SAFEN: SAFE Energy Carriers

2024-02-08 H2Cluster - H2 Market Meetup

Agenda

1. SAFEN project overview (Thomas Welte)
2. SAFEN results (Ingar Fossan)

SAFEN Project Overview

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SAFEN Joint Industry Project (JIP)

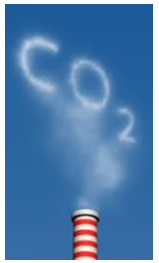
Status: JIP project started up in Q1 2022, Phase 2 started in Q3 2023

Schedule: Phase 1 (1.5 years) + Phase 2 (2.5 years)

Funding: Industry partners and consultancies (in-kind)

Project owner: Safetec

Partners: Consultancies, Authorities, Energy companies /Asset owners



Closing knowledge gaps,

sharing learnings and

developing risk-based methodologies

for hydrogen, ammonia and CCS facilities

SAFEN

SAFEN partners

Project owner

safetec

Partners
Contractors

proactima

GEXCON

DNV

Vysus Group

Partners

GASSCO

equinor

YARA

vår energi

STOREGGA

Gen2 Energy

origin

AKER HORIZONS

HYDS Hydrogen Solutions

LR

Authorities and associated members

dsb
Direktoratet for samfunnssikkerhet og beredskap

RIVM
National Institute for Public Health and the Environment
Ministry of Health, Welfare and Sport

energy institute

Sjøfartsdirektoratet
Norwegian Maritime Authority

Technology providers

Swagelok
Swagelok Norway

Safety challenges in the hydrogen, ammonia and CCS value chain

Maritime

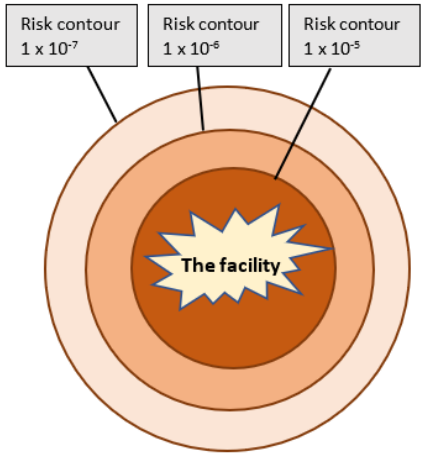
Need to prove that alternative solution is as safe as conventional technology

Alternative

Conventional

Land based production facilities

Storage of large amounts of H_2, NH_3 and CO_2

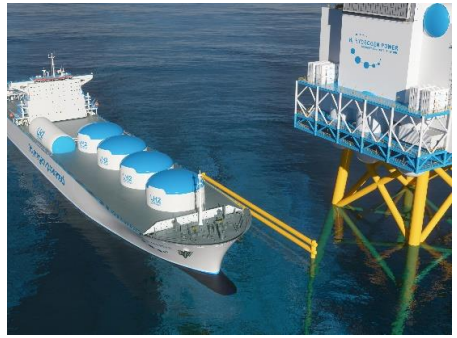


SAFEN will deliver the basis for assessing what is safe enough!

Loading, bunkering and refuelling operations

High transfer rates

Human operations



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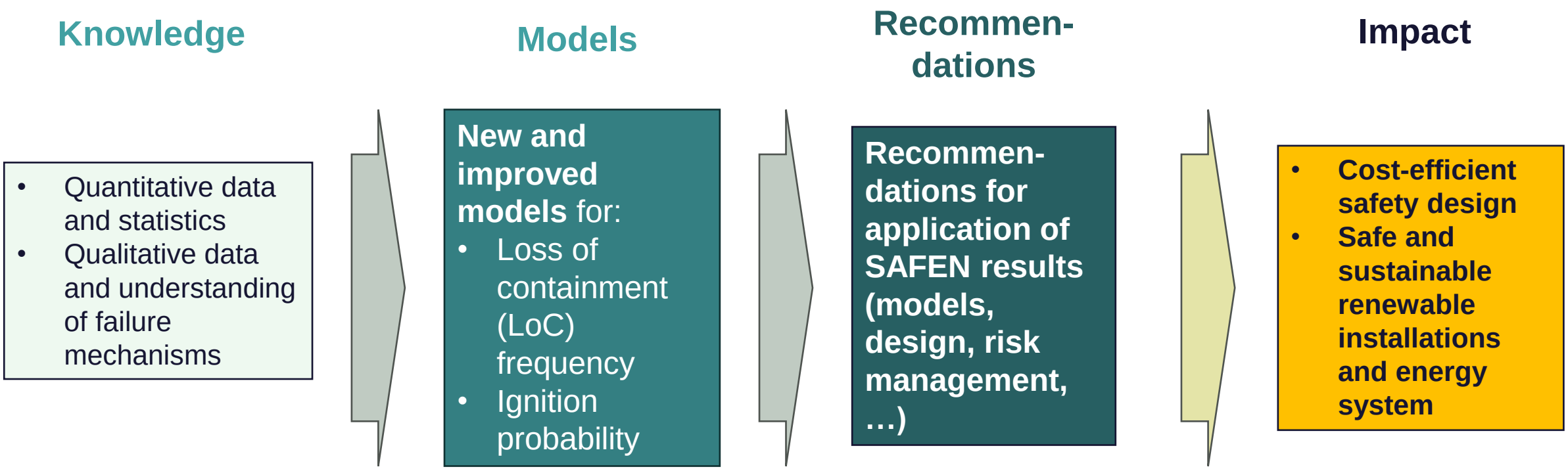
Main results and impact



