ISO/TC 197
Hydrogen technologies

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Norwegian comments to ISO CD2 19880-1

Document type:	Other committee document
Date of document:	2017-06-07
Expected action:	INFO
Background:	Here are the comments from Norway that were received after the CD 19880-1.2 Ballot had closed. They will be treated by WG 24 along with the other comments that were submitted with the CD2 Ballot.
Committee URL:	http://isotc.iso.org/livelink/livelink/open/tc197

Template for comments and secretariat observations

Date: 06.06.2017	Document: **Norwegian comments to ISO/CD 19880-1**	Project:

MB/ NC[1]	Line number (e.g. 17)	Clause/ Subclause (e.g. 3.1)	Paragraph/ Figure/ Table/ (e.g. Table 1)	Type of comment[2]	Comments	Proposed change	Observations of the secretariat
No	6	7.8.1	Paragraph 3	te	It is believed that to design for detonation may be very expensive and could be a possible showstopper. Reconsider if it should be required to design for a detonation. It can be designed to a lower pressure if it is ensured that a detonation is avoided. This can be ensured by either designing for the worst possible leak, or a probabilistic explosion analysis showing that the design explosion pressure has a frequency that is acceptable. To design the equipment for a detonation would also not match possible requirements to design to avoid human impact. A detonation is from 10 barg and higher pressures, and human tolerance is 100 times less indicating this mismatch.	Safety critical elements such as piping systems and equipment that could lead to rupture of pipes and escalation of the accident should be designed against a specified design pressure for the piping or equipment. An explosion risk analysis should be performed to obtain the pressure design accidental load (DeAL). There are two options to perform an explosion risk analysis, either probabilistic or deterministic. A deterministic approach is described in 7.11, whereas a probabilistic explosion analysis should be performed by specialist consultants. See also Appendix A.	
No	1	7.11		te	A definition of what is meant by an enclosure should be given. The hydrogen equipment is sometimes supplied with a hood or cabinet and a suction from the top of the hood. When this covered system comes in addition to a separate ventilation system in an enclosed room, a separate assessment for the room is also recommended.	Include a paragraph describing enclosures and include pictures if possible. For example, enclosures can be an enclosed room where personnel can walk in, cabinets or hoods covering only the hydrogen equipment, or a combination where a hydrogen equipment is inside a room with or without a cabinet or hood. This standard covers primarily the simple system with hydrogen equipment inside a single wall enclosure. If two enclosures are surrounding the equipment both enclosures should follow ventilation requirements.	
No	1	7.11		te	Define passive and active ventilation and write that passive, natural ventilation should primarily be used.	Add a paragraph or modify the first paragraph: Passive ventilation is ventilation driven by natural wind in a semi open skid or equipment pad, etc. Active ventilation is ventilation provided by a fan and inlet/outlet ducts or openings in an enclosure.	

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						Hydrogen equipment should primarily be placed in a naturally vented area with minimum roof coverage so that leaking hydrogen will disperse upwards.	
No	5	7.11	NOTE	te	This note should be described more instructive. It covers the main design parameters that one need to have control over: The design leak rate, the associated cloud size and the explosion pressure, and the design pressure of the walls.	Replace the note: NOTE: A small flammable cloud near the leak is unavoidable when the leak is above a certain size. First, a design leak rate need to be established (e.g. full bore rupture of the supply pipe). Then the resulting size of the flammable cloud should be established. The volume of the gas in the fuel cell and the supply piping need to be considered to establish the transient leak rate and the associated cloud size. This will then give a design cloud size. This design flammable cloud will further result in an explosion pressure in the enclosure. This pressure need to be established as a design pressure. An explosion in the design cloud should not exceed the design pressure of the walls of the enclosure. A safety margin between the calculated explosion pressure and the walls design pressure should be applied. Calculations of leak, cloud size and explosion pressures need to be performed with a CFD tool or simplified tools. The choice of the tool to be used is dependent on the criticality of this scenario. If e.g. the pipe is very small and a small leak rate is found, simplified tools can be used to show that possible explosion pressures are negligible. If it is possible that the leak can generate a cloud and a pressure that is above typical strengths of the walls, then a more detailed CFD tool should be used. If the design explosion	

