



# ANNEX 3

## Handling of gases during operation of balloon type NL-STU

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## 1. Description

As described in the Flight Manual, balloons of type NL-STU can be operated with three different lifting gases. When handling gases, accident prevention rules must be observed. For this purpose, different danger zones and hazard categories are defined according to their probability of occurrence and the effects on humans and equipment. For each category, appropriate behavior must be adopted. The procedures and definitions described here are based on common industry specifications and guidelines that are applicable throughout Europe.

NOTE: **Coal gas**, also referred to as city gas, is a mixture of various gases. These include hydrogen, methane, nitrogen and carbon monoxide. Due to its different components, the gas is toxic and flammable. For the sake of improved detectability, a component that smells of garlic is generally added.

NOTE: **Hydrogen** is a tasteless, odorless and colorless combustible gas. Escaping hydrogen gas can displace breathable air, resulting in a risk of asphyxiation! Burning off of a hydrogen/oxygen mixture can change suddenly into a detonation with generation of pressure and heat. The particular hazards resulting from these properties must be taken into consideration in a training course dealing with the handling of hydrogen. All participants must be instructed in the hazards and safety measures applicable when handling hydrogen and relevant to the local situation.

NOTE: **Helium** is a very light, non-combustible, non-toxic, colorless and odorless gas. Inhalation of helium can lead – without prior signs or symptoms – to unconsciousness, respiratory arrest and in the worst case death.



## 2. Definition of safety areas

The safety areas are defined by the manufacturer of the balloon on the basis of generally applicable accident prevention regulations. The explosion protection zones are defined in accordance with the explosion protection regulations (EX Directive, DGUV Regulation 113-001). Areas and zones are defined as follows:

### **Temporary safety area**

A place in which an explosive atmosphere consisting of a mixture with air of dangerous substances in the form of gas, vapor or mist is not likely to occur in normal operation. It is possible, however, that operation of the balloon in this area may result, for example, in mechanical hazards for people and equipment (e.g. due to moving balloon components).

### **Zone 2**

A place in which an explosive atmosphere consisting of a mixture with air of dangerous substances in the form of gas, vapor or mist is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

### **Zone 1**

A place in which an explosive atmosphere consisting of a mixture with air of dangerous substances in the form of gas, vapor or mist is likely to occur in normal operation occasionally.

### **Zone 0**

A place in which an explosive atmosphere consisting of a mixture with air of dangerous substances in the form of gas, vapor or mist is present continuously or for long periods or frequently. When handling helium, the oxygen-displacing effect of the gas must be taken into consideration (risk of asphyxiation).

NOTE: The term “frequently” is to be used in the sense of “most of the time”.  
The term “short period” corresponds to a duration of max. 30 minutes.



### 3. Definition of the safety zones at the balloon

Empirical values for the handling of hydrogen and coal gas as well as a consideration of the physical and chemical properties of the gases were taken as a basis for the definition of the extent of the areas and zones. Furthermore, empirical values from the general operation of balloons were used for defining the safety area.

- NOTE:           The zones only apply for the handling of hydrogen and coal gas. Safety areas apply for all usable lifting gases.
- The temporary safety area comprises all the explosion protection zones.
- The extent of the zones/areas depends on the operating phase of the balloon (e.g. envelope is lying on the ground or balloon is upright with the envelope inflated ready for take-off).
- On landing, the procedures described in the Instruction Manual must be observed.

