

## SECTION 1: Identification of the substance/mixture and of the company/undertaking

### 1.1. Product identifier

|                 |  |
|-----------------|--|
| Product form    | : Substance  |
| Physical state  | : Gas  |
| Substance name  | : GERMANE 99.99+%  |
| Product code    | : GEG5001  |
| Formula         | : GeH4   |
| Synonyms        | : MONOGERMANE; GERMANIUM HYDRIDE; GERMANIUM TETRAHYDRIDE |
| Chemical family | : GERMANE  |

### 1.2. Relevant identified uses of the substance or mixture and uses advised against

|                              |   |
|------------------------------|---|
| Use of the substance/mixture | : Chemical intermediate<br>For research and industrial use only |
|------------------------------|---|

### 1.3. Details of the supplier of the safety data sheet

#### GELEST, INC.

11 East Steel Road  
Morrisville, PA 19067  
USA

T 215-547-1015 - F 215-547-2484 - (M-F): 8:00 AM - 5:30 PM EST  
[info@gelest.com](mailto:info@gelest.com) - [www.gelest.com](http://www.gelest.com)

### 1.4. Emergency telephone number

|                  |   |
|------------------|---|
| Emergency number | : CHEMTREC: 1-800-424-9300 (USA); +1 703-527-3887 (International) |
|------------------|---|

## SECTION 2: Hazards identification

### 2.1. Classification of the substance or mixture

#### Classification (GHS-US)

|  |      |
|--|------|
| Flam. Gas 1                            | H220 |
| Liquefied gas                          | H280 |
| Acute Tox. 2 (Inhalation:gas)          | H330 |
| Eye Irrit. 2A                          | H319 |
| STOT SE 3                              | H335 |
| Full text of H-phrases: see section 16 |      |

### 2.2. Label elements

#### GHS-US labeling

Hazard pictograms (GHS-US)



GHS02

GHS04

GHS06

GHS07

Signal word (GHS-US)

: Danger

Hazard statements (GHS-US)

: H220 - Extremely flammable gas  
H280 - Contains gas under pressure; may explode if heated  
H319 - Causes serious eye irritation  
H330 - Fatal if inhaled  
H335 - May cause respiratory irritation

Precautionary statements (GHS-US)

: P284 - [In case of inadequate ventilation] wear respiratory protection  
P280 - Wear protective gloves/protective clothing/eye protection/face protection  
P260 - Do not breathe gas  
P264 - Wash hands thoroughly after handling  
P310 - Immediately call a doctor  
P210 - Keep away from heat, open flames, sparks. - No smoking  
P271 - Use only outdoors or in a well-ventilated area  
P304+P340 - If inhaled: Remove person to fresh air and keep comfortable for breathing  
P305+P351+P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing  
P337+P313 - If eye irritation persists: Get 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  
P403+P233 - Store in a well-ventilated place. Keep container tightly closed

# GERMANE 99.99+%

## Safety Data Sheet

P405 - Store locked up  
P410+P403 - Protect from sunlight. Store in a well-ventilated place  
P501 - Dispose of contents/container to licensed waste disposal facility.

### 2.3. Other hazards

No additional information available

### 2.4. Unknown acute toxicity (GHS-US)

No data available

## SECTION 3: Composition/information on ingredients

### 3.1. Substance

Substance type : Mono-constituent  
Name : GERMANE 99.99+%  
CAS No : 7782-65-2  
EC no : 231-961-6

| Name                   | Product identifier | %    | Classification (GHS-US)  |
|------------------------|--------------------|------|--|
| Germanium tetrahydride | (CAS No) 7782-65-2 | > 99 | Flam. Gas 1, H220<br>Liquefied gas, H280<br>Acute Tox. 2 (Inhalation:gas),<br>H330<br>Eye Irrit. 2A, H319<br>STOT SE 3, H335 |

### 3.2. Mixture

Not applicable

## SECTION 4: First aid measures

### 4.1. Description of first aid measures

First-aid measures general : Remove contaminated clothing and shoes. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). If possible show this sheet; if not available show packaging or label.

First-aid measures after inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get immediate medical advice/attention.

First-aid measures after skin contact : Wash with plenty of soap and water.

First-aid measures after eye contact : Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical advice/attention.

First-aid measures after ingestion : Never give anything by mouth to an unconscious person. Get medical advice/attention.

