Ethylene

IDENTIFICATION

Ethylene
Acetene
Ethene
Bicarburetted hydrogen
Liquid ethylene

ZVG No: 12710
CAS No: 74-85-1
EC No: 200-815-3
INDEX No: 601-010-00-3

CHARACTERISATION

SUBSTANCE GROUP CODE

140120 Hydrocarbons, aliphatic, unsaturated
162000 Organic gases

STATE OF AGGREGATION

The substance is gaseous.

PROPERTIES

colourless
faint sweetish odour

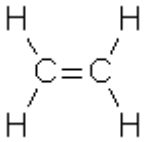
CHEMICAL CHARACTERISATION

Extremely flammable gas. Forms explosive mixtures with air.
Moderately soluble in water.

Danger of suffocation at high concentrations.
Acute or chronic health hazards result from the substance.
(see: chapter REGULATIONS).

FORMULA

C2H4



Molar mass: 28,05 g/mol
Conversion factor (gaseous phase) at 1013 mbar and 20 °C:
1 ml/m³ = 1,17 mg/m³

PHYSICAL AND CHEMICAL PROPERTIES

TRIPLE POINT

Temperature: -169,2 °C
Pressure: 0,0012 bar

MELTING POINT

Melting point: -169,18 °C

BOILING POINT

Boiling Point: -103,8 °C

CRITICAL DATA

Crit. temperature: 9,2 °C
Crit. pressure: 50,2 bar
Crit. density: 0,218 g/cm³

DENSITY

VAPOUR DENSITY
under standard conditions (0 °C, 1013 mbar)
Value: 1,2611 g/l

DENSITY OF LIQUID PHASE AT BOILING POINT
Value: 0,5679 g/cm³

RELATIVE VAPOUR DENSITY
Ratio of the density to dry air at the same temperature and pressure
Value: 0,97

VAPOUR DENSITY
Value: 1,178 kg/m³
Temperature: 15 °C
at 1 bar

VAPOUR PRESSURE

Vapour pressure: 32,4 bar
Temperature: -10 °C

Vapour pressure: 40,9 bar
Temperature: 0 °C

Vapour pressure: 41,0 bar
Temperature: 20 °C

IGNITION TEMPERATURE

Ignition temperature: 440 °C
Temperature class: T2
Minimum ignition energy: 0,082 mJ
Max. exper. safe gap (MESG): 0,65 mm
Explosion group: IIB

EXPLOSION LIMITS

Lower explosion limit:
2,4 vol. %
29 g/m³
Upper explosion limit:
32,6 vol. %
388 g/m³
Limiting oxygen concentration (LOC):
7,6 vol. %
Maximum explosion pressure:
9,7 bar

SOLUBILITY IN WATER

Concentration: 130 mg/l

PARTITION COEFFICIENT (octanol/water)

log Kow: 1,13
Recommended value of LOG KOW Databank.

HAZARDOUS REACTIONS

Hazardous chemical reactions:
Tends to polymerize spontaneously.
Risk of explosion in contact with:
fluorine
acetylene/hydrogen; aluminium chloride/catalyst; bromotrichloromethane/heat; chlorine/heavymetaloxides, chlorotrifluoroethylene; nitromethane + aluminium(III) chloride; ozone; oxygen; nitrogen oxides; tetrachloromethane/heat; tetrafluoroethene; trichlorobromomethane
The substance polymerize in contact with:
aluminium chloride; dibenzoylperoxide; copper
The substance can react dangerously with:
chlorine/light; hydrogenchloride; difluoro oxide; lithium; molecular sieve; hydrogen/pressure

FURTHER INFORMATION

ozone depletion potential : 0
global warming potential : 3

OCCUPATIONAL HEALTH AND FIRST AID

ROUTES OF EXPOSURE

Main Routes of exposure:
The main route of exposure for ethylene (E) is via the respiratory tract.[07619]

Respiratory tract:
E is only slightly resorbed after inhalation.
Clearance of inhaled atmosphere that contains E amounted to 25 l/h in a person with a body weight of 70 kg. This value represents only 5.6 % of the identified alvelolar ventilation rate of 450 l/h. This result indicates that 94.4% of the E that enters the lungs is exhaled in unchanged form.
In the steady state, alveolar retention amounts only to approx. 2% when the external exposure does not exceed 50 ppm.
This lower resorption rate was explained by the low solubility of the substance in the blood.[07980]

