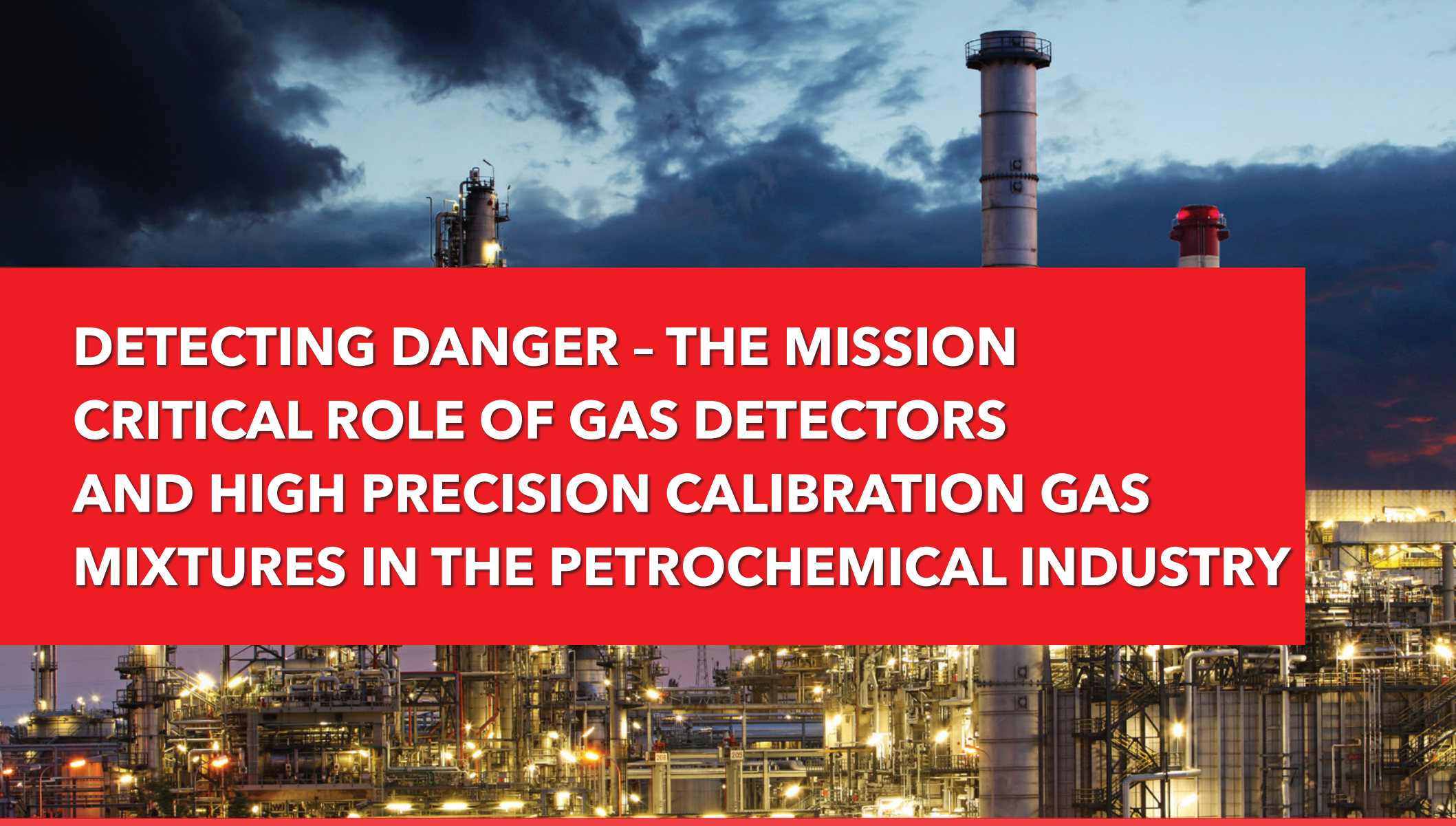

DETECTING DANGER – THE MISSION CRITICAL ROLE OF GAS DETECTORS AND HIGH PRECISION CALIBRATION GAS MIXTURES IN THE PETROCHEMICAL INDUSTRY

Refining Dangers can be Controlled

The recent blaze at the Eni refinery in the Italian town of Sannazzaro de' Burgondi, north of Milan, that took place on the 1st of December 2016 is an ever-present reminder of the sad fact that the refining and petrochemical processing sector is not without risk. However, the good news is that great strides are being taken to improve the safety of refinery personnel all around the world. So, what is behind this tremendous increase in hydrocarbon processing safety? There are many factors at play and improvements in gas detection have been tremendously important.

One aspect of improved gas monitoring is simply a better understanding of the risks of exposure to hazardous chemicals. Take the example of benzene which is now a listed carcinogen: in 1960 the 8-hour Occupational Exposure Limit (OEL) in Finland was 25ppm; in the 1970s the limit was reduced to 10ppm. Through the 80s and 90s the OEL-8h was down to 5ppm and since the year 2000 the limit has been only 1ppm. A second aspect has been the rapid evolution of high sensitivity, accuracy, reliability and selectivity of gas sensors that are built into the most modern portable and fixed gas detection equipment.