### 4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries after inhalation : Fatal if inhaled. May cause respiratory irritation. Hemolytic gas.

Symptoms/injuries after skin contact : May cause skin irritation.

Symptoms/injuries after eye contact : Causes serious eye irritation. At levels below the flammability limit, silane is expected to affect the eyes by absorption and deposition of silicon dioxide, causing severe irritation and possible corneal damage.

Symptoms/injuries after ingestion : May be harmful if swallowed.

### 4.3. Indication of any immediate medical attention and special treatment needed

No additional information available

## SECTION 5: Firefighting measures

### 5.1. Extinguishing media

Suitable extinguishing media : If unable to stop the flow of gas, germane should be allowed to burn until consumed. Secondary fires may be extinguished with alcohol resistant foam, carbon dioxide, dry chemical. Use of high expansion foam (100:1) is recommended to cover flames.

### 5.2. Special hazards arising from the substance or mixture

Fire hazard : Extremely flammable gas. Irritating fumes and organic acid vapors may develop when material is exposed to elevated temperatures or open flame.

Explosion hazard : Germane ignites readily in air.

### 5.3. Advice for firefighters

Firefighting instructions : Exercise caution when fighting any chemical fire. Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Eliminate all ignition sources if safe to do so. Germane should be allowed to burn until consumed. Excessive pressure may develop in gas cylinders exposed to fire-heated. Heated germane may explode on contact with air. Cool cylinders and surroundings with water from a suitable distance.

Protection during firefighting : Do not enter fire area without proper protective equipment, including respiratory protection. Avoid all eye and skin contact and do not breathe vapor and mist.

# GERMANE 99.99+%

## Safety Data Sheet

### SECTION 6: Accidental release measures

#### 6.1. Personal precautions, protective equipment and emergency procedures

General measures : Ventilate area. Eliminate every possible source of ignition. Use special care to avoid static electric charges.

##### 6.1.1. For non-emergency personnel

Emergency procedures : Evacuate unnecessary personnel.

##### 6.1.2. For emergency responders

Protective equipment : Equip cleanup crew with proper protection.

#### 6.2. Environmental precautions

Prevent entry to sewers and public waters. Notify authorities if liquid enters sewers or public waters.

#### 6.3. Methods and material for containment and cleaning up

Methods for cleaning up : Stop flow of gas if possible. The potential exists for spontaneous ignition and explosion. Allow vapors to disperse.

#### 6.4. Reference to other sections

See Heading 8. Exposure controls and personal protection.

### SECTION 7: Handling and storage

#### 7.1. Precautions for safe handling

Additional hazards when processed : Flammable gas. Germane ignites readily in air. Handle empty containers with care because residual vapors are flammable.

Precautions for safe handling : Containers must be properly grounded before beginning transfer. Use only non-sparking tools. Provide good ventilation in process area to prevent accumulation of vapors. Use only outdoors or in a well-ventilated area. Systems utilizing germane that do not involve complete consumption of germane should be equipped with burn boxes. See- Book of SEMI Standards, Facilities Standards and Safety Guidelines, Mountain View, CA, Semiconductor Equipment and Materials Int'l, 1993. Avoid all eye and skin contact and do not breathe vapor and mist.

Hygiene measures : Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Wash contaminated clothing before reuse.

#### 7.2. Conditions for safe storage, including any incompatibilities

Technical measures : Proper grounding procedures to avoid static electricity should be followed.

Storage conditions : Store in sealed cylinders in isolated area.

Incompatible materials : Acids. Alcohols. Halogens. Oxidizing agent.

Storage area : Store in a well-ventilated place. Store away from heat.

#### 7.3. Specific end use(s)

No additional information available

### SECTION 8: Exposure controls/personal protection

#### 8.1. Control parameters

| Germanium tetrahydride (7782-65-2) |                                      |                       |
|------------------------------------|--------------------------------------|-----------------------|
| USA ACGIH                          | ACGIH TWA (ppm)                      | 0.2 ppm               |
| USA NIOSH                          | NIOSH REL (TWA) (mg/m <sup>3</sup> ) | 0.6 mg/m <sup>3</sup> |
| USA NIOSH                          | NIOSH REL (TWA) (ppm)                | 0.2 ppm               |

#### 8.2. Exposure controls

Appropriate engineering controls : Provide local exhaust or general room ventilation.