Skin:
Information on skin resorption is not available.[99983]

Gastrointestinal tract:

Under real conditions it must not be assumed that toxicologically relevant amounts of the gaseous E are resorbed via the digestive tract.[99999]

TOXIC EFFECTS

Main toxic effects:
Acute effects: Local frostbite after direct contact with the relaxed liquid; massive inhalation impairs the central nervous system.[07742]
Chronic effects: Information relevant to humans is not available.[99983]

Acute toxicity:
Direct eye or skin contact with liquids or aerosols released from pressure containers results in extremely low evaporation temperatures that cause tissue damage as a result of local frostbite.
E gas does not possess any irritative potential at normal temperature, but concentrations > 25% are said to have caused vision disorders.
Concentrations in the range of 260-700 ppm were indicated as threshold values for the slightly sweet odour of the gas.
Persons who were exposed to a 25%-35% atmosphere reported an unpleasant taste that lasted for a prolonged period.
Unphysiological reactions were not observed after acute exposure to concentrations of up to 2.5%.
Detailed knowledge of the active potential of higher concentrations chiefly results from the application period of E as a anaesthetic or narcotic:
Inhalation of 10%-40% of E caused euphoria that subsided after a few minutes.
Concentrations of 25% and more had analgetic effects and triggered formication, numbness in the extremities, strong perspiration and abnormal sensory perceptions.
Only rare cases involved nausea.
In the case of exposure to 40% E, lack of oxygen (cyanosis) was observed. In other studies this concentration caused loss of memory and confusion within15 minutes.
E concentrations of 45%-60% caused loss of consciousness within 5 to 10 minutes, but the affected persons rapidly regained consciousness after termination of the exposure.
Even higher concentrations (80%) caused only cardiac dysfunctions in rare cases. Rare cases also involved laryngeal spasm and changes in the blood count (leukocytosis and an increased tendency to bleed).[07742]
Apparently, cardiac sensitisation is not typical for E and was also not observed in dogs.[07866]
Liver dysfunctions observed in rats after exposures to 1%-5% E over 4 hours (but only after pre-treatment with enzyme initiators that promote the metabolisation process) apparently did not occur in humans.[07619]
Altogether it was confirmed that acute E exhibits only minor toxic potentials and is to be considered chiefly an asphyxiant.[07748]
This interpretation has only limited validity, since the effects mentioned above undoubtedly confirm a systemic active potential that can be ascribed not only to hypoxia.[99999]

Chronic toxicity:
Two different studies reported only vision disorders (e.g., restricted field of vision) that

supposedly had been observed in persons after chronic exposure even when subsequently affected by – in some cases – merely relatively low exposures. Comments on the validity of these studies were not provided.[07656]
Analogous findings pertain to a moderate hyperglycaemia that might occur after repeated exposure.[99997]
In a 13-week study rats were exposed to 1% E (6 hours per day, 5 days per week). Clinical toxicity symptoms and, in the subsequent dissection, tissue anomalies were not found.[07742]
Rats exposed to 0.3% E did not exhibit any lesions or health disorders that might be ascribed to the test substance in a chronic study (6 hours per day, 5 days per week over a period of 24 months).[07866]
Mice exposed to concentrations of 90% E up to 20 times for individual periods of 60-90 minutes within 58 days developed liver disorders.
Kidneys, suprarenal glands, heart and lungs did not exhibit any abnormal findings. Details were not reported in this very old study.[07742]

Reproductive toxicity, Mutagenicity, Carcinogenicity:
For classifying the reproductive toxicity and mutagenic and carcinogenic potential see list in Annex VI of the CLP regulation or TRGS 905 or List of MAK values.
(see section REGULATIONS).
Reproductive toxicity:
The available information is insufficient.[99983]
Mutagenicity:
Certain findings in appropriate mutagenicity tests give ground for concern because of possible mutagenic action to human germ cells.
[05329]
Exposure of mice to 0.25-11 ppm (6-10 hours) entailed an alkylation of the haemoglobin and an alkylation of the DNA in several organs.
These effects, which point to a genotoxic potential, were ascribed to the primary metabolite ethylene oxide.
Industrial exposure entailed an increased adduct generation at the N-terminal valine in haemoglobin.
Carcinogenic potential:
There are grounds for suspecting carcinogenic potential.
A study on the carcinogenic potential for rats did not reveal any carcinogenic potential.
Epidemiologic data are not available.
Due to the carcinogenic effects of the ethylene oxide whose formation was confirmed in vivo, E is assumed to possess carcinogenic potential.[07619]