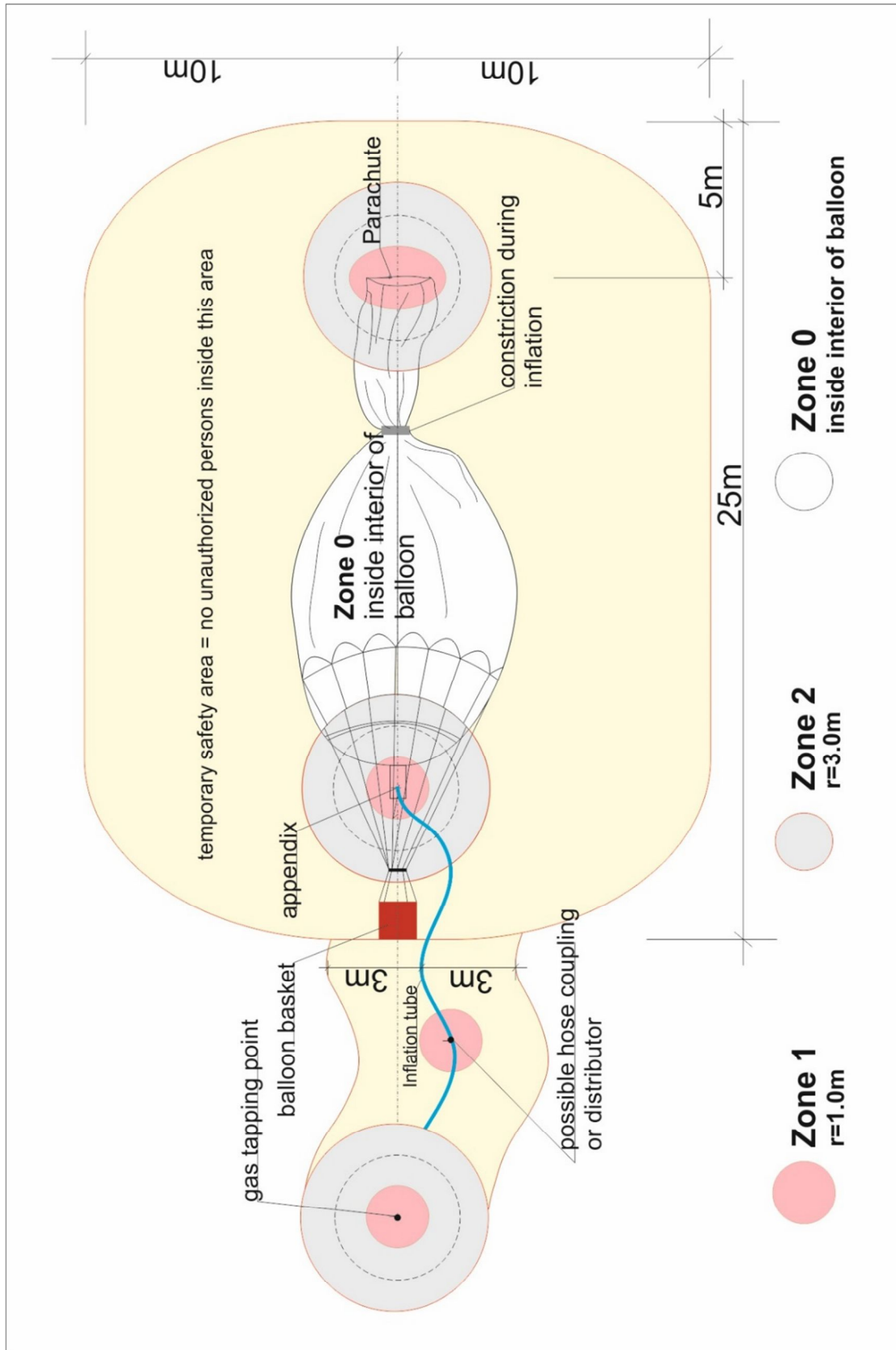


Figure 1: Zone classification, top view

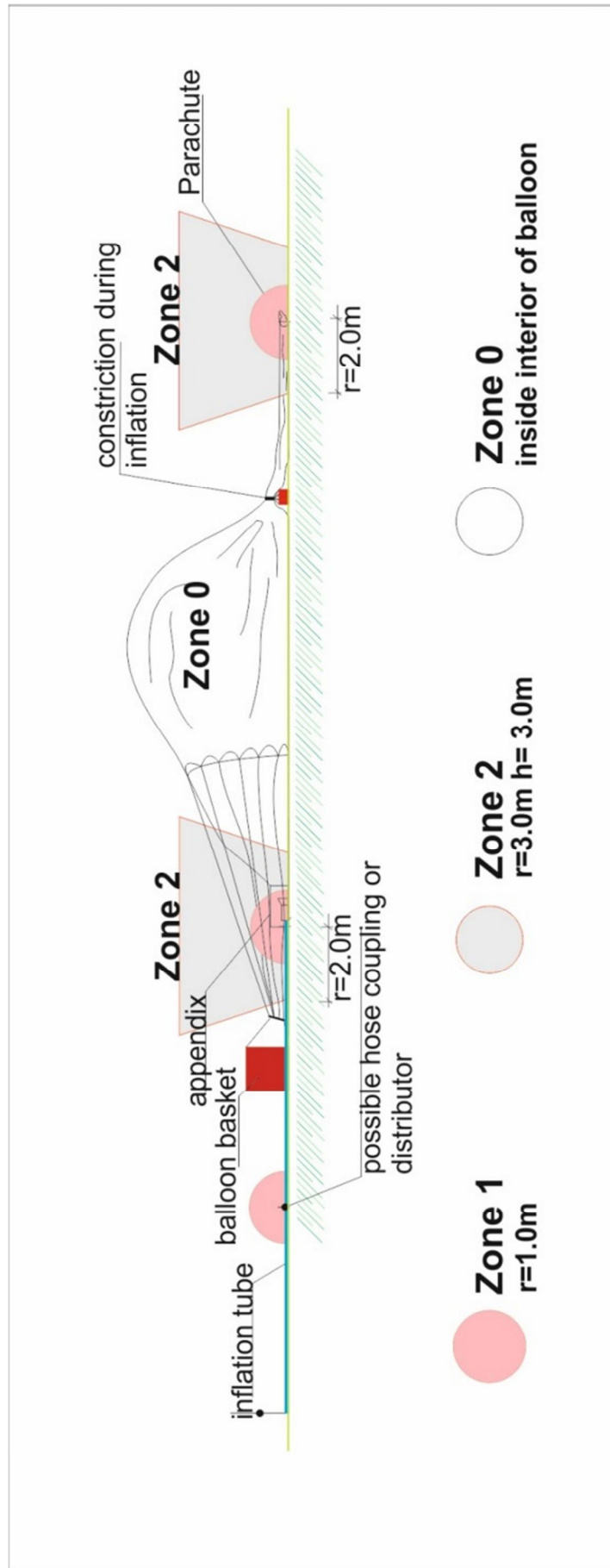


Figure 2: Zone classification, side view

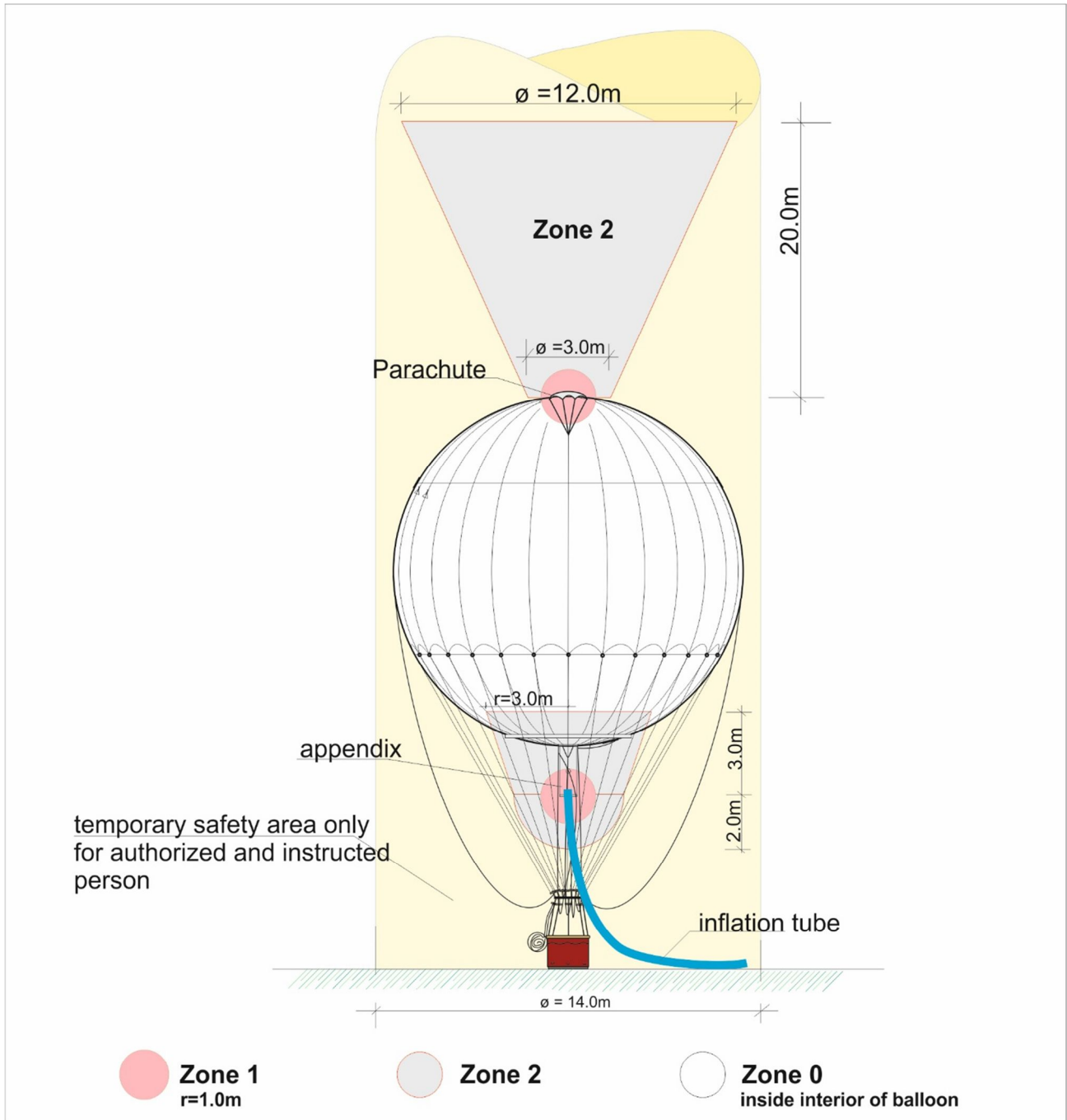


Figure 3: Zone classification, side view, after inflation

NOTE: The zones described are valid with the inflation tube both mounted and removed.



## 4. Rules of conduct in the zones/areas

A high degree of safety must always be ensured for people and equipment. All persons involved in operation of the balloon must behave responsibly in accordance with the accident prevention regulations. Responsibility for supervision and safety lie with the pilot in command of the aircraft.

### **Temporary safety area**

No unauthorized persons allowed in this area.

In this area, attention must be paid at all times to moving parts of the balloon, particularly when inflating the envelope and allowing it to rise.

Sharp-pointed objects that could damage the envelope are prohibited in this area.

