Safety Data Sheet
according to Globally Harmonized System (GHS)

Printing date 27.09.2014 Revision: 27.09.2014

1 Identification of the substance/mixture and of the company/undertaking

· **Product identifier**
· **Trade name: Tetrahydrofuran (THF)**

· **Synonyms:**
1,4-Epoxybutane; Diethylene oxide; Butylene oxide; Cyclotetramethylene oxide; Furanidine; Hydrofuran; Oxacyclopentane; Tetramethylene oxide
· **CAS Number:**
109-99-9

· **Relevant identified uses of the substance or mixture and uses advised against** :
· **Identified/Recommended uses:**
Intermediate for organic synthesis
Solvent
Raw Material for:
Chemical for synthesis

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Dairen Chemical Corporation
9th Fl., No. 301, SongJiang Rd.
Taipei City, 10483, TAIWAN
Tel: +886-2-7743-1500 Fax: +886-2-2509-9619
www.dcc.com.tw

· **Further information obtainable from:** Respective plant's environmental, health, and safety (EHS) Dept.
· **Emergency telephone number:** +886-2-7743-1500 (08:30-17:30; GMT+8)

2 Hazards identification

· **Classification of the substance or mixture**

Flam. Liq. 2	H225	Highly flammable liquid and vapour.
Carc. 2	H351	Suspected of causing cancer.
Acute Tox. 4	H302	Harmful if swallowed.
Eye Irrit. 2A	H319	Causes serious eye irritation.
STOT SE 3	H335	May cause respiratory irritation.
	H316	Causes mild skin irritation.

· **Label elements**
· **GHS label elements**
The substance is classified and labelled according to the Globally Harmonised System (GHS).
· **Hazard pictograms**

GHS02 GHS07 GHS08

· **Signal word** Danger

· **Hazard-determining components of labelling:**
tetrahydrofuran
· **Hazard statements**
Highly flammable liquid and vapour.
Harmful if swallowed.
Causes mild skin irritation.
Causes serious eye irritation.
Suspected of causing cancer.
May cause respiratory irritation.

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· **Precautionary statements**
Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
Use explosion-proof electrical/ventilating/lighting/equipment.
IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/ shower.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
Store locked up.
Dispose of contents/container in accordance with local/regional/national/international regulations.

3 Composition/information on ingredients

· **Chemical characterisation: Substances**
· **CAS No. Description**
109-99-9 tetrahydrofuran 99.5%
· **Identification number(s)**
· **EC number:** 203-726-8
· **Index number:** 603-025-00-0

4 First aid measures

· **Description of first aid measures**
· **After inhalation:** Supply fresh air; consult doctor in case of complaints.
· **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
· **After eye contact:**
Rinse opened eye for 15 minutes under running water. If symptom persists consult a doctor.
· **After swallowing:** Do not induce vomiting; call for medical help immediately.
· **Most important symptoms and effects, both acute and delayed**
Irritant effects
Coughing
Shortness of breath
Drowziness
High concentration may cause central nervous system depression resulting in headaches, dizziness, and nausea.
· **Indication of any immediate medical attention and special treatment needed**
Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

5 Firefighting measures

· **Extinguishing media**
· **Suitable extinguishing agents:**
CO_2, powder or water spray. Fight larger fires with water spray or alcohol resistant foam.
· **Special hazards arising from the substance or mixture**
Carbon monoxide (CO)
Carbon dioxide (CO2)
Vapours are heavier than air and may spread along floors.
Pay attention to flashback.
· **Advice for firefighters**
· **Protective equipment:**
Wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, trousers, boots, and gloves).

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· **Additional information**
Cool endangered receptacles with water spray.
Do not inhale explosion gases or combustion gases.
Avoid contact with skin, eye, and clothing.

6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures**
Wear protective equipment. Keep unprotected persons away.
Keep away from ignition sources.
Ensure adequate ventilation
Do not breathe dust/fume/gas/mist/vapours/spray.
Use respiratory protective device against the effects of fumes/dust/aerosol.
· **Environmental precautions:**
Dilute with plenty of water.
Do not allow to enter sewers/ surface or ground water.
· **Methods and material for containment and cleaning up:**
Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
Ensure adequate ventilation.
· **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

7 Handling and storage

· **Precautions for safe handling**
Wear protective gloves/protective clothing/eye protection/face protection.
Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
Ensure good ventilation/exhaustion at the workplace.
Open and handle receptacle with care.
Prevent formation of aerosols.
Avoid breathing vapor.
· **Information about fire - and explosion protection:**
Keep ignition sources away - Do not smoke.
Protect against electrostatic charges.
May form explosive peroxides.

