



Every two months, Prof. Dr. Thorsten Arnholt, IECEx Chairman 2014-2019, provides an update on developments within the organisation.

**Last week I once again had the opportunity to give a lecture on safety concepts when dealing with hydrogen at a conference in Munich. As usual, the interest of the conference participants in this topic was great. However, also as usual, I encountered a certain degree of scepticism here as to whether it is necessary to look particularly carefully at new hydrogen technologies with regard to safety aspects.**

After all, hydrogen is a fuel like many others and industrial processes using hydrogen have been safely mastered for decades. Both statements are only partially correct: [the meta-study processed in the European Hydrogen Incident and Accident Database \(HIAD\) 2.0, published in the International Journal of Hydrogen Energy 47 \(2022\), evaluates at least 700 accident events involving the use of hydrogen that have occurred worldwide over the past decades.](#)

The leading event types by far are explosions, followed by fires. The main causes were identified as deficiencies in safety management, faulty system design and individual human error. In addition, some properties of hydrogen differ significantly from those of hydrocarbons – unfortunately in a negative way. This was demonstrated very impressively by the presentation given by a representative of a flame arrester manufacturer at the same

## Safety concepts when dealing with hydrogen

conference: he showed videos of explosion tests in pipes.

Stoichiometric mixtures of propane, ethylene and hydrogen, i.e. IIA, IIB and IIC gases, were ignited separately one after another and the ends of the pipes that were only sealed with foil were filmed. Even for me, with 32 years of experience in explosion protection, it was impressive to see the force and intensity with which the flame front of the hydrogen-air mixture passed the end of the pipe. In contrast, the explosions of the other two gases looked like mild breezes. The reason for this is that the laminar combustion rate of hydrogen is approximately eight times that of hydrocarbons.

Even if the following comparison is not entirely scientifically correct, I cannot help but make it: there is a difference between riding a bicycle and a fast motorcycle into a wall! Moreover, there are other positive and negative properties that distinguish hydrogen from other fuels and require special attention from a safety perspective. Brief interim conclusion: in general, hydrogen is no more or less dangerous than other fuels and can certainly be safely controlled with the right technical and organisational measures. However, it is different in many ways and must therefore be treated with special respect. Especially when it leaves the isolated industrial facilities and finds numerous uses in public!

At IECEx, we have been aware of this fact for a long time and therefore made the topic of new hydrogen applications a focus of our work three years ago. I have already reported in previous articles about the activities of the [IECEX Working Group 19 "Hydrogen Technologies"](#), of which I am convenor. [A total of 17 Certified Equipment Certificates for Hydrogen Dispensers and 44 Personal Competency Certificates in accordance with Unit 11 \(Basic Knowledge of the safety of hydrogen systems\) have now been issued.](#) We are now on the verge of another highlight of

our hydrogen activities: in partnership with the International Organization for Standardization (ISO), the United Nations UNECE, Hydrogen Council and International Renewable Energy Agency (IRENA), the IEC and IECEx will be organising the 2024 IECEx International Hydrogen Conference in Singapore, on 29th May 2024.

This full day event offers a unique opportunity for industries in the Asian region to learn about latest developments in hydrogen technologies, network within the expert community and form valuable contacts. Attendees will receive information on how to benefit from the services provided by the organising partners and how to get involved. Leading experts from across the world like the CEO of the Hydrogen Council, the Chair of ISO TC 197 and the IECEx and IECQ Executive secretary will share their insights and expertise on international standardization, equipment manufacturing, inspection, repair and overhaul associated with hydrogen production, transportation and use. The conference will also address the assessment and certification of personnel competence, and tackle issues concerning regional requirements and regulations. As is usual at such international meetings of experts, in addition to the official conference program, networking between the participants on the side-lines of the event is very important.

Following the conference, we will take the opportunity to continue the work of our IECEx Working Group 19. The focus will be on intensifying cooperation with the standardisation organisations ISO and IEC, as well as expanding our activities in the Equipment and Personal Competence Scheme. I am particularly pleased that the conference location, Singapore, allows numerous experts from Asian countries to take part. These experts are highly welcome since unfortunately, from the perspective of the Western world, it is often overlooked that countries such as South Korea, Japan and China also occupy leading positions in the field of hydrogen technologies.. ■