Biotransformation and Excretion:
From the pharmacokinetic consideration of the E metabolism it must be taken into account that several simultaneous exposure sources are in place: The endogenous formation, the ubiquitous portion (that increases due, for example, to tobacco use) in the ambient atmosphere and the portion contained in the atmosphere at the workplace.[07619]
Only approx. 2% of the E amounts resorbed in the lungs are finally metabolised to 2% ethylene oxide that is hydrated to glycol via the epoxide hydrolases (and then degraded via oxidation) or/and conjugated to cysteine derivatives and thioethers with glutathione

and is then eliminated with the urine.
The portion not detoxicated might react with macro molecules (e.g., DNA, haemoglobin) and alkylate those macro molecules at certain positions.[99997]
The confirmation of specific alkylation products (hydroxyethyl valine in the erythrocytes) was recommended as a biomonitoring parameter to monitor exposure.[07620]
The internal stress involved in a medium exposure to 20-70 ppm of ethane at workplaces corresponds to the stress caused during exposure to 1 ppm ethylene oxide.[07619]

Annotation:
This occupational health information was compiled on 30.07.1999.
It will be updated if necessary.
This information was translated from German into English by Übersetzungsbüro Branco.

FIRST AID

Eyes:
In the case of local frostbite after direct contact with relaxed liquid:
Rinse the affected eye with widely spread lids for 10 minutes under running water whilst protecting the unimpaired eye.
Arrange medical treatment.
If vision disorders occur after exposure to concentrated gas-air mixtures:
Then, immediately transport the casualty to an eye doctor / to hospital.
[99997, 7742]

Skin:
In case of frostbite after contact with the relaxed liquid and because massive exposure might occur at the same time, make sure to:[99999]
Whilst protecting yourself, relocate the casualty away from the source of danger.
Do not pull off clothes that are frozen to the body, but defrost with lukewarm or cold water.[99999]
Lay the casualty down in a quiet place to rest and protect him against hypothermia.
Arrange for medical treatment.

Respiratory tract:
Whilst protecting yourself remove the casualty from the hazardous area and take him to the fresh air.
Lay the casualty down in a quiet place and protect him against hypothermia.
In the case of breathing difficulties have the casualty inhale oxygen.
If the casualty is unconscious but breathing lay him in a stable manner on his side.
If the casualty has stopped breathing give mouth to nose resuscitation. If this is not possible use mouth to mouth resuscitation. Keep his respiratory tract clear.
Arrange medical treatment.

Swallowing:
Resorption of toxicologically relevant amounts of the gas is not possible under real exposure conditions.[99999]

Information for physicians:
The acute toxicity of ethylene is minor. Unphysiological reactions must not be expected

after short-term exposure to concentrations of up to 2.5% (25,000 ppm) in the breathing air.
However, massive exposure to high concentrations caused clinical toxicity symptoms that are particularly, but not exclusively, ascribed to hypoxia.
Symptoms of acute poisoning:
Eyes and skin: Local frostbite after direct contact with relaxed solution from pressurised gas containers; irritation after exposure to gas can generally be ruled out; exposure to high concentrations might involve vision disorders;[07742]
Inhalation: Apparently, even massive exposure does not lead to an irritation of the respiratory tract;[99983]
Rapid occurrence of systemic effects;[07742]
Ingestion: Not relevant;[99999]
Resorption: Euphoria (for a very short time), analgesia, decreased responsiveness, paraesthesia, transpiration, confusion, cyanosis, narcosis; rare cases involve nausea, cardiovascular disorders, changes in the blood count.
First medical assistance:
An ophthalmologist must be consulted in all cases that involve visual disorders (that are chiefly be ascribed to repeated massive exposure).[07742]
Frostbite must be treated as usual.[99983]
Frostbite on the skin points to a simultaneous massive exposure to the inhalation of the substance; therefore, the casualty must be monitored under consideration of this fact.[99999]
Cases in which the clinical picture is characterised by unconsciousness/hyperoxia due to the inhalation of the substance require all possible measures of a cardiopulmonary cerebral resuscitation.[07638]
A sensitisation of the myocardium to adrenaline is improbable according to previous experiences in humans and animals, but it can not be ruled out.[07866]
A possibly required cerebral oedema therapy (extreme cases might also require anoxia) was reported.
Follow-up monitoring of the liver and kidney values, the blood count and the lung functions as well as the performance of an ECG were recommended.[07638]

Recommendations:
Provide the physician information about the substance/product and treatment already administered.

