

# Developments in valve stem sealing technology

Stem sealing technology has evolved fast over the last 20 years. In the past methane emissions under 10,000 ppm were not recognised as potential leaks. Nowadays, methane emission levels lower than 100 ppm must be achieved to qualify as a low-emission solution.

By Ralf Vogel

## About the author

Ralf Vogel is a mechanical engineer and has been working in the sealing industry for 26 years. Currently, he is the Technical Director of the European Sealing Association. His main experience is in the development of packings and gaskets for various applications including fugitive emission solutions.

# Valve World

## Series 2021



*Methane emissions have become more prominent on the international agenda*

**T**his rapid change has been driven by legislation. Due to the climate change agreement, methane emissions (see box text, Dark horse,) from plants are regulated in the US and the EU is working on a program to reduce these emissions to lower levels before 2030. Also, legislation like the Industrial Emissions Directive 2010/75/EU helps to improve plant emissions further. Beside legislation, industry standards work to regulate and qualify valves or valve stem solutions. Here standards like ISO 15848-1 for valve classification or API 622 for the qualification of valve packings are important to drive developments further. This has been achieved by improving valve stem sealing technology as well as the design of valves. Combined with better training for installers and maintenance personnel at end-users, emission levels and operational performance of valves have improved. Also, the safety and longevity of the solutions i.e., by life loading the gland, have been increased.

## Dark horse

Methane has been a 'dark horse' for years. This is about to change as more data has been published on this potent GHG. Policy makers, NGO's and end-users seem to have taken methane reduction more seriously. However, more action is needed to curb methane emissions in the natural gas supply chain. Natural gas has been heralded as the 'cleanest fossil fuel' by many of its proponents. As such, this fossil energy source would be extremely suitable to perform the role of transitional energy source towards more CO<sub>2</sub>-neutral energy sources such as solar, wind, hydro/tidal or nuclear energy. However, natural gas has one disadvantage which has been overlooked for some time, namely methane emissions. Methane is hard to detect because it is an invisible and colourless gas. Also, the primary focus from policymakers on CO<sub>2</sub>-emissions meant that methane 'operated in the dark'. Well, those days are over. Moving into the third decade of the 21<sup>st</sup> century, more and more is known about methane. It is a fast-acting gas that traps 84 to 87 times more heat in the atmosphere than CO<sub>2</sub> in the first twenty years after release.

## Hydrogen

Another challenge for valves and valve stem sealing solutions are new developments regarding alternative energy generation. Hydrogen comes to mind, an energy carrier which requires ultra-low temperatures. There are also improvements in the energy efficiency of power stations where the steam temperatures are raised further up to 750 °C. For these extremes new materials and solutions must be developed. Expanded graphite with oxidation inhibitors or spacer discs for oxidation protecting of graphite packings, made from vermiculite or boron nitride, are some of them.

In the following articles different aspects of these valve seal developments are covered. From special polymer spring-energised seals for critical valve applications to the use of graphite packing at low temperatures in contact with liquid hydrogen. Also, factors that can negatively influence the packing performance like valve stem corrosion. The last paper reflects on valve stem sealing standards and discusses their advantages and disadvantages.

## Valve stem technology

Two of the four articles in this series have been written by ESA (European Sealing Association) members. The ESA represents most European sealing manufacturers and aims to provide training and documentation about sealing solutions. Documents like "Sealing devices reduction of fugitive emissions document – Best available techniques" are used by the European Commission as a reference document for the update of BREF-documents.

Valve stem technology has evolved over the last years, driven by legislation and industry standards as well as a need to minimise emissions from plants further to reduce the effects of climate change. Still, efforts are made to improve a mature technology like packings even further to make valve applications better not only regarding emissions but also improving functionality by reducing friction and stress relaxation.