Trifluoroiodomethane

IDENTIFICATION

Trifluoroiodomethane

ZVG No:	491007
CAS No:	2314-97-8
EC No:	219-014-5
INDEX No:	602-086-00-0

CHARACTERISATION

SUBSTANCE GROUP CODE

141110 Halogenated hydrocarbons, aliphatic, saturated
148100 Fluorine compounds, organic
148400 Iodine compounds, organic
162000 Organic gases

STATE OF AGGREGATION

The substance is gaseous.

PROPERTIES

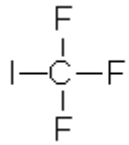
colourless

CHEMICAL CHARACTERISATION

Non-combustible gas.
Gas is heavier than air.
Acute or chronic health hazards result from the substance.
The substance is hazardous to the ozone layer.
(see: chapter REGULATIONS).

FORMULA

CF3I



Molar mass: 195,88 g/mol
Conversion factor (gaseous phase) at 1013 mbar and 20 °C:
1 ml/m³ = 8,14 mg/m³

PHYSICAL AND CHEMICAL PROPERTIES

MELTING POINT

Melting point: < -78 °C

BOILING POINT

Boiling Point: -22,5 °C

DENSITY

DENSITY
Value: 2,3608 g/cm³
Temperature: -42 °C

FURTHER INFORMATION

OCCUPATIONAL HEALTH AND FIRST AID

ROUTES OF EXPOSURE

Main Routes of exposure:
The main route of exposure for trifluoroiodomethane (TFIM) is via the respiratory tract.[99997]

Respiratory tract:
Exposure to vapours that might develop in the rapidly vaporised substance during the application of TFIM might occur, particularly as a fire-extinguishing agent for electronic appliances in narrow rooms (vapour pressure approx. 25 degrees C: 541 kPa).[99997]
Information on resorption rates is not available.[99983]
However, systemic effects after inhalation of the substance in animal experiments point

to rapid resorption.[99997]
Analogous conditions should be assumed for humans.[99999]

Skin:
Substance-specific information is not available.[99983]
However, resorption is assumed.[07750]

Gastrointestinal tract:
Due to the low boiling point of the substance, oral intake of the liquid is quite unlikely under real conditions.[99999]

TOXIC EFFECTS

Main toxic effects:
Acute effects:
Substance-specific information relevant to humans is not available.
Chronic effects:
Ditto.[99983]

Acute toxicity:
The toxicological data base for TFIM is extremely small.
Comprehensible information pertaining to humans is not available.[99983]
Analogous to other low-boiling fluorinated hydrocarbons, direct contact of the eyes or the skin with relaxed liquid from pressure gas containers is expected to trigger substantial hypothermia or frostbite of the tissue.[99999]
After repeated exposure highly concentrated TFIM vapours caused only slight irritations to the mucosae of the upper respiratory tract.[99997]
Therefore, single exposure of humans to low substance concentrations is not assumed to involve an irritative potential (warning effect).[99999]
A 4-hour exposure of rats (groups of 30 animals each) to 0, 0.5 or 1 vol. % of TFIM did not cause any fatalities, clinical toxicity signs, behavioural changes (follow-up period, 14 days), changes in the biochemical parameters or pathological-anatomical or histologically verifiable findings in any of the groups.
Higher concentrations (>/= 12 vol. %), in contrast, entailed fatalities, whereas the cardiac sensitisation was certainly the main reason for these effects.
Symptoms included arrhythmia and ventricular fibrillation. The LOAEL or the NOAEL for these effects on dogs were determined at concentrations of 0.4 or 0.2 vol. %.
With regard to possible exposures at workplaces, it was stated that the thermal load of TFIM might entail strongly toxic degradation products, particularly HF and HI.[99997]
This statement is particularly important with regard to the main application purpose of TFIM as a fire extinguishing agent; possible development of a toxic lung oedema.[99999]

Chronic toxicity:
Information pertaining to humans is not available.[99983]
In a 2-week inhalation study 4 groups of 5 rats each were exposed to 0, 3, 6 or 12 vol. % for 2 hours per day, 5 days per week (‘nose-only’ exposure chamber).
Fatalities were not reported. At the end of the individual 2-hour exposure periods, the animals of the 2 highest exposure groups exhibited symptoms of lethargy and slight

coordination disorders, which subsided after periods of 2 hours.
Further symptoms included disorders in the development of body weight, significant changes in the white blood count of the 2 groups, increased albumin levels in the 12 vol. % group and changed thyroid functions (significant rT3 increases in all exposed groups).
Although the animals of the group that underwent the highest exposures also exhibited ruffled fur, the histopathological examination did not yield any findings in any animal.
In a subsequent 13-week study 30 rats each were exposed to 0, 2, 4 or 8 vol. % for 2 hours per day, 5 days per week.
During the exposure period the 2 and 4 vol. % groups vigorously attempted to escape from the nose-only appliance.
Some fatalities were not caused by exposure, and degeneration symptoms in the testicles were only partially ascribed to exposure.
The main target organ of the subchronic exposure was the thyroid gland.
This finding was derived not only from functional changes, but also from the decreased relative organ weights.
Changes in the red and white blood counts were also confirmed.
The above information is not sufficient to derive tolerable concentrations for humans.[99997]