Annotation:
This first aid information was compiled on 21.12.1998.
It will be updated if necessary.
This information was translated from German into English by Übersetzungsbüro Branco.

SAFE HANDLING

TECHNICAL MEASURES - HANDLING

Workplace:
Provision of very good ventilation in the working area.

Devices for detecting and reporting the presence of hazardous gases should be present.

Equipment:
Use only closed apparatus.
If dangerous pressure can arise from contact with heat, suitable safety measures and equipment should be provided.
If release of the substance cannot be prevented, then it should be suctioned off at the point of exit.
Consider emission limit values, a purification of waste gases if necessary.
Empty apparatus after cooling down.
Label containers and pipelines clearly.
There should be a shutoff for the lines at a safe distance.
Suitable materials:
For cylinders and valves:
All usual materials.
For seals:
Polytetrafluoro ethylene PTFE (Teflon)
Polychloro trifluoro ethylene PCTFE
Polyvinylidene fluoride
Polyamide PA
Polypropylene PP
Butyl rubber IIR

Advice on safer handling:
Do not store cylinders at the working area.
Do not force open valve.
When changing bottles, always inspect the leak-proof closure of the filled and empty bottles.
Refilling or transfer in storage rooms is prohibited.
Prevent cylinders from falling over.
Suck back of water into the container must be prevented. Do not allow backfeed into the container.
Purge air from equipment before introducing the gas.
Usually transport occurs in containers with high pressure. Use suitable equipment for the transport.
Tightly screw on the protective caps and blind nuts when transporting. Secure cylinders against falling over, do not throw.

Cleaning and maintenance:
Regular inspection of leak test required!
Only conduct maintenance and other work on or in the vessel or closed spaces after obtaining written permission.

TECHNICAL MEASURES - STORAGE

Storage:
Containers have to be labelled clearly and permanently.
Keep container below 50 °C in a well-ventilated place.

Keep upright, protect against falling over.
Do not store in escape routes, work rooms, or in direct proximity to them.
For transporting, storing, preparing, emptying, and maintaining pressurized gas bottles, the detailed rules in TRG 280 must be absolutely adhered to. For pressurised gas packaging, observe the applicable TRG 300.

Conditions of collocated storage:
Storage class 2 A (Gases)
Only substances of the same storage class should be stored together.
Collocated storage with the following substances is prohibited:
- Pharmaceuticals, foods, and animal feeds including additives.
- Infectious, radioactive und explosive materials.
- Flammable liquids of storage class 3.
- Other explosive substances of storage class 4.1A.
- Flammable solid substances or desensitized substances of storage class 4.1B.
- Pyrophoric substances.
- Substances liberating flammable gases in contact with water.
- Strongly oxidizing substances of storage class 5.1A.
- Oxidizing substances of storage class 5.1B.
- Organic peroxides and self reactive substances.
- Combustible and non combustible acutely toxic substances of stora-ge classes 6.1A and 6.1B.
- Combustible toxic or chronically acting substances of storage class 6.1C.
- Noncombustible toxic or chronically acting substances of storage class 6.1D.
- Combustible liquids of storage class 10.

Under certain conditions the collocated storage with the following sub-stances is permitted (For more details see TRGS 510):
- Aerosols (spray bottles).
- Ammonium nitrate and preparations containing ammonium nitrate.
- Combustible corrosive substances of storage class 8A.
- Combustible solids of storage class 11.

Consider the regulations of TRG 280 at collocated storage of different compressed gases.
The substance should not be stored with substances with which ha-zardous chemical reactions are possible.

