



GERMANE

Material Safety Data Sheet

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name	GERMANE
Product Code(s)	G-35
UN-No	UN2192
Recommended Use	Compressed gas.
Synonyms	Germanium Hydride; Germanium Tetrahydride; Germanomethane; Monogermane

Supplier Address*
Linde Gas North America LLC - Linde Merchant Production Inc. - Linde LLC
575 Mountain Ave.
Murray Hill, NJ 07974
Phone: 908-464-8100
www.lindeus.com

Linde Gas Puerto Rico, Inc.
Las Palmas Village
Road No. 869, Street No. 7
Catano, Puerto Rico 00962
Phone: 787-641-7445
www.pr.lindegas.com

Linde Canada Limited
5860 Chedworth Way
Mississauga, Ontario L5R 0A2
Phone: 905-501-1700
www.lindecana.com

* May include subsidiaries or affiliate companies/divisions.

For additional product information contact your local customer service.

Chemical Emergency Phone Number
Chemtrec: 1-800-424-9300 for US/ 703-527-3887 outside US

2. HAZARDS IDENTIFICATION

DANGER!**Emergency Overview**

Extremely flammable
 Fatal if inhaled.
 May form explosive mixtures with air
 May cause adverse effects on the bone marrow and blood-forming system
 May adversely affect liver and kidney.
 Contents under pressure
 Keep at temperatures below 52°C / 125°F

Appearance Colorless**Physical State** Gas.**Odor** PungentPotential Health Effects**Principle Routes of Exposure** Inhalation.**Acute Toxicity****Inhalation** Fatal if inhaled. Early effects are commonly characterized by drowsiness, giddiness, headache, thirst and abdominal pain with vomiting. May cause red blood cell damage.**Eyes** Ignited gas can cause thermal burns.**Skin** Ignited gas can cause thermal burns.**Skin Absorption Hazard** No known effect based on information supplied.**Ingestion** Not an expected route of exposure.**Chronic Effects** May cause adverse liver and kidney effects. May cause adverse effects on the bone marrow and blood-forming system.**Main Symptoms** Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting.**Aggravated Medical Conditions** Blood disorders. Kidney disorders. Liver disorders. Respiratory disorders.**Environmental Hazard** See Section 12 for additional Ecological Information.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS-No	Volume %	Chemical Formula
Germane	7782-65-2	>99	GeH ₄

4. FIRST AID MEASURES

General Advice Immediate medical attention is required. Show this safety data sheet to the doctor in attendance.**Eye Contact** Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. If symptoms persist, call a physician.**Skin Contact** Wash off immediately with soap and plenty of water. If symptoms persist, call a physician.

Inhalation	PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF INHALATION OVEREXPOSURE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. Conscious inhalation victims should be assisted to an uncontaminated area and inhale fresh air. If breathing is difficult, administer oxygen. Unconscious persons should be moved to an uncontaminated area and, as necessary, given artificial resuscitation and supplemental oxygen. Treatment should be symptomatic and supportive.
Ingestion	Not an expected route of exposure.
Notes to Physician	There are no reported instances of germane poisoning, treatment is unknown. Treatment can be based on its similarity to arsine.
Protection of First-aiders	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. FIRE-FIGHTING MEASURES

Flammable Properties	Extremely flammable. Pyrophoric gas. May be spontaneously flammable in air.
Suitable Extinguishing Media	Carbon dioxide (CO ₂). Foam. Dry chemical. DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED.
Unsuitable Extinguishing Media	Do not use halogenated extinguishing agents or foam. The use of water spray must be weighed against the risks - germane may evolve hydrogen and ignite on contact with water.
Hazardous Combustion Products	Germanium compounds.
<u>Explosion Data</u>	
Sensitivity to Mechanical Impact	None
Sensitivity to Static Discharge	Yes
Specific Hazards Arising from the Chemical	Germane decomposes at 536°F (280°C) with a large pressure and temperature increase. Air or oxygen is not necessary for deflagration to occur at this temperature. A small amount of air greatly increases its reactivity or tendency to explode. Explosive decomposition may occur under fire conditions. May evolve hydrogen and ignite on contact with water. Continue to cool fire exposed cylinders until flames are extinguished. Cylinders may rupture under extreme heat. Damaged cylinders should be handled only by specialists.
Protective Equipment and Precautions for Firefighters	If possible, stop the flow of gas. Do not extinguish the fire until supply is shut off as otherwise an explosive-ignition may occur. If the fire is extinguished and the flow of gas continues, use increased ventilation to prevent build-up of explosive atmosphere. Ventilation fans must be explosion proof. Use non-sparking tools to close container valves. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible withdraw from area and let fire burn. Use water spray to cool surrounding containers. Be cautious of a Boiling Liquid Evaporating Vapor Explosion, BLEVE, if flame is impinging on surrounding containers. As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions	ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. All equipment used when handling the product must be grounded. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe.
Environmental Precautions	Prevent spreading of vapors through sewers, ventilation systems and confined areas.
Methods for Containment	Stop the flow of gas or remove cylinder to outdoor location if this can be done without risk. If leak is in container or container valve, contact the appropriate emergency telephone number in Section 1 or call your closest Linde location.
Methods for Cleaning Up	Return cylinder to Linde or an authorized distributor.

