



# Methane

## Incident Management

### Key Points

#### Fire

- extremely flammable
- reacts violently with various substances including halogenated compounds, hydrogen and oxygen
- in the event of a fire involving methane, use fine water spray and normal fire kit with breathing apparatus

#### Health

- inhalation causes euphoria, agitation, slurred speech, nausea, vomiting, flushing and headache
- in severe cases respiratory depression, hypotension, myocardial infarction, cardiac dysrhythmias, seizures, coma and death may occur
- dermal contact with liquefied gas may cause frostbite
- ocular exposure does not cause irritation to the eye


#### Environment

- avoid release to the environment; inform the Environment Agency of substantial incidents


## Hazard Identification

### Standard (UK) dangerous goods emergency action codes



#### ***Methane, compressed or natural gas, compressed (with high methane content)***

<b>UN</b>		1971	Methane, compressed or natural gas, compressed (with high methane content)	
<b>EAC</b>		2SE	Use fine water spray. Wear normal fire kit in combination with breathing apparatus*. Danger that the substance can be violently or explosively reactive. Spillages and decontamination run-off may be washed to drains with large quantities of water. Due care must, however, still be exercised to avoid unnecessary pollution to surface and groundwaters. There may be a public safety hazard outside the immediate area of the incident <sup>†</sup>	
<b>APP</b>		–	–	
<b>Hazards</b>	<b>Class</b>	2.1	Flammable gases	
	<b>Sub-risks</b>	–	–	
<b>HIN</b>		23	Flammable gas	
<p>UN – United Nations number, EAC – emergency action code, APP – additional personal protection, HIN – hazard identification number</p> <p>* Normal firefighting clothing is appropriate, ie breathing apparatus conforming to BS EN137 worn in combination with fire kit conforming to BS EN 469, firefighters' gloves conforming to BS EN 659 and firefighters' boots conforming to Home Office specification A29 or A30</p> <p><sup>†</sup> People should stay indoors with windows and doors closed, ignition sources should be eliminated and ventilation stopped. Non-essential personnel should move at least 250 m away from the incident</p> <p><b>Reference</b> Dangerous Goods Emergency Action Code List, National Chemical Emergency Centre (NCEC), Part of Ricardo-AEA, The Stationery Office, 2015.</p>				

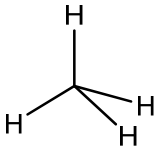
**Methane, refrigerated liquid or natural gas, refrigerated liquid with high methane content**

<b>UN</b>		1972	Methane, refrigerated liquid or natural gas, refrigerated liquid with high methane content	
<b>EAC</b>		2YE	Use fine water spray. Wear normal fire kit in combination with breathing apparatus*. Danger that the substance can be violently or explosively reactive. Spillages and decontamination run-off should be prevented from entering drains and watercourses. There may be a public safety hazard outside the immediate area of the incident†	
<b>APP</b>		–	–	
<b>Hazards</b>	<b>Class</b>	2.1	Flammable gases	
	<b>Sub-risks</b>	–	–	
<b>HIN</b>		223	Refrigerated liquefied gas, flammable	
<p>UN – United Nations number, EAC – emergency action code, APP – additional personal protection, HIN – hazard identification number</p> <p>* Normal firefighting clothing is appropriate, ie breathing apparatus conforming to BS EN137 worn in combination with fire kit conforming to BS EN 469, firefighters' gloves conforming to BS EN 659 and firefighters' boots conforming to Home Office specification A29 or A30</p> <p>† People should stay indoors with windows and doors closed, ignition sources should be eliminated and ventilation stopped. Non-essential personnel should move at least 250 m away from the incident</p> <p><b>Reference</b></p> <p>Dangerous Goods Emergency Action Code List, National Chemical Emergency Centre (NCEC), Part of Ricardo-AEA, The Stationery Office, 2015.</p>				