Personal protective equipment : Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Avoid all unnecessary exposure.

Hand protection : Neoprene or nitrile rubber gloves.

Eye protection : Chemical goggles. Contact lenses should not be worn.

Skin and body protection : Wear suitable protective clothing.

Respiratory protection : Wear respiratory protection. NIOSH-certified combination organic vapor/acid gas (yellow cartridge) respirator.

### SECTION 9: Physical and chemical properties

#### 9.1. Information on basic physical and chemical properties

Physical state : Gas

Appearance : Flammable gas.

Molecular mass : 76.62 g/mol

# GERMANE 99.99+%

## Safety Data Sheet

|   |                             |
|---|-----------------------------|
| Color                                       | : Colorless.                |
| Odor  | : Disagreeable garlic-like. |
| Odor threshold                              | : No data available         |
| Refractive index                            | : No data available         |
| pH  | : No data available         |
| Relative evaporation rate (butyl acetate=1) | : No data available         |
| Melting point                               | : No data available         |
| Freezing point                              | : -165 °C                   |
| Boiling point                               | : -88 °C                    |
| Flash point                                 | : < -40 °C                  |
| Critical temperature                        | : 308 K                     |
| Auto-ignition temperature                   | : No data available         |
| Decomposition temperature                   | : No data available         |
| Flammability (solid, gas)                   | : Extremely flammable gas   |
| Vapor pressure                              | : > 1 atm @ 20°C            |
| Critical pressure                           | : 54.8 atm                  |
| Relative vapor density at 20 °C             | : 3.2 g/l                   |
| Relative density                            | : 1.53                      |
| VOC content                                 | : 100 %                     |
| Solubility                                  | : Insoluble in water.       |
| Log Pow                                     | : No data available         |
| Log Kow                                     | : No data available         |
| Viscosity, kinematic                        | : No data available         |
| Viscosity, dynamic                          | : No data available         |
| Explosive properties                        | : No data available         |
| Oxidizing properties                        | : No data available         |
| Explosive limits                            | : No data available         |

### 9.2. Other information

Gas group : Liquefied gas

## SECTION 10: Stability and reactivity

### 10.1. Reactivity

No additional information available

### 10.2. Chemical stability

Stable in sealed cylinders stored under a dry inert atmosphere.

### 10.3. Possibility of hazardous reactions

Reacts with oxygen in air, sometimes igniting spontaneously. Mixtures with mercury explode when shaken in the presence of air. Platinum, platinum and iron salts and other Lewis acids can cause generation of flammable hydrogen gas.

### 10.4. Conditions to avoid

Heat. Sparks. Open flame.

### 10.5. Incompatible materials

Acids. Alcohols. Halogens. Oxidizing agent.

### 10.6. Hazardous decomposition products

Germanium dioxide.

## SECTION 11: Toxicological information

### 11.1. Information on toxicological effects

Acute toxicity : Inhalation:gas: Fatal if inhaled.

| Germanium tetrahydride (7782-65-2) |                                  |
|------------------------------------|----------------------------------|
| LD50 oral mouse                    | 1250 mg/kg                       |
| LD50 intravenous rat               | 56 mg/kg                         |
| LC50 inhalation mouse              | 1380 mg/m <sup>3</sup>           |
| ATE US (gases)                     | 100.000 ppmV/4h                  |
| Skin corrosion/irritation          | : Not classified                 |
| Serious eye damage/irritation      | : Causes serious eye irritation. |
| Respiratory or skin sensitization  | : Not classified                 |

# GERMANE 99.99+%

## Safety Data Sheet

### Germanium tetrahydride (7782-65-2)

|  |  |
|--|--|
| Germ cell mutagenicity                             | : Not classified   |
| Carcinogenicity                                    | : Not classified   |
| Reproductive toxicity                              | : Not classified   |
| Specific target organ toxicity (single exposure)   | : May cause respiratory irritation.  |
| Specific target organ toxicity (repeated exposure) | : Not classified   |
| Aspiration hazard                                  | : Not classified   |
| Symptoms/injuries after inhalation                 | : Fatal if inhaled. May cause respiratory irritation. Hemolytic gas.   |
| Symptoms/injuries after skin contact               | : May cause skin irritation.   |
| Symptoms/injuries after eye contact                | : Causes serious eye irritation. At levels below the flammability limit, silane is expected to affect the eyes by absorption and deposition of silicon dioxide, causing severe irritation and possible corneal damage. |
| Symptoms/injuries after ingestion                  | : May be harmful if swallowed.   |