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:
Relevant information is not available.[99983]
Mutagenicity:
Certain findings in appropriate mutagenicity tests give ground for concern because of possible mutagenic action to human germ cells.
[05323]
TFIM tested positive in an Ames test and a micronucleus test on mice and rats, but negative in a mouse lymphoma test.[99997]
Carcinogenic potential:
No information available.[99983]

Biotransformation and Excretion:
Substance-specific data are not available.[99983]
Analogous to the similarly structured bromotrifluoromethane, it must be assumed that a substantial portion of the resorbed TFIM is exhaled in unchanged condition.[99999]
However, a certain portion is apparently metabolised, since the disorders of the thyroid function caused by TFIM was also ascribed to an inhibition of the enzyme iodothyronine 5'-deiodinase, which is responsible for the transformation of thyroxine to triiodothyronine.[99997]

Annotation:
This occupational health information was compiled on 01.09.1997.
It will be ipdated if necessary.
This information was translated from German into English by Übersetzungsbüro Branco.

FIRST AID

Eyes:
Direct contact with liquid TFIM from relaxed pressure gas containers requires immediate rinsing of the affected eyes with lukewarm water.
Do not spread the eyelids with the fingers during this procedure, since there is a risk of injury of the undercooled tissue.
Subsequently immediately:[99999]
Arrange medical treatment.

Skin:
Cold damage occurring after contact of liquid TFIM with the uncovered or covered skin (white skin discolourations) should be treated with lukewarm water, initially without removing the clothes.
Do not rub subsequently, but instead cover with sterile dressing material.[99999]
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.
Arrange medical treatment.
After exposure to combustion gases or thermal degradation products that contain TFIM:[99999]
As soon as possible repeatedly have the casualty deeply breath a glucocorticoid inhalation spray in.

Swallowing:
Resorption of quantities of toxic TFIM in the gastrointestinal tract is hardly possible under real conditions.[99999]

Information for physicians:
Experience reports pertaining to human toxicities are not available.[99983]
Based on the current state of knowledge, results from animal experiments with TFIM and analogical reasoning to other fluorinated methane derivatives point to the following toxicity symptoms.[99997]
Probable symptoms of acute toxicities:
Eyes: Hypothermia up to frostbite of the tissue after direct contact with relaxed liquid; slight to non-existent irritative potential of the vapours, certainly depending on the individual concentrations;
Skin: Ditto.[99999]
Inhalation: Slight potential irritation by the vapours to the mucosae of the respiratory tract; systemic effects as of an undetermined (probably higher) concentration range;[99997] extremely high concentrations might involve asphyxia;
Ingestion: Not relevant;[99999]
Resorption: Agitation merging into lethargy; incoordination, cardiovascular disorders (arrhythmias caused by myocardial sensitisation), changes in the thyroid function,

changes in the blood count.[99997]
First medical assistance:
Due to possibly considerable eye damage after direct contact with the liquid, the casualty should be examined by an ophthalmologist immediately after performance of first aid measures.[99999]
Frostbite of large areas of the skin or the mucosae require the restoring of the vital functions, installation of a venous access and infusion with added glucose.
In cases of extensive frostbite involving a drop in the body temperature, the casualty must immediately be rewarmed in a water bath or shower (water at 40-42 degrees C). Pain treatment as required. No rewarming of thawed body areas, but elevate them instead. Determine whether the casualty is vaccinated against tetanus; provide new vaccination as required.[99997]
In cases of impending suffocation, supply fresh air or, preferably, supply air enriched with oxygen.
Severe cases require artificial respiration; shock therapy as required.
Adrenaline-ephedrine preparations should not be applied due to a possible cardiac sensitisation.
Beta blockers should be tried if the casualty suffers from arrhythmia.
If thermal degradation of the substance occurs, be careful of the development of a toxic lung oedema caused by the released hydrogen fluoride.[99999]

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

Annotation:
This first aid information was compiled on 01.07.1997.
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 good ventilation in the working area.
Devices for detecting and reporting the presence of hazardous gases should be present.
Protect ducts and sewers against penetration by the gas.

Equipment:
Use only closed apparatus.
Dry apparatus by heating and/or evacuation.
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.

Label containers and pipelines clearly.
There should be a shutoff for the lines at a safe distance.

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.
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 tightly closed.
Store in a cool place.
Keep container in a well-ventilated place.
Keep upright, protect against falling over.
Protect from exposure to sunlight.
Protect from overheating/heating up.
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 non-combustible. Select fire and explosion prevention measures according to the other used substances.
Protect parts of the system from any warming; if necessary, provide cooling with sprayed water.

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.
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".
Observe the restrictions on the employment of expectant and nursing mothers as defined in the "Mutterschutzverordnung".