Smoking is prohibited in this area.

### **Zone 2**

Ignition sources must be avoided in this zone.

Smoking is prohibited in this area.

### **Zone 1**

Ignition sources must be avoided in this zone.

Smoking is prohibited in this area.

Personal protective equipment must be worn in this zone (leather gloves, antistatic clothing that covers the skin, and antistatic footwear).

Only devices that meet the requirements of device class 2 and category 2G in accordance with the ATEX explosion protection regulations may be used in this zone.

### **Zone 0**

It is imperative that ignition sources are avoided in this zone.

The presence of persons within this zone is strictly prohibited!

Only devices that meet the requirements of device class 2 and category 1G in accordance with the ATEX explosion protection regulations may be used in this zone.





NOTE: “Unauthorized persons” refers to all persons except the balloon pilot and his instructed auxiliary personnel.

NOTE: Explosion protection in accordance with ATEX is based on the Directive of the European Court of Justice 1999/92/EC (ATEX 137) and all associated valid directives as well as their subsequently applicable publications.

Comments: Of the many potential ignition sources, the following are of particular practical relevance:

- Flames
- Hot surfaces
- Electrical equipment
- Static electricity
- Mechanically generated sparks
- Lightning
- Chemical reactions

## 5. Hazard information

A number of mandatory, warning, prohibition and hazardous substance notices are explained below. These must be observed when handling lifting gases.

General description of the symbols:



General mandatory sign

Mandatory signs must be observed.



Use eye protection

The use of eye protection (safety goggles) is recommended.



Use hand protection

The use of hand protection is recommended.



Use protective clothing

The use of protective clothing is recommended.



General warning sign

There is a risk of hazards.



Warning: explosive atmosphere

An explosive atmosphere may form.



