

# FUMIGANT SAFETY MONITORING



*Fumigation and quarantine are frequent mandatory procedures applying to oversea shipments of agriculture or forestry products. Safety and health requirements in the proximity of the fumigation process often require accurate and reliable gas monitoring of chemical compounds that are toxic even at trace levels.*

## The Challenge

Occupational exposure risks exist with most fumigation substances. Sensitive and reliable gas monitoring is often required in standard operating procedures for worker protection.

In the agriculture and forestry market, producers rely heavily on fumigation to reduce the business risk that would represent losing even a part of their production from biological destruction by nematodes, weeds, insects, fungus, etc.

However, most substances used as fumigants also raise occupational exposure toxicity issues for the actual user (the fumigator). They are also potentially hazardous for bystanders, neighbors, or the local environment.

As a consequence, the registration process of a new substance as a fumigant requires a demonstration of the availability and effectiveness of a gas monitoring method capable of reliable detection and alarming upon hazardous level of the substance.

### Monitoring Needs

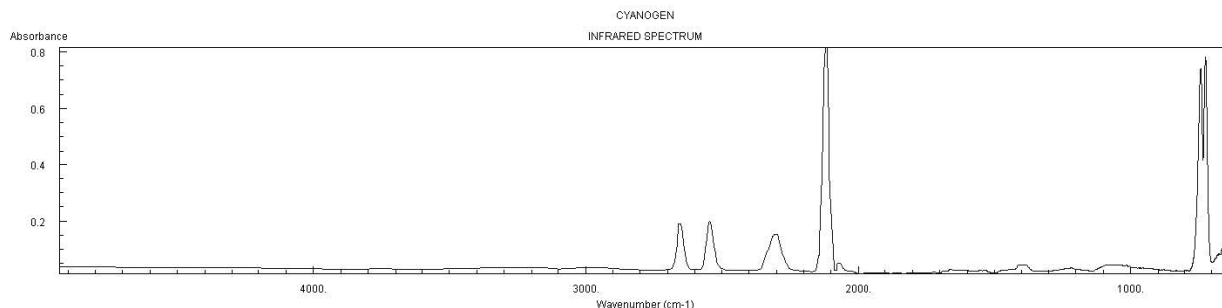
Phaseout efforts of Methylbromide (Bromomethane) resulted in development and testing of the alterna-

tive fumigation substance Ethane-dinitrile (abbreviated EDN).

EDN has a high toxicity potential and the permissible exposure limit (PEL) is set at 10 ppm by the US OSHA or by the German DFG MAK. The hazardous conditions are also linked to some degradation products: when released in air, the EDN is also partly hydrolyzed to HCN (hydrogen cyanide).

Because of its PEL of 10 ppm, its industrial promoter targeted analytical methods with a low detection limit of no more than 1 ppm for the EDN substance.

Other important operational requirements for instruments are robustness, user-friendliness, and the ability to be easily deployed in field conditions by non-experts.



*Versatile by design, the INNOVA 1512 can monitor almost any IR active gas. The target substances are selected by appropriate configuration of optical filters. The UA0984 filter is ideally centered at 2150cm-1 where the EDN shows an absorption peak.*

*[Infrared spectrum of Ethanedinitrile, originally edited and published by the Coblenz Society.]*



INNOVA 1512  
Photoacoustic Gas Monitor.

## Our Solution

The Photoacoustic Gas Monitor INNOVA 1512 is a natural candidate for this type of trace gas monitoring needs in rugged environment and/or field conditions. It features excellent portability and once it has been set up for a specific monitoring task, it is easily operated with the push of a single start/stop button. It has very stable performances, and calibrations are only recommended twice a year.

Each gas monitor can be set up and calibrated for up to 5 different gases. Before testing with EDN, it had already been evaluated on an extensive list of fumigation substances:

| Compound          | Formula                          | Optical Filter | Detection limit (ppm) |
|-------------------|----------------------------------|----------------|-----------------------|
| Bromomethane      | $\text{CH}_3\text{Br}$           | UA0968         | 0.5                   |
| Chloropicrine     | $\text{CCl}_3\text{NO}_2$        | UA0977         | 0.03                  |
| Ethylformate      | $\text{C}_2\text{H}_5\text{O}_2$ | UA0974         | 0.4                   |
| Sulfuryl fluoride | $\text{SO}_2\text{F}_2$          | UA0979         | 0.9                   |
| Hydrogencyanide   | $\text{HCN}$                     | UA0981         | 0.5                   |
| Phosphine         | $\text{PH}_3$                    | UA0936         | 0.5                   |
| Carbonylsulfide   | $\text{COS}$                     | UA0978         | 0.6                   |

Large dynamic ranges offered by the photoacoustic sensing technique complement the low limits of detection: low exposure levels and broader fumigation process conditions can be monitored with a single instrument.

### Measurement Results

The INNOVA 1512 was configured with the UA0984 filter, ideally centered at 2150  $\text{cm}^{-1}$  where the IR spectrum of EDN shows an absorption peak. The default configuration also enables the compensation from water vapor absorption.

Based on DIN 32645 evaluation methods, the detection limit for EDN is equal to 0.81 ppm for the INNOVA 1412i.

With possibility to configure 4 more optical filters in the same instrument, one can measure and compensate for  $\text{CO}_2$  and  $\text{HCN}$ , or any other fumigant as listed above if needed in the user's applications.

## Your Benefits

- ✓ Field deployable standalone monitor
- ✓ Highly sensitive on multiple targets: can monitor all major fumigation gases
- ✓ Simple operation adapted for non-experts
- ✓ Stable and reliable measurement with very limited maintenance required
- ✓ Measurement log stored in internal memory with easy export for reporting purposes



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