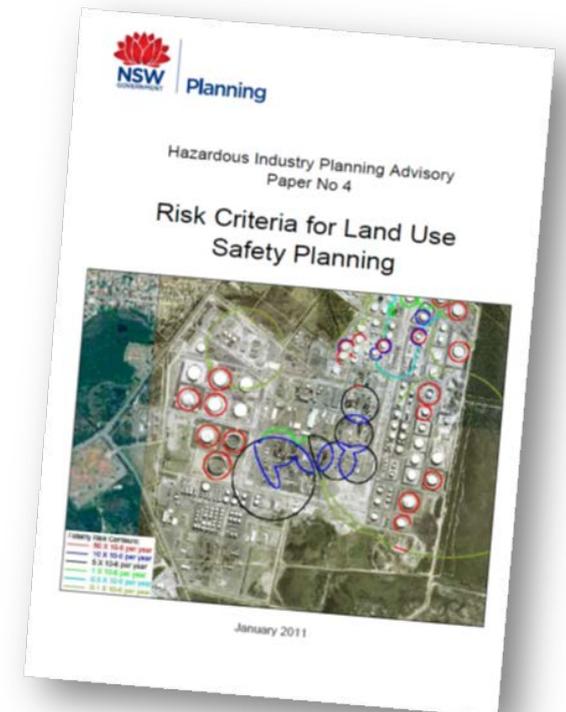
Explosion simulations



Risk Analysis for licensing



- Individual fatality risk contours
- Measurements against applicable risk acceptance criteria



Good design practices

- Natural ventilation where possible
- Avoid possibility for accumulation of buoyant gas
- Reduce or eliminate detonation potential
- Limit site congestion
- Limit potential leakage sources
- Detection of leakages by detectors plus improved control system algorithms
- Fully paved areas under pressurised systems
- Avoid asphalt paving under cryogenic systems
- Ignition source control ATEX IIC T1
- Develop suitable maintenance and inspection procedures

Major Hydrogen clients to date

Nouryon

ENGIE

equinor

FMG Fortescue

TOYOTA



PETRONAS

TiZir
TiZir Titanium & Iron

Linde

EDF

cnes

CENTRE NATIONAL D'ÉTUDES SPATIALES

BALLARD®

McPhy

nel

cmr Prototech

Air Liquide

Haskel

ATCO

NORLED

BKK

POWERCELL

GRTgaz

Rijkswaterstaat
Ministerie van Infrastructuur en Waterstaat

Thanks for your attention

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H₂

