

MATERIAL SAFETY DATA SHEET

CH₄, 6Mix in N₂

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1. IDENTIFICATION

A. Product name

- CH₄, 6Mix in N₂

B. Recommended use and restriction on use

- General use : Not available
 - Restriction on use : Not available

C. Manufacturer / Supplier / Distributor information

○ Manufacturer information

- Company name : RIGAS Co.,Ltd
 - Address : 142,Munpyeongdong-ro 48 beon-gil, Daedeok-gu,Daejeon, KOREA
 - Dept. : Customer Service Dept.
 - Telephone number : 82-42-934-6900
 - Emergency telephone number : 82-42-934-6900
 - Fax number : 82-42-935-8814
 - E-mail address : master@rigas.co.kr

○ Supplier/Distributor information

- Company name : RIGAS Co.,Ltd
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2. HAZARD IDENTIFICATION

A. GHS Classification

- Flammable gases : Category1
 - Gases under pressure : Compressed gas
 - Skin corrosion/irritation : Category2
 - Carcinogenicity : Category1A
 - Specific target organ toxicity(Single exposure) : Category3(Narcotic effects)
 - Chronic aquatic toxicity : Category4

B. GHS label elements

○ Hazard symbols



○ Signal words

- Danger

○ Hazard statements

- H220 Extremely flammable gas
- H280 Compressed gas ; Contains gas under pressure; may explode if heated
- H315 Causes skin irritation
- H336 May cause drowsiness and dizziness.
- H350 May cause cancer
- H413 May cause long lasting harmful effects to aquatic life

o **Precautionary statements**

1) Prevention

- P201 Obtain special instructions before use.
- P202 Do not handle until all safety precautions have been read and understood.
- P210 Keep away from heat/sparks/open flames/hot surfaces. ? No smoking.
- P261 Avoid breathing dust/fume/gas/mist/vapours/spray.
- P264 Wash hands thoroughly after handling.
- P271 Use only outdoors or in a well-ventilated area.
- P273 Avoid release to the environment.
- P280 Wear protective gloves/protective clothing/eye protection/face protection.
- P281 Use personal protective equipment as required.

2) Response

- P302+P352 IF ON SKIN: Wash with plenty of soap and water.
- P304+P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
- P308+P313 If exposed or concerned: Get medical advice/attention.
- P312 Call a POISON CENTER or doctor/physician if you feel unwell.
- P321 Specific treatment
- P332+P313 If skin irritation occurs: Get medical advice/attention.
- P362 Take off contaminated clothing and wash before reuse.
- P377 Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
- P381 Eliminate all ignition sources if safe to do so.

3) Storage

- P403 Store in a well-ventilated place.
- P403+P233 Store in a well-ventilated place. Keep container tightly closed.
- P405 Store locked up.
- P410+P403 Protect from sunlight. Store in a well-ventilated place.

4) Disposal

- P501 Dispose of contents/container in accordance with local/regional/national/international regulation

C. Other hazards which do not result in classification : (NFPA Classification)

o **NFPA grade (0 ~ 4 level)**

- Health : 2, Flammability : 4, Reactivity : 0

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	Trade names and Synonyms	CAS No.	Content(%)
Nitrogen	Nitrogen, Elemental	7727-37-9	Balance
Propane	Dimethylmethane	74-98-6	40
Butane	N-Butane	106-97-8	26
2-Methylpropane	Isobutane	75-28-5	17
Ethane	-	74-84-0	2.00
Methane	Methyl hydride	74-82-8	1
2-Methylbutane	Butane, 2-methyl- (TSCA, DSL, ENCS, AICS, SWISS, PICCS, ASIA-PAC, NZIoC)	78-78-4	0.01
Pentane	Amyl hydride	109-66-0	0.01

4. FIRST AID MEASURES

A. Eye contact

- Do not rub your eyes.

- Immediately flush eyes with plenty of water for at least 15 minutes and call a doctor/physician.
- Get medical attention immediately.