**Classification, labelling and packaging (CLP)\***

<b>Hazard class and category</b>	Flam. Gas 1	Flammable gas, category 1	
	Press. Gas	Pressurised gas	
<b>Hazard statement</b>	H220	Extremely flammable gas	
<b>Signal words</b>	DANGER		
<p>* Implemented in the EU on 20 January 2009</p> <p><b>Reference</b>  European Commission. Harmonised classification – Annexe VI to Regulation (EC) No. 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures. <a href="http://echa.europa.eu/information-on-chemicals/cl-inventory-database">http://echa.europa.eu/information-on-chemicals/cl-inventory-database</a> (accessed 05/2015).</p>			

## Physicochemical Properties

<b>CAS number</b>	74-82-8
<b>Molecular weight</b>	16.04
<b>Empirical formula</b>	CH <sub>4</sub>
<b>Common synonyms</b>	Marsh gas, methyl hydride, natural gas
<b>State at room temperature</b>	Colourless, tasteless gas
<b>Volatility</b>	Vapour pressure = $4.66 \times 10^5$ mmHg at 25°C
<b>Specific gravity</b>	0.55 at 0°C
<b>Flammability</b>	Flammable
<b>Lower explosive limit</b>	5.53%
<b>Upper explosive limit</b>	15%
<b>Water solubility</b>	22 mg/L of water at 25°C, almost insoluble in water
<b>Reactivity</b>	Reacts with halogens, interhalogens and strong oxidisers. Reacts with chlorine and bromine and can be explosive in light. Reacts violently with bromine trifluoride, bromine pentafluoride, chlorine, chlorine dioxide, chlorine trifluoride, dioxygen difluoride, dioxygenyl tetrafluoroborate, fluorine, hydrogen, iodine heptafluoride, nitrogen trifluoride, oxygen (and liquid oxygen), oxygen difluoride, oxygen disulphide and trioxxygen difluoride
<b>Reaction or degradation products</b>	Data not available
<b>Odour</b>	Odourless (may have artificial odour added – e.g. sulphide odour of household natural gas)
<b>Structure</b>	
<b>References</b> Hazardous Substances Data Bank [Internet]. Bethesda (MD): National Library of Medicine (US); [Last Revision Date 30/06/2014]. Acetone; Hazardous Substances Databank Number: 167. Available from: <a href="http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB">http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB</a> (as accessed 05/2015) International Programme on Chemical Safety (IPCS). International Chemical Safety Card entry for methane, ISCS 0291, 2000. World Health Organization: Geneva. Methane (HAZARDTEXT® Hazard Management). In: Klasco RK (Ed): TOMES® System. Truven Healthcare Analytics Inc., Greenwood Village, Colorado, USA. (electronic version). RightAnswer.com, Inc., Midland, MI, USA, Available at: <a href="http://www.rightanswerknowledge.com">http://www.rightanswerknowledge.com</a> (assessed 05/2015). The Merck Index (14th Edition). Methane, Entry 5952, 2006.	

## Reported Effect Levels from Authoritative Sources

### Exposure by inhalation

%	Signs and symptoms	Reference
>80	May cause asphyxia	a
<p>These values give an indication of levels of exposure that can cause adverse effects. They are not health protective standards or guideline values</p> <p><b>Reference</b></p> <p>a TOXBASE. Methane, 2009. <a href="http://www.toxbase.org">http://www.toxbase.org</a> (accessed 05/2015).</p>		

## Published Emergency Response Guidelines

### Emergency response planning guideline (ERPG) values

	Listed value (ppm)	Calculated value (mg/m <sup>3</sup> )
<b>ERPG-1*</b>	Data not available	
<b>ERPG-2†</b>		
<b>ERPG-3‡</b>		
<p>* Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined, objectionable odour</p> <p>† Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action</p> <p>‡ Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects</p>		

### Acute exposure guideline levels (AEGLs)

	ppm				
	10 min	30 min	60 min	4 hours	8 hours
<b>AEGL-1*</b>	Data not available				
<b>AEGL-2†</b>					
<b>AEGL-3‡</b>					
<p>* Level of the chemical in air at or above which the general population could experience notable discomfort</p> <p>† Level of the chemical in air at or above which there may be irreversible or other serious long-lasting effects or impaired ability to escape</p> <p>‡ Level of the chemical in air at or above which the general population could experience life-threatening health effects or death</p>					