· **Conditions for safe storage, including any incompatibilities**
· **Storage:**
· **Requirements to be met by storerooms and receptacles:**
Store in cool, dry place in tightly closed receptacles.
Store in the following material(s):
Carbon steel
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:**
Keep container tightly sealed.
Store in cool, dry conditions in well sealed receptacles.

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8 Exposure controls/personal protection

· **Additional information about design of technical facilities:**
Use local exhaust ventilation, or other engineering controls to maintain airborne levels below exposure limit requirements or guidelines.
Technical measures and appropriate working operations should be given priority over the use of personal protective equipment.

· **Control parameters**

· **Ingredients with limit values that require monitoring at the workplace:**	
109-99-9 tetrahydrofuran	
IOELV (EU)	Short-term value: 300 mg/m³, 100 ppm Long-term value: 150 mg/m³, 50 ppm Skin
TLV (Korea)	Short-term value: 280 mg/m³, 100 ppm Long-term value: 140 mg/m³, 50 ppm Skin

· **DNELs** :
· **Workers:**
DNEL (inhalation, chronic effects systemic): 150 mg/m³; AF=1
DNEL (inhalation, acute effects systemic): 300 mg/m³; AF=1
DNEL (inhalation, chronic effects local): 150 mg/m³; AF=1
DNEL (inhalation, acute effects local): 300 mg/m³; AF=1
DNEL (dermal, chronic effects systemic): 25 mg/kg bw/day
· **Consumers:**
DNEL (inhalation, chronic effects systemic): 62 mg/m³; AF=5
DNEL (inhalation, acute effects systemic): 150 mg/m³; AF=2
DNEL (inhalation, chronic effects local): 75 mg/m³; AF=2
DNEL (inhalation, acute effects local): 150 mg/m³; AF=2
DNEL (dermal, chronic effects systemic): 15 mg/kg bw/day; AF=20
DNEL (oral, chronic effects systemic): 15 mg/kg bw/day; AF=20

· **PNECs**
PNEC(fresh water): 4,32 mg/l with assessment factor of 50
PNEC (marine water): 0,432 mg/l with assessment factor of 500
PNEC (intermittent release): 21,6 mg/l with assessment factor of 100
PNEC (sewage treatment plant; STP): 4,6 mg/l with assessment factor of 100
PNEC (freshwater sediments): 23,3 mg/kg sediment dw with assessment factor of N/A
PNEC (marine sediments): 2,33 mg/kg sediment dw with assessment factor N/A
PNEC (soil): 2,13 mg/kg soil dw with assessment factor of N/A

· **Ingredients with biological limit values:**	
109-99-9 tetrahydrofuran	
BEI (USA)	2 mg/L Medium: urine Time: end of shift Parameter: Tetrahydrofuran

· **Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing
Wash hands before breaks and at the end of work.
Avoid contact with the eyes.
Avoid contact with the eyes and skin.
Be sure to clean skin thoroughly after work and before breaks.

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Ensure that washing facilities are available at the work place.

· **Respiratory protection:**
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use self-contained respiratory protective device.
Short term filter device:
Filter A/P2

· **Protection of hands:**

Protective gloves

The selected protective gloves have to satisfy the specifications of standard EN 374 or its equivalent.
Replace gloves immediately when torn or any change in appearance (dimension, colour, flexibility etc) is noticed.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

· **Material of gloves**
Splash Contact:
Butyl rubber, BR
Recommended thickness of the material: ≥ 0,7 mm
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.

· **Penetration time of glove material**
Splash Contact:
Break through time: > 10 min
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

· **Eye protection:**

Safety glasses with side shields conforming to EN166, ANSI 87.1-2010, or equivalent.