SAFEN and HICON

- Safetec has been granted funding from the Research Council of Norway for the proposed innovation project “HICON – Hydrogen Ignition CONtrol”

Forskningsrådet

Prosjek

HJEM | NYHETER OG PRESSEMELDINGER | 216 MILLIONER TIL FORSKNING PÅ FORNYBAR ENERGI

216 millioner til forskning på fornybar energi

Forskningsrådet investerer i 25 nye prosjekter innen fornybar energiproduksjon, energibruk og kraftsystemet. Alle prosjektene ledes av bedrifter.

PRESSEMELDING | PUBLISERT 18. DES 2023 DEL | LAST NED

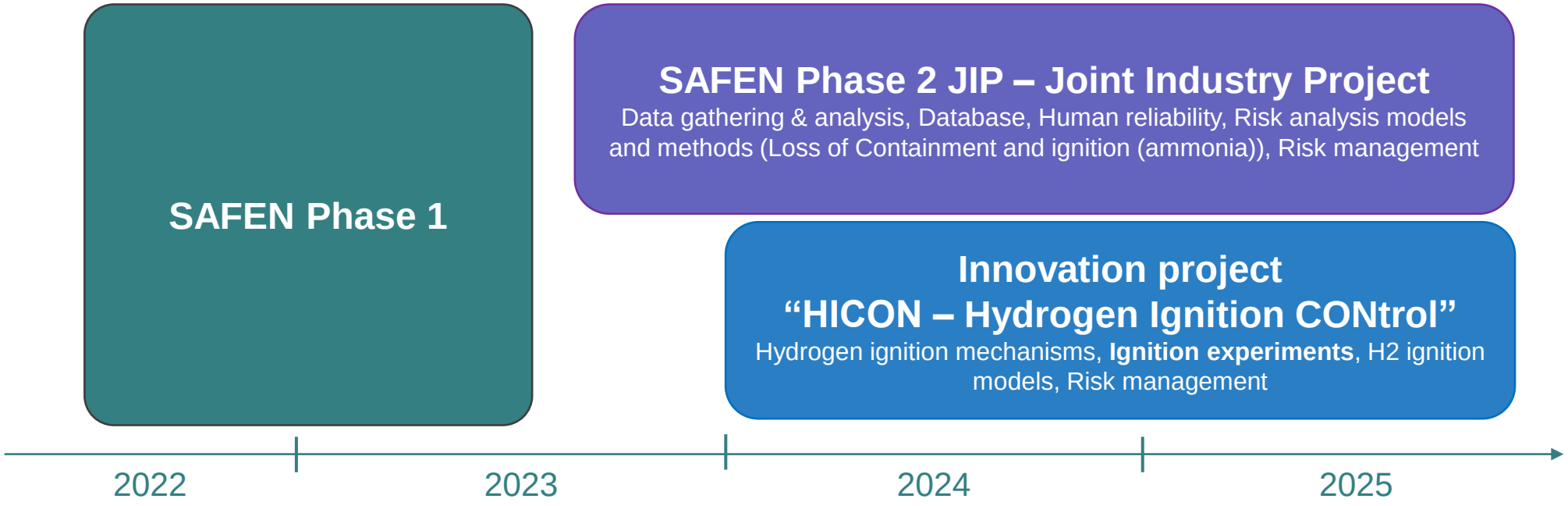
DISSE FÅR STØTTE:

Bedrift	Prosjekttittel	Innstilt beløp (i 1000)	Fylke	Kommune
SAFETEC NORDIC AS	Hydrogen Ignition CONtrol	6 450	Trøndelag	Trondheim

[216 millioner til forskning på fornybar energi (forskningsradet.no)]

SAFEN Phase 2 project structure

- Safetec has been granted funding from the Research Council of Norway for the proposed innovation project “HICON – Hydrogen Ignition CONtrol”