Warning: toxic substances

There may be toxic substances present.



Warning: flammable substances

There may be flammable substances present.



No naked flames

No naked flames; fire, open ignition source and smoking prohibited.



Skull and crossbones

Even in smaller quantities, they immediately lead to death or severe damage to health.



Flame

Flammable; liquids form potentially explosive mixtures with air; produce flammable gases in contact with water or present a risk of self-combustion.



Health hazard

Have allergenic, carcinogenic, mutagenic, reprotoxic or organ-damaging effects.

NOTE:

The information provided here is based on our current state of knowledge and is intended to describe the product with regard to the safety precautions to be taken. The information does not represent any assurance of product characteristics, however, and does not establish a legally valid contractual relationship. The current, regionally valid regulations for the handling of hazardous substances must be applied at all times.



## 5.1 Hazard information when handling hydrogen

Extract from the EC safety data sheet acc. to TRGS 220.

### Possible hazards

Hazard information                      Extremely flammable. Burns with a barely detectable, colorless flame.

### First aid measures

Inhalation                                      High concentrations can cause asphyxiation. Symptoms may include loss of mobility and consciousness. The onset of asphyxiation goes unnoticed. The victim must be brought into fresh air using self-contained breathing apparatus. Keep warm and calm. Consult a doctor. If breathing stops, initiate artificial respiration.

Ingestion                                        Ingestion is not regarded as a possible route of exposure.

### Fire-fighting measures

Suitable extinguishing agents              All known extinguishing agents can be used.

Special procedures                            If possible, stop gas escaping. Move away from the container and cool it with water from a protected position. Only extinguish escaping, burning gas if absolutely necessary. Spontaneous, explosive re-ignition is possible. Extinguish any other fire.

Hazardous combustion products              None

### Exposure controls

Personal safety precautions                Ensure adequate ventilation. Do not smoke when handling the product.

Personal protective equipment              Wear leather gloves



Eye protection

The wearing of safety goggles is recommended.

**Physical and chemical properties**

Appearance: colorless gas.

Odor: odorless.

State at 20 °C: gas

Molar weight: 2

Boiling point: -253 °C

Ignition temperature: 560 °C

Critical temperature: -240 °C

Explosive limit tva.%+n Lift): 4-77

Relative density, gaseous: 0.07

Other information:

Burns with an invisible, colorless flame.

**Stability and reactivity**

May form an explosive mixture with air. May react violently with oxidizing substances.

**Toxicological information**

General

Toxic effects of the product are not known.

**Ecological information**

General

No harmful effects of the product on the environment are known.



## 5.2 Hazard information when handling helium

Extract from the safety data sheet of industrial suppliers

### Possible hazards

Hazard information	Not classified as a hazardous substance/preparation.
Other hazards	Asphyxiating in high concentrations.

### First aid measures

Inhalation	High concentrations can cause asphyxiation. Symptoms may include loss of mobility and consciousness. The onset of asphyxiation goes unnoticed. The victim must be brought into fresh air using self-contained breathing apparatus. Keep warm and calm. Consult a doctor. If breathing stops, initiate artificial respiration.
Ingestion	Ingestion is not regarded as a possible route of exposure.

### Exposure controls

Personal safety precautions	Ensure adequate ventilation.
Personal protective equipment	Wear leather gloves.
Eye protection	The wearing of safety goggles is recommended.

### Physical and chemical properties

Appearance: colorless gas.  
Odor: odorless.  
State at 20 °C: gas  
Molar weight: 4  
Boiling point: -269 °C  
Ignition temperature: not applicable.  
Critical temperature: -268 °C  
Vapor pressure at 20 °C: not applicable.



Relative density, gaseous: 0.14

Relative density, liquid: not applicable

### **Stability and reactivity**

Stable under normal conditions.

### **Toxicological information**

General

Toxic effects of the product are not known.

### **Ecological information**

General

No harmful effects of the product on the environment are known.

## **5.3 Hazard information when handling coal gas**

As already mentioned above, coal gas, also referred to as city gas, is a mixture of various gases. These include hydrogen, methane, nitrogen and carbon monoxide. Due to its different components, the gas is toxic and flammable. For this reason, the same hazard information is to be observed when handling coal gas as for hydrogen.