## SECTION 12: Ecological information

### 12.1. Toxicity

No additional information available

### 12.2. Persistence and degradability

No additional information available

### 12.3. Bioaccumulative potential

No additional information available

### 12.4. Mobility in soil

No additional information available

### 12.5. Other adverse effects

|                              |  |
|------------------------------|--|
| Effect on ozone layer        | : No additional information available                |
| Effect on the global warming | : No known ecological damage caused by this product. |

## SECTION 13: Disposal considerations

### 13.1. Waste treatment methods

|                                |  |
|--------------------------------|--|
| Waste disposal recommendations | : Incinerate. Dispose in a safe manner in accordance with local/national regulations. Dispose of contents/container to licensed waste disposal facility. |
| Additional information         | : Handle empty containers with care because residual vapors are flammable.   |
| Ecology - waste materials      | : Avoid release to the environment.  |

## SECTION 14: Transport information

### 14.1. UN number

|             |          |
|-------------|----------|
| UN-No.(DOT) | : 2192   |
| DOT NA no.  | : UN2192 |

### 14.2. UN proper shipping name

|                            |   |
|----------------------------|---|
| Proper Shipping Name (DOT) | : GERMANE                                 |
| Hazard labels (DOT)        | : 2.3 - Poison gas<br>2.1 - Flammable gas |



|   |        |
|---|--------|
| DOT Packaging Exceptions (49 CFR 173.xxx) | : None |
| DOT Packaging Non Bulk (49 CFR 173.xxx)   | : 302  |
| DOT Packaging Bulk (49 CFR 173.xxx)       | : 245  |

### 14.3. Additional information

|                   |   |
|-------------------|---|
| Other information | : No supplementary information available. |
|-------------------|---|

# GERMANE 99.99+%

## Safety Data Sheet

### Transport by sea

- DOT Vessel Stowage Location : D - The material must be stowed "on deck only" on a cargo vessel and on a passenger vessel carrying a number of passengers limited to not more than the larger of 25 passengers or one passenger per each 3 m of overall vessel length, but the material is prohibited on passenger vessels in which the limiting number of passengers is exceeded.
- DOT Vessel Stowage Other : 40 - Stow "clear of living quarters"

### Air transport

- DOT Quantity Limitations Passenger aircraft/rail : Forbidden  
(49 CFR 173.27)
- DOT Quantity Limitations Cargo aircraft only (49 : Forbidden  
CFR 175.75)

## SECTION 15: Regulatory information

### 15.1. US Federal regulations

#### Germanium tetrahydride (7782-65-2)

Listed on the United States TSCA (Toxic Substances Control Act) inventory

### 15.2. International regulations

#### Germanium tetrahydride (7782-65-2)

Listed on the Canadian DSL (Domestic Substances List)  
Listed on IECSC (Inventory of Existing Chemical Substances Produced or Imported in China)  
Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)  
Listed on the Japanese ENCS (Existing & New Chemical Substances) inventory  
Listed on the Japanese ISHL (Industrial Safety and Health Law)  
Listed on the Korean ECL (Existing Chemicals List)  
Listed on PICCS (Philippines Inventory of Chemicals and Chemical Substances)  
Japanese Poisonous and Deleterious Substances Control Law  
Listed on the Canadian IDL (Ingredient Disclosure List)

### 15.3. US State regulations

#### GERMANE 99.99+%(7782-65-2)

|   |    |
|---|----|
| U.S. - California - Proposition 65 - Carcinogens List               | No |
| U.S. - California - Proposition 65 - Developmental Toxicity         | No |
| U.S. - California - Proposition 65 - Reproductive Toxicity - Female | No |
| U.S. - California - Proposition 65 - Reproductive Toxicity - Male   | No |

#### Germanium tetrahydride (7782-65-2)

| U.S. - California - Proposition 65 - Carcinogens List | U.S. - California - Proposition 65 - Developmental Toxicity | U.S. - California - Proposition 65 - Reproductive Toxicity - Female | U.S. - California - Proposition 65 - Reproductive Toxicity - Male | No significance risk level (NSRL) |
|---|---|---|---|-----------------------------------|
| No  | No  | No  | No  |                                   |