SAFEN Results

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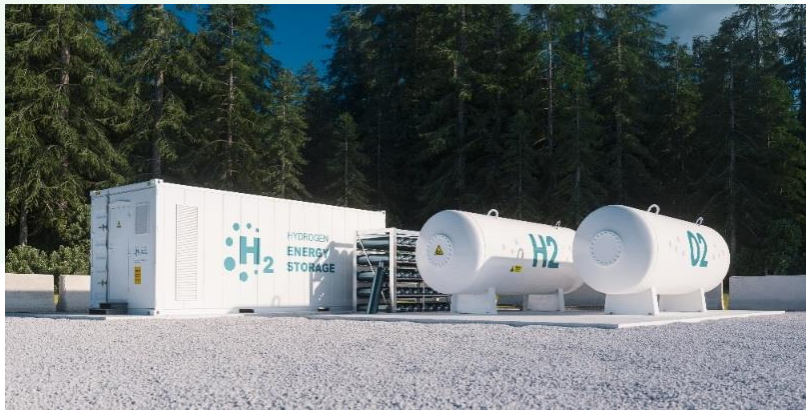
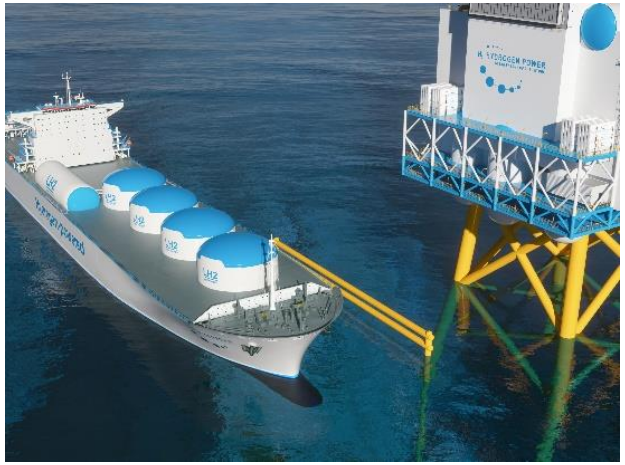
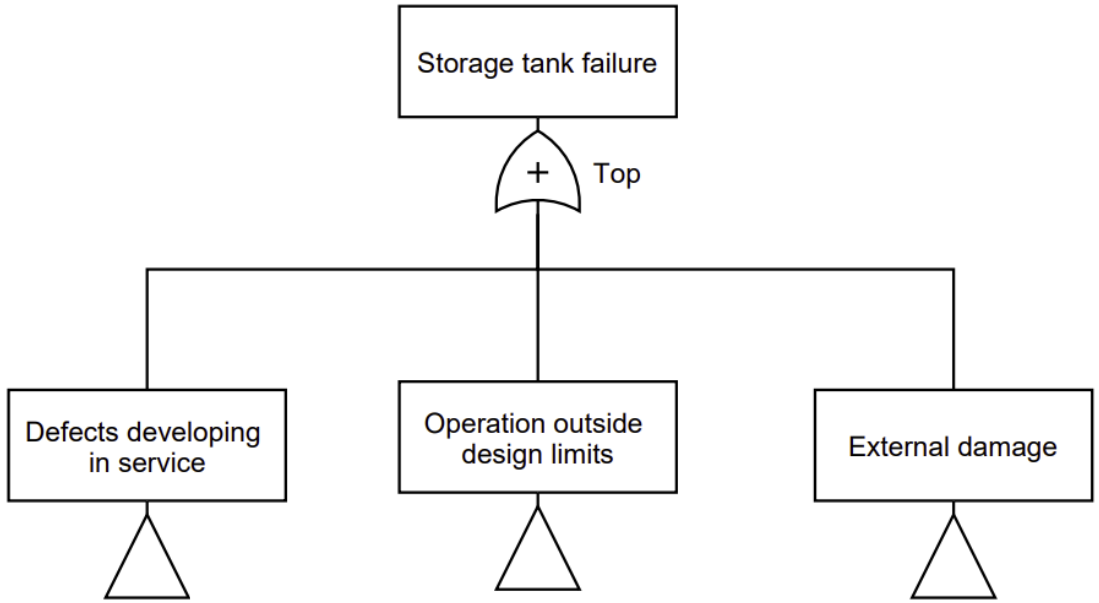
SAFEN models

- Storage tanks
  - Simple LoC model with guidelines
- Process equipment
  - New LoC model
- Transfer operations
  - SAFEN support further development of new RIVM model
- Ignition probability models
  - Hydrogen
  - Ammonia (on-going)