TECHNICAL MEASURES - FIRE AND EXPLOSION PROTECTION

Technical, constructive measures:
Substance is combustible.
Fire fighting equipment must be available.
Measures required by the "Explosionsschutz-Richtlinie":
- Preventing the formation of an explosive atmosphere (limiting and monitoring the concentration, making inert, sealing, ventilation, warning systems, etc.)
- Preventing the ignition of an explosive atmosphere (separation into zones, removal of sources of ignition, explosion-proof electrical installation, grounding, etc.)
- Architectural measures to limit the effects of an explosion (explosive-force-proof construction, release of explosive pressure, explosion suppression, etc.)

Take precautionary measures against static discharges.
Earth all parts which can be electrically charged.
Protect parts of the system from any warming; if necessary, provide cooling with sprayed water.
Suitable measures must be applied to seal off waste-water systems, cable and pipe access ways, etc. (e.g.: immersing and sand beds).

Precaution on handling:
The gas-air mixture is explosive.
Area with explosion risk.
Keep at a distance from sources of ignition (e.g. electrical devices, open flames, heat sources, sparks).
Observe the smoking prohibition!
Absolutely no welding in the working area.
Only work with vessels and lines after these have been thoroughly rinsed.
Displacement with air is only permissible under strict observance of special protective measures.
Work done with fire or open flame should only be carried out with written permission if the risk of fire or explosion cannot be completely eliminated.
Do not use any tools that cause sparks.
It must be avoided that gases or vapours can escape into other rooms where sources of ignition are present.

ORGANISATIONAL MEASURES

Instruction on the hazards and the protective measures using instruction manual (TRGS 555) are required with signature if just more than one minor hazard was detected.
Instruction must be provided before employment and then at a minimum of once per annum thereafter.
Instruction should include a hint regarding the danger of suffocation.
An escape and rescue plan must be prepared when the location, scale, and use of the work-site so demand.
Observe the restrictions on juvenile employment as defined in the "Jugendarbeitsschutzgesetz".
Only employees are permitted to enter the work areas. Signposting to this effect must be displayed.

PERSONAL PROTECTION

Body protection:
Wear flameproof, antistatic protective clothing.
Use protective boots while handling gas cylinders.

Respiratory protection:
In an emergency (e.g.: unintentional release of the substance) respiratory protection must be worn. Consider the maximum period for wear.
Wear self-contained breathing apparatus.
Do not use filter respirator.

Eye protection:
Sufficient eye protection should be worn.
When handling compressed gas, at least glasses with side protection should be worn.
When handling liquid gas, chemical safety goggles must be used as well as a protective shield.

Hand protection:
Wear leather gloves to prevent frostbite injuries from rapidly expanding gas when handling pressurised gas bottles.

Occupational hygiene:
Avoid skin contact with the liquid phase: risk of frostbite.
Avoid inhalation of gas.
Change clothing that has been in contact with or taken up any of the gas and air the clothing far from any sources of ignition.

DISPOSAL CONSIDERATIONS

Hazardous waste according to Waste Catalogue Ordinance (AVV).
Compressed gas cylinders can normally be returned to the supplier. Pressurised cans are non-returnable and must be disposed of.
Do not empty pressure vessels to the point of pressure compensation. Mark empty vessels to avoid confusion with full ones.

ACCIDENTAL RELEASE MEASURES

Shut off all sources of ignition.
Provide adequate ventilation.
Evacuate area. Warn affected surroundings.
Wear respiratory protection (see chapter Personal Protection).
Attempt to stop the gas from escaping. Otherwise place leaky bottles under a suctioning device or put them outdoors.
Use non-sparking tools.
Afterwards ventilate area.

Endangerment of watert:
No hazards to sources of water are to be feared if released into water, drainage, sewer, or the ground.

FIRE FIGHTING MEASURES

Classes of fires:
C gaseous, also compressed substances

Suitable extinguishing media:
Dry extinguishing powder
Carbon dioxide extinguisher with gas nozzle

Instructions:

In the case of fire advise fire fighters on the presence of gas cylinders.
Cool surrounding containers with water spray.
If possible, take container out of dangerous zone.
Heating causes a rise in pressure, risk of bursting and
explosion.
Shut off sources of ignition.
Only put out fire if the gas flow can be interrupted.
Risk of explosion from gas accumulation and backfire.
Use only explosion proved equipment.

Special protective equipment:
Wear self-contained breathing apparatus.

REGULATIONS

Classification:
Flammable gases, Category 1; H220
Gases under pressure, liquefied gas; H280
Specific Target Organ Toxicity (single exposure), Category 3; H336

Signal Word: "Danger"

Hazard Statement - H-phrases:
H220: Extremely flammable gas.
H280: Contains gas under pressure; may explode if heated.
H336: May cause drowsiness or dizziness.

