BENZENE – MEASUREMENT OF PPB LEVELS ACCURATELY IN REAL TIME

The DV3000 gas analyser from Duvas Technologies can detect 15 compounds simultaneously to low ppb levels in fixed or transportable applications. Benzene can be directly measured instantly with no cross sensitivity issues.

Exposure to benzene has been shown to cause bone marrow damage which can lead to acute myeloid leukaemia (AML)[1]. There is also evidence that exposure to benzene can cause damage to the reproductive organs[1].

Many techniques have been used to measure total hydrocarbon levels, measurement of benzene against a background of other BTEX gases is much more difficult. This difficulty in measurement has meant there has been a reluctance to reduce allowable levels of benzene in the atmosphere. The current long and short term exposure levels can be seen as a direct result of the lack of simple to use techniques capable of accurately measuring lower concentration levels.

The World Health Organisation have stated that "Benzene is carcinogenic to humans and no safe level of exposure can be recommended"[2].

Current techniques for measurement of benzene in air include GCMS and diffusion tubes. GCMS is complex and expensive whilst diffusion tubes offer low accuracy, "one off" sample measurement. The combination of diffusion tubes as a "preselector" together with a PID (photon ionisation detector) can be used for selective benzene measurement but only at relatively high concentrations and not for real time continuous readings.

Duvas has developed the DV3000 instrument which uses DOAS (differential optical absorption spectroscopy) to measure benzene at low ppb levels in real time. Selectivity of detection against a background of other BTEX gases is extremely good. The DV3000 produces real time readings (20ms readings) which averaged over a few seconds can offer detection levels of better than 5ppb.

The DV3000 was evaluated by the EPA (Environmental Protection Agency) during development and is now being used by the EPA in the USA for field detection of benzene and other fugitive emissions from industrial plants. The instrument is proving reliable and simple to use. The DV3000 is used in transportable mode in the back of an SUV to provide area coverage together with pollution mapping.

The EPA are at the forefront in developing legislation to enforce better control on benzene exposure in the environment. In September 2015, Legislation drafted by EPA on requirements to monitor fugitive fenceline emissions from the 147 US petrochemical refineries was signed into the stature books [3]. This legislation requires refineries to implement fenceline monitoring procedures within a three-year period. Evaluations of acceptable monitoring methodologies are being evaluated and include DOAS.

The EPA visualise this kind of fenceline legislation being applied to other chemical manufacturing plants as well as storage and distribution of materials capable of causing atmospheric benzene pollution. Enactment of such legislation will greatly increase the requirement for effective measurement instrumentation, possibly in simpler, lower cost versions.

Duvas recognises that the increasing concerns on benzene toxicity will require a range of solutions and is already working to meet anticipated requirements from other industries and from the anticipated hazards which will be present in the distribution and storage of benzene.

As ongoing concerns over benzene toxicity translate into tighter regulatory control, the retailing of petrol through filling stations will require monitoring techniques to ensure staff and public are not exposed to high levels of benzene from the handling and spillage of petrol. This requirement will see the involvement of OSHA who will define the legislation and management of this hazard. This development will require low cost personal monitoring equipment which will challenge manufacturers to meet price and performance targets which will be challenging.

Duvas is positioned to supply instrumentation to all levels of the supply chain. The current DV3000 represents proven capability of reliably detecting low ppb levels of benzene at the fenceline. Variants of the standard instrument can be supplied with sampling capability to sample automatically at 20 metre intervals along the fenceline of a refinery giving both complete fenceline and specific leak location information.

Duvas is developing a smaller, lower cost, instrument which can be deployed for point detection in smaller facilities. The company is also developing a personal monitor to protect individual staff in transport, distribution and retail situations.

To discuss how Duvas might help you combat this serious toxicity hazard, talk to Duvas Technologies today.

References:

1. Agency for Toxic Substances & disease Registry: Toxic Substances Portal – Benzene, August 2007, cas# 71-43-2
2. World Health Organisation: Exposure to Benzene: A Major Public Health Concern, 2010
3. http://yosemite.epa.gov/opa/admpress.nsf/0/D12EDC1C383ADF0385257ECF005B96B6

Author Contact Details

Dr David Frew, CEO, Duvas Technologies Ltd • Email: d.frew@duvastechnologies.com • **Web: www.duvastechnologies.com**