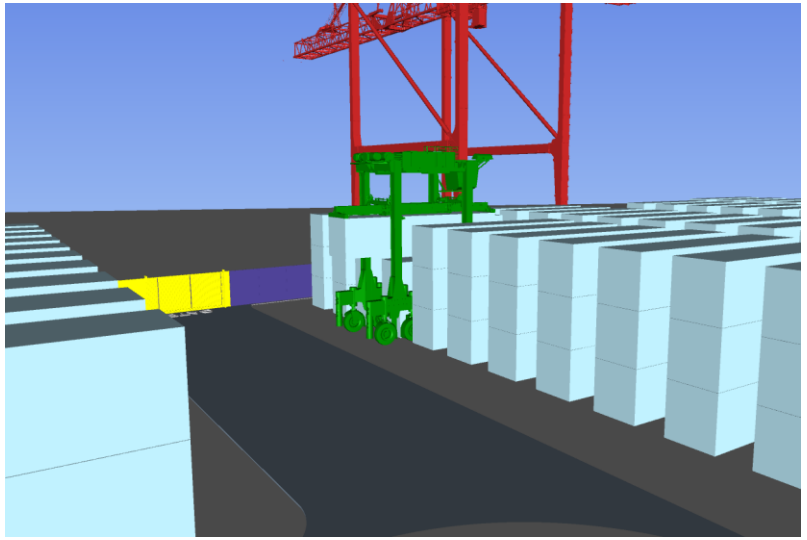




Storage tank failure



Many identical items



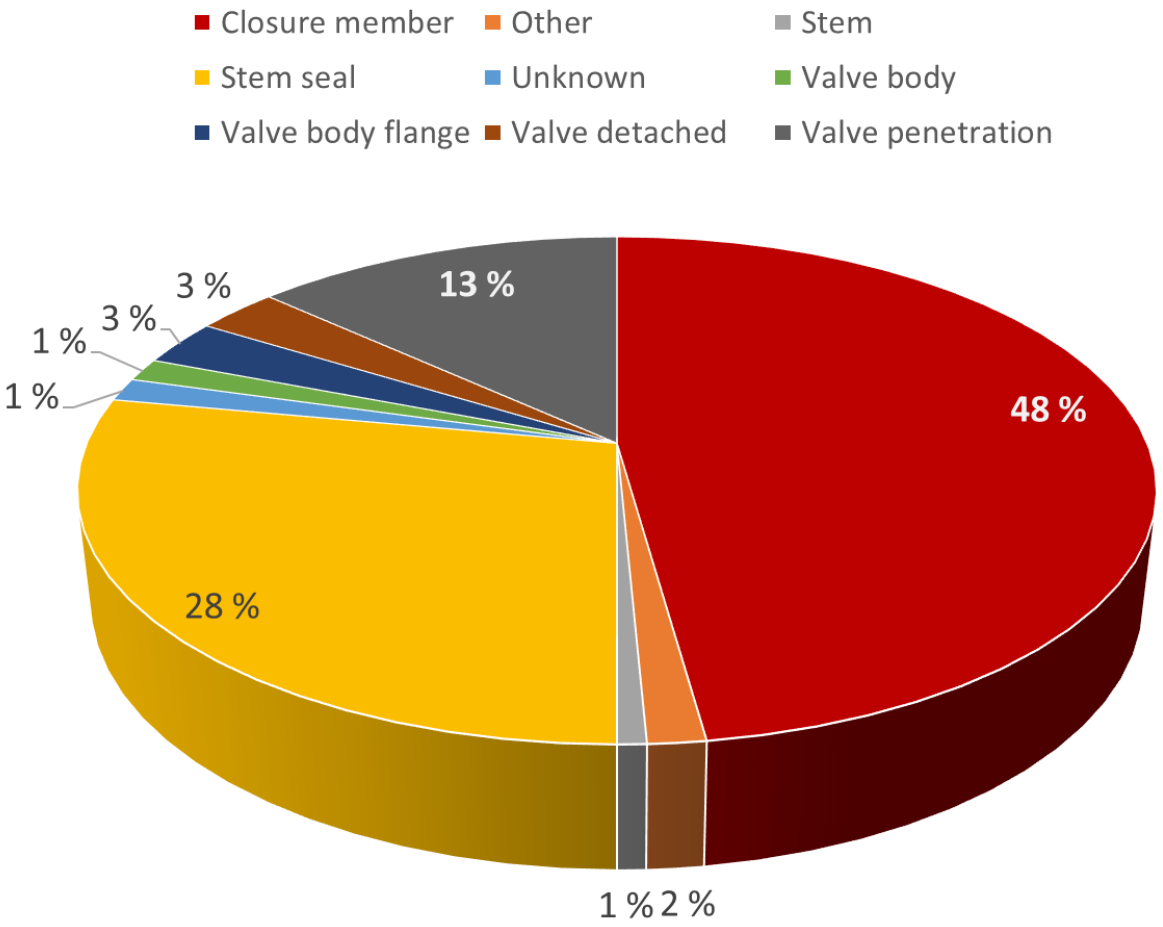
Containerized storage solutions (permanent or mobile)