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						pressures are higher than it is economic to design the enclosure for, then explosion panels should be considered. A CFD tool need to be used to design such explosion panels. Explosion tests should be applied to approve such panels.	
No	Line 11, page 38	7.11		te	It is recommended not to allow non-classified el. equipment in enclosures and rooms with hydrogen, except for equipment where this is near impossible (electrolyzers, fuelcells?). One can also suggest that equipment manufacturer makes the equipment ex proof.	The paragraph should describe which types of equipment cannot be made or obtained as classified electrical equipment. The defined non-classified equipment should not be started before the ventilation system has purged the space sufficiently with air to ensure residual gas is removed. Other equipment than the special non-classified equipment should be classified electrical equipment that is explosion proof.	
No	Line 18, page 38	7.11		te	It should be added that the volume of hydrogen in the pipe system should be minimized with using shut down valves at the inlet to the enclosure	Add the paragraph: The volume of hydrogen in the pipe system should be minimized by using emergency shut down (ESD) valves at the inlet to the enclosure. The volume of hydrogen that can leak out should be considered when calculating the dispersion cloud size and associated explosion pressure (see note above). If the volume is sufficiently small, the gas cloud size would also be reduced. The gas detection system and automatic shutdown of the ESD valve need to be considered to set the time to gas detection and shutdown of the ESD.	
No	Line 5	A.2	Paragraph 1		It can also be avoided to design piping and equipment's against detonations. This can be achieved by using an explosion risk analysis where the outcome is a design load for equipment and walls.	Using QRA may allow (for instance using mitigation measures) for shorter safety distances and/or simplified station layout and/or reduced design accidental pressure and fire loads on piping and equipment/walls. The latter will require a dedicated fire and explosion risk analysis to be	

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						performed as a part of the QRA.	
No		A.3.1, Pg 96		te	Include CFD tools FLACS and KFX-exsim, e.g.	Add the CFD tools under the list of toolkits: FLACS: Industry standard CFD tool that is widely used for ventilation, gas dispersion and explosion simulations in safety analyses. It also includes a fire module which is relatively new. KFX-Exsim: Industry standard CFD tool that is widely used for ventilation, gas dispersion and fire simulations in safety analysis. It also newly includes an explosion module (KFX-Exsim) which has been acquired from Shell. This explosion code is relatively new in KFX-Exsim, but has a long track record.	
No	9	A.2.2.6.5	Paragraph 5	te	Confined spaces or enclosures could also lead to high explosion pressures.	The turbulence in the hydrogen release, and/or the presence of objects, and/or release in a confined space can potentially result in an increase of the overpressure generated.	
No		Annex A	First paragraph.	te	The objective of the QRA should also include design loads on equipment, piping and walls. These design loads need then to be used in the design preventing an escalation of the event in case of an accident.	If high explosion pressures can be expected such as in enclosed rooms with hydrogen equipment, or when skids are large, then piping, equipment's and walls should be designed against an explosion pressure. The design accidental Load for pressure need to be calculated using a dedicated explosion risk analysis. Such analysis can also be used to design mitigating measures. The method should combine consequence results from CFD models with frequencies and probabilities from the QRA. Description of such method can be found in NORSOK Z013, annex G.	
No		Annex A	general	te	Under Annex A, it is suggested to refer to Hysafe work on Safety distances if this is not already.	http://www.sciencedirect.com/science/article/pii/S036031990700211X	
No		Annex A	A.5	te	It may be to much biased towards one approach	Add a paragraph with: the example uses HyRAM	

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					using HyRAM. It is suggested to write that other approaches such as Safeti and PhastRisk are equally well suited.	tool. Other tools such as SAFETI and PhastRisk are equally suited for this kind of QRAs.	

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