B. Skin contact

- Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
- Laundering enough contaminated clothing before reuse.
- Get medical attention immediately.
- Go to the hospital immediately if symptoms (flare, irritate) occur.
- Remove contaminated clothing, shoes and isolate.
- Wash thoroughly after handling.
- Wear gloves when washing the patient, and please avoid contact with contaminated clothing.

C. Inhalation contact

- When exposed to large amounts of steam and mist, move to fresh air.
- Take specific treatment if needed.
- Get medical attention immediately.
- If breathing is stopped or irregular, give artificial respiration and supply oxygen.

D. Ingestion contact

- About whether I should induce vomiting Take the advice of a doctor.
- Rinse your mouth with water immediately.
- Get medical attention immediately.

E. Delayed and immediate effects and also chronic effects from short and long term exposure

- Not available

F. Notes to physician

- Notify medical personnel of contaminated situations and have them take appropriate protective measures.
- If exposed or concerned, get medical attention/advice.

5. FIREFIGHTING MEASURES

A. Suitable (Unsuitable) extinguishing media

- Dry chemical, carbon dioxide, regular foam extinguishing agent, spray
- Avoid use of water jet for extinguishing

B. Specific hazards arising from the chemical

- high-pressure gas; May explode when heated.

C. Special protective actions for firefighters

- Move containers from fire area, if you can do without the risk.
- Cool containers with water until well after fire is out.
- Do not access if the tank on fire.
- Use appropriate extinguishing measure suitable for surrounding fire.
- Keep containers cool with water spray.
- Leaking gas fire: do not extinguish, unless leak can be stopped safely.
- Remove sources of ignition.

6. ACCIDENTAL RELEASE MEASURES

A. Personal precautions, protective equipment and emergency procedures

- Must work against the wind, let the upwind people to evacuate.
- Do not touch spilled material. Stop leak if you can do it without risk.
- Remove all sources of ignition.
- Handling the damaged containers or spilled material after wearing protective equipment.
- Avoid skin contact and inhalation.
- Cleanup and disposal under expert supervision is advised.

- Keep unauthorized people away, isolate hazard area and deny entry.

B. Environmental precautions

- Prevent runoff and contact with waterways, drains or sewers.
- If large amounts have been spilled, inform the relevant authorities.

C. Methods and materials for containment and cleaning up

- Large spill : Stay upwind and keep out of low areas. Dike for later disposal.
- Notification to central government, local government. When emissions at least of the standard amount
- Dispose of waste in accordance with local regulation.
- Appropriate container for disposal of spilled material collected.
- Prevent the influx to waterways, sewers, basements or confined spaces.
- Spilled material should be treated as a potential risk of waste collected.

7. HANDLING AND STORAGE

A. Precautions for safe handling

- Comply with all applicable laws and regulations for handling
- Get the manual before use.
- Refer to Engineering controls and personal protective equipment.
- Operators should wear antistatic footwear and clothing.
- Avoid contact with heat, sparks, flame or other ignition sources.
- Contaminated work clothing should not be allowed out of the workplace.
- Handling only authorized person.

B. Conditions for safe storage, including any incompatibilities

- Do not use damaged containers.
- Keep in the original container.
- Please pay attention to incompatibilities materials and conditions to avoid.
- No open fire.
- Prevent static electricity and keep away from combustible materials or heat sources.
- By specifying a storage area for carcinogenic substances.
- Collected them in sealed containers.
- Store away from water and sewer.
- Store in well ventilated area.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

A. Exposure limits

- o **ACGIH TLV**
 - [Propane] : TWA, 1000 ppm
 - [Butane] : TWA, 1000 ppm
 - [2-Methylpropane] : TWA, 1000 ppm
 - [Methane] : TWA, 1000 ppm
 - [2-Methylbutane] : TWA, 1000 ppm (2950 mg/m³)
 - [Pentane] : TWA, 1000 ppm (2950 mg/m³)

B. Engineering controls

- A system of local and/or general exhaust is recommended to keep employee exposures above the Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. The use of local exhaust ventilation is recommended to control emissions near the source.

C. Individual protection measures, such as personal protective equipment

- o **Respiratory protection**
 - Under conditions of frequent use or heavy exposure, Respiratory protection may be needed.
 - Respiratory protection is ranked in order from minimum to maximum.
 - Consider warning properties before use.
 - Any chemical cartridge respirator with organic vapor cartridge(s).

- Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s).
- Any air-purifying respirator with a full facepiece and an organic vapor canister.
- For Unknown Concentration or Immediately Dangerous to Life or Health : Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply. Any self-contained breathing apparatus with a full facepiece.
- **Eye protection**
 - Wear primary eye protection such as splash resistant safety goggles with a secondary protection face shield.
 - Provide an emergency eye wash station and quick drench shower in the immediate work area.
- **Hand protection**
 - Wear appropriate chemical resistant glove.
- **Skin protection**
 - Wear appropriate chemical resistant protective clothing.
- **Others**
 - Not available

9. PHYSICAL AND CHEMICAL PROPERTIES

A. Appearance	N₂
- Appearance	gas
- Color	Colorless
B. Odor	odorless
C. Odor threshold	Not available
D. pH	Not available
E. Melting point/Freezing point	-210 °C
F. Initial Boiling Point/Boiling Ranges	-196 °C
G. Flash point	Not available
H. Evaporation rate	Not available
I. Flammability(solid, gas)	Not available
J. Upper/Lower Flammability or explosive limits	Not available
K. Vapour pressure	1 atm (77.347 deg K)
L. Solubility	(1.18E+004mg/L(25°C))
M. Vapour density	0.97 ((air = 1))
N. Specific gravity	0.808 (kg / l at the boiling point of the liquid)
O. Partition coefficient of n-octanol/water	0.67
P. Autoignition temperature	Not available
Q. Decomposition temperature	Not available
R. Viscosity	Not available
S. Molecular weight	28

A. Appearance	CH₄
- Appearance	gas
- Color	Colorless
B. Odor	odorless
C. Odor threshold	Not available
D. pH	Not available
E. Melting point/Freezing point	-183 °C
F. Initial Boiling Point/Boiling Ranges	-161 °C
G. Flash point	Not available
H. Evaporation rate	Not available
I. Flammability(solid, gas)	Flammable gas
J. Upper/Lower Flammability or explosive limits	15 / 5 %
K. Vapour pressure	466000 mmHg (25 °C)
L. Solubility	0.0022 g/100ml (25 °C)
M. Vapour density	0.554 (air = 1)
N. Specific gravity	Not available
O. Partition coefficient of n-octanol/water	1.09
P. Autoignition temperature	537 °C

Q. Decomposition temperature	Not available
R. Viscosity	0.01087 cP (20 °C)
S. Molecular weight	16.04

A. Appearance	C2H6
- Appearance	gas
- Color	Colorless
B. Odor	odorless
C. Odor threshold	Not available
D. pH	Not available
E. Melting point/Freezing point	-172 °C
F. Initial Boiling Point/Boiling Ranges	-88 °C
G. Flash point	Not available
H. Evaporation rate	Not available
I. Flammability(solid, gas)	Flammable gas
J. Upper/Lower Flammability or explosive limits	12.5 / 3 %
K. Vapour pressure	31459 mmHg (25 °C)
L. Solubility	0.00602 g/100mℓ (25 °C)
M. Vapour density	1.05 (air=1)
N. Specific gravity	Not available
O. Partition coefficient of n-octanol/water	1.81
P. Autoignition temperature	472 °C
Q. Decomposition temperature	Not available
R. Viscosity	0.00634 cP (-78.5 °C)
S. Molecular weight	30.08

A. Appearance	C3H8
- Appearance	gas
- Color	Colorless
B. Odor	Peculiar smell
C. Odor threshold	Not available
D. pH	Not available
E. Melting point/Freezing point	190 °C
F. Initial Boiling Point/Boiling Ranges	-42 °C
G. Flash point	-105 °C
H. Evaporation rate	Not available
I. Flammability(solid, gas)	Not available
J. Upper/Lower Flammability or explosive limits	9.5 / 2.1 %
K. Vapour pressure	7150 mmHg (at 25 °C)
L. Solubility	Not available
M. Vapour density	1.55 ((air=1))
N. Specific gravity	0.5853 (at -45 C (water=1))
O. Partition coefficient of n-octanol/water	2.36
P. Autoignition temperature	450 °C
Q. Decomposition temperature	Not available
R. Viscosity	Not available
S. Molecular weight	44.11

