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Regulations, Codes & Standards for the Approval of Hydrogen Refuelling Stations

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1 Introduction

In several world regions, the roll out of commercial hydrogen fuel cell vehicles is expected to gain momentum from 2015 onwards. Germany and Japan have announced the stepwise implementation of Hydrogen Refuelling Station (HRS) infrastructures between 2015 and 2020 [1]. In Germany, a joint statement (MoU) on the development and market introduction of electric vehicles with fuel cells was announced by leading automobile manufacturers in September 2009. From 2015 onwards, several hundred thousand vehicles are anticipated worldwide. This started with a joint initiative by Daimler and Linde aimed at providing a sufficient hydrogen refuelling station infrastructure, which is the key to establishing electric vehicles with fuel cells in the market. In addition to Daimler and Linde, OMV, Shell, Total, Vattenfall Europe and EnBW are participating in this endeavour, which is supported by the German government.

This paper discusses the state of affairs regarding HRS approval.

2 What Has Been Achieved?

To successfully facilitate the implementation of a hydrogen infrastructure, local approval conditions have to be respected while applying preferably harmonised minimum requirements for the safe design, operation and maintenance of an HRS as well as a recommended permitting process. In 2007, key partners from Europe, China, Japan and the USA completed the HyApproval Handbook, which serves as a guideline to this approach [2].

Furthermore, ISO has issued a technical specification (TS) for the standardised layout of HRSs, ISO/TS 20100 *Gaseous Hydrogen — Fuelling Stations* [ISO 20100 - 2008], which was prepared by ISO/TC 197 WG11. WG11 is presently conducting further analyses of safety distances and hazardous zones. With regard to safety distances, a task group aims to improve the safety distance table of the current ISO/CD 20100 [3] for each type/category of equipment (e.g. un-/occupied buildings, flammable liquids above-/under-ground, stocks of combustible material, flammable gas storage above ground, the facility lot line, pedestrian walkways, vehicle low-speed passageways, roadways, high voltage and other overhead power lines) using a risk-informed rationale. This is considered quite an innovative approach supported by pre-normative work. If the group is successful, the implementation of a risk-based decision approach will allow more flexibility in the design of HRSs without compromising the safety of the installations, while new innovative solutions might still be allowed as long as they comply with defined risk-based criteria.

Another task group within ISO/TC 197 WG11 is in the process of defining requirements applicable to the compressor and dispensing system. Their focus is in particular on a dispenser protection table that identifies the safeguards necessary for foreseen equipment malfunctions. This addresses user safety and the protection of the vehicle-based equipment. ISO/TC 197 is working towards the development and eventual publication in 2012 of an international standard for the layout, operation and maintenance of public outdoor and non-public warehouse HRSs.

In Germany, a guideline, the VdTÜV Merkblatt Druckgas 514 (Technical Information pressurised gas) [4], has been prepared and covers the planning, construction, equipment, erection, relevant certification, commissioning and operation of HRSs and their components for the dispensing of compressed gaseous hydrogen to storage cylinders for the propulsion of hydrogen road vehicles. It also includes electric/electronic requirements as well as responsibilities derived from the German Health and Safety at Work Regulations. This German guideline for the first time harmonises the state-of-the-art technology relevant to the approval procedure in all German federal states.

3 Recommendations for Prioritized Actions

As the permitting processes for the local operation of HRSs must comply with legal requirements, an EU-harmonised approach is desired and needs to be developed over the next few years in order to allow implementation in all EU member states from 2015 onwards, based on a comparable state-of-the-art design, and to ensure legal certainty for the operator. HyApproval's key recommendation is to develop an EC regulatory framework for HRSs based on the proven combination of *essential requirements, harmonised standards, notified bodies and national authorities*. This could be most efficiently achieved through the development of an EC Framework Regulation. Such a framework, which allows the key safety issues to be addressed without impeding continued technological developments, would establish a very streamlined EU 27 uniform permitting process. Going a step further, such a framework would allow an HRS "type approval" mechanism (similar to that for road vehicles), permitting a given station design to be approved for widespread deployment in all EU 27 countries.

Until such a framework is fully established at EC level, national authorities are encouraged to support the national players in their work to obtain suitable HRS approval requirements on a global/European level. At the current stage of HRS development, it is strongly recommended that safety assessments are conducted and included as part of the required HRS approval procedure. Safety assessments are necessary to ensure that all relevant site-specific risks are taken into account. The players in the hydrogen field generally want a simple, straightforward approval process that can be applied on a European level. To achieve this, it will be necessary to establish harmonised requirements and approval criteria and preferably to have responsible authorities at a national level. It is recommended that harmonised requirements and approval criteria include requirements to undertake relevant assessments, and that the approval is not based on specific numerical criteria alone. As further developments in HRS solutions are expected in the coming years, it is important that the HRS approval framework allows for these, for example by accepting the use of a risk-based

approach to demonstrate that new solutions are as safe and reliable as the standard solutions covered by the framework.

International standards (ISO, IEC), developed on the basis of the essential requirements set out in a regulation, are the framework of choice for developing and providing HRS design rules and criteria allowing HRSs to meet regulatory and permitting requirements.

A link between a regulation and standards will be a key feature of the proposed regulatory framework and therefore close cooperation between the players in both worlds is a prerequisite - for the proper, efficient and flexible functioning of a lean regulation as well as for the mutual understanding of standards and regulatory experts among each others facilitating this cooperation.

4 Next Steps

A key recommendation of the HyApproval project and the resulting *HyApproval Handbook* was to develop an EC regulatory framework for HRSs based on the proven combination of *essential requirements* and *harmonised standards*, as for example ISO 20100 tries to provide. The EC Regulation for vehicles using hydrogen No. 79/2009 [5] of the European Parliament and the Council of 14 January 2009 addresses the need for harmonised approval requirements which would allow HRSs to be approved and built across Europe (EC regulation No. 79/2009 on type-approval of hydrogen-powered motor vehicles and amending Directive 2007/46/EC) states in paragraph 16 of the preamble "*Hydrogen-powered vehicles are unlikely to be successful on the market unless adequate filling-station infrastructure is made available in Europe. The Commission should therefore look into suitable measures to support the establishment of a Europe-wide filling-station network for hydrogen-powered vehicles.*"

As the roll out of hydrogen vehicles and related HRSs in Germany will start to increase in 2015, the number of stations will grow from some hundreds to more than 1,000 by 2020. These stations will have to be approved within less than one decade. This approval process will be much enhanced if harmonised requirements can be used as a basis. Taking into account the fact that HRSs will have to be approved in other EU27 countries as well, a unified European framework is essential for the successful introduction of hydrogen in the European transport sector.

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