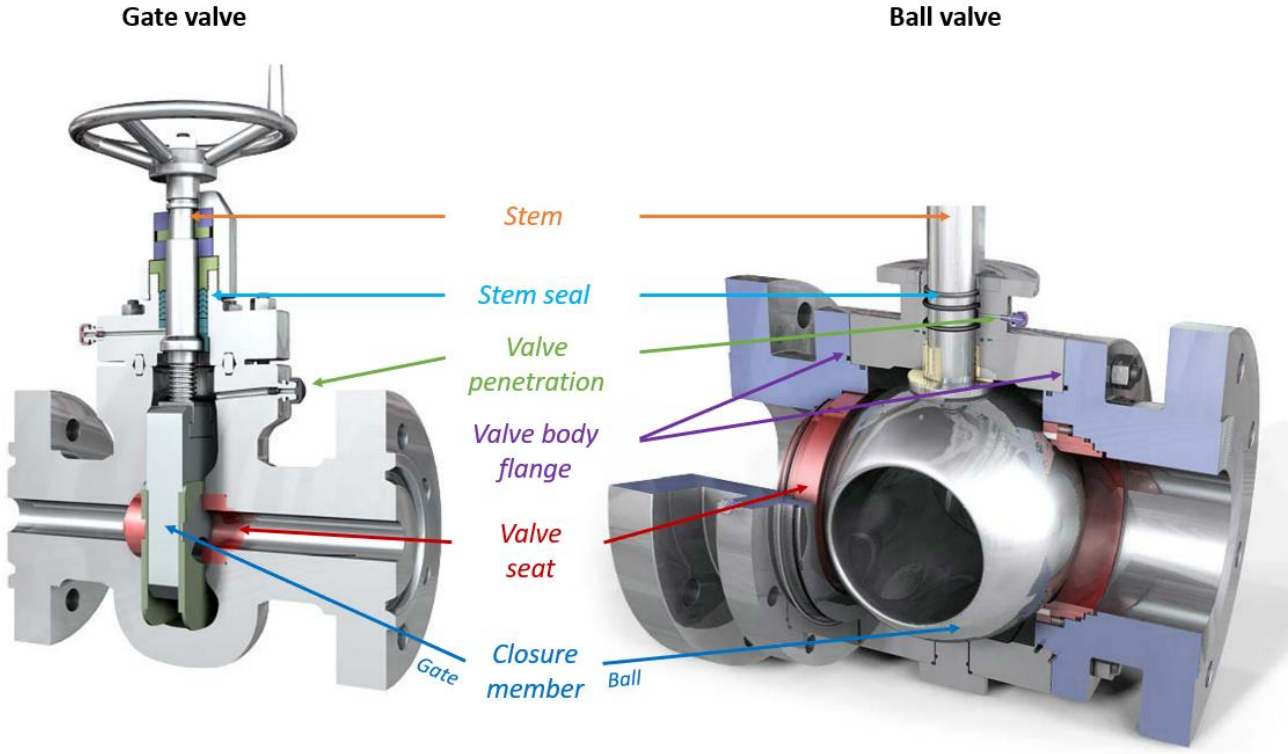
Transport modules

What is the frequency for rupture scenarios for such a design, can we extrapolate from existing models; 63 tanks · X · 10^{-y} ruptures per tank/year?

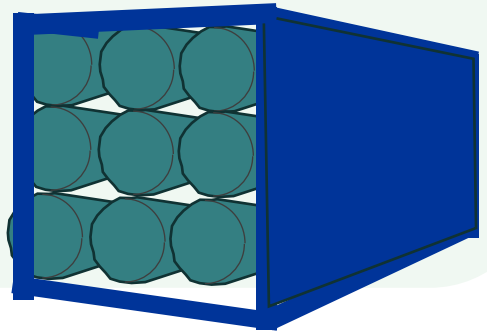
It is about operation and not about technical integrity!

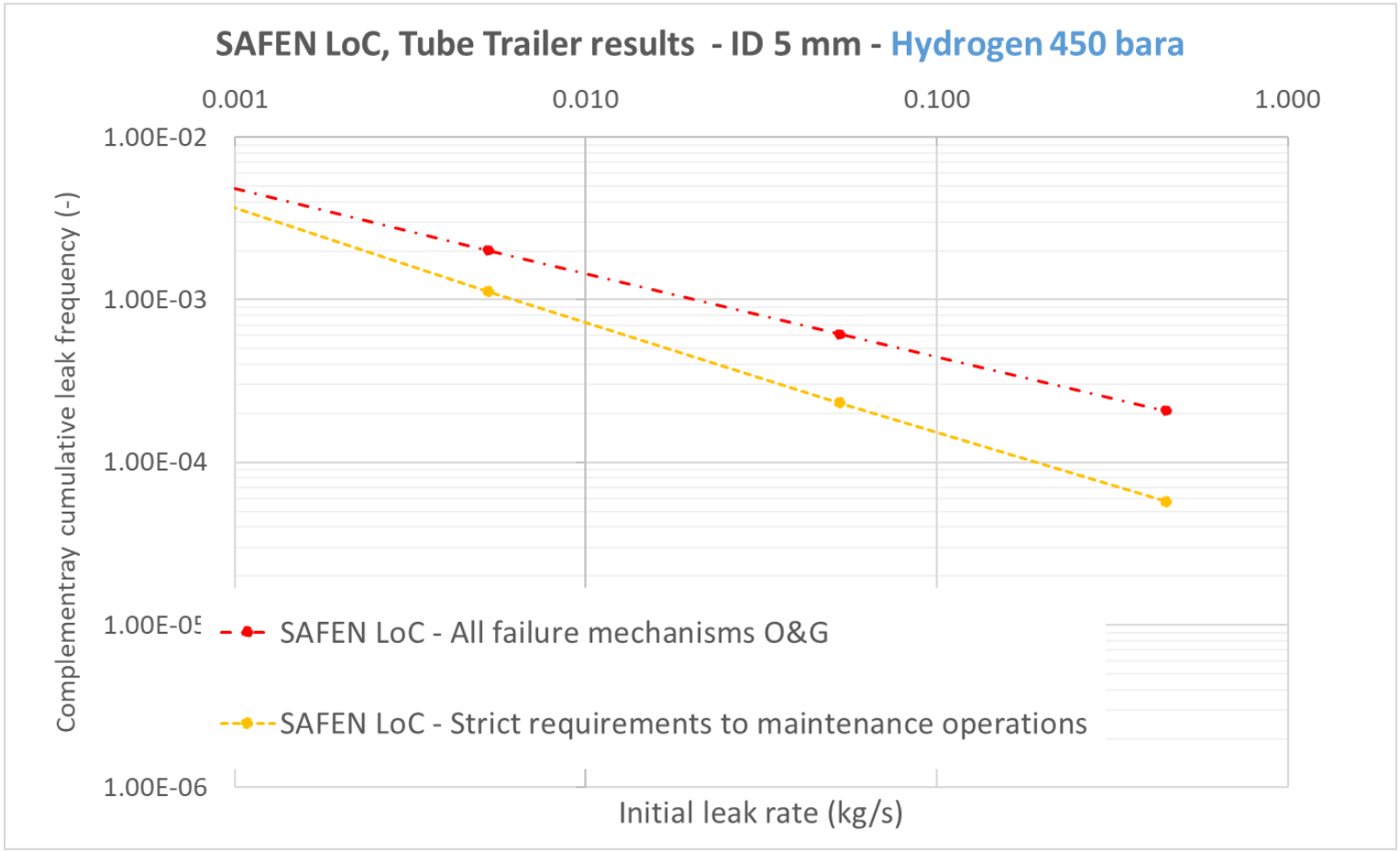
Valve in erronous position causing unintentional flow is the main driver for leaks related to valves