A. Appearance	iso-C4H10
- Appearance	Gas
- Color	Colorless
B. Odor	Petroleum odor
C. Odor threshold	Not available
D. pH	Not available
E. Melting point/Freezing point	-138.3 °C
F. Initial Boiling Point/Boiling Ranges	-11.7 °C

G. Flash point	Not available
H. Evaporation rate	Not available
I. Flammability(solid, gas)	Flammable gas
J. Upper/Lower Flammability or explosive limits	8.4 / 1.8 %
K. Vapour pressure	2611 mmHg (25 °C)
L. Solubility	0.00489 g/100ml (25 °C)
M. Vapour density	2.01 (air = 1)
N. Specific gravity	0.6 (Water = 1, liquid)
O. Partition coefficient of n-octanol/water	2.76
P. Autoignition temperature	460 °C (Closed cup)
Q. Decomposition temperature	Not available
R. Viscosity	0.238 cP (-10 °C)
S. Molecular weight	58.12

A. Appearance	n-C4H10
- Appearance	Etc.
- Color	Not available
B. Odor	Unpleasant odor
C. Odor threshold	Not available
D. pH	Not available
E. Melting point/Freezing point	-138 °C
F. Initial Boiling Point/Boiling Ranges	-0.5 °C
G. Flash point	-60 °C
H. Evaporation rate	Not available
I. Flammability(solid, gas)	Not available
J. Upper/Lower Flammability or explosive limits	8.4 / 1.8 %
K. Vapour pressure	1600 mmHg (21.1 °C)
L. Solubility	0.006 g/100ml (25 °C)
M. Vapour density	2.1
N. Specific gravity	0.6
O. Partition coefficient of n-octanol/water	2.89
P. Autoignition temperature	365 °C
Q. Decomposition temperature	Not available
R. Viscosity	Not available
S. Molecular weight	Not available

A. Appearance	iso-C5H12
- Appearance	Liquid
- Color	Colorless
B. Odor	Alcohol odor
C. Odor threshold	Not available
D. pH	Not available
E. Melting point/Freezing point	-160 °C
F. Initial Boiling Point/Boiling Ranges	28 °C
G. Flash point	<-51 °C (C.C.)
H. Evaporation rate	Not available
I. Flammability(solid, gas)	Not available
J. Upper/Lower Flammability or explosive limits	7.6 / 1.4%
K. Vapour pressure	79 kPa (20 °C)
L. Solubility	0.0048 g/100 ml (25 °C)
M. Vapour density	2.5 (air = 1)
N. Specific gravity	0.6 (Water = 1)
O. Partition coefficient of n-octanol/water	2.3
P. Autoignition temperature	420 °C
Q. Decomposition temperature	Not available
R. Viscosity	Not available

S. Molecular weight	72.2
A. Appearance	n-C5H12
- Appearance	Liquid
- Color	Colorless
B. Odor	Gasoline odor
C. Odor threshold	2.2 ppm
D. pH	Not available
E. Melting point/Freezing point	-129 °C
F. Initial Boiling Point/Boiling Ranges	36 °C
G. Flash point	-49 °C (c.c.)
H. Evaporation rate	28.6 (butyl acetate = 1)
I. Flammability(solid, gas)	Not available
J. Upper/Lower Flammability or explosive limits	7.8 / 1.5%
K. Vapour pressure	53.3 mm Hg (18.5 °C)
L. Solubility	38 mg / l (25 °C)
M. Vapour density	2.5
N. Specific gravity	0.63
O. Partition coefficient of n-octanol/water	3.39
P. Autoignition temperature	309 °C
Q. Decomposition temperature	Not available
R. Viscosity	0.289 cP (0 °C)
S. Molecular weight	72.15

10. STABILITY AND REACTIVITY

A. Chemical Stability

- high-pressure gas; May explode when heated.
- May form explosive mixture.