7. HANDLING AND STORAGE

Handling	Remove all sources of ignition. Ground and bond all lines and equipment associated with product system. All equipment should be non-sparking and explosion proof. Use only in ventilated areas. "NO SMOKING" signs should be posted in storage and use areas. Germane is noncorrosive, it can be handled in most common structural materials. Never attempt to lift a cylinder by its valve protection cap. Protect cylinders from physical damage; do not drag, roll, slide or drop. When moving cylinders, even for short distance, use a cart designed to transport cylinders. Use equipment rated for cylinder pressure. Use backflow preventive device in piping. Use an adjustable strap wrench to remove over-tight or rusted caps. Close valve after each use and when empty. Never insert an object (e.g. wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage valve, causing leak to occur. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier. Never put cylinders into trunks of cars or unventilated areas of passenger vehicles. Never attempt to refill a compressed gas cylinder without the owner's written consent. Never strike an arc on a compressed gas cylinder or make a cylinder a part of an electrical circuit.
Storage	Protect from physical damage. Cylinders should be stored upright with valve protection cap in place and firmly secured to prevent falling. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Keep at temperatures below 52°C / 125°F. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders from being stored for excessive periods of time. Always store and handle compressed gas cylinders in accordance with Compressed Gas Association, pamphlet CGA-P1, Safe Handling of Compressed Gases in Containers. There should be no ignition sources in areas where this product is used or stored. Outside or detached storage is preferred.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Germane 7782-65-2	TWA: 0.2 ppm	(vacated) TWA: 0.2 ppm (vacated) TWA: 0.6 mg/m ³	TWA: 0.2 ppm TWA: 0.6 mg/m ³

NIOSH IDLH: Immediately Dangerous to Life or Health.

Other Exposure Guidelines	Vacated limits revoked by the Court of Appeals decision in AFL-CIO v. OSHA, 965 F.2d 962 (11th Cir., 1992).
Engineering Measures	Showers. Eyewash stations. Explosion proof ventilation systems. Exhaust gas should be vented to a gas treatment system.
Ventilation	Use ventilation adequate to keep exposures below recommended exposure limits.
<u>Personal Protective Equipment</u>	
Eye/Face Protection	Wear protective eyewear (safety glasses). For emergency operations: Fire helmet with faceshield, fire resistant hood.
Skin and Body Protection	Wear fire/flame resistant/retardant clothing. Appropriate protective and chemical resistant gloves, clothing and splash protection, or fully encapsulating vapor protective clothing to prevent exposure. For materials of construction consult protective clothing manufacturer's specifications.
Respiratory Protection	
General Use	If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.
Emergency Use	Use positive pressure air line respirator or self-contained breathing apparatus for exposure over exposure limits or emergency use. For exposures above IDLH, an additional escape bottle is required.
Hygiene Measures	Wear suitable gloves and eye/face protection. Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product. When using, do not eat, drink or smoke. Provide regular cleaning of equipment, work area and clothing. Keep away from food, drink and animal feeding stuffs.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Colorless.	Odor	Pungent.
Odor Threshold	No information available.	Physical State	Gas
Flash Point	No information available.	Autoignition Temperature	No information available.
Decomposition Temperature	280-350 °C	Boiling Point/Range	-88.5°C / -127.3°F
Freezing Point	-165.98°C / -266.76°F	Molecular Weight	76.66
Water Solubility	Insoluble in water.	Evaporation Rate	No information available
Vapor Pressure	638 PSIA @ 70°F	Vapor Density	2.66 (air = 1)
VOC Content (%)	Not applicable.	Flammability Limits in Air	
		Upper	Not applicable
		Lower	100%

10. STABILITY AND REACTIVITY

Stability	Unstable. Temperatures above 280-350°C will result in vigorous decomposition. Reacts with water.
Incompatible Products	Oxidizing agents. Bromine.
Conditions to Avoid	Ignitions sources - heat, sparks and open flames. May evolve hydrogen and ignite on contact with water.
Hazardous Decomposition Products	Hydrogen gas. Germanium compounds.

Hazardous Polymerization Hazardous polymerization does not occur.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

LD50 Oral: No information available.

LD50 Dermal: No information available.

LC50 Inhalation: Per CGA P-20:LC50: 662 ppm/1 hr. (Mouse) (time-adjusted)

Inhalation Experimental exposure of mice resulted in behavioural changes, ataxia, muscle contraction and spasticity. Degenerative changes in the liver and kidneys were noted in rodents at concentrations of 445-825 ppm and neurotoxicity occurred in mice prior to death at 635 ppm.

Repeated Dose Toxicity No information available.

Chronic Toxicity

Chronic Toxicity May cause adverse liver and kidney effects. May cause adverse effects on the bone marrow and blood-forming system.