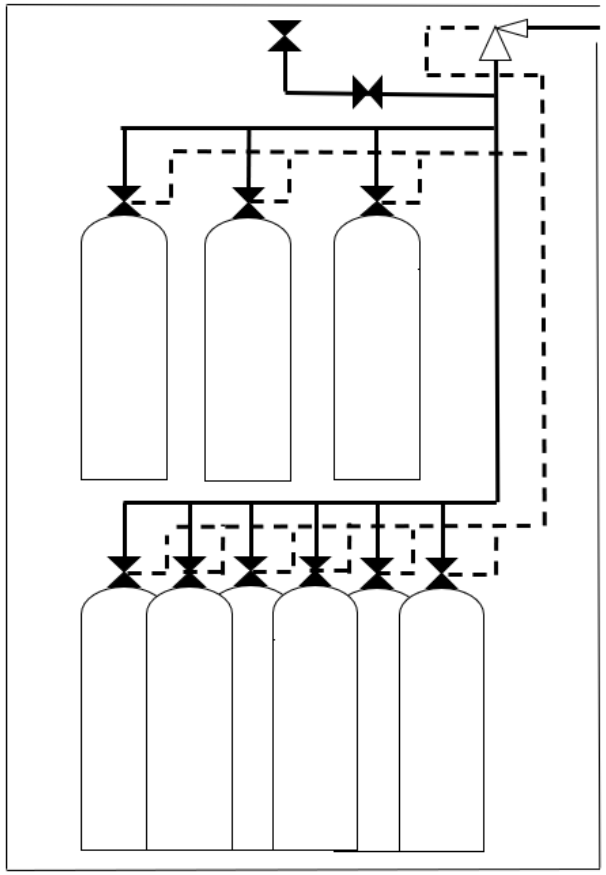




Which failure mechanisms count?