B. Possibility of hazardous reactions

- Contact with other combustible material may cause fire.
- Cylinders exposed to fire may vent and release flammable gas.

C. Conditions to avoid

- Avoid contact with incompatible materials and condition.
- Avoid : Accumulation of electrostatic charges, Heating, Flames and hot surfaces
- Avoid contact with heat, sparks, flame or other ignition sources.

D. Incompatible materials

- Not available

E. Hazardous decomposition products

- May emit flammable vapour if involved in fire.

11. TOXICOLOGICAL INFORMATION

A. Information on the likely routes of exposure

- (Respiratory tracts)
 - Not available
- (Oral)
 - Not available
- (Eye:Skin)
 - Causes skin irritation

B. Delayed and immediate effects and also chronic effects from short and long term exposure

- Acute toxicity

- * **Oral**
 - [Pentane] : LD50 400 mg/kg Rat (NLM)
- * **Dermal**
 - [2-Methylbutane] : LD50 > 2000 mg/kg Rat
- * **Inhalation**
 - [Propane] : LC50 142500 ppm/4hr Rat
 - [Butane] : LC50 277374 ppm 4 hr Rat
 - [2-Methylpropane] : LC50 = 142500 ppm/4 hr Rat
 - [Ethane] : LC50 142500 ppm/4 hr Rat
 - [Methane] : gas LC50 353553 ppm/4hr Mouse
 - [2-Methylbutane] : Steam LC50 = 280 mg/ℓ 4 hr Rat
 - [Pentane] : LC50 18.1 mg/L/4 hr Rat
- **Skin corrosion/irritation**
 - Causes skin irritation
- **Serious eye damage/irritation**
 - Not available
- **Respiratory sensitization**
 - Not available
- **Skin sensitization**
 - Not available
- **Carcinogenicity**
 - * **IARC**
 - Not available
 - * **OSHA**
 - Not available
 - * **ACGIH**
 - Not available
 - * **NTP**
 - Not available
 - * **EU CLP**
 - [Butane] : Carc.1A (butane (containing ≥ 0,1?% butadiene (203-450-8)));
 - [2-Methylpropane] : Carc.1A (isobutane (containing ≥ 0,1?% butadiene (203-450-8)))
- **Germ cell mutagenicity**
 - Not available
- **Reproductive toxicity**
 - Not available
- **STOT-single exposure**
 - May cause drowsiness and dizziness.
- **STOT-repeated exposure**
 - Not available
- **Aspiration hazard**
 - Not available

12. ECOLOGICAL INFORMATION

A. Ecotoxicity

- **Fish**
 - [Propane] : LC50 > 100 mg/ℓ 96 hr Other ((Species : Fish TLm))
- **Crustaceans**
 - [Propane] : LC50 52.157 mg/ℓ 48 hr
 - [Methane] : LC50 164.244 mg/ℓ 48 hr
 - [2-Methylbutane] : EC50 = 2.3 mg/ℓ 48 hr
 - [Pentane] : EC50 2.7 mg/ℓ 48 hr
- **Algae**
 - [Propane] : LC50 32.252 mg/ℓ 96 hr
 - [Methane] : EC50 95.717 mg/ℓ 96 hr

B. Persistence and degradability

- **Persistence**
 - [Nitrogen] : log Kow 0.67
 - [Propane] : log Kow 2.36
 - [2-Methylpropane] : log Kow = 2.76
 - [Ethane] : log Kow 1.81
 - [Methane] : log Kow 1.09
- **Degradability**
 - Not available

C. Bioaccumulative potential

- **Bioaccumulative potential**
 - [Propane] : BCF 13
 - [2-Methylpropane] : BCF = 1.57 ~ 1.97
 - [Methane] : BCF 1
 - [Pentane] : BCF 2.125
- **Biodegradation**
 - [Propane] : 65.7 (%) 35 day
 - [Butane] : 65.7 (%) 35 day ((Aerobic, Microorganism, Decomposes very well))
 - [2-Methylpropane] : Biodegradability = 65.7 (%) 35 day (Aerobic, Microorganism, Decomposes very well)
 - [Ethane] : 65.7 (%) 35 day (Aerobic, Microorganism, Decomposes very well)
 - [Methane] : 65.7 (%) 35 day
 - [Pentane] : 96 (%)

D. Mobility in soil

- Not available

E. Other adverse effects

- Not available

13. DISPOSAL CONSIDERATIONS

A. Disposal methods

- Since more than two kinds of designaed waste is mixed, it is difficult to treat sepatly, then can be reduction or stabilization by incineration or similar process.
- If water separation is possible, pre-process with Water separation process.
- Dispose by incineration.