The safety issues referred to here are not simply theoretical; they are very real. As an example of the hazards involved, consider that on the 5th of November in 2005 at the Delaware City Refinery in the USA two maintenance contractors died by suffocation. They were raising a pipe onto a reactor which was inerted with nitrogen to protect the catalyst contained within. One of the technicians fainted and fell into the reactor; the second victim was also asphyxiated in trying to save his colleague. One might wonder if these fatalities could have been avoided if the maintenance workers had been better informed of the risks and had been issued with personal gas detectors that could have been sniffing for oxygen and making an audible alarm in the case of oxygen deficiency.

Gas Detection at the Oil Field and in the Refinery

To avoid the physical hazards of explosion, the risks associated with oxygen deficiency and the health hazards of toxic gases, refinery workers wear gas detectors when working in confined spaces or close to high risk leak points. An array of fixed detectors, often strategically located at flanges, pumps, valves and other potential leak points will also generally be in place.

One of the most common refinery toxic gas hazards is H_2S. The potency of its danger may be understood when reviewing the case of Dan Gunraj who lost his life at the Marathon Robinson refinery in Illinois in on the 20th of January 2007. He was working in the alkylation unit decanting liquors to the neutralisation pits when he was overcome by high levels of H_2S. He was, in fact, wearing his portable H_2S gas detector when he was overcome by the fumes. The gas detector was audibly alarming and was found to be reading 95ppm when his body was recovered from the scene by co-workers wearing breathing apparatus.

Joeri Slootjes, Manager of International Business at 7Solutions B.V. in the Netherlands is involved in gas detection daily and, according to his experience, he informs us that "in the petrochemical industry, H_2S gas detection is common. We also work very often with CO, O_2 and hydrocarbons. The hydrocarbons will be detected with a lower explosive limit (LEL) sensor when testing for explosion risk and with a photo ionisation detector (PID) sensor when sniffing for toxic hydrocarbons such as benzene, toluene, ethylbenzene and xylene (collectively known as BTEX). Beyond this core group, many more gases are detected, depending on the unit operations present at a particular site."

Portable Gas Detectors

Gas detectors are often worn by refinery staff and count as one of the most important pieces of personal protective equipment (PPE). Their use is so important that the industry has been pulling for highly visible colours to be used in their construction. Joeri Slootjes explains why: "red, yellow and other bright colours are used for

gas detectors so that workers can quickly see that their colleagues have remembered to wear their gas detector. At 7Solutions we use orange on our WatchGas range because, as a Dutch company, it is our national colour".

So, if these gas detectors are so important, how can personnel be sure they are working when needed? Slootjes continues, "every day, gas detectors need to be 'bump tested'. This means that a small amount of test gas will be applied to the gas detector to check if the sensor and the acoustic and visual alarms are still operational. Beyond that, usually every 6 months, most gas detectors need to be calibrated. But, there are some gas detectors, like our WatchGas PDM which may be used maintenance free for 2 years in many applications."

Gas Detector Maintenance and Sensor Calibration

The daily functional test is good enough to say that the detector functions and produces an alarm, but it is not a precisely controlled calibration event. Whilst the functional test generally occurs on the refinery, the calibration generally takes place at an off-site service laboratory. Alternatively, the detector can be returned to the manufacturer's service facility for a general overhaul which may also involve replacement of some of the sensors contained in the gas detector. The calibration frequency can range from once per month to once per year depending on local regulation, how adverse the conditions are and the sensor technology used.

On this topic of gas detector calibration, let's turn to another heavyweight in the gas detection industry, MSA. Jackson Machado, their National Service Supervisor in Brazil adds, "we have the Cgcre which is a division of our national metrological institute INMETRO. Cgcre is the agency responsible for the accreditation of laboratories. They require the issuance of a calibration certificate based on the use of gas mixture cylinders which are classified as primary standards". Primary standards would, for example, be calibration gas reference materials accredited to ISO Guide 34 or ISO 17034:2016.

Sensor Calibration Gas Mixtures

The availability of 'bump test' gas mixtures is generally high. Many specialty gas suppliers around the world are able to produce cylinder gases for this purpose because the certification and accreditation requirements are relatively straight forward. The availability of accredited ISO Guide 34 calibration gas mixtures is, on the other hand, not such a simple matter.

Victor Chim, Business Development Manager at Coregas Pty Ltd in Australia comments, "our pedigree has grown from serving our gas detection customers in Australia. We have been working very closely with them and with the national accreditation body NATA for many years to develop a range of ISO Guide 34 calibration gas mixtures that can be used as reference materials for gas detector sensor calibration." The accreditation authority responsible for Coregas production and testing operations is NATA, the National Association of Testing Authorities Australia, which is the sole accreditation body in Australia. Their reputation is global and they currently hold the secretariat for the International Laboratory Accreditation Cooperation (ILAC). Chim continues, "in recent years, our reputation and our specialty gas cylinders have been travelling abroad and we are proud to be a supplier to many multi-national gas detection device manufacturers and local gas detection device servicing companies overseas".

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