Carcinogenicity Contains no ingredient listed as a carcinogen.

Irritation No information available.

Sensitization No information available.

Reproductive Toxicity No information available.

Developmental Toxicity No information available.

Synergistic Materials None known.

Target Organ Effects Blood. Central nervous system (CNS). Kidney.

12. ECOLOGICAL INFORMATION

Ecotoxicity

The environmental impact of this product has not been fully investigated.

Ozone depletion potential; ODP; (R-11 = 1): Does not contain ozone depleting chemical (40 CFR Part 82).

13. DISPOSAL CONSIDERATIONS

Waste Disposal Methods Do not attempt to dispose of residual waste or unused quantities. Return in the shipping container PROPERLY LABELED WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to Linde for proper disposal.

Contaminated Packaging

Do not re-use empty containers.

14. TRANSPORT INFORMATION

DOT

Proper Shipping Name	Germane
Hazard Class	2.3
Subsidiary Class	2.1
UN-No	UN2192
Special Provisions	This material is toxic by inhalation in Hazard Zone B.
Description	UN2192, Germane, 2.3, (2.1)
Additional Description:	"Toxic-Inhalation Hazard Zone B".
Additional Marking Requirements:	"Inhalation Hazard".
Emergency Response Guide Number	119

TDG

Proper Shipping Name	Germane
Hazard Class	2.3
Subsidiary Class	(2.1)
UN-No	UN2192
Description	UN2192, GERMANE, 2.3(2.1)

MEX

Proper Shipping Name	Germanium
Hazard Class	2.3
Subsidiary Class	2.1
UN-No	UN2192
Description	UN2192 Germanium, 2.3

IATA

UN-No	UN2192
Proper Shipping Name	Germane
Hazard Class	2.3
Subsidiary Class	2.1
ERG Code	10P
Description	UN2192, Germane, 2.3(2.1)
Maximum Quantity for Passenger	Forbidden
Maximum Quantity for Cargo Only	Forbidden
Limited Quantity	No information available.

IMDG/IMO

Proper Shipping Name	Germane
Hazard Class	2.3
Subsidiary Class	2.1
UN-No	UN2192
EmS No.	F-D, S-U
Description	UN2192, Germane, 2.3(2.1)

ADR

Proper Shipping Name	Germane
Hazard Class	2.3
UN-No	UN2192
Classification Code	2TF
Description	UN2192 Germane, 2.3,

ADR/RID-Labels

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15. REGULATORY INFORMATION

International Inventories

TSCA	Complies
DSL	Complies
EINECS/ELINCS	Complies

Legend

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory

DSL/NDL - Canadian Domestic Substances List/Non-Domestic Substances List

EINECS/ELINCS - European Inventory of Existing Commercial Chemical Substances/EU List of Notified Chemical Substances

U.S. Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311/312 Hazard Categories

Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	Yes
Sudden Release of Pressure Hazard	Yes
Reactive Hazard	Yes

Clean Water Act

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

Risk and Process Safety Management Programs

This material, as supplied, does not contain any regulated substances with specified thresholds under 40 CFR Part 68.

This product does not contain any substances regulated as Highly Hazardous Chemicals pursuant to the 29 CFR Part 1910.110.

Clean Air Act, Section 112 Hazardous Air Pollutants (HAPs) (see 40 CFR 61)

This product does not contain any substances regulated as hazardous air pollutants (HAPS) under Section 112 of the Clean Air Act Amendments of 1990.

CERCLA/SARA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

U.S. State Regulations

California Proposition 65

This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

Chemical Name	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Germane	X	X	X		X

International Regulations

Chemical Name	Carcinogen Status	Exposure Limits
Germane		Mexico: TWA= 0.2 ppm Mexico: TWA= 0.6 mg/m ³ Mexico: STEL= 0.6 ppm Mexico: STEL= 1.8 mg/m ³

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class

A Compressed gases

B6 Reactive flammable material

D1A Very toxic materials

**16. OTHER INFORMATION**

Prepared By	Product Stewardship 23 British American Blvd. Latham, NY 12110 1-800-572-6501
Issuing Date	17-Mar-2010
Revision Date	10-Sep-2010
Revision Number	1
Revision Note	(M)SDS sections updated. 1.

<u>NFPA</u>	Health Hazard 4	Flammability 4	Stability 3	Physical and Chemical Hazards W
<u>HMIS</u>	Health Hazard 2	Flammability 4	Physical Hazard 3	Personal Protection -

Note: Ratings were assigned in accordance with Compressed Gas Association (CGA) guidelines as published in CGA Pamphlet P-19-2009, CGA Recommended Hazard Ratings for Compressed Gases, 3rd Edition.

General Disclaimer

For terms and conditions, including limitation of liability, please refer to the purchase agreement in effect between Linde LLC, Linde Merchant Production, Inc. or Linde Gas North America LLC (or any of their affiliates and subsidiaries) and the purchaser.

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End of Safety Data Sheet