B. Special precautions for disposal

- The user of this product must disposal by oneself or entrust to waste disposer or person who other's waste recycle and dispose, person who establish and operate waste disposal facilities.
- Dispose of waste in accordance with all applicable laws and regulations.

14. TRANSPORT INFORMATION

A. UN No. (IMDG)

- 1954

B. Proper shipping name

- Compressed gas, flammable, n.o.s.

C. Hazard Class

- 2.1

D. IMDG Packing group

- Not available

E. Marine pollutant

- Not applicable

F. Special precautions for user related to transport or transportation measures

- Local transport follows in accordance with Dangerous goods Safety Management Law.
- Package and transport follow in accordance with Department of Transportation (DOT) and other regulatory agency requirements.
- EmS FIRE SCHEDULE : F-D (Flammable gases)
- EmS SPILLAGE SCHEDULE : S-U (Gases (flammable, toxic or corrosive))

15. REGULATORY INFORMATION

A. National and/or international regulatory information

- **POPs Management Law**
 - Not applicable
- **Information of EU Classification**
 - * **Classification**
 - [Propane] : F+; R12
 - [Butane] : F+; R12
 - [2-Methylpropane] : F+; R12
 - [Ethane] : F+; R12
 - [Methane] : F+; R12
 - [2-Methylbutane] : F+; R12 Xn; R65 R66 R67 N; R51-53
 - [Pentane] : F+; R12 Xn; R65 R66 R67 N; R51-53
 - * **Risk Phrases**
 - [Propane] : R12
 - [Butane] : R12
 - [2-Methylpropane] : R12
 - [Ethane] : R12
 - [Methane] : R12
 - [2-Methylbutane] : R12, R51/53, R65, R66, R67
 - [Pentane] : R12, R51/53, R65, R66, R67
 - * **Safety Phrase**
 - [Propane] : S2, S9, S16
 - [Butane] : S2, S9, S16
 - [2-Methylpropane] : S2, S9, S16
 - [Ethane] : S2, S9, S16, S33
 - [Methane] : S2, S9, S16, S33
 - [2-Methylbutane] : S2, S9, S16, S29, S33, S61, S62
 - [Pentane] : S2, S9, S16, S29, S33, S61, S62
- **U.S. Federal regulations**
 - * **OSHA PROCESS SAFETY (29CFR1910.119)**
 - Not applicable
 - * **CERCLA Section 103 (40CFR302.4)**
 - Not applicable
 - * **EPCRA Section 302 (40CFR355.30)**
 - Not applicable
 - * **EPCRA Section 304 (40CFR355.40)**
 - Not applicable
 - * **EPCRA Section 313 (40CFR372.65)**
 - Not applicable
- **Rotterdam Convention listed ingredients**
 - Not applicable
- **Stockholm Convention listed ingredients**
 - Not applicable
- **Montreal Protocol listed ingredients**
 - Not applicable

16. OTHER INFORMATION

A. Reference

- The information contained herein is believed to be accurate. It is provided independently of any sale of the product for purpose of hazard communication. It is not intended to constitute performance information concerning the product. No express warranty, or implied warranty of merchantability or fitness for a particular purpose is made with respect to the product or the information contained herein.

- This Safety Data Sheet was compiled with data and information from the following sources: KOSHA, NITE, ESIS, NLM, SIDS, IPCS

B. Issue date

- 2014-10-06

C. Revision number and Last date revised

- 37 times, 2015-06-12

D. Other

- This MSDS is prepared according to the Globally Harmonized System (GHS).