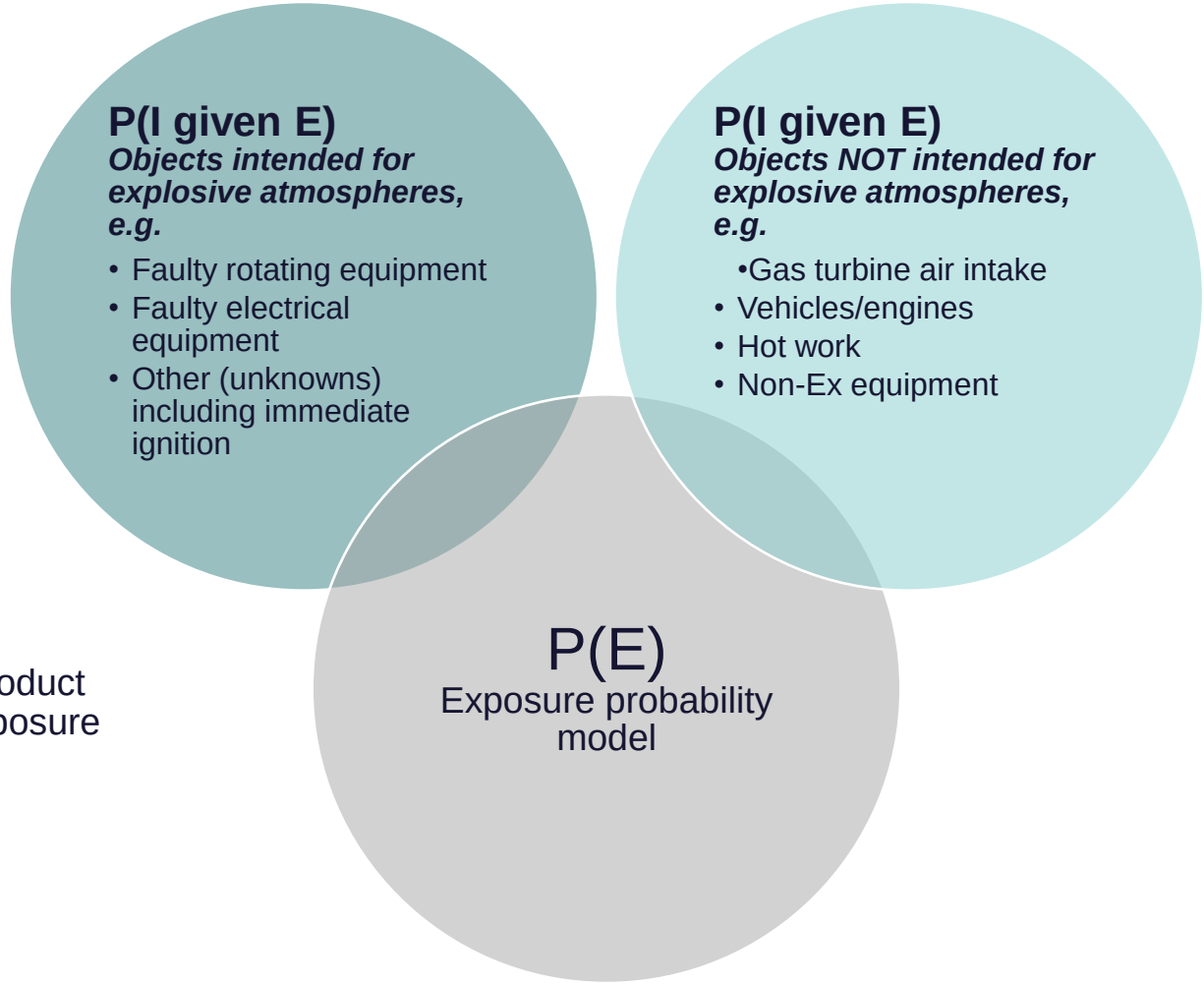




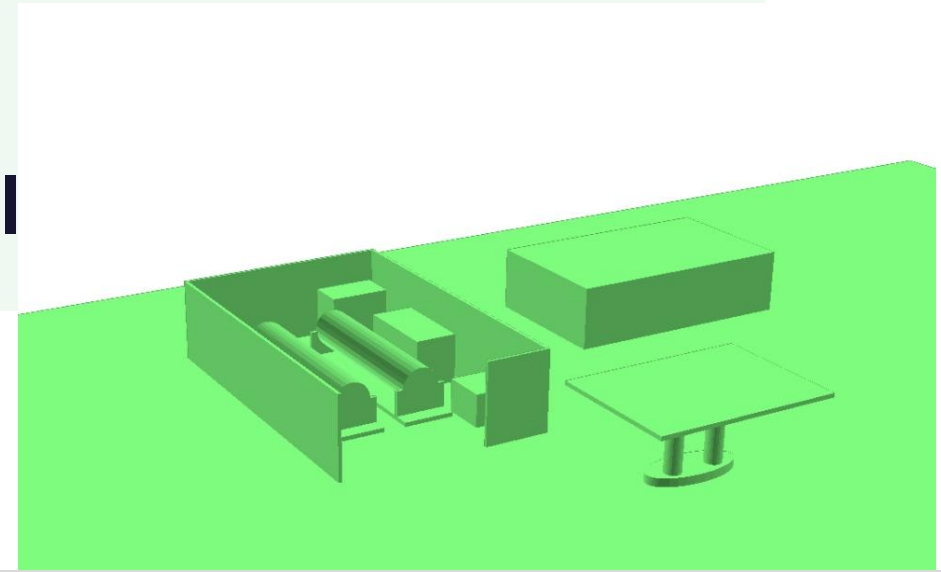


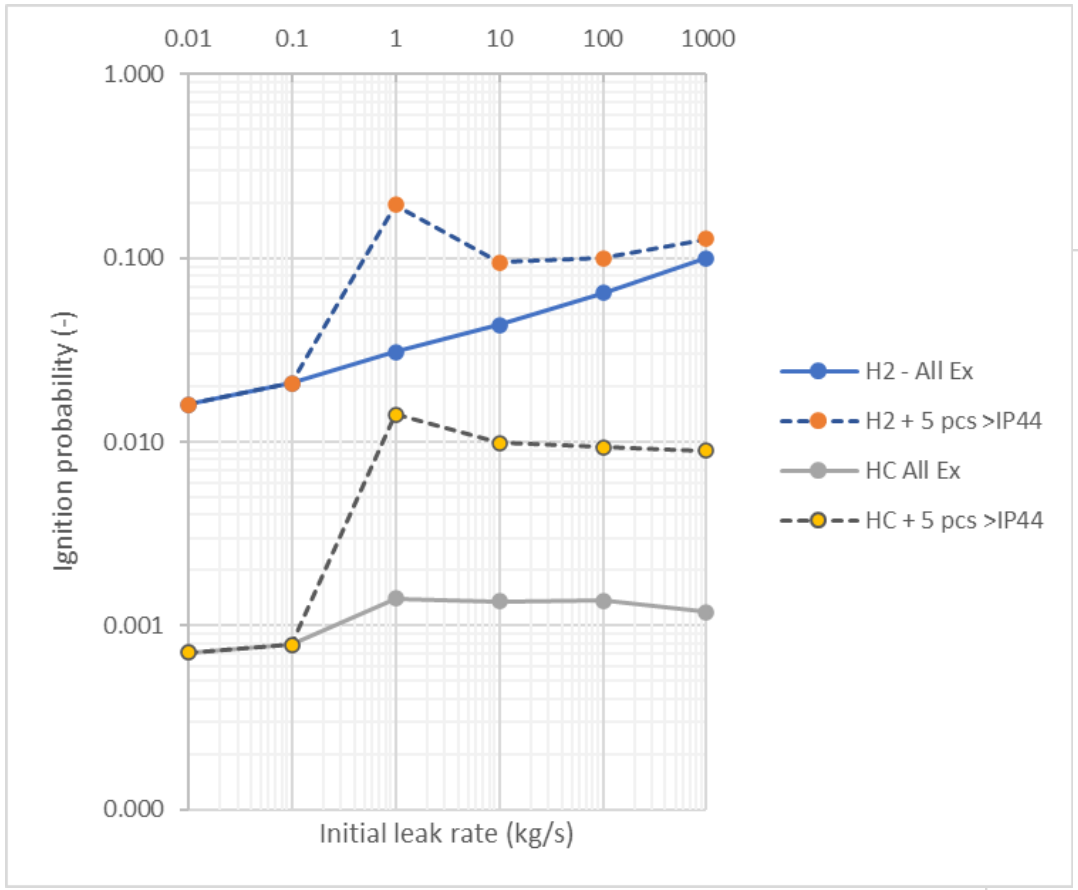
SAFEN Ignition model

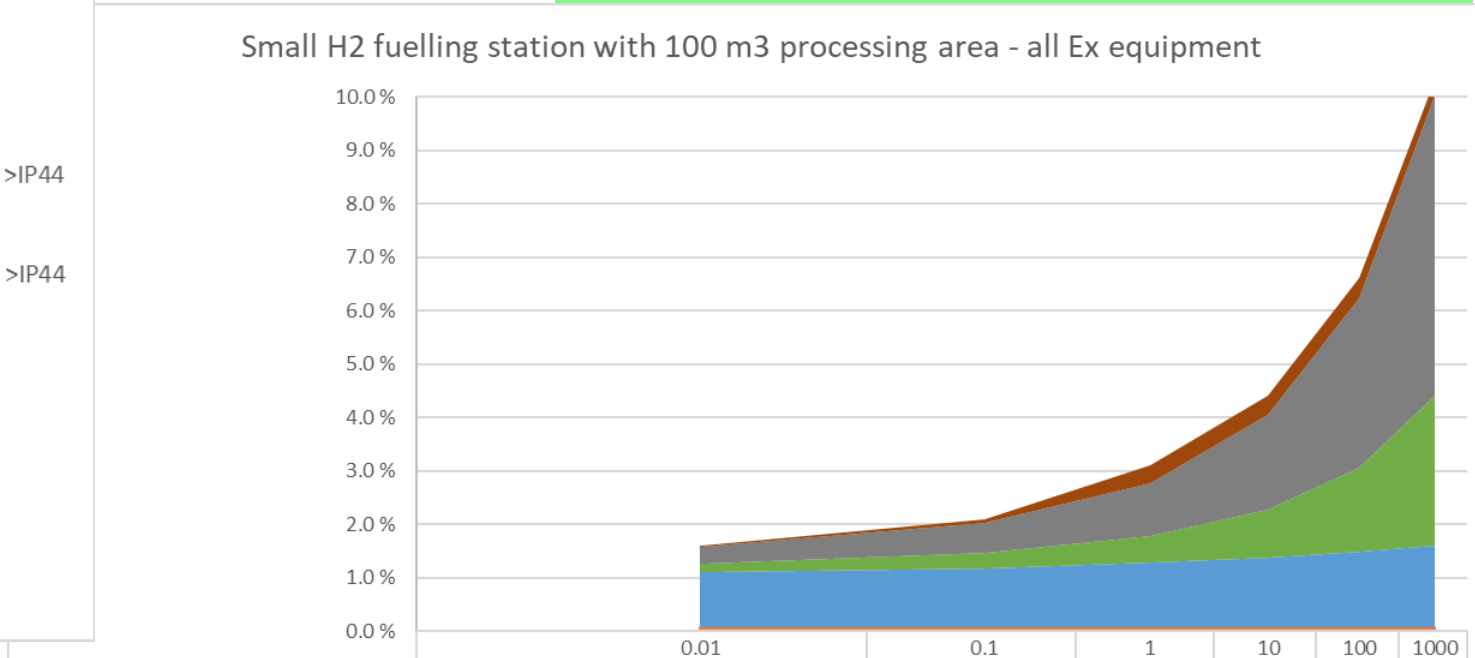
- The properties of the ignition control barrier matters
  - type of ignition sources
  - isolation of equipment
  - detection
  - etc
- The size of the combustible cloud play a role – the likelihood for exposure to a live ignition source
- Our hypothesis therefore that we should develop a model in line with the rational for MISOF model HC: the ignition probability is the product of the probability for exposure and the probability for ignition given exposure
- But we need to include parameters reflecting
  - Ignition by hot surfaces
  - Ignition by electrostatic discharges
  - Ignition by corona discharges
  - Adiabatic compression and shock waves(diffusion ignition)
  - Ignition of LH2 releases in/onto water (not implemented yet)



SAFEN H2 ignition probability model







	0.01	0.1	1	10	100	1000
Delayed (Electrostatic + Hot surface)	1.5E-04	7.0E-04	3.2E-03	3.5E-03	3.7E-03	2.8E-03
Electrostatic discharges	3.2E-03	5.6E-03	1.0E-02	1.8E-02	3.2E-02	5.6E-02
Mechancial impact	1.6E-03	2.8E-03	5.0E-03	8.9E-03	1.6E-02	2.8E-02
Diffusion total	1.0E-02	1.1E-02	1.2E-02	1.3E-02	1.4E-02	1.5E-02
Generic immediate	7.0E-04	7.0E-04	7.0E-04	7.0E-04	7.0E-04	7.0E-04

Interested to learn more about SAFEN, and how you can benefit from the project?

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