Hydrogen Enclosure Safety task force - Project proposal "CFD dispersion and explosion modelling"					
WG Name	Hydrogen and Alternative Fuels	**Chair**	Peter Kutne (DLR)	**Co-chair**	Geert Laagland (Vattenfall)
Project lead	Chris Dagnall (DNV)				
Core team	Chris Dagnall (DNV); Rob Crewe (DNV); Nicolò Cairo (ETN); Rene Vijgen (ETN); Michael Johnson (DNV)				
ETN officer	Nicolò Cairo (ETN); Rene Vijgen (ETN)				

Initiative description

Scope definition

The scope of work consists of the following:

- Build 3D models of the GT Enclosure, 3 GT Enclosure sizes
- Run CFD dispersion simulations with ventilation
- Run CFD explosion simulations
- Post process CFD results and provide conclusions

Objective setting

The main objective of this initiative is to determine whether ISO 21789 needs updating to account for hydrogen use in GT Enclosures. In addition to that, the experiments give a valuable input to the CFD analyses that are carried out by various members.

Expected outcome

- An experimental reference case that can be used to "calibrate/validate " CFD explosion simulations
- Conclusions regarding whether ISO 21789 in its current form is valid for hydrogen use in GT enclosures
- If ISO 21789 requires an update, recommendations as to what form this should take

Implementation of the activities

Project execution

ISO 21789 indicates that any flammable natural gas cloud should be detectable if its equivalent stoichiometric volume is greater than 0.1% of the free volume of the GT enclosure. This ensures that undetected leaks can generate no more than 10mbar in pressure if ignited. The same could be applied for hydrogen, however due to its rapid burning rate, the pressure generated from a 0.1% cloud could be greater. The study will combine Computational Fluid Dynamic (CFD) modelling with experimental studies in a 180m^3 explosion chamber in order to determine if an update to ISO 21789 is required. The experiments will involve small hydrogen leaks, representing a realistic case, and idealised stoichiometric balloons of hydrogen/air mixture with a volume of approximately 0.18m^3 (0.1% of the chamber volume). The CFD analysis will be used to extend investigations in a realistic enclosure geometry.

Project finances

The estimated funding necessary for the project is £277,813

Meeting schedule and dissemination

The project duration is estimated at 14 weeks for the CFD analysis and the experimental study.

Deliverables & Milestones

Deliverable 1	Report on CFD Analysis	**Timing**	October 2025
Report describing the work conducted and results from the CFD analysis.			
Deliverable 2	Report on Experiments	**Timing**	October 2025
Report describing the scope of the experimental studies and results obtained.			
Milestone 1	Project start	**Date**	April 2025
Milestone 2	Project end	**Date**	October 2025