## Exposure Standards, Guidelines or Regulations

### Occupational standards

	LTEL (8-hour reference period)		STEL (15-min reference period)	
	ppm	mg/m <sup>3</sup>	ppm	mg/m <sup>3</sup>
<b>WEL</b>	No guideline value specified			
WEL – workplace exposure limit, LTEL – long-term exposure limit, STEL – short-term exposure limit				

### Public health guidelines

<b>Drinking water standard</b>	No guideline value specified
<b>Air quality guideline</b>	No guideline value specified
<b>Soil guideline values and health criteria values</b>	No guideline value specified



## Health Effects

### Major route of exposure

- inhalation

### Immediate signs or symptoms of acute exposure

Route	Signs and symptoms
<b>Inhalation</b>	<p>Features include euphoria, agitation, decreased alertness, slurred speech, decreased visual acuity, memory loss, nausea, vomiting, flushing and headache. Increased respiratory rate and tachycardia are often early compensatory features. Ataxia, paraesthesia and progressive impairment of consciousness may develop</p> <p>Respiratory depression, hypotension, myocardial infarction, cardiac dysrhythmias, pulmonary oedema, convulsions, coma and death may occur if exposure is prolonged or if inhaled concentrations are high</p>
<b>Dermal and ocular</b>	Direct skin and eye contact with liquefied gases directly from container may cause cold burns and frostbite
<p><b>References</b></p> <p>TOXBASE. Methane, 09/2016. <a href="http://www.toxbase.org">http://www.toxbase.org</a> (accessed 11/2016)</p> <p>TOXBASE: Asphyxiant gases – features and management, 09/2016. <a href="http://www.toxbase.org">http://www.toxbase.org</a> (accessed 11/2016)</p>	

## Decontamination at the Scene

The approach used for decontamination at the scene will depend upon the incident, location of the casualties and the chemicals involved. Therefore, a risk assessment should be conducted to decide on the most appropriate method of decontamination.

Surface contamination following exposure to methane gas is unlikely; therefore decontamination should not be required. Methane may be stored as a liquid under pressure in cylinders for industrial use, this liquid will rapidly volatilise on release, though it may cause thermal burns on contact with skin.

Emergency services and public health professionals can obtain further advice from Public Health England (Centre for Radiation, Chemical and Environmental Hazards) using the 24-hour chemical hotline number: 0344 892 0555.

## Clinical decontamination and First Aid

Detailed information on clinical management can be found on TOXBASE – [www.toxbase.org](http://www.toxbase.org).

### Important notes

- decontamination is unlikely to be required for methane
- secondary care staff should not need to wear protective equipment other than routine precautions against secondary contamination with vomit and body fluids

### Dermal exposure

- treat dermal and cold injuries conventionally
- other supportive measures as indicated by the patient's clinical condition

### Ocular exposure

- not applicable

### Inhalation

- maintain a clear airway and ensure adequate ventilation
- in the event of cardiac arrest in hospital or witnessed out of hospital cardiac arrest with bystander CPR, resuscitation should be continued for at least 1 hour and only stopped after discussion with a senior clinician.
- Prolonged resuscitation for cardiac arrest is recommended following poisoning as recovery with good neurological outcome may occur
- give high flow oxygen to symptomatic patients
- monitor vital signs and measure blood sugar (BM)
- perform a 12 lead ECG in all patients who require assessment
- other supportive measures as indicated by the patient's clinical condition

### Ingestion

- not applicable

### Clinical decontamination and first aid references

- TOXBASE <http://www.toxbase.org> (accessed 11/2016)
- TOXBASE Methane, 09/2016
- TOXBASE Asphyxiant gases – features and management, 09/2016

This document from the PHE Centre for Radiation, Chemical and Environmental Hazards reflects understanding and evaluation of the current scientific evidence as presented and referenced here.

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