#### Germanium tetrahydride (7782-65-2)

U.S. - Connecticut - Hazardous Air Pollutants - HLVs (30 min)  
U.S. - Connecticut - Hazardous Air Pollutants - HLVs (8 hr)  
U.S. - Idaho - Non-Carcinogenic Toxic Air Pollutants - Acceptable Ambient Concentrations  
U.S. - Idaho - Non-Carcinogenic Toxic Air Pollutants - Emission Levels (ELs)  
U.S. - Massachusetts - Right To Know List  
U.S. - Michigan - Occupational Exposure Limits - TWAs  
U.S. - Minnesota - Hazardous Substance List  
U.S. - Minnesota - Permissible Exposure Limits - TWAs  
U.S. - New Hampshire - Regulated Toxic Air Pollutants - Ambient Air Levels (AALs) - 24-Hour  
U.S. - New Hampshire - Regulated Toxic Air Pollutants - Ambient Air Levels (AALs) - Annual  
U.S. - New Jersey - Right to Know Hazardous Substance List  
U.S. - New Jersey - Special Health Hazards Substances List  
U.S. - New York - Occupational Exposure Limits - TWAs  
U.S. - North Dakota - Air Pollutants - Guideline Concentrations - 8-Hour  
U.S. - Oregon - Permissible Exposure Limits - TWAs  
U.S. - Pennsylvania - RTK (Right to Know) List  
U.S. - Tennessee - Occupational Exposure Limits - TWAs  
U.S. - Texas - Effects Screening Levels - Long Term  
U.S. - Texas - Effects Screening Levels - Short Term  
U.S. - Vermont - Permissible Exposure Limits - TWAs

# GERMANE 99.99+%

## Safety Data Sheet

### Germanium tetrahydride (7782-65-2)

U.S. - Washington - Permissible Exposure Limits - STELs  
U.S. - Washington - Permissible Exposure Limits - TWAs  
U.S. - Wisconsin - Hazardous Air Contaminants - All Sources - Emissions From Stack Heights 25 Feet to Less Than 40 Feet  
U.S. - Wisconsin - Hazardous Air Contaminants - All Sources - Emissions From Stack Heights 40 Feet to Less Than 75 Feet  
U.S. - Wisconsin - Hazardous Air Contaminants - All Sources - Emissions From Stack Heights 75 Feet or Greater  
U.S. - Wisconsin - Hazardous Air Contaminants - All Sources - Emissions From Stack Heights Less Than 25 Feet

### SECTION 16: Other information

Abbreviations and acronyms : Abbreviations: ND: Not Determined, No Data; NA: Not Applicable; LD: Lethal Dose; LC: Lethal Concentration; ATE: Acute Toxicity Estimates; H: hour; °: °C unless otherwise stated; mm: millimeters Hg, torr; PEL: permissible exposure level; TWA: time weighted average; TLV: threshold limit value; TG: Test Guideline; NIOSH: National Institute for Occupational Safety and Health; IARC: International Agency for Research on Cancer; NTP: National Toxicology Program; HMIS: Hazardous Material Information System; CAS No.: Chemical Abstract Service Registration Number; EC No.: European Commission Registration Number; EC Index No.: European Commission Index Number; OECD: The Organisation for Economic Co-operation and Development.

Full text of H-phrases::

|                               |   |
|-------------------------------|---|
| Acute Tox. 2 (Inhalation:gas) | Acute toxicity (inhalation:gas) Category 2                  |
| Eye Irrit. 2A                 | Serious eye damage/eye irritation Category 2A               |
| Flam. Gas 1                   | Flammable gases Category 1                                  |
| Liquefied gas                 | Gases under pressure Liquefied gas                          |
| STOT SE 3                     | Specific target organ toxicity (single exposure) Category 3 |
| H220                          | Extremely flammable gas                                     |
| H280                          | Contains gas under pressure; may explode if heated          |
| H319                          | Causes serious eye irritation                               |
| H330                          | Fatal if inhaled  |
| H335                          | May cause respiratory irritation                            |

### HMIS III Rating

Health : 4 Severe Hazard - Life-threatening, major or permanent damage may result from single or repeated overexposures  
Flammability : 4 Severe Hazard  
Physical : 3 Serious Hazard

Prepared by safety and environmental affairs.

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SDS US (GHS HazCom 2012) - Custom

According to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

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