· **Body protection:**
Flame retardant antistatic protective clothing
The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

9 Physical and chemical properties

· **Information on basic physical and chemical properties**
· **General Information**
· **Appearance:**

Form:	Liquid
Colour:	Colourless
· **Odour:**	Ether-like
· **Odour threshold:**	Not determined.
· **pH-value:**	Not determined.
· **Change in condition**	
Melting point/Melting range:	-108,5 °C
Boiling point/Boiling range:	66 °C

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· **Flash point:**	-17 °C
· **Flammability (solid, gaseous):**	Not applicable.
· **Ignition temperature:**	230 °C
· **Decomposition temperature:**	Not determined.
· **Self-igniting:**	Not determined.
· **Danger of explosion:**	May form explosive peroxides.
· **Explosion limits:**	
Lower:	1,5 Vol %
Upper:	12 Vol %
· **Vapour pressure at 20 °C:**	200 hPa
· **Density at 20 °C:**	0,8892 g/cm³
· **Relative density**	Not determined.
· **Vapour density**	Not determined.
· **Evaporation rate**	Not determined.
· **Solubility in / Miscibility with water:**	Fully miscible.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not determined.
Kinematic:	Not determined.
· **Solvent content:**	
Organic solvents:	99,5 %
VOC (EC)	99,50 %
· **Other information**	No further relevant information available.

10 Stability and reactivity

· **Reactivity** When properly handled and stored, no dangerous reaction is known.
· **Chemical stability**
May form explosive peroxides.
This product is stable under prescribed use and storage.
Stabilizer: BHT
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
· **Possibility of hazardous reactions** Possible formation of peroxide.
· **Conditions to avoid** Warming
· **Incompatible materials:**
Oxygen.
Avoid contact with:
Aluminium, bronze, Zinc, Tin
various plastics
rubber
· **Hazardous decomposition products:** Peroxides

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11 Toxicological information

· **Information on toxicological effects**

· **Acute toxicity:** Harmful if swallowed.

· **LD/LC50 values relevant for classification:**		
109-99-9 tetrahydrofuran		
Oral	LD50	1650 mg/kg (rat)

· **Skin corrosion/irritation:**
Causes mild skin irritation.
Primary irritation index: 1,93 (Draizen Test)
Repeated or prolonged exposure may cause skin irritation and dermatitis, due to degreasing properties of the product.
Source: External (M)SDS

· **Serious eye damage/eye irritation:**
Causes serious eye irritation.
Rabbit: irritating to the eye (OECD 405)

· **Respiratory or skin sensitization:**
Not classified based on available data.
Mice (Local Lymph Node Assay): Not sensitizing to the skin (OECD Test Guideline 429)

· **Germ Cell Mutagenicity:**
Not classified based on available data.
In-vitro genotoxicity (mammalian cells): negative (EU Method B.17)

· **Carcinogenicity:**
Not classified based on available data.
Mouse (oral, long-term exposure): negative (OECD Guideline 416)

· **Reproductive Toxicity:**
Not classified based on available data.
Rat - Negative (87/302/EEC)

· **Specific Target Organ Toxicity - Single Exposure (STOT SE):** May cause drowsiness or dizziness.

· **Specific Target Organ Toxicity - Repeated Exposure (STOT RE):**
Not classified based on available data.

· **Aspiration Hazard:** Not classified based on available data.

· **Primary irritant effect:**
· **on the skin:** Causes mild skin irritation.
· **on the eye:** Irritating effect.
· **Sensitisation:** No sensitising effects known.
· **CMR effects (carcinogenity, mutagenicity and toxicity for reproduction)**
Carc. 2

12 Ecological information

· **Toxicity**
· **Aquatic toxicity:**
Not classified based on available data.
LC50 (96hr, freshwater fish): 2160 mg/L (OECD 203)
NOEC (fish, 33d): 216 mg/L (OECD N/A; other)
EC50 (Daphnia Magna, 48hr): 3485 ppm (OECD 202)

· **Persistence and degradability**
The product is not easily, but potentially biodegradable.
Degradation : 39% (28d, OECD 301D)

· **Bioaccumulative potential**
Bioaccumulation is not expected.

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Partition coefficient, n-octanol/water (log Pow) : 0,45 @ 25 °C

· **Mobility in soil** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Water hazard class 1 (German Regulation) (Assessment by list): slightly hazardous for water
Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.