Precautionary Statement - P-phrases:
P210: Keep away from heat, hot surfaces, sparks, open flames and other sources of ignition. No smoking.
P260: Do not breathe dust/fume/gas/mist/vapours/spray.
P304+P340: IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P315: Get immediate medical advice/attention.
P377: Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P381: Eliminate all ignition sources if safe to do so.
P405: Store locked up.
P403: Store in a well-ventilated place.

Manufacturer's specification by Air Liquide

Reference: 01401

The substance is listed in appendix VI, table 3.1 of CLP regulation.

The given classification can deviate from the listed classification, since this classification is to be complemented concerning missing or divergent danger classes and categories for the respective substance.

When handling the substance the classification according to the German Technical Rules for Hazardous Substances 905 has to be considered.

Reference: 99999

GHS-CLASSIFICATION OF MIXTURES

The classification of mixtures containing this substance results from Annex 1 of Regulation (EC) 1272/2008.

Reference: 07500

COLOUR CODING OF GAS CYLINDERS

Shoulder colour: Red
(flammable gases)

WORKPLACE LABELLING ACCORDING TO GERMAN ASR A1.3

Prohibition label:

No open flame; fire, open ignition sources and smoking prohibited

No admittance for unauthorized persons

Warning label:

Caution - gas cylinder

Caution - explosive atmosphere

Precept label:

Use safety goggles

Wear safety shoes

GERMAN WATER HAZARD CLASS

Substance No: 742

non-hazardous to waters

Classification according to the Administrative Regulation of Substances Hazardous to Water (VwVwS)

TECHNICAL INSTRUCTIONS ON AIR QUALITY CONTROL (TA LUFT)

Chapter 5.2.5 Organic Substances, class I

The following values are in all not allowed to be exceeded in the exhaust gas:

Mass flow: 0,10 kg/hr

or

Mass conc.: 20 mg/m³

TRANSPORT REGULATIONS

UN Number: 1962
Shipping name: Ethylene
Hazard Identification Number: 23
Class: 2.1 (Flammable Gases)
Packing Group: -
Danger Label: 2.1

Tunnel restrictions:
Transports in tanks: passage forbidden through tunnels of category B, C, D and E.
Other transports: passage forbidden through tunnels of category D and E.

UN Number: 1038
Shipping name: Ethylene, refrigerated, liquid
Hazard Identification Number: 223
Class: 2.1 (Flammable Gases)
Packing Group: -
Danger Label: 2.1

Tunnel restrictions:
Transports in tanks: passage forbidden through tunnels of category B, C, D and E.
Other transports: passage forbidden through tunnels of category D and E.

TRGS 905 – CLASSIFICATION OF CARCINOGENIC, MUTAGENIC AND TOXIC TO REPRODUCTION SUBSTANCES

Due to the available data the substance can not be assigned to the "carcinogenic" categories 1 - 3.

M3 - Mutagenic EG-category 3:
Substances which possibly are mutagenic for humans and thus give cause for concern

Due to the available data the substance can not be assigned to the "embryotoxic" categories 1 - 3.

Due to the available data the substance can not be assigned to the "impaired fertility" categories 1 - 3.

The reason for evaluation will be found at the publication of AGS on the site of the BAuA (see section LINKS)

Reference: 05349

RECOMMENDATIONS OF MAK-COMMISSION

This data is recommended by scientific experience and is not established law.

Carcinogenic: Category 3B
Substances which are proved/possibly carcinogenic and therefore give reason for concern. There are clues for carcinogenic effects which however are not enough for allocation into a different category. In case there are no genetically toxical effects a MAK-value can be defined.