PERSONAL PROTECTION

Body protection:
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.

At present time there is no available information about suitable filter respirator.
A self-contained breathing apparatus can be used in any case.

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 and air out clothing that has been in contact with or taken up any of the gas.

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

Wear respiratory protection, eye protection, hand protection and body protection (see chapter Personal Protection).
Attempt to stop the gas from escaping. Otherwise place leaky bottles under a suctioning device or put them outdoors.
Afterwards ventilate area.

FIRE FIGHTING MEASURES

Instructions:
Substance is incombustible. Select fire fighting measures according to the surrounding conditions.
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.
Rise in pressure and risk of bursting when heating.
Be watchful for frostbite in case of contact with fluid.

Special protective equipment:
In the case of inclusion in an ambient fire hazardous substances can be released.
Wear self-contained breathing apparatus and special tightly sealed suit.

REGULATIONS

Classification:
Gases under pressure, compressed gas; H280
Germ cell mutagenicity, Category 2; H341
Hazardous to the ozone layer, Category 1; H420

Signal Word: "Warning"

Hazard Statement - H-phrases:
H280: Contains gas under pressure; may explode if heated.
H341: Suspected of causing genetic defects.
H420: Harms public health and the environment by destroying ozone in the upperatmosphere

Precautionary Statement - P-phrases:
P201: Obtain special instructions before use.
P308+P313: IF exposed or concerned: Get medical advice/attention.
P410+P403: Protect from sunlight. Store in a well-ventilated place.
P502: Refer to manufacturer/supplier for information on recovery/recycling.

Manufacturer's specification by Sigma-Aldrich Group

Reference: 01221

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.

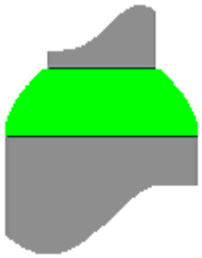
Reference: 99999

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: Shining green
(suffocating (inert) gases)

WORKPLACE LABELLING ACCORDING TO GERMAN ASR A1.3

Warning label:

Caution - gas cylinder

Precept label:

Use safety goggles

Wear safety shoes

Wear safety gloves

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: 1956
Shipping name: Compressed gas, n.o.s.
Hazard Identification Number: 20
Class: 2.2 (Non-flammable, non-toxic gases)
Packing Group: -
Danger Label: 2.2

Tunnel restrictions:
Passage forbidden through tunnels of category E.

RESTRICTIONS OF USE / BANS OF USE

Second Ordinance on the Implementation of the Federal Immission Control Act
First Section, §§ 1 and 2
It is prohibited to utilise the substance in the following facilities:
- surface treatment facilities (e.g. cleaning of items and materials)
- dry cleaning facilities and textile finishing plants
- extraction facilities (e.g. extraction of flavours, fats and oils)
Further details on prohibitions and exceptions can be taken from the Second Ordinance for the Implementation of the Federal Immission Control Act.

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 401

Gefährdung durch Hautkontakt, Ermittlung - Beurteilung - Maßnahmen; Ausgabe Juni 2008; zuletzt berichtigt März 2011

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

LINKS

Statement concerning the rating as carcinogenic, mutagenic or toxic for reproduction (in german only, source BAuA)
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: 00260
1x1 der Gase. Physikalische Daten für Wissenschaft und Praxis. Herausgeber: AIR LIQUIDE Deutschland GmbH, Düsseldorf, 1. Auflage 2005

Reference: 01221
GHS-Sicherheitsdatenblatt (GHS Material Safety Data Sheet), Sigma-Aldrich

Reference: 02000

Internet-Quelle, nicht spezifiziert

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

Reference: 05323
Begründungen zur Bewertung von Stoffen der TRGS 905 stehen als Bekanntmachung des AGS unter www.baua.de/prax

Reference: 07500
Verordnung (EG) Nr. 1272/2008 des Europäischen Parlaments und des Rates vom 16. Dezember 2008 über die Einstufung, Kennzeichnung und Verpackung von Stoffen und Gemischen, zur Änderung und Aufhebung der Richtlinien 67/548/EWG und 1999/45/EG und zur Änderung der Verordnung (EG) Nr.1907/2006 (EG-GHS-Verordnung)

Reference: 07750
R. E. Lenga "The Sigma-Aldrich Library of Chemical Safety Data" 2nd edition, Sigma-Aldrich, Milwaukee 1988

Reference: 80121
BG-Chemie-Merkblatt M 021 Ausgabe 3/2000 (BGI 648) Fluorkohlenwasserstoffe

Reference: 99983
Literaturlisten - Standardwerke, erweitert (Bibliographical reference - standard works, extended)

Reference: 99991
Analogieschluss aus Kühn-Birett-Merkblättern (Analogy from Kühn-Birett leaflets)

Reference: 99997
Projektgebundene Literaturliste Nr. 1
(Project related bibliographical reference No 1)

Reference: 99999
Angabe des Bearbeiters (Indication of the editor)