


Application Note

Phosphine

Potential industries and applications for gas detection products

- Semiconductor manufacturing
- Fumigation for pest control
- Production of pest control pellets
- Fumigation of metabolically stored products (e.g. grain)

Phosphine is the common name for Phosphorus Hydride (PH_3), also known by the IUPAC name Phosphane and, occasionally, Phosphamine. It is a colourless, flammable gas with a boiling point of -88°C at standard pressure. Pure Phosphine is odourless, but “technical grade” Phosphine has a highly unpleasant odour like garlic or rotting fish, due to the presence of substituted Phosphine and Diphosphine (P_2H_4). Phosphines are also a group of substituted Phosphines, with the structure R_3P , where other functional groups replace Hydrogens. They are important in catalysts where they complex to various metal ions; a chiral metal Phosphine complex can catalyse a reaction to give chiral products.

Phosphine			
			
General			
Systematic Name	Phosphane		
Other Names	Phosphine Phosphamine Phosphorus Hydride Phosphorated Hydrogen		
Molecular Formula	PH_3		
Appearance	Colourless gas		
CAS Number	7803-51-2		
Properties			
Vapour Density	1.17		
Melting Point	-134°C		
Boiling Point	-87.8°C		
Toxic Exposure Levels			
EH 40 Workplace Exposure Limit (WEL)			
Long-term exposure limit (8-hour TWA reference period)		Short-term exposure limit (15-minute TWA reference period)	
ppm	mg.m⁻³	ppm	mg.m⁻³
-	-	0.3	0.42
OSHA Permissible Exposure Limit (PEL)			
Long-term exposure limit (8-hour TWA reference period)			
ppm	mg.m⁻³		
0.3	0.4		
ACGIH Threshold Limit Value			
8-hour TWA workday and a 40-hour workweek		300ppb	

Industrial Applications

Phosphine is highly toxic; it can easily kill in relatively low concentrations. Because of this, the gas is used for pest control by fumigation. For farm use, it is often sold in the form of Aluminium Phosphide, Calcium Phosphide, or Zinc Phosphide pellets, which yield Phosphine on contact with atmospheric water or rodents' stomach acid. These pellets also contain other chemicals which evolve Ammonia which helps to reduce the potential for spontaneous ignition or explosion of the Phosphine gas. They may also contain other agents, such as Methanethiol, to give the gas a detectable garlic smell to help warn against its presence in the atmosphere.

Phosphine is also used as a dopant in the semiconductor industry, and a precursor for the deposition of compound semiconductors. Recently high purity Tertiary Butyl Phosphine (TBP) has been developed as a less hazardous liquid alternative to highly toxic Phosphine gas, for application in Metalorganic Vapour Phase Epitaxy (MOVPE) of III-V compound semiconductors.

Phosphine is highly toxic to organisms undergoing oxidative respiration, but is non toxic to organisms kept under low Oxygen (<1%) or that can anaerobically respire (i.e. ferment). Because of these characteristics, Phosphine is widely used as a fumigant of metabolically dormant stored products such as grain. The toxicity of Phosphine kills insect pests that might infest the grain, but does not affect the viability of the dormant grain.

Because continued use of the previously widely used fumigant Methyl Bromide has been banned under the Montreal Protocol, Phosphine is the only widely used, cost effective, rapidly acting fumigant that does not leave residues on the stored product.

Honeywell Analytics' product offering



Series 3000 XPIS



Apex



Midas®



SPM Single Point Monitor



ChemKey™ TLD



CM4



Vertex™

Our Product Range



Fixed Gas Monitoring

Honeywell Analytics offers a wide range of fixed gas detection solutions for a diverse array of industries and applications including: Commercial properties, industrial applications, semiconductor manufacturers, energy plants and petrochemical sites.

- » Detection of flammable, oxygen and toxic gases (including exotics)
- » Innovative use of 4 core sensing technologies – paper tape, electrochemical cell, catalytic bead and infrared
- » Capability to detect down to Parts Per Billion (ppb) or Percent by Volume (%v/v)
- » Cost effective regulatory compliance solutions

Portable Gas Monitoring

When it comes to personal protection from gas hazards, Honeywell Analytics has a wide range of reliable solutions ideally suited for use in confined or enclosed spaces.

These include:

- » Detection of flammable, oxygen and toxic gases
- » Single gas personal monitors – worn by the individual
- » Multi-gas portable gas monitors – used for confined space entry and regulatory compliance
- » Multi-gas transportable monitors – used for temporary protection of area during site construction and maintenance activities

Technical Services

At Honeywell Analytics, we believe in the value of great service and customer care. Our key commitment is providing complete and total customer satisfaction. Here are just a few of the services we can offer:

- » Full technical support
- » Expert team on hand to answer questions and queries
- » Fully equipped workshops to ensure quick turnaround on repairs
- » Comprehensive service engineer network
- » Training on product use and maintenance
- » Mobile calibration service
- » Customised programmes of preventative/corrective maintenance
- » Extended warranties on products

Find out more

www.honeywellanalytics.com

Contact Honeywell Analytics:

Europe, Middle East, Africa

Life Safety Distribution AG
Wilstrasse 11-U31
CH-8610 Uster
Switzerland
Tel: +41 (0)44 943 4300
Fax: +41 (0)44 943 4398
gasdetection@honeywell.com

Americas

Honeywell Analytics Inc.
405 Barclay Blvd.
Lincolnshire, IL 60069
USA
Tel: +1 847 955 8200
Toll free: +1 800 538 0363
Fax: +1 847 955 8208
detectgas@honeywell.com

Asia Pacific

Honeywell Analytics Asia Pacific
#508, Kolon Science Valley (1)
187-10 Guro-Dong, Guro-Gu
Seoul, 152-050,
Korea
Tel: +82 (0)2 2025 0307
Fax: +82 (0)2 2025 0329
analytics.ap@honeywell.com

Technical Services

ha.emea.service@honeywell.com

www.honeywell.com

Please Note:

While every effort has been made to ensure accuracy in this publication, no responsibility can be accepted for errors or omissions. Data may change, as well as legislation, and you are strongly advised to obtain copies of the most recently issued regulations, standards, and guidelines. This publication is not intended to form the basis of a contract.