SEVESO III - Directive

Annex I Part 2 Number:	18
Liquefied flammable gases, Category 1 or 2	
Qualifying Quantity Column 2:	50 t
Qualifying Quantity Column 3:	200 t

RESTRICTIONS OF USE / BANS OF USE

Directives on Safety in School (BGR/GUV-SR 2003)
Activity ban for pupils till grade 4 (form) inclusive.
Substance list to GUV-SR 2004 (as of 11.2010)
Special substitute check required (substances with CMR, T+, E, and C with R35).
Substance list to GUV-SR 2004 (as of 11.2010)

FURTHER REGULATIONS

TRGS 200
Einstufung und Kennzeichnung von Stoffen, Zubereitungen und Erzeugnissen; Ausgabe Oktober 2011

TRGS 201
Einstufung und Kennzeichnung bei Tätigkeiten mit Gefahrstoffen; Ausgabe Oktober 2011

TRGS 400
Gefährdungsbeurteilung für Tätigkeiten mit Gefahrstoffen; Ausgabe Dezember 2010; geändert und ergänzt September 2012

TRGS 555
Betriebsanweisung und Information der Beschäftigten; Ausgabe Januar 2013

TRGS 600
Substitution; Ausgabe August 2008

TRGS 407
Tätigkeiten mit Gasen - Gefährdungsbeurteilung; Ausgabe Juni 2013, berichtigt Dezember 2013

TRGS 725/TRBS 3145
Ortsbewegliche Druckgasbehälter - Füllen, Bereithalten, innerbetriebliche Beförderung, Entleeren; Ausgabe Juni 2013

TRGS 726/TRBS 3146
Ortsfeste Druckanlagen für Gase; Ausgabe April 2014

TRGS 510
Lagerung von Gefahrstoffen in ortsbeweglichen Behältern; Ausgabe Januar 2013, geändert und ergänzt November 2014

TRGS 500
Schutzmaßnahmen; Ausgabe Januar 2008, ergänzt Mai 2008

TRGS 800
Brandschutzmaßnahmen; Ausgabe Dezember 2010

LINKS

Statement concerning the rating as carcinogenic, mutagenic or toxic for reproduction (in german only, source BAuA)
International Limit Values
OECD Screening Information DataSet (SIDS)
The MAK Collection for Occupational Health and Safety
Publications of EIGA (European Industrial Gases Association) Documents Download
Publications of the IGV (Industriegaseverband e.V.) (in german only)

REFERENCES

Reference: 00001
IFA: Erfassungs- und Pflegehandbuch der GESTIS-Stoffdatenbank (nicht öffentlich)
Data acquisition and maintenance manual of the GESTIS substance database (not publicly)

Reference: 00106
Sorbe "Sicherheitstechnische Kenndaten chemischer Stoffe" ("Safety-related characteristics of chemical substances"), sicherheitsNet.de, Landsberg, 07/2011

Reference: 00240
E. Brandes, W. Möller "Sicherheitstechnische Kenngrößen" Band 1 "Brennbare Flüssigkeiten und Gase" ("Safety-related characteristics" Vol. 1 "Combustible liquids and gases"), Wirtschaftsverlag NW, Verlag für neue Wissenschaft GmbH, Bremerhaven, 2003

Reference: 00260
1x1 der Gase. Physikalische Daten für Wissenschaft und Praxis. Herausgeber: AIR LIQUIDE Deutschland GmbH, Düsseldorf, 1. Auflage 2005

Reference: 00440
Datenbank CHEMSAFE, Version 2.10 (2014), DECHEMA-PTB-BAM

Reference: 01401
GHS-Sicherheitsdatenblatt (GHS Material Safety Data Sheet), Air Liquide

Reference: 02070

LOG KOW Databank, compiled by Dr. James Sangster, Sangster Research Laboratories, Montreal, Canada, distributed by Technical Database Services (TDS), New York

Reference: 05000
Kühn-Birett-Gruppenmerkblätter

Reference: 05096
Kühn-Birett-Merkblätter: 96. Ergänzungslieferung; 02/97

Reference: 05118
Kühn-Birett-Merkblätter: 118. Ergänzungslieferung; 06/99

Reference: 05190
Kühn-Birett-Merkblätter: 190. Ergänzungslieferung; 10/2005

Reference: 05300
TRGS 510 "Lagerung von Gefahrstoffen in ortsbeweglichen Behältern" Ausgabe Januar 2013, geändert und ergänzt November 2014

Reference: 05329
TRGS 905 "Verzeichnis krebserzeugender, erbgutverändernder oder fortpflanzungsgefährdender Stoffe" in der jeweils gültigen Fassung

Reference: 05349
TRGS 905 "Verzeichnis krebserzeugender, erbgutverändernder oder fortpflanzungsgefährdender Stoffe"; Ausgabe März 2014

Reference: 06002
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