

FUELS TECHNICAL COMMITTEE ADVISORY: HYDROGEN SULPHIDE IN IMPORTED FUELS INTO SOUTH AFRICA

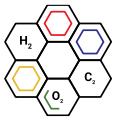
Regulations regarding hazardous chemical agents (HCAs) were gazetted by the Minister of Employment and Labour in March 2021 stipulating the occupation exposure limit (OEL) for certain HCAs. These scope of these regulations covered an employer or a self-employed person who carries out work at a workplace which may expose any person to an HCA at the workplace and a manufacturer, importer, supplier or retailer of an HCA that is intended for use at a workplace.

The OELs represent the maximum airborne concentration of an HCA for either an eight-hour time-weighted average, a ceiling limit or a short-term exposure limit. For Hydrogen Sulphide (H₂S) as provided in Table 3 of the regulations, it provides for an eight-hour time-weighted average of 2 ppm and for a ceiling limit of 10 ppm for a maximum or peak airborne concentration determined over the shortest analytically practicable period of time, which does not exceed 15 minutes.

From time-to-time high levels of Hydrogen Sulphide (H₂S) in both gasoline and diesel (gasoil) import cargos have been recorded. In the past, levels of over 40 ppm in the vapour phase has been found in diesel cargoes and more recently levels above the 10ppm ceiling limit in gasoline cargoes. It is obvious that H₂S presents a significant, real HSSE risk to both vessel and tank farm operators and needs to be closely monitored.

H₂S is a colourless, toxic and flammable gas characterized by a pungent (rotten egg) smell and is irritating to the eyes, nose and throat. The gas can be detected by its odour even at very low levels of <10 ppb and becomes generally unpleasant at levels above 5 ppm but begins to desensitise the nose at 30 ppm. Continuous inhalation of the gas even at these low levels may cause paralysis of the sense of smell making detection of the gas by its odour ineffective. Exposure at these low levels will also generally cause irritation to the mucous membranes and may result in headache, dizziness or nausea.

At levels of 150 ppm, the gas will paralyze a person's sense of smell meaning that the rotten egg odour will disappear. When the levels rise above 400 ppm, there is a serious risk of pulmonary oedema (excess fluid in the lungs) but death is not instantaneous. Exposure for more than 30 minutes at concentrations greater than



700 ppm have been fatal. At gas concentrations greater than 1000 ppm, H₂S is lethal with death resulting quickly after exposure.

As provided above, regulations pursuant to the OSH Act provides that the maximum permissible level of H₂S in the vapour phase be limited to 10ppm and it is recommended that the level of H₂S in the vapour phase of vessels' tanks at discharge ports, prior to discharge does not exceed 10 ppm. This needs to apply to all fuel cargo imports (but excluding crude oil for which different measures are taken), and each entity would need to implement the necessary interventions to ensure that the imported cargoes do not arrive in SA ports, with H₂S levels in the vapour phase, exceeding 10 ppm.

H₂S in the breathable vapor phase follows Henry's Law meaning that in terms of partitioning from the diesel (gasoil) liquid phase the following concentration of H₂S in the vapor phase *may* be expected:

1 ppm in liquid can equate to > 50 ppm in vapor space

100 ppm in liquid can equate to 20 000 ppm in vapor space

It must be noted that vapour phase levels can vary significantly according to the headspace volume, the temperature of the fuel and its agitation.

Recommendations

1. That the level of H₂S in the vapour phase of vessels' tanks at discharge ports, prior to discharge and in a safe manner (no confined space entry), be checked and recorded as part of standard operating procedures according to ASTM D 5705 using Gas Tech / Draeger tubes.
2. Calibrated test equipment to be available at all times to trained operators.
3. Additionally, a specification and test method such as IP 570 (Determination of hydrogen sulphide in fuel oils including marine residual fuels, distillates and petroleum blend stocks) be identified and implemented.
4. Continuous awareness campaigns on the dangers of H₂S be maintained within all companies as educational and safety topics to make employees continuously aware of the hazards of working around H₂S and how to adequately protect themselves in an H₂S working environment.