· **Results of PBT and vPvB assessment**
Substance does not meet the criteria for PBT or vPvB according to Regulation (EC) No 1907/2006, Annex XIII.
· **Other adverse effects** No further relevant information available.

13 Disposal considerations

· **Waste treatment methods**
· **Recommendation**
After prior treatment product has to be disposed of in an incinerator for hazardous waste adhering to the regulations pertaining to the disposal of particularly hazardous waste.
Must not be disposed together with household garbage. Do not allow product to reach sewage system.
Any disposal method should also comply with national, regional, provincial, and local laws.

· **Uncleaned packaging:**
· **Recommendation:**
Empty contaminated packagings thoroughly. They may be recycled after thorough and proper cleaning.
Empty containers may still contain hazardous residue.
Disposal must be made according to official regulations.
· **Recommended cleansing agents:** Water, if necessary together with cleansing agents.

14 Transport information

· **UN-Number**
· **ADR, IMDG, IATA** UN2056
· **UN proper shipping name**
· **ADR** 2056 TETRAHYDROFURAN
· **IMDG, IATA** TETRAHYDROFURAN
· **Transport hazard class(es)**

· **ADR, IMDG, IATA**

· **Class** 3 Flammable liquids.
· **Label** 3
· **Packing group**
· **ADR, IMDG, IATA** II
· **Environmental hazards:**
· **Marine pollutant:** No
· **Special precautions for user** Warning: Flammable liquids.
· **Danger code (Kemler):** 33
· **EMS Number:** F-E,S-D

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· **Transport/Additional information:**

· **ADR**
· **Limited quantities (LQ)** 1L
· **Transport category** 2
· **Tunnel restriction code** D/E
· **UN "Model Regulation":** UN2056, TETRAHYDROFURAN, 3, II

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**

· **Status of global inventories:**
All component(s) within this product is listed or exempted from the following country's chemical inventory:
USA – TSCA
Australia – AICS
Canada – DSL
China – IECSC
EU – EINECS/NLP
Japan – ENCS
Korea – KECI
New Zealand – NZIoC
Philippines – PICCS
Taiwan – ECSI
Mexico - INSQ

· **Chemical safety assessment:** A Chemical Safety Assessment has been carried out.

16 Other information

· **Abbreviations and acronyms:**
ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods
IATA: International Air Transport Association
EINECS: European Inventory of Existing Commercial Chemical Substances
ELINCS: European LIst of Notified Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
VOC: Volatile Organic Compounds (USA, EU)
DNEL: Derived No-Effect Level (REACH)
PNEC: Predicted No-Effect Concentration (REACH)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent
Flam. Liq. 2: Flammable liquids, Hazard Category 2
Acute Tox. 4: Acute toxicity, Hazard Category 4
: Skin corrosion/irritation, Hazard Category 3
Eye Irrit. 2A: Serious eye damage/eye irritation, Hazard Category 2A
Carc. 2: Carcinogenicity, Hazard Category 2
STOT SE 3: Specific target organ toxicity - Single exposure, Hazard Category 3

· **Sources**
Most toxicological and eco-toxicological data are obtained from European Chemical Agency (ECHA)'s public dissemination website.
http://apps.echa.europa.eu/registered/data/dossiers/DISS-9d87f855-86db-4392-e044-00144f67d249/DISS-9d87f855-86db-4392-e044-00144f67d249 DISS-9d87f855-86db-4392-e044-00144f67d249.html

· **General Disclaimers:**
DCC Group recommends that all the users/customers/recipients to study this Safety Data Sheet (SDS) carefully and understand all the data or any potential hazards associated with this product. Please consult with appropriate expert if necessary. The information herein is provided in good faith and is believed to be accurate on the date of issue. No warranty, expressed or implied, is given. It is the customer's/user's responsibility to ensure that they are complying with local, regional, state, provincial, and/or national laws in

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using this product, as regulatory requirement may differ at each level. It is also the customer's/user's responsibility to determine the necessary condition required for using this product safely, as actual operating or usage conditions are beyond DCC Group's control. DCC Group will not be responsible for any SDS obtained from elsewhere other than from DCC Group. If you are unsure whether the SDS you have is current or have obtained the SDS from another source; please contact us to obtain the latest version.